

6) Programme of work:

Before actual commencement of work the contractor shall submit a programme of construction of work with methodology clearly showing the required materials, men and equipment. The contractor will submit a programme of construction in the pattern of Bar Chart or Critical Path Method and a time table divided into four equal periods of progress of work to complete the work within the specific period for approval of the Engineer-in-Charge who reserves the right to make addition, alterations and substitutions to such programme in consultation with the contractor and such approved programme shall be adhered to by the contractor unless the same is subsequently found impracticable in part or full in the opinion of the Engineer-in-Charge and is modified by him. The contractor must pray in writing, showing sufficient reasons therein for modification of programme. The conditions laid down in clause 2 of the printed tender form regarding the division of total period and progress to work and the time table there for as provided in the said clause shall be deemed to have been sufficiently complied with the actual progress of work and does not fall short of the progress laid down in the approved time table for one fourth, half and three fourth of time allowed for the work.

7) Setting out of the work:

The contractor shall be responsible for the true and perfect setting out of the work (Electrical and Civil) and for the correctness of the position, levels, dimensions and alignments of all parts of work. If any rectification or adjustment becomes necessary the contractor shall have to do the same at his own cost according to the direction of the Engineer-in-Charge. During progress of works, if any, error appears or arises in respect of position, level, dimensions or alignment of any part of the work contractor shall at his own cost rectify such defects to the satisfaction of the Engineer-in-Charge. Any setting out that may be done or checked by either of them shall not in any way relieve the contractor of his responsibility for correctness and rectification thereof.

8) Precautions during works:

The contractor shall carefully execute the work without disturbing or damaging underground or overhead service utilities viz. Electricity, Telephones, Gas, Water pipes, Sewers etc. In case disturbances of service utilities is found unavoidable the matter should immediately be brought to the notice of the Engineer-in-Charge and necessary precautionary measures as would be directed by the Engineer-in-Charge shall be carried out at the cost and expenses of the contractor. If the service utilities are damaged or disturbed in any way by the contractor during execution of the work, the cost of rectification or restoration of damages as would be fixed by the Engineer-in-Charge concerned will be recovered from the contractor.

9) Testing of qualities of materials & workmanship:

All materials and workmanship shall be in accordance with the specifications laid down in the contract and also as per M.O.R.T. & H's specification for Road and Bridge Works (Latest Revision) and relevant IS codes and the Engineer-in-Charge reserves the right to test, examine and measure the materials/workmanship direct at the place of manufacture, fabrication or at the site of works or any suitable place. The contractor shall provide such assistance, instrument, machine, labour and materials as the Engineer-in-Charge may require for examining, measuring and testing the works and quality, weight or quantity of materials used and shall supply samples for testing as may be selected and required by the Engineer-in-Charge without any extra cost. Besides this, he will carry out tests from outside Laboratory as per instruction of Engineer-in-Charge. The cost of all such tests shall be borne by the agency and that must be considered during quoting rate.

10) Timely completion of work:

All the supply and the work must have to be completed in all respects within the time specified in Notice Inviting Tender from the date of commencement as mentioned in work order. Time for completion as specified in the tender shall be deemed to be the essence of the contract.

11) Procurement of materials:

All materials including Electrical, cement and steel required to complete the execution of the work shall be supplied by the contractor after procurement from authorised and approved source.

12) Rejection of materials:

Materials brought to the site must be approved by the Engineer-in-Charge. Rejected materials must be removed by the Contractor from the site within 24 hours of the issue of order to that effect. In case of non-compliance of such order,

the Engineer-in-Charge shall have the authority to cause such removal at the cost and expense of the contractor and the contractor shall not be entitled to any claim for any loss or damage on that account.

13) Implied elements of work in items:

Except such items as are included in the Specific Priced Schedule of probable items and approximate quantities, no separate charges shall be paid for traffic control measures, shoring, shuttering, dewatering, curing etc. and the rates of respective items of works are to be deemed as inclusive of the same.

14) Force Closure:

In case of force closure or abandonment of the works by the WBTDCL the contractor will be eligible to be paid for the finished work and reimbursement of expenses actually incurred thereof by him but not for any losses.

