STANDARD SINGLE STAGE REQUEST FOR PROPOSAL DOCUMENT

FOR

SELECTION OF BIDDER AS TRANSMISSION SERVICE PROVIDER THROUGH TARIFF BASED COMPETITIVE BIDDING PROCESS

TO

ESTABLISH INTER-STATE TRANSMISSION SYSTEM

FOR

Transmission System for Evacuation of Power from potential renewable energy zone in Khavda area of Gujarat under Phase-V (8GW): Part C

ISSUED BY

PFC CONSULTING LTD.
(A wholly owned subsidiary of Power Finance Corporation Ltd.)

Registered Office:
1st Floor, "Urjanidhi", 1, Barakhamba Lane,
Connaught Place, New Delhi-110001

26, July, 2024

PFC CONSULTING LIMITED
(A wholly owned subsidiary of Power Finance Corporation Limited)

Corporate Office:
9th Floor, A-Wing, Statesman House
Connaught Place, New Delhi-110001

Request for Proposal Document for selection of Bidder as Transmission Service Provider through tariff based competitive bidding process to establish Inter-State Transmission System for "Transmission System for Evacuation of Power from potential renewable energy zone in Khavda area of Gujarat under Phase-V (8GW): Part C" is issued by PFC Consulting Limited.

This RFP document is issued to -

M/s. _____

_____

_____

_____

_____

General Manager
PFC Consulting Limited
9th Floor, A-Wing, Statesman House
Connaught Place, New Delhi-110001
Email: pfccl.itp@pfcindia.com
Place: New Delhi
Date:
Signature: ……

REQUEST FOR PROPOSAL NOTIFICATION

PFC Consulting Limited
(A wholly owned subsidiary of Power Finance Corporation Limited)

Corporate Office:
9th Floor, A-Wing, Statesman House
Connaught Place, New Delhi-110001

1. The Government of India, Ministry of Power, vide its notification no. **CG-DL-E-06092023-248580** dated September 04, 2023 has notified PFC Consulting Limited (PFCCL) to be the Bid Process Coordinator (BPC) for the purpose of selection of Bidder as Transmission Service Provider (TSP) to establish Inter-State transmission system for "**Transmission System for Evacuation of Power from potential renewable energy zone in Khavda area of Gujarat under Phase-V (8 GW): Part C**" through tariff based competitive bidding process.

2. PFC Consulting Limited (PFCCL) (hereinafter referred to as BPC) hereby invites all prospective Bidders for issue of Request for Proposal (RFP) for selection of Bidder as Transmission Service Provider (TSP) on the basis of international competitive bidding in accordance with the "Tariff Based Competitive Bidding Guidelines for Transmission Service" and "Guidelines for Encouraging Competition in Development of Transmission Projects" issued by Government of India, Ministry of Power under section – 63 of The Electricity Act, 2003 and as amended from time to time. The responsibility of the TSP would be to establish the following Inter-State Transmission System – "**Transmission System for Evacuation of Power from potential renewable energy zone in Khavda area of Gujarat under Phase-V (8 GW): Part C"** (hereinafter referred to as 'Project') on build, own, operate & transfer basis and to provide transmission service:

S. No	Transmission System for Transmission System for Evacuation of Power from potential renewable energy zone in Khavda area of Gujarat under Phase-V (8 GW): Part C	
	Name of Transmission Element	**Scheduled COD in months from Effective Date**
1.	Establishment of 2500 MW, ±500 kV KPS3 (HVDC) [VSC] terminal station (2x1250 MW) at a suitable location near KPS3 substation with associated interconnections with 400 kV HVAC Switchyard* • 2500 MW, ±500 kV KPS3 (HVDC) [VSC] Terminal station	48 months from SPV transfer
2.	Establishment of 2500 MW, ±500 kV South Olpad (HVDC) [VSC] terminal station (2x1250 MW) along with associated interconnections with 400 kV HVAC Switchyard of South Olpad S/s* • 2500 MW, ±500 kV South Olpad (HVDC) [VSC] terminal station	
3.	Establishment of KPS3 (HVDC) S/s along with 2x125 MVAR, 420 kV bus reactors along with associated interconnections with HVDC	

	Switchyard*. The 400 kV bus shall be established in 2 sections through 1 set of 400 kV bus sectionaliser to be kept normally OPEN. 400/33 kV, 2x50 MVA transformers for exclusively supplying auxiliary power to HVDC terminal. ○ 400/33 kV, 1x50 MVA ICT along with bays : 2 Nos. ○ 125 MVAR 420 kV bus reactor- 2 Nos. (one on each section) ○ 400 kV reactor bay- 2 Nos. (one on each section) ○ 400 kV Bus sectionaliser- 1 Set **Future Provisions at KPS3 (HVDC) S/s Space for:** ○ 400 kV line bays – 6 Nos. (3 on each section) ○ 400 kV reactor bay- 2 Nos. (one on each section)	
4.	KPS3 – KPS3 (HVDC) 400 kV 2xD/C (Quad ACSR/AAAC/AL59 moose equivalent) line along with the line bays at both substations • 400 kV GIS line bays - 4 Nos. at KPS3 (2 Nos. on each bus section) • 400 kV GIS line bays - 4 Nos at KPS3 (HVDC) (2 Nos. on each bus section)	
5.	±500 kV HVDC Bipole line between KPS3 (HVDC) and South Olpad (HVDC) (with Dedicated Metallic Return) (capable to evacuate 2500 MW)	

**The 400 kV interconnections (along with all associated equipment/ bus extension, etc.) between HVDC and HVAC switchyards shall be implemented by the TSP*

Note:

i. The 1250 MW pole-1 shall emanate from 400 kV bus section 1 of KPS3 (HVDC) and terminate at South Olpad S/s. Similarly, the 1250 MW pole-2 shall emanate from 400 kV bus section 2 of KPS3 (HVDC) and terminate at South Olpad S/s.

ii. HVDC System will be designed with 100% power reversal capability as well as black start, automatic grid restoration and dynamic reactive power support capability.

iii. The rated power transmission capacity as well as the rated transmission voltage shall be defined and guaranteed at the rectifier DC Bus.

iv. TSPs of KPS3 shall provide space for scope at Sl. No. 4 as per the above scope

v. TSP of South Olpad S/s shall provide space for scope at Sl. No. 2 as per above scope ensuring

(a) indicative total space requirement for HVDC terminal station of size 400 m x 300 m. The AC switchyard connection and DC overhead line shall be from 300 m side of rectangular plot.

(b) the width of the approach road and access road shall be at least 10 m for facilitating smooth transportation of HVDC equipment including converter transformer and with access road all around the space for HVDC.

(c) the spatial arrangement for proposed space for HVDC terminal and the layout proposed for the current AC GIS transmission scheme is such that Bus duct length required for interconnection between AC GIS station and HVDC terminal is minimum to the extent possible in linear manner and the layout of the AC line termination gantries should be such that there is no crossing of present/ future AC lines and HVDC line near the termination ends of both AC and HVDC yards.

vi. Implementation timeline: 48 months from SPV transfer

3. The TSP shall ensure that design, construction and testing of all equipment, facilities, components and systems of the Project shall be in accordance with the provisions of the Transmission Service Agreement and applicable Rules/ Regulations, Orders and Guidelines issued by the Central Government.

4. **Transmission License**: The TSP shall obtain the Transmission License from the Commission.

5. **Bidding Process:** The Transmission Service Provider shall be selected through tariff based competitive bidding process for the Project based on meeting stipulated Qualification Requirements prescribed in Clause 2.1 of Section 2 of RFP and the lowest Quoted Transmission Charges discovered from Final Offers quoted during the e-reverse bidding. The selection of the TSP shall be subject to it obtaining Transmission License from the Commission, which, after expiry, may be further extended by such period as deemed appropriate by the Commission under powers vested with it to amend the conditions of the Transmission License.

   The entire bidding process shall be conducted on electronic platform created by MSTC Limited.

   The Bid shall be a single stage two envelope bid comprising the Technical Bid and the Financial Bid. The Bidders shall submit the Bid online through the electronic bidding platform. In addition to the online submission, the Bidder with lowest Final Offer will be required to submit original hard copies of Annexure 3, Annexure 4 (if applicable), Annexure 6 (if applicable) and Annexure 14 before issuance of LoI. There shall be no physical submission of the Financial Bid.

   The Technical Bid shall be opened first and the Financial Bid of only the bidder who have qualified in the Technical Bid shall be opened. The Financial Bid will comprise of two rounds. In the first round the Initial Offer of the responsive bids would be opened and Quoted Transmission Charges of Initial Offer shall be ranked on the basis of ascending order. The Bidders, in the first fifty per cent of the ranking (with any fraction rounded off to higher

integer) or four Bidders, whichever is higher, shall qualify for participating in the electronic reverse auction stage and submit their Final Offer.

6. The objective of the bidding process is to select a Successful Bidder pursuant to this RFP, who shall acquire one hundred percent (100%) of the equity shares of KPS III HVDC TRANSMISSION LIMITED along with all its related assets and liabilities as per the provisions of the Share Purchase Agreement, at the Acquisition Price to be intimated by the BPC, twenty (20) days prior to the Bid Deadline.

   The KPS III HVDC TRANSMISSION LIMITED, of which one hundred percent (100%) equity shares will be acquired by the Selected Bidder, shall be responsible as the TSP, for ensuring that it undertakes ownership, financing, development, design, engineering, procurement, construction, commissioning, operation and maintenance of the Project, and to provide Transmission Service as per the terms of the RFP Project Documents.

   The TSP shall ensure transfer of all project assets along with substation land, right of way and clearances to CTU or its successors or an agency as decided by the Central Government after 35 years from COD of project at zero cost and free from any encumbrance and liability. The transfer shall be completed within 90 days after 35 years from COD of project failing which CTU shall be entitled to take over the project assets Suo moto.

7. **Commencement of Transmission Service**: The Bidder shall have to commence Transmission Service in accordance with the provisions of the Transmission Service Agreement.

8. **Transmission Charges**: The Transmission Charges shall be payable by the Designated ISTS Customers in Indian Rupees through the CTU as per Central Electricity Regulatory Commission (Sharing of Inter-State Transmission Charges and Losses) Regulations as amended from time to time. Bidders shall quote the Transmission Charges as per the pre-specified structure, as mentioned in the RFP.

9. **Issue of RFP document:** The detailed terms and conditions for qualification and selection of the Transmission Service Provider for the Project and for submission of Bid are indicated in the RFP document. All those interested in purchasing the RFP document may respond in writing to **General Manager, Tel. +91 11 23443912, Fax +91 11 23443990, Email: pfccl.itp@pfcindia.com** at the address given in para 12 below with a non-refundable fee of Rs. 5,00,000/- (Rupees Five Lakh Only) or US$ 7000/- (US Dollars Seven Thousand Only) plus 18% GST, to be paid via electronic transfer to the following Bank Account:

   Bank Account Name : PFC Consulting Limited
   Account No. : 000705036117
   Bank Name : ICICI Bank
   IFSC : ICIC0000007
   Branch : Connaught Place, New Delhi-110001

   latest by 29.09.2024. Immediately after issuance of RFP document, the Bidder shall submit the Pre-Award Integrity Pact in the format as prescribed in Annexure B, which shall be applicable for and during the bidding process, duly signed on each page by any whole-time Director / Authorized Signatory, duly witnessed by two persons, and shall be submitted by the Bidder in two (2) originals in a separate envelope, duly superscripted with Pre-Award

Integrity Pact. The Bidder shall submit the Pre-Award Integrity Pact on non-judicial stamp paper of Rs. 100/- each duly purchased from the National Capital Territory of Delhi. In case the Bidder is in a consortium, the Pre-Award Integrity Pact shall be signed and submitted by each member of the Consortium separately.

The RFP document shall be issued to the Bidders on any working day from 26/07/2024 to 30/09/24 between 1030 hours (IST) to 1600 hours (IST). The BPC, on written request and against payment of the above mentioned fee by any Bidder shall promptly dispatch the RFP document to such Bidder by registered mail/ air mail. BPC shall, under no circumstances, be held responsible for late delivery or loss of documents so mailed.

10. **Receipt and opening of Bid:** The Bid must be uploaded online through the electronic bidding platform on or before 1500 hours (IST) on 30/09/24 . Technical Bid will be opened by the Bid Opening Committee on the same day at 1530 hours (IST) in the office of Central Electricity Authority, in the online presence of Bidders' representatives who wish to attend. If the Bid Deadline is a public holiday at the place of submission of Bid, it shall be opened on the next working day at the same time and venue. In addition to the online submission, the Bidder with lowest Final Offer will be required to submit original hard copies of Annexure 3, Annexure 4 (if applicable), Annexure 6 (if applicable) and Annexure 14 before issuance of LoI. Bidders meeting the Qualification Requirements, subject to evaluation as specified in Clause **3.2** to **3.4** shall be declared as "Qualified Bidders" and eligible for opening of Initial Offer.

11. The RFP document is not transferable. BPC reserves the right to reject all Bid and/or annul the process of tariff based competitive bidding for selection of Bidder as TSP to execute the Project without assigning any reason. BPC shall not bear any liability, whatsoever, in this regard.

12. **Nodal person for enquiries and clarifications**

All correspondence and clarification in respect of RFP document shall be addressed to:

General Manager
PFC Consulting Limited
9th Floor, A-Wing, Statesman House
Connaught Place, New Delhi - 110001, India
Tel. + 91-11-23443912
Fax + 91-11-23443990
Email: pfccl.itp@pfcindia.com

DISCLAIMER

1. This Request for Proposal (RFP) document is not an agreement or offer by the BPC to the prospective Bidders or to any other party. The purpose of this RFP document is to provide interested parties with information to assist the formulation of their Bid. The RFP document is based on material and information available in public domain.

2. This RFP, along with its Annexures, is not transferable and the information contained therein are to be used only by the person to whom it is issued. It may not be copied or distributed by the recipient to third parties (other than in confidence to the recipient's professional advisors). In the event that the recipient does not continue with its involvement in the Project in accordance with this RFP, this RFP must be kept confidential.

3. While this RFP has been prepared in good faith, neither the BPC nor its employees or advisors/consultants make any representation or warranty expressed or implied as to the accuracy, reliability or completeness of the information contained in this RFP. The Bidders shall satisfy themselves, on receipt of the RFP document, that the RFP document is complete in all respects. Intimation of any discrepancy shall be given to this office immediately. If no intimation is received from any Bidder within ten (10) days from the date of issue of this RFP document on or before the date & time mentioned in this RFP, it shall be considered that the issued document, complete in all respects, has been received by the Bidders.

   This bidding process is in accordance with the Bidding Guidelines issued by Ministry of Power, Government of India under Section 63 of the Electricity Act, 2003. Revisions or amendments in these Bidding Guidelines may cause the BPC to modify, amend or supplement this RFP document, including the RFP Project Documents to be in conformance with the Bidding Guidelines.

4. This RFP document includes statements, which reflect various assumptions arrived at by BPC in order to give a reflection of current status in the RFP. These assumptions should not be entirely relied upon by Bidders in making their own assessments. This RFP document does not purport to contain all the information each Bidder may require and may not be appropriate for all persons. It is not possible for BPC to consider the investment objectives, financial situation and particular needs of each party who reads or uses this RFP document. Certain Bidders may have a better knowledge of the Project than the others. Each Bidder should conduct its own investigations and analysis and should check the accuracy, reliability and completeness of the information in this RFP document and obtain independent advice from appropriate sources.

5. Neither BPC nor their employees or consultants make any representation or warranty as to the accuracy, reliability or completeness of the information in this RFP document.

6. Neither BPC, its employees nor its consultants will have any liability to any Bidder or any other person under the law of contract, tort, the principles of restitution or unjust enrichment or otherwise for any loss, expense or damage which may arise from or be incurred or suffered in connection with anything contained in this RFP document, any matter deemed to form part of this RFP document, the award of the Project, the information supplied by or on behalf of BPC or its employees, any consultants or otherwise arising in any way from the qualification process for the said Project.

7. By participating in the bidding process, each of the Bidder shall have acknowledged and accepted that it has not been induced to enter into such agreement by any representation or warranty, expressed or implied, or relied upon any such representation or warranty by or on behalf of BPC or any person working in the bidding process.

8. BPC may in its absolute discretion, but without being under any obligation to do so, update, amend or supplement this RFP document. Such updations, amendments or supplements, if any, will however be circulated to the Bidders not later than 15 days prior to the last date for submission of Bid.

9. Each Bidder unconditionally agrees, understands and accepts that the BPC reserves the rights to accept or reject any or all Bids without giving any reason. Neither the BPC nor its advisers shall entertain any claim of any nature, whatsoever, including without limitations, any claim seeking expenses in relation to the preparation of Bids.

10. This RFP may be withdrawn or cancelled by the BPC at any time without assigning any reasons thereof. BPC further reserves the right, at its complete discretion to reject any or all of the Bids without assigning any reasons whatsoever.

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DEFINITIONS

Any capitalized term, used but not defined in this RFP, shall have the meaning ascribed to such term in the RFP Project Documents, or the Bidding Guidelines, in that order. In absence of availability of definitions in the foregoing references, the capitalized terms shall be interpreted in accordance with the Electricity Act 2003, Grid Code or any other relevant electricity law, rule or regulation prevalent in India, as amended or re-enacted from time to time, in that order.

The following terms are defined for use in this RFP:

"Acquisition Price" shall have the same meaning as defined in the Share Purchase Agreement;

"Affiliate" shall mean a company that either directly or indirectly

i. controls or
ii. is controlled by or
iii. is under common control with

a Bidding Company (in the case of a single company) or a Member (in the case of a Consortium) and "**control**" means ownership by one entity of at least twenty six percent (26%) of the voting rights of the entity. As an illustration a chart is annexed hereto as Annexure – 12;

"Bid" shall mean Technical Bid and Financial Bid (Initial Offer and Final Offer) submitted by the Bidder, in response to this RFP, in accordance with the terms and conditions thereof;

"Bidder" shall mean either a single company (including its permitted successors and legal assigns) or a Consortium of companies (including its permitted successors and legal assigns) submitting a Bid in response to this RFP. Any reference to the Bidder includes Bidding Company, Bidding Consortium/ Consortium, Member in a Bidding Consortium and Lead Member of the Bidding Consortium jointly and severally, as the context may require;

"Bidding Company" shall refer to such single company (including its permitted successors and legal assigns) that has submitted a Bid for the Project;

"Bidding Consortium/ Consortium" shall refer to a group of companies (including their permitted successors and legal assigns) that has collectively submitted a Bid for the Project;

"Bidding Guidelines" shall mean the "Tariff Based Competitive-Bidding Guidelines for Transmission Service" and "Guidelines for Encouraging Competition in Development of Transmission Projects" issued by Government of India, Ministry of Power under Section – 63 of Electricity Act as amended from time to time;

"Bid Bond" shall mean the unconditional and irrevocable bank guarantee for Rupees 190.99 crore (Rs. One Hundred Ninety crore and Ninety Nine Lakh only), to be submitted along with the Technical Bid by the Bidder under Clause 2.11 of this RFP, as per the format prescribed in Annexure 14**;**

"Bid Deadline" shall mean the last date and time for submission of online Bid in response to this RFP, specified in Clause 2.7.1;

"Bid Process Coordinator or BPC" shall mean a person or its authorized representative as notified by the Government of India, responsible for carrying out the process for selection of Bidder who will acquire Transmission Service Provider;

"Bid Security Declaration" shall mean the declaration to be submitted along with the Technical Bid by the Bidder in lieu of the Bid Bond, as per the format prescribed in Annexure 14A [only applicable for projects for which RFP has been issued before 31.12.2021]**;**

"CEA" shall mean the Central Electricity Authority constituted under Section - 70 of the Electricity Act;

"Commission" or "CERC" shall mean the Central Electricity Regulatory Commission of India constituted under Section-76 of The Electricity Act, 2003 and any successors and assigns;

"Conflict of Interest" A Bidder shall be considered to be in a Conflict of Interest with one or more Bidders in the same bidding process if they have a relationship with each other, directly or through a common company, that puts them in a position to have access to information about or influence the Bid of another Bidder.

Provided that if two or more bidders in the bidding process have formed a Joint Venture Company or Consortium to execute another project, the Bidders will not be considered to have Conflict of Interest;

"Commercial Operation Date (COD)" shall mean the date as per Article 6.2 of the Transmission Service Agreement;

"Consents, Clearances, Permits" shall mean all authorizations, licenses, approvals, registrations, permits, waivers, privileges, acknowledgements, agreements, or concessions required to be obtained from or provided by any concerned authority for the development, execution and performance of Project including without any limitation on the construction, ownership, operation and maintenance of the transmission lines and/or sub-stations;

"Contract Performance Guarantee" shall have the meaning as per Clause 2.12 of this RFP;

"Contract Year" shall mean the period beginning on the Scheduled COD, and ending on the immediately succeeding March 31 and thereafter each period of 12 months beginning on April 1 and ending on March 31 provided that:

(i) the last Contract Year shall end on the last day of the term of the Transmission Service Agreement;

"Infrastructure sector" shall mean such sectors notified by Department of Economic Affairs in its Gazette Notification no. 13/1/2017-INF dated 14th November, 2017 and as amended from time to time;

"CTU/Central Transmission Utility" shall have same meaning as defined in the Electricity Act, 2003;

"Designated ISTS Customers" or "DICs" shall have the meaning as ascribed in Regulation 2(l) of Central Electricity Regulatory Commission (Sharing of inter-State Transmission Charges and Losses) Regulation 2020 and as amended or modified from time to time;

"Effective Date" shall have the meaning as ascribed thereto in the Transmission Service Agreement;

"Element" shall mean-each Transmission Line or each circuit of the Transmission Lines (where there are more than one circuit) or each bay of the Sub-station or switching station or HVDC terminal or inverter station of the Project, including ICTs, Reactors, SVC, FSC, etc. forming part of the ISTS which will be owned, operated and maintained by the concerned ISTS Licensee, and which may have a separate scheduled COD as per Schedule 2 of the Transmission Service Agreement and may have a separate percentage for recovery of Transmission Charges on achieving COD as per Schedule 5 of the Transmission Service Agreement;

"National Committee on Transmission" shall mean the committee constituted by the Ministry of Power, Government of India in terms of the "Guidelines for Encouraging Competition in Development of Transmission Projects", as notified from time to time;

"Final Offer" shall mean the Quoted Transmission Charges, required to be submitted as part of the Financial Bid on the electronic bidding platform during the e-reverse bidding stage. In case, no Final Offer is received during the e-reverse bidding stage then the lowest "Initial Offer" shall be deemed to be the Final Offer**;**

"Financial Bid" shall mean the Initial Offer and Final Offer, containing the Bidder's Quoted Transmission Charges, as per the format at Annexure – 21 of this RFP**;**

"Financially Evaluated Entity" shall mean the company which has been evaluated for the satisfaction of the financial requirement set forth in Clause **2.1.3** hereof;

"Government" shall mean the Central Government;

"Grid Code" / "IEGC" or **"State Grid Code"** shall mean the Grid Code specified by the Central Commission under clause (h) of sub-section (1) of Section 79 of the Electricity Act and/or the State Grid Code as specified by the concerned State Commission referred under clause (h) of sub-section (1) of Section 86 of the Electricity Act as applicable;

"Transmission Service Agreement" or **"TSA"** shall mean the agreement entered into between Nodal Agency and the TSP, pursuant to which the TSP shall build, own, operate and transfer the Project and make available the assets of the Project on a commercial basis;

"Initial Offer" shall mean the Quoted Transmission Charges, required to be submitted as part of the Financial Bid on the electronic bidding platform along with the Technical Bid**;**

"Inter State Generating Station" or "ISGS" shall mean a Central / other generating station in which two or more states have shares and whose scheduling is to be coordinated by the Regional Load Despatch Centre;

"Inter-State Transmission System" shall have same meaning as defined in the Electricity Act, 2003;

"Lead Member of the Bidding Consortium" or "Lead Member" shall mean a company who commits at least twenty six percent (26%) equity stake in the Project, meets the technical requirement as per Clause 2.1.2 and so designated by other Member(s) in Bidding Consortium;

"Letter of Intent" or "LoI" shall mean the letter to be issued by the BPC to the Bidder, who has been identified as the selected bidder, for award of the Project to such Bidder;

"Member in a Bidding Consortium/Member" shall mean each company in the Bidding Consortium;

"MOP" shall mean the Ministry of Power, Government of India;

"MOEF" shall mean the Ministry of the Environment and Forests, Government of India;

"Nodal Agency" shall mean CTU, which shall execute and implement the Transmission Service Agreement (TSA);

Provided that while taking major decisions, CTU shall consult CEA on technical matters and any other matter it feels necessary.

"Technical Bid" shall mean the bid submitted online through the electronic bidding platform, containing the documents as listed out in Clause 2.5.2 of this RFP;

"Parent Company" shall mean an entity that holds at least twenty six percent (26%) of the paid - up equity capital directly or indirectly in the Bidding Company or in the Member in a Bidding Consortium, as the case may be;

"Qualification Requirements" shall mean the qualification requirements as set forth in Section-2, Clause 2.1 of this RFP;

"Quoted Transmission Charges" shall mean the quoted single annual Transmission Charges submitted online through the electronic bidding platform by the Bidder as part of its Financial Bid as per the format in Annexure – 21 of this RFP;

"RFP" shall mean Request for Proposal document along with all schedules, formats, annexure and RFP Project Documents attached hereto, issued by BPC for tariff based competitive bidding process for selection of bidder who will acquire the TSP through e-reverse bidding to execute the Project, and shall include any modifications, amendments or alterations or clarifications thereto;

"RFP Project Documents" shall mean the following documents to be entered into in respect of the Project, by the parties to the respective agreements:

a. Transmission Service Agreement (TSA),
b. Share Purchase Agreement,
c. Agreement(s) required, if any, under Central Electricity Regulatory Commission

(Sharing of Inter-State Transmission Charges and Losses) Regulations as amended from time to time and

d. Any other agreement, as may be required;

"Scheduled COD" shall have the meaning as ascribed hereto in Clause 2.6 of this RFP;

"Statutory Auditor" shall mean the auditor appointed under the provisions of the Companies Act, 1956 / Companies Act, 2013 (as the case may be) or under the provisions of any other applicable governing law;

"Share Purchase Agreement" shall mean the agreement **PFC Consulting Limited**, KPS III HVDC TRANSMISSION LIMITED and the Successful Bidder for the purchase of one hundred (100%) per cent of the shareholding of the KPS III HVDC TRANSMISSION LIMITED for the Acquisition Price, by the Successful Bidder on the terms and conditions as contained therein;

"Successful Bidder" or **"Selected Bidder"** shall mean the Bidder selected pursuant to this RFP to acquire one hundred percent (100%) equity shares of KPS III HVDC TRANSMISSION LIMITED, along with all its related assets and liabilities, which will be responsible as the TSP to establish the Project on build, own, operate and transfer basis as per the terms of the Transmission Service Agreement and other RFP Project Documents;

"Survey Report" shall mean the report containing initial information regarding the Project and other details provided as per the provisions of Clause 1.6.2.1.1 of this RFP;

"Technical Bid" shall mean the bid submitted online through the electronic bidding platform, containing the documents as listed out in Clause 2.5.2 of this RFP;

"Technically Evaluated Entity" shall mean the company which has been evaluated for the satisfaction of the technical requirement set forth in Clause 2.1.2 hereof;

"Transmission Charges" shall mean the Final Offer quoted by Selected Bidder and adopted by the Commission, and as computed in terms of the provisions of Schedule 4 of the TSA, payable to the ISTS Licensee by the Designated ISTS Customers, and collected / disbursed by the CTU, as per Central Electricity Regulatory Commission (Sharing of Inter-State Transmission Charges and Losses) Regulations as amended from time to time;

"Transmission License" shall mean the license granted by the Commission in terms of the relevant regulations for grant of such license issued under the Electricity Act, 2003;

"Transmission Service Agreement" or **"TSA"** shall mean the agreement entered into between Nodal Agency and the TSP, pursuant to which the TSP shall build, own, operate and transfer the Project and make available the assets of the Project on a commercial basis;

"Transmission Service Provider" or "TSP" shall mean KPS III HVDC TRANSMISSION LIMITED which has executed the Transmission Service Agreement and which shall be acquired by the Selected Bidder;

"Ultimate Parent Company" shall mean an entity which owns at least twenty six percent (26%) equity in the Bidding Company or Member of a Consortium, (as the case may be) and in the

Technically Evaluated Entity and/or Financially Evaluated Entity (as the case may be) and such Bidding Company or Member of a Consortium, (as the case may be) and the Technically Evaluated Entity and/or Financially Evaluated Entity (as the case may be) shall be under the direct control or indirectly under the common control of such entity.

SECTION – 1

INTRODUCTION

SECTION 1

1. INTRODUCTION

1.1 The Government of India, Ministry of Power, , vide its notification no. **CG-DL-E-06092023-248580** dated 04.09.2023 has notified PFC Consulting Limited (PFCCL) to be the Bid Process Coordinator (BPC) for the purpose of selection of Bidder as Transmission Service Provider (TSP) to establish Inter-State transmission system for **"Transmission System for Evacuation of Power from potential renewable energy zone in Khavda area of Gujarat under Phase-V (8GW): Part C**" through tariff based competitive bidding process.

The BPC hereby invites Bids from all prospective Bidders in accordance with this Request for Proposal (RFP) to select prospective Transmission Service Provider (TSP) in accordance with the "Tariff Based Competitive-Bidding Guidelines for Transmission Service" and "Guidelines for Encouraging Competition in Development of Transmission Projects" issued by Government of India, Ministry of Power under Section – 63 of the Electricity Act. The BPC shall select the Bidder having the prescribed technical and financial capability to become TSP and be responsible for establishing the Project in the state of Gujarat. The TSP will make the Project available against payment of Transmission Charges, as adopted by the Commission, payable to the TSP, as per Central Electricity Regulatory Commission (Sharing of Inter-State Transmission Charges and Losses) Regulations as amended from time to time.

1.2 The TSP will be required to establish the following Inter State Transmission System for Transmission System for Evacuation of Power from potential renewable energy zone in Khavda area of Gujarat under Phase-V (8GW): Part C (hereinafter referred to as 'Project') on build, own, operate and transfer basis, and to provide transmission service.

S. No.	Inter State Transmission System for Transmission System for Evacuation of Power from potential renewable energy zone in Khavda area of Gujarat under Phase-V (8GW): Part C	
	Name of Transmission Element	**Scheduled COD in Months from Effective Date**
1.	Establishment of 2500 MW, ± 500 kV KPS3 (HVDC) [VSC] terminal station (2x1250 MW) at a suitable location near KPS3 substation with associated interconnections with 400 kV HVAC Switchyard*	48 months from SPV transfer
2.	Establishment of 2500 MW, ± 500 kV South Olpad (HVDC) [VSC] terminal station (2x1250 MW) along with associated interconnections with 400 kV HVAC Switchyard of South Olpad S/s*	
3.	Establishment of KPS3 (HVDC) S/s along with 2x125 MVAR, 420 kV bus reactors along with associated interconnections	

	with HVDC Switchyard*. The 400 kV bus shall be established in 2 sections through 1 set of 400 kV bus sectionaliser to be kept normally OPEN. 400/33 kV, 2x50 MVA transformers for exclusively supplying auxiliary power to HVDC terminal.	
4.	KPS3 – KPS3 (HVDC) 400 kV 2xD/C (Quad ACSR/AAAC/AL59 moose equivalent) line along with the line bays at both substations	
5.	±500 kV HVDC Bipole line between KPS3 (HVDC) and South Olpad (HVDC) (with Dedicated Metallic Return) (capable to evacuate 2500 MW)	

** The 400 kV interconnections (along with all associated equipment/ bus extension, etc.) between HVDC and HVAC switchyards shall be implemented by the TSP*

Note:

i. The 1250 MW pole-1 shall emanate from 400 kV bus section 1 of KPS3 (HVDC) and terminate at South Olpad S/s. Similarly, the 1250 MW pole-2 shall emanate from 400 kV bus section 2 of KPS3 (HVDC) and terminate at South Olpad S/s.

ii. HVDC System will be designed with 100% power reversal capability as well as black start, automatic grid restoration and dynamic reactive power support capability.

iii. The rated power transmission capacity as well as the rated transmission voltage shall be defined and guaranteed at the rectifier DC Bus.

iv. TSPs of KPS3 shall provide space for scope at Sl. No. 4 as per the above scope

v. TSP of South Olpad S/s shall provide space for scope at Sl. No. 2 as per above scope ensuring

- *(d) indicative total space requirement for HVDC terminal station of size 400 m x 300 m. The AC switchyard connection and DC overhead line shall be from 300 m side of rectangular plot.*
- *(e) the width of the approach road and access road shall be at least 10 m for facilitating smooth transportation of HVDC equipment including converter transformer and with access road all around the space for HVDC.*
- *(f) the spatial arrangement for proposed space for HVDC terminal and the layout proposed for the current AC GIS transmission scheme is such that Bus duct length required for interconnection between AC GIS station and HVDC terminal is minimum to the extent possible in linear manner and the layout of the AC line termination gantries should be such that there is no crossing of present/ future AC lines and HVDC line near the termination ends of both AC and HVDC yards.*

vi. Implementation timeline: 48 months from SPV transfer.

1.3 Project Description

Government of India has set a target for establishing 500 GW capacity from non-fossil energy sources by 2030. In this direction, in December 2020, Hon'ble Prime Minister laid the foundation stone of the world's largest renewable energy park in Gujarat's Kutch. This 30 GW capacity hybrid renewable energy park is being built along the Indo-Pak border at Khavda using both wind and solar energy and is expected to play a major role in fulfilling India's vision of generating 500 GW of non-fossil generation capacity by 2030.

Out of 30 GW, 15 GW RE capacity is expected to come up by 2024-25 and balance by 2026-27 timeframe and beyond. Transmission system for evacuation of up to 22 GW power from Khavda RE Park is already under implementation/bidding in 4 phases as per details below:

Phase	RE Capacity (GW)	Status of Transmission System
I	3	Under Implementation: • KPS1 S/s and KPS1 – Bhuj 765 kV D/C line: Awarded to Adani Transmission Ltd. (Commissioned). • KPS2 S/s: Awarded to POWERGRID with SCOD of Dec'24. • KPS1 – KPS2 765 kV D/C line: Awarded to Megha Engg with SCOD of Jan'25.
II	5	Under Implementation: • KPS3 S/s and KPS3 – KPS2 765 kV D/C line: Awarded to POWERGRID with SCOD of Dec'24. • Khavda Ph-II Part A - Awarded to Adani Transmission Ltd. with Expected SCOD of March'25. • Khavda Ph-II Parts B and C – Awarded to POWERGRID with Expected SCOD of March'25. • Khavda Ph-II Part D – Awarded to TPGL(RTM) with Expected SCOD of March'25.
III	7	Under Implementation: Khavda-Ph-III-Part A-Awarded to Adani Khavda-Ph-III-Part-B -Awarded to POWERGRID • Expected SCOD: Dec'25
IV	7	Under Bidding: • Agreed in 14th NCT –and expected SCOD is Jun'26

The Phase-V scheme has been planned to enable evacuation of an additional 8 GW RE power from Khavda RE park.

The subject scheme (under Part C) includes establishment of KPS3 (HVDC) S/s through KPS3 – KPS3 (HVDC) 400 kV 2xD/C line and establishment of 2500 MW, ± 500 kV HVDC [VSC] terminal station (2x1250 MW) at KPS3(HVDC) and South Olpad along with ±500 kV HVDC Bipole line with DMR between KPS3 (HVDC) and South Olpad (HVDC).

The subject Transmission system was deliberated and approved in the 14th NCT meeting held on 09.06.2023. The Ministry of Power vide Gazette notification dated 29.08.2023 (Copy of Gazette attached) has appointed PFCCL as BPC for implementation of the subject transmission scheme through TBCB route.

1.4 Transmission Grid Map

Transmission Grid Map indicating the location of the Project is enclosed as Annexure 18 of this RFP for information and reference of the Bidders**.**

1.5 The objective of the bidding process is to select a Successful Bidder pursuant to this RFP, who shall acquire one hundred percent (100%) of the equity shares of KPS III HVDC TRANSMISSION LIMITED along with all its related assets and liabilities as per the provisions of the Share Purchase Agreement, at the Acquisition Price to be intimated by the BPC, twenty (20) days prior to the Bid Deadline.

The KPS III HVDC TRANSMISSION LIMITED, of which one hundred percent (100%) equity shares will be acquired by the Selected Bidder, shall be responsible as the TSP, for ensuring that it undertakes ownership, financing, development, design, engineering, procurement, construction, commissioning, operation and maintenance of the Project, and to provide Transmission Service as per the terms of the RFP Project Documents.

The TSP shall ensure transfer of all project assets along with substation land, right of way and clearances to CTU or its successors or an agency as decided by the Central Government after 35 years from COD of project at zero cost and free from any encumbrance and liability. The transfer shall be completed within 90 days after 35 years from COD of project failing which CTU shall be entitled to take over the project assets Suo moto.

1.6 Brief Scope of Work

1.6.1 Scope of Transmission Service Provider

The TSP's scope of work for the Project shall comprise, but not necessarily be limited to the following:

1.6.1.1 Establishment, operation and maintenance of the Project on build, own, operate and transfer basis and completion of all the activities for the Project, including survey, detailed project report formulation, arranging finance, project management, necessary Consents, Clearances and Permits (way leave, environment & forest, civil aviation, railway/ road/river/canal/power crossing/PTCC, etc.), land compensation, design, engineering, equipment, material, construction, erection, testing & commissioning. Further, the actual location of substations, switching stations or HVDC terminal or inverter stations in the scope of TSP shall not be beyond 3 Km radius of the location proposed by the BPC in the survey report.

Further, the actual location of Greenfield substations (Switching Stations or HVDC Terminal or lnverter Stations) for a generation pooling substation and for load serving

substations in the scope of TSP shall not be beyond 3 Km radius of the location proposed by the BPC in the survey report. However, actual location of any Greenfield intermediate Substations in the scope of TSP shall not be beyond 10 Km radius of the location proposed by the BPC in the Survey Report.

1.6.1.2 The TSP shall ensure that design, construction and testing of all equipment, facilities, components and systems of the Project shall be in accordance with Transmission Service Agreement and applicable Rules/ Regulations, Orders and Guidelines issued by the Central Government.

1.6.1.3 The TSP shall ensure timely completion of entire scope of Project in all respects and its operation and maintenance, as shall be specified in the RFP documents.

1.6.1.4 The TSP shall seek Transmission License from the Commission, as per the provisions of the Electricity Act and regulations made thereunder.

1.6.1.5 The TSP shall seek approval under Section 164 of Electricity Act, from CEA after acquisition of KPS III HVDC TRANSMISSION LIMITED. The approval shall be granted by CEA generally within 30 days but in no case later than 45 days from the date of receipt of application (complete in all aspects).

1.6.2 **Scope of Bid Process Coordinator (BPC)**

BPC's scope of work is briefly outlined hereunder:

1.6.2.1 The BPC has initiated development of the Project and shall be responsible for the tasks in this regard as specified hereunder:

1. Provide to the Bidders a Survey Report for the Project at least forty five (45) days prior to the Bid Deadline. The Survey Report shall include the suggested route with approximate route length, type of terrain likely to be encountered and its likely implication in terms of Right of Way (ROW), statutory clearances, location of substations or converter stations and land area to be acquired for the substation or converter station.

2. To obtain approval for laying of overhead transmission lines under Section 68 of Electricity Act, from the Government at least twenty (20) days prior to Bid Deadline.

3. To initiate acquisition of land for location specific substations, switching stations or HVDC terminal or inverter stations, if required.

4. To initiate process of seeking forest clearance, if required

5. The BPC shall intimate to the Bidders, the Acquisition Price payable by the Selected Bidder to the **PFC Consulting Limited** for the acquisition of one hundred percent (100%) of the equity shareholding of KPS III HVDC TRANSMISSION LIMITED, along with all its related assets and liabilities at least twenty (20) days prior to the Bid Deadline.

6. The BPC shall ensure issuance of all finalized RFP Project Documents, at least fifteen (15) days prior to the Bid Deadline.

Provided that for any delay in meeting the above obligations of the BPC within the specified time period above, the Bid Deadline as per Clause 2.7.1 shall be extended on a day for day basis.

1.6.2.2 The details and documents as may be obtained by the BPC/ project specific SPV in relation to the Project shall be handed over to the TSP on an as-is-where-is basis, so that it may take further actions to obtain Consents, Clearances and Permits.

1.7 All costs (including direct and indirect) incurred by the BPC/ project specific SPV in connection with the activities concerning the Project shall be recovered from the TSP, which shall be included in the Acquisition Price.

1.8 The Project is required to be completed progressively in accordance with the schedule prescribed in this RFP.

1.9 A company under the Companies Act, 2013 by the name KPS III HVDC TRANSMISSION LIMITED has been incorporated to initiate the activities for execution of the Project. The said company shall be acquired by the successful Bidder as per terms and conditions as may be prescribed in RFP.

1.10 The Ministry of Power and the appropriate state government(s) shall provide their support to the TSP, on best endeavor basis, in enabling the TSP to develop the Project.

1.11 All Bidders are required to submit their Bid in accordance with the instructions set forth in this RFP.

1.12 Once the Successful Bidder is selected, the details and documents as may be obtained by the BPC/ project specific SPV in relation to the Project, shall be handed over to the Successful Bidder on as is where basis, so that it may take further actions to obtain all necessary Consents, Clearances and Permits and the TSP shall not be entitled for any extensions in the Scheduled COD of the Project except as provided for in the TSA.

1.13 The assets of the Project shall be made available on a commercial basis as per the terms and conditions of the Transmission Service Agreement and Central Electricity Regulatory Commission (Sharing of Inter-State Transmission Charges and Losses) Regulations as amended from time to time.

SECTION – 2

INFORMATION AND INSTRUCTIONS FOR BIDDERS

SECTION – 2

2. INFORMATION AND INSTRUCTIONS FOR BIDDERS

2.1 Qualification Requirements

2.1.1 The Bidder should be a company duly incorporated under the relevant laws (Bidding Company) or a Consortium of companies (Bidding Consortium) with one of the companies acting as the Lead Member of the Bidding Consortium. The Bidder shall be selected on meeting the Qualification Requirements specified in Section 2 of this RFP, as demonstrated by the Bidder's Technical Bid and the lowest Quoted Transmission Charges discovered from Final Offers quoted during the e-reverse bidding. A Bidding Consortium can participate in the bidding process for the Project if any Member of the Consortium has purchased the RFP document for such Project. Bidder who agree and undertake to procure the products associated with the Transmission System as per provisions of Public Procurement (Preference to Make in India) orders issued by Ministry of Power vide orders No. 11/5/2018 - Coord. dated 28.07.2020 for transmission sector, as amended from time to time read with Department for Promotion of Industry and Internal Trade (DPIIT) orders in this regard, shall be eligible hereunder. Further, it is clarified that Procuring Entity as defined in orders shall deemed to have included Selected Bidder and/ or TSP.

Besides, Department of Expenditure, Ministry of Finance vide Order (Public Procurement No 1) bearing File No. 6/18/2019-PPD dated 23.07.2020, Order (Public Procurement No 2) bearing File No. 6/18/2019-PPD dated 23.07.2020 and Order (Public Procurement No. 3) bearing File No. 6/18/2019-PPD, dated 24.07.2020, as amended from time to time, have issued directions regarding public procurement from a bidder of a country, which shares land border with India are also applicable.

2.1.2 **Technical requirement to be met by the Bidding Company or Lead Member of Bidding Consortium**

The Bidder must fulfill any one of the following technical requirements:

(i) Experience of development of projects in the Infrastructure Sector in the last ten (10) years with aggregate capital expenditure of not less than Rs. 9549.60 Crore or equivalent USD (calculated as per provisions in Clause 3.4.1). However, the capital expenditure of at least one (1) project shall not be less than Rs. 1909.92 Crore or equivalent USD and the capital expenditure of each project shall not be less than Rs. 100.00 Crore or equivalent USD (calculated as per provisions in Clause 3.4.1).

For this purpose, capital expenditure incurred on projects that have been commissioned/completed at least seven (7) days prior to Bid Deadline shall be considered. The capital expenditure discussed above shall be as capitalized and reflected in the audited books of accounts of the Technically Evaluated Entity. In case a clearly identifiable part of a project has been put into commercial operation, the capital expenditure on such part of the project shall be considered. The Technically Evaluated Entity must have either executed such

projects itself or must have held directly or indirectly at least twenty six percent (26%) of the shareholding in the company that has executed the project(s) from the date of financial closure of the project(s) till the time of commissioning/completion of such project(s).

OR

(ii) Experience in construction of project in infrastructure sector: The Technically Evaluated Entity should have received aggregate payments not less than Rs. 9549.60 Crore or equivalent USD (calculated as per provisions in Clause 3.4.1) from its client(s) for construction works fully completed during the last 10 (ten) financial years. However, the payment received from at least one (1) project shall not be less than Rs. 1909.92 Crore or equivalent USD and the payment received of each project shall not be less than Rs. 100.00 Crore or equivalent USD (calculated as per provisions in Clause 3.4.1).

For this purpose, payments received on projects that have been commissioned/ completed at least seven (7) days prior to Bid Deadline shall be considered. Further only the payments (gross) actually received, during such 10 (ten) financial years shall qualify for purposes of computing the technical capacity. For the avoidance of doubt, construction works shall not include cost of land, supply of goods or equipment except when such goods or equipment form part of a turn-key construction contract/ EPC contract for the project. Further, in cases where different individual contracts are signed between same entities for the same project, the cumulative payments received under such individual contracts shall be considered for meeting the qualification requirement.

The Technically Evaluated Entity may be the Bidding Company or the Lead Member of a Consortium or an Affiliate or Parent of such Bidding Company or the Lead Member, as the case may be.

Bidders shall furnish documentary evidence duly certified by authorized signatory of the Bidder who has been issued Power of Attorney in support of their technical capability as defined in Clause 2.1.2 of this RFP.

2.1.3 **Financial requirement to be met by the Bidding Company/Bidding Consortium**

2.1.3.1 The Bidder must fulfill following financial requirements:

A. Networth:

Networth should be not less than Rs**. 3819.84 Crore** or equivalent USD (calculated as per provisions in Clause 3.4.1**)** computed as the Networth based on unconsolidated audited annual accounts (refer to Note below) of any of the last three (3) financial years as provided in Clause 2.2.3, immediately preceding the Bid Deadline. Also, the Networth of any of the last three (3) financial years should not be negative.

Note: Audited consolidated annual accounts of the Bidder may be used for the purpose of financial criteria provided the Bidder has at least 26% equity in each company whose

accounts are merged in the audited consolidated accounts and provided further that the financial capability of such companies (of which accounts are being merged in the consolidated accounts) shall not be considered again for the purpose of evaluation of the Technical Bid. Bidders shall furnish prescribed Annexure 7 (A) duly certified by authorized signatory of the Bidder who has been issued Power of Attorney and the Statutory Auditor and separate computation sheet for Networth duly certified by Statutory Auditor in support of their financial capability as defined in Clause 2.1.3 of this RFP.

2.1.3.2 The Networth shall be computed in the following manner by the Bidder:

A. Networth

=	Equity share capital
Add:	Reserves
Subtract:	Revaluation Reserves
Subtract:	Intangible Assets
Subtract:	Miscellaneous expenditures to the extent not written off and carry forward losses

2.1.3.3 If the Technical Bid is submitted by a Bidding Consortium the financial requirement shall be met individually and collectively by all the Members in the Bidding Consortium. The financial requirement to be met by each Member of the Bidding Consortium shall be computed in proportion to the equity commitment made by each of them for investment in the Project.

2.1.4 The Bidder may seek qualification on the basis of technical and financial capability of its Parent and/ or its Affiliate(s) for the purpose of meeting the Qualification Requirements. However, in the case of the Bidder being a Consortium, the Lead Member has to meet the technical requirement on its own or by seeking the technical capability of its Parent and/or its Affiliate(s). Authorization for use of such technical or financial capability shall have to be provided from its Parent and/or Affiliate(s) as per Annexure 9. The technical and financial capability of a particular company/ particular project, including its Parents and/or Affiliates, shall not be used directly or indirectly by more than one Bidder/ Member of a Bidding Consortium/ Bidding Company. However, development and construction experience of a particular project may be used by more than one company.

The determination of the relationship of Parent or Affiliate with the Bidding Company or with the Member of the Bidding Consortium, including the Lead Member, shall be on the date at the most seven (7) days prior to the last date of submission of the Bid. Documentary evidence to establish such relationship shall be furnished by the Bidder along with the Technical Bid.

If the Technically Evaluated Entity and/or Financially Evaluated Entity is an entity other than the Bidding Company or a Member in a Bidding Consortium, the Bidding Company or Member relying on such Technically Evaluated Entity and/or Financially Evaluated Entity will have to submit a legally binding undertaking supported by a board resolution from the Technically Evaluated Entity and/or Financially Evaluated Entity or its Ultimate Parent Company, that all the equity investment obligations of the Bidding Company or the Member of the Consortium shall be deemed to be equity investment obligations of

the Technically Evaluated Entity and/or Financially Evaluated Entity or its Ultimate Parent Company, and in the event of any default the same shall be met by such evaluated entity or by or the Ultimate Parent Company. The Bidding Company or the Consortium Member shall have to provide information and documents relating to its relationship with such Technically Evaluated Entity and/or Financially Evaluated Entity including details about the equity shareholding between them as per Annexure 7(C).

2.1.5 A Bidder shall submit only one Bid in the same bidding process, either individually as Bidding Company or as a Member of a Bidding Consortium (including the Lead Member). It is further clarified that any of the Parent/ Affiliate/Ultimate Parent of the Bidder/ Member in a Bidding Consortium shall not separately participate directly or indirectly in the same bidding process. Further, if any Bidder is having a Conflict of Interest with other Bidders participating in the same bidding process, the Bids of all such Bidders shall be rejected.

2.1.6 Notwithstanding anything stated above, BPC reserves the right to verify the authenticity of the documents submitted for meeting the Qualification Requirements and request for any additional information and documents. BPC reserves the right at its sole discretion to contact the Bidder's bank and project references and verify the Bidder's information and documents for the purpose of bid evaluation.

2.1.7 The Qualified Bidder(s) will be required to continue to maintain compliance with the Qualification Requirements throughout the bidding process and till execution of the Transmission Service Agreement. Where the Technically Evaluated Entity and/or the Financially Evaluated Entity is not the Bidding Company or a Member in a Bidding Consortium, as the case may be, the Bidding Company or Member shall continue to be an Affiliate of the Technically Evaluated Entity and/or Financially Evaluated Entity till the execution of the Transmission Service Agreement. Failure to comply with the aforesaid provisions shall make the Bid liable for rejection at any stage.

2.1.8 The Selected Bidder will be required to continue to maintain compliance with the Qualification Requirements till the COD of the Project. Where the Technically Evaluated Entity and/or the Financially Evaluated Entity is not the Bidding Company or a Member in a Bidding Consortium, as the case may be, the Bidding Company or Member shall continue to be an Affiliate of the Technically Evaluated Entity and/or Financially Evaluated Entity till the COD of the Project. Failure to comply with the aforesaid provisions shall be dealt as per provisions of Transmission Service Agreement.

2.1.9 On the Bid Deadline, for the Bidder to be eligible to participate in the bidding process:

a. the Bidder & any of its Affiliate including any Consortium Member & any of its Affiliate, their directors or key personnel should not have been barred or included in the blacklist by any government agency or authority in India, the government of the jurisdiction of the Bidder or Members where they are incorporated or the jurisdiction of their principal place of business, any international financial institution such as the World Bank Group, Asian Development Bank, African Development Bank, Inter-American Development Bank, Asian Infrastructure Investment Bank etc or the United Nations or any of its agencies; or

b. the Bidder & any of its Affiliate including any Consortium Member & any of its Affiliate or their directors should not have been convicted of any offence in India or abroad.

In case any investigation is pending against the Bidder, including any Consortium Member or Affiliate, or CEO or any of the directors/ manager/key managerial personnel of the Bidder /Consortium /Member or their Affiliates, full details of such investigation including the name of the investigating agency, the charge/offence for which the investigation has been launched, name and designation of persons against whom the investigation has been launched and other relevant information should be disclosed while submitting the Bid.

The Bidders shall confirm the above though a notarized affidavit as per Annexure 22.

2.2 Submission of Bid by the Bidder

2.2.1 The information and documents in Technical Bid will be submitted by the Bidder as per the formats specified in Section – 4 (Formats for RFP) of this document

2.2.2 Strict adherence to the formats wherever specified, is required. Wherever, information has been sought in specified formats, the Bidder shall refrain from referring to brochures/ pamphlets. Non-adherence to formats and/ or submission of incomplete information may be a ground for declaring the Technical Bid as non-responsive. Each format has to be duly signed and stamped by the authorized signatory of Bidder.

2.2.3 The Technical Bid shall contain unconsolidated/consolidated audited annual accounts (consisting of unabridged Balance Sheet, Profit and Loss Account, profit appropriation account, Auditors Report, etc.), as the case may be, of Bidding Company or each Member in Consortium including Lead Member or the Financially Evaluated Entity for the last three (3) financial years immediately preceding the last date for submission of Bid for the purpose of calculation of Networth.

In case the annual accounts for the financial year immediately preceding the Bid Deadline is not audited, the Bidder shall give declaration in this regard duly certified by its statutory auditor. In such a case, the Bidder shall provide the audited annual accounts for the three (3) financial years preceding the financial year as above for which the annual accounts have not been audited.

2.2.4 <u>Bid submitted by a Bidding Consortium:</u>

2.2.4.1 The Technical Bid shall contain a legally enforceable Consortium Agreement entered amongst the Members in the Bidding Consortium, designating one of the Members to be the Lead Member (as per Annexure 6). There shall be only one Lead Member which shall continue to hold twenty six percent (26%) equity in the TSP and cannot be changed upto one (1) year from the Commercial Operation Date (COD) of the Project. Each Member in Bidding Consortium shall duly sign the Consortium Agreement making it liable for raising the required funds for its respective equity investment commitment as specified in the Consortium Agreement. In absence of Consortium Agreement, the Technical Bid will not be considered for evaluation and will be rejected.

Provided that the Lead Member of the Bidding Consortium will be required to be liable to the extent of 100% of the total proposed commitment of equity investment of the Bidding Consortium i.e. for both its own equity contribution as well as the equity contribution of other Members.

Provided further that the Consortium Agreement shall not be amended without the explicit approval of the BPC.

The Lead Member of the Consortium will be the single point of contact for the purposes of the bid process before the date of signing of Share Purchase Agreement. Settlement of any dispute amongst the Consortium Members shall not be the responsibility of the BPC and/or the CTU and the BPC and/or the CTU shall not bear any liability whatsoever on this account.

2.2.4.2 The Lead Member should designate at the most two persons to represent the Consortium in its dealings with the BPC. The person(s) designated by the Lead Member should be authorized through a Power of Attorney (as per Annexure 3) to perform all tasks including, but not limited to providing information, responding to enquiries, signing of Technical Bid on behalf of the Consortium, etc. The Bidding Consortium shall provide board resolutions from their respective Boards for committing their respective portion of equity requirement for the Project. Additionally, the Lead member shall provide a Board resolution committing to make good any shortfall in the equity for the project, in case of any member not meeting its equity commitment.

2.2.4.3 The Technical Bid should also contain signed Letter of Consent (as per Annexure 2) from each Member in Consortium confirming that the entire Technical and Financial Bids has been reviewed and each element of the Technical and Financial Bids is agreed to by them including investment commitment for the Project.

In addition, the Technical Bid should also contain Board Resolution from each Member of the Consortium other than the Lead Member in favour of their respective authorized representatives for executing the POA, Consortium Agreement and signing of the requisite formats.

2.2.5 Bid submitted by a Bidding Company

2.2.5.1 The Bidding Company should designate at the most two persons to represent the Bidding Company in its dealings with BPC. The person(s) should be authorized to perform all tasks including, but not limited to providing information, responding to enquiries, signing of Technical and Financial Bids etc. The Bidding Company should submit, along with Technical Bid, a Power of Attorney (as per Annexure 3), authorizing the signatory of the Technical and Financial Bids. The Bidding Company shall submit the board resolution committing 100% of equity requirement for the Project, in the Technical Bid.

2.3 Clarifications & Pre-Bid Meeting

2.3.1 The Bidders may seek clarifications or suggest amendments to the RFP by sending an email to the BPC at the email id indicated in Clause 2.14 within the date and time

mentioned in Clause 2.7.2. For any such clarifications or amendments, the Bidders should adhere to the format as per Annexure – 19.

2.3.2 Only those Bidders or their authorized representatives, who have purchased the RFP documents are invited to attend the pre-bid meeting(s), which will take place on date as specified in Clause 2.7.2, or any such other date as notified by the BPC. The time and address of this would be intimated later.

2.3.3 The purpose of the pre-bid meeting will be to clarify any issues regarding the RFP, including in particular, issues raised in writing by the Bidders as per the provisions of Clause 2.3.1.

2.3.4 Non-attendance at the pre-bid meeting will not be a cause for disqualification of a Bidder.

2.3.5 The BPC is not under any obligation to entertain / respond to suggestions made or to incorporate modifications sought for.

2.3.6 In case Bidders need any further clarifications not involving any amendments in respect of final RFP, they should ensure that request for such clarification is submitted through e-mail to the BPC at least ten (10) days prior to the Bid Deadline as mentioned in Clause 2.7.1. The BPC may issue clarifications only, as per its sole discretion, which is considered reasonable by it. Any such clarification issued shall be sent to all the Bidders to whom the RFP has been issued. Clarifications sought after this date shall not be considered in any manner and shall be deemed not to have been received. There shall be no extension in Bid Deadline on account of clarifications sought as per this clause 2.3.6.

