

BILL OF QUANTITIES (BOQ) - INDUSTRIAL/UTILITY SCALE SOLAR PV PROJECT

Project Name: _____

Project Location: _____

Project Capacity: _____ MWp / MWac

Grid Interconnection Voltage: _____ kV

Date: _____

Prepared By: _____

1. DC SIDE COMPONENTS

1.1 Solar PV Modules

S.No	Description	Specification	Unit	Quantity	Unit Rate	Total Amount
1.1.1	Solar PV Modules	Bifacial Mono PERC/TOPCon, W , Efficiency \geq %	Nos			
1.1.2	Module Spare (2% of total)	Same specification	Nos			

1.2 Module Mounting Structure (MMS) - Fixed/Tracker

S.No	Description	Specification	Unit	Quantity	Unit Rate	Total Amount
1.2.1	MMS Foundation	RCC/Ramming/Screw pile	Nos/MT			
1.2.2	Vertical Posts	HDG Steel, C-channel/I-section	MT			
1.2.3	Purlins/Rails	HDG Steel, C-channel	MT			
1.2.4	Module Mounting Clamps	SS/Aluminum, End & Mid	Nos			
1.2.5	Tracker System (if applicable)	Single axis, $\pm 60^\circ$	Sets			
1.2.6	Tracker Controller	With backup power	Nos			
1.2.7	Tracker Motors & Actuators	IP65 rated	Sets			
1.2.8	Fasteners & Hardware	HDG/SS grade 8.8	MT			
1.2.9	Structure Earthing Materials	GI strip, clamps	LS			

1.3 DC Cables & Accessories

S.No	Description	Specification	Unit	Quantity	Unit Rate	Total Amount
1.3.1	DC Cable (String level)	4/6 mm ² Solar cable, 1.5kV	km			
1.3.2	DC Cable (Combiner to Inverter)	95/120/150/185 mm ² XLPE, 1.5kV	km			
1.3.3	DC Cable (for Trackers)	16/25 mm ² XLPE	km			
1.3.4	MC4 Connectors	Original, 1500V DC	Pairs			
1.3.5	Y-Connectors	MC4 compatible	Pairs			
1.3.6	Cable Laying Materials	Sand, Bricks, Tiles	LS			
1.3.7	Cable Marking Materials	Tags, ferrules	LS			

1.4 String Combiner Boxes (SCB)

S.No	Description	Specification	Unit	Quantity	Unit Rate	Total Amount
1.4.1	SCB Enclosure	IP65, Thermoplastic, 16/24 string	Nos			
1.4.2	String Fuses	20/25A, 1500V DC	Nos			
1.4.3	Fuse Holders	1500V DC rated	Nos			
1.4.4	DC SPD	Type 1+2, 1500V DC	Nos			
1.4.5	String Monitoring	Current & voltage monitoring	Nos			
1.4.6	DC Disconnecter	1500V DC, motorized	Nos			
1.4.7	Bus Bars & Accessories	Tinned copper	Set			

1.5 DC Distribution System

S.No	Description	Specification	Unit	Quantity	Unit Rate	Total Amount
1.5.1	Array Junction Boxes	For parallel combining	Nos			
1.5.2	DC Isolators	1500V, ___A	Nos			
1.5.3	Recombiner Boxes	If required	Nos			

2. POWER CONVERSION SYSTEM

2.1 Inverter Station

S.No	Description	Specification	Unit	Quantity	Unit Rate	Total Amount
2.1.1	Central/String Inverters	___MW, 1500V DC input	Nos			
2.1.2	Inverter Container/Housing	With HVAC, 40ft	Nos			
2.1.3	LV Transformer (if required)	Inverter auxiliary supply	Nos			
2.1.4	Inverter Protection System	DC/AC protection panels	Set			
2.1.5	Inverter SCADA Integration	Communication equipment	LS			

