amount of a proxy bid.

Bids are submitted in decrements (decreasing bid amounts). The application automates proxy bidding by processing proxy bids automatically, according to the decrement that the auction originator originally established when creating the auction, submitting offers to the next bid decrement each time a competing bidder bids, regardless of the fact whether the competing bids are submitted as proxy or standard bids. However, it may please be noted that if a manual bid and proxy bid are submitted at the same instant manual bid will be recognized as the L1 at that instant.

In case of more than one proxy bid, the system shall bid till it crosses the threshold value of 'each lowest proxy bid' and thereafter allow the competition to decide the final L1 price.

Proxy bids are fed into the system directly by the respective bidders. As such this information is privy only to the respective bidder(s).

13. Bidders are advised to get fully trained and clear all their doubts such as refreshing of Screen, quantity being auctioned, tender value being auctioned etc from M/s {*Service provider*}.

14. M/s. {*Service provider*}, shall arrange to demonstrate/ train the bidder or bidder's nominated person(s), without any cost to bidders. M/s. {*Service provider*}, shall also explain the bidders, all the business rules related to the Reverse Auction. Bidders are required to submit their acceptance to the terms/ conditions/ modalities before participating in the Reverse Auction in the process compliance form as enclosed. Without this, the bidder will not be eligible to participate in the event.

15. Successful bidder shall be required to submit the final prices (L1) in prescribed format for price breakup, quoted during the Online Reverse Auction, duly signed and stamped as token of acceptance without any new condition (other than those already agreed to before start of auction), after the completion of auction to M/s. {*Service provider*} besides BHEL within two working days of Auction without fail.

16. Any variation between the final bid value and that in the confirmatory signed price breakup document will be considered as tampering the tender

process and will invite action by BHEL as per extant guidelines for suspension of business dealings (as available on www.bhel.com).

17. Bidders' bid will be taken as an offer to execute the work/ supplies the item as per enquiry no. *{…}* dt. *{…}*. Bids once made by the bidder, cannot be cancelled/ withdrawn and bidder shall be bound to execute the work as mentioned above at bidder's final bid price. Should bidder back out and not execute the contract as per the rates quoted, BHEL shall take action as per extant guidelines for suspension of business dealings (as available on www.bhel.com).

18. Bidders shall be able to view the following on their screen along with the necessary fields during Online Reverse Auction:

    a. Leading (Running Lowest) Bid in the Auction (only total price of package)
    b. Bid Placed by the bidder
    c. Start Price
    d. Decrement value
    e. Rank of their own bid during bidding as well as at the close of auction.

19. BHEL's decision on award of contract shall be final and binding on all the Bidders.

20. BHEL reserves the right to extend, reschedule or cancel the Reverse Auction process at any time, before ordering, without assigning any reason, with intimation to bidders.

21. BHEL shall not have any liability to bidders for any interruption or delay in access to the site irrespective of the cause. In such cases, the decision of BHEL shall be binding on the bidders.

22. Other terms and conditions shall be as per bidder's techno-commercial offers and other correspondences, if any, till date.

23. If there is any clash between this business document and the FAQ available, if any, in the website of M/s. *{Service provider},* the terms & conditions given in this business document will supersede the information contained in the FAQs. Any changes made by BHEL/ service provider (due to unforeseen contingencies) after the first posting shall be deemed to have been

accepted if the bidder continues to access the portal after that time.

24. Bidder shall not divulge either his Bids or any other exclusive details of BHEL to any other party. If the Bidder or any of his representatives are found to be involved in Price manipulation/ cartel formation of any kind, directly or indirectly by communicating with other bidders, action *as per extant BHEL guidelines for suspension of business dealings (as available on www.bhel.com)*, shall be initiated by BHEL.

On the letter head of the bidder

REF: <<<internal reference of vendor>>>

Declaration to be mandatorily submitted by the Bidder, as a compliance to Rule 144(xi) of GFR, 2017 amendment dt 23.07.2020 issued by Ministry of Finance, Govt. of India.

"I have read the clause regarding restrictions on procurement from a bidder of a country which shares a land border with India; I certify that this bidder is not from such a country or, if from such a country, has been registered with the Competent Authority. I hereby certify that this bidder fulfils all requirements in this regard and is eligible to be considered."

DATE: Authorized signatory

Office seal

Place:

Technical specification

for

Design, Supply, Installation and Commissioning
of 220kV switchyard bay
and
Interconnection between solar plant and Switchyard
for 20MW (AC) Solar Photovoltaic Grid-connected Power plant
at

Gandhar, Gujarat

Revision details :	Prepared by	Approved by	Date
	Sheetal Prasad	Rachi	18-09-2020

CONTENTS

1.0 INTRODUCTION

1.1 Overall project outline

Bharat Heavy Electricals Limited (BHEL), Electronics Division, Bangalore is setting up a Solar photovoltaic (SPV) power plant for NTPC at Gandhar, Distt Bharuch, Gujarat within Gas Based Power Plant Installation.
Solar PV modules employed at the plant generates DC electricity that in turn is inverted to AC in the range 600-800 V. Output of each solar block (5 MWp) is stepped up to 33kV. All the blocks are combined to achieve the 20MW output as per the power plant rating at main pooling switchgear.
From main pooling switchgear, cable/ transmission line shall be run upto Power transformer in 220KV Switchyard bay proposed for solar plant in existing NTPC Switchyard. The 220 kV Switchyard shall be with Double Main Bus & Transfer Switching Scheme as indicated in Tender SLD.
Details are given in subsequent clauses.

1.2 Brief outline of vendor scope

Vendor scope includes activities but not limited to design, engineering, drafting of drawings, obtaining approval from BHEL/NTPC/STU/PGCIL/CEIG /CEA whichever is applicable for the drawings, manufacture/ testing/ inspection at manufacturer's works, packing, supply, transportation, transit insurance, delivery to site, unloading, storage, erection of switchyard structures/equipment (excluding civil foundation work), coordination / liaison with concerned state / central authorities such as GETCO/ CEIG/ CEA/ GEDA etc, and commissioning for the following activities of the project:

(1) 33kV/220kV switchyard at NTPC substation consisting of 1 no of 220kV bay with all equipment viz CTs, CVTs, SF6 Breaker, Isolators (with & without earth switch), Surge Arrestors, metering panel etc including erection and commissioning of 20MVA, 33/220kV power transformer along with Fire water spray system.

(2) This 33/220 KV switchyard bay will be replica of existing adjacent 33/220 KV switchyard bay. In view of this, vendor shall visit the Switchyard site at Gandhar and obtain all necessary details from site before they participate in tender.

(3) Interconnection between 33 KV Main pooling station at Solar PV Plant and Power Transformer at NTPC Switchyard shall be partly cable laying (underground), partly cable laying in air in RCC cable trench/ on cable tray and partly 33KV transmission line. The distance between Main pooling station and power transformer is 1 KM approximately. All design, supply, installation including civil works required for Interconnection between SPV power plant Main pooling station to switchyard bay and extension further to 33 KV side of Power transformer at 220 KV substation will be in vendor's scope. There shall be multiple crossings of road, existing control cable trench, drain, Switchyard fencing. Part of cable trench route is within existing switchyard and part of the cable trench route is narrow space between fence/RCC trench/ Drain. Vendor shall submit the interconnection methodology for BHEL/ NTPC approval prior to start of the work. All items e.g. 33KV cable, cable termination kit on both ends, cable jointing kit, cable support structure, cable trays, Isolator, Insulators, Pole, BPI, 30 KV LA, LA equipment structure, cable route markers, hume pipes for crossings, cutting and repair works for fencing/drain/road/ control cable trenches etc including all civil works will be in scope of vendor.

(4) DC power will be extended from NTPC's existing switchyard control room to Main control room in Solar plant through Copper cable. Vendor shall supply, lay and terminate the cable at both

ends. Vendor shall supply and install suitable DB for extending DC supply from existing source to switchyard items and for solar plant. All item like cables, DBs, termination hardware and accessories for the same will be in scope of vendor.

(5) OFC cables will be laid and terminated between solar plant main control room and Switchyard control room for interconnection. Cable supply and termination accessories will be BHEL scope. Laying and termination of cables will be in scope of vendor.