2.4 Amendment of RFP

2.4.1. At any time before the timeline mentioned in Clause 2.7.1, the BPC may, for any reason, whether at its own initiative or in response to clarifications requested by any Bidder modify or amend the RFP, including the timelines specified in Clause 2.7.2 by issuance of addendum/modification/errata and/or revised document. Such document shall be notified in writing through a letter or fax or e-mail to all the entities to whom the RFP has been issued and shall be binding on them. In order to ensure that Bidders have reasonable time to take the modification into account in preparing their Bid, or for any other reasons, BPC may at its discretion, extend the due date for submission of Bid. Late receipt of any addendum/modification/errata and/or revised document will not relieve the Bidder from being bound by that modification.

2.4.2. All modifications shall become part of the terms and conditions of this RFP. No interpretation, revision or communication regarding this RFP is valid, unless made in writing.

2.4.3. The amendment to the RFP shall be notified to all the Bidders through the electronic bidding platform and shall be binding on them.

2.5 The Bidding Process

The entire bidding process shall be conducted on electronic bidding platform created by **MSTC Limited**. The Bid shall comprise of the Technical Bid and the Financial Bid. The Bidders shall submit the Technical Bid & Financial Bid through the electronic bidding platform. In addition to the online submission, the Bidder with lowest Final Offer will be required to submit original hard copies of Annexure 3, Annexure 4 (if applicable), Annexure 6 (if applicable) and Annexure 14 before issuance of LoI. There shall be no physical submission of the Financial Bid.

Evaluation of Technical Bid will be carried out considering the information and documents furnished by the Bidders as required under this RFP. This step would involve responsiveness check, technical and financial evaluation of the details/ documents furnished by the Bidding Company / Bidding Consortium in support of meeting the Qualification Requirements. Bidders meeting the Qualification Requirements, subject to evaluation as specified in Clause **3.2** to **3.4** shall be declared as "Qualified Bidders" and eligible for opening of Initial Offer. The BPC shall also upload the list of all Qualified Bidders and Non-Qualified Bidders on the bidding portal along with the reasons for non-qualification. Also, the Financial Bids of Qualified Bidders shall be opened after at least 24 hours from the date of declaration of the Technically Qualified Bidders.

The Financial Bid will comprise of two rounds. In the first round the Initial Offer (submitted online along with the Technical Bids) of the responsive bids would be opened and Quoted Transmission Charges of Initial Offer shall be ranked on the basis of ascending order for determination of the Qualified Bidders as provided in Section-III of RFP. The Qualified Bidders, in the first fifty per cent of the ranking (with any fraction rounded off to higher integer) or four Qualified Bidders, whichever is higher, shall qualify for participating in the electronic reverse auction stage and submit their Final Offer.

Provided however, in case only one Bidder remains after the evaluation of Technical Bid as per Clause 3.2, 3.3 and Clause 3.4, the Initial Offer of such Bidder shall not be opened and the matter shall be referred to the Government.

Provided that in the event the number of qualified Technical Bids is between two and four, then each of the qualified Bidder shall be considered as "Qualified Bidders".

Provided that in the event of identical Quoted Transmission Charges discovered from the Initial Offer having been submitted by one or more Bidders, all such Bidders shall be assigned the same rank for the purposes of determination of Qualified Bidders. In such cases, all the Qualified Bidders who share the same rank till 50% of the rank (with any fraction rounded off to higher integer) determined above, shall qualify to participate in the electronic e-reverse auction stage. In case 50% of the ranks (with any fraction rounded off to higher integer) is having less than 4 (four) Bidders and the rank of the fourth (4^{th}) Bidder is shared by more than one (1) Bidder, then all such Bidders who share the rank of the fourth (4^{th}) Bidder shall qualify to participate in the electronic reverse auction.

The applicable ceiling for electronic reverse bidding shall be the lowest Quoted Transmission Charges discovered from the Initial Offer received from the Qualified Bidders. The Qualified Bidders shall be permitted to place their Final Offer on the

electronic bidding platform, which is lower than zero point two five (0.25) % of the prevailing lowest Quoted Transmission Charges.

The initial period for conducting the e-reverse bidding should be 2 hours which will be extended by 30 minutes from the last received bid time, if the bid is received during the last 30 minutes of the scheduled or extended bid time. Subsequently, it will be extended again by 30 minutes from the latest received bid time.

The technical details with respect to access to such electronic platform are provided in Annexure-A (Technical Details with respect to electronic reverse auction).

In case of any technical clarification regarding access to the electronic reverse auction platform or conduct of the auction process, the Bidders may contact MSTC directly at the address provided in Annexure-A.

2.5.1 Bid Formats

The Bids in response to this RFP will be submitted online through the electronic bidding platform by the Bidders in the manner provided in Clause 2.9. The Bids shall comprise of the following:

2.5.2 Technical Bid comprising of:

1. Covering Letter (as per prescribed format enclosed as **Annexure 1**);

2. Letter of Consent from Consortium Members in **Annexure 2;**

3. Power of attorney issued by the Bidding Company or the Lead Member of the Consortium, as the case may be, in favour of the person signing the Bid, in the format attached hereto as **Annexure 3**.

   Additionally, in case of a Bidding Consortium, the power of attorney in favour of the Lead Member issued by the other Members of the Consortium shall be provided in as per format attached hereto as **Annexure 4**. Further, the Lead Member shall furnish Board resolution(s) from each Member of the Consortium other than the Lead Member in favour of their respective authorized representatives for executing the POA and signing of the requisite formats.

   Provided that in the event the Bidding Company or the Lead Member of the Consortium or any Member of the Bidding Consortium, as the case may be, is a foreign entity, it may issue Board resolutions in place of power of attorney for the purpose of fulfilling these requirements.

4. Bidder's composition and ownership structure in **Annexure 5**

5. Format for Authorization submitted in Non-Judicial stamp paper duly notarized as per **Annexure 5** from the Bidding Company / each Member of the Consortium authorizing the BPC to seek reference from their respective bankers & others.

6. In case of Bidding Consortium, the Consortium Agreement shall be provided in as per format attached hereto as **Annexure 6**

7. Format of Qualification Requirement (**Annexures 7A, 7B, 7C and 7D)**

8. Bidders Undertakings and details of equity investment in Project (as per prescribed formats 1 and 2 of **Annexure 8**);

9. Authorization from Parent / Affiliate of Bidding Company / Member of Bidding Consortium whose technical / financial capability has been used by the Bidding Company / Member of Bidding Consortium **(Annexure 9)**.

10. Undertaking from the Technically / Financially Evaluated Entity(ies) **OR** Undertaking from the Ultimate Parent Company, for total equity investment commitment, in the prescribed format in **Annexure – 10**, to meet any shortfall in the equity investment by the Selected Bidder in the KPS III HVDC TRANSMISSION LIMITED.

    Note: The effective Equity holding of the Selected Bidder in the KPS III HVDC TRANSMISSION LIMITED, as specified in Clause 2.5.8.1 shall be computed as per the provisions of Clause 2.5.8.3 of this RFP.

    Provided further, in case the Bidding Company or Member of a Consortium, (as the case may be) holds at least twenty six percent (26%) equity in such Technically/ Financially Evaluated Entities, whose credentials have been considered for the purpose of meeting the Qualification Requirements as per the RFP, no such Undertaking shall be required from the Technically / Financially Evaluated Entities.

11. Board resolutions, as per prescribed formats enclosed as Annexure – 11, duly certified by the Company Secretary or any Whole-time Director / Manager (supported by a specific Board Resolution), as applicable to the Bidder and mentioned hereunder,

    (a) Board resolution from the Bidding Company (and any investing Affiliate / Parent Company / Ultimate Parent Company) committing one hundred percent (100%) in aggregate of the equity requirement for the Project - Format-1 of **Annexure 11**;

    (b) Board resolutions from each of the Consortium Member of the Bidding Consortium (and any investing Affiliate / Parent Company / Ultimate Parent Company) together committing to one hundred percent (100%) in aggregate of equity requirement for the Project, in case Bidder is a Bidding Consortium - Format-1 of **Annexure 11**;

    (c) In either of the cases as in (a) or (b) above as applicable, Board resolutions as per Format 2 of **Annexure 11** for total equity investment commitment from the Technically / Financially Evaluated Entity(ies) whose technical / financial credentials had been considered for the purpose of meeting Qualification Requirements as per the RFP

    OR

Board resolutions as per Format 2 of **Annexure 11** from the Parent Company or the Ultimate Parent Company for total equity investment commitment.

Provided that such Board resolutions, as specified in (a) or (b) or (c) above, in case of a foreign entity, shall be supported by an unqualified opinion issued by an independent legal counsel practicing in the relevant country, stating that the Board resolutions are in compliance with the applicable laws of the respective jurisdictions of the issuing company and the authorizations granted therein are true and valid.

For clarity sake, illustrations identifying which Board Resolution shall be applicable in typical cases are provided in **Annexure 11A**.

12. Format for Illustration of Affiliates at the most seven (7) days prior to Bid Deadline, duly certified by Company Secretary and supported by documentary evidence **(Annexure 12)**.

    Certified copy of the Register of Members / Demat Account Statement, Share Certificate, Annual Return filed with ROC etc. submitted as documentary evidence along with **Annexure 12.**

13. Disclosure as per **Annexure 13** regarding participation of any related companies in this bidding process.

14. Bid Bond, as per the prescribed format at **Annexure 14 or** Bid Security Declaration as per prescribed format at **Annexure-14A (as applicable)**;

15. Checklist for Technical Bid submission requirements as per **Annexure 16**.

16. Last three (3) financial years' unconsolidated / consolidated audited annual accounts / statements, as the case may be, of the Financially Evaluated Entity / Technical Evaluated Entity

17. Unconsolidated audited annual accounts of both the TEE and the Bidding Company/Lead member, as applicable, for the financial years in which financial closure was achieved and the financial year in which the said project was completed / commissioned.

18. Copy of the Memorandum and Articles of Association and certificate of incorporation or other organizational document (as applicable), including their amendments, certified by the Company Secretary of Bidding Company or each Member in case of a Consortium including Lead Member.

19. For each project listed in Annexure 7(D), certified true copy of the certificates of final acceptance and / or certificates of good operating performance duly issued by owners or clients for the project, duly signed by duly signed by authorized signatory.

In addition to the online submission of above formats through the electronic platform, the Bidder with lowest Final Offer will be required to submit original hard copies of Annexure 3, Annexure 4 (if applicable), Annexure 6 (if applicable) and Annexure 14 before issuance of LoI. In case, there is a discrepancy between the online submission and physical documents, the bid would be out rightly rejected and the bidder shall be construed to have engaged in the fraudulent practice as defined in Clause 2.19.3 with consequences as mentioned in Clause 2.19.2.

2.5.3 Financial Bid (as per prescribed format at Annexure-21)

Financial Bid shall comprise of: (i) the Initial Offer; and (ii) the Final Offer. The Initial Offer is required to be submitted along with the Technical Bid. It is hereby clarified that the Financial Bid will comprise of two rounds. In the first round the Initial Offer of the responsive bids would be opened and Quoted Transmission Charges of Initial Offer shall be ranked on the basis of ascending order for determination of the Qualified Bidders as provided in Section-III of RFP.

In accordance with clause 2.5 of this RFP, the qualified Bidders shall be eligible to participate in the electronic reverse auction and submit their Final Offer.

The applicable ceiling for electronic reverse bidding shall be the lowest Quoted Transmission Charges discovered from the Initial Offer received from the Qualified Bidders. The Qualified Bidders shall be permitted to place their Final Offer on the electronic bidding platform, which is lower than zero point two five (0.25) % of the prevailing lowest Quoted Transmission Charges.

The initial period for conducting the e-reverse bidding should be 2 hours which will be extended by 30 minutes from the last received bid time, if the bid is received during the last 30 minutes of the scheduled or extended bid time. Subsequently, it will be extended again by 30 minutes from the latest received bid time.

The Bidders shall inter-alia take into account the following while preparing and submitting the Initial Offer and Final Offer of Financial Bid :-

a. The Bidders shall quote single annual Quoted Transmission Charges for a period of 35 years commencing from the Scheduled COD of the Project.

b. The Quoted Transmission Charges as per the format at Annexure-21 shall be inclusive of all charges and no exclusions shall be allowed. The Bidders shall take into account all costs including capital and operating, statutory taxes, duties, levies. Availability of the inputs necessary for operation and maintenance of the Project should be ensured by the TSP at the Project site and all costs involved in procuring the inputs (including statutory taxes, duties, levies thereof) at the Project site must be included in the Quoted Transmission Charges.

c. Annexure 21 duly digitally signed by authorized signatory.

2.5.4 Wherever information has been sought in specified formats, the Bidders shall fill in the details as per the prescribed formats and shall refrain from referring to any other document

for providing any information required in the prescribed format.

2.5.5 Transmission Charges

2.5.5.1. The Transmission Charges shall be specified in the Transmission Service Agreement and shall be payable to the TSP in Indian Rupees only. The Bidders shall quote single Transmission Charges as per the format at Annexure – 21.

2.5.5.2. The Transmission Charges of the Selected Bidder shall be inserted in Schedule 5 of the Transmission Service Agreement.

2.5.6 Bidders may note that:

a) All the information and documents in Bid shall be submitted in English language only.

b) Bidders shall mention the name, designation, telephone number, fax number, email address of the authorized signatory and complete address of the Bidder in the covering letter.

c) All pages of the Bid submitted shall be initialed and stamped by the authorized signatory on behalf of the Bidder.

d) A Bidder shall submit only one Bid in the same bidding process, either individually as Bidding Company or as a Member of a Bidding Consortium.

e) The technical and financial capability of a particular company / particular project (Parent and/ or Affiliate) shall not be used directly or indirectly by more than one Bidder/ Member of a Bidding Consortium including Lead Member / Bidding Company.

f) This Request for Proposal (RFP) document is not transferable. The RFP document and the information contained therein is for the use only by the Bidder to whom it is issued. It may not be copied or distributed by the recipient to third parties (other than in confidence to the recipient's professional advisors). In the event that the recipient does not continue with its involvement in the Project, this RFP document must be kept confidential.

g) Though adequate care has been taken while preparing this RFP document, the Bidder shall satisfy himself that the document is complete in all respects. Intimation of any discrepancy shall be given to the BPC immediately. If no intimation is received from any Bidder within ten (10) days from the date of issue of RFP document, it shall be considered that the RFP document is complete in all respects and has been received by the Bidder.

h) Bids submitted by the Bidder and opened on scheduled date and time as stipulated in this RFP shall become the property of the BPC and BPC shall have no obligation to return the same to the Bidder.

i) If any Bidder conceals any material information or makes a wrong statement or misrepresents facts or makes a misleading statement in its Bid, in any manner

whatsoever, the BPC reserves the right to reject such Bid or cancel the Letter of Intent, if issued. If such event is discovered after the Effective Date, consequences specified in Transmission Service Agreement shall apply.

j) If for any reason the Bid of the Bidder with the lowest Quoted Transmission Charges is not selected or Letter of Intent issued to such Selected Bidder is cancelled or such Bidder withdraws its Bids, the BPC may :-

i. Invite all the remaining Bidders to revalidate or extend their respective Bid Security, as necessary, and match the Bid of the Bidder with the lowest Quoted Transmission Charges (the "second round of bidding") with following cases:

- If in the second round of bidding, only one Bidder matches the Bid of the Bidder with lowest Quoted Transmission Charges, it shall be the Selected Bidder.

- If two or more Bidders match the Bid of the Bidder with the lowest Quoted Transmission Charges in the second round of bidding, then the Bidder whose Quoted Transmission Charges was lower as compared to other Bidder(s) in the first round of bidding shall be the Selected Bidder. For example, if the third and fifth lowest Bidders in the first round of bidding offer to match the Bid of the Bidder with lowest Quoted Transmission Charges in the second round of bidding, the said third lowest Bidder shall be the Successful Bidder.

- In the event that no Bidder offers to match the Bid of the Bidder with the lowest Quoted Transmission Charges in the second round of bidding, the BPC may, in its discretion, invite fresh Bids (the "third round of bidding") from all Bidders except the Bidder which quoted the lowest Quoted Transmission Charges in the first round of bidding. In case the Bidders are invited for the third round of bidding to revalidate or extend their Bid Security, as necessary, and offer fresh Bids, they shall be eligible for submission of fresh Bids provided, however, that in such third round of bidding only such Bids shall be eligible for consideration which are lower than the Quoted Transmission Charges of the second lowest Bidder in the first round of bidding; or;

ii. Annul the bid process; or

iii. Take any such measure as may be deemed fit in the sole discretion of the BPC[1]

k) The BPC may, at its sole discretion, ask for additional information / document and/or seek clarifications from a Bidder after the Bid Deadline, inter alia, for the purposes of removal of inconsistencies or infirmities in its Bid. However, no change in the substance of the Quoted Transmission Charges shall be sought or permitted by the BPC.

l) Non submission and/or submission of incomplete data/ information required under the provisions of RFP shall not be construed as waiver on the part of BPC of the obligation of the Bidder to furnish the said data / information unless the waiver is in writing.

[1] **BPC shall record reasons for the same.**

m) Bidders shall familiarize itself with the procedures and time frames required to obtain all Consents, Clearances and Permits.

n) All Bidders are required to ensure compliance with the standards and codes mentioned in Clause 1.6.1.2.

o) BPC reserves the right to reject all Bids and/or annul the process of tariff based competitive bidding for selection of Bidder as TSP to execute the Project without assigning any reason. BPC shall not bear any liability, whatsoever, in this regard.

p) Foreign companies submitting the Bid are required to follow the applicable law in their country for execution of POA, Consortium Agreement and affixation of Common Seal (wherever required) and in such cases, their Bid should be supported by an unqualified opinion issued by an independent legal counsel practicing in the relevant country, stating that execution of such POA, Consortium Agreement and the authorizations granted therein are true and valid. Foreign companies executing POA outside India shall necessarily pay the adequate stamp charges in India as per the provisions of Stamp Act.

2.5.7 Bidders to inform themselves fully

2.5.7.1. The Bidders shall make independent enquiry and satisfy themselves with respect to all the required information, inputs, conditions and circumstances and factors that may have any effect on his Bid. Once the Bidders have submitted their Bids, the Bidders shall be deemed to have inspected and examined the site conditions (including but not limited to its surroundings, its geological condition and the adequacy of transport facilities to the site), the laws and regulations in force in India, the transportation facilities available in India, the grid conditions, the adequacy and conditions of roads, bridges, railway sidings, ports, etc. for unloading and/or transporting heavy pieces of material and has based its design, equipment size and fixed its price taking into account all such relevant conditions and also the risks, contingencies and other circumstances which may influence or affect the transmission of power. Accordingly, each Bidder acknowledges that, on being selected as Successful Bidder and on acquisition of one hundred percent (100%) of the equity shares of the KPS III HVDC TRANSMISSION LIMITED, the TSP shall not be relieved from any of its obligations under the RFP Project Documents nor shall the TSP be entitled to any extension in Scheduled COD mentioned in this RFP or financial compensation for any reason whatsoever.

2.5.7.2. In their own interest, the Bidders are requested to familiarize themselves with all relevant laws of India, including without limitation, the Electricity Act 2003, the Income Tax Act 1961, the Companies Act, 1956 / Companies Act, 2013 (as the case may be), Environment Protection Act 1986 and Forest (Conservation) Act, 1980, the Customs Act, the Foreign Exchange Management Act, Land Acquisition Act, 1894, the Indian Telegraph Act 1885, Labour & Employment Laws of India, [Insurance Act] the regulations/standards framed by the Commissions and CEA, all other related acts, laws, rules and regulations prevalent in India, as amended from time to time.

In addition to the above, the Bidders are required to familiarize themselves with all

relevant technical codes and standards, including but not limited to the Grid Code / State Grid Code, Central Electricity Authority (Installation and Operations of Meters) Regulations, 2006, Central Electricity Authority (Technical Standards for Connectivity to the Grid) Regulations, 2007, Central Electricity Regulatory Commission Grant of Connectivity, Long-term Access and Medium - Term Open Access in Inter-State Transmission and related matters) Regulations, 2009, Central Electricity Authority (Technical Standards for construction of Electrical Plants and Electric Lines) Regulation, 2010, Central Electricity Authority (Technical Standards for Communication System in Power System Operation) Regulations, 2020, Central Electricity Regulatory Commission (Sharing of Inter-State Transmission Charges and Losses) Regulations, 2020 and other relevant Rules/ Regulations/ Guidelines issued by the Central Government, the CERC and the CEA and amendments thereof.

The BPC shall not entertain any request for clarifications from the Bidders regarding the above laws / acts / rules / regulations / standards. Non-awareness of the same shall not be a reason for the Bidder to request for extension in Bid Deadline. The Bidders undertake and agree that, before submission of their Bid, all such factors as generally brought out above, have been fully investigated and considered while submitting their Bids.

2.5.7.3. The Survey Report has been prepared in good faith, and on best endeavor basis. Neither BPC & Nodal Agency nor their employees or advisors/consultants make any representation or warranty, express or implied, or accept any responsibility or liability, whatsoever, in respect of any statements or omissions made in the Survey Report, or the accuracy, completeness or reliability of information contained therein, and shall incur no liability under any law, statute, rules or regulations as to the accuracy, reliability or completeness of such Survey Report, even if any loss or damage is caused to the Bidders by any act or omission on their part.

2.5.7.4. Bidders shall make best efforts and carry out its own due diligence upon survey report provided by BPC and shall consider all possible techno-commercial factors before submission of Bid. Bidders may also visit the route of the Transmission Lines associated with the Project and the surrounding areas and obtain / verify all information which they deem fit and necessary for the preparation of their Bid. Bidders may also carry out required surveys and field investigation for submission of their Bid. Bidders may also opt for any other route and is not bound to follow the route suggested in survey report provided by BPC.

2.5.7.5. Failure to investigate, examine and to inspect site or subsurface conditions fully shall not be grounds for a Bidder to alter its Bid after the Bid Deadline nor shall it relieve a Bidder from any responsibility for appropriately eliminating the difficulty or costs of successfully completing the Project.

2.5.7.6. The Selected Bidder shall obtain all necessary Consents, Clearances and Permits as required. The Bidders shall familiarize itself with the procedures and time frame required to obtain such Consents, Clearances and Permits.

2.5.7.7. The technical requirements of integrated grid operation are specified in the Indian Electricity Grid Code (IEGC). The Bidders should particularly acquaint themselves with the

requirements of connection conditions, operating code for regional grids, scheduling and dispatch instructions/codes, etc. The Bidders are also advised to fully familiarize themselves with the real time grid conditions in the country. Information regarding grid parameters such as voltage and frequency is available on the websites of Regional / State Load Despatch Centres.

2.5.8 Minimum Equity holding/Equity Lock-in

2.5.8.1. (a) The aggregate equity share holding of the Selected Bidder, in the issued and paid up equity share capital of KPS III HVDC TRANSMISSION LIMITED shall not be less than Fifty one percent (51%) up to a period of (1) one year after COD of the Project;

(b) In case the Selected Bidder is a Bidding Consortium, then any Member (other than the Lead Member) of such Bidding Consortium shall be allowed to divest its equity as long as the other remaining Members (which shall always include the Lead Member) hold the minimum equity specified in (a) above.

(c) If equity is held by the Affiliates, Parent Company or Ultimate Parent Company, then subject to the second proviso of this Clause 2.5.8.1 (c), such Affiliate, Parent Company or Ultimate Parent Company shall be permitted to transfer its shareholding in KPS III HVDC TRANSMISSION LIMITED to another Affiliate or to the Parent Company / Ultimate Parent Company. If any such shareholding entity, qualifying as an Affiliate / Parent Company / Ultimate Parent Company, is likely to cease to meet the criteria to qualify as an Affiliate / Parent Company / Ultimate Parent Company, the shares held by such entity shall be transferred to another Affiliate / Parent Company / Ultimate Parent Company.

Provided that in case the Lead Member or Bidding Company is holding equity through Affiliate/s, Ultimate Parent Company or Parent Company, such restriction shall apply to such entities.

Provided further, that the aggregate equity share holding of the Bidding Consortium or a Bidding Company in the issued and paid up equity share capital of KPS III HVDC TRANSMISSION LIMITED shall not be less than fifty one percent (51%) up to a period of one (1) year after COD of the Project and the lead Member of the Consortium shall have the equity share holding not less than twenty six percent (26%). In case the Selected Bidder is a Bidding Consortium, then any Member (other than the Lead Member) of such Bidding Consortium shall be allowed to divest its equity as long as the other remaining Members (which shall always include the Lead Member) hold the minimum equity specified in (a) above.

(d) All transfer(s) of shareholding of KPS III HVDC TRANSMISSION LIMITEDby any of the entities referred to above, shall be after prior written intimation to the Nodal Agency.

2.5.8.2. The Selected Bidder may invest in the equity share capital of KPS III HVDC TRANSMISSION LIMITED through its Affiliate(s) or Ultimate Parent Company or Parent Company. Details of such investment will have to be specified in the Technical Bid as per Format 2 of Annexure 8 of the RFP. If the Selected Bidder so invests through any Affiliate(s) or Ultimate Parent Company or Parent Company, the Selected Bidder shall be

liable to ensure that minimum equity holding/lock-in limits specified in Clause 2.5.8.1 and as computed as per the provisions of Clause 2.5.8.3 are still maintained.

2.5.8.3. For computation of effective Equity holding, the Equity holding of the Selected Bidder or its Ultimate Parent Company in such Affiliate(s) or Parent Company and the equity holding of such Affiliate (s) or Ultimate Parent Company in KPS III HVDC TRANSMISSION LIMITED shall be computed in accordance with the example given below:

If the Parent Company or the Ultimate Parent Company of the Selected Bidder A directly holds thirty percent (30%) of the equity in KPS III HVDC TRANSMISSION LIMITED] then holding of Selected Bidder A in KPS III HVDC TRANSMISSION LIMITED shall be thirty percent (30%);

If Selected Bidder A holds thirty percent (30%) equity of the Affiliate and the Affiliate holds fifty percent (50%) equity in KPS III HVDC TRANSMISSION LIMITED, then for the purposes of ascertaining the minimum equity/equity lock-in requirements specified above, the effective holding of Bidder A in KPS III HVDC TRANSMISSION LIMITED shall be fifteen percent (15%), (i.e., 30%* 50%);

2.5.8.4. The provisions as contained in this Clause 2.5.8 and Article 19.1 of the Transmission Service Agreement shall override the terms of the Consortium Agreement submitted by the Bidder as part of the RFP.

2.6 Project Schedule

2.6.1. All Elements of the Project are required to be commissioned progressively as per the schedule given in the following table;

Sl. No.	Name of the Transmission Element	Scheduled COD	Percentage of Quoted Transmission Charges recoverable on Scheduled COD of the Element of the Project	Element(s) which are pre-required for declaring the commercial operation (COD) of the respective Element
1.	Establishment of 2500 MW, ± 500 kV KPS3 (HVDC) [VSC] terminal station (2x1250 MW) at a suitable location near KPS3 substation with associated interconnections with 400 kV HVAC Switchyard*	48 months from SPV transfer	100%	All Elements are required to be commissioned simultaneously as their utilization is dependent on commissioning of each other.
2.	Establishment of 2500 MW, ± 500 kV South Olpad (HVDC) [VSC] terminal station (2x1250 MW) along with associated interconnections with 400 kV HVAC Switchyard of South Olpad S/s*			

Sl. No.	Name of the Transmission Element	Scheduled COD	Percentage of Quoted Transmission Charges recoverable on Scheduled COD of the Element of the Project	Element(s) which are pre-required for declaring the commercial operation (COD) of the respective Element
3.	Establishment of KPS3 (HVDC) S/s along with 2x125 MVAR, 420 kV bus reactors along with associated interconnections with HVDC Switchyard*. The 400 kV bus shall be established in 2 sections through 1 set of 400 kV bus sectionaliser to be kept normally OPEN. 400/33 kV, 2x50 MVA transformers for exclusively supplying auxiliary power to HVDC terminal.			
4.	KPS3 – KPS3 (HVDC) 400 kV 2xD/C (Quad ACSR/AAAC/AL59 moose equivalent) line along with the line bays at both substations			
5.	±500 kV HVDC Bipole line between KPS3 (HVDC) and South Olpad (HVDC) (with Dedicated Metallic Return) (capable to evacuate 2500 MW)			

2.7 Due dates

2.7.1. The Bidders should submit the Bids online through the electronic bidding platform before the Bid Deadline i.e. on or before 30.09.2024. In addition to the online submission, the Bidder with lowest Final Offer will be required to submit original hard copies of Annexure 3, Annexure 4 (if applicable), Annexure 6 (if applicable) and Annexure 14 before issuance of LoI.

2.7.2. Important timelines are mentioned below:

Date	Event
26-07-2024	Issuance of RFP
16-08-2024	Submission of written clarifications/amendments, if any, on the RFP / RFP Project Documents by Bidders so as to reach BPC by 1700 hours. Such written clarifications/amendments shall be in the format provided in Annexure-20.
23-08-2024	Pre-Bid meeting(s)
03-09-2024	Issue of written clarifications and revised RFP documents

Date	Event
13-09-2024	Issue of final RFP Project Documents
30-09-2024	Submission of Bid (Online submission of Bid through electronic bidding portal)
30-09-2024	Opening of Technical Bid
08-10-2024	Shortlisting and announcement of Qualified Bidders on bidding portal
09-10-2024	Opening of Financial Bid - Initial Offer
10-10-2024	Electronic reverse auction (Financial Bid – Final Offer) for the Qualified Bidders.
13-10-2024	Submission of original hard copies of Annexure 3, Annexure 4, Annexure 6, as applicable and Annexure 14 by the bidder with lowest Final Offer
18-10-2024	Selection of Successful Bidder and issue of LOI
28-10-2024	Signing of RFP Project Documents and transfer of SPV

2.7.3. To enable BPC to meet the schedule, all Bidders are expected to respond expeditiously during the bidding process. If any milestone/activity falls on a day which is not a working day or which is a public holiday then the milestone/activity shall be achieved/ completed on the next working day.

2.8 Validity of the Bid

2.8.1. The Bid shall remain valid for a period of one hundred and eighty (180) days from the Bid Deadline. The BPC reserves the right to reject any Bid which does not meet aforementioned validity requirement.

2.8.2. The BPC may solicit the Bidders' consent for an extension of the period of validity of the Bid. The request and the response, thereafter, shall be in writing. In the event any Bidder refuses to extend its Bid validity as requested by the BPC, the BPC shall not be entitled to invoke the Bid Bond. A Bidder accepting the BPC's request for validity extension shall not be permitted to modify its Bid and such Bidder shall, accordingly, extend the validity of the Bid Bond as requested by the BPC within seven (7) days of such request, failing which the Bid shall not be considered as valid.

2.9 Method of Submission

2.9.1. Both the Technical and Financial Bids duly filled in, all formats and supporting shall be scanned and uploaded online through electronic bidding platform in the manner specified in Annexure A

2.9.2. It may be noted that Technical Bid shall not contain any information/document relating to Financial Bid. If Technical Bid contains any such information/documents, the BPC shall not be responsible for premature opening of the Financial Bid.

All pages of the Bid, except for the Bid Bond (Annexure 14) and any other document executed on non-judicial stamp paper, forming part of the Bid and corrections in the Bid, if any, must be signed by the authorized signatory on behalf of the Bidder. It is clarified

that the same authorized signatory shall sign all pages of the Bid. However, any published document submitted in this regard shall be signed by the authorized signatory at least on the first and last page of such document.

2.9.3. No change or supplemental information to a Bid already submitted will be accepted after the Bid Deadline, unless the same is requested for by the BPC as per Clause 2.5.6 (k).

Provided that a Bidder shall always have the right to withdraw / modify its Bid before the Bid Deadline. No Technical Bid or Initial Offer shall be modified, substituted or withdrawn by the Bidder on or after the Bid Deadline.

2.10 Preparation cost

2.10.1. The Bidders shall be responsible for all the costs associated with the preparation of the Bid and participation in discussions and attending pre-bid meetings, and finalization and execution of the RFP Project Documents (other than the TSA), etc. BPC shall not be responsible in any way for such costs, regardless of the conduct or outcome of the process of tariff based competitive bidding for selection of Bidder as TSP as per Bidding Guidelines.

2.10.1 The cost of this RFP is **Rupees Five Lakh (Rs.5,00,000/-) or U.S. Dollar Seven Thousand Only (US$7,000 /-) plus GST** as per applicable rate, which shall be non-refundable. This amount shall be paid via electronic transfer to the following Bank Account:

Bank Account Name: PFC Consulting Limited
Account No. : 000705036117
Bank Name : ICICI Bank
IFSC : ICIC0000007
Branch : Connaught Place, New Delhi-110001

Immediately after issuance of RFP document, the Bidder shall submit the Pre-Award Integrity Pact in the format as prescribed in Annexure B, which shall be applicable for and during the bidding process, duly signed on each page by any whole-time Director / Authorized Signatory, duly witnessed by two persons, and shall be submitted by the Bidder in two (2) originals in a separate envelope, duly superscripted with Pre-Award Integrity Pact. The Bidder shall submit the Pre-Award Integrity Pact on non-judicial stamp paper of Rs. 100/- each duly purchased from the National Capital Territory of Delhi. In case the Bidder is in a consortium, the Pre-Award Integrity Pact shall be signed and submitted by each member of the Consortium separately.

2.11 Bid Bond

2.11.1. Each Bidder shall submit the Bid accompanied by Bid Bond issued by any of the Banks listed in Annexure-17. The Bid Bond shall be valid for a period of thirty (30) days beyond the validity of the Bid.

2.11.2. Subject to the provisions of Clause 2.15.5, the Bid Bond may be invoked by the BPC or its authorized representative, without any notice, demure, or any other legal process upon occurrence of any of the following:

- Bidder withdraws during the period of Bid Validity as specified in this RFP or as extended by mutual consent of the respective Bidder(s) and the BPC

- Failure to execute the Share Purchase Agreement as per the provisions of Clause 2.15.2; or

- Failure to furnish the Contract Performance Guarantee as per Clause 2.12; or

- Failure to acquire one hundred percent (100%) equity shares of KPS III HVDC TRANSMISSION LIMITED, along with all its related assets and liabilities, in accordance with the provisions of Clause 2.15.2; or

- Failure to comply with the provisions of Clause 2.15.5 and Clause 2.15.6, leading to annulment of the award of the Project.

- Bidders submitting any wrong information or making any misrepresentation in their Bid as mentioned in Clause 2.5.6.

Intimation of the reasons of the invocation of the Bid Bond shall be given to the Selected Bidder by the BPC within three (3) working days after such invocation.

2.11.3. The Bid Bond of the Selected Bidder shall be returned on submission of the Contract Performance Guarantee as per Clause 2.12 and the relevant provisions of the Transmission Service Agreement.

2.11.4. The Bid Bond of all the Bidders, whose Bids are declared non-responsive, shall be returned within a period of thirty (30) days after the date on which the Financial Bids are opened.

2.11.5. The Bid Bond of all unsuccessful Bidders shall be returned and released by the BPC on the same day on which the KPS III HVDC TRANSMISSION LIMITED is transferred to the Selected Bidder. The Bid Bond of the Successful Bidder shall be returned on submission of Contract Performance Guarantee as per Clause 2.12 of this RFP and the provisions of the Transmission Service Agreement.

2.12 Contract Performance Guarantee

2.12.1. Within ten (10) days from the date of issue of the Letter of Intent, the Selected Bidder, on behalf of the TSP, will provide to the Nodal Agency the Contract Performance Guarantee for an amount of Rs. 477.48 Crore (Rupees Four Hundred Seventy Seven Crore and Fourty- Eight Lakh Only). The Contract Performance Guarantee shall be initially valid for a period up to three (3) months after the Scheduled COD of the Project and shall be extended from time to time to be valid for a period up to three (3) months after the COD of the Project and thereafter shall be dealt with in accordance with the provisions of the Transmission Service Agreement. The Contract Performance Guarantee shall be issued by any of the banks listed in Annexure-17.

2.12.2. In case the Selected Bidder is unable to obtain the Contract Performance Guarantee for the total amount from any one bank specified in Annexure-17, the Selected Bidder may

obtain the same from not more than three (3) banks specified in Annexure-17.

2.13 Opening of Bids

2.13.1. Technical Bid will be opened by the Bid Opening Committee as per the following time schedule and in the office of Central Electricity Authority, in the online presence of Bidders' representatives who wish to attend:

Opening of Envelope (Technical Bid): 1500 hours (IST) on 30.09.2024 or such other dates as may be intimated by BPC to the Bidders.

In the event of any of above dates falling on a day which is not a working day or which is a public holiday, then the bids shall be opened on the next working day at the same venue and time.

Opening of Initial Offer: Initial Offer shall be opened by the Bid Opening Committee in presence of the Bid Evaluation Committee at 1530 hours (IST) on 30.09.2024 in the office of CEA.

2.13.2. The following information from each Bid will be read out to all the Bidders at the time of opening of Technical Bid:

- Name of the Bidding Company / Consortium Members in case of Bidding Consortium.

Information to be provided after opening of Initial Offer:

Only the lowest Initial Offer (s) shall be communicated to all the Qualified Bidders to participate in the e-reverse bidding process. During the e-reverse bidding process only the lowest prevailing bid should be visible to all the bidders on the electronic platform.

2.14 Enquiries

Written clarifications on the RFP and other RFP Project Documents as per Clause 2.3 and 2.4 may be sought from:

General Manager
PFC Consulting Limited
9th Floor, Wing-A, Statesman House,
Connaught Place, New Delhi - 110001
Tel. + 91 11 23443912
Fax + 91 11 23443990
Email: pfccl.itp@pfcindia.com

2.15 Other Aspects

2.15.1. The draft of the Transmission Service Agreement has been attached to this RFP. In addition

to above, the following documents have also been attached to this RFP:

a) Share Purchase Agreement

When the drafts of the above RFP Project Documents are provided by the BPC, these RFP Project Documents shall form part of this RFP as per Formats – 1 & 2 of Annexure 20.

Upon finalization of the RFP Project Documents after incorporating the amendments envisaged in Clause 2.4 of this RFP, all the finalized RFP Project Documents shall be provided by BPC to the Bidders at least fifteen (15) days prior to the Bid Deadline.

The Transmission Service Agreement and Share Purchase Agreement shall be signed in required number of originals so as to ensure that one (1) original is retained by each party to the Agreement(s) on the date of transfer of SPV.

2.15.2. Within ten (10) days of the issue of the Letter of Intent, the Selected Bidder shall:

a) provide the Contract Performance Guarantee in favour of the Nodal Agency as per the provisions of Clause 2.12;

b) execute the Share Purchase Agreement and the Transmission Service Agreement;

c) acquire, for the Acquisition Price, one hundred percent (100%) equity shareholding of KPS III HVDC TRANSMISSION LIMITED from PFC Consulting Limited, who shall sell to the Selected Bidder, the equity shareholding of KPS III HVDC TRANSMISSION LIMITED, along with all its related assets and liabilities;

Stamp duties payable on purchase of one hundred percent (100%) of the equity shareholding of KPS III HVDC TRANSMISSION LIMITED, along with all its related assets and liabilities, shall also be borne by the Selected Bidder.

Provided further that, if for any reason attributable to the BPC, the above activities are not completed by the Selected Bidder within the above period of ten (10) days as mentioned in this Clause, such period of ten (10) days shall be extended, on a day for day basis till the end of the Bid validity period.

2.15.3. After the date of acquisition of the equity shareholding of KPS III HVDC TRANSMISSION LIMITED, along with all its related assets and liabilities, by the Selected Bidder,

i. the authority of the BPC in respect of this Bid Process shall forthwith cease and any actions to be taken thereafter will be undertaken by the Nodal Agency,

ii. all rights and obligations of KPS III HVDC TRANSMISSION LIMITED, shall be of the TSP,

iii. any decisions taken by the BPC prior to the Effective Date shall continue to be binding on the Nodal Agency and

iv. contractual obligations undertaken by the BPC shall continue to be fulfilled by the TSP.

v. Further, the TSP shall execute the Agreement(s) required, if any, under Central Electricity Regulatory Commission (Sharing of Inter-State Transmission Charges and Losses) Regulations as amended from time to time.

2.15.4. Within five (5) working days of the issue of the acquisition of the SPV by the Successful Bidder, the TSP shall apply to the Commission for grant of Transmission License and make an application to the Commission for the adoption of Transmission Charges, as required under Section – 63 of The Electricity Act 2003.

2.15.5. If the Selected Bidder / TSP fails or refuses to comply with any of its obligations under Clauses 2.15.2, 2.15.3 and 2.15.4, and provided that the other parties are willing to execute the Share Purchase Agreement and PFC Consulting Limited is willing to sell the entire equity shareholding of KPS III HVDC TRANSMISSION LIMITED, along with all its related assets and liabilities, to the Selected Bidder, such failure or refusal on the part of the Selected Bidder shall constitute sufficient grounds for cancellation of the Letter of Intent. In such cases, the BPC / its authorized representative(s) shall be entitled to invoke the Bid Bond of the Selected Bidder.

2.15.6. If the TSP fails to obtain the Transmission License from the Commission, it will constitute sufficient grounds for annulment of award of the Project.

2.15.7. The annulment of award, as provided in Clauses 2.15.5 and 2.15.6 of this RFP, will be done by the Government on the recommendations of National Committee on Transmission. However, before recommending so, National Committee on Transmission will give an opportunity to the Selected Bidder / TSP to present their view point.

2.15.8. The annulment of the award, under Clause 2.15.5 or 2.15.6 of this RFP, shall be sufficient grounds for blacklisting the bidder, whose award has been annulled, for a period of five years or more, as decided by the National Committee on Transmission, provided that the blacklisting shall be done only after giving the bidder an opportunity for showing cause.

2.16 Confidentiality

2.16.1. The parties undertake to hold in confidence this RFP and RFP Project Documents and not to disclose the terms and conditions of the transaction contemplated hereby to third parties, except:

a) to their professional advisors;

b) to their officers, contractors, employees, agents or representatives, financiers, who need to have access to such information for the proper performance of their activities;

c) disclosures required under Law, without the prior written consent of the other parties of the concerned agreements.

Provided that the TSP agrees and acknowledges that the Nodal Agency may at any time, disclose the terms and conditions of the RFP and RFP Project Documents to any person, to the extent stipulated under the Law or the Bidding Guidelines.

2.17 Right of the BPC to reject any Bid

BPC reserves the right to reject all or any of the Bids/ or cancel the RFP without assigning any reasons whatsoever and without any liability.

2.18 Non submission and/or submission of incomplete data/ information required under the provisions of RFP shall not be construed as waiver on the part of BPC of the obligation of the Bidder to furnish the said data / information unless the waiver is in writing.

2.19 Fraudulent and Corrupt Practices

2.19.1. The Bidders and their respective officers, employees, agents and advisers shall observe the highest standard of ethics during the Bid process and subsequent to the issue of the LoI Notwithstanding anything to the contrary contained herein, or in the LoI, the BPC shall reject a Bid, withdraw the LoI, as the case may be, without being liable in any manner whatsoever to the Bidder, if it determines that the Bidder has, directly or indirectly or through an agent, engaged in corrupt practice, fraudulent practice, coercive practice, undesirable practice or restrictive practice in the Bid process. In such an event, the BPC shall forfeit the Bid Bond, without prejudice to any other right or remedy that may be available to the BPC hereunder or otherwise.

2.19.2. Without prejudice to the rights of the BPC under Clause 2.19.1 hereinabove and the rights and remedies which the BPC may have under the LoI, if a Bidder is found by the BPC to have directly or indirectly or through an agent, engaged or indulged in any corrupt practice, fraudulent practice, coercive practice, undesirable practice or restrictive practice during the Bid process, or after the issue of the LoI, such Bidder & its Affiliates shall not be eligible to participate in any tender or RFP issued by any BPC for an indefinite period from the date such Bidder is found by the BPC to have directly or indirectly or through an agent, engaged or indulged in any corrupt practice, fraudulent practice, coercive practice, undesirable practice or restrictive practices, as the case may be.

2.19.3. For the purposes of this Clause 2.19, the following terms shall have the meaning hereinafter respectively assigned to them:

a) **"corrupt practice"** means (i) the offering, giving, receiving, or soliciting, directly or indirectly, of anything of value to influence the actions of any person connected with the Bid process (for avoidance of doubt, offering of employment to or employing or engaging in any manner whatsoever, directly or indirectly, any official of the BPC who is or has been associated or dealt in any manner, directly or indirectly with the Bid process or the LoI or has dealt with matters concerning the Transmission Service Agreement or arising there from, before or after the execution thereof, at any time prior to the expiry of one year from the date such

official resigns or retires from or otherwise ceases to be in the service of the BPC, shall be deemed to constitute influencing the actions of a person connected with the Bid Process); or (ii) engaging in any manner whatsoever, whether during the Bid Process or after the issue of the LoI or after the execution of the Transmission Service Agreement, as the case may be, any person in respect of any matter relating to the Project or the LoI or the Transmission Service Agreement, who at any time has been or is a legal, financial or technical adviser of the BPC in relation to any matter concerning the Project;

b) **"Fraudulent practice"** means a misrepresentation or omission of facts or suppression of facts or disclosure of incomplete facts, in order to influence the Bid process;

c) **"Coercive practice"** means impairing or harming, or threatening to impair or harm, directly or indirectly, any person or property to influence any person's participation or action in the Bid process;

d) **"undesirable practice"** means (i) establishing contact with any person connected with or employed or engaged by the BPC with the objective of canvassing, lobbying or in any manner influencing or attempting to influence the Bid process; or (ii) having a Conflict of Interest; and

e) **"Restrictive practice"** means forming a cartel or arriving at any understanding or arrangement among Bidders with the objective of restricting or manipulating a full and fair competition in the Bid process.

SECTION - 3

EVALUATION OF THE TECHNICAL AND FINANCIAL BID

SECTION 3

1. EVALUATION OF BID

3.1. The evaluation process of Technical Bid comprises the following five steps:

Step I – Responsiveness check
Step II- Compliance with submission requirements
Step III– Evaluation of Technical Bids
Step IV– Evaluation of Financial Bids
Step V – Bidder Selection

3.2. STEP I – Responsiveness check

The Technical Bid submitted by the Bidder shall be initially scrutinized to establish "Responsiveness". Subject to clause 2.5.6 (k), any of the following conditions shall cause the Technical Bid to be "Non-responsive":

a) Technical Bid that are incomplete.

b) Technical Bid not signed by authorized signatory and / or stamped in the manner indicated in this RFP.

c) All pages of the Technical Bid submitted but not initialed by the authorized signatories on behalf of the Bidder.

d) Technical Bid not including the covering letter as per Annexure 1.

e) Technical Bid submitted by a Bidding Consortium not including the Consortium Agreement.

f) Technical Bid contains material inconsistencies in the information and documents submitted by the Bidder, affecting the Qualification Requirements.

g) Bidder submitting or participating in more than one Bid either as a Bidding Company or as a Member of Bidding Consortium.

h) More than one Member of the Bidding Consortium or a Bidding Company using the credentials of the same Parent/Affiliate.

i) Information not submitted in formats specified in the RFP.

j) Applicable Board resolutions, or any other document, as provided in Clause 2.5.2, not being submitted;

k) Bid not accompanied by a valid Bid Bond or Bid Security Declaration, as applicable;

l) Non submission of power of attorney, supported by a Board resolution;

m) Bid validity being less than that required as per Clause 2.8 of this RFP;

n) Bid not containing Format-1 (Bidders' Undertakings) of Annexure-8;

o) Bidder having Conflict of Interest

p) The Bidder has not submitted a disclosure as per Annexure 13.

q) Bidders delaying in submission of additional information or clarifications sought by the BPC.

r) If the Bidder makes any misrepresentation as specified in Clause 3.7.

s) Bid being conditional in nature.

t) More than one Member of the Bidding Consortium or a Bidding Company using the credentials of the same Parent/Affiliate.

3.3. STEP II - Compliance with submission requirements

Each Bidder's Technical Bid shall be checked for compliance with the submission requirements set forth in this RFP before the evaluation of Technical Bid is taken up. Annexure 16 and Annexure 11A shall be used to check whether each Bidder meets the stipulated requirements.

3.4. STEP III -Evaluation of Technical Bid

Evaluation of Technical Bid will be carried out considering the information and documents furnished by the Bidders as required under this RFP. This step would involve technical and financial evaluation of the details/ documents furnished by the Bidding Company / Bidding Consortium in support of meeting the Qualification Requirements

3.4.1. Interpolation of financial data.

For the Qualification Requirements data provided by the Bidders in foreign currency, equivalent rupees of Networth will be calculated using bills selling exchange rates (card rate) USD/INR of State Bank of India prevailing on the date of closing of the accounts for the respective financial year as certified by their Banker.

For the purpose of calculating the aggregate capital expenditure/construction experience of the projects completed/ commissioned where such projects are executed outside India and capital expenditure is denominated in foreign currency, bills selling exchange rates (card rate) USD/INR of State Bank of India prevailing on the date of closing of the financial year in which the projects were completed and as certified by their Banker shall be considered.

For the projects executed in the current financial year bills selling (card rate) USD/INR of State Bank of India prevailing on seven (7) days prior to the last date of submission of Technical Bid and as certified by their Banker shall be considered.

For currency other than USD, Bidders shall convert such currency into USD as per the

exchange rates certified by their Banker prevailing on the relevant date and used for such conversion. Such Bidders shall submit necessary certification from their Banker for the exchange rate used in the conversation.

If the exchange rate for any of the above dates is not available, the rate for the immediately available previous day shall be taken into account.

3.4.2. Bidders meeting the Qualification Requirements, subject to evaluation as specified in Clauses 3.2 to 3.4 shall be declared as Qualified Bidders and eligible for opening of Initial Offer.

3.4.3. The BPC shall upload the list of all Qualified Bidders and Non-Qualified Bidders on the bidding portal along with the reasons for non-qualification.

3.5. STEP IV - Evaluation of Financial Bids

3.5.1. The Bids which have been found Qualified by the BPC, based on the Steps I to III as specified above in Clauses 3.2.to 3.4, shall be opened and Quoted Transmission Charges of such Initial Offer shall be ranked on the basis of the ascending Initial Offer submitted by each Qualified Bidder.

Based on such ranking of the Qualified Bidders, in the first fifty per cent of the ranking (with any fraction rounded off to higher integer) or four Qualified Bidders, whichever is higher, shall qualify for participating in the electronic reverse auction.

Provided however, in case only one Bidder remains after the Evaluation of Technical Bid (Steps 1 to III) as per Clause 3.2 to 3.4, the Initial Offer of such Bidder shall not be opened and the matter shall be referred to the Government.

Provided that in the event the number of Qualified Bidders is between two and four, then each of the responsive Bidder shall be considered as Qualified Bidders.

Provided that in the event of identical Quoted Transmission Charges discovered from the Initial Offer having been submitted by one or more Bidders, all such Bidders shall be assigned the same rank for the purposes of determination of Qualified Bidders. In such cases, all Qualified Bidders who shares the same rank till 50% of the rank (with any faction rounded off to higher integer) determined above, shall qualify to participate in the electronic reverse auction stage. In case 50% of the rank is having less than four (4) Bidders and the rank of the fourth (4^{th}) Bidder is shared by more than one Bidder, then all such all such Bidders who share the rank of the fourth Bidder shall qualify to participate in the electronic reverse auction.

3.5.2. The Financial Bids comprising of both Initial Offer and Final Offer submitted by the Bidders shall be scrutinized to ensure conformity with the provisions of Clause 2.5.3 of this RFP. Any Bid not meeting any of the requirements as per Clause 2.5.3 of this RFP may cause the Bid to be considered "Non-responsive", at the sole decision of the BPC. Financial Bid not in conformity with the requirement of SI. No. (c) of Clause 2.5.3 of this RFP shall be rejected.

3.5.3 The Bidders shall quote the single annual Quoted Transmission Charges as specified in the format at Annexure – 21.

3.6. STEP V - Bidder Selection

3.6.1. The prevailing lowest Quoted Transmission Charges discovered from Final Offers shall only be displayed during the e-reverse bidding and the Bidder quoting such Final Offer will always remain anonymous during the e-reverse bidding. The Bidder with the prevailing lowest Quoted Transmission Charges discovered from Final Offers at the close of the scheduled or extended period of e-reverse bidding as mentioned in clause 2.5 shall be declared as the Successful Bidder, subject to verification of the original hard copies of Annexure 3, Annexure 4 (if applicable), Annexure 6 (if applicable) and Annexure 14. The Letter of Intent shall be issued to such Successful Bidder in two (2) copies.

However, if no bid is received during the e-reverse bidding stage then the Bidder with lowest quoted initial transmission charges ("Initial Offer") during e-bidding stage shall be declared as the Successful Bidder, subject to verification of the original hard copies of Annexure 3, Annexure 4 (if applicable), Annexure 6 (if applicable) and Annexure 14. The Letter of Intent shall be issued to such Successful Bidder in two (2) copies.

In case, there is a discrepancy between the online submission and physical documents, the bid would be out rightly rejected and the bidder shall be construed to have engaged in the fraudulent practice as defined in Clause 2.19.3 with consequences as mentioned in Clause 2.19.2. Further, in such a case, the provisions of Clause 2.5.6 (j) shall apply.

3.6.2. The Selected Bidder shall unconditionally accept the LoI, and record on one (1) copy of the LoI, "Accepted unconditionally", under the signature of the authorized signatory of the Successful Bidder and return such copy to the BPC within seven (7) days of issue of LoI.

3.6.3. If the Successful Bidder, to whom the Letter of Intent has been issued, does not fulfill any of the conditions specified in Clauses 2.15.2, 2.15.3 and Clause 2.15.4, then subject to Clause 2.15.5, the BPC reserves the right to annul the award of the Project and cancel the Letter of Intent. Further, in such a case, the provisions of Clause 2.5.6 (j) shall apply.

3.6.4. The BPC, in its own discretion, has the right to reject all Bids if the Quoted Transmission Charges are not aligned to the prevailing prices.

3.7. Misrepresentation by the Bidder

If the Bidder conceals any material information or makes a wrong statement or misrepresents facts or makes a misleading statement in the Technical Bid or Bid, as the case may be, in any manner whatsoever, in order to create circumstances for the acceptance of its Technical Bid/Bid, the BPC reserves the right to reject such Technical Bid/Bid, and/ or cancel the Letter of Intent, if issued. Further, in case Letter of Intent is cancelled, consequences as per provisions of the RFP shall follow.

3.8. Disposition of Technical Bid

3.8.1. Technical Bid found to be Non-responsive as per Clause **3.2,** due to any of the following

conditions, shall be liable for rejection.

- Technical Bid that is incomplete.
- Technical Bid not signed by authorized signatory and / or stamped in the manner indicated in this RFP.
- All pages of the Technical Bid submitted but not initialed by the authorized signatories on behalf of the Bidder.
- Technical Bid not including the covering letter as per Annexure 1.
- Technical Bid contains material inconsistencies in the information and documents submitted by the Bidder, affecting the Qualification Requirements.
- Information not submitted in formats specified in the RFP.
- The Bidder has not submitted a disclosure as per Annexure 13**.**
- Bidders delaying in submission of additional information or clarifications sought by the BPC.

3.8.2. Technical Bid found to be Non-responsive as per Clause **3.2,** due to any of the following conditions, shall be rejected.

- Technical Bid not received by the scheduled date and time.
- Technical Bid submitted by a Bidding Consortium not including the Consortium Agreement.
- Bidder submitting or participating in more than one response either as a Bidding Company or as a Member of Bidding Consortium.
- More than one Member of the Bidding Consortium or a Bidding Company using the credentials of the same Parent/Affiliate.
- Technical Bid having Conflict of Interest.
- If the Bidder makes any misrepresentation as specified in Clause **3.7.**

3.9. BPC reserves the right to interpret the Bid in accordance with the provisions of this RFP document and make its own judgment regarding the interpretation of the same. In this regard, BPC shall have no liability towards any Bidder and no Bidder shall have any recourse to BPC with respect to the qualification process.

BPC shall evaluate Bid using the process specified in Clause 3.1 to 3.6, at its sole discretion. BPC's decision in this regard shall be final and binding.

SECTION - 4

ANNEXURES FOR BID

SECTION – 4

I. Formats for Bid

The following formats are required to be included in the Bidder's Technical and Financial Bid. These formats are designed to demonstrate the Bidder's compliance with the Qualification Requirements set forth in Clause 2.1 of Section – 2.

Technical Bid

1. Format for the Covering Letter
2. Format for Letter of Consent from Consortium Members
3. Format for evidence of authorized signatory's authority (Power of Attorney)
4. Format for Power of Attorney from to be provided by each of the other Members of the Consortium in favor of the Lead Member
5. Format for Bidder's composition and ownership structure and Format for Authorization
6. Format for Consortium Agreement
7. Formats for Qualification Requirement
8. Format of Bidders Undertaking and details of Equity Investment
9. Authorization from Parent/Affiliate of Bidding Company/Member of Bidding Consortium whose technical/financial capability has been used by the Bidding Company/Member of Bidding Consortium.
10. Undertaking from the Technically / Financially Evaluated Entity(ies) or from Ultimate Parent Company for equity investment
11. Format of Board Resolutions
12. Format for Illustration of Affiliates
13. Format for Disclosure
14. Format for Bid Bond

14A. Format for Bid Security Declaration

15. Format for Contract Performance Guarantee
16. Checklist for Technical Bid submission requirements
22. Format for Affidavit

In addition to the online submission, the Bidder with lowest Final Offer will be required to submit original hard copies of Annexure 3, Annexure 4 (if applicable), Annexure 6 (if applicable) and Annexure 14 before issuance of LoI.

