Sher-e-Kashmir University of Agricultural Sciences &Technology of Kashmir
Estates Wing, Main Campus Shalimar – 190 025

Notice Inviting e-Tender

E-NIT NO. (22) Of 2020 **Dated:01.03.2021**

For and on behalf of Vice-Chancellor, SKUAST(K), e-tenders in **(single-cover system)** are invited from approved and eligible Electric contractors whose cards are valid up to 31-03-2021 registered with State PWD, CPWD, Railways and other State/Central Govt. departments for the following work:-

S.No	Name of the work	Estimated Cost (in lacs)	Earnest Money (Rs.)	Class of Contractor	Major Head of Account	Cost of Tender document	Time of completion
1.	**Supply, Installation, Testing and Commissioning of Hybrid Solar 50 Kwp Plant with Battery backup, complete in all respects for Veterinary Clinic at FVsc and A.H Shuhama SKUAST-K(Please see terms and Conditions in Technical Document for Serial 01 only)**	51.14	102298/-	Having Executed Similar Nature of Work Successfully	CAPEX (Under Solar/Green Energy Harvesting)	500/-	**20 days**
2.	**Supply, Installation, Testing and Commissioning of Servo voltage Stabilizers for synchronising of Solar Grid Connected PV Plant of Nundreshi Hall, Comptroller Office, Registrar Office, HVC Secretariat and Ground Mounted Solar Plant near RCRQ at various locations at Shalimar SKUAST Kashmir**	19.68	39368/-	AAY class	---do---	500/-	**20 days**
3.	**Supply, Installation, Testing and Commissioning of Hybrid Solar 5 Kwp Plant with Battery backup, complete in all respects at Gurez SKUAST-K**	5.55	11102/-	AAY class	---do---	500/-	**15 days**

a) **Position of AAA:** **Accorded**
b) **Position of T.S :** **Sanctioned**
c) **Position of funds:** **Available**

1. The Bidding document consisting of qualifying information, eligibility criteria, specifications, set of terms and conditions and other details can be downloaded from the departmental website www.jktenders.gov.in as per following schedule:-

1.	Date of issue of Tender Notice	01.03.2021
2.	Date of start of downloading	01.03.2021
3.	Pre-bid meeting date	NA
4.	Bid submission start Date	01.03.2021
5.	Bid submission end date	15.03.2021
7.	Date & Time of opening of Technical bid/ Financial Bids of qualifying bidders (online)	16.03.2021

2. Bids must be accompanied with proof of cost of Tender document in the shape of Demand Draft/Payment order drawn in favour of Assistant Comptroller, Estates SKUAST-K and Earnest money in the shape of CDR/FDR pledged to Assistant Comptroller, Estates SKUAST-K.

3. Please note that any contractor who uploads his tender on the website www.jktenders.gov.infor the captioned work but later on fails to deposit document fee (DD/Payment Order) in the office of the undersigned, he shall be liable for disqualification and shall be debarred from participation in tendering process of SKUAST-K works for next 12 months to reckon from the date of opening of financial bid of the captioned work.

4. Financial Bids of eligible bidders shall be opened online on the website www.jktenders.gov.in in the office of Estates Officer SKUAST-K Shalimar Campus (Tender receiving authority) as per the schedule.

5. The lowest bidder i.e. L1 shall be intimated to deposit the original copy of required earnest money in the shape of CDR/FDR and hard copies of all relevant documents as mentioned in the general conditions to the bidders, within 03 days of the opening of financial bid.

6. The rates quoted by the tenderer shall be final and inclusive of taxes, carriages of all materials (Mechanical/Manual), dewatering if any and all extra charges till the completion of work. The bids for the work shall remain valid for a period of 120 days from the date of opening of bids.

7. The bidder is advised to visit the site of works at his own expense and obtain all information that may be necessary for preparing the quotation.

8. **The earnest money shall be forfeited if:-**
   a. Any bidder/tenderer withdraws his bid/tender during the period of bid validity or makes any modifications in the terms and conditions of the bid.
   b. Failure of successful bidder to execute the agreement within 21 days after fixation of contract.

9. **Instructions to bidders:-**
   a. Bidders are advised to download bid submission manual from the 'Downloads' option as well as from 'Bidders Manual Kit' on website www.jktenders.gov.in.
   b. To participate in bidding process, bidders have to get 'Digital Signature Certificate (DSC)' as per information Technology Act-2000. Bidders can get digital certificate from any approved vendor.
   c. The bidder has to submit his bid online in electronic format with digital signature. No bid will be accepted in physical form.
   d. Bids will be opened online as per time schedule mentioned in Para-1.
   e. Bidders must ensure uploading scanned copy of all necessary documents with the financial bid including DD/PO and EMD.

   Note:-Scan all the documents on 100dpi with black and white option.