(6) Obtaining statutory clearance from the relevant agencies (PGCIL, STU, GETCO, GEDA, CEA, CEIG, GUVNL, SLDC etc whichever applicable) required **for Charging 33/220 KV substation bay and 33KV installation (as in vendor's scope) for charging and commissioning of 20 MW Solar plant**.

(7) Vendor shall follow NTPC approved vendor's list (attached along with specifications) for ordering of items.

The vendor shall have design capability for substation / switchyard. In case they do not have design/drafting capability, after receiving purchase order from BHEL, the vendor shall tie up with competent design consultants in which case vendor shall submit the credentials of the proposed consultants to BHEL for approval by BHEL/NTPC. Vendor shall award the supplies on the NTPC approved Vendors only. All drawings/ design documents shall be originated by the consultants, endorsed by the vendor clearly stating the name of the project, names of clients (BHEL/NTPC), drawing/document number, revision number, number of sheets etc.

All works shall be tested as per BHEL/NTPC/PGCIL/STU approved FQP that will be issued during course of project execution. All third party testing shall be carried out only at NABL accredited laboratories (or) Government laboratories.

Note: The above is only a broad outline of vendor scope for the sake of introduction. The detailed vendor scope is listed under sections 4.0 and 5.0 and elaborated in various other sections of this specification.

1.3 Location/ site address of power plant:

The 20 MW Solar PV Plant shall be setup at NTPC Gandhar Gas Power Plant in Gujarat.

District	Bharuch, Gujarat
Nearest Highway	NH 64 (10 km)
Nearest Railway Station	Bharuch Jn (25 km)
Nearest Commercial Airport	Vadodara (78 km)
Indicative Coordinate	21°49'19.0"N 73°06'53.0"E

1.4 Enclosures to this specification

(a) Tentative AC SLD of the overall 20 MW SPV plant including 220KV bay SLD
(b) Tentative Existing 220 KV NTPC Substation SLD
(c) Tentative Solar plant layout indicating main pooling Station and 220 KV Switchyard bay
(d) Tentative Earth mat design in existing 220KV Switchyard
(e) Tentative Equipment structure drawings
(f) Indicative Manufacturing Quality plan, Field quality plans and Quality assurance chapters
(g) List of NTPC approved vendors

Note that the documents are tentative and for tender purpose only. The same may change based on final drawing approval from NTPC, as submitted during detailed engineering by bidder

1.5 Other indicative details to the bidders for tender purpose:

(a) Distance between Main pooling station in Solar plant to location of power transformer in 220kV switchyard: 1 km approx.

(b) At NTPC substation side, AC/DC aux supplies for ABT metering panel and 220kV switchyard equipments in vendor scope shall be taken from the ACDB/ DCDB panels in NTPC 220KV substation Control room (2nd floor) located at approx. 1 km away from switchyard.

(c) Vendor shall visit project site prior to submission of bids so as to make a clear assessment of site conditions such as:
(1) land terrain,
(2) Nature of soil,
(3) Arrangement of existing bus (Main bus1-, Main bus-2 and Transfer bus) at NTPC substation to which the feeder extension bay will be hooked up
(4) Other details like location of extension bay and the C&R Panel Room/Main Substation Control Room for the purpose of power supply / control cabling works.
(5) Details of Earth mat extension and cable trenching and laying works
(6) Cable Routing for 33kV Underground Cable from Plant to NTPC substation.

(d) **BIDDER SHALL EMPLOY MINIMUM 70% OF LOCAL WORK FORCE (BELONGING TO DHUVARAN, GUJARAT) DURING EXECUTION OF WORKS.**

2.0 LIST OF DELIVERABLES TO BE OFFERED BY VENDOR

#	Deliverables	Qty
2.1	**Supply of all electrical equipment and other materials of 220kV switchyard at NTPC SUBSTATION:** such as CTs, CVTs, surge arrestors / lightning arrestors, Bus post insulators/ Bus Tension Insulators / Bushings, HDB / Tandem Isolators / dis-connectors, Earth switches, Motors & related controls for isolators/dis-connectors / earth switches, SF6 circuit breakers, ACSR conductors, Electrical cables & cable trays, Marshalling boxes / panels / distribution boards, ABT meter for Internal plant metering, TEM meters, Metering Panel with Main & Check and standby Meters, Control and Relay panel with BCPU, SCADA connectivity from switchyard equipment, RTU Panel for SLDC connectivity, SAS, Earth wire, Earth mat items (rods/risers etc.), Earth strips/ electrodes etc together with all related accessories (disc insulators, clamps, connectors/ bimetallic where required, cable glands/lugs/ties etc.) and complete set of hardware required to meet the electrical requirements of the switchyard , also all the related items required to hook up to the existing bay of NTPC substation, communication system as per NTPC/PGCIL/SLDC/RLDC/GETCO requirement, integration of new feeder bays with existing Communication/SCADA system at NTPC substation with all required equipment like Ethernet fiber switch, kiosk, LIU etc. as per NTPC requirement. There are three overhead 220 KV bus namely Main Bus 1, Main Bus 2 and Transfer bus. The output power of solar plant shall be hooked to these buses. Vendor scope shall also include supply of items for extension of existing High pressure water spray system for Power transformer fire protection. Detailed scope as per clause 5.15.2 of this spec.	1 Set

2.2	**Supply of structural items of 220kV switchyards:** for mounting the electrical equipment together with all related accessories and complete set of hardware required to meet the structural support requirements of the switchyards. This shall include suitable J-bolts, foundation hardware as may be applicable.	1 Set
2.3	**Supply of items towards Interconnection between Outgoer at solar plant and Power Transformer at 220KV Switchyard including OFC cabling and extending DC power to solar plant** Conducting of detailed route survey is in Vendor scope. Based on the route study, 33 KV Cables/ ACSR shall be supplied, laid and terminated by vendor suitably (underground in trenches and over cable trays/ in RCC trench with required steel structural supports (Corrosion resistance treated) and 33KV Transmission line as applicable). The methodology will be submitted to BHEL/NTPC for approval. The distance between Main pooling station and power transformer is 1 KM approximately. All supply required for Interconnection between SPV power plant Main pooling station to switchyard bay and extension further to 33 KV side of Power transformer at 220 KV substation will be in vendor's scope. There shall be multiple crossings of road, existing control cable trench, drain, Switchyard fencing. Part of cable trench route is within existing switchyard and part of the cable trench route is narrow space between fence/RCC trench/ Drain. All items e.g. 33KV cable, cable termination kit on both ends, cable jointing kit, cable support structure, cable trays, Isolator, Insulators, Pole, BPI, 30 KV LA, LA equipment structure, cable route markers, hume pipes for crossings etc will be in scope of vendor. DC power will be extended from NTPC's existing switchyard control room to Main control room in Solar plant through Copper cable (Minimum 2CX16 sqmm copper cable). Vendor shall supply, lay and terminate the cable at both ends. Vendor shall supply and install suitable DB for extending DC supply from existing source to switchyard items and for solar plant. All item like cables, DBs, termination hardware and accessories for the same will be in scope of vendor. OFC cables will be laid and terminated between solar plant main control room and Switchyard control room for interconnection. Cable supply and termination accessories will be BHEL scope. Laying and termination of cables will be in scope of vendor. Detailed scope as per section 4 of this spec.	1 set
2.4	**Supply of spare items for 220 kV switchyards:** Following spares shall be supplied along with main equipment:	1 set

Sl.No	Item Description	Quantity
1	220 kV Protection Current Transformer	1 No
2	216 kV Surge Arrester	1 No
3	Following spare for 220 kV HCB Isolator with 1E/S	
a	Male and female contact finger	1 set
b	Isolator Limit switch	1 set
c	One complete pole of Isolator with 1E/S alongwith Insulator & operating mechanism	1 No