Financial Bid

21. Format for Financial Bid

II. The following formats are for the information to the Bidders to enable them to submit their Bid.

11A. Illustration For Applicable Board Resolution Requirements Under Clause 2.5.2

17. List of Banks
18. GRID Map of the Project
19. Format for clarification/amendments on the RFP/RFP Project Documents
20. Formats for RFP Project Documents

Bidder may use additional sheets to submit the information for its detailed Bid.

ANNEXURE 1 - COVERING LETTER

(The covering letter should be on the Letter Head of the Bidding Company/ Lead Member of the Consortium)

Date: ……
From: ……
……
……
Tel. No.: ……
Fax No.: ……
E-mail address: ……

To,
PFC Consulting Limited
9thFloor, Wing-A, Statesman House,
Connaught Place, New Delhi - 110001

Dear Sir,

Sub: **Bid for selection of Bidder as Transmission Service Provider to establish Inter-State Transmission System for "Transmission System for Evacuation of Power from potential renewable energy zone in Khavda area of Gujarat under Phase-V (8GW): Part C" through tariff based competitive bidding process.**

1. Being duly authorized to present and act on behalf of M/s ……. (insert name of Bidding Company / Bidding Consortium) (hereinafter called the "Bidder") and having read and examined in detail the Request for Proposal (RFP) document, the undersigned hereby submit our Technical Bid with duly signed formats and Financial Bid (Initial Offer) as stipulated in RFP document for your consideration.

2. It is confirmed that our Bid is consistent with all the requirements of submission as stated in the RFP document and subsequent clarifications/amendments as per Clause 2.3 and 2.4 of RFP.

3. The information submitted in our Bid is complete, is strictly as per the requirements stipulated in the RFP document and is correct to the best of our knowledge and understanding. We would be solely responsible for any errors or omissions in our Bid.

4. We hereby agree and undertake to procure the products associated with the Transmission System as per provisions of Public Procurement (Preference to Make in India) orders issued by Ministry of Power vide orders No. 11/5/2018 - Coord. dated 28.07.2020 for transmission sector, as amended from time to time read with Department for Promotion of Industry and Internal Trade (DPIIT) orders in this regard.

   We hereby also agree and undertake to comply with Department of Expenditure, Ministry of Finance vide Order (Public Procurement No 1) bearing File No. 6/18/2019-PPD dated 23.07.2020, Order (Public Procurement No 2) bearing File No. 6/18/2019-PPD

dated 23.07.2020 and Order (Public Procurement No. 3) bearing File No. 6/18/2019-PPD, dated 24.07.2020, as amended from time to time, regarding public procurement from a bidder of a country, which shares land border with India.

5. We hereby agree to comply with Ministry of Power order no. 25-11/6/2018 – PG dated 02.07.2020 as amended from time to time.

6. We are herewith submitting legally binding board resolution for the total equity requirement of the Project.

7. We hereby confirm that in accordance with Clause 2.1.4 of the RFP, we are herewith submitting legally binding undertaking supported by a board resolution from the ……..(Insert name of Technically Evaluated Entity and/or Financially Evaluated Entity or its Ultimate Parent Company, as the case may be) that all the equity investment obligations of …….. (Insert name of the Bidding Company) shall be deemed to be equity investment obligations of the …… (Insert name of Technically Evaluated Entity and/or Financially Evaluated Entity or its Ultimate Parent Company, as the case may be) and in the event of any default by……. (Insert name of the Bidding Company), the same shall be met by ……. (Insert name of Technically Evaluated Entity and/or Financially Evaluated Entity or its Ultimate Parent Company, as the case may be).

[Sl. No 7 to be inserted only in case the Bidder is a Bidding Company / Lead Member of a Consortium and has sought qualification on the basis of technical and financial capability of its Affiliate(s) and/or its Parent]

8. We confirm that there are no litigations or disputes against us, which materially affect our ability to fulfill our obligations with regard to the Project.

9. We hereby confirm that we shall continue to maintain compliance with Qualification Requirements till the execution of the Transmission Service Agreement. Further, in case we emerge as Selected Bidder for the Project, we shall continue to maintain compliance with Qualification Requirements till the COD of the Project.

10. We confirm that we have studied the provisions of relevant Indian laws and regulations required to enable us to build, own, operate and transfer the said Project and to prepare this Bid.

11. We hereby confirm that we shall abide unreservedly with BPC's decision in the qualification process for selection of Qualified Bidder and further warrant that under no circumstances we shall challenge either the BPC's decision or its right to make such decision at any time in the future.

12. We confirm that the Bid shall remain valid for a period of one eighty (180) days from the Bid Deadline.

13. The details of contact person are furnished as under:
    Name: ……
    Designation: ……

Name of the Company: ……
Address of the Bidder: ……
Phone Nos.: ……
Fax Nos.: ……
E-mail address: ……

14. Bid Bond

We have enclosed a Bid Bond of Rupees …… Crores (Rs. ……) only or US$ ..... (…….US Dollars), in the form of bank guarantee no……[Insert number of the Bank Guarantee] dated……[Insert Date of the Bank Guarantee] as per your proforma (Annexure-14) from……[Insert name of bank providing Bid Bond] and valid up to ……in terms of Clause 2.11 of the RFP.

Or

We have enclosed a Bid Security Declaration as per your proforma (Annexure-14A) [To be inserted for projects wherein RFP has been issued before 31.12.2021 otherwise to be deleted]

15. Acceptance

We hereby unconditionally and irrevocably agree and accept that the decision made by the BPC on any matter regarding or arising out of the RFP shall be binding on us. We hereby expressly waive any and all claims in respect of Bid process.

16. Familiarity With Relevant Indian Laws & Regulations

We confirm that we have studied the provisions of relevant Indian laws and regulations as required to enable us to submit this Bid and execute the RFP Project Documents (other than TSA), in the event of our selection as the TSP. We further undertake and agree that all such factors as mentioned in Clause 2.5.7 of RFP have been fully examined and considered while submitting the Bid.

It is confirmed that our Bid is consistent with all the requirements of submission as stated in the RFP and subsequent communications from BPC.

The information submitted in our Bid is complete, strictly as per the requirements stipulated in the RFP and is correct to the best of our knowledge and understanding. We would be solely responsible for any errors or omissions in our Bid.

We confirm that we have not taken any deviation so as to be deemed non-responsive with respect to the provisions stipulated at Clause 2.5.1, of this RFP.

Thanking you,

Yours sincerely,

……

(Name and Signature of the authorized signatory in whose name Power of Attorney/ Board Resolution as per Clause 2.5.2 is issued)

Name: ……
Designation: ……
Address: ……

Date: ……
Place: ……

Company Rubber Stamp

ANNEXURE 2 - LETTER OF CONSENT FROM CONSORTIUM MEMBERS

(On the letter head of each Member of the Consortium including Lead Member)

Date: ……
From: ……
……
……
Tel. No.: ……
Fax No.: ……
E-mail address: ……..

To,
PFC Consulting Limited
9thFloor, Wing-A, Statesman House,
Connaught Place, New Delhi - 110001

Dear Sir,

Sub: **Bid for selection of Bidder as Transmission Service Provider to establish Inter-State Transmission System for "Transmission System for Evacuation of Power from potential renewable energy zone in Khavda area of Gujarat under Phase-V (8GW): Part C" through tariff based competitive bidding process.**

We, the undersigned Member of …… (Insert name of the Bidding Consortium) have read, examined and understood the RFP document for the short-listing of Bidders as prospective TSP to establish Inter-State Transmission System for **"Transmission System for Evacuation of Power from potential renewable energy zone in Khavda area of Gujarat under Phase-V (8GW): Part C"** through tariff based competitive bidding process. We hereby confirm our concurrence with the Bid including in particular the Consortium Agreement submitted by ……. (Insert name of the Lead Member) in response to the RFP document.

We hereby confirm our commitment to participate in the said Bidding Consortium and invest ……. % of the total equity requirement for the Project as per the terms of the Consortium Agreement dated …… and board resolution for such investment commitment is enclosed herewith.

We hereby confirm that in accordance with Clause 2.1.4 of the RFP, we are enclosing legally binding undertaking supported by a board resolution from the ……. (Insert name of Technically Evaluated Entity and / or Financially Evaluated Entity or its Ultimate Parent Company, as the case may be) that all the equity investment obligations of ……. (Insert name of the Member) shall be deemed to be equity investment obligations of the …… (Insert name of Technically Evaluated Entity and / or Financially Evaluated Entity or its Ultimate Parent Company, as the case may be) and in the event of any default by……. (Insert name of the Member), the same shall be met by……. (Insert name of Technically Evaluated Entity and / or Financially Evaluated Entity or its Ultimate Parent Company, as the case may be). [Insert if applicable]

[To be inserted by the Lead Member only] We are also enclosing legally binding board resolution for the total equity requirement of the Project in case of any breach of any of the equity investment commitment by any of the Consortium Members, in line with the provisions of the Consortium Agreement dated ……. [Bidder to insert date of Consortium Agreement].

The details of contact person are furnished as under:

Name: …….
Designation: …….
Name of the Company: …….
Address: …….
Phone Nos.: …….
Fax Nos.: …….
E-mail address: …….

Dated the ……. day of ……. of 20…

Thanking you,

Yours faithfully,

……
(Signature)

Name: …….
Designation: …….

(Signature, Name, Designation of Authorized Signatory of Consortium Member and Company's Seal)

ANNEXURE 3 - FORMAT FOR EVIDENCE OF AUTHORIZED SIGNATORY'S AUTHORITY (POWER OF ATTORNEY)

POWER OF ATTORNEY

(To be on non-judicial stamp paper of appropriate value as per Stamp Act relevant to place of execution. Foreign companies submitting bids are required to follow the applicable law in their country)

Know all men by these presents, We …….(name and address of the registered office of the Bidder) do hereby constitute, appoint and authorize Mr./Ms……(name and residential address) who is presently employed with us and holding the position of ……. as our attorney, to do in our name and on our behalf, all such acts, deeds and things necessary in connection with or incidental to our Bid for selection of Bidder as Transmission Service Provider to establish Inter-State Transmission System for "**Transmission System for Evacuation of Power from potential renewable energy zone in Khavda area of Gujarat under Phase-V (8GW): Part C"** through tariff based competitive bidding process in the country of India, including signing and submission of all documents related to the Bid, including, undertakings, letters, certificates, acceptances, clarifications, guarantees, etc., making representations to the BPC, and providing information / responses to the BPC, representing us in all matters before the BPC, and generally dealing with the BPC in all matters in connection with our Bid for the said Project till the completion of the bidding process in accordance with the RFP and signing of the Share Purchase Agreement by all the parties thereto.

We hereby agree to ratify all acts, deeds and things lawfully done by our said attorney pursuant to this Power of Attorney and that all acts, deeds and things done by our aforesaid attorney shall and shall always be deemed to have been done by us.

All the terms used herein but not defined shall have the meaning ascribed to such terms under the RFP.

For ……. [Insert name of the Bidder on whose behalf PoA is executed]

……..
(Signature)

Name: ……..
Designation: ……..

Accepted

……..
(Signature of the Attorney)

Name: ……..
Designation: ……..
Address: .....
.....

(Name, Designation and Address of the Attorney)

Specimen signatures of attorney attested by the Executant

……
(Signature of the Executant)

……..
(Signature of Notary Public)

Place: ……
Date: ……

Notes:

1) To be executed by Bidding Company or the Lead Member, in the case of a Bidding Consortium, as the case maybe.

2) The mode of execution of the Power of Attorney should be in accordance with the procedure, if any, laid down by the applicable law and the charter documents of the executant(s) and when it is so required, the same should be under common seal of the executant affixed in accordance with the applicable procedure. Further, the person whose signatures are to be provided on the power of attorney shall be duly authorized by the executant(s) in this regard.

3) Also, wherever required, the executant(s) should submit for verification the extract of the charter documents and documents such as a Board resolution / power of attorney, in favour of the Person executing this power of attorney for delegation of power hereunder on behalf of the executant(s).

4) In case of foreign Bidders, refer to clause 2.5.6 (p)

ANNEXURE 4 - FORMAT FOR POWER OF ATTORNEY TO BE PROVIDED BY EACH OF THE OTHER MEMBERS OF THE CONSORTIUM IN FAVOUR OF THE LEAD MEMBER

POWER OF ATTORNEY

(To be on non-judicial stamp paper of appropriate value as per Stamp Act relevant to place of execution. Foreign companies submitting bids are required to follow the applicable law in their country)

KNOW ALL MEN BY THESE PRESENTS THAT M/s……., having its registered office at ……., …..,….and M/s ……. having its registered office at ……. , (Insert names and registered offices of all Members of the Consortium), the Members of Consortium, have formed a Bidding Consortium named ……. (insert name of the Consortium) (hereinafter called the **"Consortium"**) vide Consortium Agreement dated…….. and having agreed to appoint M/s…… as the Lead Member of the said Consortium do hereby constitute, nominate and appoint M/s……..a company incorporated under the laws of ……and having its Registered / Head Office at ……..as our duly constituted lawful Attorney (hereinafter called as **"Lead Member"**) which is one of the Members of the Consortium, to act as the Lead Member and our true and lawful attorney, to do in our name and on our behalf, all such acts, deeds and things necessary in connection with or incidental to submission of Consortium's Bid for the Project, including signing and submission of the Bid and all documents related to the Bid, including, undertakings, letters, certificates, acceptances, clarifications, guarantees, etc, making representations to the BPC, and providing information / responses to the BPC, representing us and the Consortium in all matters before the BPC, and generally dealing with the BPC in all matters in connection with our Bid for the said Project, till completion of the bidding process in accordance with the RFP and signing of the Share Purchase Agreement by all the parties thereto.

It is expressly understood that in the event of the Consortium being selected as Successful Bidder, this Power of Attorney shall remain valid, binding and irrevocable until the Bidding Consortium achieves execution of all RFP Project Documents.

We, as the Member of the Consortium, agree and undertake to ratify and confirm all whatsoever the said Attorney/Lead Member has done on behalf of the Consortium Members pursuant to this Power of Attorney and the same shall bind us and deemed to have been done by us.

All the terms used herein but not defined shall have the meaning ascribed to such terms under the RFP.

IN WITNESS WHEREOF M/s ……., as the Member of the Consortium have executed these presents on this…….. day of .....

For and on behalf of
Consortium Member

……
(Signature of the Authorized Signatory)

Name: ……
Designation: .....
Place: ……
Date: ……..

Name: ……
Designation: .....
Place: ……
Date: ……..

Accepted
Specimen signatures of attorney attested

……
(Signature)

……

……
(Signature of Notary Public) ……
(Name, Designation and Address of the Attorney)

Place: ……
Date: …….

Notes:

1. The mode of execution of the power of attorney should be in accordance with the procedure, if any, laid down by the applicable law and the charter documents of the executant(s) and when it is so required, the same should be under common seal of the executant affixed in accordance with the applicable procedure. Further, the person whose signatures are to be provided on the power of attorney shall be duly authorized by the executant(s) in this regard.

2. Also, wherever required, the executant(s) should submit for verification the extract of the charter documents and documents such as a Board resolution / power of attorney, in favour of the Person executing this power of attorney for delegation of power hereunder on behalf of the executant(s).

3. In case of foreign Bidders, refer to clause 2.5.6 (p)

ANNEXURE 5 - FORMAT FOR BIDDER'S COMPOSITION AND OWNERSHIP STRUCTURE

1. Corporate Details:

Please provide the following information for the Bidder. If the Bidder is a Consortium, please provide this information for each Member including the Lead Member:

a. Company's Name, Address, and Nationality:

Name: ……

Address: ……
……
……

Website Address: ……..

Country of Origin: ……

b. Year Organized: ……..

c. Company's Business Activities: ……
.....

d. Status as a Bidder:

i. Bidding Company
ii. Lead Member of the Bidding Consortium
iii. Member of the Bidding Consortium

Note: tick the applicable serial number

e. Company's Local Address in India (if applicable):

……
……
……

f. Name of the Authorized Signatory: .....

g. Telephone Number: ……

h. Email Address: ……

i. Telefax Number: ……

j. Please provide the following documents:

i. Copy of the Memorandum and Articles of Association and certificate of incorporation or other equivalent organizational document (as applicable), including their amendments, certified by the Company Secretary as

Attachment 1 for Bidding Company / each Member of Bidding Consortium including Lead Member.

ii. Authority letter (as per format for authorization given below) in favour of BPC from the Bidder/every Member of the Consortium authorizing BPC to seek reference from their respective bankers & others as **Attachment 2** as per Clause 2.1.6 of the RFP.

2. Details of Ownership Structure:

Equity holding of Bidding Company/ each Member of Bidding Consortium including Lead Member owning 10% or more of total paid up equity.

Name of the Bidding Company / Consortium Member: …….
Status of equity holding as on ……

Name of the Equity Holder	Type and No. of Shares owned	Extent of Voting Control (%)
1.		
2.		
3.		
4.		
5.		
6.		
7.		
8.		
….		

Notes:

1. The above table is to be filled in separately for each Consortium Member.
2. Status of equity holding should be provided not earlier than thirty (30) days prior to Bid Deadline.

For and on behalf of Bidding Company / Lead Member of the Bidding Consortium
M/s…….

……..
(Signature of authorized representative)
Name: ……..
Designation: ……

……..
(Stamp)

Date: ……
Place: ……

FORMAT FOR AUTHORISATION

(In case of Bidding Consortium, to be given separately by each Member)
(On Non – judicial stamp paper duly attested by notary public. Foreign companies submitting bids are required to follow the applicable law in their country)

The undersigned hereby authorize(s) and request(s) all our Bankers, including its subsidiaries and branches, any person, firm, corporation or authority to furnish pertinent information deemed necessary and requested by **PFC Consulting Limited** to verify our Bid for selection of Bidder as Transmission Service Provider to establish Inter-State Transmission system for "**Transmission System for Evacuation of Power from potential renewable energy zone in Khavda area of Gujarat under Phase-V (8GW): Part C"** through tariff based competitive bidding process or regarding our project development experience, financial standing and general reputation.

For and on behalf of M/s……. (Insert Name of Bidding Company or Member of the Consortium)

.....
(Signature)

Name of Authorized Signatory: …….

(Signature and Name of the authorized signatory of the Company)

Place: ……
Date: ……

……..
(Company rubber stamp/seal)

……..
(Signature of Notary Public)

Place: ……
Date: ……

ANNEXURE 6 - FORMAT FOR CONSORTIUM AGREEMENT

(To be on non-judicial stamp paper of appropriate value as per Stamp Act relevant to place of execution. Foreign companies submitting bids are required to follow the applicable law in their country)

THIS CONSORTIUM AGREEMENT executed on this..... day of .....Two thousand.....between M/s....., a company incorporated under the laws of ..... and having its Registered Office at ..... (hereinafter called the "Party 1", which expression shall include its successors, executors and permitted assigns) and M/s.....a Company incorporated under the laws of ..... and having its Registered Office at ..... (hereinafter called the "Party n", which expression shall include its successors, executors and permitted assigns) and for the purpose of submitting the Bid, acquisition of KPS III HVDC TRANSMISSION LIMITED (in case of award) and entering into other Agreement(s) as specified in the RFP (hereinafter referred to as "Agreements") as may be entered into with the Nodal Agency.

WHEREAS, the BPC had invited Bid in response to RFP issued to …… (insert the name of purchaser of RFP) for selection of the bidder as the Transmission Service Provider to establish Inter-State Transmission System for **"Transmission System for Evacuation of Power from potential renewable energy zone in Khavda area of Gujarat under Phase-V (8GW): Part C"**.

AND WHEREAS, Clause 2.2.4 of the RFP document stipulates that the Bidders qualifying on the strength of a Bidding Consortium will have to submit a legally enforceable Consortium Agreement in a format specified in the RFP document wherein the Consortium Members have to commit equity of a specific percentage in the Project.

AND WHEREAS, Clause 2.2.4 of the RFP document also stipulates that the Bidding Consortium shall provide along with the Bid, a Consortium Agreement as per prescribed format whereby the Consortium Members undertake to be liable for raising the required funds for its respective equity investment commitment as specified in Consortium Agreement.

NOW THEREFORE, THIS INDENTURE WITNESSTH AS UNDER:

In consideration of the above premises and agreement all the parties in this Consortium do hereby mutually agree as follows:

1. In consideration of the selection of the Consortium as the selected bidder by the BPC, we the Members of the Consortium and parties to the Consortium Agreement do hereby unequivocally agree that M/s..... (Insert name of the Lead Member), shall act as the Lead Member as defined in the RFP for self and agent for and on behalf of ……., ..., ..., ... (the names of all the other Members of the Consortium to be filled in here).

2. The Lead Member is hereby authorized by the Members of Consortium and parties to the Consortium Agreement to bind the Consortium and receive instructions for and on behalf of the Members.

3. Notwithstanding anything contrary contained in this Consortium Agreement, the Lead Member shall always be liable for the equity investment obligations of all the Consortium Members, i.e., for both its own equity contribution as well as the equity contribution of other Members.

4. The Lead Member shall be liable and responsible for ensuring the individual and collective commitment of each of the Members of the Consortium in discharging all their respective equity obligations. Each Consortium Member further undertakes to be individually liable for the performance of its part of the obligations without in any way limiting the scope of collective liability envisaged in this agreement.

5. Subject to the terms of this agreement, the share of each Member of the Consortium in the "issued equity share capital of the project company" shall be in the following proportion: (if applicable)

Name	Percentage of equity holding in the Project
Party 1	…….
…….	…….
Party n	…….
Total	**100%**

[**Note:** The percentage equity holding for any Consortium Member in the Project cannot be zero in the above table]

6. The Lead Member shall inter alia undertake full responsibility for liaising with lenders and mobilizing debt resources for the Project and achieving financial closure.

7. In case of any breach of any of the equity investment commitment by any of the Consortium Members, the Lead Member shall be liable for the consequences thereof.

8. Except as specified in the Agreement, it is agreed that sharing of responsibilities as aforesaid and equity investment obligations thereto shall not in any way be a limitation of responsibility of the Lead Member under these presents.

9. It is further specifically agreed that the financial liability for equity contribution of Lead Member shall, not be limited in any way so as to restrict or limit its liabilities. The Lead Member shall be liable irrespective of their scope of work or financial commitments.

10. It is expressly understood and agreed between the Members that the responsibilities and obligations of each of the Members shall be as delineated as annexed hereto as **Appendix-I,** forming integral part of this Agreement. It is further agreed by the Members that the above sharing of responsibilities and obligations shall not in any way be a limitation of joint

and several responsibilities and liabilities of the Members, with regards to all matters relating to the Project.

11. It is clearly agreed that the Lead Member shall ensure performance under the Agreements and if one or more Consortium Members fail to perform its /their respective obligations under the Agreement(s), the same shall be deemed to be a default by all the Consortium Members.

12. This Consortium Agreement shall be construed and interpreted in accordance with the Laws of India and courts at **Delhi** alone shall have the exclusive jurisdiction in all matters relating thereto and arising there under.

13. It is hereby agreed that, the Lead Member shall furnish the bid bond, as stipulated in the RFP, on behalf of the Consortium Members.

Or

It is hereby agreed that, the Lead Member shall furnish the bid security declaration, as stipulated in the RFP, on behalf of the Consortium Members. [To be inserted for projects wherein RFP has been issued before 31.12.2021 otherwise to be deleted]

14. It is hereby agreed that in case of selection of Bidding Consortium as the selected bidder, the parties to this Consortium Agreement do hereby agree that they shall furnish the contract performance guarantee on behalf of the TSP in favor of the Nodal Agency, as stipulated in the RFP and Transmission Service Agreement.

15. It is further expressly agreed that the Consortium Agreement shall be irrevocable and shall form an integral part of the RFP Project Document and shall remain valid till the execution of the Share Purchase Agreement, unless expressly agreed to the contrary by the Nodal Agency. Over the term of the Transmission Service Agreement, Central Electricity Regulatory Commission (Sharing of Inter-State Transmission Charges and Losses) Regulations as amended from time to time shall apply on the Consortium Members.

16. The Lead Member is authorized and shall be fully responsible for the accuracy and veracity of the representations and information submitted by the Consortium Members respectively from time to time in response to the RFP and for the purposes of the Project.

17. It is hereby expressly agreed between the parties to this Consortium Agreement that neither party shall assign or delegate its rights, duties or obligations under this Agreement except with the prior written consent of the Nodal Agency.

THIS CONSORTIUM AGREEMENT:

a. has been duly executed and delivered on behalf of each party hereto and constitutes the legal, valid, binding and enforceable obligation of each such party,

b. sets forth the entire understanding of the parties hereto with respect to the subject matter hereof;

c. may not be amended or modified except in writing signed by each of the parties and with prior written consent of the Nodal Agency.

IN WITNESS WHEREOF, the parties to the Consortium Agreement have, through their authorized representatives, executed these present on the Day, Month and Year first mentioned above.

For and on behalf of Consortium Member 1 (Party 1)
M/s……

.....
(Signature of authorized signatory)

Name: …….
Designation: .....
Place: ……..
Date: ……

For and on behalf of Consortium Member n (Party n)
M/s……

.....
(Signature of authorized signatory)

Name: ……
Designation: .....
Place: ……..
Date: ……..

Attested:
……..
(Signature)
(Notary Public)

Place: ……
Date: ……

Note: In case of foreign Bidders, refer to clause 2.5.6 (p)

Appendix 1 to the Consortium Agreement:

Name of the Consortium Member	Responsibilities under the Consortium Agreement
M/s …… (Party 1)	
M/s ……	
M/s …… (Party n)	

ANNEXURE 7 A - FORMAT FOR QUALIFICATION REQUIREMENT

A. NET WORTH

To,
PFC Consulting Limited
9th Floor, Wing-A, Statesman House,
Connaught Place, New Delhi - 110001

Dear Sir,

Sub: Bid for selection of Bidder as Transmission Service Provider to establish Inter-State Transmission System for "Transmission System for Evacuation of Power from potential renewable energy zone in Khavda area of Gujarat under Phase-V (8GW): Part C" through tariff based competitive bidding process

1. [Note: Applicable in case of Bidding Company]

We certify that the Financially Evaluated Entity(ies) had a Networth of Rs. …… Crore or equivalent USD* computed as per instructions in this RFP based on unconsolidated audited annual accounts (refer Note-2 below) of any of the last three (3) financial years as provided in Clause 2.2.3, immediately preceding the Bid Deadline. Also, the Networth of any of the last three (3) financial years is not negative.

Name of Financially Evaluated Entity(ies)	Relationship with Bidding Company**	Financial Year	Networth (Rs. Crore)
1. ……..			
2. ……..			
3. ……..			
….			
Total Networth			

*Equivalent USD shall be calculated as per provisions of Clause 3.4.1.
** The column for "Relationship with Bidding Company" is to be filled in only in case financial capability of Parent/Affiliate has been used for meeting Qualification Requirements.

2. [Note: Applicable in case of Bidding Consortium]

We certify that the Financially Evaluated Entity(ies) had a minimum Networth of Rs. …….. Crore or equivalent USD* computed as per instructions in the RFP and based on unconsolidated audited annual accounts (refer Note-2 below) of any of the last three (3) financial years as provided in Clause 2.2.3, immediately preceding the Bid Deadline. Also, the Networth of any of the last three (3) financial years is not negative.

Name of Consortium Member	Equity Commitment in the Project (%)	Networth of Member (Rs. Crore)	Networth Requirement to be met by Member in proportion to the Equity Commitment (Rs. Crore)	Whether the Member meets the Networth Requirement
(1)	(2)	(3) (As per table below)	(4)= (2 x Total Networth requirement for the Project)	(5)
1. ……				Yes / No
2. ……				Yes / No
..				Yes / No
Total Networth for financial requirement				

Member – I (Lead Member)

[Note: Similar particulars for each Member of the Consortium is to be furnished, duly certified by the Member's Statutory Auditors]

i. Name of Member: .....

ii. Total Networth requirement: Rs …… Crore

iii. Percentage of equity commitment for the Project by the Member: ……%

iv. Networth requirement for the Member***: Rs. ……. Crore

v. Financial year considered for the Member: …….

Name of Financially Evaluated Entity(ies)	Relationship** with Member of Consortium	Financial Year	Networth (Rs. Crore)
1. …….			
2. …….			
3. …….			
Total Networth			

* Equivalent USD shall be calculated as per provisions of Clause 3.4.1;

** The column for "Relationship with Member of Consortium" is to be filled in only in case the financial capability of Parent / Affiliate has been used for meeting Qualification Requirements;

*** Networth requirement to be met by Member should be in proportion to the equity commitment of the Member for the Project.

Yours faithfully

……
(Signature and name of the authorized signatory of the Company and Stamp)

Name: …….
Date: …….
Place: …….

……
(Signature and Stamp of statutory Auditors of Bidding Company / each Member of Consortium)

Name: …….
Date: …….
Place: …….

Date: …….

Notes:

1. Along with the above format, in a separate sheet, please provide details of computation of Networth of last three (3) financial years duly certified by Statutory Auditor.

2. Audited consolidated annual accounts of the Bidder may be used for the purpose of financial criteria provided the Bidder has at least 26% equity in each company whose accounts are merged in the audited consolidated accounts and provided further that the financial capability of such companies (of which accounts are being merged in the consolidated accounts) shall not be considered again for the purpose of evaluation of the Bid.

3. In case Bidder or a Member of Consortium takes recourse to its Parent/Affiliate for meeting technical / financial requirements, then the financial years considered for such purpose should be same for the Bidder / Member of Consortium and their respective Parent / Affiliate.

ANNEXURE 7B - FORMAT FOR TECHNICAL REQUIREMENT

To,
PFC Consulting Limited
9th Floor, Wing-A, Statesman House,
Connaught Place, New Delhi - 110001

Dear Sir,

Sub: Bid for selection of Bidder as Transmission Service Provider to establish Inter-State Transmission System for "Transmission System for Evacuation of Power from potential renewable energy zone in Khavda area of Gujarat under Phase-V (8GW): Part C" through tariff based competitive bidding process

1. To be used by Bidder using the development experience in infrastructure sector

We certify that M/s. …….. (Insert name of Technically Evaluated Entity(ies)) have experience of development of projects in the Infrastructure sector in the last ten (10) years whose aggregate capital expenditure is Rs. ……. Crore or equivalent USD*. We further certify that the capital expenditure of at least one (1) project shall not be less than Rs. 1909.92 Crore or equivalent USD and the capital expenditure of each project shall not be less than Rs. 100.00 Crore or equivalent USD*. For this purpose, capital expenditure incurred on projects which have been either wholly completed / commissioned or partly completed projects put under commercial operation and for which operation has commenced till at least seven (7) days prior to the Bid Deadline has been considered.

The project(s) considered for the purpose of technical experience (as per table given below) have been executed and owned to the extent as indicated in the table below (to be atleast twenty – six percent (26%)) by the Bidding Company / Lead Member of the Consortium / our Parent / our Affiliate(s) [strike off whichever is not applicable] on operation of the projects.

This technical requirement has been calculated as per the instructions provided in the RFP on the basis of following projects:

Name of Company (which has executed the project at (3)) whose technical capability has been used for Qualification Requirement	Relationship** with Bidding Company / Lead Member	Project name	Nature of Project (BOOT, BOT, BOOM, DBFOT etc.)	Relevant Infrastructure sector	Date of Financial Closure of the Project (in DD / MM / YYYY)	Date of Completion / Commissioning / Commercial Operation of partly completed projects	Project cost (Rs. Crore)	Percentage Equity Holding of Company at (1) in Completed project(s)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
……		……. (Project 1)						
……		…….						
Total (Rs. Crore)								

* Equivalent USD shall be calculated as per provisions of Clause ____

** The column for "Relationship with Bidding Company / Lead Member" is to be filled in only in case technical capability of Parent/Affiliate has been used for meeting Qualification Requirements.

We further certify that the Company(ies) as indicated in column (1) of the above table, whose technical capability has / have been used for meeting the qualification requirement, has / have held shareholding respectively of atleast twenty – six percent (26%)from the date of financial closure till the date of commissioning / completion of the above project(s).

2. To be used by Bidder using construction experience in infrastructure sector.

We certify that M/s. …….. (Insert name of Technically Evaluated Entity(ies)) have received aggregate payments not less than Rs. ……. Crore or equivalent USD (calculated as per provisions in Clause 3.4.1) from its client(s) for construction works fully completed during the last 10 (ten) financial years. We further certify that the payment received from at least one (1) project shall not be less than Rs. 1909.92 Crore or equivalent USD and the payment received of each project shall not be less than Rs. 100.00 Crore or equivalent USD (calculated as per provisions in Clause 3.4.1). For this purpose, payments received on projects that have been commissioned/completed at least seven (7) days prior to the Bid Deadline shall be considered. Further only the payments (gross) actually received, during such 10 (ten) financial years shall qualify for purposes of computing the technical capacity.

We also confirm that construction works does not include cost of land supply of goods or equipment except when such goods or equipment form part of a turn-key construction contract/ EPC contract for the project.

This technical requirement has been calculated as per the instructions provided in the RFP on the basis of following projects:

Name of Company (which has executed the project at (3)) whose technical capability has been used for Qualification Requirement	**Relationship ** with Bidding Company / Lead Member**	**Project name**	**Nature of Project (EPC, Turnkey etc)**	**Relevant Infrastructure sector**	**Date of award of contract (in dd/mm/yy)**	**Date of Completion / Commissioning**	**Payment received (Rs. Crore)**
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
……		……. Project 1					
……		…….					
……		…….					
	Total (Rs. Crore)						

Yours faithfully

……..
(Signature and name of the authorized signatory of the Company and stamp)

Name: ……..
Date: ……..
Place: ……..

……..

(Signature and Stamp of statutory Auditors of Bidding Company/ Lead Member of Consortium)

Name: ……..
Date: ……..
Place: ……..

Date: …….

Notes:

1. Along with the above format, in a separate sheet, please provide details of computation of capital expenditure of projects duly certified by Statutory Auditor of the project company. In addition, the Statutory Auditor of the project company should also certify that the capital expenditure of projects commissioned or completed 7 days prior to Bid Deadline has been capitalized in the books of accounts.

   Additionally, in case construction experience is used, a certificate(s) from the statutory auditors stating the payments received and the concerned client(s) stating the works commissioned during the past 10 years in respect of the projects specified above. In case a particular job/ contract has been jointly executed by the Bidder (as part of a consortium), it should further support its claim for the share in work done for that particular job/ contract by producing a certificate from its statutory auditor or the client.

2. In case the accounts for the financial year in which the project claimed for meeting qualification requirement has been commissioned are not audited, the Bidder shall give declaration in this regard duly certified by its statutory auditor. In such a case, Bidder shall provide details of computation of capital expenditure of such project(s) duly certified by Statutory Auditor of the project company and the Statutory Auditor of the project company should also certify that the capital expenditure of projects commissioned or completed shall be capitalized in the books of accounts upon finalization.

3. The unconsolidated audited annual accounts of both the TEE and the Bidding Company / Lead Member for the respective financial years (financial years in which financial closure was achieved to the financial year in which the said project was completed / commissioned) should be submitted.

ANNEXURE 7C - FORMAT FOR TECHNICAL & FINANCIAL REQUIREMENT – RELATIONSHIP & DETAILS OF EQUITY SHAREHOLDING

[To be filled by Bidding Company / each Member of the Bidding Consortium including Lead Member if credentials of Parent and / or Affiliates have been used by them]

To,
PFC Consulting Limited
9th Floor, Wing-A, Statesman House,
Connaught Place, New Delhi - 110001

Dear Sir,

Sub: Bid for selection of Bidder as Transmission Service Provider to establish Inter-State Transmission System for "Transmission System for Evacuation of Power from potential renewable energy zone in Khavda area of Gujarat under Phase-V (8GW): Part C" through tariff based competitive bidding process

We certify that M/s. ……. (insert name of the **Bidding Company / Consortium Members**) have considered the technical and financial capability of its Parent and / or Affiliates, for the purpose of meeting Qualification Requirements as per the instructions provided in the RFP. The name of Parent and / or Affiliate, nature of relationship(s) with such Parent and / or Affiliate and details of equity holding are as follows:

Name of Company whose credentials considered	Type of credentials considered (technical and / or financial)	Relationship with Bidding Company / Consortium Member (Parent / Affiliate)	Details of equity shareholding (refer notes below)
Company 1			
…….			
…….			
…….			
……..			

NOTES:

i. In case of Parent, the equity holding of the Parent in the Bidding Company / Member of the Bidding Consortium, including the Lead Member of the Consortium, need to be specified.

ii. In case of Affiliate under direct control of Bidder, the equity holding of the Bidding Company / Member of the Bidding Consortium, including the Lead Member of the Consortium in the Affiliate, needs to be specified.

iii. In case of Affiliate under common control of Parent, the equity holding of the Parent in the Affiliate of the Bidding Company / Member of the Bidding Consortium, including the Lead Member of the Consortium, needs to be specified.

iv. Relationship of Parent / Affiliate with Bidding Company / Member of Consortium to be at the most seven (7) days prior to the Bid Deadline (as per Clause 2.1.4 of RFP)

Yours faithfully

……
(Signature and name of the authorized signatory of the Company and stamp)

Name: ……
Date: ……
Place: ……

……
(Signature and Stamp of statutory Auditors of Bidding Company / each Member of Bidding Consortium)

Name: ……..
Date: ……..
Place: ……..
Date: ……..

ANNEXURE 7D - ADDITIONAL INFORMATION FOR VERIFICATION OF FINANCIAL AND TECHNICAL CAPABILITIES OF BIDDERS.

……

(Name of Bidder (Bidding Company/ Bidding Consortium or Technically/Financially Evaluated Entity(ies))

(Note: In case of Consortium, details to be filled in by Lead Member for each Member of the Consortium including the Lead Member and in case of the qualification requirements of Technically / Financially Evaluated Entity(ies) being used, to be filled by each of such entity(ies)

i. Financial capability (Attachment 1):

1. Bidders shall attach unconsolidated / consolidated audited annual accounts, statements, as the case may be, (refer Clause 2.1.3) for the last three (3) financial years as Attachment 1. Such unconsolidated audited annual accounts shall include a Balance Sheet, Profit and Loss Account, Auditors Report and profit appropriation account.

ii. Technical capability (Attachment 2):

a. This attachment shall include details of projects completed/commissioned or partly completed projects for which commercial operation has commenced to be considered for the purpose of meeting Qualification Requirements.

1. To be used by Bidder using development experience in infrastructure sector

Particulars	Year 1	Year 2	……..	Year 9	Year 10
Name(s) of project(s) from Infrastructure sectors					
Location(s) including country(s) where project was set up					
Nature of Project					
Voltage level (if any)					
Capital cost of project(s) Rs. in Crore					
*Status of the project					
% of equity owned in the project(s)					

***Note 1:** Date of completion/commissioning/commercial operation to be mentioned

Note 2: For each project listed in the table, the Bidder shall furnish an executive summary including the following information:

- Project model, i.e., BOO, BOOT, BOOM;

- Debt financing and equity raised and provided by Bidder/Bidder's Parent/Bidder's Affiliate for the project, including names of lenders and investors;
- Size and type of installation;
- Technical data/information on major equipment installed
- Description of role performed by the Bidder/Bidder's Parent/Bidder's Affiliate on the project
- Clearances taken by the Bidder/Bidder's Parent/Bidder's Affiliate including but limited to right-of-way (RoW), forest clearance and other statutory / Govt. clearances.
- Cost data (breakdown of major components)
- Name of EPC and/or other major contractor
- Construction time for the project
- Names, addresses and contact numbers of owners of the projects
- Operating reliability over the past five (5) years or since date of commercial operation
- Operating environmental compliance history
- Names of supervisory entities or consultant, if any
- Date of commercial operation
- Total duration of operation

2. To be used by Bidder using construction experience in infrastructure sector

Particulars	Year 1	Year 2	….	Year 9	Year 10
Name(s) of project(s) from Infrastructure sectors					
Location(s) including country(s) where project was set up					
Nature of Project					
Voltage level (if any)					
Revenue received Rs. in Crore					
*Status of the project					
% of equity owned in the project(s)					

***Note 1:** Date of completion/commissioning/commercial operation to be mentioned

Note 2: For each project listed in the table, the Bidder shall furnish an executive summary including the following information:

- Project model, i.e., EPC, Turnkey;
- Size and type of installation;
- Technical data/information on major equipment installed
- Description of role performed by the Bidder/Bidder's Parent/Bidder's Affiliate on the project

- Cost data (breakdown of major components)
- Name of sub-contractor
- Construction time for the project
- Names, addresses and contact numbers of owners of the projects
- Operating reliability over the past five (5) years or since date of commercial operation
- Operating environmental compliance history
- Names of supervisory entities or consultant, if any
- Date of commercial operation
- Total duration of operation

iii. Attachment-3:

a. For each project listed in Attachment 2 above, certificates of final acceptance and/or certificates of good operating performance duly issued by owners for the project and the same shall be certified as true by authorized signatory of the Bidding Company or the Lead Member of Consortium). In case the project listed in Attachment 2 is under BOOT / DBFOT mechanism, the certificates of final acceptance and/or certificates of good operating performance must be issued by the authority / independent engineer of the project as defined in the respective project agreement.

For and on behalf of Bidding Company/Consortium

M/s…….

…….
(Signature of authorized signatory)

Name: ……
Designation: ……
Date: ……
Place: ……

ANNEXURE 8 -UNDERTAKING AND DETAILS OF EQUITY INVESTMENT

Format 1: Bidders' Undertakings

[On the Letter Head of the Bidding Company/Lead Member of Bidding Consortium]

Date: .....

To,

PFC Consulting Limited
9th Floor, Wing-A, Statesman House,
Connaught Place, New Delhi - 110001

Dear Sir,

Sub: Bidders' Undertakings in respect of Bid for selection of Bidder as TSP to establish Inter-State transmission system for "Transmission System for Evacuation of Power from potential renewable energy zone in Khavda area of Gujarat under Phase-V (8GW): Part C"

We hereby undertake on our own behalf and on behalf of the TSP, that if selected as the Successful Bidder for the Project:

1. The Project shall comply with all the relevant electricity laws, codes, regulations, standards and Prudent Utility Practices, environment laws and relevant technical, operational and safety standards, and we shall execute any agreements that may be required to be executed as per law in this regard.

2. We confirm that the Project shall also comply with the standards and codes as per Clause 1.6.1.2 of the RFP and the TSP shall comply with the provisions contained in the Central Electricity Regulatory Commission Grant of Connectivity, Long-term Access and Medium-term Open Access in inter-state Transmission and related matters Open Access) Regulations, 2009.

3. We give our unconditional acceptance to the RFP dated 26.07.2024 issued by the BPC and the RFP Project Documents, as amended, and undertake to ensure that the TSP shall execute all the RFP Project Documents, as per the provisions of this RFP.

4. We have submitted the Bid on the terms and conditions contained in the RFP and the RFP Project Documents. Further, the Financial Bid submitted by us is strictly as per the format provided in Annexure 21 of the RFP, without mentioning any deviations, conditions, assumptions or notes in the said Annexure.

5. Our Bid is valid up to the period required under Clause 2.8 of the RFP.

6. Our Bid has been duly signed by authorized signatory and stamped in the manner and to the extent indicated in this RFP and the power of attorney / Board resolution in requisite format as per RFP has been enclosed with this undertaking.

7. We have assumed that if we are selected as the Successful Bidder, the provisions of the Consortium Agreement, to the extent and only in relation to equity lock in and our liability thereof shall get modified to give effect to the provisions of Clause 2.5.8 of this RFP and Article 18.1 of the Transmission Service Agreement. ***(Note:*** *This is applicable only in case of a Bidding Consortium)*

8. We confirm that our Bid meets the Scheduled COD of each transmission Element and the Project as specified below:

Sl. No.	Name of the Transmission Element	Scheduled COD	Percentage of Quoted Transmission Charges recoverable on Scheduled COD of the Element of the Project	Element(s) which are pre-required for declaring the commercial operation (COD) of the respective Element
1.	Establishment of 2500 MW, ± 500 kV KPS3 (HVDC) [VSC] terminal station (2x1250 MW) at a suitable location near KPS3 substation with associated interconnections with 400 kV HVAC Switchyard*	48 months from SPV transfer	100%	All Elements are required to be commissioned simultaneously as their utilization is dependent on commissioning of each other.
2.	Establishment of 2500 MW, ± 500 kV South Olpad (HVDC) [VSC] terminal station (2x1250 MW) along with associated interconnections with 400 kV HVAC Switchyard of South Olpad S/s*			
3.	Establishment of KPS3 (HVDC) S/s along with 2x125 MVAR, 420 kV bus reactors along with associated interconnections with HVDC Switchyard*. The 400 kV bus shall be established in 2 sections through 1 set of 400 kV bus sectionaliser to be kept normally OPEN. 400/33 kV, 2x50 MVA transformers for exclusively supplying auxiliary power to HVDC terminal.			
4.	KPS3 – KPS3 (HVDC) 400 kV 2xD/C (Quad ACSR/AAAC/AL59 moose equivalent) line along with the line bays at both substations			
5.	±500 kV HVDC Bipole line between KPS3 (HVDC) and South Olpad (HVDC) (with			

	Dedicated Metallic Return) (capable to evacuate 2500 MW)			

We agree that the payment of Transmission Charges for any Element irrespective of its successful commissioning on or before its Scheduled COD shall only be considered after the successful commissioning of Element(s) which are pre - required for declaring the commercial operation of such Element as mentioned in the above table.

Scheduled COD for the Project: 48 months from the SPV Transfer Date

9. We confirm that our Financial Bid conforms to all the conditions mentioned in this RFP, and in particular, we confirm that:

   a. Financial Bid in the prescribed format of Annexure 21 has been submitted duly signed by the authorized signatory.

   b. Financial Bid is unconditional.

   c. Only one Financial Bid has been submitted.

10. We have neither made any statement nor provided any information in this Bid, which to the best of our knowledge is materially inaccurate or misleading. Further, all the confirmations, declarations and representations made in our Bid are true and accurate. In case this is found to be incorrect after our acquisition of KPS III HVDC TRANSMISSION LIMITED, pursuant to our selection as Selected Bidder, we agree that the same would be treated as a TSP's Event of Default under Transmission Service Agreement, and relevant provisions of Transmission Service Agreement shall apply.

11. We confirm that there are no litigations or other disputes against us which materially affect our ability to fulfill our obligations with regard to the Project as per the terms of RFP Project Documents.

12. Power of attorney/ Board resolution as per Clause 2.5.2 is enclosed.

Signature and name of the authorized signatory of the Company and stamp of Bidding Company or Lead member of Consortium

Note:

1. In case of foreign Bidders, refer to clause 2.5.6 (p)

Format 2: Details of equity investment in Project

1.1.a Name of the Bidding Company/ Bidding Consortium:

1.1.b Name of the Lead Member in the case of a Bidding Consortium:

1.2 Investment details of the Bidding Company/Member of the Bidding Consortium investing in KPS III HVDC TRANSMISSION LIMITED as per Clause 2.5.8.2.

S. No.	Name of the Bidding Company/ Member in case of a Bidding Consortium	Name of the Company investing in the equity of the _____[Name of SPV]	Relationship with Bidding Company /Member of the Bidding Consortium	% of equity participation in the _____[Name of SPV]
(1)	(2)	(3)	(4)	(5)
TOTAL				100%

* In case the Bidder proposes to invest through its Affiliate(s) / Parent Company / Ultimate Parent Company, the Bidder shall declare shareholding pattern of such Affiliate(s) / Parent Company / Ultimate Parent Company and provide documentary evidence to demonstrate relationship between the Bidder and the Affiliate(s) / Parent Company / Ultimate Parent Company. These documentary evidences could be, but not limited to, demat account statement(s) / Registrar of Companies' (ROC) certification / share registry book, etc duly certified by Company Secretary.

Members of the Consortium or the Bidding Company making investment in the equity of the _____[Name of SPV] themselves to fill in their own names in the column (3)

Signature and Name of authorized signatory in whose name power of attorney has been issued

Signature of authorized signatory

Name: …….

Designation: ……..

Date……

Company rubber stamp

ANNEXURE 9 -AUTHORISATION FROM PARENT / AFFILIATE OF BIDDING COMPANY / MEMBER OF BIDDING CONSORTIUM WHOSE TECHNICAL / FINANCIAL CAPABILITY HAS BEEN USED BY THE BIDDING COMPANY / MEMBER OF BIDDING CONSORTIUM.

[On the Letter Head of the Parent /Affiliate]

Name: ……
Full Address: …….
Telephone No.: ……..
E-mail address: ……..
Fax / No.: ……

To
PFC Consulting Limited
9th Floor, Wing-A, Statesman House,
Connaught Place, New Delhi – 110001.

Dear Sir,

Sub: Authorization for use of Technical / Financial Capability of M/s……. (Insert name of Parent / Affiliate) by M/s …….. (Insert name of Bidding Company / Member of Bidding Consortium).

We refer to the RFP dated 26.07.2024 ('RFP') issued by you for selection of Bidder as Transmission Service Provider for establishing the Inter-State Transmission System for "**Transmission System for Evacuation of Power from potential renewable energy zone in Khavda area of Gujarat under Phase-V (8GW): Part C**".

We confirm that M/s. ……. (Insert name of Bidding Company/ Consortium Member) has been authorized by us to use our technical and/or financial capability [strikeout whichever is not applicable] for meeting the Qualification Requirements for "**Transmission System for Evacuation of Power from potential renewable energy zone in Khavda area of Gujarat under Phase-V (8GW): Part C"**.

We have carefully read and examined in detail the RFP including in particular, Clause 2.1.4 of the RFP, and we are also submitting legally binding undertaking supported by a board resolution that all the equity investment obligations of M/s……. (Insert Name of Bidding Company / Consortium Member), shall be deemed to be our equity investment obligations and in the event of any default the same shall be met by us.
For and on behalf of M/s……. (Insert Name of Parent / Affiliate)

……
(Signature and Name of the authorized signatory of the Company and stamp)

Name: ……
Date: ……

Place: …….

Notes:

1. The above undertaking can be furnished by Ultimate Parent of Technically Evaluated Entity or Financially Evaluated Entity, as the case maybe, if legally binding undertaking is also furnished by the Ultimate Parent on behalf of such Financially Evaluated Entity/Technically Evaluated Entity.

ANNEXURE 10- FORMAT OF UNDERTAKING BY TECHNICALLY / FINANCIALLY EVALUATED ENTITY / ULTIMATE PARENT COMPANY

[On the Letter Head of the Technically / Financially Evaluated Entity / Ultimate Parent Company]

Name: ……

Full Address: ……

Telephone No.: ……

E-mail address: ……

Fax/No.: ……..

To:
Chief Executive Officer
PFC Consulting Limited
9thFloor, Wing-A, Statesman House,
Connaught Place, New Delhi – 110001

Sub: **Undertaking for equity investment**

Dear Sir,

We refer to the Request for Proposal dated 26.07.2024 ('RFP') issued by you regarding setting up of Inter-State transmission system for "Transmission System for Evacuation of Power from potential renewable energy zone in Khavda area of Gujarat under Phase-V (8GW): Part C" Project on build, own, operate and transfer basis.

We have carefully read and examined in detail the RFP and the RFP Project Documents, including in particular, Clause 2.1.4 of the RFP and Clauses 2.5.2 and 2.5.8 of the RFP, regarding submission of an undertaking regarding the investment in the equity share capital of KPS III HVDC TRANSMISSION LIMITED and provisions for minimum equity holding and equity lock-in. We have also noted the amount of the equity investment required to be made in KPS III HVDC TRANSMISSION LIMITED by the ……. [Insert the name of the Bidder or the Consortium Member] for the Project.

In view of the above, we hereby undertake to you and confirm that in the event of failure of ……[Insert the name of the Bidder or the Consortium Member] to invest in full or in part, in the equity share capital of KPS III HVDC TRANSMISSION LIMITED as specified in the Bid, we shall invest the said amount not invested by…….[Insert the name of the Bidder or the Consortium Member] in KPS III HVDC TRANSMISSION LIMITED by purchase of existing shares or subscribing to the new shares of KPS III HVDC TRANSMISSION LIMITED, as stipulated by you.

We have attached hereto certified true copy of the Board resolution whereby the Board of Directors of our Company has approved issue of this Undertaking by the Company.

All the terms used herein but not defined, shall have the meaning as ascribed to the said terms under the RFP.

Certified as true.

……..

(Signature and Name of the authorized signatory of the Company and stamp)

Note:

1. Wherever required, extract of the charter documents and documents such as a Board resolution should be submitted for verification.

ANNEXURE 11 - FORMATS FOR BOARD RESOLUTIONS

Format 1

Format of the Board resolution for the Bidding Company / each Member of the Consortium / investing Affiliate / Parent Company / Ultimate Parent Company, where applicable

[Reference Clause 2.5.2 of the RFP and the illustrations in Annexure 11A]

[Note: The following resolution no.1 needs to be passed by the Boards of each of the entity/(ies) making equity investment]

The Board, after discussion, at the duly convened Meeting on …….. [Insert date], with the consent of all the Directors present and in compliance of the provisions of the Companies Act, 1956/2013, passed the following Resolution:

1. RESOLVED THAT pursuant to the provisions of the Companies Act, 1956 / Companies Act 2013 (as the case may be) and compliance thereof and as permitted under the Memorandum and Articles of Association of the company, approval of the Board be and is hereby accorded for investment of…….% (……per cent) of the total equity share capital of KPS III HVDC TRANSMISSION LIMITED representing the entire amount proposed to be invested by the company for the transmission system for **Transmission System for Evacuation of Power from potential renewable energy zone in Khavda area of Gujarat under Phase-V (8GW): Part C**, partly by acquisition of the existing equity shares from PFC Consulting Limited and / or partly by subscribing to the new equity shares, as per the terms of the RFP.

[Note: Equity investment obligations by the Bidding Company/each Member of the Bidding Consortium/investing Affiliate or Parent or Ultimate Parent should add up to 100%.]

[Note: In the event the Bidder is a Bidding Consortium, the following Board resolution no. 2 also needs to be passed by the Lead Member of the Bidding Consortium]

2. RESOLVED THAT approval of the Board be and is hereby accorded to contribute such further amount over and above the ;……. percentage (__%) limit to the extent becoming necessary towards the total equity share in the _____[Name of SPV], obligatory on the part of the company pursuant to the terms and conditions contained in the Consortium Agreement dated ……executed by the company as per the provisions of the RFP.

[Note: In the event, the investing entity is an Affiliate or Parent or Ultimate Parent of the Bidder, the following Board resolution no. 3 shall also be passed by the Bidder]

3. FURTHER RESOLVED THAT the Board hereby acknowledges the Board Resolution(s) passed by the…….. [Name of the Affiliate(s)/ Parent / Ultimate Parent] regarding the investment of…….(….%) of the equity share capital requirements of KPS III HVDC TRANSMISSION LIMITED, which is to be invested by the ……[Name of the Affiliate(s)/ Parent / Ultimate Parent] for the KPS III HVDC TRANSMISSION LIMITED, partly by acquisition of the existing equity shares from PFC Consulting Limited and partly by subscribing to the new equity shares, as per the terms of the RFP.

[Note: The following resolution no. 4 is to be provided by the Bidding Company / Lead Member of the Consortium only]

4. FURTHER RESOLVED THAT MR/MS ……..be and is hereby authorized to take all the steps required to be taken by the Company for submission of the Bid, including in particular, signing of the Bid, making changes thereto and submitting amended Bid, all the documents related to the Bid, certified copy of this Board resolution or letter or undertakings etc, required to be submitted to BPC as part of the Bid or such other documents as may be necessary in this regard.

Certified True Copy

Company rubber stamp to be affixed

[Notes:

1) This certified true copy should be submitted on the letterhead of the Company, signed by the Company Secretary or any Whole Time Director/ Manager (supported by a specific board resolution) of the Bidding Company or the Lead Member of Consortium.

2) The contents of the format may be suitably re-worded indicating the identity of the entity passing the resolution, i.e., the Bidding Company, each Member of the Bidding Consortium.

3) This format may be modified only to the limited extent required to comply with the local regulations and laws applicable to a foreign entity submitting this resolution. For example, reference to Companies Act 1956 / Companies Act 2013 (as the case may be) may be suitably modified to refer to the law applicable to the entity submitting the resolution. However, in such case, the foreign entity shall submit an unqualified opinion issued by the legal counsel of such foreign entity, stating that the Board resolutions are in compliance with the applicable laws of the respective jurisdictions of the issuing company and the authorizations granted therein are true and valid.]

Format 2

Format for the Board resolution of Technically / Financially Evaluated Entity / Ultimate Parent Company (in case credentials of such TEE/ FEE has been utilized by the Bidding Company or Bidding Consortium)

The Board, after discussion, at the duly convened Meeting on ……. [Insert date], with the consent of all the Directors present and in compliance of the provisions of the Companies Act, 1956 / 2013, passed the following Resolution:

RESOLVED THAT pursuant to the provisions of the Companies Act, 1956 / Companies Act, 2013 (as the case may be) and compliance thereof and as permitted under the Memorandum and Articles of Association of the company, approval of the Board be and is hereby accorded for issuing an Undertaking to the BPC, in the format specified in the RFP issued by the BPC, draft of which is attached hereto and initialed by the Chairman whereby the company undertakes to invest …….percent (.... %) of the total equity share capital of KPS III HVDC TRANSMISSION LIMITED representing the entire amount proposed to be invested by ……[insert the name of the Bidder or Member] for the said Project, in case of failure of ……[Insert the name of the Bidder or Member] to make such investment".

FURTHER RESOLVED THAT .....,be and is hereby authorized to take all the steps required to be taken by the Company, including in particular, signing the said Undertaking, submitting the same to the BPC through ……[Insert name of Bidding Company/Lead Member of the Consortium] of all the related documents, certified copy of this Board resolution or letter, undertakings etc, required to be submitted to BPC as part of the Bid or such other documents as may be necessary in this regard.

Certified True Copy

Company rubber stamp to be affixed

Note:

1. This certified true copy should be submitted on the letterhead of the Company, signed by the Company Secretary or any Whole-time Director/Manager (supported by a specific board resolution) of Bidding Company or Lead Member of the Consortium.

