

ROYAL GOVERNMENT OF BHUTAN
Department of Energy, Ministry of Energy and Natural Resources



Section V- Employer's Requirements

For

**Design and Build contract for Design, Supply, Installation, Testing and
Commissioning of Grid-Tied Rooftop Solar Photovoltaic Systems including
Remote Monitoring Device.**

July 2026

1. Background

The Department of Energy under the Ministry of Energy and Natural Resources initiated the assessment of suitable solar technologies for central schools as part of Bhutan's broader strategy to diversify renewable energy resources and strengthen national energy security.

As part of this initiative, the Department has undertaken this feasibility assessment of suitable solar technologies for 20 central schools. The primary objective of the study was to evaluate the technical feasibility and rooftop solar PV potential of selected schools while also identifying opportunities for other suitable solar applications such as solar thermal systems, mini-grids, and energy-efficient technologies.

In consultation with the Department of Education under the Ministry of Education and Skills Development, a total of 20 central schools were identified for the deployment of suitable solar technologies. Among these schools, a phased implementation approach has been proposed based primarily on the renovation schedules of the respective schools, as most central schools are currently undergoing major infrastructure upgrades, as informed by the school managements. Accordingly, the schools have been prioritized for implementation in accordance with the status of their renovation works. For the Fiscal Year 2026-27, Grid-Tied Rooftop Solar PV system will be implemented in three school viz. Chukha Central School, Shari Higher Secondary School, and Samtegang Central School.

2. Objective

The objective of this tender is to Design, Supply, Installation, Testing and Commissioning of Grid-Tied Rooftop Solar Photovoltaic Systems including Remote Monitoring Device in 3 schools viz. Shari Higher Secondary School, Chukha Central School, and Samtegang Central School. The system shall include all devices, materials and installation from Solar modules to AC distribution board.

3. Scope of Work

The Contractor shall be performing the following activities.

a) Rooftop Assessment

Just after the Notice to Commence, the Contractor shall analyze 'in situ' all factors related to roof features that may affect PV system performance, such as roof surface orientation, roof inclination, shading, and building obstructions (trees, chimneys, skylights, TV satellite, etc.) in order to design the facilities in an efficient manner and as per specifications listed below.

The rooftop assessment shall include, but is not limited to, the following aspects:

- The location of the different school buildings (Latitude, Longitude, Elevation).

- Carry out a Structural Integrity Assessment of each building proposed for the installation of the Rooftop Solar PV System prior to the detailed design and installation works. The assessment shall be undertaken by a Civil/Structural Engineer and shall verify that the existing roof structure is capable of safely supporting all additional dead, live, wind and other applicable loads imposed by the Solar PV System, including PV modules, mounting structures, cable trays and associated equipment, in accordance with the applicable building codes and structural design standards.
- Submit a Structural Integrity Assessment Report, including structural calculations, design assumptions, inspection findings, photographs, and certification by the concerned Engineer, confirming the suitability of the roof for the proposed installation. Where the assessment identifies structural deficiencies or insufficient load-bearing capacity, the contractor shall promptly notify the Employer and shall not commence installation on the affected building until an approved remedial solution has been implemented.
- Identify the usable roof area from the total area of the roof by removing the area of objects obstructing the layout of the PV panels.
- Estimate the location of the PV array on the selected building roof. More than one of the preferred sides of the roof (south) may be considered if their area is suitable for PV panel installation.
- Analyze roof orientation and roof tilt angle.
- Check the grid system connection and wires installed in the building.

b) Design SPV Rooftop Systems

The Contractor shall develop a design for each building as mentioned below. It is the responsibility of the contractor to assess the buildings structural integrity, roof condition, shading limitations, etc. to provide a design that complies with the technical specifications included in this Employer Requirement.

