

- 4.3 Installation, Testing and Commissioning of String Monitoring Units.
- 4.4 Installation, Testing and Commissioning of Power Conditioning Units.
- 4.5 Installation, Testing and Commissioning of data acquisition system.
- 4.6 Earthing and lightning protection system of PV Modules, Module Mounting Structures, PCU, switchgear panels and all other electrical equipment.
- 4.7 Pre-commissioning checks and tests for all equipment.
- 4.8 Synchronization and Commissioning of plant as per DISCOM / TRANSCO requirements.
- 4.9 Any other works related to installation, testing and commissioning not mentioned but required to complete the Solar Power Plant facilities in all respect.

5.0 CIVIL WORK

- 5.1 Earthwork for site as required.
- 5.2 Construction of foundation for Module Mounting Structures (MMS) and erection of MMS.
- 5.3 Construction of foundation for lightning mast, lighting poles as required.
- 5.4 Construction of plumbing network for cleaning of PV Modules including O&M period.
- 5.5 Roof treatment shall be done by the bidder to ensure that no seepage occurs from the roof due to the installation of roof-top solar power plant.
- 5.6 All approvals, equipment, items and works, which are not otherwise specifically mentioned in this document but are required for successful completion of the work in all aspects, including construction, commissioning, O&M of Solar PV Power Plant and guaranteed performance are deemed to be included in the scope of the contractor.

6.0 STATUTORY APPROVAL

- 6.1 Obtaining statutory approvals / clearances / compliances on behalf of the Employer from various Government Departments, not limited to, the following:
 - Pollution control board clearance, if required
 - Mining Department, if required
 - Forest Department, if required
 - All other approvals as and when necessary for setting up of a solar power plant, power evacuation, railways, power line crossing, panchayat, NHAI etc. as per the suggested guidelines.
- 6.2 All statutory approvals / permissions and/or No Objection Certificates (NoC) etc. from DISCOM / TRANSCO for obtaining connectivity at the substation as per Project Particulars provided above.
- 6.3 All other statutory approvals and permissions and their respective compliances, not mentioned specifically but are required to carry out hassle free Construction and O&M of the plant.

- 6.4 Adequate and seamless insurance coverage during EPC and O&M period to mitigate all risks related to construction and O&M of the plant to indemnify the Employer.
- 6.5 The Contractor shall comply with the provision of all relevant acts of Central or State Governments including payment of Wages Act 1936, Minimum Wages Act 1948, Employer's Liability Act 1938, Workmen's Compensation Act 1923, Industrial Dispute Act 1947, Maturity Benefit Act 1961, Mines Act 1952, Employees State Insurance Act 1948, Contract Labour (Regulations & Abolishment) Act 1970, Electricity Act 2003, Grid Code, Metering Code, MNRE guidelines or any modification thereof or any other law relating thereto and rules made there under or amended from time to time.

7.0 OPERATION AND MAINTENANCE

- 7.1 Total Operation & Maintenance of the SPV Plant shall be with the Contractor, after operational acceptance of the plant till culmination of the O&M period. No other extra charges whatsoever will be paid later on during O&M Period.
- 7.2 To maintain accurate and up-to-date operating logs, records and monthly Operation & Maintenance reports at the facility. Contractor shall keep the measured daily data at regular intervals and provide the same to Employer in electronic form, compatible in CSV format. The right to use the data shall remain with the Employer.
- 7.3 Breakdown maintenance, Preventive maintenance to maximize the availability of the solar power plant.
- 7.4 Cleaning of the module regularly but not less than 2 times in a month.
- 7.5 Bidder is required to maintain the spare during the O&M contract period of the solar power plant so that to maximize availability and generation of the plant.
- 7.6 Replacement of spares shall be as per the OEM recommendations. Equipment/spare parts/updation of software being phased out or not being supported by OEM's is also included in bidder's scope.
- 7.7 To carry out periodic overhauls or maintenance required as per the recommendations of the original equipment manufacturer (OEM) and to furnish all such periodic maintenance schedules at the time of plant commissioning/ start of O&M contract.
- 7.8 The contractor shall ensure that all safety measures are taken at the site to avoid accidents to his employees associated in the project. The Contractor shall immediately report the accidents, if any, to the Engineer in charge and all the concerned authorities as per prevailing laws of the state.
- 7.9 The Contractor shall comply with the provision of all relevant Acts of Central or State Governments including payment of Wages Act 1936, Minimum Wages Act 1948, Maturity Benefit Act 1961, Employer's Liability Act 1938, Workmen's Compensation Act 1923, Industrial Dispute Act 1947, Employees State Insurance Act 1948, Contract Labour (Regulations & Abolishment) Act 1970 or any modification thereof and rules made there under from time to time.