2. The contents of the format may be suitably re-worded indicating the identity of the entity passing the resolution.

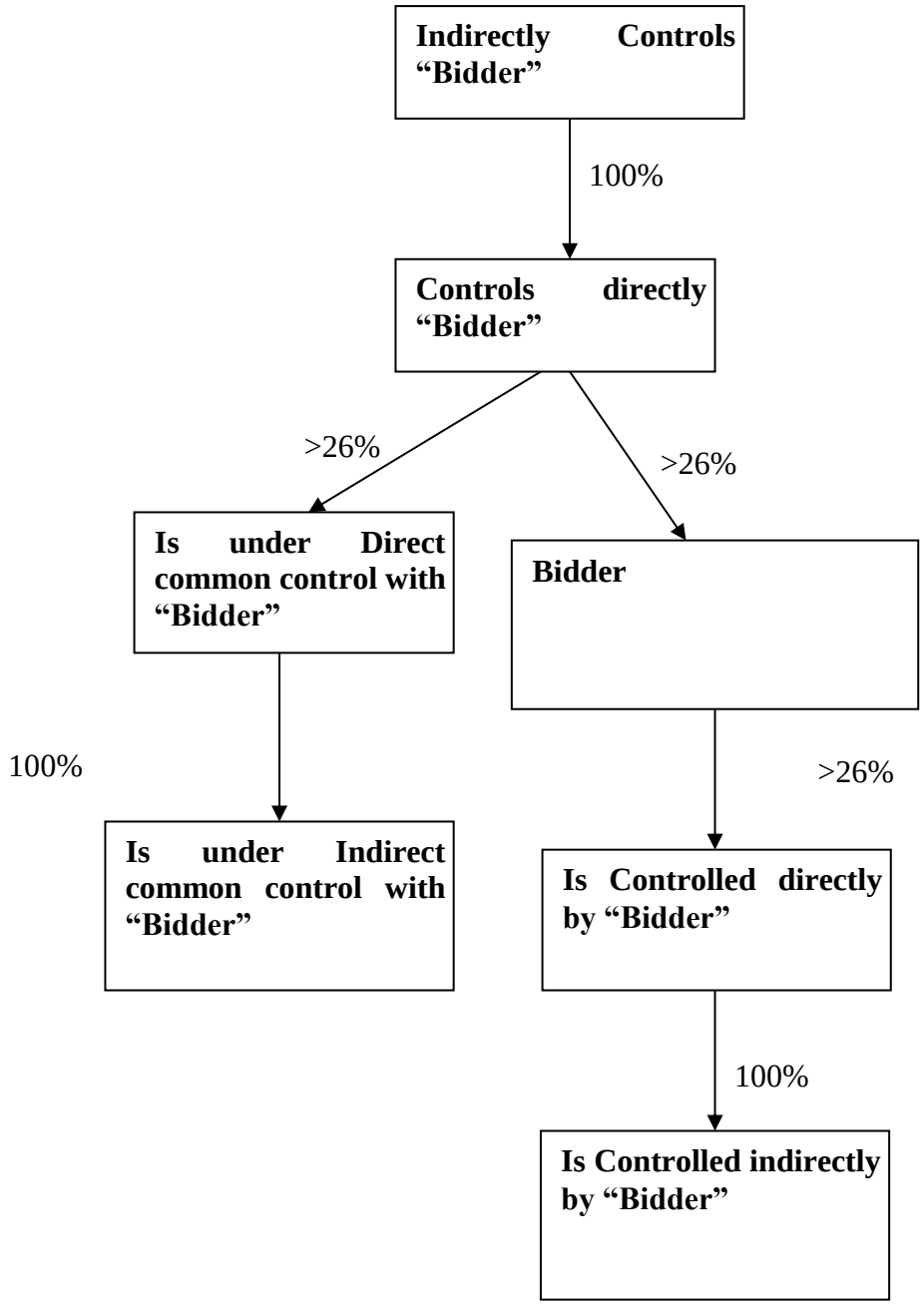
3. This format may be modified only to the limited extent required to comply with the local regulations and laws applicable to a foreign entity submitting this resolution. For example, reference to Companies Act 1956 / Companies Act 2013 (as the case may be) may be suitably modified to refer to the law applicable to the entity submitting the resolution. However, in such case, the foreign entity shall submit an unqualified opinion issued by the legal counsel of such foreign entity, stating that the Board resolutions are in compliance with the applicable laws of the respective jurisdictions of the issuing company and the authorizations granted therein are true and valid.

ANNEXURE 11A – ILLUSTRATION FOR APPLICABLE BOARD RESOLUTION REQUIREMENTS UNDER CLAUSE 2.5.2

Investor in the TSP	Entities (other than Bidder) whose credentials (financial and/or technical) used by the Bidder for meeting RFP criteria	Applicable Board Resolutions	Requirement of Undertaking (Annexure 10)
Bidder himself for 100% equity	None	a) Format 1 of Annexure 11 - Resolution: 1, 2 and 4 from the Bidder	None
Bidder himself for 100% equity	Affiliate and/or Parent Company and/or Ultimate Parent	a) Format 1 of Annexure 11 - Resolution: 1, 2, and 4 from the Bidder b) Format 2 of Annexure 11 by either Technically/ Financially Evaluated Entity(ies) whose credentials have been used, or Ultimate Parent. Provided, if the Bidder himself is the Ultimate Parent, then Format 2 need not be provided.	Yes, by either Technically / Financially Evaluated Entity(ies) Affiliate(s) whose credentials have been used, or Ultimate Parent. Provided, if the Bidder himself is the Ultimate Parent, then the undertaking need not be provided.
Bidder himself + others (Affiliate and/or Parent Company and/or Ultimate Parent) in aggregate holding 100% equity	None	a) Format 1 of Annexure 11 - Resolution: 1,2, 3 and4 from the Bidder. b) Format 1 of Annexure 11 - Resolution: 1 from the Affiliate and /or Parent and /or Ultimate Parent investing in the equity	None
Bidder himself + others (Affiliate and/or Parent	Affiliate and/or Parent Company and/or Ultimate Parent	a) Format 1 of Annexure 11 - Resolution: 1,2, 3 and 4 from the Bidder. b) Format 1 of	Yes, by either Parent/ Affiliate(s) whose credentials have been used, or Ultimate Parent

Investor in the TSP	Entities (other than Bidder) whose credentials (financial and/or technical) used by the Bidder for meeting RFP criteria	Applicable Board Resolutions	Requirement of Undertaking (Annexure 10)
Company and/or Ultimate Parent) in aggregate holding 100% equity		Annexure 11 - Resolution: 1 from the Affiliate and/or Parent and/or Ultimate Parent investing in the equity c) Format 2 of Annexure 11 by either Parent / Affiliate(s) whose credentials have been used and /or Ultimate Parent investing in the equity	

ANNEXURE 12 - FORMAT FOR ILLUSTRATION OF AFFILIATES



NOTE: **Bidder to provide the illustration, as applicable in their case, duly certified by the Company Secretary and supported by documentary evidence in this regard.**

ANNEXURE 13 - FORMAT FOR DISCLOSURE

[On the letter head of Bidding Company / Each Member in a Bidding Consortium]

Date: ……

DISCLOSURE

We hereby declare that the following companies with which we/ have direct or indirect relationship are also separately participating in this Bid process as per following details

S. No.	Name of the Company	Relationship
1.		
2.		
3.		

In case there is no such company please fill in the column "name of the company" as Nil.

Further we confirm that we don't have any Conflict of Interest with any other company participating in this bid process.

Certified as True

……..
(Signature)

Name: .....

Signature & Name of authorized signatory of the Company and Stamp

The above disclosure should be signed and certified as true by the authorized signatory of the Bidding Company or of the Member, in case of a Consortium).

ANNEXURE 14 - FORMAT OF THE BID BOND

FORMAT OF THE UNCONDITIONAL AND IRREVOCABLE BANK GUARANTEE FOR BID BOND

(To be on non-judicial stamp paper of appropriate value as per Stamp Act relevant to place of execution.)

In consideration of the .....[Insert name of the Bidder] submitting the Bid inter alia for establishing the Inter-State transmission system for "**Transmission System for Evacuation of Power from potential renewable energy zone in Khavda area of Gujarat under Phase-V (8GW): Part C"** on build, own, operate and transfer basis, in response to the RFP dated 26.07.2024 issued by PFC Consulting Limited , and the Bid Process Coordinator (hereinafter referred to as BPC) agreeing to consider such Bid of ……. [Insert the name of the Bidder] as per the terms of the RFP, the [Insert name and address of the bank issuing the Bid Bond, and address of the Head Office] (hereinafter referred to as "Guarantor Bank") hereby agrees unequivocally, irrevocably and unconditionally to pay to _____[Name of BPC] or its authorized representative at _____[Address of BPC] forthwith on demand in writing from _____[Name of BPC] or any representative authorized by it in this behalf, any amount up to and not exceeding Rupees _____ Only (Rs _____ Crore),on behalf of M/s……[Insert name of the Bidder].

This guarantee shall be valid and binding on the Guarantor Bank up to and including …… [Date to be inserted on the basis of Clause 2.11 of this RFP] and shall not be terminable by notice or any change in the constitution of the Guarantor Bank or by any other reasons whatsoever and our liability hereunder shall not be impaired or discharged by any extension of time or variations or alternations made, given, or agreed with or without our knowledge or consent, by or between concerned parties.

Our liability under this Guarantee is restricted to Rupees _____ Only (Rs ____ Crore). Our Guarantee shall remain in force until ……..[Date to be inserted on the basis of Clause 2.11 of this RFP]. _____[Name of BPC] or its authorized representative shall be entitled to invoke this Guarantee until …… [Insert Date, which is three sixty five days (365) days after the date in the preceding sentence]. The Guarantor Bank hereby expressly agrees that it shall not require any proof in addition to the written demand from _____[Name of BPC] or its authorized representative, made in any format, raised at the above mentioned address of the Guarantor Bank, in order to make the said payment to _____[Name of BPC] or its authorized representative.

The Guarantor Bank shall make payment hereunder on first demand without restriction or conditions and notwithstanding any objection, disputes, or disparities raised by the Bidder or any other person. The Guarantor Bank shall not require _____[Name of BPC] or its authorized representative to justify the invocation of this BANK GUARANTEE, nor shall the Guarantor Bank have any recourse against _____[Name of BPC] or its authorized representative in respect of any payment made hereunder.

This BANK GUARANTEE shall be interpreted in accordance with the laws of India.

The Guarantor Bank represents that this BANK GUARANTEE has been established in such form and with such content that it is fully enforceable in accordance with its terms as against the Guarantor Bank in the manner provided herein.

This BANK GUARANTEE shall not be affected in any manner by reason of merger, amalgamation, restructuring or any other change in the constitution of the Guarantor Bank.

This BANK GUARANTEE shall be a primary obligation of the Guarantor Bank and accordingly _____[Name of BPC] or its authorized representative shall not be obliged before enforcing this BANK GUARANTEE to take any action in any court or arbitral proceedings against the Bidder, to make any claim against or any demand on the Bidder or to give any notice to the Bidder to enforce any security held by _____[Name of BPC] or its authorized representative or to exercise, levy or enforce any distress, diligence or other process against the Bidder.

Notwithstanding anything contained hereinabove, our liability under this Guarantee is restricted to Rupees _____ Only (Rs ____ Crore) and it shall remain in force until …… [Date to be inserted on the basis of Clause 2.11 of RFP], with an additional claim period of three hundred sixty five (365) days thereafter. We are liable to pay the guaranteed amount or any part thereof under this BANK GUARANTEE only if _____[Name of BPC] or its authorized representative serves upon us a written claim or demand.

In witness whereof the Bank, through its authorized officer, has set its hand and stamp on this…….. day of ..... at……

Witness:

1……. Signature: ……..
Name and Address Name: ……..

2. ……. Designation with Stamp:
Name and Address

Signature ……..

Attorney as per power of attorney No……

For:
…… [Insert Name of the Bank]

Banker's Stamp and Full Address:

Dated this……day of…… 20……..

Notes:

5. The Stamp Paper should be in the name of the Executing Bank.

ANNEXURE 15 - FORMAT FOR CONTRACT PERFORMANCE GUARANTEE

(To be on non-judicial stamp paper of appropriate value as per Stamp Act relevant to place of execution. Foreign entities submitting Bids are required to follow the applicable law in their country)

In consideration of the …… [Insert name of the SPV or Selected Bidder on behalf of SPV or Lead Member in case of the Consortium, with address] agreeing to undertake the obligations under the Transmission Service Agreement dated …… and the other RFP Project Documents and the Nodal Agency and ……._[Name of BPC], agreeing to execute the RFP Project Documents with the Selected Bidder, regarding setting up the Project, the……[Insert name and address of the bank issuing the guarantee and address of the head office] (hereinafter referred to as "Guarantor Bank") hereby agrees unequivocally, irrevocably and unconditionally to pay to the Nodal Agency at…… [Insert Place and Address of the Nodal Agency indicated in TSA] forthwith on demand in writing from the Nodal Agency or any Officer authorized by it in this behalf, any amount up to and not exceeding Rupees……Crores (Rs……..) only [Insert the amount of the bank guarantee] on behalf of M/s…… [Insert name of the Selected Bidder / SPV].

This guarantee shall be valid and binding on the Guarantor Bank up to and including ……and shall not be terminable by notice or any change in the constitution of the Bank or the term of the Transmission Service Agreement or by any other reasons whatsoever and our liability hereunder shall not be impaired or discharged by any extension of time or variations or alternations made, given, or agreed with or without our knowledge or consent, by or between parties to the respective agreement.

Our liability under this Guarantee is restricted to Rupees …….. Crores (Rs……) only. Our Guarantee shall remain in force until…… [Insert the date of validity of the Guarantee as per Clause 2.12.1 of the RFP]. The Nodal Agency shall be entitled to invoke this Guarantee up to three hundred sixty five (365) days of the last date of the validity of this Guarantee.

The Guarantor Bank hereby expressly agrees that it shall not require any proof in addition to the written demand from the Nodal Agency, made in any format, raised at the above mentioned address of the Guarantor Bank, in order to make the said payment to the Nodal Agency.

The Guarantor Bank shall make payment hereunder on first demand without restriction or conditions and notwithstanding any objection by KPS III HVDC TRANSMISSION LIMITED, …… [Insert name of the Selected Bidder], …… [Insert name of the TSP] and/or any other person. The Guarantor Bank shall not require the Nodal Agency to justify the invocation of this BANK GUARANTEE, nor shall the Guarantor Bank have any recourse against the Nodal Agency in respect of any payment made hereunder.

This BANK GUARANTEE shall be interpreted in accordance with the laws of India.

The Guarantor Bank represents that this BANK GUARANTEE has been established in such form and with such content that it is fully enforceable in accordance with its terms as against the Guarantor Bank in the manner provided herein.

This BANK GUARANTEE shall not be affected in any manner by reason of merger, amalgamation, restructuring, liquidation, winding up, dissolution or any other change in the constitution of the Guarantor Bank.

This BANK GUARANTEE shall be a primary obligation of the Guarantor Bank and accordingly the Nodal Agency shall not be obliged before enforcing this BANK GUARANTEE to take any action in any court or arbitral proceedings against KPS III HVDC TRANSMISSION LIMITED or the Selected Bidder, to make any claim against or any demand on KPS III HVDC TRANSMISSION LIMITED or the Selected Bidder, as the case may be, or to give any notice to KPS III HVDC TRANSMISSION LIMITED or the Selected Bidder, as the case may be, or to enforce any security held by the Nodal Agency or to exercise, levy or enforce any distress, diligence or other process against KPS III HVDC TRANSMISSION LIMITED or the Selected Bidder, as the case may be.

The Guarantor Bank acknowledges that this BANK GUARANTEE is not personal to the Nodal Agency and may be assigned, in whole or in part, (whether absolutely or by way of security) by Nodal Agency to any entity to whom the Nodal Agency is entitled to assign its rights and obligations under the Transmission Service Agreement.

The Guarantor Bank hereby agrees and acknowledges that the Nodal Agency shall have a right to invoke this Bank Guarantee either in part or in full, as it may deem fit.

Notwithstanding anything contained hereinabove, our liability under this Guarantee is restricted to Rupees ……..Crores (Rs ……..) only and it shall remain in force until [Date to be inserted on the basis of Article 3.1.2 of TSA], with an additional claim period of three hundred sixty five (365) days thereafter. This BANK GUARANTEE shall be extended from time to time for such period, as may be desired by…… [Insert name of the Selected Bidder or Lead Member in case of the Consortium or SPV]. We are liable to pay the guaranteed amount or any part thereof under this Bank Guarantee only if the Nodal Agency serves upon us a written claim or demand.

In witness where of:

Signature……

Name: ……

Power of attorney No.: ……..

For:

…… [Insert Name of the Bank]
Banker's Seal and Full Address, including mailing address of the Head Office

Notes:

1. The Stamp Paper should be in the name of the Executing Bank.

ANNEXURE 16 – FORMAT OF CHECKLIST FOR TECHNICAL BID SUBMISSION REQUIREMENTS

[This format needs to be duly filled in, signed by the authorized signatory of the Bidder (Bidding Company / Lead Member in case of a Bidding Consortium) and submitted along with the Bidder's Technical Bid]

Technical Bid Submission Requirements			Response (Yes / No)
1.	Format for the Covering Letter on the letterhead of Bidding Company or Lead Member of the Consortium, as applicable;		
2.	Format for Letter of Consent from each Consortium Member, including Lead Member, on their respective letterheads;		
3.	Format for evidence of authorized signatory's authority ;		
4.	Board resolution from the Bidding Company / Lead Member of the Consortium in favour of the person executing the Power of Attorney as per **Annexure 3**;		
5.	Power of Attorney from each Consortium Member in favour of Lead Member to be provided by each of the other Members of the Consortium as per **Annexure 4**;		
6.	Board Resolution from each Member of the Consortium, other than the Lead Member, in favour of their respective authorized representatives for executing the POA, Consortium Agreement and signing of the requisite formats;		
7.	Format for Bidder's composition and ownership structure, along with status of equity holding (owning ten percent or more of the total paid up equity) not earlier than thirty (30) days prior to the Bid Deadline as per **Annexure 5**;		
8.	Consortium Agreement duly signed as per **Annexure 6**, along with Appendix-1, indicating the responsibilities and obligations of each Member of the Consortium;		
9.	Format for Qualification Requirement:		
	a.	Calculation sheets, detailing computation of Networth considered for meeting Qualifying Requirements, duly signed and stamped by the Statutory Auditor of the Bidding Company / each Member in case of a Bidding Consortium / FEE in cases where credentials of FEE is taken;	
	b.	Calculation sheets, detailing computation of capital expenditure of projects and revenue received in construction projects considered for meeting	

Technical Bid Submission Requirements			Response (Yes / No)
		Qualification Requirements, duly signed and stamped by the Statutory Auditor of the Bidding Company / Lead Member in case of Bidding Consortium / TEE in cases where credentials of TEE is taken;	
	c.	Last financial year unconsolidated / consolidated audited annual accounts / statements, as the case may be, of the Financially Evaluated Entity / Technical Evaluated Entity	
	d.	Unconsolidated audited annual accounts of both the TEE and the Bidding Company/Lead member, as applicable, from the financial years in which financial closure was achieved till the financial year in which the said project was completed / commissioned.	
10.	Copy of the Memorandum and Articles of Association and certificate of incorporation or other organizational document (as applicable), including their amendments, certified by the Company Secretary of Bidding Company or each Member in case of a Consortium including Lead Member.		
11.	Attachment of **Annexure 7(D)**, detailing projects completed / commissioned and for which commercial operation has commenced including Executive Summary for each project.		
12.	For each project listed in the attachment above, certified true copy of the certificates of final acceptance and / or certificates of good operating performance duly issued by owners or clients for the project, duly signed by authorized signatory in support of technical capability as defined in Clause 2.1.2 of RFP.		
13.	Authority letter in favour of BPC from the Bidder/every Member of the Consortium authorizing the BPC to seek reference from their respective bankers & others.		
14.	Authorization from Parent / Affiliate of Bidding Company / Member of Bidding Consortium whose technical / financial capability has been used by the Bidding Company / Member of Bidding Consortium.		
15.	Initialing of all pages of Technical Bid by the Authorized Signatory in whose favour the POA (**Annexure 3**) has been executed.		
16.	Format for Illustration of Affiliates at the most seven (7) days prior to the Bid Deadline, duly certified by Company Secretary and supported by documentary evidence.		

Technical Bid Submission Requirements		Response (Yes / No)
17.	Certified copy of the Register of Members / Demat Account Statement, Share Certificate, Annual Return filed with ROC etc. submitted as documentary evidence along with **Annexure 12**.	
18.	Format for Disclosure by Bidding Company / each Member of the Consortium.	
19.	Format for Affidavit by the Bidding Company / each Member of the Consortium	
20.	Format for Authorization submitted in Non-Judicial stamp paper duly notarized.	
21.	Bidders Undertaking and details of Equity Investment	
22.	Proof of Payment of RFP Fees	
23.	Bid Bond/ Bid Security Declaration (As applicable)	
24.	Board Resolution as per Annexure 11 (If required)	

[**Note:** The checklist is not exhaustive. Bidders are required to submit all the information/documents as per requirement of RFP]

For and on behalf of Bidder

M/s. ……..

……..
(Signature of authorized signatory)

ANNEXURE 17 – LIST OF BANKS

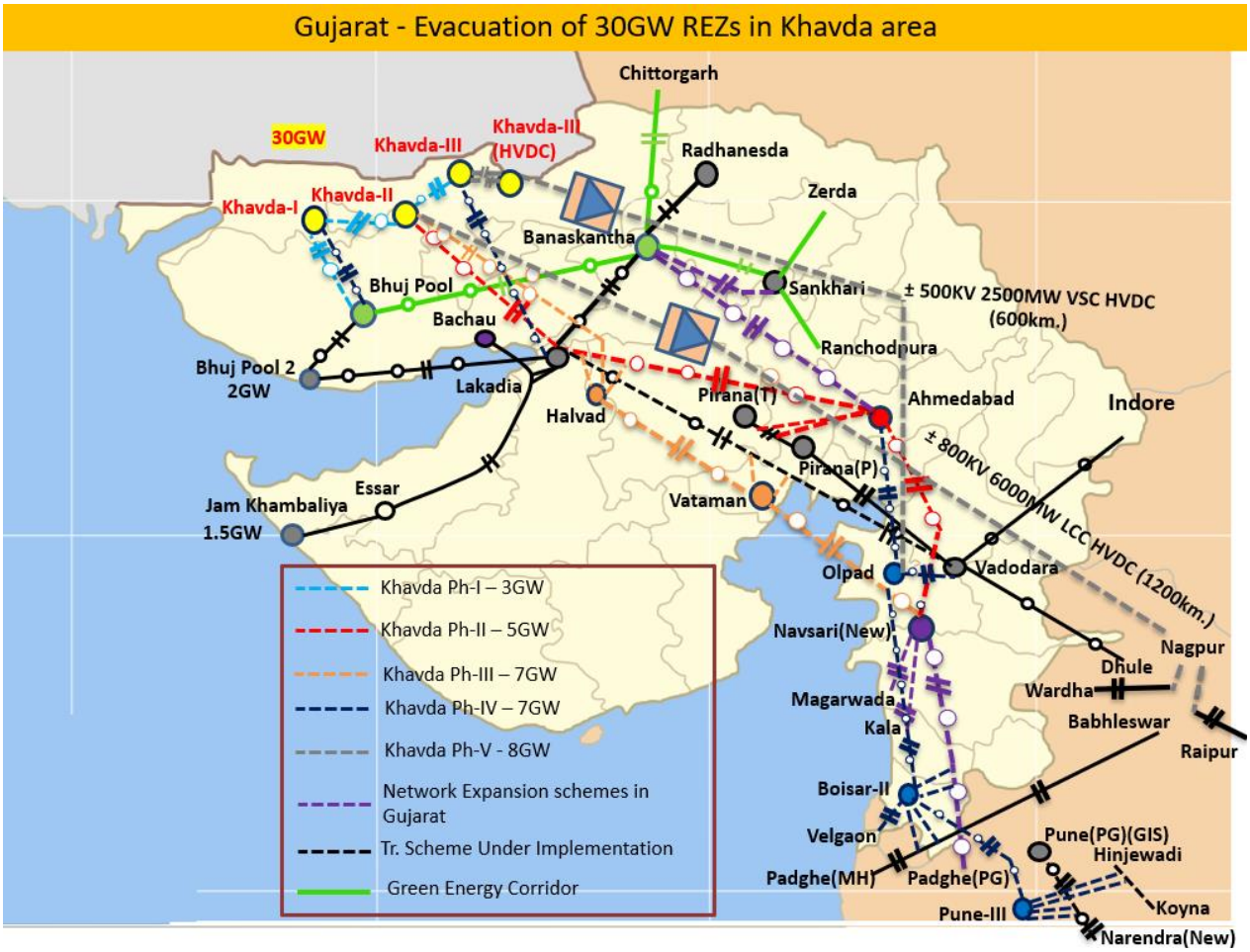
The list of banks shall include all Scheduled Commercial Banks as per Second Schedule of RBI Act-1934 and any amendments thereof.

Note:
The above list of banks is indicative and can be modified by the BPC as required and any such change shall not be construed as a deviation from this document.

ANNEXURE 18 - GRID MAP OF THE PROJECT

Transmission Grid Map indicating the details of the Project is given below:

Transmission Grid Map



Location details of existing / proposed substations:

a. **South Olpad substation:**

Substation is under bidding under separate scheme.

b. **KPS3 Substation:**

24°12'26.58'N, 69°29'41.53"E

Note: *The above coordinates/location of substation indicated is approximate in the substation area. Exact coordinates for the corresponding bays/gantry for termination of the respective line may be verified and finalized in coordination with actual site.*

ANNEXURE 19 - FORMAT FOR CLARIFICATIONS / AMENDMENTS ON THE RFP / RFP PROJECT DOCUMENTS

S. No.	Name of the Document	Clause No. and Existing provision	Clarification required	Suggested text for the amendment	Rationale for the Clarification or Amendment

Signature ……

Name……..

For

Bidder's Rubber Stamp and Full Address.

(Note: This format shall be used for submission of requests for clarifications/ amendments on the draft RFP Project Documents as per the provisions of Clause 2.3.1)

ANNEXURE 20 - LIST FOR RFP PROJECT DOCUMENTS

ENCLOSURE 1: TRANSMISSION SERVICE AGREEMENT (Provided separately)

ENCLOSURE 2:SHARE PURCHASE AGREEMENT (Provided Separately)

……..

[To be inserted by the BPC]

ANNEXURE 21 - FORMAT FOR FINANCIAL BID

[To be uploaded online]

Quoted Transmission Charges ……..

Notes

1. The Bidders are required to ensure compliance with the provisions of Clause 2.5.3 of this RFP.

2. Quotes to be in Rupees Millions and shall be up to two (2) decimal points.

3. The contents of this format shall be clearly typed.

4. The Financial Bid shall be digitally signed by the authorized signatory in whose name power of attorney as per Clause 2.5.2 is issued.

5. Ensure only one value for annual Transmission Charges is quoted. The same charge shall be payable every year to TSP for the term of TSA.

ANNEXURE 22 – FORMAT FOR AFFIDAVIT

[On non-judicial stamp paper. Foreign companies submitting bids are required to follow the applicable law in their country]

AFFIDAVIT

We [including any of our Affiliate and Consortium Member & any of its Affiliate], hereby declare that as on Bid Deadline:

a. the Bidder & any of its Affiliate including any Consortium Member & any of its Affiliate, their directors or key personnel have not been barred or included in the blacklist by any government agency or authority in India, the government of the jurisdiction of the Bidder or Members where they are incorporated or the jurisdiction of their principal place of business, any international financial institution such as the World Bank Group, Asian Development Bank, African Development Bank, Inter-American Development Bank, Asian Infrastructure Investment Bank etc. or the United Nations or any of its agencies; or

b. the Bidder & any of its Affiliate including any Consortium Member & any of its Affiliate or their directors have not been convicted of any offence in India or abroad.

We further declare that following investigations are pending / no investigation is pending [strike off whichever is not applicable] against us [including any of our Consortium Member or Affiliate or Parent or Ultimate Parent or Affiliate] or CEO or any of our directors/ manager/key managerial personnel of the Applicant /Consortium Member or their Affiliates.

We further undertake to inform the BPC of any such matter as mentioned above on its occurrence after the date of this affidavit till the Effective Date.

We undertake that, in case, any information provided in relation to this affidavit is found incorrect at any time hereafter, our BID / Letter of Intent / contract (if entered) would stand rejected / recalled / terminated, as the case may be.

…….
Signature and Name of the authorized signatory of the Company Bidding Company / Lead Member of the Bidding Consortium

……..
(Signature of Notary Public)

Place: ……
Date: ……

Note: In case any investigation is pending against the Applicant, including any Consortium Member or Affiliate, or CEO or any of the directors/ manager/key managerial personnel of the Applicant

/Consortium /Member or their Affiliates, full details of such investigation including the name of the investigating agency, the charge/offence for which the investigation has been launched, name and designation of persons against whom the investigation has been launched and other relevant information should be disclosed under this affidavit.

ANNEXURE A
Technical Details with respect to electronic bidding

Registration Methodology

In order to submit online bids in the e-bidding process for selection of Transmission Service Provider, interested Bidders are required to register themselves with the e-procurement website of MSTC limited namely www.mstcecommerce.com/eprochome/tsp/index.jsp. To register with the website, the Bidder is required to fill up the online form available under the link Register as Vendor in the above website and fill up the same and click on Submit.

During this process, the Bidder shall create his user id and password and keep note of the same. The Bidder shall ensure that the secrecy of his user id and password is maintained at all time and he/she shall alone be responsible for any misuse of the user id and password.

The Bidder may check the details entered by it before final submission. On successful submission of the online registration Form, the Bidder shall receive a confirmation mail in the registered email address advising the Bidder to submit the following documents.

i. Self-attested Income Tax PAN Card. In case of a registered Company or Firm, the Firm's PAN card and in case of a proprietorship firm, proprietor's personal PAN card is required. In case of partnership firm, PAN of the firm and that of the authorized partner are to be submitted.

ii. Copy of the confirmation email Letter received from MSTC after successful completion of on-line registration.

iii. A non-refundable registration fee of Rs.10,000/- plus GST as per applicable rate to be paid online. The account details will be available in the System generated email sent by MSTC post registration.

Please provide details of payment made like UTR No, remitting bank name, date of payment and amount in the covering letter.

The Bidder shall have to submit all the above documents to MSTC Limited for verification and activation of their login ids. The Bidders should send scanned copies of the above documents to the designated email id only which is given below.

tsp@mstcindia.co.in

It may be noted that Bidders need not visit any of the offices of MSTC Limited for submission of the documents.

Contact persons of MSTC Limited:

Ms. Archana Juneja
9990673698

Mr. Setu Dutt Sharma
7878055855

Once the complete set of documents and requisite registration fee are received from a Bidder, MSTC shall activate the Bidder's login after verification / scrutiny of the documents. MSTC Limited reserves the right to call for additional documents from the Bidder if needed and the Bidder shall be obliged to submit the same.

On completion of the above stated registration process, a Bidder shall be able to login to MSTC's website.

ANNEXURE B
Draft Pre-Award Integrity Pact

GENERAL

This pre-bid contract Agreement (herein after called the Integrity Pact) is made on …….. day of the month of ……. 20……, between, on one hand, …… [Insert name of BPC] through Shri …….. [Insert Name & designation of representative of BPC] (hereinafter called the "Bid Process Coordinator/ BPC", which expression shall mean and include, unless the context otherwise requires, his successors in the office and assigns) of the First Part and M/s …… represented by Shri …….. [Insert Name & Designation of Authorized Signatory of the Bidder/ Lead Member of Consortium] (hereinafter called the "Bidder" which expression shall mean and include, unless the context otherwise requires, his successors and permitted assigns) of the Second Part.

WHEREAS the BPC is conducting the bidding process for selection of bidder as Transmission Service Provider (TSP), who will be responsible to set up the transmission project on build, own, operate and transfer (BOOT) basis and to provide Transmission Service.

WHEREAS the Bidder is a Private Company/Public Company/Government Undertaking/ Partnership, constituted in accordance with the relevant law in the matter and the BPC is a Public Sector Undertaking (PSU) performing its function on behalf of the Ministry of Power, Government of India.

NOW, THEREFORE,

To avoid all forms of corruption by following a system that is fair, transparent and free from any influence/prejudiced dealings during the complete bidding process with a view to:-

Enabling the BPC to select the bidder as TSP in conformity with the defined procedures by avoiding the high cost and the distortionary impact of corruption on public procurement, and

Enabling Bidder to abstain from bribing or indulging in any corrupt practice in order to emerge as selected bidder by providing assurance to them that their competitors will also abstain from bribing and other practices and the BPC will commit to prevent corruption, in any form, by its officials by following transparent procedures.

The parties hereto hereby agree to enter into this Integrity Pact and agree as follows:

Commitments of BPC

1.1 The BPC undertakes that no official of the BPC, connected directly or indirectly with

the bidding process, will demand, take a promise for or accept, directly or through intermediaries, any bribe, consideration, gift, reward, favour or any material or immaterial benefit or any other advantage from the BIDDER, either for themselves or for any person, organization or third party related to the bidding process in exchange for an advantage in the bidding process, bid evaluation, contracting or implementation process related to the contract.

1.2 The BPC will, during the bidding stage, treat all bidders alike, and will provide to all bidders the same information and will not provide any such information to any particular bidder which could afford an advantage to that particular bidder in comparison to the other bidders.

1.3 All the officials of the BPC will report the appropriate Government office any attempted or completed breaches of the above commitments as well as any substantial suspicion of such a breach.

2. In case of any such preceding misconduct on the part of such official(s) is reported by the Bidder to the BPC with the full and verifiable facts and the same is *prima facie* found to be correct by the BPC, necessary disciplinary proceedings, or any other action as deemed fit, including criminal proceedings may be initiated by the BPC and such a person shall be debarred from further dealings related to the bidding process. In such a case while an enquiry is being conducted by the BPC the proceedings under the bidding process would not be stalled.

Commitments of Bidder

3. The Bidder commits itself to take all measures necessary to prevent corrupt practices, unfair means and illegal activities during any stage of its bid or during any pre award stage in order to emerge as Selected Bidder or in furtherance to secure it and in particular commits itself to the following:-

3.1 The Bidder will not offer, directly or through intermediaries, any bribe, gift, consideration, reward, favour, any material or immaterial benefit or other advantage, commission, fees, brokerage or inducement to any official of the BPC, connected directly or indirectly with the bidding process, or to any person, organization or third party related to the bidding process in exchange for any advantage in the bidding, evaluation, contracting and implementation of the bidding process.

3.2 The Bidder further undertakes that it has not given, offered or promised to give, directly or indirectly any bribe, gift, consideration, reward, favour, any material or immaterial benefit or other advantage, commission, fees, brokerage or inducement to any official of the BPC or otherwise in bidding process or for bearing to do or having done any act in relation to bidding process or any other contract with the Government for showing or forbearing to show favour or disfavour to any person in relation to the

bidding process or any other contract with the Government.

3.3 The Bidder shall disclose the name and address of agents and representatives and Indian Bidder shall disclose their foreign principals or associates.

3.4 The Bidder shall disclose the payments to be made by them to agents/brokers or any other intermediary, in connection with this bid.

3.5 The Bidder further confirms and declares to the BPC that the Bidder has not engaged any individual or firm or company whether Indian or foreign to intercede, facilitate or in any way to recommend to the BPC or any of its functionaries, whether officially or unofficially for selection of Bidder as TSP, nor has any amount been paid, promised or intended to be paid to any such individual, firm or company in respect of any such intercession, facilitation or recommendation.

3.6 The Bidder, either while presenting the bid or during pre-award negotiations or before signing the Share Purchase Agreement, shall disclose any payments he has made, is committed to or intends to make to officials of the BPC or their family members, agents, brokers or any other intermediaries in connection with the bidding process and the details of services agreed upon for such payments.

3.7 The Bidder will not collude with other parties interested in the bidding process to impair the transparency, fairness and progress of the bidding process.

3.8 The Bidder will not accept any advantage in exchange for any corrupt practice, unfair means and illegal activities.

3.9 The Bidder shall not use improperly, for purpose of competition or personal gain, or pass on to others, any information provided by the BPC as part of the business relationship, regarding plans, technical proposal and business details, including information contained in any electronic data carrier. The Bidder also undertakes to exercise due and adequate care lest any such information is divulged.

3.10 The Bidder commits to refrain from giving any complaint directly or through any other manner without supporting it with full and verifiable facts.

3.11 The Bidder shall not instigate or cause to instigate any third person to commit any of the actions mentioned above.

3.12 The Bidder shall not lend to or borrow any money from or enter into any monetary dealings or transactions, directly or indirectly, with any employee of the BPC.

4 Previous Transgression

4.1 The Bidder declares that no previous transgression occurred in the last three years immediately before signing of this Integrity Pact, with any other company in any

country in respect of any corrupt practices envisaged hereunder or with any Public Sector Enterprise in India or any Government Department in India that could justify Bidder's exclusion from the bidding process.

4.2 The Bidder agrees that if it makes incorrect statement on this subject, Bidder can be disqualified from the tender process or the contract, if already awarded, can be terminated for such reason.

5 Bid Bond (Security Deposit)/ Bid Security Declaration (as applicable)

5.1 Along with the technical bid, the Bidder shall submit Bid Bond for an amount of Rs……. (as per the amount specified in Request for Proposal (RFP) Document) issued by any Banks from the list provided in RFP Document as Earnest Money/Security Deposit, with the BPC.

5.2 The Earnest Money/Security Deposit shall be valid & retained by the BPC for such period as specified in the RFP Document.

5.3 No interest shall be payable by the BPC to the Bidder on Earnest Money/Security Deposit for the period of its currency.

6 Sanctions for Violations

6.1 Any breach of the aforesaid provisions by the Bidder or any one employed by it or acting on its behalf (whether with or without the knowledge of the Bidder) shall entitle the BPC to take all or anyone of the following actions, wherever required:-

(ii) To immediately call off the pre-award negotiations without assigning any reason or giving any compensation to the Bidder. However, the proceedings with the other Bidder (s) would continue.

(iii) The Bid Bond (in pre-award stage) shall stand forfeited either fully or partially, as decided by the BPC and the BPC shall not be required to assign any reason therefore.

(iv) To immediately cancel the award, if already awarded, without giving any compensation to the Bidder.

(v) To cancel all or any other contracts with the Bidder. The Bidder shall be liable to pay compensation for any loss or damage to the BPC resulting from such cancellation/rescission.

(vi) To debar the Bidder from participation in any tender or RFP issued by any BPC for an indefinite period.

(vii) To recover all sums paid in violation of this Pact by Bidder to any middleman or agent or broker with a view to securing the award.

6.2 The BPC will be entitled to take all or any of the actions mentioned at para 6.1 (i) to (vi) of this Pact also on the Commission by the Bidder or anyone employed by it or acting on its behalf (whether with or without the knowledge of the Bidder), of an offence as defined in Chapter IX of the Indian Penal code, 1860 or Prevention of Corruption Act, 1988 or any other statute enacted for prevention of corruption.

6.3 The decision of the BPC to the effect that a breach of the provisions of this Pact has been committed by the Bidder shall be final and conclusive on the Bidder. However, the Bidder can approach the Independent Monitor(s) appointed for the purposes of this Pact.

7 Independent Monitors

7.1 The BPC has appointed Independent Monitors (hereinafter referred to as Monitors) for this Pact in consultation with the Central Vigilance Commission (Names and Addresses of the Monitors to be given).

7.2 The task of the Monitors shall be to review independently and objectively, whether and to what extent the parties comply with the obligations under this Pact.

7.3 The Monitors shall not be subject to instructions by the representatives of the parties and perform their functions neutrally and independently.

7.4 Both the parties accept that the Monitors have the right to access all the documents relating to the project/procurement, including minutes of meetings.

7.5 As soon as the Monitor notices, or has reason to believe, a violation of this Pact, he will so inform the Authority designated by the BPC.

7.6 The Bidder accepts that the Monitors has the right to access without restriction to all Project documentation of the BPC including that provided by the Bidder. The Monitor shall be under contractual obligation to treat the information and documents of the Bidder /Subcontractors(s) with confidentially. [As all the bid documents are with BPC only]

7.7 The BPC will provide to the Monitors sufficient information about all meetings among the parties related to the Project provided such meetings could have an impact on the contractual relations between the parties. The parties will offer to the monitor the option to participate in such meetings.

7.8 The Monitor will submit a written report to the designated Authority of the

BPC/Secretary in the Department within 8 to 10 weeks from the date of reference or intimation to him by the BPC / Bidder and, should the occasion arise, submit proposals for correcting problematic situations.

8 Facilitation of Investigation

In case of any allegation of violation of any provisions of this Pact or payment of commission, the BPC or its agencies shall be entitled to examine all the documents including the Books of Accounts of the Bidder and the Bidder shall provide necessary information and documents in English and shall extend all possible help for the purpose of such examination.

9 Law and Place of Jurisdiction

This Pact is subject to Indian Law. The place of performance and jurisdiction is the seat of the BPC.

10 Other Legal Actions

The actions stipulated in this Integrity Pact are without prejudice to any other legal action that may follow in accordance with the provisions of the any extent law in force relating to any civil or criminal proceedings.

11 Validity

11.1 The validity of this Integrity Pact shall be from date of its signing and upto 6 months from the date of transfer of project specific SPV i.e. signing of Share Purchase Agreement with BPC. In case Bidder is unsuccessful, this Integrity Pact shall expire after 15 days from the date of transfer of project specific SPV to successful bidder.

11.2 Should one or several provisions of this Pact turn out to be invalid, the remainder of this Pact shall remains valid. In this case, the parties will strive to come to an agreement to their original intentions.

12. The Parties hereby sign this Integrity Pact at_____ on _____.

Bid Process Coordinator (BPC)	**BIDDER**
Name of the Officer Designation Name of the BPC with address Witness: 1._____ 2. _____	Name of Whole time Director/Authorized Signatory Name of the Bidder with address Witness: 1._____ 2. _____

ANNEXURE-C

SPECIFIC TECHNICAL REQUIREMENTS FOR TRANSMISSION LINE

Annexure-A

Specific Technical Requirement of 2500 MW (2x1250 MW), ±500 kV HVDC [Type: Voltage Source Converter (VSC)]

1. General

The proposed HVDC link shall be ±500 kV, 2500 MW HVDC line between KPS 3 (Gujarat) and South Olpad (Gujarat) using Dedicated metallic return and consist of Bipole (2x1250 MW). The bipole shall consist of Pole-1 (1250 MW) and Pole-2 (1250 MW). The HVDC terminals shall be implemented with 100% power reversal capability.

The system shall generally conform to the requirements of the Central Electricity Authority (Technical Standards for Construction of Electrical Plants and Electric Lines) Regulations 2022, Central Electricity Authority (Measures relating to Safety and Electric Supply) Regulations, 2023, Central Electricity Authority (Safety requirements for construction, operation and maintenance of electrical plants and electric lines) Regulations, 2011 as amended from time to time and any other relevant Rules/ Regulations/ Standards/ Guidelines.

2. Abbreviations

The following terminology shall apply at various places of this specification:

DMR:	Dedicated Metallic Return
DMRTB:	Dedicated Metallic Return Transfer Breaker
DPS:	Dynamic Performance Studies
ESCR:	Effective Short Circuit Ratio
FAT:	Factory Acceptance Tests
HMI:	Human Machine Interface
HVAC:	High Voltage Alternating Current
HVDC:	High Voltage Direct Current
HVRT:	High Voltage Ride Through
IBR:	Inverter Based Resources
Id:	Direct current (any defined value)
LCC:	Line Commutated Converter
VSC:	Voltage Source Converter
LI/SI:	Lightning Impulse/Switching Impulse
LVRT:	Low Voltage Ride Through

NBS:	Neutral Bus Switch
NGBS:	Neutral Ground Bus Switch
PCC:	Point of Common Coupling
POI:	Point of Interconnection
PMR:	Pole Metallic Return
PMRTB:	Pole Metallic Return Transfer Breaker
RPC:	Reactive Power Control
SAS:	Substation Automation System
SCADA:	Supervisory Control and Data Acquisition
SCR:	Short Circuit Ratio
SSTI:	Sub-synchronous Torsional Interaction
TSP:	Transmission Service Provider
Ud:	Direct voltage (any defined value)

3. Definitions

Bipole: A pair of two (2) poles which are connected to opposite polarities (positive and negative). For power transmission in one Bipole, two such pairs are required.

Forward Power flow direction: Active power transmission from Khavda PS3 to South Olpad HVDC.

Inverter: HVDC terminal which is receiving the power.

MMC: (**Modular Multi-level Converter**): Multi-level converter in which each valve arm consists of multiple power modules connected in series.

MMC building block: self-contained, two-terminal controllable voltage source together with D.C. capacitor(s) and immediate auxiliaries, forming part of a MMC.

PCC (Point of Common Coupling)/ POI (Point of Interconnection): The connection point between the HVDC and the power system at which performance requirements are defined.

Reverse Power flow direction: Active power transmission from South Olpad to Khavda PS3

VSC phase unit: Equipment used to connect the two DC terminals to one AC terminal.

VSC unit: Three VSC phase units, together with VSC unit control equipment, essential protective and switching devices, DC storage capacitors, phase reactors and auxiliaries, if any, used for conversion

VSC converter unit: Individual operative unit comprising all equipment between the point of connection on the AC side and the point of connection on the DC side, essentially one or more VSC converters, together with one or more interface/converter transformers, converter unit control equipment, essential protective and switching devices and auxiliaries, if any, used for conversion.

VSC converter station (HVDC Substation): Part of VSC HVDC system which consists of one or more VSC converter units including DC switchgear, DC fault current controlling devices, if any, installed in a single location together with buildings, reactors, filters, reactive power supply, control, monitoring, protective, measuring and auxiliary equipment.

VSC HVDC system: High-voltage direct current transmission system connecting two VSC converter stations transferring energy in the form of HVDC including related transmission lines and/or cables, switching stations, if any, as well as other equipment and sub-systems needed for operation

STATCOM operation: Mode of operation of a converter when only reactive power (capacitive or inductive) is exchanged with the AC system [Ref: IEC 62747:2019]

SCR: Ratio of the AC network short-circuit level (in MVA) at 1 p.u. voltage at the point of connection to the AC bus of the HVDC substation, to the rated DC power of the HVDC substation (in MW) [Ref: IEC 62747:2019]

Operating state: Condition in which the HVDC substation is energized and the converters are de-blocked [Ref: IEC 62747:2019].

Valve blocking: State condition of a valve when all IGBTs are turned off [Ref: IEC 62747:2019]
In reading of this RfP, term “BIGT” can be used interchangeably for “IGBT”.

Converter blocking: Operation to initiate a mode change from operating state to blocked state of a VSC unit [Ref: IEC 62747:2019].

Converter deblocking: Operation to initiate a mode change from blocked state to operating state of a VSC unit [Ref: IEC 62747:2019].

Inductive operation: Operation in which the converter consumes reactive power from the AC system with or without exchanging active power [Ref: IEC 62747:2019].

Capacitive operation: Operation in which the converter feeds reactive power into the AC system with or without exchanging active power [Ref: IEC 62747:2019].

4. For Definition, relevant standards as mentioned in the clause 51 of this Annexure may be

referred.

VSC Transmission configuration:

± 500 kV HVDC Bipole system between KPS3 (HVDC) and South Olpad (HVDC) shall be VSC transmission in bipolar configuration with dedicated metallic return as indicated in Fig.1 below.

The PCC points shall be connection of Pole 1 and Pole 2 to 400 kV AC Bus sections at KPS-3 (HVDC) substation and connection of Pole 1 and Pole 2 to 400 kV AC Bus at South Olpad.

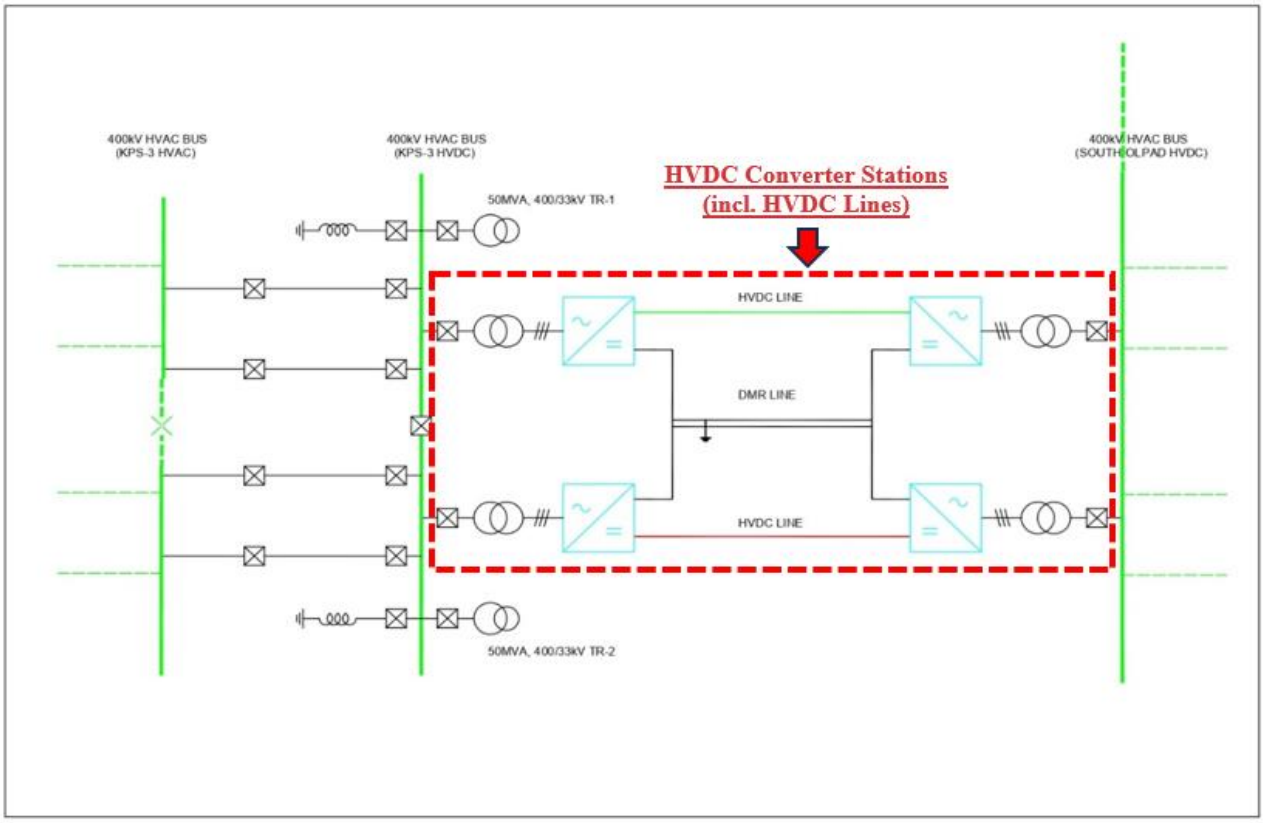


Fig.1: VSC transmission in bipolar configuration with dedicated metallic return

Design Consideration:

The salient technical features for HVDC terminals shall be as follows (Table 1):

Table 1

Sl. No.	Item Description	Parameters
1.	Rectifier station location (Forward direction power)	Near KPS3 (Gujarat) [If the power direction is reversed, Khavda becomes inverter]
2.	Inverter station location (Forward direction power)	South Olpad (Gujarat) [If the power direction is reversed, South Olpad will become rectifier]
3.	Rated DC voltage (1.0 pu)	± 500 kV DC at Rectifier HVDC Pole Bus

Sl. No.	Item Description	Parameters
4.	Rated power (1.0 pu)	2500 MW at Rectifier DC Bus
5.	Minimum DC Power	0 MW
6.	AC system frequency	Nominal 50 Hz
7.	Fault Current level AC system	63 kA for 1 sec for Khavda (HVDC) Near KPS3 63 kA for 1 sec for South Olpad
8.	Minimum Short circuit level (MVA) at 400 kV Khavda KPS3 (both rectifier and inverter operation)	14400 MVA# for both Sec-I and Sec-II (with IBR) 12600 MVA# for both Sec-I and Sec-II (without IBR) *(Considering outage of 2x1500 MVA ICTs on each section, with 400 kV bus sectionaliser kept open)*
9.	Minimum Short circuit level (MVA) at 400 kV South Olpad (both rectifier and inverter operation)	15400 MVA# *(Considering outage of 1x1500 MVA ICT)*
10.	Reverse power rating	100% of rated forward direction power transfer rating$
11.	Reduced voltage	80% of rated DC voltage [Applicable for both power flow directions]
12.	Converter transformer	Single phase two winding design
13.	IGBT/BIGT Valve	Water cooled
14.	Valve cooling system	Dry type design
15.	HVDC control system*	Main + hot standby
16.	HVDC protection system*	Duplicated Protection
17.	Auxiliary supply source	Two supplies shall be fetched from the 33 kV side of 2 Nos. of 400/33 kV transformer (50 MVA) at KPS3 HVDC and 33 kV tertiary of 2 Nos. 765/400/33 kV ICT at South Olpad.
18.	DC Harmonic filter	DC filter for each pole at each HVDC terminal station, if required as per TSP/OEM design
19.	AC Network Impedance	5th Harmonic 1.5% 7th Harmonic 1.0% Other Harmonics 0.5% (each) Further, Relevant CIGRE/ IEC document shall be used for the Network harmonic impedance together with information in PSSE network files

Sl. No.	Item Description	Parameters
		provided by CTU.
20.	Negative sequence voltage (fundamental frequency)	1% for Performance 1.5% for rating of equipment
21.	Online fault locator for HVDC pole lines	One No. per pole at each terminal station [when not integrated with Control and Protection System]
22.	Blocking filter	As per requirement
23.	Reliability and Availability Design Targets	As per Table 10
24.	Station Loss evaluation criteria	Methodology as per IEC 61803 and IEC 62751 and Target figures stated in Table 10
25.	System Grounding	Solidly grounded or Resistive Grounding as per OEM Practice

 # The values of short circuit level are based on available network topology and generalized parameters for various network elements.

** TSP can provide integrated Control and Protection system as well meeting functional requirements.*

$ The power reversal in HVDC links shall be possible from the maximum active power transmission capacity from KPS3 (HVDC) to South Olpad (HVDC) to the maximum active power transmission capacity from South Olpad (HVDC) to KPS3 (HVDC) within 60 minutes.

The criteria for the design and control of the network shall be as follows:

- 400 kV AC bus voltages shall normally be within ±5.0% of nominal voltage (400 kV). Bus voltages outside this range may occur from time to time and may exist for long periods due to abnormal loads and/or contingencies. Unless otherwise stated, all equipment shall be rated to operate safely for AC voltages between 360 kV – 440 kV at the converter stations.

- AC system frequency shall normally be within 48.5 Hz to 51 Hz and the HVDC system shall operate in this range without any restrictions on power transfer. However, equipment shall be rated for 47.5 Hz to 52.5 Hz band except AC/ DC filters, if any.

- For calculating reactive power exchange and filter performance (if any), the 400 kV AC voltage variations to be taken, shall be from 380 kV to 420 kV and the frequency shall be from 49.0 Hz to 50.5 Hz. Frequency range for AC/DC filter (if any) rating shall be 48.5 Hz to 51 Hz.

5. Environmental Data

The environmental data shall be considered as per following Table-2:

Table 2

Sr. No.	System data	Khavda (HVDC) Near KPS3	South Olpad
1	Max/ min Ambient temperature (dry bulb one-hour average) Max dry bulb 24 hr average	50 deg C max 0 deg C min 40 deg C	50 deg C max 0 deg C min 40 deg C
2	Relative Humidity (%, max)	100	100
3	Average annual rainfall	As per rainfall map of IMD	As per rainfall map of IMD
4	Iso-keraunic level	As applicable	As applicable
5	Wind Zone	As per National Building Code 2016	As per National Building Code 2016
6	Seismic Level	As per Seismic zone of the site	As per Seismic zone of the site
7	Altitude above sea level	< 1000 m	< 1000 m
8	Pollution level (IEC 60815)	Heavy	Heavy

6. System Performance

The HVDC system shall be designed to meet all performance requirements and shall be compatible with the existing power system. The HVDC system shall not cause instability to the existing AC network. Also, it shall not cause adverse effects to other HVDC system(s) in vicinity, solar based generation plants (near Khavda KPS-3) as well as other Generating Units. This shall be verified by stability, multi-infeed and Sub Synchronous Resonance (SSR) studies and any other Study required, if applicable. The steady state, dynamic, HVRT, LVRT, Harmonic and flicker performance requirements as per applicable Rule/ Regulations/ Standards/ Guidelines shall be applicable.

The rated power transmission capacity shall be defined and guaranteed at Rectifier DC Bus and rated transmission voltage shall be defined at the rectifier DC bus. In the calculation of the power transmission capability, the most unfavourable combination of control and measurement tolerances shall be considered and without redundant cooling and submodules. All components of the transmission system shall be rated to meet the requirements given in this section and other requirements specified elsewhere in this Specification.

HVDC system performance and rating requirements for high voltage equipment and other critical equipment shall be determined taking into account the extreme values of environmental and AC and DC system parameters as applicable for performance/rating requirements given in this specification and manufacturing and measuring tolerances.

TSP shall determine the PQ diagram of the individual converters as well as the total DC transmission system. The PQ diagram shall be valid for all 400 kV AC bus voltages in the range of 380 kV to 420 kV and for all frequencies in the range of 48.5 Hz to 51.0 Hz. The PQ diagram shall also show, where applicable, different limits for 47.5 Hz to 52.5 Hz and for bus bar voltages in the range of 360 kV to 440 kV.