2.2 MV Transformer Station

S.No	Description	Specification	Unit	Quantity	Unit Rate	Total Amount
2.2.1	Step-up Transformer	0.69/___kV, ___MVA, ONAN/ONAF	Nos			
2.2.2	Transformer Foundation	RCC with oil pit	Nos			
2.2.3	HV Bushings & Arrestors	___kV rated	Set			
2.2.4	Neutral Grounding Resistor	If required	Nos			
2.2.5	Oil Testing Kit	Portable	Nos			

2.3 Medium Voltage Switchgear

S.No	Description	Specification	Unit	Quantity	Unit Rate	Total Amount
2.3.1	Ring Main Unit (RMU)	___kV, SF6/Vacuum	Nos			
2.3.2	MV Switchgear Panel	Metal clad, ___kV	Nos			
2.3.3	Circuit Breaker	VCB/SF6, ___A, ___kV	Nos			
2.3.4	Protection Relays	Numerical, multifunctional	Nos			
2.3.5	CT & PT for Metering	___kV, accuracy class 0.2	Sets			

3. AC COLLECTION SYSTEM

3.1 LV AC Cables (690V)

S.No	Description	Specification	Unit	Quantity	Unit Rate	Total Amount
3.1.1	LV Power Cable	3.5C x ___mm ² XLPE/XLPO	km			
3.1.2	Cable Termination Kits	Heat shrink/Cold shrink	Sets			
3.1.3	Cable Jointing Kits	Straight through	Sets			

3.2 MV AC Cables (11/22/33kV)

S.No	Description	Specification	Unit	Quantity	Unit Rate	Total Amount
3.2.1	MV Power Cable	3C x ___mm ² XLPE, ___kV	km			
3.2.2	Cable Termination Kits	Outdoor/Indoor type	Sets			
3.2.3	Cable Jointing Kits	Straight/Transition	Sets			
3.2.4	Cable Fault Locator	Portable	Nos			

3.3 Cable Laying & Management

S.No	Description	Specification	Unit	Quantity	Unit Rate	Total Amount
3.3.1	Cable Trenching	1.2m depth	km			
3.3.2	Cable Trays (Plant room)	HDG, ladder type	m			
3.3.3	RCC Hume Pipes	For road crossing	m			
3.3.4	Warning Tape	"Danger" printed	km			
3.3.5	Route Markers	RCC/FRP	Nos			

4. GRID INTERCONNECTION & SUBSTATION

4.1 Main Substation Equipment

S.No	Description	Specification	Unit	Quantity	Unit Rate	Total Amount
4.1.1	Power Transformer	___/___ kV, ___ MVA	Nos			
4.1.2	HV Circuit Breaker	___kV, SF6/Vacuum	Nos			
4.1.3	Isolators	___kV, motorized	Sets			
4.1.4	Current Transformer	___kV, metering + protection	Nos			
4.1.5	Potential Transformer	___kV, metering + protection	Nos			
4.1.6	Lightning Arrestor	___kV, gapless	Nos			
4.1.7	Wave Trap (if required)	___kV rated	Nos			

4.2 Control & Relay Panel

S.No	Description	Specification	Unit	Quantity	Unit Rate	Total Amount
4.2.1	Control & Relay Panel	Simplex/Duplex	Nos			
4.2.2	Distance Protection Relay	Numerical	Nos			
4.2.3	Differential Protection	Transformer/Line	Nos			
4.2.4	SCADA RTU	IEC 61850 compatible	Nos			
4.2.5	GPS Time Synchronization	Master clock	Set			

4.3 Substation Auxiliary

S.No	Description	Specification	Unit	Quantity	Unit Rate	Total Amount
4.3.1	Station Transformer	___kVA, ___/0.433kV	Nos			
4.3.2	LT Distribution Panel	With AMF	Nos			
4.3.3	DG Set	___kVA, with AMF	Nos			
4.3.4	Battery Bank	110/220V DC, ___AH	Set			
4.3.5	Battery Charger	Float cum boost	Nos			
4.3.6	DC Distribution Board	With monitoring	Nos			