10. The department will not be responsible for delay in online submission due to any reasons.

11. **Price escalation and Taxes:** The item-wise rates be quoted by the bidder entirely in **Indian Rupees** and the cost/offer quoted shall be deemed to include **price escalation and all taxes**, all carriages **(Mechanical/ Manual)** to the site of work and all extra charges including dewatering if any till completion of the work. Deduction on account of taxes as applicable shall be made from the bills of the contractor on gross amount of the bill as per the rates prevailing at the time of recovery.

12. Bidders are advised to use **'My Document'** area in their use on JK tenders e-tendering portal to store such documents as are required.

13. The documents to be submitted with the financial bid shall include:
   a. Copies of original documents defining constitution/legal status/place of registration and principal place of Business with latest renewal.
   b. Valid GST& PAN No along with latest acknowledgement receipt of GST return.
   c. Scanned copy of CDR/FDR (Earnest money) from any scheduled or nationalized bank.
   d. Scanned copy of Payment order/Demand Draft (cost of tender document) for downloading of tender document.

14. **Self-attested Affidavit on plain paper to the extent that:-**
    a. The bidder would be able to invest a minimum of 25% of contract value.
    b. Information regarding any litigation current or during the last five years, in which the bidder is involved, the parties concerned and disputed amount.
    c. The bidder is not black-listed/debarred by any Govt. or Semi-Govt. Department for participation in tendering.
15. **Unbalanced bid:- i)** In case price bid of the L1 bidder is found unbalanced viz 20% or more below the advertised cost, he has to produce an **additional performance security of 3%**in the shape of CDR/FDR/TDR/BG pledged to Assistant Comptroller, Estates before issuance of allotment.
    ii) In case the Tender Opening Committee finds the offered price of L_1 being unreasonable giving rise to compulsive circumstance, he shall have to deposit security bid under such compulsive circumstances in the shape of CDR/BG pledged to Asstt. Comptroller Estates SKUAST-Kashmir to the extent as may be deemed fit by the competent authority. The bid security thus deposited by the L_1 shall be released in his favour after completion of his contract in all respects.
16. **Clearance of Site**:- On completion of contract the contractor shall be responsible to remove all debris etc. and restore all work in its original position.
17. **Material specification**:-Steel of all sorts as shall be required for execution of the work shall conform **to SAIL or equivalent.** Cement: **JK Cement/Khyber or equivalent**
18. **Departmental materials, if any supplied for execution of the work shall be deducted from the work done bills at the following rate/s:-**

i)	**Cement :**	**Rs. 500/- per bag**
ii)	**Tor Steel (of all sorts)**	**Rs. 75/- per Kg**
iii)	**Structural steel (of all sorts)**	**Rs. 78/- per Kg**

19. **Defect Liability Period**:- The DLP shall be calculated from the date of certified completion of work and period shall be 12 months.
20. **Retention Money**:- An amount equivalent to 10 % shall be deducted from each running bill of the successful contractor which shall be released after virtual completion of work in all respects.
21. The intending bidders are advised to inspect the site of work before bidding.
22. Any topographical error if found in the Bill of Quantities (BOQ), the same shall be allowed/corrected as per original estimate/book of specifications/schedule of rates.
23. **Any Contractors having poor performance in any SKUAST-K work/s, his financial bid shall be opened or not considered at the discretion of Tender Opening Committee, Estates Wing.**

Executive Engineer
SKUAST-K Shalimar

No. Au/Estates/e-NIT(22)/204-211
Dated: 01.03.2021

Copy for information to:-

1. Estates Officer SKUAST-K
2. Asstt. Executive Engineer(Electric) Estates SKUAST-K
3. Assistant Comptroller/DDO Estates SKUAST-K
4. Secretary to Vice-Chancellor for information of Hon'ble Vice-Chancellor
5. I/C ARIS Shalimar for up-loading the tender notice on University website
6. Technical Officer, Estates SKUAST(Kashmir)
7. Notice Board
8. Office File

ELIGIBILITYCONDITIONS

- **The Bidder shouldbe**
  A PV System integrator working in the field of SPV Power plants who has

Experience of having successfully completed *similar works during last 4 years ending last day of month previous to the one in which applications are invited should be either of the following: -

a. Two similar completed works costing not less than the amount equal to 50% of the estimated cost.

OR

c. One similar completed work costing not less than the amount equal to 80% of the estimated cost.

Definition of Similar Works: ON Grid/OFF Grid Solar Power Plants

OR

Company Registered with MSME / Startup India / with similar nature of work..

(A copy of the work orders or Said registered certificates need to be enclosed)

(A copy of the work order and certificate indicating its successful execution to be enclosed)

01. TECHNICAL REQUIREMENTFOR HYBRID SOLARSYSTEMS.

(i) The Primary Requirement and specifications of Hybrid Solar Systems is provided below. This is not exhaustive in nature and shall include everything that is required as per technicalspecifications.