- Design the System to occupy the available roof areas.
- Ensure that the Solar System arrays shall not exceed the dimensions of the areas available. All proposals should provide the exact dimensions of the installed arrays so that it is clear the arrays will not exceed the allotted space.
- Provide the designs and drawings for all buildings in a school
- Ensure that a professional engineer sign and stamp the structural and the electrical drawings. One hard copy shall be submitted, as well as electronic copy of all documents. The electrical drawing should consist of Single Line Diagram (SLD) with details of string size, inverters, cables and protection at each DC & AC side before integrating to the grid.

Additionally, the Contractor shall provide design documents including the following information:

- Timeline/Project Schedule for installation in each school.
- System description.
- Equipment details and description.
- Layout of the installation for DCDB, ACDB, and inverter.
- Detailed single-line diagram based on specific recommended equipment.
- Layout of supporting equipment.
- Specifications for equipment procurement and installation. All equipment proposed shall comply the technical specifications listed in the **Annexure-I**.
- All engineering assessment and designs associated with structural and mounting details.
- Performance of equipment components, and subsystems including the efficiency rating of the proposed solar PV panels.
- Estimated production simulation, including all factors and assumptions applied to model output.
- Solar Panel datasheets.
- Inverter datasheets.

Concerning electrical wiring diagram, the Contractor shall provide the following minimum information:

- Module type and quantities.
- String configurations.
- Cable specifications - size and type.
- Over-current protective device specifications (where fitted) - type and ratings
- Array junction box locations (where applicable)
- DC isolator type, location and rating.
- Inverter complying to anti-islanding feature.
- Array over-current protective devices (where applicable) - type, location and rating.
- Details of all earth / bonding conductors - size and connection points.
- Details of any connections to an existing Lightning Protection System (LPS).
- Details of any surge protection device installed (both on AC and DC lines) to include location, type and rating.
- AC isolator location, type and rating.
- AC over current protective device location, type and rating.
- Residual current device location, type and rating (where fitted).
- Carry out detailed energy yield assessment
- Where bifacial PV modules are proposed, the Contractor shall account for the expected bifacial gain in the detailed energy yield assessment. The Contractor shall be responsible for ensuring that the proposed installation configuration enables effective utilization of rear-side irradiance.

The Contractor should identify the area for the inverter equipment that will meet the following criteria:

- Ease of maintenance and monitoring.
- Low operating losses.
- Secured location and hardware.
- Compatibility with existing facilities.

c) Design Approval

The design of the System will be subject to approval by DoE. The Contractor may not proceed with construction until designs have received approval and DoE has issued a formal Notice to Proceed for each school. The Contractor shall maintain a set of drawings for the systems, including all (DoE approved) design changes made during construction, in case they are needed. Upon completion of construction, and as condition for the performance of the acceptance test, the Contractor shall submit final design documents, including final drawings with details of PV system structural support, all roof penetrations, electrical single-line diagrams and shadow analysis. Three (3) hard copies shall be submitted, as well as electronic copy of all documents.

d) Design and approval of monitoring system

The SPV systems should be fitted with monitoring equipment capable of monitoring, analyzing, and displaying real-time and historical solar electricity generation data as per technical specification included in the **Annexure-I**. Such specifications set the minimum data that is required. The Contractor shall specify and install fully functional, web-based monitoring software for each system as outlined.

The Contractor shall also supply, install and commission the system hardware necessary for all monitoring activities. The Contractor shall demonstrate the features of the software as a DEMO to DoE for approval system/interface of monitoring during design stage.

e) Supply and Installation

The Contractor shall be required to supply all equipment, materials and labor necessary to install the SPV rooftop systems and integrate them to grid. Installation includes, but is not limited to the following:

- Mechanical Equipment and Installation.
- Furnish and install all mounting equipment for deploying modules on the roof.
- Furnish and install all solar modules, inverters and other conditioning equipment and other required materials in order to have a complete and whole system.
- Where roof penetrations are made, they shall be properly sealed and waterproofed.