- 7.10 Contractor shall be responsible to carry out all test and work as per statutory requirement.
- 7.11 Arrangement of water pipeline and pipes etc. shall be done by the contractor on his own cost from the nearby existing water availability points.
- 7.12 The contractor shall at his own expense provide all amenities to his workmen as per applicable laws and rules.
- 7.13 If negligence / mal operation of the contractor's operator results in failure of equipment, such equipment should be repaired/replaced by the contractor free of cost.
- 7.14 Any damage due to mishandling by the person deputed by the Contractor shall have to be restored back to its original condition by the Contractor at their own cost.
- 7.15 Maintenance, repair/replacement & up keeping of all necessary protections like lightning protection, surge protection, earthing protection, grid islanding etc. which are provided there for the protection of the plant and different equipment associated with it. Any parts/consumables for these protection systems is in the scope of work of Comprehensive Operation and maintenance of the plant
- 7.16 Any other activities required for completion of project, but not specified in the above shall be in the scope of contractor. The Contractor must provide the BOM of the plant as per the design during the time of submission of design basis report. The detailed technical specifications of major equipment to be followed strictly and are described in the technical specification section.

CHAPTER-III

SYSTEM DESCRIPTION

1.0 SYSTEM DESCRIPTION AND GENERAL ARRANGEMENT

1.0.1 860 kWp Roof top and 160 kWp Ground Mounted Solar Power Plant

Total installed capacity at the proposed locations shall be minimum 1020 kWp. The aggregate capacity of solar inverter capacity shall be 1020 kW with a variation of -5% to +10 %. However, individual inverter capacity will be based on the installed capacity of solar at the proposed locations. The mono crystalline module of capacity 535Wp (min) shall be used for roof top installation of solar power plant. Modules alignment and tilt angle shall have to be calculated by the bidder to provide the maximum annual energy output. The height of support structure shall be such that there shall be sufficient clearance for solar PV array to remain shadow free, prevent shadow of front structures to fall onto the one installed behind. The row space would also allow easy access to array for cleaning and repairs.

The proposed installed capacity (rooftop and ground mounted) is based on the available data of the projects. However, location wise capacity may vary during detailed design.

1.0.2 Various locations for roof top installations are given below.

1.0.2.1 Barka-Sayal Area, Ramgarh, Jharkhand

Five locations have been identified for installation of roof-top solar power plants in Barka-Sayal Area of CCL. Total installed capacity in Barka-Sayal Area will be approximately 378kWp. The proposed locations, its coordinate and approximate installed capacities are given below.

Sl. No.	Location	Co-ordinate (Latitude-Longitude)	Installed Capacity(kWp) (Approx.)
1.	P.O. office, Urimari OCP	23°41'29.87"N - 85°18'5.66" E	79
2.	P.O. office, Birsa OCP	23°41'53.22"N- 85°18'40.41"E	36
3.	Executive Hostel, Urimari	23°41'24.99"N - 85°18'4.91"E	52
4.	AKC Hospital, Bhurkunda	23°39'21.00"N - 85°21'4.86"E	101
5.	DAV School, Urimari	23°41'54.86"N- 85°18'44.00"E	110

1.0.2.2 Ramgarh Area, Ramgarh, Jharkhand

Four locations have been identified for installation of roof-top solar power plants in Ramgarh Area of CCL. Total installed capacity in Ramgarh Area will be approximately 394kWp. The proposed locations, its coordinate and approximate installed capacities are given below.

