

Technical Compliance Sheet for 100 KW (AC) NIWE ROOF TOP, Chennai Solar PV project							
Serial No.	Tender chapter	Item	Tender Clause	Specifications	Required	Compliance Statement	Remarks
1	1	PV Modules	1.1	Technology	Crystalline Silicon- Mono PERC		
				Specifications	<ol style="list-style-type: none"> 1. Minimum 380 Wp Rated Power at STC, Minimum Efficiency of 19 % at STC , 2. Maximum Temperature Coefficient of Pmax: - 0.45%/°C, 3. Minimum 4 Bus bars, 		
				General Specifications	<ol style="list-style-type: none"> 1. PID compliant, salt mist & ammoniareistant. 2. High transmittance tempered/arc glass, (c) durable layered structure for back sheet with moisture barrier properties, elongationretention and UV resistance. 3. UV resistant Encapsulant 4. Edge tapesfor sealing are not allowed. 5. Anodized Aluminum module frames 6. The Models enlisted in ALMM list issued by MNRE 7. Resistant junction boxes with minimum three numbers of bypass diodes and two numbers of MC4 connectors, (h)IP67 degree of protection, 8. RF Identification (RFID) Tag inside themodule lamination 9. PV modules must be warranted for minimum of 10 years against all material, manufacturing defects and workmanship. 		

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1	1	PV Modules	1.1	General Specifications	10. PV modules must be warranted for linear degradation rate of power output except for first year and shall guarantee 90% of the initial rated power output at the end of 10 years and 80 % by the end of 25 years.		
		PV Modules	1.2	Standards and Certification	Copies of certificates of the following standards: IS 14286, IEC 61215 Ed.2, IEC61730-1 Ed1.2, IEC 61730-2 Ed1.1, IEC 61701 Ed.2		
2	2	(A) String Combiner Box	2.1	Technical requirements	<ol style="list-style-type: none"> As per the design requirement of Solar Array and Strings As per the design requirement of Solar Array and Strings SPD Type II 		
			2.2	General Specifications	<ol style="list-style-type: none"> Enclosure with at least IP67, Mechanical impact resistance at least IK07. 		
			2.3	Standards and Certification	Copies of certificates of the following standards: IEC 60529, IEC62262, IEC 60269-1 IEC 60269-6, IEC 61643-12, IEC 62852		
		(B) String Monitoring Unit	Parameters to be measured	String current, Bus voltage, Output current, Cabinet Temperature, DC disconnecter switch ON/OFF status, SPD operating status.			

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3	3	DC Cables	3.1	Insulation and Conductor	XLPE cable with copper conductor		
				Voltage Rating	1.1 kV DC		
			3.2	General Specifications	UV resistant, Single core, Armoured, Flame Retardant Low Smoke (FRLS), Flame Retardant Non-Corrosive (FRNC)		
			3.3	Standards and Certifications	1. DC Cable: IS 7098- Part 1		
4	4	Invertor Type /Power Conditioning Unit	4.1	Technical Requirements	<ol style="list-style-type: none"> 1. Hybrid (capable of both off-grid and On-grid mode) 2. Rated AC power 120 kVA , 3. Maximum input voltage of 1000 V DC 4. Output Voltage range 3 Phase 4 wire (415 AC) 5. Frequency 50hZ 6. Minimum Inverter efficiency of 97 %, 7. Degree of protection: IP 54 for Indoor, IP 66 for outdoor 8. Total Harmonic Distortion: < 3% at 100 % load. 		
			4.2	General specifications	<ol style="list-style-type: none"> 1. Integrated MPPT with PCU, 2. SPD Type II, 3. Standalone UPS with 2 hours backup to meet auxiliary power requirement of PCU, 4. Communication interface with SCADA 		