15) Tender Rate:

The contractor should note that the tender is strictly based on the rates quoted by the Contractor on the priced schedule of probable item of work. The quantities for various other items of works as shown in the priced schedule of probable items of works are based on the drawing and design prepared by WBTDCL. If variations become necessary due to design consideration and as per actual site conditions, those have to be done by the contractor at the time of execution at the rate prescribed in the tender clause. **No conditional rate will be allowed in any case.**

16) Delay due to modification of drawing and design:

The contractor shall not be entitled for any compensation to any loss due to delays arising out of modification of the drawing, addition & alterations of specifications.

17) Additional Conditions:

A few additional conditions under special terms and conditions:

- 1) Rate quoted shall be inclusive of clearing site as per direction of the Engineer-in- Charge.
- 2) Rate quoted shall be inclusive of West Bengal Sales Tax, Income Tax, Octroi and all other duties, if any.
- 3) **Display board (Informatory) of size 150 cm X 90 cm** is to be provided at the work-site with aluminum plate hoisted on steel tubular pipe/angle post to a height of 1.5 Meter at the cost of the contractor including fitting, fixing, painting, lettering, etc. complete as per direction of Engineer-in-Charge.
- 4) The Contractor is to display caution board at his own cost as per direction of Engineer- in-Charge.
- 5) Deep excavation of trenches and left out for days shall be avoided.
- 6) Labour welfare CESS will be deducted @ 1% (one percent) of gross bill value as per rule.
- 7) The whole work will have to be executed as per drawings supplied in this connection at the tender rate.
- 8) Income Tax will be deducted from each bill of the contractor as per applicable rate and rules in force.
- 9) In accordance with the West Bengal Taxation Laws (amendment) Ordinance, 1993 amending the West Bengal Finance (Sales Tax) Act, 1994 necessary S.T / GST will be deducted as per rate in force from the bill in addition to other deduction as per extent rules.

18) Special Condition:-

- 1) Mobilization advance @ 30% (Thirty Percent) of tendered value may be given against unconditional bank guarantee from any nationalized bank is claimed.
- 2) Balance payment would be given, after completion of work.

SECTION – D

Specification of Works

1) General:

The information given hereafter is without any prejudice. The intending bidders should satisfy themselves regarding the latest conditions of the site and its surroundings by personal check and investigation.

2) Name of Work:

As mentioned in N.I.T.

3) Scope of Work:

The Work shall, interalia, broadly consist of:-

- 1) Works as mentioned in specific Priced Schedule of probable items of work.

2) Location of Worksite:

As mentioned in N.I.T.

3) Working condition:

During execution of work, contractor will remain responsible for providing unhindered passage to traffic on road adjacent to site, providing lighting and guarding arrangement during night for safety and no extra cost will be paid on this account.

It is to be noted that there will not be any electrical facility at work site. Bidder should make his own arrangement for water, necessary power of lighting, welding, running of pumps etc. and the cost for such arrangement shall be deemed to have been included in the rates quoted by the bidder.

Work shall have to be executed in accordance with the rules and regulations in vogue of Government of West Bengal and local authorities.

4) Specifications:

Details of Specifications to be followed in the Proposed Construction are given here-in-after, in the Price Schedule.

N.B. Specifications of any item of works not covered here in above shall be guided by the PWD Schedule of Rates in force at the time of N.I.T. and latest edition of relevant Indian Standard Specifications and Codes of Practice.

In case of inadvertent typographical mistake found in specific price schedule of rates / NIT / Terms & Condition, the same will be treated to be so corrected as to conform to the relevant PWD (WB) schedule of rates of building / S&P and or Technical sanction or WBF:2911_ii as the case may be.

General Manager (North)

West Bengal Tourism Development Corporation Limited.

Technical Specification

General Technical Specification for 10 Kwp solar PV Power Project with state of the art technology (rooftop) solar PV systems.