Sl. No.	Location	Co-ordinate (Latitude-Longitude)	Installed Capacity(kWp) (Approx.)
1.	Central Hospital, Naisarai	23°38'49.94"N - 85°30'37.86"E	237
	a) Old Building b) Surgical Block Building		75
2.	Mine Rescue Station, Naisarai	23°38'42.29"N - 85°30'35.42"E	46
	a) Main Office Building b) Water Treatment Plant		36

1.0.2.3 Barkakana CWS, Ramgarh, Jharkhand

Two locations have been identified for installation of roof-top solar power plants in Barkakana CWS Ramgarh Area of CCL. Total installed capacity in Barkakana CWS, Ramgarh Area will be approximately 88kWp. The proposed locations, its coordinate and approximate installed capacities are given below.

Sl. No.	Location	Co-ordinate (Latitude-Longitude)	Installed Capacity(kWp) (Approx.)
1.	Regional Store, Central Store	23°37'20.43"N - 85°27'22.74"E	40
2.	JET Hostel, Central Workshop	23°37'13.85"N - 85°27'18.61"E	48

1.0.3 Ground mounted solar power plant at Mine Rescue Station, Ramgarh, CCL

Beside the rooftop locations as mention above the following locations have been identified for installation of ground mounted solar power plants Mine Rescue Station, Ramgarh of CCL.

Sl. No.	Location	Co-ordinate (Latitude-Longitude)	Installed Capacity(kWp) (Approx.)
1.	Back Side of Community Hall at MRS	23°38'37.63"N - 85°30'37.20"E	114
2.	Back Side of Guest House at MRS	23°38'45.36"N - 85°30'35.61"E	26
3.	Near Switch-room at MRS	23°38'43.49"N - 85°30'34.16"E	20

1.0.4 Plant Layout and System Requirement

1.0.4.1 The electrical design of the plant can be split into the DC and AC systems with DC system comprising of Array(s) of PV modules, Inverters, DC cabling (module, string and main cable), DC connectors (plugs and sockets), Junction boxes/combiners, Disconnects/switches, protection devices, earthing. The AC system includes AC cabling, switchgear, earthing and lightning protection.

Based on optimum utilization of the area, monocrystalline type PV panel of capacity 535 Wp (minimum) has been selected. To maximize the output, these PV modules will be installed facing true south direction. Total plant capacity of the plant has been envisaged to be 1020 kWp.

1.0.4.2 The DC Power generated from the DC Field shall be converted into AC power by using solar inverters. Power generated from the respective locations shall be fed to the existing power supply arrangement in the associated buildings or nearby suitable switchboard. A 415V/230V switchboard panel shall be installed/existing for this purpose which will integrate solar power plant with existing grid.

1.0.4.3 In the event of a power failure on the electric grid, it is required that any independent power producing inverter attached to the grid shall be turns off. This prevents the DC-to-AC inverters from continuing to feed power into small sections of the grid, known as "islands." The Rooftop PV system shall be equipped with islanding protection. In addition to disconnection from the grid (due to islanding protection) disconnection due to under and over voltage conditions shall also be provided.

A manual disconnect 4 pole isolation switch beside automatic disconnection to grid shall also to be provided at utility end to isolate the grid connection by the utility personnel to carry out any maintenance. This switch shall be locked by the utility personnel. Relevant Standards shall be as follows: IEC 62305 IS:3043-1987

1.0.4.4 The monitoring, data processing & upkeeping of Data Acquisition System (DAS) of the solar plant including communication/data transfer devices attached with the inverters, wi-fi device router and keeping all parameter of DAS system functional and calibrated as per the standards are in the scope of this tender. Reports of each month generation shall be submitted quarterly by the contractor.