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4	4	Invertor Type /Power Conditioning Unit	4.3	Standards and Certifications	IEC 61683 Ed.1, IEC 61727, IEC 62109-1 Ed.1, IEC 62109-2 Ed.1, IEC 61000-6-2 Ed.2, IEC 61000-6-4 Ed.2.1, IEC 60068-2-1:2007, IEC 60068-2-2:2007, IEC 60068-2-14:2009, IEC 60068-2-30:2005, IS 16221 (Part 1): 2016, IS16221 (Part 2): 2015, IS 16169: 2014		
5	5	AC Cables	5.1	Technical Requirements	LT Cable (Inverter to NIWE Substation) XLPE insulated PVC sheathed cables.HT Cable (Inverter to NIWE substation Inter connection point)		
			5.2	General Specifications	UV resistant, Armored, Flame RetardantLow Smoke (FRLS)		
			5.3	Standards and Certifications	IS 7098-1		
			5.2.6	LT Cable	LT cable (from the inverter to LT NIWE Substation) shall be laid through the GI Tray with supports. The output of invertor LT cables should be connected to NIWE substation LT panel with required MCCB and Automatic change over switch and other necessary equipment (panels, controls, indication lamps and measurement instruments etc.,)		

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6	6	Distribution Switch gear	6.1	Technical Requirements	MCCB : 1. Rated voltage of 415V, 2. Release: Thermal magnetic/ microprocessor, 3. 4 pole type with rated insulation level of 690V. 4. 2.1 x short circuit breaking capacity		
			6.2	General Specifications	Panel of Modular type with compartmentalized construction with IP54 as per IS 2147 and outdoor protection of IP 65.		
			6.3	Standards and Certifications	IEC 61439-1, IEC 61439-2, IEC 60947-1, IEC 60947-2, IEC 60947-3, IEC 60947-4-1, IEC 60947-5-1, IEC 60947-11, IS 694, IEC 61869, IS 3043, IEC 60255		
7	7	UPS	7.1	General Specifications	1. Data/ logger/ SCADA 2. HMI of SCADA 3. Emergency Lighting 4. Inverter's Auxiliary supply 5. UPS battery backup system for minimum 2 hours.		
8	8	Earthing	8.1	Standards and Codes	IS 3043, IEEE 80, IEEE 142		
			8.2	General Specifications	1. Earth grid shall be formed consisting of a number of earth electrodes. 2. Earth electrode of high tensile low carbon with high conductivity carbon. Inspection chamber and lid shall be provided.		

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9	9	Lighting Protection System	9.0	General	<ol style="list-style-type: none"> 1. Early streamer emission air terminal as per NFC 17-102:2011. Protection level -1. 2. Highly insulated poly plastic adapter to fix the ESE air terminal with the FRP mast. 3. Down Conductor- EN 50164-2 4. EN 50164-6 or equivalent standard. 5. Earth termination system with NFC 17-102. 6. Earth electrodes EN50164-2 7. Earth enhancing compounds EN 50164-7 8. Type tests reports NFC 17-102:2011 		
10	10	SCADA	10.1	General Requirements	<ul style="list-style-type: none"> • The SCADA shall perform the following operations, which include the measurement and continuous recording at an interval of 1 minute and 10 minutes <ol style="list-style-type: none"> 1. DC bus output of SCB 2. Inverter output power, energy, voltage , current and pf 3. AC and DC side power of the inverter 4. Energy delivered to the grid in kWh 5. System frequency 6. Current and voltage of each sub array/string 7. Any other parameter considered necessary by supplier based on current prudent practice 8. SCADA should be compatible with transmitting the data to the NIWE server or any other institution as directed by NIWE. 9. Should provide a complete state of the art SCADA system with accessories for safe, reliable and efficient operation of entire solar plant and its auxiliary system. 		