Mode	Power Range	Min Capacitive Reactive power per pole (MVAr)	Min Inductive reactive power per pole (MVAr)
Pole Power	0-1250 MW	410	410
Pole in STATCOM mode	0	625	625

There shall be no restriction on connecting, starting and operating the HVDC link if frequency and AC voltage at rectifier station are within 48.5-51.0 Hz and 380 - 420 kV respectively. Khavda end of link shall be operated as a grid forming facility that provides 50 Hz power frequency and controls the AC voltage level at 400 kV bus.

For calculations, the maximum line resistance shall be taken at a maximum conductor temperature of 85^{o}C with minimum wind velocity and maximum solar radiation while for minimum line resistance the conductor temperature shall be taken as 0^{o}C.

7. DC Voltage:

The nominal direct voltage at the Rectifier converter station shall be ± 500 kV relative to neutral. This voltage shall be maintained within ± 10 kV by tap changer and modulation index control for all power flows with balanced current between the poles/converters for all AC bus bar voltages between 380 kV and 420 kV and for all AC system frequencies between 49.0 Hz and 50.5 Hz.

In any monopolar operation, the rectifier Pole Voltage to Ground may be decreased by equivalent Voltage drop in DMR line.

In the event that the AC system voltage is below 380 kV, down to 360 kV, the DC line voltage may be correspondingly reduced.

If the AC system voltage at Rectifier or Inverter end is above 420 kV but not exceeding 440 kV, the DC line voltage to ground may be increased but shall not exceed 525 kV at Rectifier.

The above references to DC pole voltages shall be interpreted as extremes and shall not be exceeded due to measurement error, tap changer control dead band, tolerances in the manufacture or in the control system, harmonics or for any other reason.

8. Reduced DC Line Voltage

The HVDC system shall be capable of operating continuously at a nominal pole voltage of 400

kV relative to neutral at rectifier DC bus in bipolar as well as in monopole modes. Rectifier station shall be capable of transmitting power flows upto 2000 MW in bipolar link and 1000 MW in Monopole. Redundant cooling may be in service. The pole voltage shall be within 10 kV of the above, provided that the AC bus voltage is below 400 kV.

It shall also be possible to set DC voltage reference between 400 kV to 500 kV in either pole in the steps of 1 kV by the operator action.

Power levels in this voltage range shall be as permitted by the main circuit rating of the equipment. However, reduced voltage attempt by DC line protection shall directly first achieve 400 kV. The reduced voltage may be achieved by a combination of tap changer and modulation index control.

Reduced voltage operation shall be possible to be ordered by operator from either station. The change from normal to reduced voltage operation and vice versa shall not require a converter block or reduction in power below that achievable with the reduced voltage. It shall be possible to start the transmission in reduced voltage mode.

9. Converters Operating modes

The HVDC equipment at both Converter Stations shall be designed and rated to operate with different DC power orders. Necessary facilities shall be provided to permit these modes of operation and to allow the individual Pole power and/or voltage to be set as per below.

Each Pole and Bipole shall be capable of transmitting power for the system short circuit levels specified in this specification. These operating modes shall also be available for reverse power and reduced voltage operation. The poles should have the facility to operate independently with capability to transfer any excess power requirement from one pole to the other in the event of a trip of one pole. The healthy pole shall be limited to its rated capacity.

The minimum operating modes are as follows:

(a) **Balanced Bipolar**: This mode is the normal mode of operation for the link. In this mode DC currents in the two poles should be balanced and any small unbalance current between the poles should flow through DMR.

(b) **Unbalanced bipolar operation**: Two poles running at different power levels and difference in pole currents flowing through DMR.

(c) Monopolar operation with Dedicated Metallic Return (DMR i.e., D1 or D2 or D1||D2) mode

(d) Monopolar operation with Pole Metallic Return (PMR) mode.

(e) **Constant frequency and AC voltage control mode**: HVDC station at Khavda is connected to HVAC network integrated with renewable solar and wind generators. During disturbances HVAC network at Khavda may get isolated therefore the HVDC station at rectifier shall always operate as a grid forming facility that provides 50 Hz power frequency and control the AC voltage at 400 kV level. The operator shall be able to set an appropriate droop in the AC voltage control to achieve a reasonable contingency reserve and sharing of reactive power with other reactive power in the system

(f) **Reactive Power and AC voltage control mode:** each Converter Station shall be designed and able to independently control the reactive power or the AC voltage. The operator shall be able to select between the reactive power and AC voltage control modes and shall also be able to select the reference values for Q/ U_{ac}. The voltage control strategy should not result in excessively high tap changer operations of converter transformers. AC voltage and reactive power control of each converter station shall operate stably with nearby reactive power compensation devices. Any oscillations of power and voltage at the HVDC converter shall be well damped and eliminated.

(g) **STATCOM mode:** In case HVDC pole is not transmitting power, healthy converter shall be capable of operating independently under Statcom Mode. The operator shall be able to activate Statcom mode separately for each converter station.

(h) **Black start:** Facility for Black start capability shall be possible for both the stations. TSP shall determine and provide any additional equipment such as diesel back up, batteries, etc. that is required to be able to carry out black start in both directions. This shall include any hardware and all the necessary control functions to perform the black start.

10. System Studies

The TSP shall be responsible for overall system engineering and detailed design of all elements, systems, facilities and equipment. The TSP shall have to carry out following studies and shall submit the study reports for this purpose for both directions of power flow. The TSP may note that the following list is only indicative and if any other studies, calculations etc. are required the same shall have to be done by TSP.

(a) Main circuit parameters

(b) Transient Current Requirement and Short circuit studies

(c) Thermal Rating Study for Key Equipment

(d) Studies for Overvoltage Protection and Insulation co-ordination for AC and DC systems

(e) AC, DC Harmonics (if applicable, required as per OEM's design) filter design, rating and

performance

(f) Temporary overvoltage (TOV) and Fundamental Frequency Temporary Over Voltage-(FFTOV) and Ferro Resonance Overvoltage Studies

(g) AC and DC Transient overvoltage Study, surge arrester stress

(h) Runback and run up studies (the Last Line/ Last Breaker logic (if required) shall be limited to the AC lines and AC breakers within the HVDC stations)

(i) AC breaker Transient Recovery Voltage (TRV) and rate of rise of recovery voltage (RRRV) studies

(j) DC High Speed Switch Requirement Study (as applicable)

(k) AC equivalent study

The equivalents to be prepared for peak load, light load and extremely weak (minimum SCR) network scenarios. The dynamic network equivalent shall be prepared with full machine models having exciters, governor-turbine, generators, stabilizer models instead of voltage source models, up to a minimum of two buses away. These dynamic equivalent networks shall be used in PSCAD DPS, Real Time Digital Simulator (RTDS) DPS, with actual control and Protection panels.

(l) DC Commutation switch requirements (as applicable)

(m) Load flow, stability, modulation and frequency controller design study

(n) LVRT, HVRT, harmonic resonance and other dynamic studies

(o) Black start islanded operation studies at both ends

(p) Electrical interference (RI and PLC) study , filter design, rating and performance

(q) Reliability and availability study

(r) Audible noise study

(s) Loss calculations/study

(t) Studies for deciding the operational logic and sequences considering Dedicated Metallic Return Conductor (DMR) operation and Metallic return with pole conductor, in case of monopolar Operation

(u) Impact of parallel AC lines

(v) Real Time Simulator-based studies for testing of actual HVDC Controls (Factory Acceptance Test or Factory System Test)

(w) AC/ DC system interaction studies

(x) Interaction studies between this VSC HVDC and other nearby HVDC stations and nearby Inverter Based Resources (IBR)

(y) Studies to determine the requirements for communication between the converter stations and remote Load Despatch Centres (LDCs).

(z) Studies for designing the equipment for Dedicated Metallic Return Conductor (DMR) operation and metallic return with pole conductor, in case of monopolar operation up to rated power.

(aa) Sub synchronous Resonance and Self Excitation Studies

These studies shall be carried out to demonstrate that the HVDC system does not excite the torsional modes of oscillations and self-excitation of the generators and Sub-synchronous Resonance in thermal/gas turbine generators near Converter Stations under all defined system operating conditions. The study shall demonstrate that the HVDC system has positive damping for all sub synchronous torsional modes of the generators.

(bb) Studies of DC Current flowing through Windings of Converter Transformers

(cc) Studies of DC Current flowing through breakers on AC side of converter transformer for earth faults on converter side of transformer at locations as applicable and sizing of auxiliary resistor to ensure zero crossings in the total current in the AC breaker.

(dd) AC line and other bays protection co-ordination studies in grid forming mode.

(ee) Studies for the Control, Protection and Communication Systems

(ff) DC over voltage studies

(gg) Low frequency characteristics

(hh) High frequency characteristics

(ii) Station earthing

The study reports shall include the following study results:

(i) Dynamic Performance Study including the RE Resources near Converter Stations

(ii) Hierarchical Structure of the Control and Protection

(iii) Redundancy of the Control and Protection Systems

(iv) DC Power and Voltage Control Modes and Features

(v) Switching Sequences and interlocking

(vi) AC and DC System Protections

For each protection, the report shall include the following:

a) Purpose of the protection

b) Principle of protection operation

c) Required accuracy of measuring signals

d) Fault detection and coordination between the DC controls and the protection and AC protection.

e) Consequences of protection operation, such as DC control and sequence control initiated at both converter stations

f) Redundancy of protection and operation of backup protection

g) Detailed calculations of the protection settings together with limiting fault cases and/or criteria that determine these settings.

h) Description of the applicable protection in case of loss of telecommunication.

(vii) Reactive Power Control

The study shall include at least the following:

a) Reactive power control principles for converter operation during steady state and transient conditions including STATCOM mode of operation

b) Switchover and control feature between AC voltage/reactive power controls

c) Reference variable control criteria

d) Criteria for switching of reactive power sub banks, as applicable.

e) Operator operation, including control and monitoring features

f) Equipment description, emphasizing reliability/availability and maintenance features

g) Validity checking of signals

(viii) Telecommunication Interface Requirements

(ix) Station Control and SCADA System

(x) Control for Converter Transformer Tap changer

(xi) Additional Control Study

The report, as applicable shall include the studies of the following control modes with the AC network condition of Khavda and South Olpad and actual performance of converter equipment and possible fault condition being taken into account.

a) Power ramp down

b) Power ramp up

c) Damping of sub-synchronous oscillations

d) Abnormal AC voltage and frequency control

e) Supplementary modulation signals

f) Fault current infeed studies

g) Negative sequence current infeed studies

(xii) Multi Infeed Interaction Study with nearby HVDC Systems

(xiii) Black Start Mode network studies.

(jj) Any other studies as deemed necessary by TSP

TSP shall carry out necessary studies for performance under this RfP considering the 400 kV Bus-sectionalizer at KPS-3 (S/s) in both Open and closed condition.

The load flow and dynamic file shall be provided to the TSP in PSS/E 34 or newer version format. This will include maximum and minimum fault contribution from conventional generation and IBRs considering full power, reduced dc voltage power, black Start modes and other network scenarios which can lead to highest possible dynamic overvoltage variations. Necessary Generic Models for IBRs or modelling assumptions shall also be provided for studies requiring the same. Conventional generator, lumped mass model and controller models in vicinity shall also be provided. For sharing User defined Models (UDMs) TSP and Solution Providers will be required to abide with the statutory requirements of the UDM provider if required.

In case of absence of detailed models of nearby inverters and 6000 MW LCC HVDC, the harmonic distortions shall be considered as per the relevant CEA Regulations. The impedance of RE Park at the Pooling station PCC will be provided to the TSP. The rest of the network may be modelled by the harmonic impedance and the rating and performance studies shall be done accordingly. Harmonic impedance shall take into account all contingencies in base file, N-1, N-2 and other PSS/E scenarios for network for full power and reduced DC power.

PSS/E files shall be provided based on the data available at the time of issuance of the RfP. The TSP is required to validate the data before carrying out simulation. However, clarification, if any, may be sought before the bid submission. CEA/ CTU shall endeavour to give clarification to the extent possible. In case of any discrepancy observed/ non-availability of data for any of the machines and other control devices, typical values may be used in the studies with the intimation to CEA/ CTU.

11. Digital Models

TSP shall provide to CTU following models of all supplied circuit components and control and protection of the HVDC Systems. The models shall be up to date with all the design features implemented in the Project.

(a) PSCAD
(b) PSS/E

TSP shall provide both UDM and Generic model for RMS based stability model (in PSS/E V36 or above) and EMT (PSCAD). All appropriate control features shall be modelled in the above

models and necessary documentation on the theory and use of model should be provided. Further, a generic model, benchmarked to the extent possible to the UDM PSS/E and PSCAD model, shall also be furnished. Generic models can be shared by the CEA, CTU and Grid-India with the concerned stakeholders/**external party(ies)** e. g. STUs etc. **on need basis**. For User Defined model, confidentiality shall be maintained by the CEA, CTU and Grid-India. For PSCAD, User Defined model shall be provided by the TSP for which confidentiality shall be maintained by the CEA, CTU and Grid-India. Both UDM (PSCAD and PSS/E) and Generic model (PSSE) shall be provided by OEMs to CEA/CTU/GRID-INDIA without any NDA (Non-Disclosure Agreement)

Data sharing requirements as per Procedure for First Time Charging/ Energization (FTC) and Integration of New or Modified Power System Element to Grid Controller of India Ltd. (GRID-INDIA) shall also be done by the TSP. All the requisite data/ reports/ models including User defined models/ documents as required as per the CEA/CTU/Grid India Standards/ Guidelines shall be provided by the TSP. Data sharing format will be subject to the agreement or other statutory requirements mandated by HVDC Solution Providers if required.

12. DC power circuit switching requirement:

The TSP shall provide all DC switching devices as per the requirements of this Specification to enable the smooth and efficient operation of the HVDC system. TSP may decide at which end DMR shall be connected to earth based on the practices being followed by the Original Equipment Manufacturer (OEM).

All disconnectors or isolators which are used to provide isolation for maintenance on any equipment shall have visible breaks. If a visible break is not inherent then an additional separate isolator having a visible break shall be provided.

The equipment arrangement shall be designed to ensure that no single contingency, fault or loss of any piece of equipment except common equipment to both the poles can cause or result in a bipolar shutdown or transient reduction in power transfer to less than the rating of one Pole.

High speed switches for discharge of the DC line shall be provided with disconnector.

The station layout shall provide safe access to all equipment for service and maintenance. The DC power circuit arrangement shall provide at least the following functions:

(a) Isolating and grounding Converter Station Pole for maintenance.

(b) Isolating and grounding either or both DC transmission line Poles for maintenance.

(c) Isolating and grounding the DMR conductor at the Converter Station for maintenance when operating in bipolar mode with balanced DC currents. All primary equipment, control, protection and measuring equipment necessary to achieve this function shall be provided. All the studies and design engineering necessary for the HVDC System to operate in such modes shall be performed.

(d) Clearing of a Pole for maintenance without affecting the power flow on the other Pole.

(e) Switching between active power transmission and STATCOM mode

(f) Grounding of the neutral bus through a high-speed switch (NBGS) during bipolar operation balanced current mode.

(g) Clearing neutral bus fault on one Pole.

13. Insulation co-ordination

(a) HVDC System shall be suitably protected against Impulses and disturbances external and internal to the system such as switching impulses, lighting impulses, steep front impulses, dynamic over voltages and load rejection (1 pu power). The insulation of all equipment shall be properly protected and coordinated with surge arresters and/or surge capacitors. Insulation coordination shall be done keeping in mind the minimum electrical clearances, safety clearances and maintenance clearances as per Switching Impulse Withstand Level (SIWL). Insulation coordination shall be done as per relevant IS/ IEC Standards.

(b) The insulation of the equipment and protection levels of Surge Arresters connected to the converter AC bus bars of the converter stations at both rectifiers and inverter shall be coordinated with the insulation and surge arrester characteristics of the connected AC systems to which the converter stations are to be connected without exceeding the discharge duty of these arresters so as not to overload these existing arresters of the network. Only 336 kV surge arrester (rated voltage) shall be used on 400 kV AC incoming line side.

(c) The tripping action for lines shall be initiated if the fundamental frequency over voltage exceeds 1.1 pu for 5 seconds and if 1.5 pu fundamental frequency voltage persists for more than 100 milliseconds. The HVDC over voltage strategy shall be coordinated with such setting.

(d) The minimum **insulation levels** for 500 kV DC transmission line to ground shall be as per CEA Regulations:

- Lightning impulse withstand voltage (1.2/50 micro sec) (kVp): 1800 kV
- Switching surge withstand voltage under wet condition (kVp): 1000 kV

(e) The ratio of **impulse withstand voltage** to impulse protective level shall be in line with Table 3 of IEC-60071-11.

(f) The TSP shall carry out insulation coordination studies for the Project. The TSP shall perform all necessary HVDC digital simulator studies and shall keep detailed report(s) on

insulation coordination in its record. The TSP shall carry out insulation coordination studies for rating of all arresters supplied for the project, establishing the required insulation level for supplied equipment and the clearances between energized parts and between energized parts and the ground. The arrester arrangement and protective levels shall be selected such that, generally, the overvoltage on the AC side is protected by arresters on the AC side, and overvoltage on the DC side are adequately limited by an arrangement of arresters on the DC side. Critical components of the supplied converter equipment shall be directly protected by arresters connected closest to them. The arresters installed shall be rated such that these arresters are not overstressed for all operating modes and configurations. The studies must show that any existing 420 kV equipment including any existing surge arrestors will not be overstressed for all modes of operation and configurations of either Converter Station when HVDC station is extension of an existing AC station.

The report(s) shall detail the characteristics of the surge arresters, energy ratings and shall demonstrate that the selected insulation protective and withstand levels, discharge and coordinating currents, and arrester ratings and discharge capabilities are adequately coordinated and comply with the requirements of this Specification. It shall also detail all insulation and air clearances and leakage distances and shall justify the selected values based on the present Specifications. The report(s) shall include all assumptions made for the study parameters and describe the types of events modeled (i.e. AC and DC faults, transformer bushing faults, converter valve or control mis-operations, etc.) and identify the decisive cases that establish the insulation design.

(g) **Temporary Overvoltage**

High voltages at the converter buses can occur due to load rejections or other cause. The HVDC system shall remain connected and provide dynamic voltage control to mitigate the voltage rise within the capability of the equipment. The requirement for ac system voltage control during an overvoltage has highest priority and therefore it is permissible to run back the active power transfer to limit the overvoltage.

The converter valves shall be capable of continuing to operate under the temporary overvoltage conditions specified below, which could occur with the valves deblocked and also that the valves are capable of deblocking under the highest temporary over voltage conditions within five (5) cycles of the initiation of a fault or disturbance. The equipment shall be designed for the applicable short circuit ratio and overvoltage arising thereby.

Temporary Overvoltage caused by Bipole link HVDC transmission shall be controlled to 1.4 pu or below. Temporary overvoltage caused by other equipment in the AC network shall be controlled within the limits of the capability of the deblocked converter. In case of DC line permanent fault, the converters should restart in STATCOM mode for AC grid support. In case the converter is tripped, and not possible to restart within seconds, filter tripping shall be allowed to limit overvoltage as applicable.

The actual temporary overvoltage shall be determined by the TSP, but the equipment shall be designed for temporary over voltage not less than the values given above. In addition, so as to prevent operation and overstressing of the arresters, the TSP shall limit the temporary over voltages including harmonic, resonant, and ferro-resonant effects on the 400 kV AC bus bars so that:

- **705 kV crest phase to ground is not exceeded by more than 3 peaks;**
- **565 kV crest phase to ground is not exceeded by more than 10 cycles;**
- **510 kV crest phase to ground is not exceeded by more than 20 cycles.**

In the calculation of temporary over voltages on the AC side the TSP shall allow for blocking of the complete Bipole from up to the highest steady state transmission capability of the installation. On the DC side the TSP shall allow for the maximum load rejection which could occur and which leaves converter deblocked.

The converter Equipment shall be designed to withstand temporary over voltages corresponding to AC Side which are not less than 1.5 times 400 kV upto 100ms at converter stations with the converter blocked

The TSP shall provide and commission all equipment necessary to limit the temporary over voltages on the AC bus bars to the levels specified above. The actual temporary overvoltage shall be determined by the TSP but AC equipment shall be designed for temporary overvoltage not less than the values given above.

The connected AC harmonic filter shall be assumed to be that with the highest MVAr applicable to the mode of operation which does not exceed the maximum reactive power exchange with the AC system as specified in this specification.

The converter equipment shall be rated for continued operation under the maximum over voltage conditions to be defined by the TSP taking into consideration the dynamic over voltage profiles as determined by the design studies to be performed by the TSP. Irrespective of the over voltage profile derived by the TSP, the equipment shall be rated to withstand an over voltage according to above figures following deblocking.

DC withstand voltage design of equipment shall take due consideration of the temporary voltage stresses that the respective equipment may be exposed to based on studies of different disturbances as applicable.

Any switching equipment within the scope of supply of the TSP which may be called upon to operate at this voltage in either a main or backup role shall have the appropriate capability.

HVRT Strategy:

The HVDC Station shall enter into HVRT mode (exit from continuous operating region) when the Voltage at AC bus i.e. 400 kV side (RMS) is above 1.1p.u. due to faults/control actions/or any other cause.

The HVDC Station shall remain connected to the grid when voltage at the interconnection point (AC bus), on any or all phases (symmetrical or asymmetrical overvoltage conditions) rises above the specified values given below for specified time:

Over voltage (pu#)	**Minimum time to remain connected and Deliver the rated reactive support (Second) at POI**
V > 1.50	Instantaneous trip
1.50 ≥ V > 1.30	100 ms
1.30 ≥ V > 1.10	10 sec
1.10 ≥ V > 1.05	15 minutes
V ≤ 1.05	Continuous

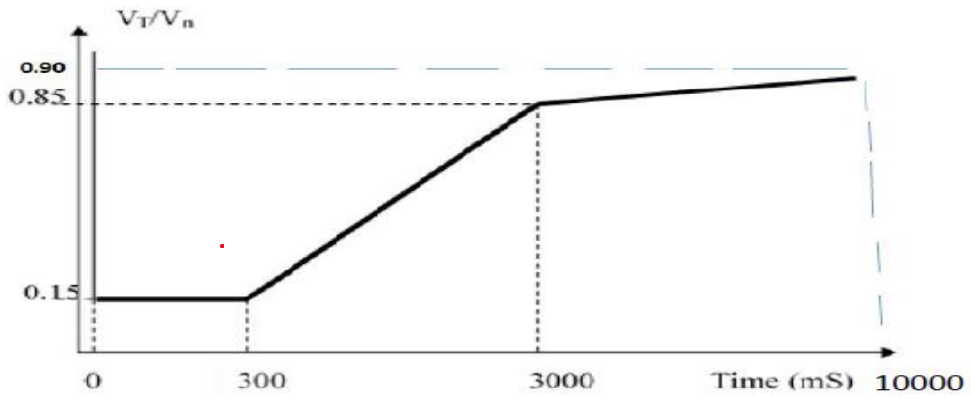
 # 1 pu = 400 kV (3 phase RMS voltage at POI)

During HVRT mode, HVDC Station shall provide reactive power support (absorption) at POI proportional to Voltage at POI (inductive operation). There shall be maximum VSC current (up to 0.8 p.u..) during inductive operation considering voltage of 1.3 p.u. at AC side (POI). 1 p.u. of VSC current is the current corresponding to 1 p.u. of apparent power (1250 MW per pole active power and 410 MVAr per pole reactive power) under nominal system condition.

LVRT Strategy:

The HVDC Station shall enter into LVRT mode (exit from continuous operating region) when the Voltage at AC bus i.e. 400 kV side (RMS) is below 0.9 p.u. due to faults/control actions/or any other cause.

The HVDC Station must remain connected to the grid when voltage at the interconnection point (AC bus), on any one, two or all phases (symmetrical or asymmetrical overvoltage conditions) dips up to the level depicted by the thick lines in the following curve:



1 p.u. = 400 kV (3 phase RMS voltage at POI)

During the voltage dip, the supply of reactive power has first priority, while the supply of active power has second priority. Restoration of voltage shall be said to be achieved when the voltage at PoI settles within ±5% of pre fault voltage. Active power shall be restored to at least 90% of the pre-fault level within 1 sec of restoration of voltage.

During LVRT mode, HVDC Station shall withstand all above low voltage conditions and needs to be coordinated to provide reactive power support (injection) at POI with a maximum VSC current of 0.8 p.u. (capacitive operation). 1 p.u. of VSC current is the current corresponding to 1 p.u. of apparent power (1250 MW per pole active power and 410 MVAr per pole reactive power) under normal system condition.

(h) **Transient and Temporary over voltages**

In the calculation of transient over voltages the TSP shall consider at least:

(i) Lightning surges propagating down the AC and DC overhead lines, including direct strike to line conductors and back flashover.

(ii) Lightning surges due to direct strike within the converter station in the event of shielding failure

(iii) Steep fronted waves resulting from flashovers or faults, including those to ground from the valve windings of the converter transformers with tripping of bipole or monopole based on feasibility of survival of healthy pole.

(iv) Over voltages due to switching of converter transformers, AC filters and shunt capacitors, shunt reactors, 765 kV and 400 kV transmission lines, 765 kV and 400 kV class transformers or other equipment.

(v) For re-closure of AC filters, residual voltage on the capacitors shall be considered.

(vi) The saturation effects of converter transformer due to presence of remnant flux shall also be considered.

(vii) Application and clearing of single phase and three-phase to ground faults which may be cleared by AC circuit breakers; Possibilities of breaker re-strikes shall also be considered although the breaker should be designed as restrike free.

(viii) Faults within converter equipment, including control and telecommunication malfunctions.

(ix) Over-voltages due to blocking of converter of monopole or bipole.

(x) Over-voltages due to DC and DMR line resonance.

(xi) Uneven distribution of over-voltages, particularly within the converter valves.

(xii) Arrester location relative to protected equipment and arrester characteristics.

(xiii) For determination of maximum transient and temporary overvoltages at converter bus with a sequence of clearance of three phase /single phase AC bus fault along with the following scenarios shall be checked and highest value shall be considered for suitable protection actions:

a. Blocking of one pole or both poles running at full load with appropriate AC filters remaining connected OR

b. Highest temporary overvoltage as mentioned in clause 13 g above

(xiv) Single pole to ground and Pole to Pole fault at DC line or at either station followed by tripping of pole/bipole as applicable.

(i) **Limitation of Overvoltage**

Blocking of the converter valves to protect them and other DC side equipment from sustained over voltages as per table under HVRT Strategy appearing on the AC system shall not be permitted. The use of converter valve group controls to limit temporary (dynamic) over voltages shall be permitted provided that the valves and other converter equipment are adequately rated.

(j) **Determination of Overvoltage**

The TSP shall determine the highest transient and temporary over voltages, which can occur with the equipment parameters selected and with the AC system and DC line as defined in this Specification.

(k) **Arrester Protective Levels**

The transient overvoltage imposed across insulation shall be limited by surge arresters. Dynamic over voltages may also be limited by surge arresters but only if the arresters are adequately rated for such duty.

The discharge current (coordinating current) shall be determined by the TSP appropriate to the arrester location and line and equipment parameters. For arresters connected to the 400 kV AC bus bars, the 8/20 microsecond wave coordinating discharge current shall be 10 kA, 15 kA or 20 kA as appropriate. Where multicolumn arresters are used or where arresters in separate housings are connected in parallel, unequal sharing of the discharge current shall be considered.

The TSP shall design the converter equipment to withstand a maximum continuous AC system voltage of 440 kV. The calculations for determination of arrester energy requirement shall be based on a maximum pre-fault voltage of 440 kV.

(l) **Lightning shield**

The TSP is responsible for the design of the lightning shield. The system shall also be designed to provide "effective shielding" to ensure that almost no insulation flashover can result from atmospheric discharges striking the overhead shielding.

Effective and adequate lightning protection shall be provided to protect all converter equipment including wall bushings and the Converter Station buildings from damage due to atmospheric discharges and shall ensure that any lightning strikes shall not cause flashover or mal-operation of any equipment which can affect the power transmission capability of the Converter Station.

14. Radio Interference (RI), Acoustic Noise (AN) and DC field

(a) All the necessary precautions shall be made during HVDC design to ensure that there shall be no mal-operation, damage or danger to any equipment, system or personnel due to electromagnetic or electrostatic interference effects. The converter terminal(s) shall neither damage nor cause mal-operation of the DC control and protection system or the DC tele-control system.

(b) All the necessary precautions shall be taken in the form of noise suppression techniques, shielding and filtering devices to prevent harmful interference, which may be generated by the converter terminals, with the Power Line Carrier (PLC) systems, Radio communication systems, Television systems, VHF, UHF and microwave radio systems.

(c) The audible noise shall be limited to the following values for various areas of the converter station and buildings. It is to be demonstrated by calculation and site measurement that the specified sound pressure levels are not be exceeded.

Table 5

Valve hall (in places where long term access is required during normal operation) Mechanical equipment indoor areas requiring long term access (measured at 2 meter distance)	90 dBA
Equipment in outdoor areas (measured at 15 meter distance) except converter transformers	75 dBA
Office area*	45 dBA
Control rooms*	45 dBA
Diesel generator (Operating area)	75 dBA
Compressor areas (measured at 2 meter distance)	90 dBA
At the station boundary (Outside wall or fence)	70 dBA

* *"Background" noise from the ventilation system.*

(d) For area with permanent access, the total calculated electric field at ground level shall not exceed 20 kV/m in the DC outdoor yard. For areas with permanent access in DC outdoor yard, calculated Ion current density shall be less than 20 nA/m^2 at ground level.

(e) Radio Interference (RI)

The TSP shall take the necessary precautions in the form of valve hall and building shielding to meet his own requirements plus the following:

(i) With the Bipole operating at any of the specified operating modes and power levels and within the design range of IGBT switching, the Radio Interference Level (RIL) from electromagnetic radiation generated by the converter shall not exceed 100 micro volt/m under fair weather conditions at any point outside station fence which are:

500 meters or more from the nearest bus connecting the valve to the converter transformers within the station

and

at a lateral distance of 30 m for the conductors of any outgoing AC line, HVDC line and DMR line.

This RIL criterion shall be achieved at all frequencies within the range of 150 kHz to 300 MHz.

(ii) The valve hall design shall incorporate the screening requirements. The use of a mesh screen external to the building, covering all or part of the switchyard shall not be permitted.

(iii) The shielding shall be designed so that the specified radio interference levels

shall not be exceeded assuming any earth resistivity between 10 and 1000 ohm-meter.

(iv) Maximum radio interference voltage for frequency between 0.5 MHz to 2 MHz at 1.1 times of maximum DC voltage for 500 kV DC system, 266 kV RMS for 400 kV system and 156 kV RMS for 220 kV system and 92 kV RMS for 132 kV system shall be 2500, 1000, 1000 and 500 micro-Volt respectively.

(f) Television Interference (TVI)

The Television Interference Level (TVIL) shall not exceed 10 micro volts/m at the locations/contour line specified above.

(g) Interference with Power-Line Carrier Systems

The TSP shall take the necessary precautions in the form of noise suppression techniques and filtering devices to prevent harmful interference from the converter stations to Power Line Carrier (PLC) systems operating on the HVAC transmission line networks connected to each station and also to other power line carrier systems located adjacent to the HVDC bipolar line such that PLC systems shall operate reliably in fair weather conditions. The frequency spectra to be protected for PLC system is 40 kHz to 500 kHz.

15. Dynamic Performance

(a) The purpose of dynamic performance design is to determine the control parameters for HVDC system and to ensure that the HVDC system shall have smooth, stable and fast operation for both steady state and transient conditions without adversely affecting the connected AC grid.

The principal objectives of the design shall include:

1. Optimal response of HVDC controls following step change in ordered parameters like current, power, DC voltage etc.
2. Stable operation of the DC system following major disturbances.
3. Stabilization of the ac system following major disturbances.
4. Control of temporary over voltages and avoidance of self-excitation of the generators.
5. Control of frequency following quasi-static (slow) and fast changes in ac system load / generation at the rectifiers and/or inverter ends.
6. Control of power levels depending on the system configuration. Such a control may require ac line load control (ACLLC) and Run Back control features.

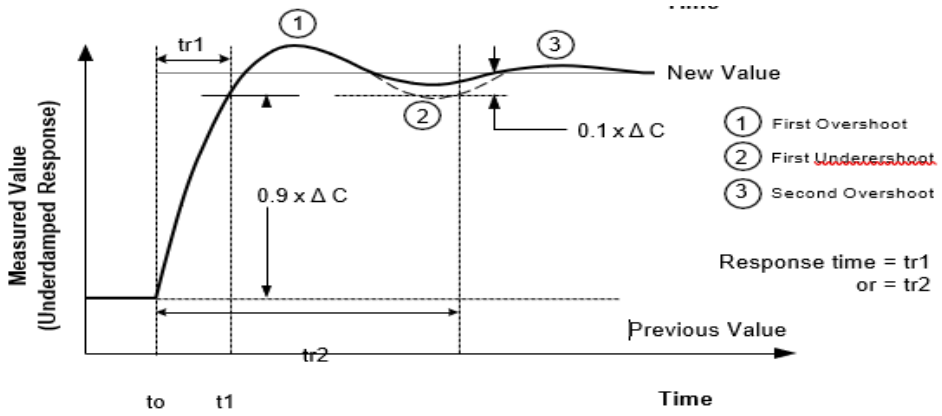
(b) The HVDC system shall recover to 90% of the pre-fault DC power transfer level consistently within 100 ms from the instant of fault clearing, without subsequent

sustained oscillation for all inverter AC system fault conditions. For all rectifiers AC system fault conditions, the recovery time, to 90% pre-fault power level, shall be within 100 ms from the instant of fault clearing. The TSP shall verify that such response time does not give rise for any risk of AC system instability in any system configuration. If it is in the interest of the overall improved recovery of the AC/ DC system, in such cases the recovery times other than those specified shall also be acceptable, subject to review.

(c) HVDC should continue operation at reduced power if conditions get outside the voltage, frequency and short circuit capacity ranges specified in system data as much as possible with its inherent capability.

HVDC terminal Characteristic and Step responses: The response time (tr1) is defined as the time from the initiation of the order change to the time when 90% of the ordered change has been accomplished, subject to the condition that the measured value remains at the new order within a tolerance of +10% of the ordered change at rectifiers DC terminal after the first overshoot. If the measured value exceeds the tolerance of +10% of the ordered change after the first overshoot, then the response time (tr2) shall be defined to be the interval from the initiation of the order change to the time when the measured value returns to and thereafter remains at the new order within a tolerance of +10% of the ordered change. The first overshoot shall not exceed 30% of the ordered change and the measured value shall settle at the new order within a tolerance of +2% by the second overshoot. For an over damped system, the response times (tr3) is defined as the time from initiation of the order change to the time when 90% of the ordered change has been accomplished. The measured value shall settle at the new order within a tolerance of +2% by four times tr3. Step response to changes in power (current) order shall be executed in the following manner:

When the ordered change is *positive*:



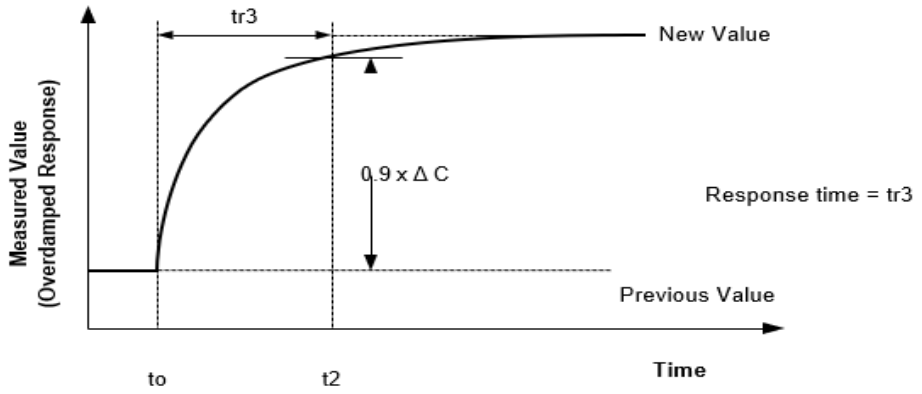


Fig 2- Definition of response to positive step change

When the ordered change is *negative*:

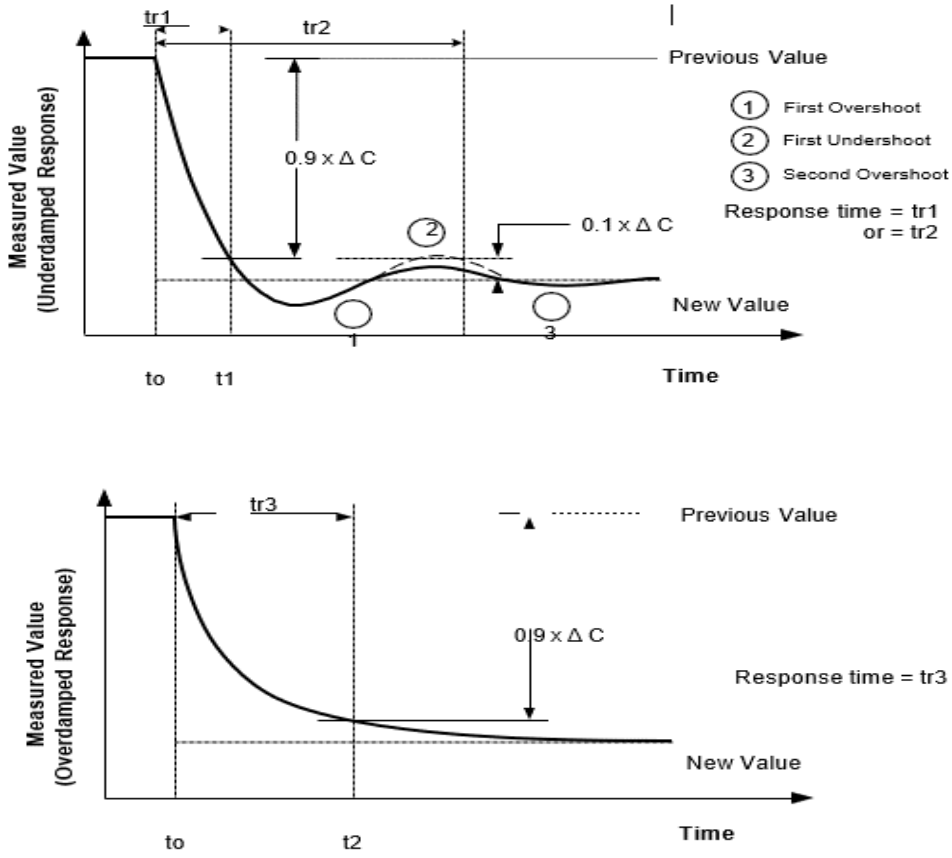


Fig 3- *Definition of response to negative step change*

(d) Power Order Step Response

The HVDC controls, when in power control mode or any other mode where the DC power transfer is controlled, shall respond to maintain the power transfer of the Poles at the ordered or desired level at any power level between minimum and rated capacity of the HVDC system.

When operating at any power order between the minimum and rated power transfer, the DC power controller shall respond to either a step increase or a step decrease in

DC power order such that 90% of the ordered change is achieved within 150 milliseconds of the power order change at the rectifier. The TSP shall verify that such response time does not give rise for any risk of AC system instability in any system configuration. If it is in the interest of the overall improved recovery of the AC/ DC system, in such cases the recovery times other than those specified above shall also be acceptable.

(e) Response to AC Bus Voltage Change

The TSP shall demonstrate the response of the power controls to sudden changes in AC bus voltages of -5.0% to + 2.0% from its nominal value and ensure that it is stable.

(f) Power Voltage Instability

HVDC links operating in constant DC power control and weak AC system conditions can lead to power voltage instability under certain disturbances. To prevent such power voltage instability, the TSP shall provide control measures to prevent AC system collapse during AC system disturbance due to the action of the HVDC control. The TSP may adopt change over to grid forming mode and a power reduction or a dynamic gain supervision function in the control system to avoid such instability if the short circuit MVA changes during a particular power transmission level.

16. Main Circuit Design

The purpose of Main Circuit design is mainly to determine the operating characteristics and rating of converter valves and converter transformers (MVA, tap changer range etc.) It also forms the input for AC Filter and Reactive compensation design. The main circuit arrangement and circuit shall depend on type of HVDC system, Power Transmission requirements, DC Voltage Levels, connected AC voltage levels, Reactive Power requirements and AC and DC Harmonic requirements. The system shall meet various harmonic performance parameters, as specified elsewhere in this specification, on both AC Side and DC side. This requirement along with those given in Table-2, shall be met simultaneously by the AC/DC filters.

17. HVDC Station Equipment

The function blocks of converter station are Converter area (converter valves, converter transformer, smoothing reactor(if required)), DC yard (DC filters (if required), DCCT, DC Voltage Divider, PLC filters of DC side (if required), DC pole arresters, Disconnectors and ground switches), AC filter yard (as per design requirement), AC yard and auxiliaries. A typical VSC based HVDC station shall consist of the following main equipment:

(a) IGBT/BIGT valves and its accessories e.g. damping and grading circuits, converter cooling system etc.;
(b) Converter transformers;

(c) Arm Reactors/Phase reactors
(d) Smoothing reactors (if required);
(e) DC filters; (if required);
(f) AC filters (Harmonic filters and PLC filters) and shunt compensation; (if required);
(g) Control and protection of AC and DC side;
(h) Electrical and mechanical auxiliaries;
(i) Dedicated Metallic Return (DMR);
(j) AC switchyard equipment;
(k) DC switchyard equipment;
(l) AC and DC Surge arresters;
(m) AC and DC Measuring instruments;
(n) Communication system between converter stations (OPGW)
(o) DC wall bushings
(p) AC wall bushings (if applicable)
(q) Auxiliary Power System
(r) Key interlocking system for valve hall, DC filters (if applicable), AC filter (if applicable)
(s) Fundamental frequency blocking filter, if required
(t) Pre -insertion resistors with bypass breaker for charging of converter module capacitors.
(u) High speed DC discharge switch and resistor to allow fast DC line fault discharge if required for fast dc line fault recovery.

18. Converter Station AC Yard, Transformer yard and valve hall

(a) AC commutating bus equipment

The AC circuit breakers, disconnectors, instrument transformers and other switchyard equipment shall be similar to that of the equipment specified under Regulation 46 of Central Electricity Authority (Technical Standards for Construction of Electrical Plants and Electric Lines) Regulations, 2022. The bus rating shall be adopted according to the calculation considering single bus outage. The switching duties of the AC circuit breakers will be decided based on transient over voltage study, insulation co-ordination, AC filters and protection studies.

Insertion resistors:

Insertion resistors shall be used to limit inrush currents during energization of the converter. They shall be located on the primary or converter side of the converter transformer. After the energization process is completed, the resistor shall be bypassed by a disconnector or bypass switch.

(b) AC harmonic filters and shunt compensation, if required

State-of-the-art Voltage-Sourced Converters (VSC) in modular multi-level converter (MMC) topologies generate nearly no or only a small amount of harmonics. The need of ac harmonic filters shall be evaluated based on study results. Suitable redundancy shall be provided in the filters to avoid reduction of transmission capacity of the station due to outage of any particular sub-bank for maintenance.

The AC harmonic filters shall be switched in and out by circuit breakers in FIFO logic to increase lifetime of switchgear. Based on the studies, reactive power requirement for the terminal and bank or sub-bank size shall be determined such that reactive power exchange with the AC bus shall remain within specified limits.

System Contribution:

Bidder may suitably model nearby different RE generators as all these generators are required to meet harmonics requirement under "CEA Technical standards for Connectivity to the grid" regulations.

At Converter station ac bus, combined converter and static compensator (if used) harmonic currents as calculated for rating purposes shall be increased to allow for harmonic currents from the ac system *(if applicable)* in following manner:

a) At 3rd and 5th Harmonics the increase in current to be allowed shall be calculated based on the assumption that the existing distortion shall be considered as 2% with respect to nominal voltage at converter bus. This is to be considered for 3rd and 5th harmonic Filter component rating

b) At all even order harmonics and at all other non-characteristic or theoretically cancelled harmonics the increase in current to be allowed shall be not less than 50 (fifty) percent provided that the contribution of the harmonic in question to any rating parameter, in the absence of the above increase, is not greater than 10 (ten) percent of the total harmonic rating.

c) At all characteristic harmonics or at any other harmonic which is effectively filtered (i.e. the harmonic contributes more than 10% of the total harmonic rating of a component in the absence of the increase) the increase in current to be allowed shall not be below 20 (twenty) percent.

(c) If filters are required, the main filter equipment namely capacitors, reactors and resistors shall comply with the requirements of following IEC or Equivalent IS as follows:

A. Capacitors-IEC 60871;
B. Reactors - IEC 60076-6;
C. Resistors - IEC 62001/As per owner's specification.
D. Only air-core reactors shall be used in AC and DC filters for harmonic filtration.

(d) If study results confirm the need for power line carrier (PLC) filtering, PLC filters shall

be installed close to converter transformers to mitigate high frequency harmonic currents generated during IGBT/BIGT switching.

Performance Requirement

The AC harmonic performance shall be better or equal to as defined by following performance parameters:

A. The individual harmonic distortion, D_n, shall not exceed 1.5%
Individual Harmonic Distortion, $D_n = V_n/V_1$

B. The Telephone Influence Factor (TIF) shall not exceed 50.
Telephone Influence Factor, TIF = $\sqrt{}$ (Σ $(V_n*F_n/V_1)^2$)
Where Fn: Weighting factor for nth harmonic according to EEI publication - 60-68(1960) corrected to 50 Hz operation by graphical interpolation

C. The Total Effective Distortion, Deff, as defined below shall not exceed 3%:

$$\mathbf{Deff} = \sqrt{\sum_{n=2}^{n=50} \frac{V_n^2}{V_1^2}} \boldsymbol{X100}$$

'1' refers to fundamental frequency (50 Hz)
'n' refers to the harmonic of n^{th} order (corresponding frequency is 50 x n Hz)

The active impedance presented by VSC HVDC at AC bus shall have no undamped or negative impedance region for all harmonics included inter harmonic based on IEC 62001-5, clause 9.2 and 9.3. In case, certain network harmonic impedance cannot be addressed by VSC HVDC, required solution should be included.

The performance of the AC harmonic shall be determined by calculation and shall be based on either as-tested parameters of components or the extreme values of manufacturing tolerances if as-tested values are not available. Performance requirements are to be met for all operating modes. In all Modes of operation, except the reduced DC line voltage modes, the performance requirement shall be met up to rated power with one larger size filter sub-bank and one characteristic harmonic sub-bank (largest) being out of service. All filter banks, sub-banks and branches shall be rated such that the remaining filter components are not overloaded due to detuning or resonance within the filters or between the filters, the generators, and the AC system for any combination of AC system voltage and/or frequency and configuration, or for any operating condition of the converters, or combination thereof, for which the converter valves are capable of continuous operation, or switching time between de-energized and energized states and there is no restriction on the operating power level for any operating conditions with one filter bank outage for power level up to 1.0 p.u. Short-time and transient conditions as well as operation with discontinuous DC current must be fully taken into account.

(e) Shunt Reactor Banks

Shunt reactors, if required, of suitable size shall be provided to meet reactive power

exchange requirements derived from the studies. The shunt reactor must be switched in or out by a circuit breaker. The shunt reactor shall conform to CEA's Standard Specifications and Technical Parameters for Transformers and Reactors (66 kV and above voltage class). The shunt reactor shall be covered under automatic switching under the reactive power control strategy.

(f) Converter transformers

(i) The converter transformer shall be designed in accordance with IEC- 60076-57-129. The converter transformers shall be single phase two winding units. The maximum flux density in any part of the core and yoke at the rated MVA, voltage and frequency shall be such that under 10% continuous over voltage condition it does not exceed 1.9 Tesla. The Converter transformer shall be capable of withstanding minimum DC current of 10 A per single phase transformer entering through the neutral.

(ii) Transformers shall withstand combined voltage and frequency fluctuations which produce the following over fluxing conditions:

a. 110 % for continuous

b. 125 % for 1 minute

c. 140 % for 5 seconds

(iii) It shall be demonstrated in design that the converter transformer shall not move to saturation beyond the design limit for overvoltage magnitude and duration applicable for the project.

(iv) The insulation level for the transformer AC (line side) windings and bushings shall be as given at Regulation 45 of Central Electricity Authority (Technical Standards for Construction of Electrical Plants and Electric Lines) Regulations, 2022 and insulation levels of the valve side windings shall be determined in accordance with studies. The impedance of the transformer shall be determined as in accordance with studies and variations in impedance shall be as per the requirement of relevant standards.

(v) Converter transformers shall be equipped with On Load Tap Changer (OLTC) and Metal Oxide Varistor (MOV) devices shall be provided between tap leads of the OLTC. The OLTC tap steps shall be determined in accordance with the operating strategy of both the converters. The OLTC shall be designed for a minimum 2,50,000 operations without repair or change of any part including oil. The OLTC shall be designed for a contact life of minimum 6,00,000 operations.

(vi) The requirements of soak pits and firewalls shall be in line with Regulation 46 of Central Electricity Authority (Technical Standards for Construction of Electrical Plants and Electric Lines) Regulations, 2022.

(vii) The converter transformer bushing shall be designed in accordance with IEC-60137/ IEC-65700, as applicable.

19. Converter valves and valve cooling system

(a) The converter valve assembly shall be designed and tested as per relevant IEC 62501. The valve shall be designed and protected during operating conditions for various over voltage and over current stresses to which it may be subjected to due to faults occurring in various parts of the station.

(b) The converter valve modules, used for converting AC to DC or vice versa, shall be complete with associated electronic IGBT switching system; protection, monitoring and damping system, auxiliaries and cooling system. Adequate redundant devices shall be provided to enable continued operation in case of failure of an individual component. Advanced converter topologies shall be used to reduce losses of VSC based HVDC converters.

(c) The IGBT power modules shall be water cooled, air insulated and indoor type. The valves shall be either suspended type or floor mounted type depending upon the operating DC voltage and seismic requirements.

(d) Necessary control and monitoring including tripping of the HVDC system in case of cooling system failure shall be provided.

(e) The valves shall be placed in the valve hall which shall have a positive pressure over atmospheric pressure and humidity control feature through HVAC system.

(f) No oil immersed part is permitted to be used inside the valve as well as valve hall. The electronic components located within the valve shall be designed to eliminate overheat and arcing. Only components of low flammability, high reliability and adequate ratings in margins can be used.

(g) Description of Valve Cooling System:

(i) **Fine Water Circuit**

The fine water circuit shall consist of a main circuit and a water treatment circuit. The cooling medium in the fine water circuit shall be deionised water with low conductivity.

(ii) **Main Water Circuit**

The main cooling circuit shall consist of water within the converter valves, a de-aeration vessel /venting, pumps and filters.

The main circuit shall be provided with an expansion vessel with level transducers and or pressurised with nitrogen, as per requirement of OEM design. The level transducers shall be used for control of the make-up water for the system, if applicable, and for detection of leakages.

There shall be two water pumps. One of the two water pumps shall circulate the 100% water through the main cooling circuit and the water treatment circuit. The

other pump shall be included for redundancy purpose. The operation shall be automated and arranged into alternative weeks between these two pumps. Upon failure of the unit in service, the redundant shall be automatically activated.

(iii) **Water Treatment Circuit**

A part of the main flow shall be circulated in the water treatment circuit. The water treatment circuit shall consist of oxygen removers (if required), ion exchangers and mechanical filter. Sensors shall be provided for measuring conductivity of the water, both in the main cooling circuit and in the treatment circuit at the exit side of the ion-exchanger. The water treatment circuit shall have provision to connect makeup pump and associated valves and strainers. The water pipe for fine water make up shall be connected to main fine water circuit through the water treatment circuit.

(iv) **Air Cooled Liquid Coolers**

The air-cooled dry type liquid coolers shall cool the water from the converter valves. At least one cooler unit or minimum 10% of total cooler units required to achieve the operating water temperatures for rated power (whichever is more), shall be provided by the TSP as redundant over and above the quantity required.

All the stations shall have dry type coolers. Each cooler shall consist of cooling fans with separated air channels.

Suitable protection against corrosion, oxidation etc. shall be provided for all cooling equipment.

(v) **Mechanical Design**

The cooling system shall be pre-fabricated. There shall be three main parts:

- fine water pump unit;
- air cooled liquid coolers;
- piping.

The fine water pump unit shall be mounted on a frame and shall be placed in the valve cooling room. The air-cooled liquid coolers shall be placed outdoors, near to the valve cooling rooms. The piping shall be especially designed stainless steel and adapted to the station building.

(vi) **Control Equipment**

The valve cooling control equipment shall be specially designed for application to the cooling system for converter valves. There shall be two computer-based control systems such that either both are in ACTIVE mode, or when one system is in ACTIVE mode the other system shall be in ACTIVE STANDBY mode. Each computer-based system shall be self-checking and an automatic changeover to

the other system shall take place in the case of failure of the active system.

(vii) **Design Criteria for the Cooling System**

Features to ensure high reliability, proper function and prolonged life time for the cooling system and converter valves shall be included. The following main components shall be supplied with redundancy in order to increase the availability:

- main circulation water pump
- air cooled liquid cooler (with redundant cooler as provided in (iv) above)
- bypass valves
- transducers
- nitrogen bottles, if applicable

(viii) **Design Cooling Requirements**

Separate cooling system shall be designed to cool the heat generated in each monopole for converter stations.

Cooling system shall be capable to operate and guarantee the design temperature specified under steady state conditions, up to max specified design dry bulb ambient temperature. Redundant Uninterrupted Power System/drive for valve cooling for each pole shall be rated for 2 minutes.

(ix) **Ambient conditions**

Ambient Conditions are specified in Table 2 of the specification.

(x) **Materials**

The materials in contact with the cooling water as well as for manufacturing of the air-cooled liquid cooler shall be selected in order to minimize the risk of corrosion.

(xi) **Measure Against Water Leakage**

The design of the valve cooling system shall be made to minimise leakages. The following precautions shall be taken to minimize the risk of water leakage from the system:

- choice of water pipe joint
- number of water pipe joints in the system shall be kept as low as possible, particularly in the IGBT based converter ;
- velocity of de-ionized water in the pipes and in the IGBT based converter submodules heat sinks shall be kept low
- water circulation within the pipes shall be free from trapped air bubbles

(xii) **Valve Cooling Control and Monitoring**

The valve cooling control systems shall be redundant and be equipped with an

integrated data collecting unit that is connected to the station sequential event recorder system.

(xiii) **Cooling Capacity Control**

The water temperature to and from the Converter/IGBT valves are used as an input to the cooling capacity control.

In order to avoid condensation at the pipe lines within the Converter/IGBT valves the inlet fine water temperature shall be kept in an appropriate range.

(xiv) **Protections**

The following protections/monitoring shall be included:

- Temperature of the water from the valves
- Temperature of the water to the valves
- Water flow through the valves
- Water level in the expansion vessel
- Conductivity of the water from the water processing unit
- Conductivity of the water in the main circuit
- Pressure in the expansion vessel, if required
- Pressure in the nitrogen bottle, if required.

(xv) **Leakage Detection**

There shall be three leakage detection methods used in parallel by the cooling control system. These methods can, depending on the nature of the leakage, generate trip of the converter and cooling system. However, one of the methods of leakage detection shall generate a leakage alarm if volume of leakage exceeds the reference volume, during the last 24 hours.

Besides these detection methods alarms for frequent make up and for long make up when automatic make-up of cooling water is used, generated by the cooling control program shall be provided. The total schematic of valve cooling system with valve position, flow, temperature, make up details, conductivity, pump running etc. shall be made available to the SCADA system of HVDC terminal.

20. Converter Station DC Outdoor Yard

(a) The DC yard shall comprise of equipment such as HVDC bushings, smoothing reactors (if required), DC filters (as required), DC current and voltage measuring instruments and switchgear, surge arrester, insulators, clamps and connectors.

(b) The specific creepage distance (corresponding to highest DC voltage) for DC yard and other areas shall be maintained as follows:

Table 6

Insulator type	Under light and medium pollution	Under heavy and very heavy pollution
Indoor porcelain or composite insulators for valve hall (other than valves) and indoor smoothing reactor area (if any)	20 mm/ kV	
IGBT Valves	14 mm/ kV	
Outdoor porcelain insulators or bushings with RTV# coating	50 mm/ kV	60 mm/KV
Outdoor composite insulators or bushings	50 mm/ kV	

 # RTV silicon coating shall be in accordance with IS 11310.

Note: Specific creepage distances less than 50 mm/ kV but not less than 45mm/ kV can be accepted for outdoor silicone rubber bushings due to manufacturing limitations and for HVDC equipment requiring necessary internal/ external insulation co-ordination. However, specific creepage distance less than 50 mm/kV and flash distance less than 12 mm/kV shall not be acceptable for outdoor jointed bushing.

(c) **DC wall bushing**

DC wall bushing shall be designed as per IEC-65700. DC wall bushings, used for electrical connection between the equipment inside the valve hall and the outdoor DC yard shall be of polymer housing as per relevant standards. All bushings inside the valve hall including HVDC wall bushing shall be dry type/SF_6 gas filled or combination of both. There shall be no oil filled components inside valve hall.

(d) **DC reactors**

The smoothing reactor/Arm reactor/phase reactor/ DC filter reactor (as applicable) shall be designed as per IEC-60076-6. The reactors shall be of air core type. The reactors shall comply with relevant standards and shall have successfully passed DC tests as per their application. Each converter station shall be provided with one spare coil of each reactor with all fitments, hardware and accessories. Minimum four Nos. of insulators of each type for reactors shall be provided as spare.