- The Contractor shall design the system for the minimal house penetrations necessary to meet the wind loading of the System.
- Safely transporting, lifting, and placing all materials, equipment, and installation tools required for the Works onto the roof using appropriate methods and equipment, without causing damage to the building or its surroundings.
- Inspect and survey the structural materials and solar panels for manufacturing flaws and defects before installing.
- Inspect and survey the structure.
- Clean the work area at the job site upon completion.

The electrical installation includes, but is not limited to, the following:

- Include all necessary equipment installation and wiring for a complete and whole system.
- Furnish and install transition boxes at the end of each source circuit to transition from exterior wire on panels to conduit.
- Furnish and install equipment necessary for proper grounding and arching.
- Field wires the solar panels, arrays, etc. and install to identify sources with proper conduiting.

The Contractor is responsible to organize storage and logistics within the country.

The installations shall be undertaken by school as per the schedule agreed with DoE. More than one school can be installed at the same time in order to comply with the required timing as per agreed schedule.

f) Inspection and Testing

The contractor is responsible to conduct all the required inspection and testing as per the **Annexure-II**.

g) Miscellaneous

All item against which no brand has been mentioned must confirm to relevant international/national standards. For complete work, the contractor shall carry out the work as per the approved drawings, technical specifications, and instructions provided by the employer.

All the miscellaneous items should be packed properly for safe transportation to the project site. Electrical safety of the installations must be taken into account and all the safety rules and regulations applicable as per Electricity Regulatory Authority of Bhutan must be followed.

Annexure-I

Item No	Name of goods	Detailed technical specification and standards required
1	Solar PV Module/Panel	• The PV modules used must qualify to the latest edition of International Electrotechnical Commission (IEC) standards or equivalent Indian Standard (IS) or other international Standards. i. IEC 61215/ IS 14286: Design Qualification and Type Approval for Crystalline Silicon Terrestrial PV Modules. ii. IEC 61730-1,2: PV module safety qualification-Part 1: Requirements for Construction, Part 2: Requirements for Testing iii. IEC 61853-Part I/IS 16170-Part I: PV module performance testing and energy rating: Irradiance and temperature performance measurements, and power rating iv. IEC 62804: PV modules-Test methods for the detection of potential-induced degradation • The PV modules shall be monocrystalline silicon, half-cut cell, PERC or equivalent technology, with a minimum rated power output of 580 Wp, minimum module efficiency of 21% under STC, power tolerance of $\pm 3\%$ or better. • The module frame shall be made of corrosion resistant materials, preferably with anodized aluminum. • Other general requirement for the PV modules and subsystems shall be the following: i. PV modules shall be of the same model and power rating and shall be supplied from the same manufacturing bin to ensure uniform electrical characteristics. ii. Bidder shall provide typical I-V and P-V characteristics curves at Standard Test Conditions (STC) for the offered module model • PV module interconnections shall be made using standardized, weatherproof, touch-safe connectors (MC4 or equivalent) suitable for outdoor PV applications • Warranty: 1. Material Warranty: i. The manufacturer should warrant the solar modules to be free from the defects and/or failures specified below for a period not less than Ten years from the date of sale a. Defects and/or failures due to manufacturing b. Defects and/or failures due to quality of materials ii. The warranty must state that the malfunctioning of solar PV