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10	10	SCADA	10.4	Software Requirements	Industry standard operating systems like WINDOWS, etc. 1. MODBUS (TCP/IP, RTU, ASCII) 2. IEC 60870-5-101/104 3. Any other protocol		
11	11	List of deliverables	11.0	General	1. Solar Photovoltaic (SPV) Modules 2. String Combiner Box (SCB) & String Monitoring Unit (SMU) 3. DC Cables 4. Power Conditioning Unit 5. AC Cables 6. Distribution Switch Gear 7. Uninterrupted Power Supply (UPS) 8. Earthing Approvals 9. Lighting Protection System 10. SCADA 11. All other required materials and instruments.		
12	12	Civil Works	12.0	General Requirements	Shall conform to relevant Indian Standards such as BIS, IRC, NBC, etc.		
13	13	Module Mounting Structure (MMS)	13.1	General	1. Capable of withstanding wind load of 170km/hr. 2. Grouting material for SPV structures as per M25 (1:2:2) concrete specification. 3. If on roof top PCC foundation and bottom array to a height of 60cm from the ground.		

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13	13	Module Mounting Structure (MMS)	13.2	Galvanization	MMS structure shall be hot-dip galvanized with minimum thickness of 75 microns.		
14	14	Plant Layout	14.0	General	Project Plant Layout		
15	15	Performance Measurement Procedure	15.1	Performance Ratio	$\text{Performance Ratio} = \frac{\text{(Energy Generated (kWh) x Reference inplane irradiance (W/M2))}}{\text{(Installed capacity of the plane (kWp) x Total inplane irradiance (kWh/ M2))}}$		
16	16	Completion of Project and Penalty	16.1	Project completion	Design engineering supply, Construction, Erection, Testing, commissioning, Grid synchronization, of Hybrid Roof-Top 100 kW (AC) Mono crystalline (PERC) Solar PV Power Plant at NIWE, Chennai, Tamil Nadu with 5 years of comprehensive AMC, Warranty, insurance and O&M from the date of commissioning. 100 kW (AC) Solar m-Si (monocrystalline solar module technology- MONO PERC) PV Power Plant at National Institute of Wind Energy, Chennai, Tamil Nadu, has to be completed in all respects on or before 2 months from the date of Purchase order		
				Performance ratio (PR) Minimum 78%	The contractor shall maintain a minimum PR of 78% for the entire duration of O&M activities 5 years		
				Penalty	PR are calculated after the completion of 12 months from the Date of completion (DoC) of the SPV Power Plant. The penalties will be levied after calculating the PR at the end of every 12 th month from the Date of Completion during the O & M activates of 5 years.		

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16	16	Completion of Project and Penalty	16.2	Penalty	All the penalties to be imposed will be recovered from any due payments to the Contractor or from the performance guarantee.		
					Performance Ratio (PR)-Minimum 78% (for the entire AC capacity installed for 100 kW AC export of energy during the operation)		
					In addition, the Contractor will have to pay the penalty for non-achievement of minimum specified PR during the O&M period (5 years) as compensation calculated at a discounted factor of 9.08% (prevailing practices) as per the given formula under Clause 16.3.		
					In case if the contractor fails to pay the penalty within the stipulated time levied by NIWE, NIWE has the rights to invoke the Bank Guarantee and the customer has to accept the same.		
			16.3	Performance guarantee-based compensation for the life time of the plant after the O&M period	$COM = \sum_{n=1(6)}^{20(25)} \frac{[\frac{\sum \text{penalty amount of O\&M duration}}{\text{O\&M duration (years)}} * 1]}{(1 + \text{Discount factor}\%)^n}$		
16.4	Operation & Maintenance (O & M)	<p>Any loss of data measurements affecting PR calculations for more than 50 solar hours (sunrise to sunset) in a year</p> <ul style="list-style-type: none"> • 50-100 Hours -1% of O&M amount for that year • 100-150 hours- 3% of O&M amount for that year • >150 hours- 5% of O&M amount for that year 					

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17	17	Operation & Maintenance (O&M) Requirements	17.0	General	The Contractor shall be responsible for 5 years of comprehensive AMC, Warranty, insurance and Operation and Maintenance of the 100 kW (AC) Solar Power from the date of commissioning at the location.		
					All Indian applicable laws, including environmental protection, pollution, sanitary, employment and safety laws (Government Rules).		
					<ol style="list-style-type: none"> 1. To maximum plant capacity 2. To minimize plant downtime. 3. To optimize the useful life of all the equipment of the energy project. 		
18	18	Handing Over	18.0	O&M	At the end of 5 years, shall handover the complete system to NIWE in the best working condition.		
19	19	Staff	19.0	Power Plant Staff	Under the charge of an Engineer supported by adequate staff.		
20	20	Training	20.0	During Commissioning of plant	Training to O&M staff and Owner's technical personnel. <ol style="list-style-type: none"> 1. About nature, purpose and limitations of all plant and equipment. 2. Detailed operating instructions. 3. Normal start-up and shutdown program for the plant. 4. The emergency procedures and all related HSE issues as per the standards. 		