The reactor shall be designed for Class H for inter turn insulation as per IEC 60085, however, the maximum allowed hot-spot temperature rise shall be limited to one class lower i.e. Class F insulation.

(e) **DC Voltage and Current Measuring Devices**

The DC voltage and DC Current measuring equipment shall be installed at each pole. These equipment can be optical type or conventional type. The DC measuring equipment at pole and neutral bus shall be suitably located based on the control philosophy and different protection zones such that complete pole and neutral equipment are protected. The details of DC Measuring Equipment shall be as per '***Appendix C.1'*.**

(f) **DC Filters (if required)**

Suitable numbers of DC filter per pole per station shall be provided in DC yard to limit harmonic voltages present on the DC lines (pole lines and DMR line) as required by HVDC OEM design.

The design shall be based on passive DC filters. The DC Filters shall consist of Low order filters, Harmonic Filters and High Frequency Filters as per the requirement of project specific studies. The main filter equipment like capacitors, reactors and resistors shall comply with the requirements of relevant IS/IEC standards/ CIGRE documents. A fundamental frequency series blocking filter shall be provided, as per requirement. The required switches shall be provided. It shall be possible to connect and isolate a single DC filter arm without causing any reduction in transmitted power on the affected Pole.

The calculation of DC filter performance and rating shall be based on values of components, detuning, and harmonic voltages and currents. The TSP shall use model as per CIGRE TB 766 and 811 or equivalent for calculating performance and rating of DC filters.

There shall be no limitation on the energization of the DC filter arms by reason of either ambient temperature, frequency, initial mistuning or DC voltage within the ranges defined in this Specification. The DC filter components shall not become overloaded due to detuning or resonance within the DC filter or between the DC filter arms and the HVDC circuit, or the DMR, for any combination of conditions for which the converters are capable of continued operation.

TSP shall ensure that fundamental and 2^{nd} harmonic resonance and adverse amplification does not occur on DC side. A parallel low order (2^{nd} Harmonic) DC Filter shall be provided across each converter of each station. Earth resistivity along the DC line route will be considered as 250 ohm-m.

DC filter Performance:

The individual harmonic current (In) at any harmonic shall not exceed the value which could cause mal-operation of the HVDC system control and protection equipment supplied. The maximum equivalent disturbing current (Ieq), up to rated power in forward power direction, without any filter outage, for balanced bipolar and monopolar mode with metallic return or Dedicated Metallic Return (DMR) modes of operation shall be as follows:

Table 7

Operating Mode	Ieq
Balanced bipolar operation	1500 mA
Monopolar mode with metallic or DMR mode	2200 mA

The equivalent disturbing current includes not only the harmonics which flow in the DC Pole conductors and DMR lines but also the harmonics which are induced into the ground wires of the DC transmission line.

Mutual impedance calculation algorithms require that the ground wires be "eliminated" for this configuration; however, as specified herein, the current flow in the ground wires must be eventually taken into account in the calculation of equivalent disturbing current.

In Bipolar operation, the equivalent disturbing current shall be the psophometric weighted residual current of all harmonics of fundamental frequency from the 2nd to the 60th (i.e. 100-3000 Hz) according to the following formula:

$$Ieq(x) = \sqrt{[IeC(x)^2 + IeS(x)^2]}$$

Where,

Ieq(x) is the equivalent disturbing current in milliamps (mA) psophometrically weighted at any point along the transmission corridors specified herein

IeC (x) is the magnitude of the RSS equivalent disturbing current component due to harmonic voltage sources at Khavda (mA)

IeS(x) is the magnitude of the RSS equivalent disturbing current component due to harmonic voltage sources at South Olpad Converter Station (mA)

x denotes the relative location along the transmission corridors.

The equivalent disturbing current at any point along the corridor due to harmonics from either Khavda or South Olpad Converter Stations shall be calculated as follows:

$$Ie(x) = \sqrt{\sum_{n=1}^{n=60}\{\mathrm{Ir}(n,x) * P(n) * Hf\}^2}$$

Where,

Ir (n, x) is the magnitude of the equivalent residual rms current at each harmonic in milliamps.

(n) is the psophometric weighting at harmonic "n" as per Consultative Committee for International Telephony and Telegraphy (CCITT)

n denotes the harmonic number.

Hf is the coupling factor which represents the normalized frequency dependent effects of typical coupling impedances to open wire circuits. The coupling factor Hf will be assumed as per table below:

Table 8

Frequency (Hz)	Coupling Factor (Hf)
40-500	0.70
600	**0.80**
800	1.00
1200	1.30
1800	1.75
2400	2.15
3000	2.55
3600	2.80

As defined above, all harmonics up to the 60th shall be included in the calculation of equivalent disturbing current. The equivalent disturbing current shall be based on a "worst consistent set" of harmonic voltages at either end of the line.

The "worst consistent set" is defined as that set of harmonic driving voltages which could occur at any particular operating condition which results in the highest value of equivalent disturbing current that could occur for a period of longer than ten minutes.

A particular operating condition is defined in terms of:

a) The mode of operation, i.e. bipolar or monopolar in any specified mode of operation.

b) The DC voltage anywhere within the normal range for the mode of operation.

c) Reduced DC voltage operation on both Poles and reduced DC voltage on one Pole with the other Pole at nominal DC voltage.

d) The modulation index anywhere within the range applicable to the mode of operation as defined above which shall include modulation index associated with reactive power control.

e) Worst case induced voltage from any parallel lines.

f) The converter AC bus voltages anywhere within the normal range specified.

g) The maximum 50Hz negative phase sequence voltage of 1.5% for achievement of performance limits.

h) The DC current anywhere within the range applicable to the mode of operation.

i) Ambient temperature as defined in Table 2.

j) Differences in the smoothing reactor (if installed) harmonic impedances of the Poles

DC filter rating

The rating of the DC filter components shall be based on the assumption that the per pole harmonic voltage is individually maximized at each harmonic for any particular operating mode, and the filter component currents due to the harmonic voltages at the terminals shall be assumed to add as RSS (Root Sum Squared) at each harmonic.

For the rating of the DC filter components, it shall be assumed that any one DC filter arm can be out of service in any converter Pole The possible impact of reduced voltage operation and increased reactive absorption on the ratings of the DC filters shall also be considered.

Short time and transient conditions as well as operation with discontinuous DC current must be fully taken into account. Due allowances shall be made for possible current amplification resulting from resonances between the arms of the DC filters. In the calculation of the impedance of the DC transmission system when used for calculation of DC filter component rating, ±10% tolerance in the respective line length shall be included. AC system voltage and frequency variations as functions of duration specified in Table 2 shall be allowed in the calculation of harmonic voltages and DC filter detuning. In addition, capacitor unit or element failures appropriate to the duration for which the DC filter has to remain connected, shall be allowed for in the calculation of DC filter detuning.

(g) **Surge Arrester**

Surge arresters shall be gapless Metal Oxide arresters and shall be designed and tested as per relevant IS/IEC. The arresters shall be designed to absorb the desired amount of energy during a system disturbance and shall be coordinated with recovery of DC system following a disturbance as applicable. Arresters at appropriate places may be provided as per requirement.

(h) **Fundamental frequency blocking filter:**

A fundamental frequency blocking filter may be installed, if found necessary, to block the 50 Hz induced current in DC line in order to minimize the risk of converter transformer saturation due to possible induced fundamental frequency current from parallel AC lines

This induced current usually results from AC side second harmonic positive sequence voltage and from AC lines running parallel to DC line.

For design purpose, 50 km of parallel un-transposed 765 kV AC Double Circuit line and 50 km of parallel un-transposed 400 kV AC Double circuit line within a radial distance of 70 m to be considered by the TSP to consider any possible inductive and capacitive coupling between the lines. The parallel section of AC lines shall be considered to be located at a point that results in maximum fundamental frequency current at each

converter station.

Such a filter is formed of capacitor, reactor, resistor and arrester. Internal arrangement of these components is left to designer but the overall filter should offer significant impedance to 50 Hz current flowing in DC circuit. Blocking filter reactor shall be designed for Class H for inter turn insulation as per IEC 60085, however, the maximum allowed hot-spot temperature rise shall be limited to one class lower i.e. Class F insulation. The reactor may preferably have similar design as smoothing reactor (if any) to share common spare. The AC/DC/PLC/RI reactor shall be designed for Class F insulation as per IEC 60085, however, the maximum allowed hot-spot temperature rise shall be limited to one class lower i.e. Class B insulation.

(i) **DC commutation switches:**

These switches are required for commutating the DC current from one path to the other. They comprise of Dedicated Metallic Return Transfer Breaker (DMRTB), Pole Metallic Return Transfer Breaker (PMRTB), Neutral Bus Grounding Switch (NBGS). These switches shall be rated for transfer of the full load current online without converter trip or block leading to power loss. Neutral Bus Switch (NBS) shall also be provided suitably at both ends in all the poles.

21. Dedicated Metallic Return (DMR)

The neutral current return path for bipolar configuration or monopolar configuration shall be via a Dedicated Metallic Return (DMR) conductor connecting both converter terminals.

22. Control and Protection System

It shall be demonstrated that the HVDC control system is stable under all operating conditions and cannot excite oscillations, such as sub-synchronous oscillations, between the HVDC and AC system. The control system shall be tuned for optimal overall performance for all conditions and configurations of the AC system. The details of operator Control and Monitoring are mentioned in ***'Appendix C.2'.***

It shall also be demonstrated, by applying system faults and step responses in current order and power order during the factory acceptance testing (FAT), that the as-built control system does not excite low order harmonic resonance(s) in the AC system and/or between HVDC and AC systems for any system configuration.

The performance of the integrated DC and AC systems shall also be demonstrated using an EMT-type program (such as PSCAD) in order to validate the system performance requirements. In the DPS program, all the HVDC protections shall be modelled. All feeders in the ac converter bus should have the required protections modelled for DPS studies with network equivalent.

DPS studies shall be done with DPS model of Khavda LCC HVDC, DPS model of Khavda Pooling station and RE Park in vicinity. DPS models shall be provided for the LCC HVDC and Khavda Pooling station including RE park shall be provided to TSP.

Software based controls and protection shall be used to permit flexibility in effecting modifications. Protection and controls shall be duplicated for reliability. The control and protection shall provide fast controllability of the HVDC system.

(a) Control System:

(i) The control system shall have redundancy with hot standby. Transfer of controls from Active Control system to Hot standby control system shall be seamless and there shall be no power interruption during this transition. Outage of one control system or part thereof, shall not result in any power reduction.

(ii) The control shall be designed to give fast, stable and proper response to normal control actions as well as during disturbances such as AC and DC faults.

(iii) DC converter terminals shall be either manned by operator or controlled by remote operation of SCADA system. The control system hierarchy shall be as follows:

1. Master Control
2. Station/Bipole Control
3. Pole/ Converter Control
4. Valve Control

(iv) The HVDC Station/Bipole shall have control features including but not limited to the following:

1. AC Voltage and Reactive power control
2. DC Voltage and Active power control
3. Frequency control
4. Power modulator, pole power compensation. The modulator, if required, shall have feature which shall provide positive damping of AC network oscillations over the range of frequencies considered during system studies.
5. A. Sub Synchronous Resonance (SSR) Damping Controller (if required) based on studies.

   All necessary studies shall be carried out to ensure that the DC system shall not excite the mechanical, electromechanical or other natural frequencies of the nearby region generators and turbines under any operating mode. It shall be demonstrated by studies that the nearby generators shall not be adversely affected by the HVDC system, particularly with regard to Sub Synchronous

Oscillation (SSO)/Sub Synchronous Resonance (SSR) and harmonic injection and self-excitation. Sub Synchronous Damping (SSD) Controller shall be provided for converter stations near Generating stations.

B. Power Oscillation Damping (POD) Controller in STATCOM mode of operation.

6. RE Park Sub synchronous control interaction studies, Temporary and Transient overvoltage checks, harmonic interactions, stability, HVRT, LVRT etc.

7. Interaction studies among various HVDC links and STATCOMs (planned/ execution) which are electrically coupled nearby e.g. LCC based ±800 kV, 6000 MW converter at KPS-2;~~,~~ STATCOMS as per following table:

Sr. No.	Capacity of STATCOM	Name of Substation
1	±300 MVAr	KPS-1 (Section-I)
2	±300 MVAr	KPS-1 (Section-II)
3	±300 MVAr	KPS-3 (Section-I)
4	±300 MVAr	KPS-3 (Section-II)
5	±200 MVAr	Boisar-II (Section-I)
6	±200 MVAr	Boisar-II (Section-II)
7	±300 MVAr	Navsari (New)

8. The TSP shall study all interaction aspects between these converter stations, STATCOMs and devise control strategies to ensure that no adverse interaction takes place among the above stations during steady state and fault recovery. Various fault cases for the purpose of this study shall be finalized with the employer during detailed engineering.

9. The HVDC system shall conform to the performance requirements specified herein. It shall be designed to optimally co-ordinate all aspects of its controls to ensure safe and reliable operation without adversely affecting the connected ac system and shall assist the latter following disturbances. The performance requirements shall be met under all specified ambient conditions, modes of operation, ac system conditions and other parameters as given in this specification

10. Run back/Run up controller (10 points) with provision to be linked to Special protection Scheme (SPS) of System Operator.

11. AC system stability function, such as power swing damping function.

12. Any other Controller as deemed required for stable HVDC system operation with connected AC network.

(b) Protection System

The protection system shall be designed in Main-I and Main-II set up.

(i) HVDC system protection shall consist of two parts:

(A) **AC side protection**

AC side protection function shall cover the zone for converter transformer, AC filters(as applicable), shunt capacitors, shunt reactors, and busbars. These protections shall generally follow the same philosophy as in a typical AC substation i.e. detection of fault by relay and tripping of circuit breaker or may be dealt in similar way as described for DC side protection.

(B) **DC side protection**

DC side protection shall cover the zones consisting of HVDC AC PLC Area to Converter transformer Primary, Converter Transformer, Area between converter transformer, Phase reactor and the valve hall, Converter Protection Zone, DC Bus bar Protection Zone, DC switchyard including smoothing reactor (if applicable) and DC filters (as applicable), DC line, and DMR line. The protection equipment shall be designed to be fail safe and shall ensure high security to avoid mal-operation/ unwanted shutdown due to protection equipment failures. 'Main-I and Main-II' or 'Main and Standby' protection philosophy shall be adopted for HVDC equipment and system.

(ii) Following a DC Line fault, the HVDC System shall have the facility to restart. The DC transmission system shall be capable of recovery in a controlled and stable manner during recovery following AC and DC system faults. The post fault power order shall be equal to the pre-fault power order unless AC/ DC systems dictate otherwise.

(iii) Protection system shall have two redundant systems with following protections (Some protection can be combined).

a) Converter differential protection
b) Converter Protection
c) AC, DC over current/under current protection
d) AC, Overload Protection.
e) AC, DC bus differential protection
f) AC conductor ground fault protection
g) DC filter protection, if applicable
h) Converter transformer valve winding protection
i) DC line differential protection
j) DC under voltage/ over voltage protection
k) DC line ground fault protection with restarts
l) High Impedance DC ground fault Protection
m) Harmonic Protection on AC side and DC side.
n) Negative Sequence Protection.

o) Phase current unbalance.
p) Dedicated Metallic Return (DMR) protection
q) DMR monitoring
r) AC filter protections, as applicable
s) Protection Block Failure or Repetitive Blocking failure protection
t) Converter arm harmonic protection
u) DC Line Overcurrent Protection
v) DC Line harmonic protection
w) Power module failure monitoring
x) SSTI Protection (corresponding to POWER Plants)
y) SSDC Control Interaction Protection. (Corresponding to RE Plants).

Other Protections required for successful operation of VSC HVDC with HVDC LCC and RE Park in vicinity like transfer trips to RE Park 400 kV bus and LCC HVDC Converter. Provision for transfer Trip options shall be available in TSP's own Protection panels in digital and analog hardware form. Necessary assistance for integrating with OPGW shall also be included.

23. DC Line fault locator

DC online fault locators shall be provided to monitor the entire DC line length and give location of the fault with good accuracy in the range of + 1000 meters for pole conductors. DC line Fault Locators shall utilize a method of measurement of time of arrival at each end of the HVDC line of the steep wave fronts, resulting from a fault on the HVDC, affected by the accuracy of the time measurements. Since the wave fronts shall propagate along the lines at $3x10^8$ m/sec (or 300 metres per microsecond), the time measurements must be in microseconds with an accuracy of ±3 microseconds in order to achieve a location accuracy of approximately ±1 km. Greater precision of fault location would be desirable. The DC online Fault Locator equipment at each station shall be time synchronized to the master clock system at the station in order to facilitate analysis of system disturbances recorded on the DC Line Fault Locators, the transient fault recorders and the alarm monitoring and recording system. Manually re-settable fault counter shall be provided as part of the equipment.

ELECTRIC CHARACTERISTICS

1) Control Panels

Identical control panels shall be provided for each DC Line Fault Locator within its own cubicle(s). The control panel shall include, but not be limited to the following facilities.

- Equipment on/ off control and indication;
- Equipment alarm or failure indications;
- Fault location readout display for the last detected line fault;
- Manual initiation of automatic self-test routines;
- Any other controls or indications

2) Printers

A printer shall be provided for each DC Line Fault Locator or it may be integrated with operator control and monitoring system. The printer shall print the day, hour, minute, second and millisecond of each fault or manual or automatic system test. The printer shall also print the location of each fault in kilometres from the respective station.

If fault locator is integrated with operator control and monitoring system that all these details shall be displayed on Video Display Unit (VDU) and stored in archives in the backup memory.

3) Power Requirements

The equipment shall be suitable for operation from the station battery supply. There shall be no loss of accuracy within specified variations of DC input voltage.

Note: Alternatively, TSP may also propose an integrated solution with the fault locator integrated into the HVDC Control and Protection system meeting the system requirements. If fault locator is integrated with operator control and monitoring system then all these details shall be displayed on Video Display Unit (VDU) and stored in archives in the backup memory.

24. Operations supervision and control

a) The TSP shall provide the control facilities from the operator control desk through a monitor and keyboard/mouse system. These facilities shall include all control operations, digital setting, indicating devices, Station single line diagram and symbols, any other special control devices and meters required for control and monitoring of the complete HVDC system.

b) The layout of the station single line diagram, together with control, indicating and metering devices on the control desk shall be logical, compact, of pleasing appearance, and shall facilitate efficient supervision and operation of the station(s) by the operator. Every detected change of position shall immediately be displayed in the single-line diagram on the station screen, recorded in the event list and printable.

c) Graphic representation of Converter valves and valve cooling piping network shall be provided on station monitoring system. The graphical representation shall also display indicating faulty valve submodules position.

d) The 'Sequence of events' recorder, transient fault recorder, on-line DC Line fault locator, GPS system, Station Master Clock, visual display system, operator control protection and monitoring system shall be a part of the HVDC system.

The details of operator control and monitoring system are provided at 'Annexure-Operator Control and Monitoring System'. The Transient Fault Recorder provided for the HVDC system shall be as per '***Appendix C.3***'

25. Telecommunication

For smooth operation of the HVDC system, communication network with high reliability and availability shall be provided for transmission of control and protection signals between the two or more (in case of multi-terminal DC) HVDC terminals. The communication system design shall be as per ***'Annexure- Specific Technical Requirements for communication'*.**
A limited remote data transfer of the HVDC system from the Load dispatch centers shall be provided by TSP. All required remote control and remote monitoring facilities shall be provided at each converter station. Complete remote monitoring of each converter station shall be possible from opposite converter station.

Synchro phasor measurement using Phasor Measurement Units (PMUs) along with fibre optic connectivity, Global Positioning System Receiver and communication equipment shall be provided for monitoring AC side of converter bays of HVDC station.

26. Valve Hall

The valve hall shall mainly contain BIGT/IGBT valve, its associated structure, cooling and arresters. No oil filled equipment shall be present inside the valve hall. In case the turret of converter transformers (having oil) is protruding inside the valve hall, suitable fire barrier matching with adjacent valve hall wall fire rating shall be provided. The valve halls shall be provided with interference screening, if required by OEM. In addition, the control cable and cable termination rooms shall be suitably screened to minimize radio interference. Necessary measures shall be taken to take care of high frequency noise emission from valves.

The valve halls shall have ample clearances such that the inspection of valves can be possible and allow access of mobile valve servicing equipment without any dismantling. The valve hall building shall be pressurized to prevent the ingress of unfiltered air. In addition, the building shall be properly sealed to minimize the flow of outside air into it and vice versa. Openings for equipment and services shall be weather proof. The Valve Hall building shall consist of steel framed structure. The steel building shall be pre-engineered building fabricated in the factory and shall be assembled at site. Minimum two Nos. scissor lift for erection and maintenance of valve modules shall be provided per station. Proper cable sealing shall be provided for cable entry into valve hall and control room to avoid entry of water and moisture.

27. Ventilation System and air conditioning for Valve Hall

Each valve hall shall have an independent ventilation and/or air conditioning system. Each ventilation systems shall consist of two 100% capacity systems, one operating and one stand-by.

The ventilation of the valve hall shall be of a positive pressure type. Once through ventilation system will not be acceptable. The ventilation system shall be a closed cycle with fresh air

intake limited to a maximum of 20% of the total air requirement. Fresh outdoor air shall be filtered and dehydrated before being blown into the valve hall by the air fans to avoid dust accumulation and condensation on components present in the valve hall. Suitable measures shall be taken to minimise stagnant air. Each valve hall shall be provided with remotely operated motorized exhaust dampers which shall be normally closed and will be opened under high pressure/emergency conditions only.

Air-conditioning of valve hall for reducing the operating temperature of Converters may be used if required. Airconditioning units will be provided with minimum one redundant unit (atleast 25% capacity).

To ensure that the air being supplied to the valve hall is free from dust particles, a minimum three stage dust filtration process shall be supplied. This shall consist of at least the following:

1. Pre-Filters: To remove dust particles down to 10 microns in size with at least 95% efficiency.
2. Fine Filters: To remove dust particles down to 5 microns in size with at least 99% efficiency.
3. Absolute Filters: To remove dust particles down to 0.3 microns in size with at least 99.5% efficiency.

All the filters shall be panel type. Easy access should be available to the filters for replacement/cleaning.

It shall be possible to maintain specified conditions continuously inside the valve hall, both automatically and manually controllable from the station service panel (located in the control room) as well as from the local control panel.

In addition to the alarms for particular parameters like pressure, temperature and relative humidity etc., indicating instruments shall be provided for each valve hall. These parameters shall be integrated with station monitoring system also.

The valve hall shall be kept at a pressure above the atmospheric pressure under all conditions. The test shall be conducted at site to measure the pressure inside the valve hall for 48 hours.

Adequate numbers of de-humidifiers shall be provided for each valve hall as per design requirement.

28. Air Conditioning System

Air conditioning shall be provided on a continuous basis in the control room, bay kiosks, valve module workshop and storage rooms, control and protection workshops, offices, first aid room, conference room, entrance halls, corridors etc. and all rooms containing electronic equipment.

The air conditioning system for the control room shall consist of two (2) systems each of 100% capacity; one operating and one stand-by. Both units shall be interconnected so that, in the event of breakdown of one unit, the stand-by unit can be placed into service. Stand-by and operating units shall be alternated monthly for regular operation. The operation of the units shall be automatically controlled including sequential start and stop with single command.

If valve base electronics and/or valve cooling control cubicles are located at places other than in the station control room, these areas can be cooled by using split Air Conditioning units of appropriate capacity. At least two units shall be provided, one operating and one stand-by with the facility of automatic changeover after operator assigned time period.

A separate air conditioning system shall be provided for other areas of the service building. This shall also consist of two (2) Nos. each of 100% capacity; one operating and one stand-by.

29. Visual monitoring system (VMS) for watch and ward of station premises:

Visual monitoring system for effective watch and ward of substation premises shall cover all the transformers and reactors, outdoor DC yard, valve halls, indoor and outdoor isolators, earth switches, breakers, AC and DC capacitors, all other major AC Equipment (such as CB, isolators, CT, CVT, SA etc. as applicable), panel room, all entrance doors for the service building, other buildings, all the gates of switchyard and all entry and exit points of control room building and accordingly the location of cameras shall be decided. The camera shall be high definition colour CCD camera with night vision feature. The VMS data partly/completely shall be recorded (minimum for 30 days) at least @25fps (or better) and stored on network video recorder and followed by transfer of the data to a juke box. The system shall use video signals from various cameras installed at different locations, process them for viewing on workstations/monitors in the control room and simultaneously record all the cameras. The operation of cameras shall be integrated with the Network server placed in Control room of HVDC station. Sensors shall also be placed on boundary walls to prevent intrusion from outside and shall be connected to the CCTV system. The VMS data should go only to the intended personnel/ facility and not to the remote server of the Camera (VMS supplier)

Mouse/ keyboard controllers shall be used for pan, tilt, zoom and other functions of the desired camera. The Visual Monitoring System shall have provision of WAN connectivity for remote monitoring.

All camera recordings shall have Camera ID and location/area of recording as well as date/time stamp. The equipment should generally conform to Electromagnetic compatibility requirement for outdoor equipment in EHV substation.

At existing HVAC substations, the visual monitoring system if available shall be augmented as per existing or better specification as required.

30. Building Management System

A fully computerized and automatic Building Management System (BMS) shall control the operation of the mechanical systems serving the valve hall and service building and other systems as detailed below.

Scope of Work

The scope of work shall cover all necessary system provisions (including hardware and software) for synchronizing/integrating the BMS with the control and monitoring of

- Air Conditioning system,
- Valve hall ventilation and air conditioning system
- Fire Fighting Systems including Fire Spray and Hydrant systems, water level in Fire Water Tanks etc.
- Utility Services i.e. Water Storage and Supply,
- Access Control including Motorised Gate at the entrance to the station and for all entrance doors for the control room building including provision of electromagnetic door locks, card readers etc.
- Fire Detection and Alarm System.
- Illumination systems
- VMS

31. Water Supply and Distribution System

The water supply and distribution system shall include the supply, distribution and storage of water in the HVDC Station at least the following purposes.

a) storage of water for the firefighting system;

b) storage of water sufficient for 24 hours of continuous operation of HVDC converter in the event of interruption of water supply to the tanks;

c) water supply for the valve cooling system;

d) water supply for sanitary services;

Two Nos. 100% capacity water storage RCC tanks shall be provided. Each tank shall be constructed in such a way that there shall be segregation between requirement for fire water storage and water for other purposes such that fire water is not used for other purpose. Both the tanks shall have interconnection piping with isolation valves for both tanks. Separate piping as per IS/IEC standard for firefighting, valve cooling and other purposes shall be provided from the tanks from independent headers.

32. Grounding and Safety:

a) The design of the grounding system shall be based on relevant IS/IEC/IEEE standards.

b) In order to prevent adverse effect (i.e. overheating due to induced circulating current) of magnetic field of air core reactors, special care shall be taken e.g. no closed loops are formed by the earthing conductors and in reinforcement bars of the foundation or other necessary mitigation measure to be provided. Air core reactor manufacturer's guidelines shall be followed.

c) The electrical safety clearances for the DC side shall not be less than the clearances

applicable for an AC switchyard at the equivalent BIL level.

d) The total electric field at ground level shall be as prescribed in relevant standards.

e) Fencing and electrical interlocking and mechanical key arrangements shall be provided for all non-accessible areas, for valve halls, and for areas where for equipment mounted directly on ground without suitable height of steel structure, e.g. smoothing reactor area, AC and DC filter areas, as applicable.

f) Safety precautions in regards to gas/oil pipe lines in vicinity of HVDC/ AC lines shall be taken coordination with gas/ petroleum authorities.

33. Cables:

All cables shall be FRLSH type. The High Voltage (6.6 kV to 33 kV) power cables shall be XLPE insulated conforming to IS-7098 Part-2. The Low Voltage power cables shall be 1.1 kV XLPE insulated conforming to IS-7098 Part 1 or relevant IEC standards and/or PVC insulated conforming to IS-1554 Part 1. The control cables shall be 1.1 kV PVC insulated conforming to IS-1554 Part-1. The rating and size of cables shall be determined by TSP. All cables shall be armored except cables used for special purpose as per OEM recommendation. Fibre optic cables conforming to IEC– 60793 and 60794 shall be used to transmit the signals to and from various equipment and panels located in the AC/DC switchyards, Valve Halls, control rooms, valve cooling rooms etc.

34. Auxiliary Power Supply System:

The auxiliary power supply system shall have the following:

a) Highly reliable duplicated supply sources from two separate sources with automatic change-over facilities. These sources of auxiliary power shall be from 33 kV side of 2 Nos. of 400/33 kV transformers (50 MVA) at KPS3 HVDC and 33 kV tertiary of existing 2 Nos. 765/400/33 kV ICT at South Olpad. This source shall be stepped down to 433 V by means of station service transformer of minimum 2000 kVA capacity and rated 33/ 0.433 kV.

b) Completely separated secondary distribution (415 V) systems for the auxiliaries of each converter.

c) Duplicated supply by two different 415 V power sources to essential loads

d) Diesel Generator (DG) Set of minimum 1500 kVA capacity per pole shall be provided to meet essential loads. This generator set shall start automatically and cater load immediately in case of loss of all the normal and standby supply sources. The DG sets

shall be designed and rated so as to meet the load time characteristics of the essential loads of the entire station as determined by the TSP with a 10% margin on the load.

e) Parallel operation between station service transformers shall not be permitted at any voltage level in order to limit fault currents, prevent back feed into the AC bus and to ensure independence of supply sources. Also, parallel operation shall not be permitted between transformers and the DG set.

f) Suitable protection on all primary MV and LV supply connections shall be provided.

g) The 220 V DC supply system(s) per pole shall consist of at least two independent DC systems; each system consisting of one float-cum-boost charger, one battery bank and one distribution panel. A 48 V DC system consisting of two battery sets, two battery chargers and two distribution boards shall also be supplied for communication panels (wherever supplied). If desired, 48 V supply may be obtained from 220 V DC battery bank by use of adapters, without compromising backup time.

   (i) The station services DC system shall cater to the DC loads of HVAC and HVDC switchyards, auxiliary services control, valve and pole control, protection circuits, communication system loads etc.

   (ii) Minimum lighting load shall be connected to the station DC system.

   (iii) Sizing of 220 V battery and battery charger shall be done based on the number of bays specified (including future bays) as per CEA Regulations and relevant IS. 2 sets of 48 V battery banks for PLCC and communication equipment for present and future scope shall be provided at each new Substation with at least 10-hour battery backup and extended backup, if required.

h) All auxiliaries shall give rated output at voltage variation of ±10% and frequency variation of -5% to +3%. Sizing of LT Switchgear shall be suitable to cater the requirement for all present and future bays. AC and DC distribution boards shall have modules for all the feeders (including future as specified).

i) For substation extensions, existing facilities shall be augmented as required.

An indicative SLD for the Auxiliary Supply System is enclosed at ***'Appendix-C.5'.***

For the requirement of the Auxiliary Power as described above, Essential Load is defined as per below: -

Essential loads: *These are the loads whose failure shall affect the conversion capability of the HVDC system. These loads shall include, but not be limited to, the cooling and other auxiliaries of the converters, the cooling of transformers and reactors, valve hall cooling, etc. In addition, loads that must remain working in case of complete loss of the AC power supply shall also be included in essential loads. These loads shall include, but not be limited to, the station battery*

chargers, disconnecting switching and circuit breakers operating mechanism, the emergency lighting, fans to keep over pressure in valve halls, etc.

35. Fire Detection, Alarm and Protection system:

A comprehensive fire detection, alarm and protection system as per Central Electricity Authority (Measures Relating to Safety and Electric Supply) Regulations, 2023 shall be provided. Valve Hall shall have Air aspiration system (fast and early smoke detection system). Suitable Infra-Red (IR) and Ultra Violet (UV) detector to detect the flashover inside the Valve Hall shall also be provided. The Valve hall wall towards converter transformers shall be suitable for minimum 3-hour fire rating.

Suitable fire detection system using smoke detectors and/or heat detectors shall be provided in HVDC Station for all room and areas. These smoke fire detection systems shall be connected to a separate Fire annunciation system clearly identifying the zone.

Hydrant System:

Suitable No. of hydrants shall be provided for protection of HVDC Station equipment in the yard and HVDC Station building.

HVWS System:

High Velocity Water Spray (HVWS) system shall be provided for converter transformer, ICTs and Shunt Reactors.

36. Testing and trial operation

All equipment/ components including IGBT valves, Converter Transformers, smoothing reactors, EHV DC Transformer bushings and wall bushings shall be subjected to Type tests, Routine tests, Factory Acceptance Test (FAT), Site Acceptance Test (SAT) as per relevant IS / IEC/ IEEE as applicable. The SAT shall consist of sub-system and system tests and shall be carried out after installation of equipment at site. The sub-system tests cover the major sub-system like valve cooling, AC and DC filters, HVDC converter, auxiliary systems, communication etc. After completion of sub-system tests, system tests covering power transmission tests, transient and dynamic control tests, measurement of electric field and RFI etc. shall be conducted. After completion of all system tests, final trial operation of the HVDC System shall be carried out for continuous period of normal operation of not less than 10 days for each Pole/Bipole separately. The HVDC System shall be declared under Commercial Operation after the successful completion of its Trial Operation.

37. Reactive power exchange

The 400 kV Bus sectionaliser at KPS3 is planned to be normally open. However, the design should also consider the possibility of 400 kV Bus sectionaliser to be kept open/closed based on system conditions.

Each monopole shall have a capability of providing dynamically varying reactive power between 0.95 leading power factor to 0.95 lagging power factor at PCC for any active power between -1250 MW to +1250 MW. This capability shall be achieved at all AC voltages within the continuous operating limits and ambient temperature limits. For voltages outside the continuous operating limits, the reactive power support shall be provided as per LVRT/HVRT strategy.

The control of reactive power exchange with AC grid in response to Q mode or V mode of RPC shall be fully automatic and shall be continuously monitored. The control equipment, however, shall allow both automatic and operator-initiated switching. In the former case, adequate annunciation shall be provided to the operator.

Fault infeed during faults shall be 1 p.u. of rated AC current for dead short circuit at Converter transformer AC bus. Dynamic reactive power support shall be over and above the steady state reactive power support.

The studies of DC Current flowing through breakers on AC side of converter transformer for earth faults on converter side of transformer at locations as applicable and sizing of auxiliary resistor to ensure zero crossings in the total current in the AC breaker.

Each breaker used for switching shunt reactive elements shall have point-on-wave switching control for energizing its branch, to minimize voltage disturbances while switching capacitors and filters, and minimize DC offset current while switching shunt reactors. Breakers used for switching shunt reactive and filter elements must be capable of de-energizing their branch at the maximum temporary overvoltage conditions specified in this specification, or as determined by the TSP's studies, including full load rejection studies, whichever is greater. The reactive compensation and overvoltage limiting equipment shall be designed such that at any power transfer level up to rated power in either direction, a complete or partial interruption of DC power transfer shall not result in a fundamental frequency over voltage beyond the values specified in this specification.

All the necessary studies of reactive compensation and voltage control shall be performed. The calculations of reactive power exchange and of voltage control shall be based on the most unfavorable combination of tolerances on equipment, connected system configuration and of changes in operating conditions.

38. Pole Blocking

The HVDC System shall recover to 90% of the pre-fault DC power transfer level consistently within about 300 milliseconds from the instant of fault clearing, without sustained oscillation for all inverter system fault conditions. For all rectifier AC system fault conditions, the recovery

time, to 90% pre-fault power level, shall be within 100 milliseconds from the instant of fault clearing. This recovery time shall be achieved for all short circuit levels as defined in this specification.

If it is in the interest of the overall improved recovery of the AC/ DC system, in such cases the recovery times other than those specified shall also be acceptable, subject to review

39. Pole Deblocking and Converter Start-up

A coordinated sequence of starting an HVDC Pole shall be established and demonstrated during FAT. The sequence shall be in a such a manner that it will not impact the connected AC system beyond steady state abnormal voltage limits. It shall be possible to start and deblock at minimum DC power specified in this specification earlier while maintaining all the AC and DC filter performance requirements.

40. AC bus fault

The TSP shall demonstrate the response of the power controller to DC voltage changes in the rectifiers and inverter for solid converter AC bus faults, both single phase-to-ground and three phase-to-ground.

The HVDC system shall recover to 90% of the pre-fault DC power transfer level consistently within 120 ms from the instant of fault clearing, without sustained oscillation for all inverter AC system fault conditions. For all rectifiers AC system fault conditions, the recovery time, to 90% pre-fault power level, shall be within 100 ms from the instant of fault clearing. This recovery time shall be achieved for the fault levels above the minimum specified in Table-1. Recovery times greater than specified above shall be acceptable only if the higher recovery times results in the overall AC and DC system improvement.

The response time shall be determined in accordance with the general criteria defined in this specification. The specified response for the rectifier AC system and inverter AC system faults shall be demonstrated [400 kV level at KPS3 (HVDC), 400 kV and 765 kV level at KPS3, 765 kV level at KPS2, 765 kV level at Lakadia, 400 kV level at South Olpad HVDC, 400 kV and 765 kV level at South Olpad, 765 kV level at Vadodara, 765 kV level at Ahmedabad, 765 kV level at Boisar-II] for the following conditions:

(i) Single phase-to-ground faults, for five cycle, ten cycle, and twenty cycle fault clearing and with fault levels resulting in voltage reduction to 90%, 70%, 50%, 30%, 20%, and 5% of nominal converter AC bus voltage.

(ii) Three Phase-to-ground faults, for five cycle fault clearing, with fault levels resulting in voltage reduction to 90%, 70%, 50%, 30%, 20% and 0% of nominal converter AC bus voltage.

(iii) Zero impedance three phase 400 kV AC busbar faults at Khavda and South Olpad which are cleared after five cycles and which result in the loss of one DC pole.

(iv) Three phases to ground, five cycle, and Single line to ground, ten cycle faults. The outage of components would include 400 kV single circuits, 400 kV double circuits if these are on same tower, generator, filter bank etc.

(v) Three phase to ground, five cycle, and Single line to ground, ten cycle faults following conditions when system is already running under single contingency and which result in outage of further system components. The outage of components would include 400 kV single circuits, 400 kV double circuits if these are on same tower, generator, filter bank etc. Under such conditions it shall be shown that the system stability is maintained although the time required for recovery may exceed the values given above. For certain cases if there is a need for run back condition on HVDC the same shall be evolved by the TSP.

(vi) TSP shall demonstrate LVRT and HVRT Capability as per the performance criteria mentioned in this document.

41. DC Line Faults

The DC line fault protection sequence shall detect the fault, de-energize the faulted line Pole by control action, allow a time period for fault deionization (settable between 50 ms to 1000 ms), and then automatically attempt restoration of the DC power transfer on the Pole.

For pole to ground faults, the TSP shall provide a sequence to de-ionize the fault and restart the monopole automatically after a predetermined programmable time. The first restart attempt shall be at pre-fault DC voltage and second restart attempt shall be at reduced DC voltage. The third attempt shall be in STATCOM mode. This constitutes one complete recovery sequence.

All equipment shall be dimensioned considering these 3 restart attempts.

The first restart attempt including fault clearing time and achieving pre-fault power level, shall not exceed 2 seconds for pole to ground faults, however, it shall be endeavor to mininise the fault recovery time. During second restart attempt tap changer may be used to achieve reduced DC voltage. The maximum time for the second restart attempt shall be limited to time taken by tap changer or the time taken by the drive of the breaker/switch to recharge. In case the second attempt fails then the converters shall automatically go into STATCOM mode of operation

The system shall be designed and capable of the following:

a) During the DC line fault the power transfer on the non-faulted Pole shall be completed as quickly the extent possible in order to minimize the impact on the DC power transfer. This should be possible even when telecommunication is out of service.

b) In case a fault occurs within 15 minutes of the last fault then both these faults shall be counted as attempts within single DC line fault recovery sequence. A fault that occurs after 15 minutes of the last fault shall be treated as start of new DC line fault recovery sequence. Maximum cooling period between two consecutive DC line fault recovery

sequences shall be 60 minutes during which tripping may be allowed.

The clearing and recovery of a DC line Pole fault shall be demonstrated in bipolar and monopolar mode at 1.0 p.u. power transfer prior to the fault for the particular mode. Faults shall be applied at the line ends and at the line midpoint in both power directions. The demonstration shall include the influence of the function provided to transfer power from the faulted Pole to the other Pole.

Suitable modeling of the DC line, which takes into account the electro-magnetic coupling between the Poles, shall be considered in the above studies.

All high voltage equipment in the VSC station including charging resistors and neutral bus arresters shall have adequate thermal capacity to support an unsuccessful automatic restarts. In case DC line is tripped due to line fault, affected pole shall be left in a state ready for manual restart in STATCOM mode.

42. Operation During Reduced AC Voltage Conditions

To assist in the recovery of the network, the Converter Stations shall be able to continue operation with reduced AC bus bar voltages.
In addition to the requirements of operation under over voltage conditions specified in this specification, the converter equipment shall be able to continue operating without blocking of converters with AC bus voltage reduced below 15% of nominal voltage during three phase faults, and to zero on one phase during single line to ground faults, for a period of 1 second followed by voltage recovery to 80%. In this condition, reactive power feed to fault shall be prioritized. The converters shall continue to transmit power to the extent possible under the above reduced voltage conditions. The valves as well as all the cooling equipment shall be rated for these conditions. The cooling system shall not trip during AC system faults.

43. Controlled Shutdown

Each Pole shall be able to be shut down in a controlled manner by the automatic reduction in the power order accompanied by appropriate AC harmonic filter bank switching. The block and isolation of a Pole shall be done without the block or shutdown of other Pole converters.

44. Power Runback

The controls shall be capable of achieving 90% of any step change requested by run-back modulation signals including within 200 milliseconds of receipt of the run-back signal.

45. Cyber security

The designed system shall be compliant with:

a) IEC-27001 Information security management

b) IEC-62443

c) CEA (Cyber Security in Power Sector) Guidelines, 2021

Cyber security shall be incorporated in the overall design of the HVDC controls, protection, communications, HMI and SCADA systems. The TSP shall propose a secure and robust design in the control and LAN systems, using next generation firewalls, dual firewall communication designs, routers, gateways, data diodes, etc. that have built in cyber secure measures.

46. Performance Guarantee for Converter Station (excluding HVDC line)

a) HVDC Station losses: The Guaranteed losses of HVDC converter stations shall include the no load operating state loss and load losses during Operation with 100% rated active power(1250 MW / pole) and 100% rated reactive power (410 MVAr / pole). The Guaranteed losses shall be verified as per IEC 61803 and IEC 62751. The above losses shall be guaranteed at nominal DC voltage (±500 kV at rectifier end) and nominal AC system Voltage (400 kV, 50 Hz) at ambient temperature of 40 deg C and relative humidity of 50%.

b) No load loss shall be guaranteed corresponding to converter transformer set at principal tap[##] with nominal AC system voltage and nominal frequency. Also refer maximum guaranteed loss figures in table below:

c) The system shall meet various harmonic performance parameters on both AC side and DC side.

Design targets for HVDC station Reliability and Availability^^ and station guaranteed losses shall be as per Table-10.

Table - 10

1	Overall Energy availability of HVDC scheme (a) Overall Performance (b) Excluding transformer	 Not less than 97% Not less than 98%
2	Forced Energy Unavailability (FEU)	Not more than 0.6%
3	Schedule Energy Unavailability (SEU)	Not more than 1%
4	Single Pole outage per station per year	Not more than 8 (with average outage duration of 7.5 hours)
5	Bipole outage per station per year	Not more than 0.2 (with average outage duration of 8 hours)
6	No-load operating state losses	0.2 % of Bipole Rating per station
7	Load losses at operation with 100% rated active power and 100% rated reactive power at nominal DC Voltage	Max–1.0–% of Bipole Rating per station

##Principal tap is the Tap Position of converter transformers when HVDC converters shall be delivering 1 p.u. power (2500 MW, 0 MVAR) at nominal DC voltage at rectifier (± 500 kV) keeping AC system voltage 400 kV, 50 Hz at 40 deg C ambient temperature and humidity of 50%.

^^The details for calculating Availability are mentioned in ***'Appendix C.4'.***

For the loss guarantee stated above, following equipment/systems shall be considered:

a) Determination of losses

The total losses of the HVDC converter station other than HVDC valves shall be calculated as the sum of the losses determined for each individual equipment in line with IEC 61803. The major components to be included in the loss calculation and guarantees and the method of assessment for each component shall be as follows, as applicable:

1. Converter Transformers as per IEC 60076-57-129
2. Phase/ valve reactors
3. DC Smoothing Reactors
4. Converter Valves as per IEC 62751
5. High frequency damping circuits (if applicable)
6. Reactive Power Equipment, AC Filter
7. Auxiliary Power Transformers
8. DC Filters and 50 Hz blocking filter as per IEC 61803
9. Losses for RI and PLC filters
10. All items covered in IEC 61803

Specific Exclusion:

Equipment specifically excluded from the loss calculations shall be the oil treatment plant and firefighting load, station auxiliary system energy consumption (such as illumination of indoor and outdoor services, Air conditioning and ventilation system for control room, service building, kiosk, battery and battery charger etc.) except auxiliary power consumption required by Converter transformer cooling and Valve cooling system.

b) Guaranteed Failure Rate of Power module.

The maximum annual guaranteed Power module failure rate shall not exceed 1.0 % per pole per station. The failure rate shall not include failures directly attributable to operating and maintenance errors.

c) AC/DC HV Filter Capacitor Failure Rate Guarantee (If applicable)

The maximum guaranteed annual capacitor failure rate shall not exceed 0.15% except first unit failure. The capacitor shall be considered as failed if its Capacitance value varies more than ±5% of the (actual measured) name plate value or as indicated by manufacturer. Leakage of oil from the capacitor and deformation of the capacitor unit shall be considered as a failure even if the capacitance value is within the tolerance limits. Failure rate shall be

monitored on per pole per station basis.

d) Flashover Guarantee

Flashover is defined as breakdown of insulation for self-restoring insulation media which leads to outage as defined elsewhere in this specification. TSP shall guarantee that there shall be not more than two pollution related flashovers per station per year for DC yards (base environmental conditions as given in this specification will be considered). In case of a flashover, TSP shall make necessary investigations to establish the cause of the same, propose mitigation measures and implement the same.

e) Guaranteed Failure Rate of Relay Module/ C&P Module/Component

The guaranteed failure rate of relay module/ C&P module/ component shall not be more than 0.5% (except 1st unit failure). This will include individual circuit boards but not computers. The failures directly attributable to operation and maintenance errors and other incidents unrelated to the DC system shall not be included in the calculation. The relay module/ C&P module/ component failure rate shall be monitored on per pole per station basis.

47. Commissioning and start of operation

The purpose of commissioning period is to demonstrate to the Nodal Agency/Independent Engineer's satisfaction that the equipment is ready for its purpose and it functions satisfactorily under normal operating conditions. The testing and commissioning period will have the necessary duration to demonstrate the proper functioning of all the Project equipment and systems.

a) Site Testing

After the installation and preliminary adjustments of equipment, the Site tests shall be performed in the following stages:

- Erection checks
- Commissioning tests
- Sub-system tests
- Sub-system energization tests
- System tests

The site testing has been categorized in above stages for the sake of convenience only. There may be overlapping of two or more stages for particular tests. The TSP shall perform the site testing with complete responsibility.

The TSP shall provide all instruments, equipment and facilities required to perform these site tests. Calibration certificates for the test equipment shall be made available at site prior to the start of the testing.

All special and test equipment necessary to simulate devices or switching sequences and required for commissioning shall be provided by the TSP. Results of the site tests shall be well documented and shall form a part of plant documentation.

48. Mandatory Spares:

The mandatory spares for the HVDC Station shall be as per 'Annexure-B, 4. Mandatory spares for HVDC stations (substation/switchyard level)' of CEA's 'Guidelines for availability of spares and inventories for power transmission system, transmission lines and substation/switchyard) assets, 2020'.

The specific exclusion to the above list is Sl. No. 2.1, Converter Transformer. Other Converter Transformer spares from Sl. No. 2.2. to Sl. No. 2.41 to be provided.

Minimum one No. (single phase two winding) spare Converter transformers of each type and rating per station, shall be provided. The spare Converter Transformers shall be inclusive of all fitments, hardware, bushings, as well coolers if mounted on the tank, accessories and oil complete in all respect.

49. HVDC building:

The Building shall comprise of but not limited to the following facilities:

1. Control and Relay Panel room
2. ACDB and DCDB room
3. Battery room
4. Service Room cum workshop
5. Valve hall
6. Cooling system room
7. AHU Room
8. Valve Hall Ventilation Room
9. Any Other room/facilities as per functional requirement

50. For Type Test requirement of equipment, CEA's 'Guidelines for the Type Tests for major equipment of Power Sector' is to be followed.

51. TSP shall supply complete VSC HVDC control and protection replica system without

redundancy along with a real time simulator for both the poles based on project specification mentioned in this document. The software and hardware design philosophy of control and protection replica shall be based on the design of ± 500 kV, 2500 MW Khavda - South Olpad VSC HVDC system for the purpose of dynamic performance testing, commissioning, troubleshooting and optimization during operation and training. Figure-4 shows a general diagram of the scope of Control Replica.

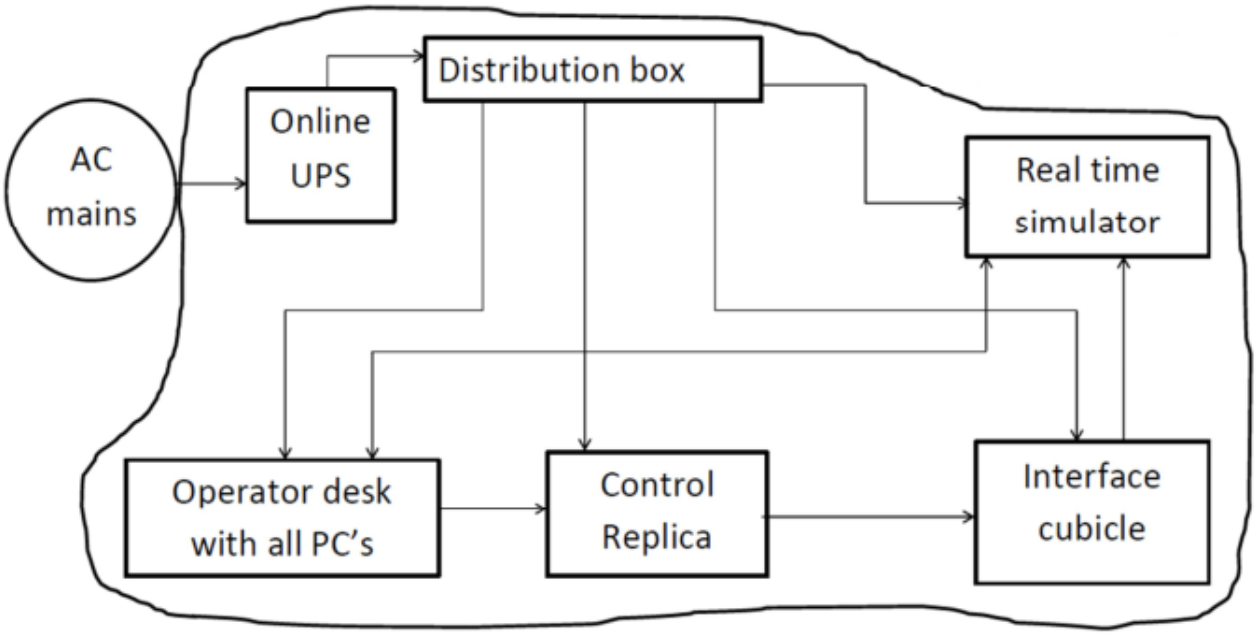


Fig 4 : Scope of contractor for Control Replica

As show in Figure-4, the supply shall include simulator interface panel, station HMI, Transient Fault Recorder, Station GPS clock, network equipment, Uninterrupted Power Supply (UPS) system, communication cables, cable trays/racks, tools and tackles, suitable furniture including operator desk, spares and other accessories required to implement the Control Replica. The dynamic performance test for 2500 MW Khavda – South Olpad HVDC VSC Bipole may be carried out with Control Replica, and the same shall be delivered to site after completion of site acceptance tests. The simulator shall contain AC network modelled as both voltage sources behind short circuit impedance and detailed AC equivalent network as provided to enable TSP to carry out test cases with both options.

52. Applicable Standards:

All equipment and material shall be designed, manufactured, tested and commissioned in accordance with latest Indian Standards / IEC or IEEE standards, / CIGRE guidelines and the Acts, Rules, Laws and Regulations of India. Some of them are as follows:

Table 11

Sr. No.	Description	Standard
1	Terminology for HVDC transmission	IEC 62747
2	High-voltage direct current (HVDC) power transmission using voltage sourced converters (VSC)	IEC TR 62543
3	Performance of voltage sourced converter (VSC) based high-voltage direct current (HVDC) transmission – Part 1: Steady-state conditions	IEC TR 63363-1
4	High-Voltage Direct Current (HVDC) installations - System tests	IEC 61975
5	High-Voltage Direct Current (HVDC) systems - Guidance to the specification and design evaluation of reactive power exchanges	IEC 62001 (1-5)
6	Bushings for DC Applications	IEC 65700
7	Insulation Coordination	IEC 60071 (1- 4,11,12)
8	Application guide for metal oxide arresters without gaps for HVDC converter stations	CIGRE report 33/14-05
9	Converter transformers	IEC 60076-57-129
10	Power transformers - Part 6: Reactors	IEC 600076-6
11	Shunt capacitors for AC power systems having a rated voltage above 1000 V	IEC 60871-(1-4)
12	Guidelines for the system design of HVDC project	IEC/TR 63127 Ed. 1.0
13	SYSTEMS WITH MULTIPLE DC INFEED	CIGRE 364
14	Guidelines on Asset Management for HVDC Installations	IEC/TR 62978 Ed. 1.0
15	Transformer for HVDC applications	IEC:60076-57-129
16	Surge Arresters – Metal Oxide Surge Arresters without gaps for HVDC converter stations	IEC: 60099-9-Part -9
17	Instrument Transformers	IEC 61869
18	Disconnectors and Earthing Switches	IEC 62271
19	Cyber Security	IEC 62443 IEC 27001
20	UPS, SMPS and Other Power supply units	IEC 62040 IEC 61558
21	Terminology for Voltage Source Converters for high-voltage direct current (HVDC) transmission.	IEC 62747
22	Power losses in voltage sourced converter (VSC) valves for high-voltage direct current (HVDC) systems - Part 2: Modular multilevel converters	IEC 62751
23	Voltage sourced converter (VSC) valves for high-voltage direct current (HVDC) power transmission - electrical testing	IEC 62501
24	Power losses in voltage sourced converter (VSC) valves for high-voltage direct current (HVDC) systems -: Modular multilevel converters- Part 1	IEC 62747

25	Testing and commissioning of VSC HVDC systems	CIGRE 697
26	Dynamic characteristics of inverter-based resources in bulk power systems	IEC 63401
27	IEEE Standard for Interconnection and Interoperability of Inverter-Based Resources (IBRs) Interconnecting with Associated Transmission Electric Power Systems	IEEE P2800-2022
28	Wind Energy Generation Systems	IEC-61400
29	TESTING AND MEASUREMENT TECHNIQUES - POWER QUALITY MEASUREMENT METHODS	IEC 61000-4-30
30	Other items as per relevant and prevailing standards specified elsewhere in the specification for substation works.	

i) CERC (Indian Electricity Grid Code) Regulations, 2023

ii) Manual on Transmission Planning Criteria, 2023

iii) CEA Technical Standards for Construction of Electrical Plants and Electric Lines Regulations, 2022

iv) CEA Technical Standards for Connectivity to Grid, Regulations, 2007 (including subsequent amendments)

Appendix- C.1

DC Voltage Measuring Equipment

A proven type of voltage divider shall be provided for DC voltage measurement. The accuracy of the device shall not vary more than 0.5% with an ambient temperature change of 50^{o}C. The overall voltage measuring system shall have an accuracy of at least 1.0% of full scale. The response time shall not be longer than 150 micro seconds, accepting an overshoot of up to 20% at that rise time. The measuring system shall achieve proper operation of the control and protection system to which it is connected.

The measurement range shall be sufficient to measure voltages up to 1.5 p.u. Preference shall be given to devices which provide isolation between the HV primary connection and the output signal. If the output signal is not completely isolated from the HV connection, protection shall be provided to limit the possible output signal voltages to less than 2 kV in the event of a fault on the device.

All low-level signals shall be cabled separately from high level signals. The divider shall be so arranged that no leakage current on the surface of the insulator can pass to the measuring circuit. The insulator shall for this reason be continuous without any metallic intermediate flanges. Furthermore, the interior of the divider shall be so arranged that interior leakage currents do not influence the measurement.

For voltage measuring equipment to be erected in the outdoor switchyard, it shall be ensured that discharge activity on the housing shall not cause interference with the output signal.

For each voltage measuring device furnished, all necessary auxiliary power plus any equipment necessary for the transformation of the auxiliary power to an acceptable form shall be provided. Such transformation equipment shall be mounted in the control cubicles.

For power quality measurement compatibility, the transducers including its interface with control and protection panels and display like Transient fault recorders should be compatible with IEC 61000-4-30 Class A in order to check compatibility with Grid Connectivity requirements over and above the requirements given above.

Direct Current Measuring Equipment

Direct Current Transducers supplied shall be mounted in bushings, if available. In locations where bushings are not available, free-standing transducers shall be provided. For each transducer furnished, the all-necessary auxiliary power plus any equipment necessary for the transformation of the auxiliary power to an acceptable form shall be provided.

The design of the measuring system shall be based on maximum interchangeability where any electronic module shall be compatible with any of the core and coil assemblies.