2.5	**Installation of 220kV Switch Yard :** Vendor shall install Power transformer with accessories, all vendor supplied electrical equipment's and steel structures. Civil foundation work including RCC control cable trench construction, jelly spreading is in scope of BHEL. Earthing chambers will be made by Vendor. Mounting of cable trays and laying of cables, cable terminations / interconnections, installation of earthing electrodes, construction of earthing chambers with lids, earthing terminations extension of earth grid to existing earth mat of NTPC substation, together with all related activities etc., marking of all electrical equipment / cables, installation of sign / danger boards etc. and hooking up the switchyard to the existing bus (Main bus 1, Main bus 2 and Transfer bus) at 220KV substation. Scope shall also include installation of (vendor-supplied) ABT and TEM metering panels along with PQM meter for PPC (Class-A type) compliance as per CERC 2019 regulations including & all related electrical works such as cable trenching, laying, terminations, interconnections (including aux AC/DC supply & distribution boards as required for Metering Panels and other equipment), and earthing connections. Vendor scope shall also include extension work of existing High pressure water spray system for Power transformer fire protection. Detailed scope as per section 4.0 of this spec.	1 AU
2.6	**I&C for Interconnection between Outgoer at solar plant and Power Transformer at 220KV Switchyard including OFC cabling and extending DC supply to solar plant** (1 km approx) Conducting of detailed route survey is in Vendor scope. Based on the route study, Cables/ ACSR shall be laid suitably (underground in trenches and over cable trays/ in RCC trench with required steel structural supports (Corrosion resistance treated) and 33KV Transmission line as applicable). The methodology will be submitted to BHEL/NTPC for approval. The distance between Main pooling station and power transformer is 1 KM approximately. All design and installation works including civil and fabrication works required for Interconnection between SPV power plant Main pooling station to switchyard bay and extension further to 33 KV side of Power transformer at 220 KV substation will be in vendor's scope. There shall be multiple crossings of road, existing control cable trench, drain, Switchyard fencing. Part of cable trench route is within existing switchyard and part of the cable trench route is narrow space between fence/RCC trench/ Drain. All cutting and repair works for fencing/drain/road/ control cable trenches etc including related civil works will be in scope of vendor. Vendor shall submit the interconnection methodology for BHEL/ NTPC approval prior to start of the work. DC power will be extended from NTPC's existing switchyard control room to Main control room in Solar plant through Copper cable (Min 2CX16sqmm	1 AU

	Copper cable). Vendor shall supply, lay and terminate the cable at both ends. Vendor shall supply and install suitable DB for extending DC supply from existing source to switchyard items and for solar plant. All item like cables, DBs, termination hardware and accessories for the same will be in scope of vendor. OFC cables will be laid and terminated between solar plant main control room and Switchyard control room for interconnection. Cable supply and termination accessories will be BHEL scope. Laying and termination of cables will be in scope of vendor. Detailed scope as per section 4.0 of this spec.	
2.7	**Pre-commissioning inspections: All** checks / tests on 220kV switchyard equipment's / Power transformer / 33KV cabling/Line / C&R panel / CT / CVT / Isolator / SF6 Breaker / ABT metering panel etc and coordination / liaison activities with related state / central departments / GETCO/GUVNL/CEIG/GEDA/SLDC etc as applicable for necessary approvals/ clearances for drawings/ documents/ inspection at equipment manufacturers' works and at site by NTPC/PGCIL/STU/GETCO/ CEIG / GEDA /CEA and also for plant commissioning activities viz line-charging/ grid synchronization. Detailed scope as per section 4.0 of this spec	1 AU

Note 1: Final scope of supply and installation works for the feeder bay at NTPC substation and the 33KV Interconnection shall be as per customer requirement.

Note 2: There are no separate charges for design/ drafting of engineering documents viz drawings/ schemes/ layouts/ calculations etc. and consultancy, as these charges shall be deemed to be absorbed in the above line items.

3.0 DOCUMENTS TO BE SUBMITTED ALONG WITH OFFER

a) Statement expressing compliance to this BHEL specification (NIL deviation statement).
b) Acceptance to Indicative Manufacturing Quality plan, Field quality plans and quality assurance chapters

4.0 DETAILED SCOPE OF BHEL AND VENDOR

4.1 220kV switchyard at NTPC SUBSTATION

All 220kV Equipment Ratings shall be as per attached Single Line Diagram.

This switchyard bay area to be developed is located at existing NTPC substation and this Sub-station bay shall be replica of the existing sub-station bays next to area to be developed. The overall size and **layout of switchyard with 1 bay shall be proposed by the vendor** (for approval by BHEL/NTPC) based on the space required to accommodate the electrical equipment (including the 20 MVA power transformer that is in BHEL scope of supply, duly considering the spacing / clearances between the various electrical equipment as per relevant standards and Indian

electricity rules (1956), CBIP, state electricity board / GETCO/ DISCOM/ CEA/ CEIG regulations/ PGCIL/ any other statutory directives etc.

Accordingly, the respective scopes of BHEL and the vendor are listed as below, whereas detailed specifications are provided in other sections of this specification.

4.1.1 BHEL scope

	Scope description	**Quantity**
1	Supply of Outdoor, Oil Immersion type, 3-phase, 20MVA ONAF/12MVA ONAN, 220/33kV, YNYn0 Vector Group Power Transformer along with RTCC panel	1 No
2	Supply of OFC cables along with termination accessories and HDPE pipe for interconnection between solar plant and 220KV Switchyard control room will be supplied by BHEL.	1 No
3	Bushing NCTs and Bushing CT 400/1A for Transformer differential protection as part of power transformer	1 set
4	Construction of 20 MW solar power plant till 33KV Main pooling Switchgear installation	1 set
5	Construction of all civil foundations (220KV equipment foundations, power transformer foundation, oil pit construction, control cable trench construction within switchyard, spreading of stone jelly, fencing, major levelling and grading except for excavation/ levelling towards earthing and 33KV cable trench work). NOTE- i. Earthing chambers, pipeline works, Switchyard soil sterilization / antiweed treatment and any other related works not mentioned here and that may be required for bay construction shall be in vendor scope. ii. All civil foundation design will be prepared and submitted by vendor for BHEL/NTPC approval. iii. It will be vendor's responsibility to supervise the 220 KV foundation works being executed by Civil contractor of BHEL in line with approved drawings iv. Any civil works towards Interconnection work between solar plant and 220KV Switchyard/ control room shall be in vendor's scope. ***Civil design will be in vendor's scope.** ***Civil design and works for Interconnection work from solar plant to 220KV Switchyard will be in vendor's scope.**	1 set
6	Auxiliary supply (AC and DC) shall be tapped from existing 220KV substation control room. AC/DC Distribution boards, as required shall be in Vendor's scope.	1 set
7	SCADA system with GPS Time Synchronizing System	1 set

4.1.2 Vendor's scope

(a) Supply, Installation and commissioning

Supply, Unloading including BHEL supplied items for switchyard, installation, testing and commissioning as per relevant standards, Indian electricity rules (1956), CBIP, State electricity board / GETCO/ DISCOM/ CEA/ CEIG regulations/ GERC/Electricity Act-2003 etc. will be in vendor's scope and shall be as approved by BHEL/NTPC.

The new bay for this project shall be constructed by the vendor at the designated location in NTPC substation. Further, the bay shall be hooked up by the vendor to the existing bus.
It shall be the absolute responsibility of the Vendor to make an accurate assessment of the exact requirements of supply and installation as per site conditions. **ACCORDINGLY, VENDOR SHALL VISIT THE SITE PRIOR TO SUBMISSION OF OFFER.**

The vendor scope of supplies and works are listed here below, whereas detailed specifications of individual equipment / activities are provided in various sections of this specification.