(a) For SPP(HYBRID)

S No.	Item
1	Solar Photovoltaic Modules
2	DC Distribution Box
3	Hybrid Power Conditioning Unit
4	Battery Bank Rating
5	AC Distribution Box
6	Module Mounting Structure (MMS)
7	AC & DC Cables with conduits and other associated accessories
8	Remote Monitoring System
9	Lightening Arrestor
10	Earthing & Associated accessories
11	Fire Extinguisher
12	Wiring, Switches and accessories for Loadsegregation. The system should be connected to the specified available load within the limits of the PV power plant.

(ii) An Hybrid Photovoltaic (SPV) power plant consists of SPV array, Module Mounting Structure, Hybrid Power Conditioning Unit, Batteries and Controls & Protections, interconnect cables, Junction boxes, Distribution boxes and switches. PV Array is mounted on a suitable structure. Components and parts used in the SPV power plants including the PV modules, metallic structures, cables, junction box, switches, PCUs etc., should conform to the BIS or IEC or international specifications, wherever such specifications are available andapplicable.

02. *TECHNICAL SPECIFICATIONS FOR MAJOR EQUIPMENT OF HYBRID SOLAR PV SYSTEMS ARE AS BELOW:-*

(i) The design, manufacture, erection and testing of the equipment and material to be supplied shall comply with latest revisions of relevant Indian Standards or equivalent IEC standards, latest MNRE's specification, standards,requirements.

Solar PV system shall consist of followingequipment/components

- Solar PV arrays consisting of required number of Crystalline PVmodules.
- Hybrid Power Conditioning Unit with Remote Monitoring System
- Mountingstructures
- Batteries
- Junction Boxes
- Earthing and lighteningprotections
- IR/UV protected PVC/XLPE armored/unarmored Cables, pipes and accessories
- Fire ProtectionDevices

(ii) The detailed Technical specifications and applicable IEC codes for major equipment is as below:-

Solar PhotovoltaicModules

ii. The Technical Specifications required for Solar Modules are asbelow:

Detail Specification	**Acceptable Norms**
PV module types.	Mono Perc / Vikram Solar, Saatvik Green, Adani)
IEC 61215/ IS 14286	Design Qualification and Type Approval for Crystalline Silicon Terrestrial Photovoltaic (PV) Modules
IEC 61730-1, 2	Photovoltaic (PV) Module Safety Qualification – Part 1: Requirements for Construction, Part 2: Requirementsfor Testing
IEC 61853- Part 1/ IS 16170 : Part 1	Photovoltaic (PV) module performance testing and energy rating –: Irradiance and temperature performance measurements, and powerrating.

Minimum wattage of individual Solar PV module	**≥ 300Wp MONO PERC**
The rated output variation of individual module fromaverage modules in single Unit.	+/-3% in single plant so as to reduce mismatch losses Each module shall display rating and power curve shall be available for inspection.
Power output rating	To be given for standard test conditions (STC). I-V curve of the sample module shall be submitted.
Salt Mist and Ammonia resistant Corrosion Testing	As per IEC 61701 (applicable for projects installed in highly corrosive environments)
Module Frame	Aluminum anodized corrosion resistant material. Shall be electrolytically compatible with mounting material
Module cover surface	Toughened high transmissive glass at front. Multi-layered polymer sheet/glass cover atback Suitable encapsulation and sealants to protect module from environmental effect such as moisture anddust.

Detail Specification	Acceptable Norms
Photo electrical conversion Efficiencyof SPV module	>16% for 300Wp crystalline type .
Fill factor	>= 75%
Origin	Manufactured in India
Range of Temperature and Humidity for Satisfactoryperformance	Relative humidity up to 85% Temperature between -10 degree to +85 degree
Degradation warranty of Module	Mono Crystalline silicon type modules shall carry warranty of minimum 25 years. Panel output (Wp) capacity to be >=90% of design nominal power for 10 years and >=80% of design nominal power for next 15 years.
Termination box	Thermo-plastic, IP 65, UV resistant
RF Identification tag for each solar module	Shall be provided inside the module and must be able to withstand environmental conditions and last the lifetime of the solar module.
RF Identification tag data	Name of the manufacturer ofPVModule Name and Monogram or symbol of the Manufacturer of Solar cells. Month, year and Place of manufacture (separately for solar cells andmodule). Country of origin (separately for solar cells and module). I-V curve for the module. Wm, Im, Vm and FF for the module. Unique Serial No and Model No of the module, Date and year of obtaining IEC PV module qualification certificate. Name of the test lab issuing IEC certificate. Other relevant information on traceability of solar cells and module as per ISO 9000 standard. Type or model number; Unique serial number Maximum suitable system voltage for the module

iii. Adequate protective devices against surges at the PV module shall be provided. Low voltage drop bypass diodes shall be provided.