The transducer output signal shall be of sufficient magnitude to ensure that the content of the signal is usable at all levels of primary current from 1% to 300% of the rated current, with a measurement output possible up to 600% before saturation of the output signal occurs.

In the event of high current (up to 0.2s short circuit current), the DC CT shall remain unsaturated for 20 ms or longer. This time shall be measured from the instant the current attains 10 pu. The DC CT shall be provided with interlock circuits that indicate saturation of the DC CT, as well as DC CT faults.

It shall be ensured that any low-level signals generated are kept shielded from interference due to other higher voltage circuits. The low-level signals shall be cabled separately from high level signals.

It shall be ensured that all DC current measurement outputs are accurately calibrated with all the respective loads connected. Sufficient buffered outputs shall be provided at the time of the initial installation for all future output signal requirements. If required, on-site adjustments to output calibration shall be possible. The sensitivity of the devices supplied for such calibration shall be appropriate for setting the required accuracy.

The electronic module shall be provided with interlock circuits to indicate that the measuring system is fully operable.

Each transducer shall be provided with a capacitive tap.

In case of Optical DC measuring system, the materials used in it shall be non-corrosive in nature.

For power quality measurement compatibility, the transducers including its interface with control and protection panels and display like Transient fault recorders should be compatible with IEC 61000-4-30 Class A in order to check compatibility with Grid Connectivity requirements over and above the requirements given in this specification.

Stationary Accuracy

The composite accuracy of all DC current measurement systems used for protective purposes shall be equal to or better than ±2% of rated DC current up to 120% of the maximum rated current and ±10% of rated DC current up to 1.2 times peak calculated fault DC current.

All DC current measuring system used for control purposes shall have a composite accuracy of ±0.75% of rated DC current from minimum rated current to 120% of the maximum rated current and ±10% of rated DC current from 120% up to 300% of the rated current.

All transducers used for corresponding functions, e.g. pole differential protection etc shall have matching accuracies equal to or better than ±2% of rated current up to 300% of the rated current.

Dynamic Accuracy

The response of the measuring systems shall be such that a linear current change within 150%

of maximum rated current and with a rise time of 45 ms, is tracked by the transducer output with an error which does not exceed +0%, -2% of rated current on any point of the curve. The rise time is defined as the time required for the current to change from 10 to 90% of the full current change. The frequency response shall be within +3% at 1500 Hz.

Appendix C.2

Operator's Control, Monitoring and Support Systems

A. General Requirements

All hardware such as computers, computer peripherals/printers/ accessories, testing equipment etc and networking products shall conform to latest products based on industry standard. It shall be possible to fully monitor and control both stations as described below-

- Operation control of both converter station (from monitors) from Khavda
- Operation control of both converter stations (from monitors) from South Olpad
- In separate operation control mode, all the terminals shall be able to control their own station individually.

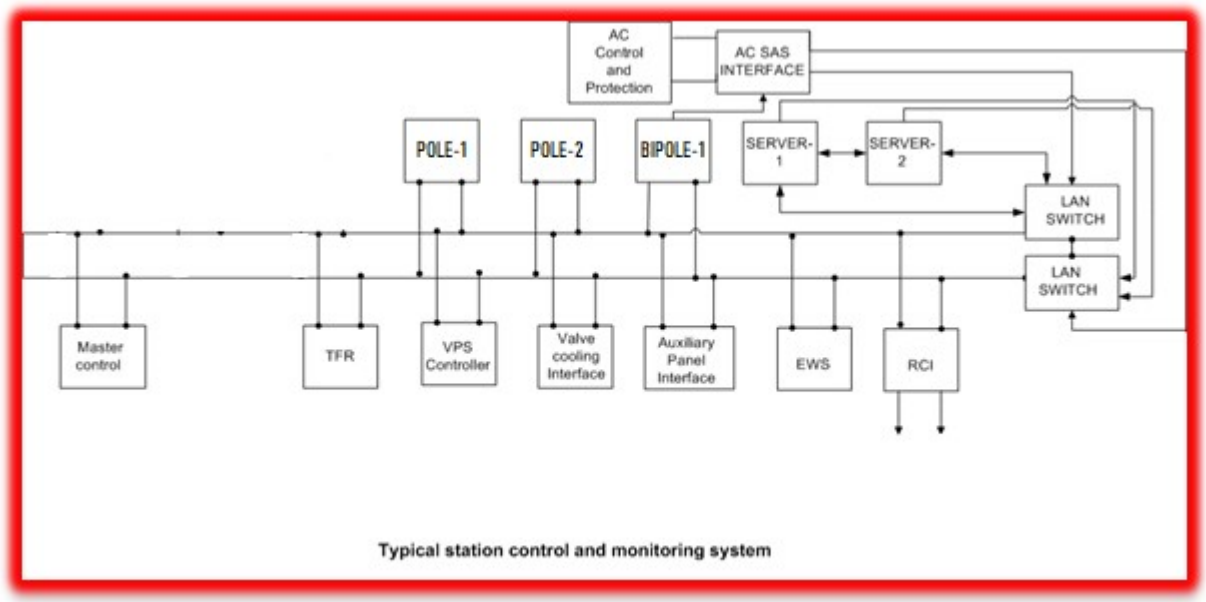
The above selection modes shall be separately provided for control of the DC system and the AC systems of either station.

A Station operator desk to be supplied at each converter station shall be able to control the stations. The control shall be possible from TFT Monitors and operator key board/ mouse. In the event of failure of the system, control and monitoring shall be by means of direct control at the Bipole control panels, circuit breaker controls panels etc. generally as shown in 'Figure-A'. This control could be made from PC connected to these control panels and necessary interface shall be provided to achieve this. The control functions to be provided from the equipment control panels shall include at least those listed under 'Table-A' and 'Table -B'. It shall also be possible for operator to know individual alarms by selecting the particular panel on the display monitor.

The TSP shall provide the equipment necessary for the purpose of control, status indication and metering of all equipment (keeping in view the intermediate Bay Kiosks to be provided in AC and DC yard,) Khavda and South Olpad.

The control room shall generally house the following equipment:

- Operator control, monitoring and support system
- DC line fault location equipment, if not integrated within C&P system.
- Transient fault recorders, if not integrated within C&P system.
- Master controller equipment, if not integrated within C&P system.
- Station fire alarm, control and monitoring panel



'Figure – A'

(System shall be redundant with system A and system B. Only one system has been represented.)

i. HVDC Controls

The station control room at each converter station shall have facilities that include, but not be limited to, the functions shown on Table-A and B

A description of major HVDC control functions is outlined below:

1. **Controlling Station (Master Station) Selector Switch**

Control location selector switches shall be provided in each station control room. These selector switches shall enable the operator to control the HVDC system and/or the HVAC yard of any converter station from either Khavda and South Olpad stations. HVDC and HVAC yard control and monitoring of other converter station shall be provided from TFT Monitors.

2. **Bipole Controls**

Bipole controls shall refer to the common control functions that affect both poles in a Bipole. These functions are typically Bipole power order, power direction, power limit and power ramp rate.

The power flow over the Bipole shall be maintained at the Bipole power order as set by the operator.

The power ramp rate shall control the timing sequence for loading Bipole at a pre-selected rate (within specified range) set by the operator.

The power limit control shall enable the operator to set different limits to Bipole loading. It shall also be possible to operate each pole separately from Bipole Controls.

3. **Pole/Converter Current Order/Limit**

The power setting divided by voltage shall determine the current order to either pole. However, this shall not preclude the ability to control each pole, by means of a directly entered manual current order signal.

The pole current limit set point shall enable the operator to raise/ lower current limits to optimize link capabilities under varying conditions such as ambient temperature, temporary reduction in capability etc.

4. **HVDC System Control Mode Selection (Per Pole)**

The following basic control modes shall be provided:

a) Active Power Control Mode
b) DC Voltage Control Mode

Disturbance free transfer of any pole from one control mode to another shall be possible.

5. **Miscellaneous Operator Controls**

a) DMR (Dedicated Metallic Return) Line Current Null Control

This control shall enable the operator to null the current flowing in the DMR (Dedicated Metallic Return) Line resulting from unequal sharing of load between poles during balanced operation.

b) Block/ Deblock

This control shall enable the operator to stop (block) or start (deblock) a converter. Automatic sequences shall be provided to fulfil preconditions for deblock. A normal stopping sequence initiated by “block" contact involves a sequence at each end that causes the voltage and current to drop to zero.

c) Pole Start/ Stop

This control shall enable start or stop of the complete pole, comprising converters at either of the rectifiers and the inverter and shall take care of all interlocks, start/stop preconditions and sequences automatically.

d) Direction of Power Transfer

Power flow shall be possible in both directions.

e) Pole Metallic Return/DMR (Dedicated Metallic Return)

This selector switch (or switches) shall enable an automatic sequence from Pole metallic return to DMR and vice versa. This mode change shall be possible even with power flowing in the DC system.

f) DC Filter Connect/ Isolate

Motorized disconnects are specified for switching the filter arms to allow disconnection of a faulty filter bank or arm and for restoration to service as quickly as possible. An automatic switching sequence shall be provided which shall take care of all the interlocks.

g) DC Line Isolator

DC line isolators are specified for maintenance purposes and their electrical operation in local shall be possible. Operation shall be permitted only with pole blocked and station ground connected. Automatic operation shall also be possible if required by any sequences subject to satisfying all interlocks permitting the operation.

h) Grounding Switches in DC Yard

Grounding switches are specified for the DC switchyard area to allow each isolatable section of bus to be grounded. Only local electrical operation is required. However, if operation of any grounding switches is part of any automatic sequence(s), or is specified elsewhere, then those grounding switch(es) shall be operable locally as well as remotely.

i) Valve Hall Ground Switches

Remotely controlled motor operated grounding switches are specified for the valve halls to protect maintenance personnel. The operation of all the valve hall ground switches together as a group shall be possible by initiating a sequence from the control room. Provision shall however be made (key operated switch) for defeating the interlock to permit entry of personnel into the restricted area of the valve hall.

j) Maintenance/Bypass Isolators for Metallic Return Transfer Switch / Bus (MRTS or MRTB)

Electrically local operated isolators shall be provided to establish a ground reference when MRTS is being maintained. These shall be interlocked with the MRTS.

k) Emergency Stop

An emergency stop button on pole basis shall be provided in the control room. Operation of this button shall automatically ramp down at a fast rate the direct power, lead to blocking of the converters and reach safe shut down with Operation of High speed parallel/ De-parallel switches.

l) HVAC Controls

HVAC controls shall consist of close-open operations for circuit breakers and motor operated disconnectors.

ii. Station Control Facilities

The TSP shall provide the control facilities from the operator control desk through a TFT monitor and keyboard/ mouse system. These facilities shall include all control operations, digital setting,

indicating devices, Station single line diagram and symbols, any other special control devices and meters required for control and monitoring of the complete HVDC system. The layout of the station single line diagram, together with control, indicating and metering devices on the control desk shall be logical, compact, and shall facilitate efficient supervision and operation of the station(s) by the operator.

iii. Station Level Status Supervision

The position of each switchgear e.g. Circuit breaker, isolator, earthing switch, transformer tap changer etc. shall be supervised continuously. Every detected change of position shall immediately be displayed in the single-line diagram on the station screen, recorded in the event list and an option to take hard copy printout of event list shall be available. Alarms shall be initiated in the case of spontaneous position changes.

The switchgear positions shall be indicated by two auxiliary switches, normally closed (NC) and normally open (NO), which shall give ambivalent signals. An alarm shall be initiated if these position indications are inconsistent or if the time required for operating mechanism to change position exceeds a predefined limit.

iv. System Indications and Power Measuring Facilities

The TSP shall provide DC and AC system / equipment indication facilities in the station control room at each converter station that shall include, but not be limited to, the functions shown on Table A and Table B. Alarms of slave stations shall be indicated and displayed both at Master Station and slave stations and vice-versa.

Graphic representation of valves and valve cooling piping network shall be provided on station monitoring system. The graphical representation shall also display faulty power modules in different colours indicating faulty power module position.

Pressure, temperature and relative humidity of each valve hall shall also be displayed in the control room. Alarm(s) shall be raised in case any of the parameters exceed limits.

'Table A' provides a list of minimum AC and DC metering facilities required, which shall be included on TFT monitors.

v. Energy Metering

Energy meters as per relevant CEA Guidelines and Specifications/Regulations for the 765 kV , 400 kV , 220 kV and 132 kV AC switchyards (as applicable) and 33 kV feeders at HVDC terminals shall be provided by the TSP.-

B. System Requirements

General

The main control and monitoring systems shall be configured as dual redundant computer-based systems in a main and hot standby configuration generally as shown in 'Figure A'. The operator control, monitoring and support system could be integrated with station control system. Outage of any subsystem or complete loss of one system shall not affect the control and monitoring of the HVDC station. The system shall be based on open system concept in hardware and software and industry standard communication protocols and graphical user interface.

The redundant, computer-based system shall accept control inputs from the Operator by means of TFT monitor/ mouse etc and send these commands to the HVDC and the HVAC control systems.

The system shall gather alarm, status and measurand data from the plant and display it to the Operator on the mimic diagram on TFT monitors, loggers etc. as further defined below. The system shall be so designed that no alarm and status data or control data shall be lost.

Table -A Controls and Indications at Khavda and South Olpad :-

Sl. No.	Signal Name	Khavda	South Olpad
	CONTROLS SIGNALS		
1.	Bipole power order	√	√
2.	Bipole power order ramp	√	√
3.	Bipole power order limit	√	√
4.	Bipole power/current control	√	√
5.	Power direction P1, P2	√	√
6.	Power/Current control P1, P2	√	√
7.	Current order setting	√	√
8.	Current ramp start/stop	√	√
9.	Current order ramp setting	√	√
10.	Current limit setting	√	√
11.	Master station transfer	√	√
12.	Metallic/DMR switching	√	√
13.	Reduced voltage on/off P1, P2	√	√
14.	Start/Stop and Block/deblock P1, P2	√	√
15.	Power Swing modulation on/off	√	√
16.	DC power /current control	√	√
17.	Emergency stop P1, P2	√	√
18.	Frequency control/on/off	√	√
19.	Frequency target/limits	√	√
20.	Connect/isolate P1, P2	√	√
21.	Joint/separate, Sync/Async	√	√

Sl. No.	Signal Name	Khavda	South Olpad
22.	DC Filter connect/isolate P1, P2	√	√
23.	RPC auto/man off switching	√	√
24.	RPC Volt/Reactive Selection	√	√
25.	RPC MVAr/Voltage set points	√	√
26.	Open line test auto/man P1, P2	√	√
27.	AC Filter (bank/ sub-bank) breaker open/close	√	√
28.	Conv. Trans Breaker open/close	√	√
29.	AC Filter (bank/sub-bank) Disconn open/close	√	√
30.	Conv. Trans Disconn open/close	√	√
31.	Tap changer auto/man P1, P2	√	√
32.	Valve hall Gr. Switch open/close P1, P2	√	√
33.	Khavda Sw. yard Breaker open	√	√
34.	South Olpad Sw. yard Breaker open	√	√
35.	Sub Synchronous Resonance Detected	√	√
36.	Sub Synchronous Damping Control Activated,	√	√
37.	Power Oscillation Damping Activated	√	√
38.	Sub Synchronous Control Interaction Detected	√	√
39.	Sub Synchronous Control Damping activated	√	√
	INDICATIONS		
40.	DC OP Mode Pwr./current	√	√
41.	Gr/metallic return indication. P1, P2	√	√
42.	Power direction P1, P2	√	√
43.	Pole Telecommunication healthy	√	√
44.	Pole blocked/deblock P1, P2	√	√
45.	Master station Khavda-South Olpad- LDC	√	√
46.	STATCOM Mode on	√	√
47.	Power ramp in progress	√	√
48.	Stabilization control on/off	√	√
49.	Full/reduced DC voltage indication P1, P2	√	√
50.	Tap changer Auto/Man indication.	√	√
51.	Pole connect/isolate indication.	√	√
52.	Power direction normal/reverse	√	√
53.	Runback activated indication.	√	√
54.	Frequency control on/off	√	√
55.	Frequency control activated	√	√
56.	AC bay Circuit breakers indication Phase wise.	√	√

Sl. No.	Signal Name	Khavda	South Olpad
57.	AC bay disconnectors indication.	√	√
58.	Bypass Breaker Indication Phase wise	√	√
59.	Pole Discharge Switch Indication	√	√
60.	DC filter con/isolated indication.	√	√
56.	Grid Forming Mode Enabled	√	√
57.	Grid Following Mode Enabled	√	√
58.	Virtual Synchronous Machine Mode Active	√	√
59.	DC Voltage Control Station	√	√
60.	Active Power Control Station	√	√
61.	HVRT / LVRT Activated	√	√

Table -B Indication Signals to RLDC

S. No	Signal Name	RLDC
1.	Bipole power order	√
2.	Power Swing modulation on/off	√
3.	DMR/metallic return indication. P1, P2	√
4.	Pole blocked/deblock P1, P2	√
5.	Runback activated indication.	√
6.	Frequency control on/off	√
7.	Frequency control activated	√
8.	Full/reduced DC voltage indication.	√
9.	AC bay Circuit breakers indication.	√
10.	AC bay disconnectors indication.	√
11.	DC Power Bipole	√
12.	DC Line current/ voltage P1. P2	√
13.	AC side A/MW/MVAR/ P1, P2	√
14.	AC Filter/Cap A. MVAR all banks	√
15.	AC Lines A/MW/MVAR/	√
16.	Station/AC system MW exchange	√
17.	Station/AC System MVAR exch.	√
18.	AC Bus Voltage	√
19.	AC Bus Frequency	√

The system shall also be designed to allow input of signals from the Dispatch centre - for example, load frequency control (LFC) signals. The system shall be capable of meeting the control and monitoring requirements of each converter station and LDC while operating at maximum rating, with a reserve capacity of minimum twenty-five per cent. Equipment bins that

are not fully equipped with cards shall be fully wired and be ready to accept additional cards. Power supply units shall be rated to meet the full capacity requirements.

C. Functional Requirements

1. General

The redundant computer-based system shall be a highly reliable integrated system, which shall provide Operator's interface, alarm and monitoring system and operator guidance/ expert system.

The high-voltage apparatus within the station shall be operated from different places:

- Remote control centres
- Station operator control.
- Local Bay controller IED (in the bays)

Operation shall be possible by only one operator at a time. The operation shall depend on the conditions of other functions, such as interlocking, synchro-check etc.

2. Run Time Command Cancellation and Self-Supervision

Command execution timer (configurable) must be available for each control level connection. If the control action is not completed within a specified time, the command should get cancelled. Continuous self-supervision function with self-diagnostic feature shall be included.

3. User Configuration

The monitoring, controlling and configuration of all input and output logical signals and binary inputs and relay outputs for all built-in functions and signals shall be possible both locally and remotely.

It shall also be possible to interconnect and derive input and output signals, logic functions, using built-in functions, complex voltage and currents, additional logics (AND-gates, OR gates and timers). (Multi-activation of these additional functions should be possible).

The Functional requirement shall be divided into following levels:

a) Bay Level Functions.
b) System Level Functions.

D. Computer Information System Requirement:

A computer-based information system shall perform following functions:

- Initiation of commands to control HVDC system.
- Control and monitor the Valve cooling system.

- Monitoring of process data to give brief overview as well as a comprehensive view of each subsystem.
- Sequence of event recording and alarm system including determination of Event Categories (major, warning, alarm).
- Process data archiving and trending.

Soft copy of complete station documentation shall be available on Operator Work Stations.

All the system trends shall be available at least for one-year period and retrievable on demand from the main storage system. The process data logging shall have hourly/ daily logging of station data. Archiving and back up storing facility of the log sheets shall be possible and facilities taking backup on External hard discs/ Drives minimum 2 tera bytes shall be provided.

E. Remote Control, Monitoring and Tele Control systems

The TSP shall provide facilities for coordinated control and monitoring of the HVDC system. All required remote control and remote monitoring facilities shall be provided at each converter station. Complete remote monitoring of each converter station shall be possible from opposite converter station. The HVDC tele-control system equipment shall be used in the processing of signals to be transmitted over the fibre optic communication system between the converter stations of Bipolar scheme.-

Appendix C.3

Transient Fault Recorders

1. General

The transient fault recorders (TFR) shall continuously monitor the power system. These could be integrated with operator control and monitoring system or supplied as standalone units.

Below requirements are specified for standalone units. Similar functional requirements will be applicable for integrated TFR.

One recorder per pole shall be provided at each converter station. The TFR may be provided in the form of central unit together with Data Acquisition Units (DAUs). Initiation by any one of the fault detecting sensors or external initiating contacts shall cause the fault recorder to record on all channels. The record shall comprise-fault information, time of fault information and post fault information. The TSP shall determine the number of analog and event inputs required for each recorder and supply these number plus minimum 25% spare channels. The TFR shall also have facility for harmonic analysis upto 100^{th} harmonics, inter-harmonics of waveforms. Transient fault recorders should be compatible with IEC 61000-4-30 Class A in order to check compatibility with Grid Connectivity requirements over and above the requirements given below. It should also be compatible for checking DC harmonic performance values.

Recorders shall be of solid-state modular construction microprocessor based and without moving parts. First in, first out (FIFO) printing logic shall be used. The necessary software for directly analyzing the records on the memory of the TFR shall also be supplied.

Facilities shall also be provided for data retrieval from TFR and analyse by means of a master station based on compatible PC having minimum configuration of 2.8 GHz clock speed, 1 TB hard disc and 16 GB RAM capacity, complete with 24-inch LED monitor, keyboard/ mouse etc and include laser colour printer with capability to print on A3 and A4 size paper. All necessary software package(s) along with facility to communicate between TFR and PC shall be provided by the TSP.

2. Input Signals

The input signals and starting sensors required for the HVDC system for commissioning and operation shall be determined by the TSP. The input signals to each fault recorder system for a pole shall include, but not be limited to, the following:

- Converter module voltage;
- Converter arm current
- Converter module energy

- Reactive Power Control Values Active Power Control Values Control references and limits e.g. Id, Iq,Vdc, Pdc. .
- Pole Voltage Order
- Active and Reactive power order
- AC Voltage (Converter)
- Real and Reactive Power Measurement Values
- Real and reactive current Measurement Values
- Pole current order;
- DC line voltage (own pole);
- DC line voltage (other pole);
- DC neutral Bus voltage (Both poles)
- DC line current (own pole);
- DC line current (other pole);
- DC power (each pole and both converters)
- DC power (other pole and both converters)
- DC line to Line Voltage
- Line-Line DC voltage Reference value for the DC voltage control
- DC line current limitations
- Current order
- AC bus voltage (3 phases);
- AC current to each valve group and transformer primary currents.
- Positive Sequence Filtered Current as RMS value (network side)
- Positive Sequence Filtered Current as RMS value (converter side)
- Converter transformer Primary and Secondary voltages.
- Positive Sequence Filtered Line-Line Voltage Line side
- Positive Sequence Filtered line to line Voltage converter side
- AC Positive Sequence filtered Frequency
- DC Current in DMR line
- DC Neutral Current (Own Pole)
- DC Neutral Current (Other Pole)
- Ground Current on DC Side grounding point

The Triggering of TFR shall include all protection initiations and following inputs:

- Pole Block/ Deblock
- Pole gate triggering loss
- Pole last Breaker opened
- Pole DC Protection Voltage level trigger
- Converter Protection operated along with different types
- Pole MR/ GR sequence initiated
- AC Over voltage/ under voltage Protection operated.
- Full voltage/ RVO Changeover

- DC O/V, U/V
- Telecommunication Fail.
- Converter Status including Converter/ Pole Block/ Deblock/ESOF/Transmission status/Rectifier/Inverter etc
- Pole PMR/ DMR sequence initiated
- Binary Converter Status Signals

Each fault recorder shall be equipped with suitable input circuits and starting sensors for all of the input signals. The TSP shall ensure that the characteristics of the input circuits and starting sensors are well matched to the characteristics of the signal sources.

3. Electrical Characteristics

(i) Monitoring Systems

The recorder shall be a digital based type. Operation of the equipment shall be based on programs stored in non-volatile solid-state memory. Programs shall be stable and no inadvertent change of program(s) shall occur.

The recorder shall be equipped with a built-in post fault record- length timer, adjustable over a range of 0.5 to 10 seconds after the fault.

Normally open operation alarm contacts shall close while the fault recorder system is operating and be utilized as inputs to the alarm monitoring and reporting system. A three digit, manually resettable operations counter shall be provided that indicates the number of faults or disturbances recorded.

Facility for automatic storage of information to a PC or an independent storage device (e.g. a disc drive) shall be provided. The output shall be possible to be printed on plain paper in the A4/A3 format.

The recorded information shall include but not necessarily be limited to:

- Station Identification
- Identity of trigger source
- Record Identification for Analog, Event and Sensor traces
- Date/ Time: Year, Day, Hour, Minute, Second, Millisecond
- Analog traces
- Event traces
- Sensor traces
- Time marker trace which shall allow time interpolation of records to 2 ms.
- Start of record line.

(ii) Operations

The fault recorder shall continuously monitor the power system. Initiation by fault detecting sensors or by other input contacts or pre-selected events shall cause that particular recorder to

record the fault information. The other pole recorder shall also record in a slave mode. Operation of any one of the initiating sensors shall start the recording mechanism or otherwise cause all channels to record until the fault clears or the record-length timer setting is exceeded.

The transient fault recorder shall have facility for suitable interface for transmission of recorded analog and digital information to a remote station. This shall be demonstrated by the TSP at site by using inter-station communication.

(iii) Input Circuitry

The input circuits for the recording channels shall be insulated for operation at potentials of 2000 Vrms between channels and between channel and ground. Each input recording channel shall be capable of operating from the output of 1A rms nominal secondaries of current transformers and capacitive voltage transformers with 63.5 V rated secondary. Each channel shall be supplied with a selection of current shunts and voltage multipliers to provide a range of high and low current or voltage ranges which can be selected by straps or similar method. The recorder shall also be capable of operating from the DCCT's and direct voltage devices supplied for the station. Any device required for processing of input signals in order to make them compatible to the equipment shall form an integral part of the supplied equipment. However, such processing of input signals shall in no way distort its waveform. The equipment shall be carefully screened, shielded, earthed and protected as may be required for its safe functioning. It shall be possible to position the reference point of any of the analog channels to any position on the record. The individual traces shall be identified on the record by numbering them in the order they are connected at the input.

The current values of scaling parameters related to the various channels shall be printed on each printout to enable quick interpretation of the records.

(iv) Starting Sensors

The initiating or detecting devices, which start the recording, shall be solid state and automatic self-resetting type.
Each sensor shall be equipped with an indicating lamp, viewable from the front of the cabinet, which operates when the sensor operates. The lamp shall remain 'on' until reset by the station operator. Failure to reset the lamp shall not affect subsequent operation of the sensor. Sensor settings shall be easily adjustable and easily accessible. One starting sensor for at least each of the following types of changes shall be provided.

- Level Changes Over Current Over Voltage Under voltage
- Swing Rate of change of nominal input
- Frequency
- Under frequency
- Over frequency

It shall be possible to adjust the response time of the sensors, in each case, to ensure the most rapid operation consistent with the characteristics of the analogue quantity being monitored.

It shall also be possible to initiate the fault recording, as required, by additional external relay contacts, either NO or NC.

(v) Pre-fault Periods

The recording system shall accurately record power system transient disturbances with a pre-fault period, which shall be settable between 50 to 250 ms.

(vi) Memories

Sufficient memory shall be provided to prevent any loss of records under all normal operating circumstances.

(vii) Time

A means shall be provided to record on the chart the time of occurrence of each fault or disturbance to a resolution of 2 milliseconds or better. The time clock shall be synchronized with the station master clock signal. Facility shall exist to display the time in hour, minutes and seconds on the front of the panel.

(viii) Calibrations

The recording system shall be so designed that each channel may be calibrated separately. Calibration shall be accomplished by applying the calibration level input in the test switches. Controls and switches shall be provided on the front panel to facilitate calibration.

(ix) Resolutions

a) Analog resolution

Analog to digital conversion shall be 12 bits (minimum). The amplitude of the recording shall be adjustable and magnification in fixed steps, of the recording, shall be provided.

b) Events Resolution

The event resolution at the lowest scan rate shall be two milliseconds or better.

c) Transient Response (analog channels)

The transient response delay of the analog input conditioning circuits to a step function input shall be less than 400 microseconds between 10% and 90% values of the step function with overshoot of the final value of the step function being not more than 2%.

(x) Recording Quality

Static trace width	1.5 mm maximum
Residual channel noise	0.1% of full-scale maximum at 50 Hz or any harmonic thereof

Recording resolution	0.1% of full scale
Phase error between channels	Less than 5 degrees at 50 Hz
Crosstalk	Lower than 50 dB (DC to 1500 Hz)

Scale alteration/ expansion facilities shall be provided.

(xi) Alarm Circuits and Indicators

Alarm circuits shall be provided to indicate inability for automatic operation due to power failure, out of paper condition, incorrect switch positioning or other failure(s), which shall be prominently visible on the recorder panel. Each alarm circuit shall include a normally open contact which shall be integrated into the station alarm monitoring and reporting system.

(xii) Power Requirements

The recording system shall be suitable for operation from the station battery supply. There shall be no loss of accuracy in the recording system for specified variations of DC input voltage.

Transient fault recorders should be compatible with IEC 61000-4-30 Class A in order to check compatibility with Grid Connectivity requirements over and above the requirements given below. It should also be compatible for checking DC harmonic performance values. Most stringent of requirements defined above should be considered.

Appendix C.4

DEFINITIONS

OUTAGE TERMS

1. Outage

   The state in which equipment or a unit of equipment is unavailable for normal operation due to an event directly related to the same equipment or some unit of equipment.

2. Scheduled Outage

   Scheduled outage is an outage which can be scheduled at least one week in advance. This includes planned maintenance, normally conducted on annual basis, and also unplanned maintenance or repair which can be deferred at least one week subsequent to discovery of the need for maintenance or repair. If the outage is extended due to additional work which would have otherwise caused a forced outage, the excess period is counted as a forced outage.

3. Forced Outage

   The state in which equipment is unavailable for normal operation, but is not in the scheduled outage state, i.e. an outage which is not a scheduled outage.

4. Pole Outages

   An outage which causes a reduction in the Bipole DC power system transfer capacity equal to or less than the power rating of one pole

5. Bipole Outages

   An outage which causes a reduction in the bipolar DC system power transfer capacity greater than the power rating of one pole

CAPACITY TERMS

1. Maximum Continuous Capacity (Pm)

   The maximum bipolar HVDC system capacity (MW) for which continuous operation under normal conditions is possible referred on to the rectifier DC bus, i.e. 2500 MW.

2. Outage Capacity (Po)

The capacity reduction in MW which the outage would have caused if the HVDC system were operating at its maximum continuous capacity (Pm) at the time of the outage.

3. Outage Derating Factor (ODF)

   The ratio of outage capacity (Po) to maximum continuous capacity (Pm). ODF = Po/Pm

OUTAGE DURATION TERMS

1. Actual Outage Duration (AOD)

   The time elapsed in hours between the start and the end of an outage. The time shall be counted to the nearest 1/10th of an hour. Time less than 1/10 of an hour shall be counted as having duration of 1/10 of an hour.

2. Equivalent Outage Duration (EOD)

   The actual outage duration (AOD) in hours, multiplied by the outage derating factor (ODF), so as to take account of partial loss of capacity.

   EOD = AOD x ODF

   Each equivalent outage duration may be classified according to the type of outage involved, i.e. equivalent forced outage duration (EFOD) and equivalent scheduled outage duration (ESOD).

TIME CATEGORIES

1. Period Hours (PH)

   The number of hours in the reporting period.

   In a full year the Period Hours are 8760 h (8784 h for a leap year). If the equipment is commissioned part way through a year the period hours shall be proportionately less than 8760 h. (This shall not be applicable for verification of guarantees).

2. Actual Outage Hours (AOH)

   The sum of actual outage durations within the reporting period

   AOH = ∑ AOD

   The actual outage hours (AOH) may be classified according to the type of outage involved, i.e. AFOH and ASOH.

3. Equivalent Outage Hours (EOH)

   The sum of all equivalent outage durations within the reporting period.

   EOH = ∑ EOD

   The equivalent outage hours may be classified according to the type of outage involved, i.e. equivalent forced outage hours (EFOH) and equivalent scheduled outage hours (ESOH).

   If outage duration overlaps the beginning or end of a reporting period, only the EOD which lie within the reporting period shall be included in EOH.

AVAILABILITY AND RELIABILITY TERMS

1. Energy Unavailability (EU)

   Energy unavailability is a measure of the energy which could not have been transmitted due to (scheduled and forced) outages.

   Energy Unavailability % (EU) = EOH/PH x 100

   Forced Energy Unavailability % (FEU) = EFOH/PH x 100

   Scheduled Energy Unavailability % (SEU) = ESOH/PH x 100

2. Energy Availability (EA)

   A measure of the energy which could have been transmitted except for limitations of capacity due to outages, arising from any cause, either forced or scheduled.

   Energy Availability % (EA) = (100 - EU)

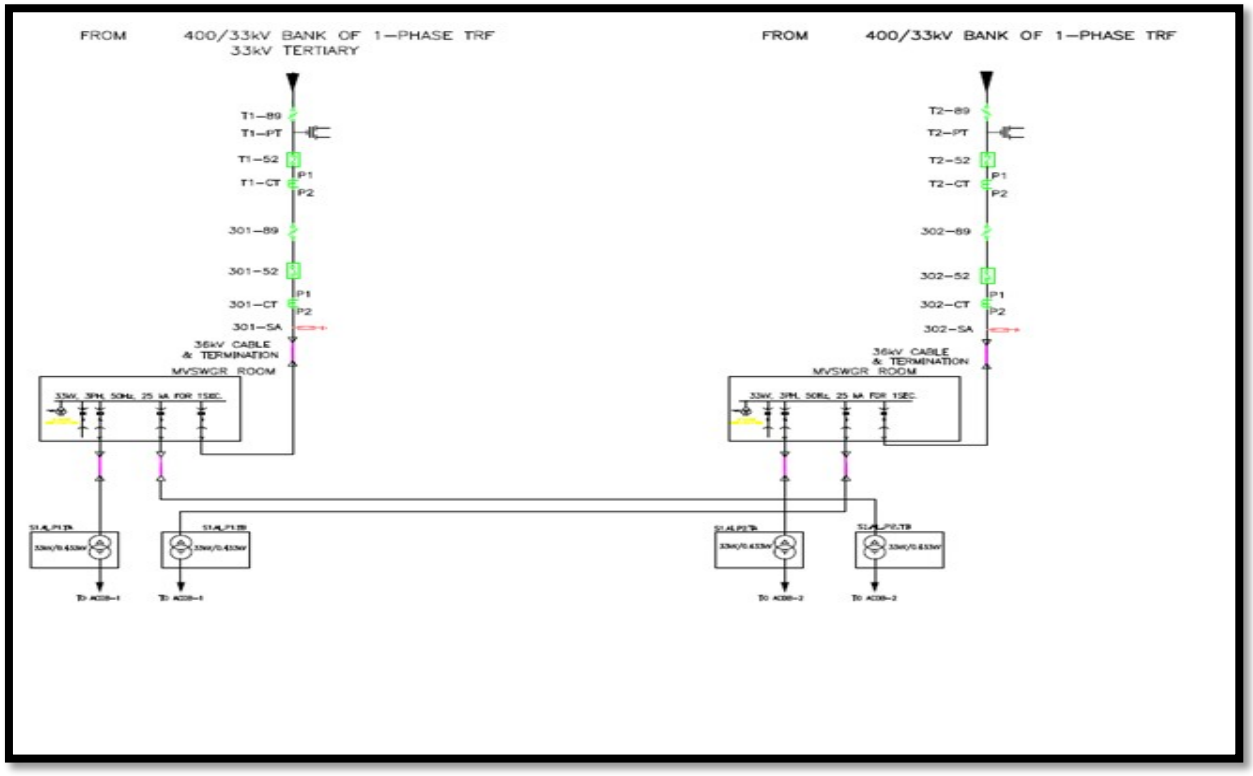
3. Energy Utilisation (U)

   A factor giving a measure of energy actually transmitted over the system.

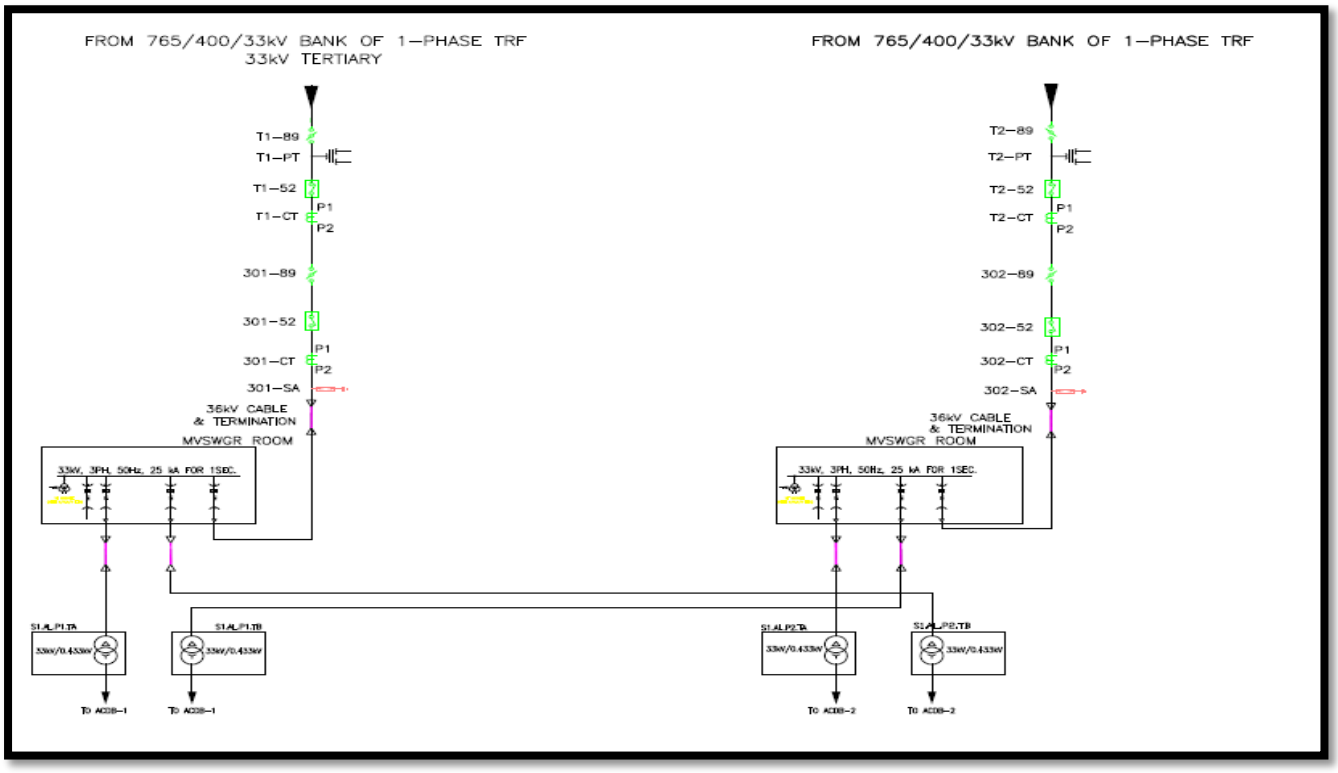
   Energy Utilisation % (U) = [Total energy transmitted/ (Pm x PH)] x 100]

Appendix-C.5

For KPS3:



For South Olpad:



Annexure – E1

SPECIFIC TECHNICAL REQUIREMENTS FOR ±500 kV HVDC TRANSMISSION LINE

A.1.0 The design, routing and construction of HVDC transmission lines shall be in accordance with CEA (Technical Standards for Construction of Electrical Plants and Electric Lines) Regulations 2022, as amended from time to time. Other CEA Regulations and MoP guidelines, as applicable, shall also be followed.

A.2.0 Selection of tower type shall be made as per CEA Regulations, however in case lattice type towers are used, the following shall also be applicable:

A.2.1 Steel section of grade E 250 and/or grade E 350 as per IS 2062, only are permitted for use in towers, extensions, gantry structures and stub setting templates. For towers in snowbound areas, steel sections shall conform to Grade-C of IS-2062.

A.2.2 Towers shall be designed as per IS-802:2015, however the drag coefficient of the tower shall be as follows: -

Solidity Ratio	Drag Coefficient
Up to 0.05	3.6
0.1	3.4
0.2	2.9
0.3	2.5
0.4	2.2
0.5 and above	2.0

A.3.0 Transmission Service Provider (TSP) shall adopt any additional loading/design criteria for ensuring reliability of the line, if so desired and /or deemed necessary.

A.4.0 Transmission line shall be designed considering wind zones as specified in wind map given in National Building Code 2016, Vol.1. The developer shall also make his own assessment of local wind conditions and frequent occurrences of high intensity winds (HIW) due to thunderstorms, dust-storms, downburst etc. along the line route and wherever required, higher wind zone than that given in wind map shall be considered for tower design for ensuring reliability of line. Further, for transmission line sections passing within a distance of 50 km from the boundary of two wind zones, higher of the two wind zones shall be considered for design of towers located in such sections.

A.5.0 Selection of reliability level for design of tower shall be as per CEA Regulation (Technical Standards for Construction of Electrical Plants and Electric Lines) Regulations 2022, as amended from time to time.

A.6.0 A) For power line crossing of 400 kV or above voltage level (if crossed over the existing line), large angle and dead-end towers (i.e. D/DD/QD) shall be used on either side of power line crossing.

B) For power line crossing of 132 kV and 220 kV (or 230 kV) voltage level, angle towers (B/C/D/DB/DC/DD/QB/QC/QD) shall be used on either side of power line crossing depending upon the merit of the prevailing site condition and line deviation requirement.

C) For power line crossing of 66 kV and below voltage level, suspension/tension towers shall be provided on either side of power line crossing depending upon the merit of theprevailing site condition and line deviation requirement.

D) For crossing of railways, national highways and state highways, the rules/regulations of appropriate authorities shall be followed.

A.7.0 The relevant conductor configuration shall be as follows: -

i. Type of conductor: ACSR / AAAC / AL59

Basic parameters for Transmission Line associated with HVDC Bipole link:

Transmission line	ACSR Conductor specified	AAAC conductor based on 53 % conductivity of AL Alloy (Size as per IEC-1089)	Minimum size of AL59 conductor based on 59% conductivity of AL Alloy (Size as per Swedish -SS-420814)	Sub-conductor Spacing
±500 kV HVDC transmission lines *(Quad bundle configuration per pole)*	Lapwing: Strandin 45/4.78 mm-Al - 7/3.18 mm-Steel 38.22 mm diameter 807.5 mm^2 Aluminium area; Maximum DC Resistance at 20°C (Ω/km): 0.0358; Minimum UTS 188.0 kN	Stranding details 61/4.38mm, 39.5 mm diameter; 921 mm^2 Aluminium alloy area; Maximum DC Resistance at 20°C (Ω/km): 0.0361; Minimum UTS: 244.0 kN	Stranding details 61/4.36mm, 39.2 mm diameter; 910 mm^2 Aluminiun alloy area; Maximum DC Resistance at 20°C (Ω/km): 0.0326; Minimum UTS: 199.0 kN	457 mm

Note: The transmission lines shall have to be designed for a maximum operating conductor temperature of 85 deg C.

A.8.0 The required pole to pole spacing shall be governed by the tower design as well as minimum live metal clearances under different insulator swing angles. However, pole to pole clearance shall not be less than 12.5 m.

A.9.0 All electrical clearances including minimum live metal clearance, ground clearance and minimum mid span separation between earth wire and conductor as given below shall be considered:

1) Minimum live metal clearances for ±500 kV line:

a.(i) Swings and Clearances:

Wind Pressure Condition	Minimum Electrical Clearance
a) Swing angle (0º)	3.75 m

(ii) Swings and Clearances: For Jumper

Wind Pressure Condition	Minimum Electrical Clearance
a) Swing angle (0º)	3.75 m
b) Swing angle (15º)	3.15 m
c) Swing angle (57º)	1.1 m

(b) Minimum ground clearance: 12.5 m

c) Minimum mid span separation between earthwire and Pole conductor: 9.0 m

A.10.0 Shielding angle shall not exceed 10 deg for Pole.

A.11.0 Two numbers of Dedicated Metallic Return (DMR) line shall be provided for the ±500 kV HVDC transmission line. Design and selection of conductor of DMR shall be done by the TSP based on sound engineering practice, minimum power losses, meeting the statutory clearances and other technical requirement of RfP.

A.12.0 At least one out of two earth wires shall be OPGW and second earth wire, if not OPGW, shall be either of Galvanized Stranded Steel (GSS) or Aluminum Alloy Conductor Steel Reinforced (AACSR) or any other suitable conductor type depending upon span length and other technical consideration. However, minimum size of Galvanized Stranded Steel (GSS) shall be 7/4.5 mm and diameter 13.50 mm.

A.13.0 Each tower shall be earthed such that tower footing impedance does not exceed 10 ohms. Pipe type or Counterpoise type earthing shall be provided in accordance with relevant IS. Additional earthing shall be provided on every 7 to 8 km distance for direct earthing of both shield wires. If site condition demands, multiple earthing or use of earthing enhancement compound shall be used.

A.14.0 Pile type foundation shall be used for towers located in river or creek bed or on bank of river

having scourable strata or in areas where river flow or change in river course is anticipated, based on detailed soil investigation and previous years' maximum flooddischarge of the river, maximum velocity of water, highest flood level, scour depth and anticipated change in course of river based on river morphology data of at least past 20 years to ensure availability and reliability of the transmission line.

A.15.0 Transmission line route shall be finalized, in consultation with appropriate authorities so as to avoid the habitant zones of endangered species and other protected species. Bird diverters, wherever required, shall be provided on the line. In order to optimize the route use of GATISHAKTI platform shall also be made.

A.16.0 The transmission lines shall be designed with porcelain/glass/ Composite Insulators as per site pollution severity level in the concerned area. However, minimum creepage distance and insulator length shall be as per follows:

Sl. No.	Description	Type of Insulator	Insulator for ±500 kV HVDC Transmission Lines
1.	Minimum Creepage Distance for both Light and medium as well as for Heavy and very heavy pollution level	Composite Insulator	27500 mm
	Minimum Creepage Distance for Light and medium pollution level	Porcelain/Glass Insulator	22345 mm
2.	Minimum length of insulator	Composite/ Porcelain/Glass Insulator	6970 mm

A.17.0 Wherever, transmission lines are passing through cyclone prone areas i.e. areas upto 60 km from coast following shall also be applicable:

a) Terrain category-I, with terrain roughness factor (K2) of 1.08 shall be considered for tower design.

b) Importance factor for cyclonic region (K4) of 1.3 shall be considered for tower design.

c) The number of consecutive spans between the section points/ angle point shall not exceed 10 spans or 3km instead of conventional practice of 15 spans or 5km, in order to reduce the failure of such towers in coastal areas due to cascading effect. The section shall be terminated with tension tower/ angle tower and angle of deviation should be based on the site requirement.

A.18.0 Wherever, transmission lines are passing through cyclone prone areas (i.e. areas upto 60 km from coast)/ creek regions/ aggressive soil areas following shall also be applicable:

d) The fabricated tower parts and stubs shall have a minimum overall zinc coating of 900 g/m^2 of surface area except for plates and sections below 5 mm thickness which shall have a minimum overall zinc coating of 610 g/m^2 of surface area. The average

zinc coating for all sections and plates of 5 mm and above thickness shall be maintained as 127 microns and that for plates and sections below 5 mm shall be maintained as 87 microns.

e) Ready mix concrete of M30 Grade shall be used to avoid use of locally available saline water. However, design mix concrete of M30 Grade conforming to IS 456 with potable water can be used at locations where transportation of ready-mix concrete is not feasible. Minimum cement content in any case shall not be less than 330 kg/m^3.

f) The surface of the reinforced steel shall be treated with epoxy-based coating to enhance corrosion performance of foundation. Use of epoxy coated reinforcement in foundation shall be as per IS 13620. In addition, two (2) coats of bituminous painting of minimum 1.6 kg/m^2 per coat shall be applied on all exposed faces of foundation (i.e. pedestal and base slab).

g) Double coat of 20 mm thick cement plaster shall be provided on all exposed concrete surface up to 300 mm below ground level to give protection to concrete surface from environmental and saline effect.

h) Before coping of chimney top portion, three coats of anti-corrosive paint of minimum 30-35 microns dry film thickness each shall be applied on the stub in the 50 mm coping portion as well as up to 350 mm above CL portion.

A.19.0 The raised chimney foundation is to be provided in areas prone to flooding/water stagnation like paddy field /agricultural field and undulated areas to avoid direct contact of water with steel part of tower. The top of the chimney of foundation should be at least above HFL (High Flood Level) or the historical water stagnation/ logging level (based on locally available data) or above High Tide Level or 500 mm above Natural Ground level (whichever is higher).

A.20.0 The TSP shall abide by the Guidelines of CEA w.r.t. shifting of transmission lines for NHAI projects and other projects.

A.21.0 Safety precautions in regard to gas/oil pipelines in vicinity of Transmission lines shall be taken in coordination with gas/ petroleum authorities.

Annexure – E2

SPECIFIC TECHNICAL REQUIREMENTS FOR HVAC TRANSMISSION LINE

A.1.0 The design, routing and construction of transmission lines shall be in accordance with Chapter V, Part A of CEA (Technical Standards for Construction of Electrical Plants and Electric Lines) Regulations 2022, as amended from time to time. Other CEA Regulations and MoP guidelines, as applicable, shall also be followed.

A.2.0 Selection of tower type shall be made as per CEA Regulations, however in case lattice type towers are used, the following shall also be applicable:

A.2.1 Steel section of grade E 250 and/or grade E 350 as per IS 2062, only are permitted for use in towers, extensions, gantry structures and stub setting templates. For towers in snowbound areas, steel sections shall conform to Grade-C of IS-2062.

A.2.2 Towers shall be designed as per IS-802:2015, however the drag coefficient of the tower shall be as follows: -

Solidity Ratio	Drag Coefficient
Up to 0.05	3.6
0.1	3.4
0.2	2.9
0.3	2.5
0.4	2.2
0.5 and above	2.0

A.3.0 Transmission Service Provider (TSP) shall adopt any additional loading/design criteria for ensuring reliability of the line, if so desired and /or deemed necessary.

A.4.0 Transmission line shall be designed considering wind zones as specified in wind map given in National Building Code 2016, Vol.1. The developer shall also make his own assessment of local wind conditions and frequent occurrences of high intensity winds (HIW) due to thunderstorms, dust-storms, downburst etc along the line route and wherever required, higher wind zone than that given in wind map shall be considered for tower design for ensuring reliability of line. Further, for transmission line sections passing within a distance of 50 km from the boundary of two wind zones, higher of the two wind zones shall be considered for design of towers located in such sections.

A.5.0 Selection of reliability level for design of tower shall be as per CEA Regulation (Technical Standards for Construction of Electrical Plants and Electric Lines) Regulations 2022, as amended from time to time.

A.6.0 A) For power line crossing of 400 kV or above voltage level, large angle and dead-end towers (i.e. D/DD/QD) shall be used on either side of power line crossing.

B) For power line crossing of 132 kV and 220 kV (or 230 kV) voltage level, angle towers (B/C/D/DB/DC/DD/QB/QC/QD) shall be used on either side of power line crossing depending upon the merit of the prevailing site condition and line deviation requirement.

C) For power line crossing of 66 kV and below voltage level, suspension/tension towers shall be provided on either side of power line crossing depending upon the merit of the prevailing site condition and line deviation requirement.

D) For crossing of railways, national highways and state highways, Regulations of appropriate authorities shall be followed.

A.7.0 The relevant conductor configuration shall be as follows: -

Name : KPS3 – KPS3 (HVDC) 400 kV 2xD/C Line
Type of conductor: ACSR / AAAC / AL59

Basic parameters:

Transmission line	**ACSR Conductor specified**	**Equivalent AAAC conductor based on 53% conductivity of Al Alloy**	**Equivalent minimum size of AL59 conductor based on 59% conductivity of AL Alloy***	**Sub-conductor Spacing**
400 kV D/C (Quad Bundle) transmission lines	**Moose: Stranding** 54/3.53mm-Al + 7/3.53 mm-Steel; 31.77 mm diameter; 528.5 mm^2, Aluminium area; Maximum DC Resistance at 20°C (Ω/km): 0.05552; Minimum UTS: 161.20 kN	**Stranding details:** 61/3.55mm 31.95mm diameter; 604 mm^2 Aluminium alloy area; Maximum DC Resistance at 20°C (Ω/km): 0.05506; Minimum UTS: 159.80 kN	**Stranding details:** 61/3.31 mm 29.79 mm diameter; 525 mm^2 Aluminium alloy area; Maximum DC Resistance at 20°C (Ω/km): 0.0566; Minimum UTS: 124.70 kN	457 mm

Note:

1. **To select any size above the minimum, the sizes mentioned in the Indian standard i.e IS-398(part-6) should be followed.*

2. *The transmission lines shall have to be designed for a maximum operatingconductor temperature of 85 deg C.*

A.8.0 The required phase to phase spacing and horizontal spacing for 400 kV line shall be governed by the tower design as well as minimum live metal clearances for 400 kV voltage level under different insulator swing angles. However, the phase to phase spacing for 400 kV lines shall not be less than 8 m respectively.

A.9.0 All electrical clearances including minimum live metal clearance, ground clearance and minimum mid span separation between earth wire and conductor as given below shall be considered.

Minimum live metal clearances for 400 kV line:

i. a). Under stationary conditions:

From tower body: 3.05 m

b). Under Swing conditions

Wind Pressure Condition	Minimum Electrical Clearance
a) Swing angle (22º)	3.05 m
b) Swing angle (44º)	1.86 m

ii. Minimum ground clearance for 400 kV: 8.84 m

iii. Minimum mid span separation between earth-wire and conductor for 400 kV line: 9.0 m

A.10.0 Shielding angle shall not exceed 20 deg for 400 kV transmission line.

A.11.0 The Fault current for design of line shall be 63 kA for 1 sec for 400 kV.

A.12.0 In case of 400 kV voltage class lines, at least one out of two earth wires shall be OPGW and second earth wire, if not OPGW, shall be either of Galvanized Stranded Steel (GSS) or Aluminum Alloy Conductor Steel Reinforced (AACSR) or any other suitable conductor type depending upon span length and other technical consideration.

A.13.0 Each tower shall be earthed such that tower footing impedance does not exceed 10 ohms. Pipe type or Counterpoise type earthing shall be provided in accordance with relevant IS. Additional earthing shall be provided on every 7 to 8 km distance at tension tower for direct earthing of both shield wires. If site condition demands, multiple earthing or use of earthing enhancement compound shall be used.

A14.0 Pile type foundation shall be used for towers located in river or creek bed or on bank of river having scourable strata or in areas where river flow or change in river course is anticipated, based on detailed soil investigation and previous years' maximum flooddischarge of the river, maximum velocity of water, highest flood level, scour depth and anticipated change in course of river based on river morphology data of at least past 20 years to ensure availability and reliability of the transmission line.

A.15.0 Transmission line route shall be finalized, in consultation with appropriate authorities so as to avoid the habitant zones of endangered species and other protected species. Bird diverters, wherever required, shall be provided on the line. In order to optimize the route use of GATISHAKTI platform shall also be made.

A.16.0 Wherever, transmission lines are passing through cyclone prone areas i.e. areas upto 60 km from coast following shall also be applicable:

a) Terrain category-I, with terrain roughness factor (K2) of 1.08 shall be considered for tower design for exposed open terrain with few or no obstruction which also includes open sea coasts, open stretch of water, desert and flat treeless plains.

b) Importance factor for cyclonic region (K4) of 1.3 shall be considered for tower design.

c) The number of consecutive spans between the section points/ angle point shall not exceed 10 spans or 3 km instead of conventional practice of 15 spans or 5 km, in order to reduce the failure of such towers in coastal areas due to cascading effect. The section shall be terminated with tension tower/ angle tower and angle of deviation should be based on the site requirement.

A.17.0 Wherever, transmission lines are passing through cyclone prone areas (i.e. areas up to 60 km from coast)/ creek regions/ aggressive soil areas following shall also be applicable:

a) The fabricated tower parts and stubs shall have a minimum overall zinc coating of 900 g/m^2 of surface area except for plates and sections below 5 mm thickness which shall have a minimum overall zinc coating of 610 g/m^2 of surface area. The average zinc coating for all sections and plates 5 mm and above thickness shall be maintained as 127 microns and that for plates and sections below 5 mm thickness shall be maintained as 87 microns.

b) Ready mix concrete of M30 Grade shall be used to avoid use of locally available saline water. However, design mix concrete of M30 Grade conforming to IS 456 with potable water can be used at locations where transportation of ready-mix concrete is not feasible. Minimum cement content in any case shall not be less than 330 kg/m^3.

c) The surface of the reinforced steel may be treated with epoxy-based coating to enhance corrosion performance of foundation. Use of epoxy coated reinforcement in foundation shall be as per IS 13620. In addition, two (2) coats of bituminous painting of minimum 1.6 kg/m^2 per coat shall be applied on all exposed faces of foundation (i.e. pedestal and base slab).

d) Double coat of 20 mm thick cement plaster shall be provided on all exposed concrete surface up to 300 mm below ground level to give protection to concrete surface from environmental and saline effect.

e) Before coping of chimney top portion, three coats of anti-corrosive paint of minimum 30-35 microns dry film thickness each shall be applied on the stub in the 50mm coping portion as well as up to 350 mm above CL portion.