1	Design calculations for equipment mounting structure, civil foundation, earth mat grid, Relay settings, Conductor sizing calculation etc for 220kV switchyard in Designated place at NTPC SUB STATION.
2	Unloading, Installation, testing and commissioning of 20MVA, 33/220 kV, YNyn0 Power transformer along with RTCC panel. **Note: RTCC panel shall be installed inside the existing NTPC Switchyard Control room which is 1 KM away approximately.**
3	Supply and installation of Control and relay panels along with the numerical relays and other components as required as per SLD. **Note: Control and Relay panel shall be installed inside the existing NTPC Switchyard Control room which is 1 KM away approximately.**
4	Supply, installation and commissioning of following outdoor switchyard items including mechanical operations (bolting, bending, welding etc.), electrical cabling, ACSR conductor terminations, terminations at marshalling boxes for CT/ CVT (PT) / bay marshalling kiosks, other related panels/ distribution boards and hardware, earthing connections etc. (a) 216kV, 10kA nominal discharge current, class-3 gapless metal oxide surge arrestor (LA) – 3 Nos (exclusive of spare quantity) (b) 245kV CVT (PT) (2-core) – 3 Nos for metering (c) 245kV CVT (PT) (3-core) – 3 Nos for protection (d) 245kV CT (1-core) – 3 Nos for metering (e) 245kV CT (5-core) – 3 Nos for protetction (f) 245kV 2000A Tandem Isolator, horizontal central break, triple pole, with Single earth switch, motor operated (locally) – 1 set (g) 245kV 2000A Tandem Isolator, horizontal central break, triple pole, with Double earth switch, motor operated (locally) – 1 set (h) 245kV 2000A Tandem DB Isolator, horizontal Double break, triple pole, without earth switch, motor operated (locally) – 2 sets (i) 245kV SF6 Motorized breaker with local/remote operation – 1 set (j) ABT meter- for internal metering network of NTPC as detailed in relevant clause along with PQM meter for PPC (Class-A type) compliance as per CERC 2019 regulations

	(k) 3 nos of TEM meters for tariff metering (Main, Check and Standby) along with metering panel (l) Bus post Insulator (BPI) and Bus Tension Insulator as per site requirement. (m) Switchyard structures Gantry, beams and towers– as per NTPC requirement (n) ACSR conductor and Al tubular conductor for connecting to Bus 1,2 & Transfer bus and normal ACSR conductor for connecting of LA, CT & PTs etc. (o) Control panel, Relay panel shall be supplied, erected and commissioned at Main control room located at 1 KM approx. away from switchyard. (p) Auxiliaries system such as Illumination system, DBs (q) Fire protection system (r) Special maintenance tools and tackles. (s) Power, control & special cables, earthing & lighting protection system etc. (t) GI structures with all necessary hardware for mounting the above electrical equipment's. (u) Disc insulators (suspension/ tension) along with other accessories such as clamps, hardware etc. – quantity as required. (v) ACSR conductor with related accessories for termination such as connectors/ bimetallic where required, clamps, hardware etc. – quantity as required. (w) Marshalling boxes for CTs/PTs – quantity as required (x) Bay marshalling kiosks – quantity as required (y) Motors and motor control boxes for GOS isolators/ earth switches (z) LT aux power supply cables and control cables (aa) Cable trays for laying of cables in cable trenches (bb) Underground earth mat grid items comprising of risers, electrodes, earth rods, earth chambers etc (cc) GI earth strips for earthing of structures, electrical equipment's, panels/ DBs/ marshalling boxes etc. (dd) Earth pits / chambers with lids. **Note:** LA shall have separate earthing. Any other items considered essential to meet the functional / operational requirements of the 220kV switchyard as per relevant standards or Indian Electricity rules (1956), CBIP, state electricity board/ GETCO/ DISCOM/ CEA/ CEIG/ any other statutory requirements etc.
5	Supply, Installation, Testing and commissioning of Substation Automation System (SAS) for SLDC Connectivity- both at 33kV and 132 kV feeder level. Real time data communication from SPV Plant (RTU) and extension of this data (Communication equipments) to SLDC as per LDC requirements shall be in the scope of the vendor.
6	**Telemetry Requirement:** The arrangement to transmit data required by the Load Dispatch Centre (LDC) from Solar plant to NLDC/RLDC/SLDC as per extant regulations and procedures for grid management upto switchyard at NTPC Gas power project shall be in vendor's scope. Necessary software and Hardware, including laying of Communication/Fibre Optic cable upto NTPC Switchyard substation required for communication of Solar plant data from Solar plant SCADA to Load Dispatch Center (LDC) is included in the vendor's scope. Communication link and communication controller/Gateway used for data communication to LDC shall be redundant (one for normal operation and other as hot standby). It is vendor's responsibility to update themselves with State LDC requirement for compliance related to Automatic Meter Reading (AMR), telemetry data, channel and procedures for engineering of telemetry solution accordingly.

	Cable supply, laying and termination in solar plant SCADA (at Main control room of solar plant) will be in vendor's scope.
7	Installation of BHEL supplied SCADA panel in NTPC control room and cable laying and termination for aux power and communication of all switchyard items in BHEL supplied SCADA. All associated items like cables, hardware etc supply as required will be in scope of vendor.
8	Extension of existing Heavy Water Spray system for fire protection of Power transformer as detailed in relevant clause. This include civil work in Vendor's scope.
9	Other switchyard related activities such as (a) marking / installation of all the switchyard equipment's and earthing locations, (b) all relevant danger and sign boards, (c) painting of steel structures etc. for protection against erosions and corrosions.
10	Sign boards, danger boards with inscriptions in three languages, Gujarati, Hindi and English as per Customer requirements.
11	Supply shall be as per final approved technical specifications / datasheets/drawings as approved by NTPC.

(b) Design, drawings, guaranteed technical particulars, quality plan, manuals for 220kV switchyard.

Vendor shall submit the following documents for BHEL/NTPC for approval within 7 days after receipt of purchase order or at every stage of project implementation as applicable and as mutually agreed with BHEL/NTPC.

1	Design calculations, as per relevant standards, together with drawings, layout and bill of materials shall be submitted for underground earth mat grid required for earthing of 220kV switchyard equipments for BHEL/NTPC approval. Vendor shall also obtain approval from concerned state / central approval agency such as GETCO/ DISCOM/ CEA/ CEIG etc. as applicable before commencement of supplies and works.
2	Preparing and obtaining approval of NTPC for Civil design. Civil work will be done by BHEL based on drawings as submitted by vendor.
3	Layout drawing of the complete 220kV switchyard, showing locations of various electrical equipment (including transformers), earth chambers, earthing of all structures cable trenches, marshalling boxes, other panels (if any), chain link fencing, stone jelly, steel gates etc.
4	Cross section diagram of 220kV switchyard, showing the overall dimensions (such as height, width, clearances etc.) of various electrical equipment mounted on the structures, gantries / beams etc.
5	The switchyard shall be suitable for outdoor application having saline atmosphere and shall have tropical and fungicidal treatment.
6	Detailed bill of materials of 220kV switchyard, with item description, rating, make, model number, item quantity shall be submitted.
7	Manufacturing quality plan with routine/ type / acceptance tests, sampling plan, applicable test standards shall be submitted for BHEL/NTPC approval for all the vendor-supplied items including but not limited to 220kV switchyard equipment's (SF6 breaker, CTs, PTs, GOS isolators, Earth switches, BPI etc.), Control panel, Relay panel, marshalling boxes of individual electrical equipment, bay marshalling kiosks, other panels (if any applicable), HT/LT/ control cables, ACSR conductors, steel

	structures, cable trays, towers, gantries, beams, motors & motor control boxes/panels and all related accessories such as insulators of all types, clamps, connectors etc.
13	The conductor size of tubular bus and stranded conductors shall also be sized considering short circuit conditions, corona / voltage gradient and effect of solar radiation.
15	Complete Switchyard shall be designed to withstand the Seismic acceleration as per relevant IS.
16	Submission of Guaranteed technical particulars, datasheets, GA drawings, O&M manuals of all the electrical equipment's/panels/boxes, structures, towers, beams, cables, cable trays, other accessories such as insulators of all types, clamps, connectors etc.
17	The following design calculations shall be provided for BHEL for review during detailed engineering of the switchyard. • Sag tension calculation • Earthing calculation • Lightning protection system calculation • SC forces for sizing conductor • Bus bar sizing calculation • Short circuit forces on support insulators • Design calculation for spacer Span • CTs, PTs, CVTs burden calculation • Relays settings calculations 220V DC Battery sizing calculation supported with DBR.

4.2 Interconnection between solar plant to 220KV Switchyard/ control room including OFC cabling

Distance: 1000m approx.