		module shall be replaced by the manufacturer. The replacement solar module shall be identical to, or an improvement upon, the original design of the malfunctioning solar module. 2. Performance Warranty: - A performance warranty guarantees a solar panel installation will meet or exceed a baseline electric production output over the lifetime of the panels - Offered module shall have a power output warranty of 90% of the rated power for 10 years and, at the same time, a maximum degradation of 2.5% in the first year, and between 0.5-0.7% per year thereafter.
2	Solar PV Inverter	- The inverters should comply with following IEC standard or equivalent IS or other international Standards: - IEC 61000-3: Electromagnetic compatibility - IEC 61727 PV systems-Characteristics of the utility interface - IEC 62109-1 Part 1: Safety of power converters for use in PV power systems-General requirements, and safety of power converters for use in PV power systems. - IEC 62109-2-Part 2: Particular requirements for inverters. Safety compliance (Protective Degree IP 65 for outdoor mounting. IP 54 for indoor mounting) - IEC 62116 Test procedure of islanding prevention measures for utility-interconnected PV inverters. - Capacity of inverter shall be selected to have Pnorm ratio within 1.2 -1.3 with maximum efficiency of more than 97%. - Inverter output should be compatible with the grid frequency. - The inverter should have internal protection arrangement against any sustainable fault in feeder line and against the lightning on feeder. - Built-in meter and data logger to monitor system performance through external computer shall be provided. - The inverter shall incorporate an advanced digital control system capable of MPPT, grid synchronization, protection, fault detection, self-diagnostics, and communication with the monitoring system. - Ambient temperature considered: As per site conditions. - Humidity: 95% (non-condensing) - Protection of Enclosure: - IP-20 (Minimum) for indoor - IP-65 (Minimum) for outdoor - The Bidder shall submit the manufacturer's datasheet, installation manual, commissioning manual, grid compliance certificate, or

		manufacturer's declaration confirming that the inverter shall provide configurable grid protection settings indicated below: ○ Grid Frequency Tolerance Range: 49.9 Hz to 50.05 Hz ○ Grid Voltage tolerance: +- 6% ○ Capable to reduce generation when voltage surpasses certain threshold (i.e. +10%, to be adjustable) atomically and increase generation when it's below threshold. The inverter shall support voltage-dependent active power control (Volt-Watt function), whereby the active power output shall automatically reduce when the grid voltage exceeds a configurable threshold • The voltage threshold and corresponding power reduction curve shall be adjustable according to the requirements of Bhutan Power Corporation (BPC) • The successful Contractor shall configure these settings during commissioning and submit the final configuration records for approval. • THD:<3% • Power Factor: Up to 0.85 leading and lagging • The inverter matching is to be done using the guidance from the inverter manufacturer • Inverter shall be capable of complete automatic operation including wake-up synchronization and shutdown. • Inverter shall have provisions/features to allow interfacing with monitoring software and hardware devices and should have Wi-Fi connectivity capability. It shall be provided information about generation power for different period (hour, day, month, and year) • Inverter shall have LCD screen to display power, voltage, ampere, and energy parameter/information. • Inverter should be suitably placed in covered area on a suitable platform or concrete platform (on rubber mat) with complete safety measure • Inverter ventilation: Inverters generate heat and should be provided with sufficient ventilation. Clearance distances as guide to the Installation of PV systems specified by the manufacturer (e.g. to a heat sink) should also be observed. Inverter locations such as plant or boiler rooms, or roof spaces prone to high temperatures, should be carefully considered to avoid overheating. In addition, there should be a certain distance between the right and left sides of the back plate when installing the inverter. • Inverters should not be exposed to direct sunlight • Inverters should not get wet from rain or snow
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		• Installation of the inverter cannot be tilted too much (15 Deg. Maximum, inverter, or tilted. • Is important the performance of the inverter in high altitudes areas must be taken into account. Some brands of inverters may be less efficient in elevated areas, so check is better that with the manufacturer about those features and request a certification this test as warranty. • Inverter Warranty: Must be warranted against any manufacturing/design for a minimum period of 5 years.
3	Module Mounting Structure (MMS)	• The rooftop MMS shall be aluminum of suitable grade minimum alloy AA6063 or better. Necessary protection towards rusting needs to be provided either by coating or anodization • MMS shall be corrosion resistant and electrolytically compatible with the materials used in the module frame, its fasteners, and nuts and bolts • The fasteners used should be made up of stainless steel
4	Array Junction Box	• 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 indoor use • The JB shall be made up of Poly Carbonate/PP/ABS with dust, water and vermin proof. It should have with proper locking arrangements • DCCB 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 busbars etc. Suitable ferrules shall also have to be provided to identify interconnections.
5	DC distribution Board (DCDB)	• DCDB shall be dust and vermin proof conform having IP 65 or better protection, as per site conditions • The bus bars are made of copper of desired size • Suitable capacity miniature circuit breakers (MCB) and Molded Case Circuit Breaker (MCCB), shall be provided for controlling the DC power output to the inverter along with necessary surge arrestors.
6	AC Distribution Board (ACDB)	• AC distribution board shall control the AC power from inverter and should have necessary surge arrestors. Interconnection from ACDB to mains at LT Bus bar while in grid tied mode. • All switches and the circuit breakers, connectors should conform to IEC 60947, part I, II and III, or equivalent IS standards. • The ACDB shall be designed for minimum expected ambient extreme temperatures, as per site conditions, 100% humidity and