iv. PV modules must be tested and approved by one of the IEC/NABL authorized testcenters.

v. The Bidder shall carefully design & accommodate requisite numbers of the modules to achieve the rated power in projects. Only minor changes at the time ofexecution.

vi. 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 maybe.

vii. The orientation & tilt of the solar module array should be such that the plant's generation should be at its maximum possible in thelocation.

viii. The warranty to be provided for Solar Modules are asbelow

a. The Bidder 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 sale to the original customer ("Customer"), Defects and/or failures due to manufacturing, Defects and/or failures due to quality of materials shall be covered under warranty.

b. Non-conformity to specifications due to faulty manufacturing and/or inspection processes. If the solar Module(s) fails to conform to this warranty, the Bidder will repair or replace the solar module(s), at the Owners soleoption.

c. In addition to the product guarantee, manufacturers shall grant exponential nominal power guarantees year on year for a minimum period of 25 years. Under these guarantees manufacturer shall ensure that module will deliver nominal power output based on manufacturer provided annual degradation rate. The output shall be measured at string level. The nominal power guarantees shall be in lieu of manufacturing defects and workmanship; the minimum set terms shall be asbelow:

d. **0 to 5 years** – for a period of five years from the date of commissioning, if any module produces a nominal power output below 94.7% as set out in manufacturer's data sheet, bidder shall replace module free of cost with a new guarantee for balance period and compensate the developer for the loss of revenue caused by the failure. Else, refund the then current market price of modules with monetary compensation at the then energy prices of the power purchasing company. The process of facilitation of the replacement should be done by the contractor assigned the job of initial sourcing of modules (Turnkey EPC contractor if job is assigned on turnkey basis or work contractor is contract is awarded inparts.

e. **6 to 12 years** – for a period of seven years from the date of completing five years of nominal power guarantee, if any module produces a nominal power output below 89.8% as set out in manufacturer's data sheet, manufacturer shall replace module free of cost with a new guarantee for balance period and compensate the developer for the loss of revenue caused by the failure. Else, refund the then current market price of moduleswith monetary compensation at the then energy prices of the power purchasing company. The process of facilitation of the replacement should be done by the contractor assigned the job of initial sourcing of modules (Turnkey EPC contractor) if job is assigned on turnkey basis or work contractor is contract is awarded inparts.

f. **13 to 25 years** – for a period of thirteen years from the date of completing twelve years of nominal power guarantee, if any module produces a nominal power output below 80.7% as set out in manufacturer's data sheet, manufacturer shall replace module free of cost with a new guarantee for balance period and compensate the developer for the loss of revenue caused by the failure. Else, refund the then current market price of modules with monetary compensation at the then energy prices of the power purchasing company.

ix. The other guarantees specifications required for Solar Modules are asbelow

(a) NominalPowerTolerance:Thenominalpowertoleranceofmodulesshallbebeyond +5%; However, preference may be given to manufacturers giving higher positive power tolerance.

(b) Efficiency: Minimum acceptable efficiency of all the modules under standard test conditions is 16%; However, preference may be given to modules having higher efficiency thandesired.

(c) Temperature Coefficients: Variation in temperature has a significant effect on electrical parameters of PV modules; following are the benchmark for the maximum temperature coefficients for all the proposed modules bymanufacturers:

(i) Temperature Coefficient of Pmpp - 0.41%/°C (forCrystalline)

(ii) Temperature Coefficient of Voc - 0.32%/°C (forCrystalline)

x. In addition to the best construction requirements of respective manufacturers, following are the specific requirements for all the crystallinemodules:

(a) All the modules shall be equipped with IP67 or higher protection level junction box and appropriately sized output power cable of symmetric length with twist locking connectors.

(b) Fill factor for proposed PV modules shall not be less than 0.75 In order to minimize power loss due to partial shading on modules, all modules shall be equipped with bypassdiodes.

(c) Modules shall be capable of withstanding a wind pressure of 2400Pa or the local wind loading, whichever ishigher.

(d) Modules may be subjected to high intensity hail-storms thus appropriate measures should be taken for selectingglass.

(e) Module frames shall be corrosion resistant and shall have adequate holes for mounting, water drain and connecting ground conductor. All modules shall be appropriately grounded.

xi. The modules should be free of PID and IEC 62804 certified documents for the same should be submitted. Conditions of the PID test should be for a humidity of 85% and a cell temperature of 80oC at 1000Volts.The Insurance to be provided for Solar Modules are as below:

(a) The Supplier shall at its expense take out and maintain, during the execution of the Contract, the insurance set forthbelow;

(b) Transit insurance (including marine and inland transportation) during transport to cover loss or damage to modules supplied by themanufacturer.