4.2.1 BHEL scope

	Scope description	Quantity
1	Supply of OFC cables along with termination accessories and HDPE pipe for interconnection between solar plant and 220KV Switchyard control room will be supplied by BHEL.	1 No
2	Construction of 20 MW solar power plant till 33KV Main pooling Switchgear installation	1 set
3	SCADA system supply	1 set

4.2.2 Vendor scope

Interconnection between 33 KV Main pooling station at Solar PV Plant and Power Transformer at NTPC Switchyard shall be partly cable laying (underground), partly cable laying in air in RCC cable trench/ on cable tray and partly 33KV transmission line. The distance between Main pooling station and power transformer is 1 KM approximately. All design, supply, installation including civil and fabrication works required for Interconnection between SPV power plant Main pooling station to switchyard bay and extension further to 33 KV side of Power transformer at 220 KV substation will be in vendor's scope. There shall be multiple crossings of road, existing control cable trench, drain, Switchyard fencing. Part of cable trench route is within existing switchyard and part of the

cable trench route is narrow space between fence/RCC trench/ Drain. Vendor shall submit the interconnection methodology for BHEL/ NTPC approval prior to start of the work. Any other item and works, if required for statutory clearance by CEA/ CEIG for 33KV interconnection between Main pooling switchgear and power transformer shall be in scope of vendor. STU/ All items e.g. 33KV cable, cable termination kit on both ends, cable jointing kit, cable support structure, cable trays, Isolator, Insulators, Pole, BPI, 30 KV LA, LA equipment structure, cable route markers, hume pipes for crossings, cutting and repair works for fencing/drain/road/ control cable trenches etc including all civil works will be in scope of vendor.

OFC cables will be laid and terminated between solar plant main control room and Switchyard control room for interconnection. Cable supply and termination accessories will be BHEL scope. Laying and termination of cables will be in scope of vendor.

Conducting of detailed route survey is in Vendor scope. Based on the route study, Cables/ ACSR/ OFC shall be laid suitably (underground in trenches and over cable trays/ in RCC trench with required steel structural supports (Corrosion resistance treated) and 33KV Transmission line as applicable). The methodology will be submitted to BHEL/NTPC for approval.

(a) Installation, testing and commissioning as per relevant standards, Indian electricity rules (1956), CBIP, GETCO/ DISCOM/ CEIG/GEDA regulations etc. and as shall be approved by BHEL/NTPC/GETCO

(b) Design, drawings, guaranteed technical particulars, quality plan, manuals

Vendor shall submit the required documents for BHEL/NTPC approval within 7 days after receipt of purchase order or at every stage of project execution as applicable and as mutually agreed with BHEL/NTPC

1. Route survey for Interconnection from Solar plant to 220KV Switchyard/ Existing NTPC Switchyard control room
2. Supply items GA, GTP, QP as applicable
3. Civil design documents

4.3 Pre-commissioning / commissioning / State, CEIG clearances / Liaison etc

<table>
<tr><th>#</th><th>Scope description</th></tr>
<tr><td>1</td><td>Pre-commissioning inspections / checks / tests, MRT tests and coordination / liaison activities with state / central departments / GETCO/ DISCOM/ CEIG / CEA / SLDC etc for necessary approvals / clearances for commissioning, synchronization with grid and post-commissioning operation of the plant. (Clearances shall include obtaining prior approvals for all applicable drawings / documents etc from concerned state / central departments / GETCO / DISCOM/ CEA / CEIG etc.)
<table>
<tr><td>A</td><td colspan="2">Basic checks</td></tr>
<tr><td></td><td>A1</td><td>Tightness checks:</td></tr>
<tr><td></td><td></td><td>1) Terminations of HT(33kV)/LT/Control cables at 33/220kV transformer, C&R panels, ABT-TEM metering panels, marshalling boxes, bay marshalling kiosks, motor/ control boxes etc
2) ACSR conductor terminations
3) Fasteners of all the switchyard structures: bolts/nuts/washers
4) Fasteners at earthing chambers: bolts/nuts/washers</td></tr>
</table>
</td></tr>
</table>

	A2	Electrical continuity checks
	A3	Cable megger checks: All LT cables
	A4	IR test and Hi Pot test on 33 KV cable
	A5	AC/DC power supply checks at all electrical equipments/ panels/ DBs
	A6	Check ground connections for quality of weld and application of zinc rich paint over weld joint of galvanized surfaces.
	A7	All checks and tests specified by the manufactures in their drawings and manuals as well as all tests specified in the relevant code of erection.
	A8	Pressure test on all pneumatic lines at 1.5 times the rated pressure shall be conducted.
B	Pre-commissioning electrical tests:	
	B1	33/220kV transformer
		1. Oil filtration: Equipment of adequate evacuation/ heating/ oil circulation capacity shall be deployed at site for this purpose. Filtration shall be carried out adequately in order to achieve the BDV, ppm, tan delta values within the limits as per relevant standards and as measured by NABL accredited laboratory. The machine shall have built-on BDV measuring set up for in-situ checking of BDV during filtration process. 2. IR tests LV-HV, HV-E, LV-E 3. Vector group 4. Voltage ratio 5. Magnetizing current 6. Magnetic balance 7. Winding resistance at all taps 8. Capacitance, tan delta of HV/LV bushings 9. Fault simulation checks from C&R panel: Buchholz, OTI, WTI, PRV, LOLA, REF etc
	B2	Outdoor CT
		1) IR tests (all cores): Pri-Sec, Sec-Sec, Pri-E, Sec-E 2) Ratio tests / primary injection 3) Ratio identification test-checking of all ratios on all cores by primary injection of current. 4) Dielectric test of oil (wherever applicable). 5) Magnetizing characteristics test. 6) Capacitance and tan delta measurement at minimum 10kV.
	B3	Outdoor PT/CVT
		1) IR tests (all cores): Pri-Sec, Sec-Sec, Pri-E, Sec-E 2) Voltage ratio test 3) Polarity test 4) Dielectric test of oil (if applicable). 5) Capacitance and tan delta measurement at minimum 10kV.
	B4	SF6 breaker
		1) IR tests of each pole 2) Contact resistance measurement (CRM) 3) Timing test: close/ open/ close-open 4) Slow and power closing operation and opening 5) Functional checks: breaker open/close, control circuits, interlocks, tripping through protective relays, spring-charged motor 6) Functional checking of compressed air plant and all accessories 7) Trip free and anti pumping operation

		8) Minimum pick up volts of coils 9) Insulation resistance of control circuits, motor etc 10) Resistance of closing and tripping coils 11) Remote operation from C&R panel: open/close, command/status, lamp indications 12) Check adjustments, if any, suggested by manufacturer
	B5	GOS isolator / Earth switch
		IR tests of each pole Contact resistance measurement (CRM) Functional checks: open/close manual, open/close motorized operation Manual and electrical operation on interlocks Insulation resistance of control circuits and motors. Ground connections Proper alignment to minimise the vibration to the extreme possible during operation. Measurement of operating torque for isolator and Earth switch Resistance of operating and interlocking coils.
	B6	Surge arrestor (LA)
		1) IR tests 2) Grading leakage current. 3) Resistance of ground connection. 4) Resistive current drawn at rated voltage after energisation.
	B7	Phasing Out
		The phasing out of all supplies in the station system shall be carried out.
	B8	Bus post insulator
		IR tests
	B9	Neutral CT for transformer
		IR tests
	B10	Numerical relays at C&R panel
		1. Relay calibration using applicable kit/ software 2. Overcurrent/ earth fault pickup/ tripping time tests
	B11	Earth resistance measurements for all chambers
		1. With electrode connected to grid 2. Without connecting electrode to grid 3. Check soil resistivity 4. Check continuity of grid wires 5. Check for weld joint and application of zinc rich paint on galvanised surface. 6. Dip test on earth conductor prior to use
	B12	Conductor Stringing and Power Connectors
		1) Line megger test 2) Physical check for finish 3) Electrical clearance check 4) Testing of torque by torque by torque wrenches on all bus power connectors and other accessories 5) Sag and tension check on conductors.