		dusty weather • All indoor panels will have protection of IP54 or better. All outdoor panels will have protection of IP65 or better, as per site conditions • All the 415 or 230 volts (or voltage levels as per regulations of the ERA) AC devices / equipment like bus support insulators, circuit breakers, etc., mounted inside the switchgear shall be suitable for continuous operation and satisfactory performance under the following supply conditions: i. Variation in supply voltage: as per ERA regulations ii. Variation in supply frequency: as per ERA regulations
7	Switchgear and protection	• Both AC & DC lines should have properly sized miniature circuit breakers (MCB) and surge protection devices according to the relevant standard. • The complete operation process & safety instructions should be printed on the sticker & suitably pasted on the near inverters. • All boxes/panels should be equipped with appropriate functionality, safety (including fuses, grounding, etc.) and protection • Adequate rating fuses & isolating RCD/RCCD/ELCB should be provided. • Switchgears should also ensure the trouble-free isolations of the equipment and enhance system availability by allowing more than one source to feed the load. • The proposed PV system shall include, at a minimum, one fused DC disconnect, and one fused AC disconnect for safety and maintenance concerns. • An AC disconnection switch should be installed next to the inverter.
8	Lighting/Surge arrestor and over voltage protection	• The SPV rooftop should be provided with lightening (surge arrestor) and over voltage protection. The entire space occupying solar PV array shall be suitably protected against lightning by deploying the required number of lightning arrestors. Lightning protection should be provided as per IEC 62305 standard. • Lightning protection shall be provided by the use of metal oxide varistors (MOV) and suitable earthing such that induced transients find an alternate route to earth. Protection shall meet the safety rules of the Electricity Regulatory Authority (ERA) of Bhutan. • The current carrying cable from lightning arrestor to the earth pit should have sufficient current carrying capacity according to IRC 62305.
9	Earthing	• The Contractor shall design, supply, install, test, and commission a complete earthing and bonding system for the PV installation in

	protection	accordance with IEC 60364, IEC 62548, IEC 62305 (where applicable), or the equivalent requirements of IS 3043:2018, and the applicable requirements of the BPC and ERA. • All PV module mounting structures, inverter enclosures, ACDBs, DCDBs, metallic cable trays, surge protection devices, lightning protection systems (where provided), and other exposed conductive parts shall be effectively bonded to the earthing system. • The earthing conductor shall be copper, copper-clad steel, or other approved corrosion-resistant conductor of adequate size suitable for the fault current and environmental conditions. • The completed earthing system shall achieve an earth resistance of not more than 5 Ω, unless a lower value is required by BPC/ERA or the applicable regulations. Where the required earth resistance cannot be achieved, the Contractor shall install additional electrodes or adopt other suitable measures to meet the specified value. • The Contractor shall measure and record the earth resistance upon completion and submit certified test reports as part of the commissioning documentation. • The complete earthing system should be electrically and mechanically connected to ensure an independent return path through earth. AC lines must be provided with proper earth connections and all DC grounding from the array junction boxes grounded separately to an earth.
10	AC & DC Cables & Accessories	• All cables should be of copper and should be graded as per requirement of relevant IEC/IS. • 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. • Wire losses in DC and AC circuit shall be <1.5% • UV protected solar cables must be used • AC Cables should have an operating temperature, as per site conditions. The electric cables for DC system for rated voltage of 1500 V shall conform to IS 17293:2020 • All cables must be installed inside protective conduits (RPVC) or galvanized steel cable trays and must be permanently labeled with durable identification markers so that each cable can be easily recognized during installation, inspection, maintenance, and troubleshooting.