(c) The Developer shall be named as co-insured under these insurance policies. Said policies shall be obtained after finalization and as soon as practicable prior to commencement of any activities under the Contracts. The Developer shall have the right to assign these policies to itslenders.

(d) Upon conducting the functional tests, modules shall be classified under multiple bin classes. The maximum allowable difference between the two consecutive classes shall be 0.1A. For ease in identification, the manufacturer shall designate colour codes to each of the bin classification; these shall be then packed in same bin class pallets and cardboard boxes. Packs of 20 modules having a single bin class shall be dispatched and delivered onsite..

(e) During Operation, Owner may check the power output degradation of modules at regular interval on sampling pattern. In case if the degradation found to be more than the linear guaranteed limits on the individual modules, Bidder shall supply new modules as a replacement of degraded module of the same type or the improved version of the modules if the technology advances without any additional cost to Owner. New modules shall be supplied by the Bidder at site location, India 60 days from the date of issuance of Notice by theOwner.

PCU /Inverter

i. PCU must be tested and approved by any of the MNRE accredited testlabs.
ii. PCU shall include a facility to convert the DC energy produced by solar array to AC voltage, through DC bus to extract maximum energy from array and produce ACpower.
iii. The inverter capacity shall be equal or more than then approved projectcapacity.
iv. It must have modes to prioritize between solar, grid andbattery.
v. The output of power factor of PCU inverter is suitable for all voltage ranges or sink of reactive power, inverter should have internal protection arrangement against the lightning onfeeder.
vi. The PCU/ inverters should be tested from the MNRE approved test centers/ NABL/ BIS/ IEC accredited testing- calibration laboratories. In case of imported power conditioning units, these should be approved by international testhouses.

vii. The Technical Specifications required for Hybrid PCU/ Inverters are as below:-

Technical Specification	Requirement
Input DC voltage range	As required for the Solar Hybrid inverter DC input.
Nominal AC output voltage	440V
Make	MNRE Approved.
Operation AC voltage regulation	180V – 260V
Operating Frequency range	47.5 – 55.5 Hz
Nominal frequency	50 Hz
Waveform	Pure Sine Wave
Harmonics	AC side total harmonic current distortion <3%
Ripple	DC Voltage ripple content shall be not more than 3 %
DC Content	Less than 0.5 %
Power factor of the inverter	> 0.9
Surge Rating	Up to 300% of the continuous rating for a minimum of 30 seconds.
Built-in Protection	AC high / low voltage; AC high /lowfrequency
Operating ambient temperature range	-10 deg C to +50 deg C Shall conform to local temperature conditions of thesite.
Humidity	0 – 95% Rh
Inverter efficiency (Hybrid)	As per IEC 61683/IS 61683
Protection degree (casing protection levels)	Minimum IP 21 for indoor mounting /IP65 for outdoor
Communication interface	RS 485 / RS 232 / RJ45 / USB Port
Environmental Testing	IEC 60068-2
Efficiency Measurement Procedure	IS/IEC 61683

Technical Specification	Requirement
Operation	Completely automatic including wake up, synchronization (phase-locking) and shut Down
Cooling	Convection
Internal Wiring	Copper wires shall be insulated with flame resistant material
Display type	LCD for data display. LCD / LED for status display
Indication through LED/LCD display	Invertor ON Grid ON Invertor under/over voltage Invertor overload Invertor over temperature
Display on front panel	DC voltage (v) DC current (A) AC voltage AC frequency ACcurrent Battery bank volts. Battery bank current Load

Batteries & Rack

i. The battery shall be Tubular Lead Acid flooded electrolyte type as per MNRE specs/guidelines and from approved MNRE empanelled battery manufactures like **EXIDE,Solar / AMARON Solar** It should conform to IS 13369. The Battery Bank capacity is set to **300AH/02V or equivalent AH/V for 50 KW Solar Plant with 3 hr backup** and total battery bank size will be the depth of discharge should be considered not less than 80% at the end of 5th year. It must be rugged for transportation & durable for harsh environment. The battery must also offer high charge and discharge efficiency, low self-discharge and low electrolyteloss.

ii. Battery rack shall be of MS with duly painted with acid resisted paint. Placing of battery should be such that maintenance of the battery may be carried out easily. The non-reactive acid proof mats shall be provided to cover the entire floor space of the battery room and is to be arranged along with supply of battery bank. Supplier will take full responsibility of any damage of the floor due to leakage. Thermometer, cell tester, hydrometer, acid and distilled water pouring container of required size, battery connecting leads, are required to be supplied with each batterybank.

iii. **Warranty:** The battery should have a minimum life of 5 years or 1800 discharge cycles (whichever is later) with discharge depth not less than80%.