4.4 Transmission Line (if applicable)

S.No	Description	Specification	Unit	Quantity	Unit Rate	Total Amount
4.4.1	Transmission Towers	___kV, lattice type	Nos			
4.4.2	Conductors	ACSR/AAAC ___sq.mm	km			
4.4.3	Ground Wire	OPGW/Earth wire	km			
4.4.4	Insulators	Disc/Polymer type	Nos			
4.4.5	Tower Foundation	RCC	Nos			

5. EARTHING & LIGHTNING PROTECTION

5.1 Plant Earthing System

S.No	Description	Specification	Unit	Quantity	Unit Rate	Total Amount
5.1.1	Equipment Earthing	50x6mm GI Strip	km			
5.1.2	Earthing Grid	40x6mm GI Strip	km			
5.1.3	Earth Electrodes	CI pipe, 100mm dia, 3m	Nos			
5.1.4	Earth Enhancement Material	Bentonite/GEM	MT			
5.1.5	Earth Pit Chambers	With cover plate	Nos			
5.1.6	Exothermic Welding	Molds and powder	Sets			

5.2 Lightning Protection System

S.No	Description	Specification	Unit	Quantity	Unit Rate	Total Amount
5.2.1	Lightning Masts	15-20m height	Nos			
5.2.2	Air Terminals	Franklin rod type	Nos			
5.2.3	Down Conductors	70mm ² Aluminum	km			
5.2.4	Equipotential Bonding	At inverter/transformer	LS			

6. MONITORING & CONTROL SYSTEM

6.1 SCADA System

S.No	Description	Specification	Unit	Quantity	Unit Rate	Total Amount
6.1.1	SCADA Server	Redundant, industrial PC	Set			
6.1.2	SCADA Software	Licensed, unlimited tags	Nos			
6.1.3	Operator Workstation	With dual monitors	Nos			
6.1.4	Network Equipment	Managed switches, routers	Set			
6.1.5	Firewall	Industrial grade	Nos			
6.1.6	UPS for SCADA	10kVA, 30 min backup	Nos			

6.2 Weather Monitoring Station

S.No	Description	Specification	Unit	Quantity	Unit Rate	Total Amount
6.2.1	Pyranometer	Class A, with tracker	Nos			
6.2.2	Module Temperature Sensor	PT100	Nos			
6.2.3	Ambient Temperature	With radiation shield	Nos			
6.2.4	Wind Speed & Direction	Ultrasonic type	Nos			
6.2.5	Rain Gauge	Tipping bucket	Nos			
6.2.6	Data Logger	With remote transmission	Nos			
6.2.7	Reference Cell	Calibrated	Nos			
6.2.8	Soiling Station	With measurement	Nos			

6.3 Security System

S.No	Description	Specification	Unit	Quantity	Unit Rate	Total Amount
6.3.1	CCTV Cameras	IP66, IR, 4MP minimum	Nos			
6.3.2	PTZ Cameras	For perimeter	Nos			
6.3.3	NVR System	With ___TB storage	Set			
6.3.4	Perimeter Intrusion System	Fence mounted sensors	km			
6.3.5	Access Control System	Biometric/RFID	Sets			
6.3.6	Security Cabin Equipment	Monitors, controls	LS			

6.4 Communication System

S.No	Description	Specification	Unit	Quantity	Unit Rate	Total Amount
6.4.1	Optical Fiber Cable	24 core, armored	km			
6.4.2	OFC Accessories	Joint boxes, pigtails	Set			
6.4.3	Wireless Communication	If required	Set			
6.4.4	RTU/Data Concentrators	At field level	Nos			