C	Testing agency	
		Credentials of testing agency to be submitted to BHEL for approval prior to awarding of work.
D	Coordination and Liaison activities to be carried out by vendor:	
		1. Vendor shall prepare and submit the drawings/ schemes/ layouts/ calculations (earth mat etc) to the concerned state/central agency GETCO/ DISCOM/ CEIG/ CEA etc for their approval after clearance from BHEL. 2. Submission of site test reports to customer (NTPC/CEA/CEIG etc) after obtaining approval from BHEL. 3. Preparation of application (along with supporting documents: drawings, factory test reports, site test reports etc) to concerned agency (CEIG/CEA etc) for site inspection, obtaining signatures from customer (NTPC) and submission to the inspection agency. 4. Coordination with customer (NTPC) and liaison with inspection agency (CEIG/CEA etc) for inviting the inspectors for site inspection prior to plant commissioning. 5. Vendor shall organize inspection at site by above agency with all suitable technical and commercial arrangements. All necessary testing kits/ instruments shall be arranged as per the requirements of inspection agency. Basic instruments such as digital multimeter, 5kV digital megger, earth resistance meter etc shall be organized at site at the time of inspection. Competent electrical technical shall also be made available at the site. 6. Subsequent to site inspection, vendor shall follow-up with the inspection agency, coordinate with the customer to obtain early clearance for plant commissioning. 7. Vendor shall implement all the observations of CEA/ CEIG so as to secure their final approval that is mandatory to continue with regular operation of the plant. **Notes:** 1. Vendor shall take frontline lead in obtaining the clearance of inspection agency. 2. Vendor shall suitably interact with the contractors of BHEL executing the other portions of solar plant (from solar array up to 33kV side of solar plant) and mobilize all necessary inputs/ documents required from them in the process of getting approval of the inspecting agency for commissioning. 3. Scope of coordinating with concerned state/central electricity departments, GETCO/ DISCOM/ CEIG/ CEA etc to get their clearances / approvals for licensed/ statutory operation of the power plant on a continuous basis includes all transactions required for successful liaison and clearances. Application fees and renewal fees (say, in the form of DD/ web-based online payment) to be enclosed with application/ renewal documents shall be in the scope of BHEL/NTPC. All other expenses in the above process shall be in the scope of vendor.

			Statutory Approvals shall also include: 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 approval as and when, as necessary for setting up of a solar power plant including CEIG/ CEA, connectivity, power evacuation etc. as per the suggested guidelines -All other statutory approvals and permissions and their respective compliances, not mentioned specifically but are required to carry out hassle free Construction of the plant. -The Contractor shall comply with the provision of all relevant acts of Central or State.
	E	Commissioning of power plant	
			1) Vendor shall organize all necessary tools/ measuring instruments required to operate the various electrical equipments on 220kV side of power plant at the time of commissioning. 2) It is the responsibility of the vendor to interact technically with the substation for successful charging of 220kV grid line followed by charging of 33/220kV transformer. 3) Vendor shall suitably interact with the contractors of BHEL executing the other portions of solar plant (from solar array up to 33kV side) to enable successful grid synchronization of inverters. 4) Vendor shall participate actively in the commissioning until it is established that there is successful flow of power through the 220kV portion of power plant following the synchronization of inverters with grid. 5) Vendor shall deploy competent technicians at site to effectively interact with the substation on every technical aspect so as to ensure resolution of any technical problems related to grid encountered during commissioning.

4.5 General conditions applicable during supply, installation and commissioning phase

1	Vendor shall arrange for safe storage of all the vendor/BHEL supplied materials. For this purpose, vendor shall construct appropriate storage shed with gates, locks and keys. Security watch and ward shall be deployed round the clock. Insurance of the vendor-supplied items shall be in vendor scope until the end of trial run following the commissioning of the power plant.
2	Vendor shall organize power supply on their own. Accordingly, DG sets of suitable capacity shall be deployed by the vendor for construction works.
3	Similarly, water required for construction works shall be organized by vendor.
4	All machinery such as cranes, hydra, JCBs, forklifts, transport trucks, trolleys etc necessary for movement and installation of materials / panels / equipment etc shall be organized by the vendor.

5	All necessary tools and tackles such as crimping tool, screw driver set, power screw drivers, cutting pliers, nose pliers, spanner sets, adjustable spanners, hole saw cutter set, bending tools, torque wrenches, hack saw blades, pipe wrenches, flat / round files, HV termination tools, drilling machines, welding machines, concrete mixers, steel bar bending tools / templates for RCC works, spade, shovel, hammer etc shall be organized by the vendor.
6	All necessary measuring instruments such as digital multimeter, electrical testers, digital meggers (1kV, 2.5kV, 5kV) with feature to display, earth resistance meters, weighing machines, water level indicators etc shall be organized by the vendor.
7	Vendor shall make their own arrangements for necessary food, drinking water and accommodation for their labour and employees posted at the site. Similarly, food and drinking water required at the site, during the construction operations, shall also be in scope of vendor.
8	Vendor shall organize all necessary steps to meet statutory requirements such as labour license, PF, ESI etc and also ensure compliance with relevant acts such as minimum wages act, income tax act, employee insurance act etc for their labour deployed at site.
9	Vendor shall maintain updated labour register, with name, age, qualification, salary, attendance details etc at the site.
10	Vendor shall use danger boards, appropriate warning/sign boards, wherever required, to ensure safety of the persons during the work at site.
11	Vendor shall adhere to all necessary safety norms such as use of helmet, goggles, hand gloves, gumboots, aprons etc. It is the ultimate responsibility of the vendor in all respect to prevent accidents at the site and safeguard their labour from accidents.
12	Vendor shall, at the completion of every work, clear off the debris, which resulted out of the work. In case of excavation work such as cable trench etc, vendor shall finish the land neatly with necessary leveling, rolling etc.
13	Vendor shall carry out the work without causing inconvenience to other contractors of BHEL at site. In case of conflicts with other contractors, it is the responsibility of the vendor to ensure that the matter is resolved at once amicably so that the progress of work is not affected.
14	Any damages on the building, structures etc attributable to the acts of labour / employees of vendor shall be rectified and made good by the vendor at their own cost.
15	No child labour shall be employed for execution of the present contract.
16	Any miscellaneous materials, which are found essential for technical completion of the contract but not mentioned explicitly in this specification, shall be deemed to be included in the specification. Accordingly, such materials shall be included by the vendor as part of the offer.
17	BHEL/NTPC shall witness routine/ acceptance/ type tests performed at manufacturer works for the items supplied by vendor. Vendor shall accordingly provide inspection call to BHEL with submission of internal test results in advance. For the items bought out from dealers, test certificates, as per relevant IS / IEC standards, as issued by manufacturer shall be submitted to BHEL. However, prior approval shall be obtained from BHEL/NTPC for procurement of the item from dealers.
18	Field Quality Plan / Quality control system Vendor shall set up a field quality control laboratory with full set up to facilitate testing of all civil construction materials in accordance with FQP (Field quality control plan) that shall be submitted to BHEL for approval by BHEL/NTPC. Similarly, FQP for electrical works in respect of switchyards / transmission tower line shall also be submitted to BHEL. Vendor shall deploy a well experienced quality control engineer to monitor all QC activities at site as per approved FQP. Specifically, with reference to civil works, vendor shall submit all concrete mix designs and bituminous mix designs for BHEL/NTPC approval before starting of work. All the third

	party testing should be conducted in laboratories approved by BHEL/NTPC for which relevant details shall be submitted to BHEL prior to taking up work with the laboratory.
19	Any deviations shall be discussed with BHEL/NTPC site engineers and implementation shall be taken up only after approval from BHEL/NTPC.
20	Vendor shall submit periodic status report, on daily as well as weekly consolidated basis, to BHEL on the progress of the contract.

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, Employees State Insurance Act 1948, Contract Labor (Regulations & Abolishment) Act 1970 or any modification thereof or any other law relating whereto and rules made there under from time to time.