Module Mounting Structure

i. The Technical Specifications required for Module Mounting Structures are asbelow

Detailed specifications	**Acceptable Norms**
Wind velocity withstandingcapacity	As per wind speed at the project site. (Minimum 150 km/hr)
Structure material	The array structure shall be made of hot dipped galvanized MS angles of suitable size subject to withstand the wind load (minimum 80 micron thickness of galvanization)
Material for the structuremounting	IS 2062 - standards for Hot Rolled Medium and High Tensile Structural Steel IS 4759; 2006 - Hot-dip Zinc Coatings on Structural

Detailed specifications	Acceptable Norms
	Steel and Other Allied Products
Bolts, nuts,fasteners, panel mounting clamps	Stainless steel SS 304
Minimum distance between terrace and MMS at any point	Min. 300 mm – for flat roof Min 50 mm – for shed type roof installations
Mounting arrangement for metal sheet roofs	Mounting directly on the sheet metal, ensuring stability and wind withstanding capacity, or penetrating the sheet metal and fixing to the substructure, ensuring that the roof remains water-proof and ensuring stability and wind withstanding Capacity
Mounting arrangement for elevated structures	The elevated structure has to be securely anchored to the supporting surface. Concrete foundations of appropriate weight and depth for elevated structures mounted directly on the ground; bolted with anchor bolts of appropriate strength for elevated structures mounted on RCC surfaces. The array structure shall be grounded properly using maintenance free earthing kit suitable for mounting over building terrace.
Installation	The structures shall be designed for simple mechanical on-site installation. There shall be no requirement of welding or complex machinery at the installation site. The mounting of solar modules shall be done in such a way that there is no possibility of short circuit due to water logging. In addition, the structure of the Unit or the module should be mounted in such a way so as to cause no puncturing or any other damage to the roof.
Access for panel cleaning and Maintenance	All solar panels must be accessible from the top for cleaning and from the bottom for access to the module junction box.
Panel tilt angle	Each structure should have an angle of inclination as per the site conditions to take maximum insolation. However to accommodate more capacity the angle of inclination may be reduced until plant meets the specified performance ratio requirements. The structure should be fixed type.
Module weight and StructureStrength	The total load of the structure (when installed with PV modules) on the terrace should be less than 60 kg/m2. It is clarified that the bidder shall be responsible for verification of the roof's structural strength for installation of the Unit. Factor of safety for designing shall be considered Min. 1.5. The

Detailed specifications	Acceptable Norms
	bidder must furnish test certificates /STAAD report along with detailed GA drawing of the structure for its validity.

Junction Boxes (JBs); if applicable:

i. Specifications for junction boxes to be used in proposed roof top SPV power packs on roofs.
ii. IEC 60529: Junction boxes and solar panel terminal boxes shall be of the thermo plastic type with IP 65 protection for outdoor use, and IP 21 protection for indooruse
iii. The array junction box will also have suitable surgeprotection.
iv. The junction boxes should be able to combine groups of modules into independent charging sub-arrays.
v. The junction boxes should provide arrangement for disconnection for each of thegroups
vi. It should provide a test point for each sub- group for quick fault location to provide group arrayisolation.
vii. The current carrying rating of the junction box shall be suitable with adequate safety factor to inter-connect the Solar PVarray.
viii. The junction boxes shall have suitable cable entry points fitted with cable glands of appropriate size for both incoming & outgoingcables.
ix. Suitable markings shall be provided on the bus bar for easy identification & cable ferules shall be fitted at the cable termination points foridentification.
x. Junction boxes and solar panel terminal boxes shall be of the thermo plastic type with IP 65 protection for outdoor use and IP 54 protection for indooruse.
xi. Cable terminations shall be taken through thermo-plastic cable glands. Cable ferrules shall befitted at the cable termination points foridentification

DC Combiner Box and DistributionBox

i. A DC Combiner Box shall be used to combine the DC cables of the solar module arrays with DC fuse/ MCB protection for the outgoing DC cable(s) to the DC DistributionBox.
ii. A DC distribution box shall be mounted close to the SPV area. The DC distribution box shall be of the thermo-plastic IP65 DIN-rail mounting type and shall comprise the following components and cableterminations:
    - Incoming positive and negative DC cables from the DC CombinerBox;
    - DC circuit breaker, 2 pole (the cables from the DC Combiner Box will be connected to this circuit breaker on the incomingside);
    - DC surge protection device (MOV) or (SPD)- class 2 as per IEC 61643-11:2011 / IS 15086-5 (SPD)
    - Outgoing positive and negative DC cables to the solar gridinverter.

AC Distribution Panel Board:

i. An AC distribution box shall be mounted close to the solar grid inverter. The AC distribution box shall be of the thermoplastic IP65 (Outdoor) & IP21 (Indoor) DIN rail mounting type and shall comprise the following components and cableterminations
ii. Incoming 3-core (single-phase) cable from the solar off- gridinverter
iii. AC circuit breaker,2-pole.
iv. AC surge protection device (SPD), class 2 as per IEC 60364-5-53
v. Outgoing cable to the building electrical distributionboard.