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21	21	Energy Meter	21.0	Energy Meter	<ol style="list-style-type: none"> 1. Supply, installation, calibration, testing and commissioning of Energy meter (3 phase 4 wire 415 AC) at NIWE substation / near by the inverter (Energy meter and other required instruments shall be borne by the contractor) for calculating the total Energy in kWh. 2. Energy meter should be compatible to transmit the data digitally to SCADA and NIWE as per NIWE requirement. 3. All type of approvals under scope of bidder. 		
22	22	General	22.0	General scope of work	<ol style="list-style-type: none"> 1. The Contractor has to make necessary arrangements for the continuous supply of deionized water to the required level of 75ppm for cleaning solar modules. 2. Solar panel shall be 100% Indian Make, and 40% of the other equipment shall be of Indian Make. 3. The Models enlisted in ALMM list issued by MNRE are only eligible to participate in the tender. 4. Bidders must visit the site at NIWE, Chennai (Monday to Friday between 9am to 5.30pm). 5. Contractor has to make arrangements for power supply for construction & commissioning of the project successfully. 6. Contractor must provide Walkway for cleaning of SPV power plant. 7. The Contractor can submit a maximum of two PV syst simulation reports using Atlas data for the project site along with technical offer. More than one PV syst report for PR of 78%. 		

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22	22	General			<p>8. Contractor should dismantle the existing structures, concrete construction and panels at their own cost. NIWE will provide the area for storage of dismantled materials.</p> <p>9. Contractor shall submit complete literature regarding Equipment/Machinery. Solar panel shall be 100% Indian Make, and 40% of the other equipment shall be of Indian Make.</p> <p>10. Supply, installation, commissioning, and handing over of the 100 kW (AC) SPV plant at the location is to be completed within the stipulated period of 2 months from the date of the Purchase Order with the technical specifications as mentioned.</p> <p>11. The contractor shall provide the necessary technical support for re-location of the solar power plant within or outside NIWE if any such request made by NIWE within 5 years for which a declaration shall be given by the contractor.</p> <p>12. Supply and installation of required Reverse Power Protection relay / unit, Zero export device (ARPC) by the contractor.</p> <p>13. 62.5 kVA and 400 kVA generator synchronization required.</p>		

* All technical details, such as, make, model, capacity, manufacturer, self-certification on Make in India (as per MNRE guideline).

* Sign and seal the all pages of tender documents

* Panels must comply with the ALMM list issued by MNRE.

* Manufactures authorization letter for Panels.

* Attach all the technical datasheets as per tender requirement.

Eligibility criteria - Bidder must submit all the above details. If not submitted along with the technical bid the bid will be rejected and will not be technically evaluated.

APPENDIX I
LIST OF ELECTRICAL /CIVIL/DOCUMENTS/DRAWINGS TO BE SUBMITTED

(Successful Bidders shall submit all Electrical & Civil Design Documents vetted by Certified Government Approved Agencies to NIWE)