1. Introduction:-

- (i) In grid-connected solar photo-voltaic (PV) systems, solar energy is fed into the building loads that are connected to the WBSEDCL/CESC grid through a service connection with surplus energy being fed into the grid and short fall being drawn from the grid. Production of surplus energy may happen when solar energy produced exceeds the energy consumption of the building. This surplus is fed into the grid. During the night, or when during the day energy demand in the building exceeds solar energy generation, energy is drawn from the grid. Grid-connected solar PV systems have no battery storage and will not work during grid outage. For buildings with grid-connected solar PV systems, the service connection meter needs to be of the bidirectional type, whereby import kWh and export where separately recorded
- (ii) A grid-connected solar PV system consists of the solar panels, solar panels mounting structure, one or more solar grid inverters, protection devices, meters, inter connection cables and switches.
- (iii) Components and parts used in solar PV systems should conform to the BIS or IEC or other international specifications, wherever such specifications are available and applicable.

2. Quality and Workmanship:-

- (i) Solar PV modules are designed to last 25 years or more. It is therefore essential that all system components and parts, including the mounting structures, cables, junction boxes, distribution boxes and other parts also have a life cycle of at least 5 years. Therefore all works shall be undertaken with the highest levels of quality and workmanship. During inspection special attention will be given to neatness of work execution and conformity with quality and safety norms. Non-compliant works will have to be redone at the cost of the Installer.

3. System Sizing:-

As per the solar net metering orders of the West Bengal Electricity Regulatory Commission (WBSERC) of 13-11-2013, crediting of energy for the purpose of net-metering is limited to 90% of the consumed energy during a 12 month settlement period. The maximum recommended solar PV capacity for grid-connected solar PV systems is therefore a capacity that produces not more than 90% of the annual energy consumption of the building.

4. Certification:

PV Modules - Crystalline Silicon Terrestrial PV Modules IEC 61215 / IS14286. In addition, the modules must conform to IEC 61730 Part 1- requirements for construction & Part 2 - requirements for testing, for safety qualification or Equivalent IS. PV modules shall be suitable to be used in North Bengal areas.

BALANCE OF SYSTEM (BOS) ITEMS/ COMPONENTS:-

The BOS items / components of the SPV power plants/ systems deployed under the contract must conform to the latest edition of IEC/ Equivalent BIS Standards/ MNRE specifications / as specified below:

BOS Item /System	Applicable BIS /Equivalent IEC Standard Or MNRE Specifications	
	Standard Description	Standard Number
Charge Controller / MPPT		IEC 60068-2 (1,2,14,30) /
Units	Environmental Testing	Equivalent BIS Std.
Power Conditioners/	Efficiency Measurements	IEC 61683 / IS 61683

Inverters** including MPPT and Protections	Environmental Testing	IEC 60068-2 (1, 2, 14, 30) / Equivalent BIS Std. IEC 62116
Cables	General Test and Measuring Method PVC insulated cables for working voltage up to and including 1100 V and UV resistant for outdoor Installation	IEC 60227 / IS 694 IEC 60502 / IS 1554 (Pt. I & II)
Switches/Circuit Breakers /Connectors	General Requirements Connectors –safety A.C. /D.C.	IEC 60947 part I,II, III / IS 60947 Part I,II,III EN 50521
Junction Boxes Enclosures for Inverters/Charge Controllers/Luminaries	General Requirements	IP 65(for outdoor)/ IP21(for indoor) as per IEC 529

5. Specification of Solar PV Modules:-

- (i) Solar PV modules shall be of the crystalline silicon type, manufactured in India. Detailed specifications of the solar PV modules are given below:

Type	Crystalline silicon, Mono Perc.
Origin	Manufactured in India
Efficiency	$\geq 16\%$
Fill factor	$\geq 77\%$
Degradation warranty	Panel output (W_p) capacity to be $\geq 90\%$ of design nominal power after 10 years and $\geq 80\%$ of design nominal power after 25years.
Module frame	Non-corrosive and electrolytic ally compatible with the mounting structure material
Termination box	Thermo-plastic, IP 65, UV resistant
Module minimum rated power	The nominal power of a single PV module shall not be less than 400 W_p .
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	<ul style="list-style-type: none"> a) Name of the manufacturer of PV Module b) Name of the Manufacturer of Solar cells c) Month and year of manufacture (separately for solar cells and module) d) Country of origin (separately for solar cells and module) e) I-V curve for the module f) W_m, I_m, V_m and FF for the module
	Certificate j) Other relevant information on traceability of solar cells and module as per ISO 9000 standard
Power output rating	To be given for standard test conditions (STC). I-V curve of the sample module shall be submitted.
Compliance with standards and codes	IEC 61215 / IS 14286 IEC 61730 Part 1 and 2

<i>Salt Mist Corrosion Testing</i>	As per IEC 61701
<i>Modules shall be PID resistance</i>	

6. Solar PV Modules Mounting Structure:-

(i) The PV modules shall be mounted on fixed metallic structures having adequate strength and appropriate design, which can withstand the load of the modules and high wind velocities. The support structure shall be hot dip galvanized steel or aluminium.