5.0 TECHNICAL DATA

5.1 SCOPE AND GENERAL INFORMATION

5.1.1. This specification intends to cover the following activities, services and works in respect of Interconnection with existing 220 kV switchyard (220 KV bay construction in existing 220KV switchyard is in scope of vendor) & execution of 33kV Interconnection (approx. 1 KM distance) from Main pooling switchgear at Solar plant to 220KV NTPC Substation at Gandhar Gas Power Project situated in the state of Gujarat, India. The brief scope is as mentioned below-

a) Complete design and engineering of all the systems, sub-systems, equipment, material and services including civil/ electrical/ mechanical designs. AC SLD is attached for reference.
b) Providing engineering data, drawings and O&M manuals for BHEL/NTPC review, approval and records.
c) Manufacturing, supply, testing, packing, transportation from the manufacturer's work to the site.
d) Receipt, storage, security, preservation and conservation of equipment at the site.
e) Fabrication, pre-assembly (if any), erection, testing and putting into satisfactory operation of all the equipment/material including successful commissioning.
f) Furnishing of spares.
g) Satisfactory completion of the system

5.1.2 The Bidder shall be responsible for providing all material, equipment and services specified or otherwise which are required to fulfill the intent of ensuring operability, maintainability and the reliability of the complete work covered under this specification. The systems, sub-systems and equipment shall conform in all respect to high standards of engineering, design and workmanship, and shall be capable of performing in continuous commercial operation.

5.1.3 The 220 kV Switchyard shall be with Double Main Bus & Transfer Switching Scheme as indicated in AC SLD. The scope of work shall comprise, but not limited to the design, engineering, manufacture, testing and inspection at manufacturer's works, packing, supply, transportation, transit insurance, delivery to site, unloading, storage and equipment erection, associated structural works. Further, it shall include cabling, lighting, lightning protection, earthing, association of sub vendors if any in the erection, supervision, site testing, inspection and commissioning of 220 kV Switchyard & Interconnection work.
I) 220 kV Bay details : Execution of Solar bay at Existing 220 kV Switchyard
- One no. of 33/220 kV Tie-Transformer bay

II) 33 kV Interconnection work-
Interconnection between 33 KV Main pooling station at Solar PV Plant and Power Transformer at NTPC Switchyard shall be partly cable laying (underground), partly cable laying in air in RCC cable trench/ on cable tray and partly 33KV transmission line. The distance between Main pooling station and power transformer is 1 KM approximately. All design, supply, installation including civil works required for Interconnection between SPV power plant Main pooling station to switchyard bay and extension further to 33 KV side of Power transformer at 220 KV substation will be in vendor's scope. There shall be multiple crossings of road, existing control cable trench, drain, Switchyard fencing. Part of cable trench route is within existing switchyard and part of the cable trench route is narrow space between fence/RCC trench/ Drain. Vendor shall submit the interconnection methodology for BHEL/ NTPC approval prior to start of the work. All items e.g. 33KV cable, cable termination kit on both ends, cable jointing kit, cable support structure, cable trays, Isolator, Insulators, Pole, BPI, 30 KV LA, LA equipment structure, cable route markers, hume pipes for crossings, cutting and repair works for fencing/drain/road/ control cable trenches etc including all civil works will be in scope of vendor.
DC power will be extended from NTPC's existing switchyard control room to Main control room in Solar plant through Copper cable. Vendor shall supply, lay and terminate the cable at both ends. Vendor shall supply and install suitable DB for extending DC supply from existing source to switchyard items and for solar plant. All item like cables, DBs, termination hardware and accessories for the same will be in scope of vendor.
OFC cables will be laid and terminated between solar plant main control room and Switchyard control room for interconnection. Cable supply and termination accessories will be BHEL scope. Laying and termination of cables will be in scope of vendor.
Interconnection between 33 KV Main pooling station at Solar PV Plant and Power Transformer at NTPC Switchyard shall be partly cable laying (underground), partly cable laying in air in RCC cable trench/ on cable tray and partly 33KV transmission line. OFC cables will be laid and terminated between solar plant main control room and Switchyard control room for interconnection. Cable supply and termination accessories will be BHEL scope. Laying and termination of cables will be in scope of vendor.

5.1.4 This scope covers all the work required for mobilization of necessary equipment/ machinery, providing necessary engineering supervision and technical personnel, preparations for the type of foundations and the safe bearing capacity for different sizes of foundations for 220 bay.

5.1.5 The equipment and materials to be supplied by the Contractor shall form a complete 220 kV switchyard bay & Interconnection work including terminations on both ends. The equipment and services as detailed in all sections of the specification and as shown on the tender drawings shall be within the scope of supply of the Contractor.

5.1.6 The following is the list of items under the scope of contractor. However any items though not specifically mentioned but which are required to make the 220 kV switchyard & 33 kV cabling work complete in all respects for its safe, efficient, reliable and trouble free operation shall be supplied and erected by the Contractor, unless they are specifically excluded in the text of exclusions given elsewhere.
220 kV Switchyard :
- 220kV equipment: Circuit Breakers, Isolators (with and without earth switches), Current Transformers, Surge arresters, Bus post insulators, Capacitor voltage transformers, Control and Relay panel, SAS, TEM and ABT meters with metering panel.
- Extension of Existing High pressure water spray system for Power Transformer fire protection
- 220kV Switchyard materials:
    - 4" EHIPS Aluminum tube
    - ACSR 'Moose' Conductor

- 10.98 dia G.S. Earthwire
- Insulator, Insulator string and hardware
- Clamps, connectors and spacers
- Bay Marshalling kiosks

- Complete earthing grid (inclusive of supply of 40mm dia MS rod and GI flat) earthing of all switchyard equipment and its connection to existing earthing grid.
- Direct Stroke Lightning Protection of 220 kV switchyard either through LM or through Shield wire based on detail engineering as applicable.
- Armoured Power, Control and Screen cables, cabling (including interpole and interpanel), Cabling between Contractor supplied equipment and BHEL supplied/ Existing equipment (Existing LT switchgear, DCDB etc.)
- Armoured Power, Control cables, optical fibre cable, screen cable and Cabling among Contractor supplied equipment and BHEL supplied/ Existing equipment
- Cable support angles & accessories necessary for cable erection and any other items such as glands, lugs, clamps for cables, ferrules, cable ties, hume pipe etc. cable route markers for buried cable trench are also included in the scope.
- Power & Control cable schedule & termination schedules, optical fibre cable & screened cable shall be prepared by the Contractor.
- Outdoor lighting system for 220 kV switchyards.
- BCU and BPU for all the bays including Disturbance Recorder. Standalone Event logger and Time synchronizing equipment for bays under present scope and owners use as well.
- Modification in the existing control and protection scheme including supply of hardware/ software for integration of bays under present scope with the existing system like bus bar protection, islanding system etc.
- Interfacing with the existing RTU for extending the data from bays under present scope to RLDC.
- Relay setting calculations shall be prepared by the Contractor and approved by BHEL/NTPC
- Supply, erection, commissioning of Automatic start/ stop type centrifugal pump for sump pit.

33 kV Interconnection from Main pooling switchgear in Solar plant to 220KV NTPC Substation:

- All items and accessories in vendor's scope except for OFC cable as detailed in clause 4.2.
- All works including civil and fabrication works in scope of vendor.

5.1.7 SERVICES AND ITEMS

The scope also include but not limited to the following services/items described herein and elsewhere in specification:

a) System design and engineering
b) Supply of equipment and material
c) Structural works
d) Erection works
e) Project management and site supervision
f) Testing and commissioning
g) Interface coordination
h) Performance testing
i) Clearance from statutory authority. Owner shall provide support for this activity.

5.1.8 System Design and Engineering

a) The Contractor shall be responsible for detailed design and engineering of overall system, sub-systems, elements, system facilities, equipments, auxiliary services, etc. It shall include proper definition and execution of all interfaces with systems, equipment, material and services of NTPC for proper and correct design, performance and operation of the project.

b) Contractor shall provide complete engineering data, drawings, reports, manuals, etc. for BHEL/NTPC review, approval and records.
c) The scope shall also include the design and engineering as per details elaborated elsewhere in this specification.
d) For all structural works, the Contractor shall prepare design and fabrication drawings. Similarly for civil works, the detailed construction drawings shall be prepared for those items whose design is to be done by the Contractor.

5.1.9 Supply of Equipment and Material
a) The Contractor shall be responsible for design, engineering, manufacture, testing, inspection at manufacturer's works, supply, transportation, delivery at site, unloading, storage, in plant transportation at site, complete erection & supervision, site testing & inspection, and successful commissioning of all the equipment and material as detailed elsewhere in specification and as shown on the tender drawings. Any item though not specifically mentioned, but is required to complete the project works in all respects for its safe, reliable, efficient and trouble free operation shall be supplied and erected by the Contractor unless it is explicitly excluded as given elsewhere in the chapter.
b) All consumables, wastages and damages shall be to the account of Contractor.