7. CIVIL & GENERAL WORKS

7.1 Site Development

S.No	Description	Specification	Unit	Quantity	Unit Rate	Total Amount
7.1.1	Land Grading & Leveling	Cut/fill as required	m ³			
7.1.2	Boundary Wall/Fencing	2.4m height, with gates	km			
7.1.3	Internal Roads	WBM/Concrete	km			
7.1.4	Storm Water Drains	RCC/Masonry	km			
7.1.5	Culverts	At road crossings	Nos			

7.2 Buildings & Structures

S.No	Description	Specification	Unit	Quantity	Unit Rate	Total Amount
7.2.1	Control Room Building	With HVAC	m ²			
7.2.2	Inverter Room	If indoor type	m ²			
7.2.3	Warehouse/Store	For spares	m ²			
7.2.4	Security Cabin	At entry gates	Nos			
7.2.5	Switchyard Control Room	Fire resistant	m ²			

7.3 Other Civil Works

S.No	Description	Specification	Unit	Quantity	Unit Rate	Total Amount
7.3.1	Cable Trenches	RCC with covers	km			
7.3.2	Equipment Foundations	For transformers/inverters	m ³			
7.3.3	Water Storage Tank	50,000L capacity	Nos			
7.3.4	Septic Tank & Soakpit	For building utilities	Set			
7.3.5	Landscaping	Around buildings	m ²			

8. FIREFIGHTING & SAFETY SYSTEM

8.1 Firefighting Equipment

S.No	Description	Specification	Unit	Quantity	Unit Rate	Total Amount
8.1.1	Fire Extinguishers	CO2/ABC Powder, 6kg	Nos			
8.1.2	Fire Hydrant System	Complete with pumps	Set			
8.1.3	Water Sprinkler System	For buildings	m ²			
8.1.4	Fire Detection System	Smoke/heat detectors	Set			
8.1.5	Fire Alarm Panel	Addressable type	Nos			
8.1.6	Emergency Lighting	LED, battery backup	Nos			

8.2 Safety Equipment

S.No	Description	Specification	Unit	Quantity	Unit Rate	Total Amount
8.2.1	First Aid Kits	Industrial type	Nos			
8.2.2	Safety Shower & Eye Wash	Stainless steel	Sets			
8.2.3	Warning Signs & Boards	Multi-language	LS			
8.2.4	Safety Barriers	For restricted areas	m			
8.2.5	Personal Protective Equipment	Helmets, gloves, safety shoes	LS			

9. POWER QUALITY & GRID COMPLIANCE

9.1 Power Quality Equipment

S.No	Description	Specification	Unit	Quantity	Unit Rate	Total Amount
9.1.1	Power Quality Analyzer	Class A, IEC 61000-4-30	Nos			
9.1.2	Harmonic Filter	If required	Set			
9.1.3	Reactive Power Compensation	STATCOM/SVC if required	Set			
9.1.4	Power Factor Correction	Capacitor banks	kVAR			

9.2 Grid Compliance Equipment

S.No	Description	Specification	Unit	Quantity	Unit Rate	Total Amount
9.2.1	Anti-Islanding Relay	IEEE 1547 compliant	Nos			
9.2.2	Frequency Relay	Over/Under frequency	Nos			
9.2.3	Voltage Relay	Over/Under voltage	Nos			
9.2.4	Synchroscope	For synchronization	Nos			

10. TESTING & COMMISSIONING

10.1 Testing Equipment

S.No	Description	Specification	Unit	Quantity	Unit Rate	Total Amount
10.1.1	Earth Tester	Digital, 4-pole method	Nos			
10.1.2	Insulation Tester	5kV, digital	Nos			
10.1.3	Multimeter	True RMS, CAT IV	Nos			
10.1.4	Oscilloscope	4-channel, 100MHz	Nos			
10.1.5	Power Analyzer	3-phase, harmonics	Nos			
10.1.6	High Pot Tester	AC/DC, 100kV	Nos			