(II) Detailed specifications for the mounting structure are given below:-

<i>Wind velocity withstanding capacity</i>	As per the IS of that area. STAAD Pro or any other authentic software report signed by structural engineer has to be provided.
<i>Structure material</i>	Hot dip galvanized steel with a minimum galvanization thickness of 85 microns or aluminum alloy.
<i>Bolts, nuts, fasteners, panel mounting clamps</i>	Stainless steel SS 304/316
<i>Mounting arrangement for RCC-flat roofs</i>	With removable concrete ballast made of pre-fabricated PCC (1:2:4), with concrete foundation of M25 grade.
<i>Mounting arrangement for metal sheet roofs</i>	Mounting directly on the sheet metal, ensuring stability and wind withstanding capacity, or penetrating the sheet metal and fixing to the sub- structure, ensuring that the roof remains water proof and ensuring stability and wind withstanding capacity.
<i>Mounting arrangement for elevated structures</i>	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.
<i>Mounting arrangement for ground installations</i>	With removable concrete ballast made of pre-fabricated PCC (1:2:4), M25 grade; assuring enough ground clearance to prevent damage of the module through water, animals and other environmental factors.
<i>Installation</i>	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.
<i>Minimum distance between roof edge and mounting structure</i>	0.3m
<i>Access for panel cleaning and maintenance</i>	All solar panels must be accessible from the top for cleaning and from the bottom for access to the module- junction box.
<i>Panel tilt angle</i>	As per the maximum generation.(22degree true south)

(ii) The prospective Installer shall specify installation details of the solar PV modules and the support structures with lay-out drawings and array connection diagrams. The work shall be carried out as per the designs approved by the Customer.

7. Solar Array Fuse:

(i) The cables from the array strings to the solar grid inverters shall be provided with DC fuse protection. Fuses shall have a voltage rating and current rating as required. The fuse shall have DIN rail mountable fuse holders and shall be housed in thermoplastic IP 65 enclosures with transparent covers.

8. Solar Grid Inverter:

(i) The solar grid inverter converts the DC power of the solar PV modules to grid-compatible AC power.

(ii) The detailed specifications of the solar grid inverter are given below.

<i>DC power input</i>	Shall be more than the panel capacity in Wp.
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<i>Total output power (AC)</i>	To match solar PV plant capacity while achieving optimum system efficiency
<i>Input DC voltage range</i>	As required for the solar grid inverter DC input.
<i>Maximum power point(MPPT) tracking</i>	Shall be incorporated
<i>Number of independent MPPT inputs</i>	2 or more
<i>Operation AC voltage</i>	Single phase 230V or Three phase 415V (+ 12.5%, -20%)
<i>Operating Frequency range</i>	47.5 – 52.5 Hz
<i>Nominal frequency</i>	50 Hz
<i>Power factor of the inverter</i>	>0.98 at nominal power
<i>Total harmonic distortion</i>	Less than 3%
<i>Built-in Protection</i>	AC high / low voltage; AC high /low frequency
<i>Anti-islanding protection</i>	As per VDE 0126-1-1, IEC 60255.5 / IEC 60255.27
<i>Operating ambient temperature range</i>	-10 °C - +60°C
<i>Humidity</i>	0 – 95% Rh
<i>Inverter efficiency</i>	>=98.2%
<i>Inverter weighted (EURO) efficiency</i>	>=95%
<i>Protection degree</i>	IP 65 for outdoor mounting, IP 54 for indoor mounting
<i>Communication interface</i>	RS 485 / Wi-Fi
<i>Safety compliance</i>	IEC 62109-1, IEC 62109-2
<i>Environmental Testing</i>	IEC 60068-2 (1,2,14,30)
<i>Efficiency Measurement Procedure</i>	IS/IEC 61683
<i>Cooling</i>	Smart Cooling
<i>Display type</i>	LCD for data display. LCD / LED for status display
<i>Display parameters to include</i>	Output power (W), cumulative energy (Wh), DC voltage (V), DC current (A), AC voltage (V), AC frequency (Hz), AC current (A), cumulative hours of operation (h).