11	Data acquisition and monitoring system	• The PV rooftop system shall include data monitoring, remote diagnosis, data storage and visualization. • The Contractor shall provide a software (web-based monitoring) able to collect data from the inverter, keeping DoE terminal informed of the system's status at any given time, including data - but not limited about: i. Site (Latitude, Longitude, Elevation, ID Building, School), ii. Generation before inverter (DC) and after inverter (AC) in kWh, voltage, current, etc. • The program shall be capable to show instantaneous and historical data. • Such system must be capable to provide information for each installation and to add different installations as needed by DoE through the dashboard installed for monitoring on a single computer at DoE premises. • The Contractor is responsible for providing data connection for each Project. Communications shall be transmitted via the most effective way in each location. • System shall display data in real time and record and log performance data at regular intervals to be agreed, over min. two years. Data could be downloaded in any moment in format compatible with MS EXCEL. • The contract shall specify the system and demonstrate the features of the software as DEMO to DoE for approval during design stage.
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Annexure-II

The following inspections and tests shall be performed:

1. Factory Acceptance Test

The factory acceptance tests shall be carried out by the manufacturer in accordance with the following table.

Component	IS/ Any other relevant equivalent standard
PV modules	IS 14286, IS 16170
PV module safety	IEC/IS 61730
Inverter	IS/IEC 62109-1, IS/IEC 62109-2, IS/IEC 61683
Anti-islanding and grid protection	IS/IEC 62116, IS/IEC 62109

Contractor shall dispatch the material, only after the successful completion of Routine Tests/Factory Acceptance Tests (FAT) and after receiving written Material Dispatch Clearance (MDC) from the Purchaser.

2. Site Inspection prior to installation of respective components

Sl. No.	Component	Inspection
1	PV Modules	Physical inspection and validation with technical datasheet provided
2	Mounting structures	Physical inspection
3	Inverter	Physical inspection and validation with technical datasheet provided
4	Bi-Directional Energy Meter	Physical inspection and validation with technical datasheet provided
5	Array Junction Box DC distribution Board (DCDB) AC Distribution Board (ACDB) Switchgear and protection Lighting/Surge arrestor and over voltage protection Earthing protection AC & DC Cables & Accessories	Physical inspection

3. Precommissioning Test

The Contractor shall undertake final inspection over installation prior to the start-up and system testing. The Contractor should check for the following:

- a) Installation matches the design documentation.
- b) Conductors, junction box, and disconnect are sized appropriately.
- c) Terminal connections and screws are securely tightened.
- d) Compliance with all technical specification specify in this bid.
- e) Equipment is securely mounted (such as modules, racking, inverters, meters, panels and disconnects and so on).
- f) Roof penetrations are properly weather sealed.
- g) Applicable warning signs and labels are posted appropriately.
- h) The job site is clean and orderly.
- i) The documentation package is complete.
- j) Attention has been paid to details such as removing tools from the site before commissioning.

4. Commissioning and Acceptance Test

Acceptance and commissioning tests shall be carried out as specified below.

The commissioning and operational acceptance test will be carried out by contractor in presence of officials from DoE and other relevant agencies that will verify each system performance. The DoE team and Contractor will review the system before grid connection. After that, and only when approved by DoE & BPC, the system will be connected to the grid for generation monitoring testing. The Contractor shall be starting up each system until it achieves the optimum performance requirements. Test will include three activities:

- Thermographic Test for PV module, Inverter, and other related components.
- Generation monitoring over a consecutive seventy-two (72) hours period.