03. PLANNING &DESIGNING

The Bidder should carry out Shadow Analysis at the site and accordingly design strings & arrays layout considering optimal usage of space, material and labour. The bidder should also submit the array layout drawings along with shadow analysis report to the owner for approval.

04. SAFETYMEASURES

The Bidder shall take entire responsibility for electrical safety of the installation(s) and follow all the safety rules & regulations applicable as per Electricity Act, 2003 and CEA guidelines and relevant Electricity Regulatory Commission guidelines.

05. TOOLSKIT

Necessary tool kit is to be provided along with each battery bank for any immediate maintenance. Adequate firefighting equipment such as portable fire extinguishers be incorporated for fire protection of control room including adequate sand buckets. The firefighting equipment should conform to BIS standards.

06. DATA ACQUISITION SYSTEM ANDMONITORING

i. Data Acquisition System i.e. Web based shall be provided for each of the solar PVplant
ii. The following parameters should be accessible via the operating interface display in real time separately for solar powerplant:
- ACVoltage.
- AC Outputcurrent.
- Output Power
- Powerfactor.
- Battery ChargingStatus
- BatteryVoltage
- DC InputVoltage.
- DC InputCurrent.
- Protective function limits (viz. AC Over voltage, AC Under voltage, over frequency, under frequency, ground fault, PV starting voltage, PV stopping voltage).

07. PROTECTIONSYSTEMS:

1) The system should be provided with all necessary protections like earthing, Lightning arrestors, and grid anti-islanding asfollows:

(a) **Lightening Protection:** The SPV power plants shall be provided with lightning & overvoltage protection. Bidder shall provide conventional Franklin Rod type Lightning Arrestor. The main aim in this protection shall be to reduce the over voltage to a tolerable value before it reaches the PV or other sub system components. The source of over voltage can be lightning, atmosphere disturbances etc. The entire space occupying the SPV array shall be suitably protected against Lightning by deploying required number of Lightning Arrestors. Lightning protection should be provided as per IEC 62305 standard. The protection against induced high-voltages shall be provided by the use of metal oxide varistors (MOVs) and suitable earthing such that induced transients find an alternate route toearth.

IEC 62561 Series (Part 1 & 2) (Chemical earthing)	IEC 62561-1 Lightning protection system components (LPSC) - Part 1: Requirements for connection components IEC 62561-2 Lightning protection system components (LPSC) - Part 2: Requirements for conductors and earth electrodes IEC 62561-7 Lightning protection system components (LPSC) - Part 7: Requirements for earthing enhancing compounds

(b) **Surge Protection:-**Internal surge protection shall consist of three MOV type surge-arrestors connected from +ve and –ve terminals toearth.

IEC 60364-5-53/ IS 15086-5 (SPD)	Low-voltage surge protective devices - Part 11: Surge protective devices connected to low voltage power systems - Requirements and test methods

(c) **Earthing Protection:-**The system shall have separate earthing for DC Side, AC Side & Lightning Arrestor. The PV module structure components shall be electrically interconnected and shall be grounded. Earthing shall be done as per RE Norms,providedthatearthingconductorsshallhaveaminimumsizeof6.0mm2 copper, 10 mm2 aluminum or 25X3 hot dip galvanized steel strip. Unprotected aluminium or copper-clad aluminum conductors shall not be used for final underground connections to earth electrodes. A minimum of two separate dedicated and interconnected earth electrodes must be used for the earthing of the solar PV system support structure with a total earth resistance not exceeding 5 Ohm. Earth- pit shall be maintenance free chemical earth-pit with chemical compound and 3 meter copper electrode. The earth electrodes shall have a precast concrete enclosure with a removable lid for inspection and maintenance. The entire earthing system shall comprise non-corrosive components. PV system shall be provided with adequate rating fuses, fuses on inverter input side (DC) as well as output side (AC) side for overload and short circuit protection and disconnecting switches to isolate the DC and AC system for maintenance. Fuses of adequate rating shall also be provided in each solar array module to protect them against short circuit.