9. DC Combiner Box:-

- (i) A DC Combiner Box shall be used to combine the DC cables of the solar module arrays with DC fuse protection for the outgoing DC cable(s) to the DC Distribution Box.

10. DC Distribution Box if any:-

- (i) A DC distribution box shall be mounted close to the solar grid inverter. The DC distribution box shall be of the thermo-plastic IP65 DIN-rail mounting type and shall comprise the following components and cable terminations:
- (ii) Incoming positive and negative DC cables from the DC Combiner Box;
- (iii) DC circuit breaker, 2 pole (the cables from the DC Combiner Box will be connected to this circuit breaker on the incoming side);
- (iv) DC surge protection device (SPD), class 2 as per IEC 60364-5-53;
- (v) Outgoing positive and negative DC cables to the solar grid inverter.
- (vi) As an alternative to the DC circuit breaker a DC isolator may be used inside the DC Distribution Box or in a separate external thermoplastic IP 65 enclosure adjacent to the DC Distribution Box. If a DC isolator is used instead of a DC circuit breaker, a

DC fuse shall be installed inside the DC Distribution Box to protect the DC cable that runs from the DC Distribution Box to the Solar Grid Inverter.

11. AC Distribution Box:-

- (i) An AC distribution box shall be mounted close to the solar grid inverter. The AC distribution box shall be of the thermo plastic IP65 DIN rail mounting type and shall comprise the following components and cable terminations:
 - Incoming 3-core / 5-core (single-phase/three-phase) cable from the solar grid inverter
 - ACCircuitbreaker,2-pole/4-pole
 - AC surge protection device (SPD), class 2 as per IEC 60364-5-53
 - Outgoing cable to the build in electrical distribution board.

12. Connection to the Building Electrical System:-

- (i) The AC output of the solar grid inverter shall be connected to the building's electrical system after the WBSEDCL/CESC service connection meter and main switch on the load side. The solar grid inverter output shall be connected to a dedicated module in the Main Distribution Board (MDB) of the building. It shall *not* be connected to a nearby load or socket point of the building. The connection to the electrical system of the building shall be done as shown in typical wiring diagram 1 in the Annexure 2
- (ii) For buildings or loads with diesel generator back up, the wiring of the solar grid inverter shall be such that the solar grid inverter *cannot* run in parallel with the diesel generator. This implies that the solar grid inverter must be connected to a distribution board on the grid side of the automatic or manual change-over switch as shown in typical wiring diagram 2 in the Annexure 2.

13. Cables:-

- (i) All cables shall be supplied conforming to IEC 60227 /IS694 & IEC 60502/ IS1554. Voltage rating: 1,100 V AC, 1,500 VDC
- (ii) For the DC cabling, XLPE or XLPO insulated and sheathed, UV stabilized single core flexible copper cables shall be used. Multi-core cables shall not be used.
- (iii) For the AC cabling, PVC or XLPE insulated and PVC sheathed single or multi-core flexible copper cables shall be used. Outdoor AC cables shall have a UV-stabilized outer sheath.
- (iv) The total voltage drop on the cable segments from the solar PV modules to the solar grid inverter shall not exceed 2.0%.
- (v) The total voltage drop on the cable segments from the solar grid inverter to the building distribution board shall not exceed 2.0%
- (vi) 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 of 1.5mm.
- (vii) Cables and wires used for the interconnection of solar PV modules shall be provided with solar PV connectors (MC4) and couplers.
- (viii) 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 4.0mm² copper. In three phase systems, the size of the neutral wire size shall be equal to the size of the phase wires. The following colour coding shall be used for cable wires:
 - (ix) DC positive: red (the outer PVC sheath can be black with a red line marking)
 - (x) DC negative: black
 - (xi) AC single phase: Phase: red; neutral: black
 - (xii) AC three phase: Phases: red ,yellow, blue ;neutral :black
 - (xiii) Earth wires: green