After this test period and considering the optimum performance requirements was successful, DoE will issue a formal letter of approval as Final Acceptance Test. At the same time, the Contractor will hand the responsibilities to the owner for operation and maintenance.

Annexure-III: Bill of Quantity

A. Shari Higher Secondary School

Item	Description	Unit	Provisional Quantity	Unit Price (Nu.)	Total price (Nu)
	PLANT				
1.1	Supply and Delivery of PV Modules	Wp	158400		
1.2	Supply and Delivery of Photovoltaic Grid Inverters with a minimum total AC capacity complying with the specified DC/AC ratio.	Wp	132000		
1.3	Supply and Delivery of Mounting Structures for PV Modules	Wp	158400		
1.4	PV plant: Supply and Delivery of DC Distribution Boards (DCDBs). The DC protection system shall include all necessary isolators, surge protection devices, string combiner box with cable entry flanges, cable glands, terminal block, IP 65 [DC isolator and SPD will be installed]	No.	10		
1.5	PV plant: Supply and Delivery of AC Distribution Boards (ACDBs). The AC protection system shall include all necessary AC Isolators (MCB) to disconnect inverter, IP 65, Surge Protection Device, Type II (for AC) for inverter output, AC combiner box with cable entry flanges, cable glands, terminal block, IP 65 [AC isolator and AC SPD will be installed] and other accessories as required	No.	10		

1.6	Supply and Delivery of DC cable, UV stabilized, multi-strand XLPE PVC insulated for string cable including UV-resistant heavy-duty PVC conduit	m	150		
1.7	Supply and Delivery of AC cable from Inverter to main supply board including PVC Casing & Cappings	m	100		
1.8	PV plant: Supply and Delivery of Earthing materials, and other necessary accessories equivalent to the number of buildings with solar pv installations as approved in the design	Wp	158400		
	PV plant: Supply and Delivery of Lightning Arrestors as approved in the design	Wp	158400		
1.9	Supply and Delivery of BoS (Balance of System): All accessories such as MC4 connectors, WEEB for equipotential bonding, stainless steel cable clips	Wp	158400		
	Supply and Delivery of BoS (Balance of System): Central Remote Monitoring System	Wp	158400		
	Supply and Delivery of BoS (Balance of System): Grid connection box fitted with Type A or Type B RCD, Residual current device (RCD) or Residual Current Circuit Breaker (RCCB) type A or Type B	Wp	158400		
2	Transportation Charges	Lumpsum			
Subtotal					-

B. Chukha Central School

Item	Description	Unit	Provisional Quantity	Unit Price (Nu.)	Total price (Nu)
	PLANT				
1.1	Supply and Delivery of PV Modules	Wp	144100		
1.2	Supply and Delivery of Photovoltaic Grid Inverters with a minimum total AC capacity complying with the specified DC/AC ratio.	Wp	120083		
1.3	Supply and Delivery of Mounting Structures for PV Modules	Wp	144100		
1.4	PV plant: Supply and Delivery of DC Distribution Boards (DCDBs). The DC protection system shall include all necessary isolators, surge protection devices, string combiner box with cable entry flanges, cable glands, terminal block, IP 65 [DC isolator and SPD will be installed]	No.	14		
1.5	PV plant: Supply and Delivery of AC Distribution Boards (ACDBs). The AC protection system shall include all necessary AC Isolators (MCB) to disconnect inverter, IP 65, Surge Protection Device, Type II (for AC) for inverter output, AC combiner box with cable entry flanges, cable glands, terminal block, IP 65 [AC isolator and AC SPD will be installed] and other accessories as required	No.	14		
1.6	Supply and Delivery of DC cable, UV stabilized, multi-strand XLPE PVC insulated	m	210		