5.1.10 Structural Works
The scope of structural works shall include design, engineering & construction of all structural works including supply of all materials complete for all equipments, gantry structures and associated facilities for the Switchyard & 33KV cabling.
a) Detailed design criteria including basis of design shall be prepared by the Bidder based on various requirements specified elsewhere in the specifications. All the above documents shall be finalised after BHEL/NTPC's approval and the same shall form the basis of Detailed Engineering Work.
b) Structural works associated with switchyard gantry structure (Towers & Beams) and Lightning Mast including proto assembly and substructure as required complete.
c) Structural works associated with switchyard equipment supporting structures and cable sealing ends including proto assembly and substructure as required complete.
d) Installation of Control & protection panels etc. in Existing Switchyard control room building and all other related works complete as per system requirement.
e) Structural works of rails for movement of Transformers, arrangement for cabling etc. all complete.
f) Civil & Structural works associated with 33 kV cabling, Cable sealing ends
g) All necessary embedments, inserts, supporting structures, supporting members as per requirement. All cable tray supporting structures including angles/bends/insert plates etc. inside existing control room building are also in scope of bidder.
h) All pipe and cable supporting arrangement/structures, pipe and cable trenches etc.
j) Supply of all materials for the construction of structures / facilities in the switchyard extension area. Bidder has to make arrangements for supply of all materials.
k) Soil sterilization /anti-weed treatment
l) Foundation for Lighting Poles.
m) Any other facility / structure that would be required as per system requirements.
n) All protection measures to prevent any damage to the adjoining structures / facilities.
o) Scope of the Bidder shall also include supply and laying of 40mm dia MS Rods as earthing mat as per requirement.

5.1.11 All works relating to design, preparation of drawings including fabrication drawings, procurement of material, fabrication, proto assembly, mass fabrication, transportation to site, handling, storage and erection of all Towers & Beams, Lightning Mast and Equipment supporting

structures (both lattice type and pipe type) for the switchyard extension area as per design and drawings to be prepared by the Contractor and approved by the BHEL/NTPC. This shall also include all types of bolts, nuts, hangers, shackles, clamps, step bolts etc. and any other items those are required to complete the job.
The Contractor shall construct, erect and install all structures, equipments and material of switchyard extension area. He shall be responsible for provision of all labour, tools and plant, and supervisory staff for safe, reliable, proper and correct erection of project components.
The tools and plant shall include, but not limited to, special hoisting equipment, cranes, stringing equipment, slings, consumables and all other articles and supplies as required.
The Contractor shall ensure periodic cleaning of work sites and removal of all waste material, packing material, surplus earth and left-overs and their proper disposal.

5.1.12 Testing and Commissioning
a) The scope includes testing and commissioning of all equipment, subsystems and systems of the project and putting them into successful commercial operation. The scope shall include but not limited to the requirements given elsewhere in the specification.
b) The Contractor shall be responsible to provide all necessary testing and commissioning personnel, tools and plant, test equipment, etc.

5.1.13 **Interface Coordination**
a) The Contractor shall identify all interface issues with BHEL/NTPC and other agencies, and shall be responsible for such interfacing, coordination and exchange of all necessary information.
b) The Contractor shall submit all drawings for review and approval of BHEL/NTPC. Contractor shall list the detailed requirements of interface between Contractor's work and the material and services to be provided by BHEL/NTPC.

5.1.14 **SPARES**
All spares supplied under this specification shall be strictly interchangeable with the parts for which they are intended for replacement. The spares shall be treated and packed for long term storage in the climatic conditions prevailing at the site. Small items shall be packed in sealed transparent plastic covers with desiccant bags as necessary.
Each spare part shall be clearly marked and labeled on the outside of the packing together with the description when more than one spare part is packed in single case.
A general description of the contents shall be shown on outside of the case and detailed list enclosed. All cases, containers and other packages must be suitably marked and numbered for the purpose of identification.

5.1.15 DETAILED SCOPE OF WORK - ELECTRICAL
5.1.15.1 Contractor shall be responsible for design and engineering of overall system/station, and all elements, systems, sub-systems, facilities, equipments, material, etc. The Contractor shall submit design calculations, drawings, codes, codes of practices, construction drawings, etc. for BHEL/NTPC approval.
5.1.15.2 The basic design based on tender SLD shall include, but not limited to, the following:
a) Development of general arrangement.
b) Development of detailed layout (plan & section/elevation) drawings.
c) Protection and control philosophy and selection of protection, control and annunciation schemes.
d) Development of interlocking schemes.
e) Development of switchyard structure loading details.
f) Development of earthing system
g) Development of direct stroke lightning protection system.
h) Insulation coordination of the EHV equipment.

i) Calculation of static and dynamic force load, and selection of spacer spans and equipment terminal loading.
j) Development of clearance diagrams.
k) Lighting design, Lux level calculation and conduit wiring diagram.
l) Development of power & control cable laying and termination schedules.
m) Relay setting calculations.
n) Development of erection key diagram with bill of material.
o) Foundation design and construction drawings.
p) Development of cable trench layout and sections and construction drawings.
q) Effect of nearby conductors due to electric field adjoining building and providing shielding.

5.1.15.3 Contractor shall furnish detailed drawings for the various equipments covered in their scope for BHEL/NTPC approval. The equipment shall conform to type tests as per specification and applicable standards and reports of the same shall be furnished for approval.

5.1.15.4 Contractor shall furnish design calculations and construction drawings for all civil works showing details of pockets to be left in foundations and embedments to be provided in cable trenches.

Contractor shall furnish the schematics, general arrangement drawings, cable schedules, interconnection schedules, panel wiring diagrams, etc. for various control and relay panels for BHEL/NTPC approval. Contractor shall also furnish the recommended relay settings to be adopted.

5.1.15.5 The Contractor shall note that the list of standards specified elsewhere in this specification is not complete. Whenever necessary the list of standards shall be considered in conjunction with specification, IS & IEC. In case governing standards for the equipment is different from IS or IEC, the salient points shall be clearly brought out along with English language version of the same.

5.1.15.6 Exposed live parts shall be placed high enough above ground to meet the requirements of Indian Electricity Rules and other statutory codes. All responsibilities regarding co-ordination with Electrical Inspection Agencies and obtaining clearance certificate from them rests with the Contractor.

5.1.15.7 For 220kV switchyard, the Main buses (Bus I & II) shall be Quad ‘moose’ ACSR conductor & Transfer Bus shall be Twin moose ACSR conductor. The equipment interconnections shall be through 4” IPS Al. tube/Twin moose ACSR conductor. The spacing for Twin moose ACSR conductor shall be 450 mm. All the ‘T’ off connections shall be provided with a bye pass utilizing two PG clamps for each ‘T’ off. As far as possible the conductor shall pass without cut/joints unless otherwise necessary for planned shutdown/ maintenance.

All equipment shall be supplied with suitable terminal connectors. The terminal connector shall be well coordinated with the type/size of conductor and equipment to be connected. The conductor terminations for equipment shall be either rigid or expansion type suitable for 4” IPS Al. tube or horizontal or vertical take-off suitable for Quad/Twin moose ACSR conductor. The exact requirement & type of terminal clamps would be finalised by the Contractor in consultation with BHEL/NTPC based on layout requirement. The terminal pads shall preferably be capable of taking the required conductor span under normal, short circuit and meteorological conditions, without affecting the performance of the equipment.

5.1.15.8 The rigid busbars for equipment inter connections shall have rigid connections at one end and expansion /flexible at other end. The tubular Al .connections shall have not more than one joint per span. Since no wastages are permissible, the bidder shall workout the cut lengths of Aluminium tube based on the finalised layout, & dispatch the same to site without requiring BHEL/NTPC approval. Corona Bell shall be provided at the end of the rigid busbars. The connectors and clamps shall be rated same as `the connected equipments.

5.1.15.9 The minimum vertical distance from the bottom of the lowest porcelain part of the bushing, porcelain enclosures or supporting insulators to the bottom of the equipment base, where