Sl. No.	Document/Drawing Title
1	Design Basis Report (Annual Energy Yield for 25 Years, PV Syst Report, Shadow Analysis Report)
2	Electrical System Calculation & Parameters of PV Plant
3	DC Single Line Diagram & Capacity Calculation
4	AC Single Line Diagram
5	DC solar Cables (Module to SCB) - Sizing & Drop calculation, Schedule
6	DC solar Cables (Module to SCB) - GTP, GA, vendor document, Type Test Certificates and MQP
7	String Combiner Box - GTP, GA, Schematic Diagrams, vendor document, MQP and Type Test Certificates
8	DC Cable (SCB to Inverter) - Sizing & Drop calculation, Schedule
9	DC Cable (SCB to Inverter) - GTP, GA, vendor document, MQP and Type Test Certificates
10	DC Cables - Overall Cable Routing Layout & Trench Details
11	Inverter - GTP, GA, Schematic Diagrams, vendor document, MQP and Type Test Certificates
12	AC LT Power Cables (Inverter to LT Panel at NIWE substation)- Sizing & Drop calculation and schedule
13	AC LT Power Cables (Inverter to LT Panel at NIWE substation)- GTP, GA, vendor document, MQP and Type Test Certificates
14	UPS for control room - Sizing Calculation including Battery capacity
15	UPS - GTP, GA & vendor documents and MQP
16	DC System with Batteries - Sizing Calculation
17	DC System with Batteries - GTP, GA & vendor documents, MQP and DCDB details.
18	Lightning arrestors of PV Array - Design calculation and GTP, GA & vendor documents

19	Layout for Overall Lightning Protection
20	AC Earthing - GA and Layout (Design)
21	DC Earthing for PV Array & SCB - Design calculation, GA and Layout (Design), (Calculation)
22	AC DB - GTP, GA, vendor documents, SLD & Schematics and MQP
23	SCADA - Configuration /Architecture Diagram with list of I/O signals
24	SCADA - Vendor Documents, GA drawing & Schematics and MQP
25	Control and Communication Cables - GTP, GA and vendor documents, MQP and schedule
26	Overall plant layout
27	Lightning Arrestor foundation details
28	Module Mounting Structure - Design document

APPENDIX II

LIST OF TESTS (IEC 61215) SUGGESTED FOR SPV PANELS AT MNRE/NABL ACCREDITED LAB

Sl. No	Clause	Testing	Testing / measuring equipment material needed
1	5	Marking and documentation	- All equipment as described in clause 5 of IEC61215-1:2016 in Testing and measuring equipment list
2	11.1	Visual inspection (MQT 01)	- All equipment as described in clause 4.1 of IEC61215 2:2016 in Testing and measuring equipment list
3	11.2	Maximum power determination (MQT 02)	- All equipment as described in clause 4.2 of IEC61215-2:2016 in Testing and measuring equipment list
4	11.3	Insulation test (MQT 03)	- All equipment as described in clause 4.3 of IEC61215-2:2016 in Testing and measuring equipment list
5	11.4	Measurement of temperature coefficients (MQT04)	- All equipment as described in clause 4.4 of IEC61215-2:2016 in Testing and measuring equipment list
6	11.5	Measurement of nominal module operating temperature (NMOT) (MQT 05)	- All equipment as described in clause 4.5 of IEC61215-2:2016 in Testing and measuring equipment list
7	11.6	Performance at STC (MQT 06.1) and NMOT (MQT 06.2)	- All equipment as described in clause 4.6 of IEC61215-2 1st Edition in Testing and measuring equipment list
8	11.7	Performance at low irradiance (MQT 07)	- All equipment as described in clause 4.7 of IEC61215-2:2016 in Testing and measuring equipment list
9	11.8	Outdoor exposure test (MQT 08)	- All equipment as described in clause 4.8 of IEC61215-2:2016 in Testing and measuring equipment list
10	11.9	Hot-spot endurance test (MQT 09)	- All equipment as described in clause 4.9 of IEC61215-2:2016 in Testing and measuring equipment list
11	11.10	UV preconditioning (MQT 10)	- All equipment as described in clause 4.10 of IEC61215-2:2016 in Testing and measuring equipment list
12	11.11	Thermal cycling test (MQT 11)	- All equipment as described in clause 4.11 of IEC61215-2:2016 in Testing and measuring equipment list
13	11.12	Humidity-freeze test (MQT 12)	- All equipment as described in clause 4.12 of IEC61215-2:2016 in Testing and measuring equipment list