1.0.4.5 The array structures are to be connected to earth pits as per Indian/International standards. All other electrical equipment (PCU/Inverter, ACDB and DCDB) will be earthed through the proper conductor. It shall be ensured that all the earthing points are bonded together to make them at the same potential.

The SPV power plants shall be provided with lightning & overvoltage protection. The main aim in this protection shall be to reduce the over voltage to a tolerable value before it reaches the PV or other sub system components. The source of over voltage can be lightning, atmosphere disturbances etc. The entire space occupying the SPV array shall be suitably protected against Lightning by deploying required number of Lightning Arrestors. Lightning protection shall be provided as per IEC 62305 standard.

1.0.4.6 A fixed tilt module mounting system has been chosen for the PV plant. The mounting structures to be selected shall comply with the appropriate industrial standards and shall be capable of withstanding on-site loading and climatic conditions. Material to be used shall be a combination of hot-dipped galvanised mild steel and pre-galvanised cold rolled sheets sheared to form structural members for module mounting. The pre-galvanized sheets post process shall be appropriately coated anti-corrosion compounds for the project life cycle. The withstanding wind speed for mounting structure designs should be exceeding the upper limit of the maximum wind speed range at each particular location.

1.0.4.7 Two no. of portable fire extinguishers (4.5/5 kg CO₂) shall be provided at each plant location near power evacuation point preferably near inverter installation.

1.0.5 Civil

Necessary civil works of the project have to be carried out based on the existing conditions of the site. The sub soil conditions at site (ground mounted) will be taken care during design as well as during construction. The natural drainage conditions are to be maintained to the maximum extent so as to avoid flooding of site during rainy seasons and minimise the cost of land grading & levelling operations. Necessary quality controls have to be maintained at site during construction.

Any other misc. requirement necessary for completion of commissioning & operation in line with Bidder's technical proposal / detailed Engineering.

2.0 BILL OF QUANTITY

Sl. No.	Description	Unit	Quantity
A	Design, Supply, installation, commissioning & testing of total 1020 kWp (Solar Photovoltaic grid connected Power Plant) with suitable rating Inverters without battery bank, Mounting Structure of Galvanized M.S. Angle, Mono-Crystalline SPV modules of capacity min. 535 Wp to be connected in appropriate series-parallel combinations to form a SPV array, DC copper cabling and AC aluminum cabling of suitable size & rating, junction boxes, MCCBs/MCBs with all other fitting & fixing, Data Acquisition System, suitable protection system, earthing system and associated civil work, arrangement to feed solar power to grid including required AC cable, arrangement of required statutory permissions from any govt./local authorities for grid connection & synchronization and any other work or material required for successful commissioning of the system with 5 years Comprehensive Operation & Maintenance in line with MNRE and other guideline as per specification detailed, on following Locations:		
A.1	Barka-Sayal Area -378 kWp 378 kWp Solar Rooftop Power Plant 5 Nos. of rooftop buildings (P.O. office, Urimari OCP, P.O. office, Birsa OCP, Executive Hostel, Urimari, AKC Hospital, Bhurkunda and DAV School, Urimari) with suitable rating Inverters (or any suitable combination).	Lot	1
A.2	Ramgarh Area -394 kWp 394 kWp Solar Rooftop Power Plant 4 Nos. of rooftop buildings (Old Building & Surgical Block Building of Central Hospital, Naisarai and Main Office Building & Water Treatment Plant of Mine Rescue Station, Naisarai) with suitable rating Inverters (or any suitable combination).	Lot	1
A.3	Barkakana CWS -88 kWp 88 kWp Solar Rooftop Power Plant 2 Nos. of rooftop buildings (Regional Store, Central Store and JET Hostel, Central Workshop) with suitable rating Inverters (or any suitable combination).	Lot	1
A.4	Mine Rescue Station -160 kWp (Ground mounted) 160 kWp ground mounted at 3 nos. of locations in the premise of Mine Rescue Station in Ramgarh with suitable rating Inverters (or any suitable combination).	Lot	1