10.2 Commissioning Services

S.No	Description	Specification	Unit	Quantity	Unit Rate	Total Amount
10.2.1	Pre-commissioning Tests	Visual, mechanical, electrical	LS			
10.2.2	Performance Testing	Grid code compliance	LS			
10.2.3	SCADA Testing	Communication protocols	LS			
10.2.4	Protection System Testing	Primary/secondary injection	LS			
10.2.5	Performance Ratio Test	As per IEC 61724	LS			

11. OPERATION & MAINTENANCE

11.1 O&M Equipment

S.No	Description	Specification	Unit	Quantity	Unit Rate	Total Amount
11.1.1	Module Cleaning Equipment	Water fed/Robotic	Set			
11.1.2	Thermal Imaging Camera	For inspection	Nos			
11.1.3	I-V Curve Tracer	For module testing	Nos			
11.1.4	Irradiance Meter	Portable	Nos			
11.1.5	Tracker Maintenance Tools	Specialized kit	Set			

11.2 Spare Parts (2 Years)

S.No	Description	Specification	Unit	Quantity	Unit Rate	Total Amount
11.2.1	String Fuses	20/25A, 1500V DC	Nos			
11.2.2	DC Contactors	For combiner boxes	Nos			
11.2.3	Protection Relays	5% of total	Nos			
11.2.4	HV Fuses	For transformers	Nos			
11.2.5	Cable Joints	Emergency stock	Sets			
11.2.6	Inverter Cooling Fans	Replacement	Nos			
11.2.7	Tracker Drive Components	Motors, gears	Set			

12. ENVIRONMENTAL & MISCELLANEOUS

12.1 Environmental Monitoring

S.No	Description	Specification	Unit	Quantity	Unit Rate	Total Amount
12.1.1	Noise Level Meter	Class 1, digital	Nos			
12.1.2	Water Quality Testing Kit	pH, conductivity	Set			
12.1.3	Dust Measurement	PM2.5/PM10	Nos			
12.1.4	Bird Protection System	Anti-perching devices	LS			

12.2 Project Management

S.No	Description	Specification	Unit	Quantity	Unit Rate	Total Amount
12.2.1	Project Management	Complete project duration	LS			
12.2.2	Design & Engineering	Detailed engineering	LS			
12.2.3	Statutory Approvals	CEA, CEIG, Pollution Board	LS			
12.2.4	Insurance	EAR/CAR policy	LS			
12.2.5	Training	Operation & maintenance	LS			

12.3 Documentation

S.No	Description	Specification	Unit	Quantity	Unit Rate	Total Amount
12.3.1	As-built Drawings	CAD drawings, 3 copies	Set			
12.3.2	Operation Manuals	Equipment manuals	Set			
12.3.3	Test Certificates	All equipment	Set			
12.3.4	Warranty Certificates	25 years for modules	Set			

SUMMARY

S.No	Major Components	Total Amount	% of Total
1	DC Side Components		
2	Power Conversion System		
3	AC Collection System		
4	Grid Interconnection & Substation		
5	Earthing & Lightning Protection		
6	Monitoring & Control System		
7	Civil & General Works		
8	Firefighting & Safety System		
9	Power Quality & Grid Compliance		
10	Testing & Commissioning		
11	Operation & Maintenance		
12	Environmental & Miscellaneous		
	TOTAL PROJECT COST		100%

TERMS & CONDITIONS:

1. All rates are inclusive of material, labor, transportation, taxes, and duties as applicable
2. Performance guarantee: 25 years for modules, 10-20 years for inverters
3. Warranty: As per manufacturer's standard warranty terms
4. Price validity: 60 days from date of quotation
5. Payment terms: As per contract agreement
6. Delivery period: ___ months from date of award
7. Performance ratio guarantee: $\geq 85\%$ at STC conditions

8. Grid code compliance: As per Central/State Electricity Regulatory Commission

Prepared by: _____

Signature: _____

Date: _____

Reviewed by: _____

Signature: _____

Date: _____