	for string cable including UV-resistant heavy-duty PVC conduit				
1.7	Supply and Delivery of AC cable from Inverter to main supply board including PVC Casing & Cappings	m	140		
1.8	PV plant: Supply and Delivery of Earthing materials, and other necessary accessories equivalent to the number of buildings with solar pv installations as approved in the design	Wp	144100		
	PV plant: Supply and Delivery of Lightning Arrestors as approved in the design	Wp	144100		
1.9	Supply and Delivery of BoS (Balance of System): All accessories such as MC4 connectors, WEEB for equipotential bonding, stainless steel cable clips	Wp	144100		
	Supply and Delivery of BoS (Balance of System): Central Remote Monitoring System	Wp	144100		
	Supply and Delivery of BoS (Balance of System): Grid connection box fitted with Type A or Type B RCD, Residual current device (RCD) or Residual Current Circuit Breaker (RCCB) type A or Type B	Wp	144100		
2	Transportation Charges	Lumpsum			
Subtotal					-

C. Samtegang Central School

Item	Description	Unit	Provisional Quantity	Unit Price (Nu.)	Total price (Nu)
	PLANT				
1.1	Supply and Delivery of PV Modules	Wp	381700		
1.2	Supply and Delivery of Photovoltaic Grid Inverters with a minimum total AC capacity complying with the specified DC/AC ratio.	Wp	318083		
1.3	Supply and Delivery of Mounting Structures for PV Modules	Wp	381700		
1.4	PV plant: Supply and Delivery of DC Distribution Boards (DCDBs). The DC protection system shall include all necessary isolators, surge protection devices, string combiner box with cable entry flanges, cable glands, terminal block, IP 65 [DC isolator and SPD will be installed]	No.	29		
1.5	PV plant: Supply and Delivery of AC Distribution Boards (ACDBs). The AC protection system shall include all necessary AC Isolators (MCB) to disconnect inverter, IP 65, Surge Protection Device, Type II (for AC) for inverter output, AC combiner box with cable entry flanges, cable glands, terminal block, IP 65 [AC isolator and AC SPD will be installed] and other accessories as required	No.	29		
1.6	Supply and Delivery of DC cable, UV stabilized, multi-strand XLPE PVC insulated	m	435		

	for string cable including UV-resistant heavy-duty PVC conduit				
1.7	Supply and Delivery of AC cable from Inverter to main supply board including PVC Casing & Cappings	m	290		
1.8	PV plant: Supply and Delivery of Earthing materials, and other necessary accessories equivalent to the number of buildings with solar pv installations as approved in the design	Wp	381700		
	PV plant: Supply and Delivery of Lightning Arrestors, as approved in the design	Wp	381700		
1.9	Supply and Delivery of BoS (Balance of System): All accessories such as MC4 connectors, WEEB for equipotential bonding, stainless steel cable clips	Wp	381700		
	Supply and Delivery of BoS (Balance of System): Central Remote Monitoring System	Wp	381700		
	Supply and Delivery of BoS (Balance of System): Grid connection box fitted with Type A or Type B RCD, Residual current device (RCD) or Residual Current Circuit Breaker (RCCB) type A or Type B	Wp	381700		
2	Transportation Charges	Lumpsum			
Subtotal					-

D. Design Services

Item	Description	Unit	Total price (Nu)		
1.1	Design & engineering of Rooftop Solar PV plant for all the three schools	Lumpsum			
Sub-Total					

E. Installation and other services

Item	Description	Unit	Total price (Nu.)		
1.1	Installation, Testing, and Commissioning of all the three schools	Lumpsum	Shari HSS	Chukha CS	Samtegang CS
subtotal					

F. Total Cost

School Name	Shari HSS	Chukha CS	Samtegang CS	Total Cost
Supply and Delivery of PV Plants				
Design Services				
Installation, Testing, and Commissioning				
Grand Total				