08. CABLES:-

i. Cables of appropriate size to be used in the system shall have the followingcharacteristics:

ii. All cables shall be supplied conforming to any of these standards IEC 60227/ IS 694/ IEC 60502/ IS 1554 considering the voltage rating: 1100V for AC and DC

iii. For the DC cabling, XLPE or XLPO insulated and sheathed, UV stabilized single core flexible tinned copper cables shall be used. Multi-core cables shall not beused.

iv. For the AC cabling, PVC or XLPE insulated and PVC sheathed multi-core flexible copper cables shall be used. Outdoor AC cables shall have a UV-stabilized outersheath.

v. The total voltage drop on the cable segments from the solar PV modules to the solar grid inverter shall not exceed2.0%.

vi. The total voltage drop on the cable segments from the solar grid inverter to the building distribution board shall not exceed2.0%

vii. The DC cables from the SPV module array shall run through a UV-stabilized PVC conduit pipe of adequate diameter with a minimum wall thickness of1.5mm.

viii. Cables and wires used for the interconnection of solar PV modules shall be provided with solar PV connectors (MC4) andcouplers.

ix. All cables and conduit pipes shall be clamped to the rooftop, walls and ceilings with thermo-plastic clamps at intervals not exceeding 50 cm. The minimum DC cable size shall be 4.0 mm2 copper. The minimum AC cable size shall be 4.0 mm2 copper. In three phase systems, the size of the neutral wire size shall be equal to the size of the phase wires. The following color coding shall be used for cablewires:

- DC positive: red (the outer PVC sheath can be black with a red linemarking)
- DC negative:black
- AC single phase: Phase: red; neutral:black
- AC three phase: Phases: red, yellow, blue, neutral:Black
- Earth wires:green

x. Cables and conduits that have to pass through walls or ceilings shall be taken through a PVC pipesleeve.

Cable conductors shall be terminated with tinned copper end-ferrules to prevent fraying and breakingofindividualwirestrands.TheterminationoftheDCandACcablesattheSolar Grid Inverter shall be done as per instructions of the manufacturer, which in most cases will include the use of special connectors.

xi. DC Cables inplants

- BS EN 50618: Electric cables for photovoltaic systems (BT(DE/NOT)258), mainly for DCcables
- All module interconnecting cables and those between solar module and array junction boxes shall be of flexible type. UV protected cables these shall be laid along the module mountingstructures.
- Size of interconnection for modules and from modules to inverter shall be so selected that loss would not be more than2%.
- The expected life of cables shall be not less than 30(thirty)years
- The cables shall have suitable insulation and outersheath:
- No fire propagation/flameretardant
- Low smoke emission in case offire
- Halogen-free
- High ambient temperature range -40 deg. C and +90 deg. C
- Withstand conductor temperature of 120C
- It shall have high resistance to UV, water, vapor, chemical,corrosion.

10. TOOLS & TACKLES ANDSPARES

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. The list of tools and tackles and its make, to be supplied by the Bidders, will have to be approved by SKUAST.

11. DANGER BOARDS ANDSIGNAGES

Danger boards should be provided as and where necessary as per IE Act. /IE rules as amended up to date. Three signage shall be provided one each at battery/control room, solar array area and main entry from administrative block. Text of the signage may be finalized in consultation with SKUAST.

12. FIREEXTINGUISHERS

i. The firefighting system for the proposed power plant for fire protection shall be consisting of:

- Portable fire extinguishers in the control room for fire caused by electrical short circuits. (Minimum 3Kg)
- Sand buckets in the controlroom.

ii. The installation of Fire Extinguishers should confirm to TAC regulations and BIS standards. The fire extinguishers shall be provided in the control room housing PCUs as well as on the Roof or site where the PV arrays have beeninstalled.

iii. Approved ISI and reputed makes for equipment beused.

Load Segregation and Connected Load Connected Load to the PV System should be within limits of the specifications of the Inverter/Power Conditioning System. Load Segregation is the responsibility of the EPC Contractor to suit to the capacity of the Inverter and there shall be a vertical DB for the segregated load as per the needs of the building.

OPERATION ANDMAINTENANCE

The Successful bidder shall also provide Training to staff of beneficiary institution along with providing an exhaustive O&M manual.

DRAWINGS & MANUALS

- Two sets of Engineering, Electrical drawings as are to be supplied and Installation and O&M Manual. Bidder shall provide complete technical data sheets for each equipment giving details of specifications along with make /makes in their bid with basic design of the power plant and power evacuation, synchronization along with protectionequipment.
- Approved ISI and reputed makes for equipment beused.
- For complete Electro-mechanical works, bidders shall supply complete design, details and drawings for approval to owner before initiating the installationwork.

WARRANTY:

1. The Bidder must provide guarantee which includes replacement warranty for parts and components *(such as battery, PCU, electronics, etc.)* of Solar Photovoltaic Power Plants for 5 (five) years for maintenance of SPPs. For PV modules, the replacement warranty is for 25 (twenty-five) years from the date ofsupply.

2. Bidder shall without prejudice to any other clauses of the order repair/replace the defective parts and restore the system to satisfactory working/performance within 7 days of intimation of fault without any additional cost to SKUAST within the period of warranty and shall carryout quarterly preventive maintenance of thesystems.

3. The agreement will be valid for seven years from the date of completion of thejob