CHAPTER-IV

TECHNICAL SPECIFICATION OF MAJOR ITEMS

The specifications mentioned for all the equipment which include Solar modules, PCU, combiner boxes, DC cables, module mounting structures, LT cables, interfacing panels, switch gears & other associated equipment etc., to complete the power generation and evacuation, in the bidding documents are for the reference only. It is subject to revise/ alter as per the design/ planning/ good engineering practices etc., to be carried out by the selected bidder, to the satisfaction of the Employer or its authorized representatives. It is advised that the bidders must satisfy himself with the prevailing site conditions before design/ plan. The design must be optimized as per the site conditions and directed to achieve the maximum output from the installed capacity at all times. Moreover, the components not separately mentioned, but are required to complete the plant for operation is also included in the scope of bidder and shall be vetted by the Employer or its authorised representatives.

All equipment and installation shall confirm to the following rules/acts/regulations amended up to the date:

1. The Indian Electricity Act
2. The Indian Electricity Rules
3. CEA Regulations
4. MNRE Guideline
5. Safety rules, acts and regulations

Broad technical specification of following electrical equipment have been provided in the section:

Electrical System

1. Photovoltaic Modules
2. String Monitoring Unit
3. Solar and DC Cables
4. Power Conditioning Unit/Inverter
5. AC Cables
6. LT Switchgear
7. Earthing
8. Lightning Protection System
9. Illumination

1.0 Photovoltaic Modules

1.1 Standards and Codes

Photovoltaic Modules shall comply with the specified edition of the following standards and codes.

Standard	Description
IEC 61215-1:2016 Ed.1	Terrestrial photovoltaic (PV) modules - Design qualification and type approval - Part 1: Test requirements
IEC 61215-1-1:2016 Ed.1	Terrestrial photovoltaic (PV) modules - Design qualification and type approval - Part 1-1: Special requirements for testing of crystalline silicon photovoltaic (PV) modules
IEC 61730-1:2016 Ed.2	Photovoltaic (PV) module safety qualification - Part 1: Requirements for construction
IEC 61730-2:2016 Ed.2	Photovoltaic (PV) module safety qualification - Part 2: Requirements for testing
IEC 61701:2011 Ed.2	Salt mist corrosion testing of photovoltaic (PV) modules (Applicable for coastal and marine environment)
IEC 62716:2013 Ed.1	Photovoltaic (PV) modules - Ammonia corrosion testing (if applicable)
IEC TS 62804-1:2015 Ed.1	Photovoltaic (PV) modules - Test methods for the detection of potential-induced degradation - Part 1: Crystalline silicon (under conditions of 85°C/85% RH for minimum 192 hours)

As per the Solar Photovoltaics, Systems, Devices and Components Goods (Requirements for Compulsory Registration) Order, 2017, PV Modules used in the grid connected solar power projects shall be registered with BIS and bear the Standard Mark as notified by the Bureau of Indian Standards.

Further, PV Modules should have been included in the ALMM list as per MNRE Approved Models and Manufacturers of Solar Photovoltaic Modules (Requirements for Compulsory Registration) Order, 2019.

- 1.2 PV cells in a crystalline silicon module shall be protected by encapsulation between front glass and back sheet/back glass. The glass shall be made of high transmissivity and front surface shall give high encapsulation

The technical details of Solar PV Modules shall be as given below:

Sl. No.	Description	Details
1	Type of SPV Module	Mono Crystalline Silicon
2	Peak Power rating of Module at STC	Shall not be less than 535 Wp
3	Rated power at STC	No negative tolerance is allowed
4	Temperature co-efficient of power	Not less than -0.43%/°C
5	Module efficiency	≥17.0 %