A.18.0 The raised chimney foundation is to be provided in areas prone to flooding/water stagnation like paddy field /agricultural field and undulated areas to avoid direct contact of water with steel part of tower. The top of the chimney of foundation should be at least above HFL (High Flood Level) or the historical water stagnation/ logging level (based on locally available data) or above High Tide Level or 500 mm above Natural Ground level (whichever is higher).

A.19.0 Routing of transmission line through protected areas of India shall be avoided to the extent possible. In case, it is not possible to avoid protected areas, the towers of the transmission line up to 400 kV level which are installed in protected areas shall be designed for Multi-circuit (4 circuits) configuration of same voltage level considering reliability level of at least two (2). The top two circuits of these multi-circuit towers shall be used for stringing of the transmission line under present scope and the bottom two circuits shall be made available for stringing of any future transmission line of any transmission service providers/ State transmission utilities/Central transmission utilities passing through the same protected area. Further, the configuration and coordinates of such transmission towers shall be submitted to CEA, CTU and BPC by the TSP.

A.20.0 The TSP shall abide by the Guidelines of CEA w.r.t. shifting of transmission lines for NHAI projects and other projects.

A.21.0 Safety precautions in regards to gas/oil pipe lines in vicinity of transmission lines shall be taken in coordination with gas/ petroleum authorities.

ANNEXURE-E3

SPECIFIC TECHNICAL REQUIREMENTS FOR HVAC EQUIPMENT

The 400 kV switchyard at **KPS3 (HVDC) S/s, extension of KPS3 S/s and extension of South Olpad S/s** shall be GIS type generally conforming to the requirements of CEA (Technical Standards for Construction of Electrical Plants and Electric Lines) Regulations 2022 as amended from time to time.

All other CEA Regulations/guidelines as amended up to date and MoP guidelines shall also be followed.

B.1.0 Salient features of Substation Equipment and Facilities

The design and specification of substation equipment are to be governed by the following factors:

B.1.1 Insulation Coordination

The system design parameters for substations/switchyards shall be as given below:

Sl. No.	Description of parameters	400 kV KPS3 (HVDC) / KPS3 GIS Extn.	400 kV South Olpad GIS Extn
		400 kV System	400 kV System
1.	System operating voltage	400 kV	400 kV
2.	Maximum voltage of the system (rms)	420 kV	420 kV
3.	Rated frequency	50 Hz	50 Hz
4.	No. of phases	3	3
5.	Rated Insulation levels		
i)	Lightning Impulse withstand voltage for (1.2/50 micro sec.) - for Equipment other than Transformer and Reactor - for Insulator String	 1425 kV p 1550 kV p	 1425 kV p 1550 kV p
ii)	Switching impulse withstand voltage (250/2500 micro sec.) dry and wet	1050 kV p	1050 kV p
iii)	One-minute power frequency dry withstand voltage (rms)	650 kV	650 kV
6.	Corona extinction voltage	320 kV	320 kV
7.	Max. radio interference voltage for frequency between 0.5 MHz and 2 MHz	1000 micro-volts at 266 kV rms	1000 micro-volts at 266 kV rms

Sl. No.	Description of parameters	400 kV KPS3 (HVDC) / KPS3 GIS Extn.	400 kV South Olpad GIS Extn
		400 kV System	400 kV System
8.	Minimum creepage distance for insulator string/ longrod insulators/ outdoor bushings	13020 mm (31 mm/ kV)	13020 mm (31 mm/ kV)
9.	Minimum creepage distance for switchyard equipment	13020 mm (31 mm/ kV)	13020 mm (31 mm/ kV)
10.	Max. fault current	63 kA	63 kA
11.	Duration of fault	1 Sec	1 Sec

B.1.2 Switching Scheme

The switching schemes, as mentioned below, shall be adopted at various voltage levels of substation/switchyard:

Substation	400 kV side
400 kV KPS3 (HVDC)	One and Half breaker
400 kV KPS3 Extn	One and Half breaker
400 kV South Olpad Extn.	One and Half breaker

Notes: -

i) For one and half breaker switching scheme, any double circuit line consisting of two numbers of feeders and originating from the same transmission or generating switchyard shall not be terminated in one diameter.

ii) Two transformers of the same HV rating shall not be connected in the same diameter and similarly, two bus reactors of same HV rating shall also not be connected in the same diameter.

iii) A diameter in one and half breaker scheme is a set of 3 circuit breakers with associated isolators, earth switches, current transformers etc for controlling of 2 numbers of feeders.

iv) TSP shall plan distribution of line and transformer feeders to bus bar in such a way that all power can be evacuated successfully without crossing thermal limit at any point of bus-bar.

v) 400 kV Bus Sectionaliser shall be placed such that each section shall have proper distribution of Pole(s), ICT, Feeders and filter bank(s)/sub-bank(s) so as to have maximum operational flexibility.

vi) In case of GIS substation where the bus scheme is One and Half breaker scheme, the diameters shall be complete with feeder/line side isolator and GIS duct of the future bay shall be brought outside the GIS hall/building with extension/interface module suitably.

B.2.0 Substation

Equipment and facilities (Voltage level as applicable):

The switchgear shall be designed and specified to withstand operating conditions and duty requirements. All equipment shall be designed considering the following minimum capacity.

Sl. No.	Description of bay	Ampacity		
		400 kV KPS3 (HVDC) GIS S/s	400 kV KPS3 GIS Extn	400 kV South Olpad GIS Extn
		400 kV	400 kV	400 kV
1.	Bus Bar	4000 A	4000A	4000A
2.	Line bay	3150 A	3150A	--NA--
3.	Converter bay	3150 A	--NA--	3150 A
3.	ICT bay	3150 A	--NA--	--NA--
4.	Bus Reactor bay	3150 A	--NA--	--NA--
5.	Bus Sectionaliser bays	4000 A	--NA--	--NA--

B.2.1 400/33 kV, 50 MVA Transformers [for exclusively supplying auxiliary power to HVDC terminal]

50 MVA, 400/33 kV, 3-Phase Transformers shall conform to CEA's "Standard Specifications and Technical Parameters for Transformers and Reactors (66 kV and above voltage class)" available on CEA website.

B.2.2 420 kV, 3-Phase, Shunt Reactor

125 MVAR, 420 kV, 3-Phase Reactor shall conform to CEA's "Standard Specifications and Technical Parameters for Transformers and Reactors (66 kV and above voltage class)" as amended up to date available on CEA website.

B.2.3 400 kV GIS Substation equipment

GIS (Gas Insulated Switchgear) shall be Indoor type in accordance to IEC: 62271-203. The switchgear shall be designed and specified to withstand operating conditions and duty requirements. All the switchgear such as Circuit Breaker, isolator, earth switch including CT, PT etc. shall be GIS type. The Surge Arrestor and Voltage Transformer shall be either GIS or outdoor AIS type.

The GIS assembly shall consist of separate modular compartments e.g. Circuit Breaker compartment, Bus bar compartment filled with SF6 Gas and separated by gas tight partitions so as to minimize risk to human life, allow ease of maintenance and limit the effects of gas leaks failures and internal arcs etc. These compartments shall be designed to minimize the risk of damage to adjacent sections and protection of personnel in the event of a failure occurring within the compartments. Rupture diaphragms with suitable deflectors shall be provided to prevent uncontrolled bursting pressures developing within the enclosures under worst operating conditions, thus providing controlled pressure relief in the affected compartment. The arrangement of gas sections or compartments shall be such as to facilitate future extension of any make without any drilling, cutting or welding on the existing equipment. To add equipment, it shall not be necessary to move or dislocate the existing switchgear bays. The layout of Gas Insulated Bus Ducts shall be properly planned to optimize the length of bus ducts and for easy accessibility for maintenance. The length of busbars, bus ducts, isolator sections shall be optimized considering effects of fast transient voltage due to isolator operations.

The bus bar modules including auxiliary bus modules (wherever applicable) shall be provided with suitable End Piece (Interface) module on both sides with the test link facility for future extension as per provisions of future requirement. The end piece module shall be designed in such a way so that future GIS module may be tested without extending test voltage to existing bus and vice-versa by removing the test link.

TSP shall make available the complete details for the design of interface module such as cross section, enclosure material, enclosure dimensions (inner and outer), Flange diameter (inner and outer), conductor cross-section and connection arrangement, bolt spacing and dimension, rated gas pressure, Gasket detail etc. Further, adequate space for GIS busbar interface module shall be taken into account for future scope.

Each section shall have plug-in or easily removable connection pieces to allow for easy replacement of any component with the minimum disturbance to the remainder of the equipment. Inspection windows (View Ports) shall be provided for Disconnector Switches and both type of earth switches i.e. Maintenance and fast operating.

Local control cabinets (LCC) shall be provided as per requirement. The alarm and annunciation of GIS equipment shall be wired to the SCADA System.

The material and thickness of the enclosures shall be such as to withstand an internal flash over without burns through for a period of 300 ms at rated short time withstand current. The material shall be such that it has no effect of environment as well as from the by-products of SF6 breakdown under arcing conditions. This shall be validated with Type Test.

Service continuity requirement for GIS: The GIS equipment with the given bus switching arrangement shall be divided into different gas compartments. During the work such as a fault

repair or major maintenance, requiring the dismantling of a gas compartment for which more than one compartments may need to be de-gassed.

TSP shall meet the following Service continuity conditions (to the extent possible) with ensuring equipment and operating personnel's safety:

- For One and half breaker bus switching scheme, during a fault in Circuit Breaker compartment, no bus bar and feeder is permitted out of service during maintenance and repair/replacement.
- During a fault in a GIS compartment other than the Circuit Breaker compartment, maximum of one bus bar and/or one feeder is permitted out of service during maintenance and repair/replacement.

UHF sensors in GIS for PD (Partial Discharge) detection:

The adequate number of Ultra High frequency (UHF) sensors shall be provided in the offered GIS along with suitable portable type Partial Discharge (PD) measuring instrument for detection of Partial discharge (of 5 pC and above as per IEC 60270). The number and location of these sensors shall be based on laboratory tests on the typical design of GIS as per recommendations of CIGRE Document No. 654 (Application Guide for sensitivity verification for UHF Partial discharge detection system for GIS).

B.2.3.1 Circuit Breakers (GIS)

GIS Circuit breakers shall in general be of C2-M2 class and comply with IEC-62271-100. The rated break time shall not exceed 40 ms (milli second) for 400 kV. Circuit breakers shall be suitable for single phase and three phase auto reclosing. Each breaker shall have two sets of trip circuits which would be connected to separate DC supplies for greater reliability. The Circuit breakers controlling 400 kV lines wherever required shall be provided with pre-insertion closing resistor of about 400 ohms with 8 ms insertion time or Controlled Switching Device (CSD) for lines longer than 200 km. The short line fault capacity shall be same as the rated capacity and this is proposed to be achieved without use of opening resistors. Controlled switching device shall be provided in Circuit Breaker of switchable line reactor bay and in 400 kV and above Main and Tie bay circuit breakers of line with non-switchable line reactors, Bus reactors and Transformers.

B.2.3.2 Isolators (GIS)

The isolators shall comply with IEC 62271-102 in general. Earth switches shall be provided at various locations to facilitate maintenance. Main blades and earth blades shall be interlocked and interlock shall be fail safe type. All isolators and earth switches shall be motor operated type.

Isolator shall be of extended mechanical endurance class-M2 and suitable for Bus Transfer Current Switching duty as per IEC standard. High speed earthing switches shall be provided for grounding purpose at overhead line terminations and cable terminations and shall have fault making capability as specified. Earth switch for line isolator shall be of earthing switch class E1 and shall be suitable for induced current switching duty as defined for Class-B as per relevant standard.

B.2.3.3 Current Transformers (GIS)

Current Transformers shall comply with IEC 61869 in general. All ratios shall be obtained by secondary taps only. Generally, Current Transformers (CT) shall have five cores (four for protection and one for metering) whereas; CT in Tie bays shall have six cores (four for protections and two for metering) suitably distributed on both sides of CB (for 400 kV and above voltage class). The burden and knee point voltage shall be in accordance with the requirements of the system including possible feeds for telemetry. Accuracy class for protection core shall be PX and for metering core it shall be 0.2S. The rated burden of cores shall be closer to the maximum burden requirement of metering and protection system (not more than 20 VA for metering core) for better sensitivity and accuracy.

The instrument security factor shall be less than 5 for CTs up to 400 kV voltage class.

B.2.3.4 Voltage Transformer (GIS)

The voltage transformers shall conform to IEC-61869. Voltage transformers shall be of electromagnetic type with SF6 gas insulation. The earth end of the high voltage winding and the ends of the secondary winding shall be brought out in the terminal box. The voltage transformers shall be located as a separate bay module and will be connected phase to ground and shall be used for protection, metering and synchronization. The voltage transformers shall be of inductive type, nonresistant and shall be contained in their own-SF6 compartment, separated from other parts of installation. The voltage transformer shall be effectively shielded against high frequency electromagnetic transients. The voltage transformer shall have three secondary windings out of which two shall be used for protection and one for metering. The voltage transformer should be thermally and dielectrically safe when the secondary terminals are loaded with the guaranteed thermal burdens. The accuracy class for protection cores shall be 3P. The accuracy of 0.2 on metering core should be maintained throughout the entire burden range on all the three windings without any adjustments during operation. The rated burden of cores shall be closer to the maximum burden requirement of metering and protection system (not more than 50 VA for metering core) for better sensitivity and accuracy.

B.2.3.5 Surge Arresters (GIS) (if applicable)

336 kV Station High (SH) duty gapless type Surge arresters with thermal energy (Wth) of minimum 12 kJ/kV respectively shall be provided for 420 kV system conforming to IEC 60099-

4 in general. Other characteristics of Surge arrester shall be chosen in accordance with system requirements. Surge arresters shall be provided at line entrances, near transformers and reactors so as to achieve proper insulation coordination. A leakage current monitor with surge counter shall be provided with each surge arrester.

B.2.3.6 SF_6 to Air Bushing

Outdoor bushings, for the connection of conventional external conductors to the SF6 metal enclosed switchgear, shall be provided. Bushings shall generally be in accordance with the requirements of IEC-60137. The creepage distance over the external surface of outdoor bushings shall not be less than 31 mm/kV. SF6 to air Bushing shall be of Polymer / composite type and shall be robust and designed for adequate cantilever strength to meet the requirement of seismic condition. The electrical and mechanical characteristics of bushings shall be in accordance with IEC-60137. Polymer/composite insulator shall be seamless sheath of silicon rubber compound. The housing and weather sheds should have silicon content of minimum 30% by weight. It should protect the bushing against environmental influences, external pollution and humidity. The hollow silicon composite insulators shall comply with the requirements of IEC 61462 and the relevant parts of IEC-62217.

B.2.4 400 kV AIS Substation equipment (as applicable)

B.2.4.1 Capacitive Voltage Transformers (AIS)/ AC Voltage Transformer/ AC Voltage Divider

Capacitive Voltage transformers/AC Voltage Transformer/ AC Voltage Divider shall comply with IEC 61869 in general. These shall have three secondaries out of which two shall be used for protection and one for metering. The Accuracy class for protection cores shall be 3P and for metering core shall be 0.2. The Capacitive voltage transformers on lines shall be suitable for Carrier Coupling. The Capacitance of CVT for 400 kV shall be of 4400/8800 pF depending on PLCC requirements. The rated burden of cores shall be closer to the maximum burden requirement of metering and protection system (not more than 50 VA for metering core) for better sensitivity and accuracy.

For power quality measurement compatibility, the transducers including its interface with control and protection panels and display like Transient fault recorders should be compatible with IEC 61000-4-30 Class A in order to check compatibility with Grid Connectivity requirements over and above the requirements given above.

B.2.4.2 Surge Arresters (AIS)

336 kV Station High (SH) duty gapless type Surge arresters with thermal energy (Wth) of minimum 12 kJ/ kV conforming to IEC 60099-4 in general shall be provided for 400 kV systems. Other characteristics of the Surge arrester shall be chosen in accordance with system requirements. Surge arresters shall be provided at line entrances, near transformers and reactors so as to achieve proper insulation coordination. Surge Arresters shall be provided

with porcelain/ polymer housing fitted with pressure relief devices. A leakage current monitor with surge counter shall be provided with each surge arrester.

B.2.5 Protection Relaying and Control System

The protective relaying system proposed to be provided for transmission lines, auto-transformers, reactors and bus bars to minimize the damage to the equipment in the events of faults and abnormal conditions, is dealt in this section. All main protective relays shall be numerical type with IEC 61850 communication interface and should have interoperability during integration of numerical relays to communicate over IEC61850 protocol with RTU/SAS/IEDs of different OEMs. All numerical relays shall have built in disturbance recording feature.

The protection circuits and relays of transformer and reactor shall be electrically and physically segregated into two groups each being independent and capable of providing uninterrupted protection even in the event of one of the protection groups failing, to obtain redundancy, and to take protection systems out for maintenance while the equipment remains in service.

a) Transmission Lines Protection

400 kV transmission lines shall have Main-I numerical three zone distance protection scheme with carrier aided inter-tripping feature. 400 kV lines shall also have Main-II numerical distance protection scheme like Main-I but from different make that of Main-I. The Main-I and Main-II protection relays of same make may be provided only if they are of different hardware and manufacturing platform or different principle of operation.

However, Line Current Differential relay (with back up distance protection feature) as Main–I and Main-II shall be considered at both ends for short lines (line length below 30 km) having Fibre Optic communication link. Differential relay at remote end shall be provided by the TSP. Associated power and control cabling and integration with SAS at remote end shall be provided by respective bay owner.

Further, all 400 kV lines shall be provided with single and three phase auto-reclosing facility to allow reclosing of circuit breakers in case of transient faults. These lines shall also be provided with distance to fault locators to identify the location of fault on transmission lines.

All 400 kV lines shall also be provided with two stages over voltage protection. Over voltage protection and distance to fault locator may be provided as in-built feature of Main-I and Main-II protection relays. Auto reclose as built-in function of Bay Control Unit (BCU) is also acceptable.

The Main-I and Main-II protection relays shall be fed from separate DC sources and shall be mounted in separate panels.

For 400 kV transmission lines, directional IDMT earth fault relay should be provided as standalone unit or in-built feature of Main-I and Main -II feature.

b) Auto Transformer Protection

These shall have the following protections:

i) Numerical Differential protection
ii) Numerical Restricted earth fault protection
iii) Numerical Back-up Directional Over-current and earth fault protection on High Voltage (HV) and Intermediate Voltage (IV) side
iv) Numerical Over fluxing protection on HV and IV side
v) Numerical Overload alarm

Further, Numerical Back-up Over-current and earth fault protection on HV and IV side of autotransformer shall not be combined with other protective functions in the main relays and shall be independent relays. Besides these, power transformers shall also be provided with Buchholz relay, Magnetic Oil Gauge (MOG) with low oil level alarm, protection against high oil and winding temperature and pressure relief device etc.

Suitable monitoring, control (operation of associated circuit breaker and isolator) and protection for LT auxiliary transformer connected to tertiary winding of auto-transformer for the purpose of auxiliary supply shall be provided. The over current and other necessary protection shall be provided for the auxiliary transformer. These protection and control may be provided as built in feature either in the bay controller to be provided for the auxiliary system or in the control and protection IEDs to be provided for autotransformer.

c) 400 kV Reactor Protection

Reactor shall be provided with the following protections:

i) Numerical Differential protection.
ii) Numerical Restricted earth fault protection
iii) Numerical Back-up impedance protection

Besides these, reactors shall also be provided with Buchholz relay, MOG with low oil level alarm, protection against oil and winding temperatures and pressure relief device, etc.

d) Bus bar Protection

The high speed low impedance type bus bar differential protection, which is essential to minimize the damage and maintain system stability at the time of bus bar faults, shall be provided for 400 kV. Duplicated bus bar protection is envisaged for 400 kV bus-bar protection. Bus bar protection scheme shall be such that it operates selectively for each bus and incorporate necessary features required for ensuring security. The scheme shall have

complete bus bar protection for present as well as envisaged future bays i.e. input / output modules for future bays shall also be provided.

Bus Bar protection system for new substation shall be de-centralized (distributed) type.

In case, the bus section is provided, then each side of the bus section shall have separate set of bus bar protection schemes.

For existing substations, the existing bus bar protection shall be augmented as per requirement.

e) Local Breaker Back up Protection

This shall be provided for each 400 kV circuit breakers and will be connected to de-energize the affected stuck breaker from both sides.

Notes:

1. *LBB and REF relays shall be provided separately from transformer differential relay.*
2. *LBB relay may also be provided as built-in protection function of distributed bus bar protection scheme; however in such case separate LBB relay shall be provided for tie bays (in case of One and Half breaker scheme).*
3. *Over fluxing and overload protection can be provided as built-in feature of differential relay.*
4. *In 400 kV switchyard, if spare bay of half diameter is identified as future, Tie CB relay panel shall be with Auto-reclosure feature.*

B.2.6 Substation Automation System

a) For all the new substations, a state-of-art Substation Automation System (SAS) conforming to IEC-61850 shall be provided. The distributed architecture shall be used for Substation Automation system, where the controls shall be provided through Bay control units. The Bay control unit is to be provided bay-wise for voltage level 400 kV and above. All bay control units as well as protection units are normally connected through an Optical fibre high speed network. The control and monitoring of circuit breaker, dis-connector, re-setting of relays etc. can be done from Human Machine Interface (HMI) in the control room.

The functions of control, annunciation, disturbance recording, event logging and measurement of electrical parameters shall be integrated in the Substation Automation System.

At new substations, the Substation Automation System (SAS) shall be suitable for the operation and monitoring of the complete substation including proposed future bays/elements.

In existing substations with a Substation Automation System (SAS), augmentation of existing SAS shall be done for bays under the present scope.

In existing Substations where Substation automation is not provided, control functions shall be done through control panels.

Necessary gateway and modems (as required) shall be provided to send data to RLDC/SLDC as per their requirement and shall be provisioned with 2+2 redundancy i.e. 2 channels for Main Control Centre and 2 channels for Backup Control Centre. In order to meet this requirement, suitable redundancy at port and card level need to be ensured by the TSP to avoid any single point of failure which may lead to interruption in real-time grid operation. Accordingly, all the hardware for communication services of station as stated above shall support dual redundancy for data transmission of station to respective main and backup RLDCs. Any augmentation work at RLDC/SLDC is excluded from TSP's scope. However, all the configuration work at substation end required to send data to RLDC/SLDC shall be in the scope of TSP.

b) Time synchronization equipment

Time synchronization equipment complete in all respect including antenna, cable, processing equipment required to receive time signal through GPS or from National Physical Laboratory (NPL) through INSAT shall be provided at new substations. This equipment shall be used to synchronize SAS and IEDs etc.

B.3.0 Substation Support facilities

Certain facilities required for operation and maintenance of substations as described below shall be provided at new substation. In existing substation, these facilities have already been provided and would be extended/ augmented as per requirement.

B.3.1 Fire Fighting System

Fire-fighting system for substation including transformer and reactor shall conform to CEA (Measures Relating to Safety and Electric Supply) Regulations, 2023 as amended time to time.

Further, adequate water hydrants and portable fire extinguishers shall be provided in the substations. The main header of firefighting system shall be suitable for extension to bays covered under the future scope; necessary piping interface in this regard shall be provided.

Optical Beam type heat detection for GIS hall fire protection system shall be provided for all the GIS halls.

At existing substations, the fire-fighting systems, as available, shall be augmented/ extended to meet the additional requirements.

B.3.2 Oil evacuating, filtering, testing and filling apparatus

To monitor the quality of oil for satisfactory performance of transformers, shunt reactors and for periodical maintenance necessary oil evacuating, filtering, testing and filling apparatus would be provided at new substations. Oil storage tanks of adequate capacities for storage of transformer oil would be provided.

Online Transformer Oil Drying Out System shall be provided in line with the provisions of Standard Specification and Technical Parameters for Transformers and Reactors (66 kV and above voltage class) as amended up to date available on CEA website.

B.3.3 Illumination

Normal and emergency AC and DC illumination shall be provided adequately in the control room and other buildings of the substation. The switchyard shall also be provided with adequate illumination.

Lighting of the entire control room building, fire-fighting pump house, other building (if any) and switchyard shall be done by LED based low power consumption luminaires.

B.3.4 Control Room

For new substation, substation control room shall be provided to house substation workstations for station level control (SAS) along with its peripheral and recording equipment, AC and DC distribution boards, DC batteries and associated battery chargers, Fire Protection panels, Telecommunication panels and other panels as per requirements. Air conditioning shall be provided in the building as functional requirements. Main cable trenches from the control room shall have adequate space provision for laying of cables from control room for all the future bays also.

Common control may be constructed for HVDC and HVAC systems.

At existing substations, the adequacy of size of control room shall be ascertained and the same shall be augmented as per requirement.

B.3.5 GIS hall

The Gas Insulated Switchgear (GIS) of each voltage level along with other associated equipment shall be housed inside separate GIS building. The panels i.e. Bay level units, bay mimic, relay and protection panels, RTCC panels, PLCC panels, panels for tele-communication system etc. are to be placed in a separate room in the GIS building. The size of the room shall be such that all the panels for the bays under present scope shall be accommodated. The panel room shall be air-conditioned. Further, the temperature of the room shall be monitored through substation automation system by providing necessary temperature transducers. Ventilation system of suitable capacity shall be provided for each GIS hall.

One EOT Crane of suitable capacity for erection and Maintenance of largest GIS component/assembly and all plant installed in the GIS switchgear room shall be provided in

each GIS hall. The crane shall be capable of fulfilling all special requirements for erection and maintenance of GIS equipment. The capacity of the crane shall be sized to lift the heaviest GIS switchgear component.

For extension of existing GIS, existing facilities shall be suitably augmented/ extended for GIS equipment under present scope.

B.3.6 Control Concept

All the EHV circuit breakers in substation/switching stations shall be controlled and synchronized from the switchyard control room/remote control center. All the isolators shall have control from remote/local whereas the earth switches shall have local control only.

B.4 General Facilities

a. Line Gantry/Towers are envisaged for bays under present scope only. However, for adjacent future line bay, tower shall be designed for extension (considering Quad conductors for 765 kV and 400 kV future lines) wherever applicable.

b. Bay extension works at existing substation shall be executed by TSP in accordance with the requirement/provisions mentioned above. However, interface points shall be considered keeping in view the existing design/arrangement at the substation.

c. TSP has to arrange for construction power and water on its own.

d. All outdoor steel structures including anchor/foundation bolts shall be fully galvanized. The weight of the zinc coating shall be at least 610 g/m^2. However, for coastal/creek regions it shall be at least 900 g/m^2.

e. In 765 kV and 400 kV switchyard, if spare bay of half diameter is identified as future, all the equipment for Tie and Future Bay shall be designed considering the current rating of line bay i.e. 3150A.

f. Boundary wall shall be brick masonry wall with RCC frame or Stone masonry wall or Precast RCC wall under present scope along the property line of complete substation area including future switchyard area to prevent encroachment and unauthorized access. Minimum height of the boundary wall shall be of 1.8 m from finished ground level (FGL).

g. All electrical equipment shall be installed above the Highest Flood Level (HFL) and where such equipment is not possible to be installed above the Highest Flood Level, it shall be ensured that there is no seepage or leakage or logging of water.

B.5 EXTENSION OF EXISTING SUBSTATION

The following drawings/details of existing substation is attached with the RFP documents for further engineering by the bidder.

Sl. No.	Drawing Title	Drawing No./Details	Rev. No.
A.	**400 kV South Olpad GIS S/s**		
1.0	Single Line Diagram	The substation is under bidding in separate scheme. Thus, drawings are not available at this stage.	
2.0	General Arrangement		
3.0	Earthmat Layout		
4.0	Visual Monitoring System		
5.0	Bus Bar Protection		
6.0	Substation Automation System (SAS)		
B.	**400 kV KPS3 GIS S/s-Section I**		
1.0	Single Line Diagram	023012-E-IS-SY-1L-0001	H
2.0	General Arrangement	023012-E-IS-SY-EL-0002	C
3.0	Earthmat Layout	Drawings are yet to be finalized by developer.	
4.0	Visual Monitoring System		
5.0	Bus Bar Protection		
6.0	Substation Automation System (SAS)		
C.	**400 kV KPS3 GIS S/s-Section II**		
1.0	Single Line Diagram	The substation is under bidding in separate scheme. Thus, drawings are not available at this stage.	
2.0	General Arrangement		
3.0	Earthmat Layout		
4.0	Visual Monitoring System		
5.0	Bus Bar Protection		
6.0	Substation Automation System (SAS)		

Bidder is also advised to visit the substation sites and acquaint themselves with the topography, infrastructure such as requirement of roads, cable trench, drainage etc. and also the design philosophy.

Annexure – F

SPECIFIC TECHNICAL REQUIREMENTS FOR COMMUNICATION

The communication requirement shall be in accordance to CEA (Technical Standards for Communication System in Power System Operations) Regulations, 2020, CEA (Technical Standards for Construction of Electrical Plants and Electric Lines) Regulations, 2022, CERC (Communication System for inter-State transmission of electricity) Regulations, 2017, and CEA (Cyber Security in Power Sector) Guidelines, 2021, all above documents as amended from time to time.

The complete ISTS communication system commissioned by TSP under the RFP shall be the asset of ISTS and shall be available for usage of ISTS requirements as suggested by CTU from time to time.

The communication services viz. SCADA, VoIP, PMU, AGC and AMR (wherever applicable) have been identified as critical services and therefore shall be provisioned with 2+2 redundancy i.e. 2 channels for Main Control Centre and 2 channels for Backup Control Centre. In order to meet this requirement, suitable redundancy at port and card level need to be ensured by the TSP to avoid any single point of failure which may lead to interruption in real-time grid operation.

PMU to PDC communication (wherever required) shall be through 2 channels to the PDC (main) as there is no backup PDC at present.

Accordingly, all the hardware for communication services of station as stated above shall support dual redundancy for data transmission of station to respective main and backup RLDCs.

In order to meet the requirement for grid management and operation of substations, Transmission Service Provider (TSP) shall provide the following**:**

For smooth operation of the HVDC system, communication network with high reliability and availability shall be provided for transmission of control and protection signals between the two or more (in case of multi-terminal DC) HVDC terminals. The communication system design shall be as follows:

- Main-I
- Main-II (as hot standby to Main-I)
- Back-up communication

The TSP shall supply, install and commission SDH equipment required for the converter stations at **KPS3 and South Olpad** and the necessary repeater stations. The repeater stations

for fibre optic communication are also included in the scope of the TSP. The number and locations of repeaters shall be finalized after survey by TSP.

COMMUNICATION SYSTEMS GENERAL

Duplicated (2X100%) main communication systems (Main-I and Main-II) at KPS3 and South Olpad terminal and its repeaters shall comprise first cubicle of Main Fibre Optic Terminal equipment (FOTE) and second cubicle of Standby FOTE and be provided to meet the requirements of the control, protection, data transfer and telephone systems. System shall be based on the fibre optic communication between the converter stations through ± 500 KV DC lines. Each Main and Standby FOTE system shall be independent of each other. TSP to design the optical fibre Communication system between the converter stations in such a way that communication is available even when there is complete failure of one FOTE system. All repeater stations required for the communication system shall be provided by TSP. The TSP shall provide all required equipment, accessories, routers, modems and facilities etc., as required, for successful commissioning and use of the communication channels at KPS3 and South Olpad HVDC Bipole terminal.

The backup communication link shall also be provided through OPGW on AC Lines. Necessary support shall be provided by the TSP to other TSP/s whose existing communication network is required to be configured for backup communication. Configuration work shall be done by the backup communication system owner/s for the KPS3 and South Olpad HVDC link in coordination with the TSP. TSP shall be responsible for all interface requirements with the Communication system of the other TSP(s) whose OPGW/Communication equipment are required for successful commissioning of the backup communication link including hardware/accessories etc .

C.1.0 Establishment of 2500 MW, ± 500 kV KPS3 (HVDC) [VSC] terminal station (2x1250 MW) at a suitable location near KPS3 substation with associated interconnections with 400 kV HVAC Switchyard.

(i) TSP shall supply, install and commission one or more no. FODP (120 F or higher) alongwith panel and approach Cable (24F each) with all associated hardware fittings from gantry tower to Control Room for all the incoming lines envisaged under the present scope.

(ii) TSP shall supply, install and commission 2 Nos. STM-16 (FOTE) equipment locally patched (in redundant mode connected with separate fibre pairs of same OPGW) alongwith panel/s supporting minimum Five (5) directions with MSP (Multiplex Section Protection – 1+1, excluding local patching) at KPS3 (HVDC) S/s with necessary interfaces to meet the voice and data communication requirement

among KPS3 HVDC, KPS3 GIS, South Olpad (HVDC)/ Repeater Stations. The suitable DC Power Supply and backup to be provided for each communication equipment operational in redundant mode.

(iii) FODP and FOTE equipment with panels shall be provided in Control Room of KPS3 (HVDC) S/s. FOTE and FODP Eq can be accommodated in same panel to optimize space.

(iv) The FOTE under present scope at HVDC shall be integrated by TSP with the existing FOTE at control room of **KPS3 GIS**. TSP to provide necessary FODP sub rack / Splice trays/ Patch cords etc. and optical interfaces/equipment in the existing FOTE/FODP panels in control room for providing required optical directions with the existing FOTE for onwards data transmission.

(v) The new communication equipment under the present scope shall be compatible for integration with existing regional level centralized NMS. The local configuration of the new communication equipment shall be the responsibility of TSP. The configuration work in the existing centralized NMS for integration of new Communication equipment shall be done by Regional ULDC Team, however all the necessary support in this regard shall be ensured by TSP.

(vi) TSP shall supply, install and commission Firewall in redundant mode (1+1) in line with the specification attached at **Annexure F.1**.

(vii) The maintenance of all the communication equipment and software thereof including FOTE, FODP, approach cable, Repeater Station, PMU, DCPS along with Battery Bank and Firewall shall be the responsibility of TSP.

C.2.0 Establishment of 2500 MW, ± 500 kV South Olpad (HVDC) [VSC] terminal station (2x1250 MW) along with associated interconnections with 400 kV HVAC Switchyard of South Olpad S/s.

(i) TSP shall supply, install and commission one or more No. FODP (96 F) or higher) alongwith panel and approach Cable (24F each) with all associated hardware fittings from gantry tower to Control Room for all the incoming lines envisaged under the present scope.

(ii) TSP shall supply, install and commission 2 Nos. of STM-16 (FOTE) equipment locally patched (in redundant mode connected with separate fibre pairs of same OPGW) alongwith panel/s supporting minimum four(4) directions with MSP (Multiplex Section Protection – 1+1, excluding local patching) at South Olpad

(HVDC) S/s with necessary interfaces to meet the voice and data communication requirement among South Olpad (HVDC), South Olpad GIS, KPS3 (HVDC) and Repeater Stations. The suitable DC Power Supply and backup to be provided for each communication equipment operational in redundant mode.

(iii) FODP and FOTE equipment with panels shall be provided in Control Room of South Olpad (HVDC) S/s. FOTE and FODP Eq can be accommodated in same panel to optimize space.

(iv) The FOTE under present scope at HVDC shall be integrated by TSP with the existing FOTE at control room of **South Olpad GIS**. TSP to provide necessary approach cables/FODP sub rack / Splice trays/ Patch cords etc. and optical interfaces/equipment in the existing FOTE/FODP panels in control room for providing required optical directions with the existing FOTE for onwards data transmission.

(v) The new communication equipment under the present scope shall be compatible for integration with existing regional level centralized NMS. The local configuration of the new communication equipment shall be the responsibility of TSP. The configuration work in the existing centralized NMS for integration of new Communication equipment shall be done by Regional ULDC Team, however all the necessary support in this regard shall be ensured by TSP.

(vi) TSP shall supply, install and commission Firewall in redundant mode (1+1) in line with the specification attached at **Annexure F.1**.

(vii) The maintenance of all the communication equipment and software thereof including FOTE, FODP, approach cable, Repeater Station, PMU, DCPS along with Battery Bank and Firewall shall be the responsibility of TSP.

C.3.0 KPS3 – KPS3 (HVDC) 400 kV 2xD/C (Quad ACSR/AAAC/AL59 moose equivalent) line.

On KPS3 – KPS3 (HVDC) 400 kV 2xD/C line, TSP shall supply, install and commission One (1) No. OPGW cable containing 24 Fibres (24F) on one E/W peak and conventional earth wire on other E/W peak **on each of the D/C lines**.

The TSP shall install this OPGW from gantry of KPS3 GIS up to the gantry of KPS3 (HVDC) S/s with all associated hardware including Vibration Dampers, mid-way and gantry Joint Boxes (called **OPGW Hardware** hereafter) and finally terminate in Joint Boxes at end

Substations. The transmission line length is 2 kms (approx.) where repeater is not required to meet link budget requirement of KPS3 GIS – KPS3 (HVDC).

C.4.0 4 No. of 400 kV line bays at KPS3 for KPS3 – KPS3 (HVDC) 400 kV 2xD/C line

(i) TSP shall supply, install and commission one or more No. FODP (144 F or higher) along with panel and required Approach Cable (24F) with all associated hardware fittings from gantry tower to Bay Kiosk and from the Bay Kiosk to Control room.

(ii) TSP shall supply, install and commission 2 Nos. of STM-16 (FOTE) equipment along with panel/s supporting minimum three (3) directions with MSP (Multiplex Section Protection – 1+1, excluding local patching) at KPS3 GIS with necessary interfaces to meet the voice and data communication requirement between, KPS3 (HVDC) and KPS3 GIS. The suitable DC Power Supply and backup to be provided for each communication equipment operational in redundant mode.

(iii) FOTE/FODP panel shall be installed in the new Bay Kiosk/ Switchyard Panel Room (SPR). The FOTEs under present scope shall be integrated by TSP with the existing/proposed FOTE at control room of **KPS3 GIS**. TSP to provide necessary FODP sub rack / Splice trays/ Patch cords etc. and optical interfaces/equipment in the existing FOTE/FODP panels in control room for providing required optical directions with the existing FOTE for onwards data transmission.

In case spare optical direction is not available in the existing FOTE at the control room, the TSP shall coordinate with station owner to reconfigure the directions in existing FOTE at control room. Alternatively, the TSP may integrate the FOTE under the present scope with existing FOTE in the nearby Kiosk connected to the control room FOTE (if available with spare direction). For this purpose, TSP shall provide necessary FODP sub rack / Splice trays/ Patch cords etc. and suitable optical interfaces/ equipment in the existing FOTE/FODP panels in another Kiosk (SPR).

(iv) FOTE and FODP can be accommodated in same panel to optimize space.

(v) The new communication equipment under the present scope shall be compatible for integration with existing regional level centralized NMS. The local configuration of the new communication equipment shall be the responsibility of TSP. The configuration work in the existing centralized NMS for integration of new Communication equipment shall be done by Regional ULDC Team, however all the necessary support in this regard shall be ensured by TSP.

C.5.0 ±500 kV HVDC Bipole line between KPS3 (HVDC) and South Olpad (HVDC) (with Dedicated Metallic Return) (capable to evacuate 2500 MW).

On ±500 kV HVDC Bipole line between KPS3 (HVDC) and South Olpad (HVDC) (with Dedicated Metallic Return), TSP shall supply, install and commission One (1) no. OPGW cable containing 24 Fibres (24F) on one E/W peak and conventional earth wire on other E/W peak. OPGW diameter shall be in line with earthwire parameters mentioned in Annexure-E1 (Specific technical requirements for HVDC transmission line).

The TSP shall install this OPGW from gantry of KPS3 (HVDC) up to the gantry of South Olpad (HVDC) S/s with all associated hardware including Vibration Dampers, mid-way and gantry Joint Boxes (called **OPGW Hardware** hereafter) and finally terminate in Joint Boxes at end Substations. The transmission line length is 600 km (approx.) where repeaters are required to meet link budget requirement of KPS3 (HVDC) – South Olpad (HVDC).

TSP shall finalize the location and number of repeater stations depending upon the actual site conditions. Further TSP shall comply to the requirements mentioned as per **Appendix-F.1**.

Maintenance of OPGW Cable, OPGW Hardware and repeater equipment and items associated with repeater shelter shall be responsibility of TSP.

Specific Requirement for Phasor Measurement Units (PMUs)

TSP shall supply, install and commission required No. of Phasor Measurement Units (PMUs) PMUs at all the locations under the scope of TSP under this RFP as per CEA (Technical Standards for Construction of Electrical Plants and Electric Lines) Regulations, 2022 (along with all amendments if any), and all the applicable Regulations, Standards, Guidelines issued time to time. These PMUs shall be provided with GPS clock and LAN switch and shall connect with LAN switch of control room of respective substations/ generating stations with Fibre Optic cable. These PMUs shall be connected with the FOTE at Substation/ generating stations for onwards data transmission to the PDC (Phasor Data Concentrator) located at respective RLDC. Configuration work in existing PDC at RLDC for new PMU integration shall be done by respective RLDC, however all the necessary support in this regard shall be ensured by TSP. The maintenance of all the PMUs and associated equipment shall be the responsibility of TSP.

Note: Existing Station owner/s to provide necessary support to integrate different equipment and applications of new extended bays with the existing substation e.g. Communication (through FOTE), Voice etc. for smooth operation and monitoring of new added grid elements.

Appendix-F.1

Repeater Requirements

FOTE to be provided by TSP in repeater station/s shall be 2x STM-16 (FOTE) equipment (in redundant mode connected with separate fibre pairs of same OPGW/UGFO/Approach Cable)

- If the repeater location is finalized in the Control Room of a nearby substation, TSP shall provide 1 no. OPGW (48F) on a single Earthwire peak with OPGW Hardware and mid-way Joint Boxes etc. of the line crossing the main line and 1 no. Approach Cable (48F) with all associated hardware fittings, to establish connectivity between crossing point of main transmission line up to the repeater equipment in substation control room.

  TSP shall co-ordinate for Space and DC power supply sharing for each operational communication equipment at repeater station in redundant mode.

  TSP shall provide FODP, FOTE (with STM-16 capacity) with suitable interfaces require for link budget of respective link.

OR

- If the repeater location is finalized in the nearby substation premises, the TSP shall identify the Space for repeater shelter in consultation with station owner. Further TSP shall provide 1 no. OPGW (48F) on a single Earthwire peak with OPGW Hardware and mid-way Joint Boxes etc. of the line crossing the main line and 1 no. Approach Cable (48F) / UGFO (48F) with all associated hardware fittings, to establish connectivity between crossing point of main transmission line up to the substation where the repeater shelter is to be housed.

  TSP shall provide repeater shelter along with FODP, FOTE (with STM-16 capacity) with suitable interfaces require for link budget of respective link, reliable power supply provisioning for AC and DC supply, battery bank, Air Conditioner and other associated systems for each operational communication equipment at repeater station in redundant mode.

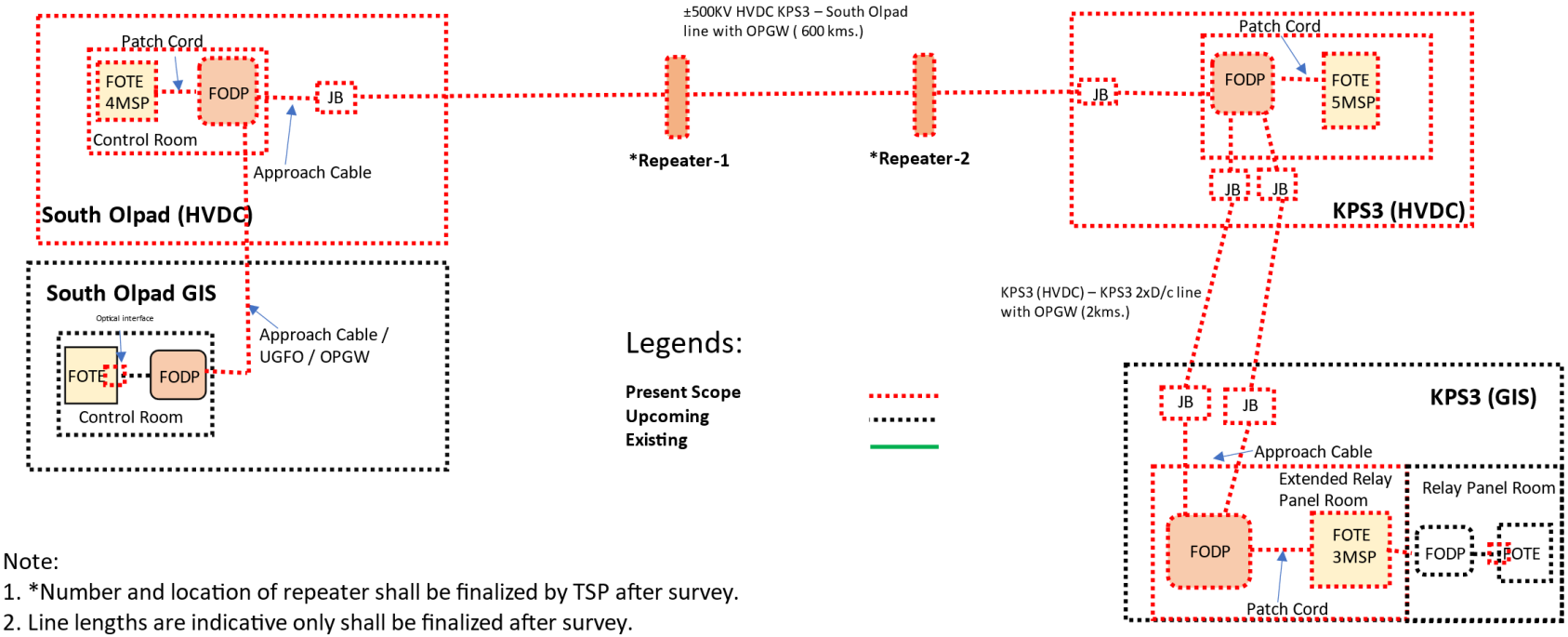
OR

- If the repeater location is finalized on land near the transmission tower. TSP shall make the provisions for Land at nearby tower for repeater shelter. Further TSP shall provide 1 no. Approach Cable (48F) / UGFO (48F) with all associated hardware fittings to establish connectivity up to the location of repeater shelter.

TSP shall provide repeater shelter along with FODP, FOTE (with STM-16 capacity) with suitable interfaces require for link budget of respective link, reliable power supply provisioning for AC and DC supply, battery bank, Air Conditioner and other associated systems for each operational communication equipment at repeater station in redundant mode.

Maintenance of OPGW Cable and **OPGW Hardware**, repeater equipment and items associated with repeater shelter shall be responsibility of TSP.

Proposed Communication for Transmission System for Evacuation of Power from potential renewable energy zone in Khavda area of Gujarat under Phase-V (8 GW): Part C



Note:

1. *Number and location of repeater shall be finalized by TSP after survey.
2. Line lengths are indicative only shall be finalized after survey.
3. Two no. of FOTE are to be provided at KPS3 HVDC, KPS3 GIS SPR & South Olpad HVDC Stations.
4. The existing FOTE at KPS3 GIS SPR and South Olpad GIS shall be integrated with respective FOTE to be provided at HVDC stations.

Figure F.1

Annexure-F.1

Next Generation Firewall (NGFW)

TSP shall provide 2 NGFW one in Main and another in Standby mode having electrical ethernet interfaces/ports and placed between FOTE and SAS gateway/s at the substation. All ethernet based applications shall be terminated in the firewall ports directly (e.g. PMU, AMR, VOIP, SAS/SCADA etc.). Each port of firewall shall work as a separate zone. Firewall shall be hardware based with features of Block/Allow/drop and IPSec VPN (network encryption).

The number of ports/interfaces in each firewall (i.e. Main and Standby) shall be minimum 16 Nos. TSP shall provide either single firewall or multiple firewalls to meet this interfaces requirement, each for main as well as standby firewall. Minimum throughput of firewall shall be 300 Mbps.

The Firewall shall be managed/ configured as standalone at present and shall also have compatibility to manage/configure through Centralized Management Console (CMC) remotely in future.

Firewall shall be tested and certified for ISO15408 Common Criteria for least EAL4+. Further, the OEM must certify that it conforms to Secure Product Development Life Cycle requirements as per IEC62443-4-1. The firewall shall generate reports for NERC-CIP Compliance.

The specifications for the firewalls are given at **Annexure-F.2** and schematic diagram showing firewall placement given at **Figure F.2**.

Annexure F.2

Specifications of Next Generation Firewall (NGFW)

1. NGFW shall have following features including but not limited to:
   Encryption through IPSec VPN (Virtual Private Network), Deep Packet Inspection (DPI), Denial of service (DoS) and Distributed Denial of Service (DDoS) prevention, Port Block/ Allow, rules/ policies for block/allow, IP (Internet Protocol) and Media Access Control (MAC) spoofing protection, threat detection, Intrusion Prevention System (IPS), Anti-Virus, Anti-Spyware, Man In The Middle (MITM) attack prevention.
2. The proposed firewall shall be able to handle (alert, block or allow) unknown /unidentified applications e.g. unknown TCP and UDP packets. It shall have the provision to define application control list based on application group and/or list.
3. Firewall shall have feature and also have capability to update the definition/ Signatures of Anti-Virus online as well as offline. Firewall shall also be compatible to update the definitions/signatures through CMC. There shall be a defined process for security patching and firmware up-gradation. There shall be a feature to field validate firmware checksum. The same shall also be validated before using the OEM provided file/binary in the process of firmware up-gradation and security patching
4. Firewall shall have Management Console port to configure remotely.
5. Firewall shall be EMI/EMC compliant in Substation environment as per IEC 61850-3.
6. Firewall shall be rack mounted in existing standard equipment cabinets.
7. Firewall shall have support of SCADA applications (IEC-60870-5-104), ICCP, PMU (IEEE C37.118), Sub-Station Automation System (IEC 61850), Ethernet and other substation environment protocols.
8. Client based Encryption/ VPN must support different Operating System platforms e.g. Windows, Linux and Mac.
9. The solution must have content and comprehensive file detection policies, blocking the files as function of their types, protocols and directions.
10. Firewall shall have logging facility as per standard logs/events format. Firewall shall have features to export the generated/stored logs/events in csv (Comma Separated Value) and also any other standard formats for offline usage, analysis and compliance. Firewall shall have suitable memory architecture and solution to store and be enable to export all logs/events for a period of last 90 days at any given time.
11. Firewall shall have features and be compatible with local as well as central authentication system (RADIUS, LDAP, or TACACS+) for user account and access right management. It shall also have Role Based User management feature.
12. Firewall shall have the capability to configure sufficient number of VLANs.
13. Firewall shall have the capability to support sufficient number of sessions.
14. Firewall shall have provision to configure multiple IP Sec VPNs, at least 100 Nos. (one-to-many or many-to-one). Shall support redundant operation with a similar router after creation of all the IP Sec VPN. IPSec VPN shall support encryption protocols as

AES128, AES256 and hashing algorithms as MD5 and SHA1. IPSec VPN throughput shall support at least 300 Mbps

15. Firewall shall be capable of SNMP v3 for monitoring from Network Management system. It shall also have SNMPv3 encrypted authentication and access security
16. Firewall shall support in Active/Passive or Active-Active mode with High Availability features like load balancing, failover for firewall and IPsec VPN without losing the session connectivity.
17. Firewall should have integrated traffic shaping (bandwidth, allocation, prioritisation, etc.) functionality
18. Shall support simultaneous operation with both IPv4 and IPv6 traffic
19. Firewall shall be compatible with SNTP/NTP or any other standards for clock synchronization
20. Firewall shall have the features of port as well as MAC based security
21. Firewall shall support exporting of logs to a centralized log management system (e.g. syslog) for security event and information management.
22. Firewall time shall be kept synchronised to official Indian Timekeeping agency, time.nplindia.org.
23. Firewall product shall be provided with all applicable updates at least until 36 months since the applicable date of product shipping to the concerned utility.

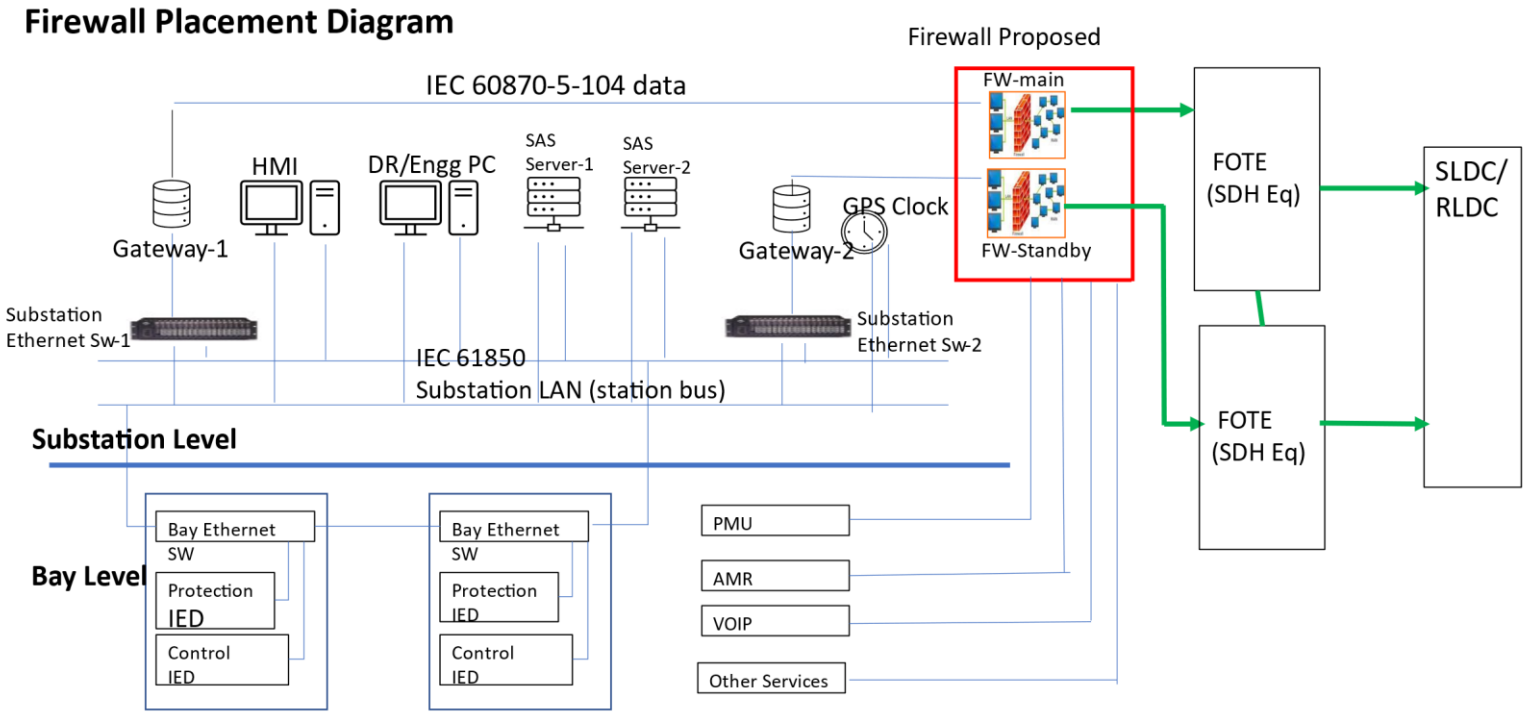

Firewall Placement Diagram
Firewall Proposed
IEC 60870-5-104 data
FW-main
FW-Standby
FOTE
(SDH Eq)
SLDC/
RLDC
FOTE
(SDH Eq)
HMI
DR/Engg PC
SAS
Server-1
SAS
Server-2
GPS Clock
Gateway-1
Gateway-2
Substation
Ethernet Sw-1
Substation
Ethernet Sw-2
IEC 61850
Substation LAN (station bus)
Substation Level
Bay Level
Bay Ethernet
SW
Protection
IED
Control
IED
Bay Ethernet
SW
Protection
IED
Control
IED
PMU
AMR
VOIP
Other Services

Figure F.2

C.6.0 PLCC and PABX:

Power line carrier communication (PLCC) equipment complete for speech, tele-protection commands and data channels shall be provided on each transmission line. The protections for transmission line and the line compensating equipment shall have hundred percent back up communication channels i.e. two channels for tele-protection in addition to one channel for speech plus data for each direction. The PLCC equipment shall in brief include the following:

(i) Coupling device, line traps, carrier terminals, protection couplers, HF cables, PABX (if applicable) and maintenance and testing instruments.

(ii) At new substation, a telephone exchange (PABX) of 24 lines shall be provided at as means of effective communication among various buildings of the substation, remote end substations and with control centers (RLDC/SLDC) etc.

(iii) Coupling devices shall be suitable for phase to phase coupling for 400 kV Transmission lines. The pass band of coupling devices shall have sufficient margin for adding communication channel in future if required. Necessary protection devices for safety of personnel and low voltage part against power frequency voltages and transient over voltage shall also be provided.

(iv) The line traps shall be broad band tuned suitable for blocking the complete range of carrier frequencies. Line Trap shall have necessary protective devices such as lightning arresters for the protection of tuning device. Decoupling network consisting of line traps and coupling capacitors may also be required at certain substation in case of extreme frequency congestion.

(v) The carrier terminals shall be of single side-band (SSB) amplitude modulation (AM) type and shall have 4 kHz band width. PLCC Carrier terminals and Protection couplers shall be considered for both ends of the line.

(vi) PLCC equipment for all the transmission lines covered under the scheme shall be provided by TSP as per following configuration. CVT and Wave trap for all the line bays under present scope shall be provided by TSP.

Sl. No	Line name	PLCC configuration
1.	KPS3 – KPS3 (HVDC) 400 kV 2xD/C line	1 set Analog PLCC + 1 set Digital Protection Coupler for each circuit at both ends. OR 2 Sets of Digital Protection Coupler for each circuit at both ends with physically diverted path.

Further, CVT and Wave trap for all line bays under present scope shall be provided by TSP where analog PLCC is required.

(vii) All other associated equipment like cabling, coupling device and HF cable shall also be provided by the TSP.

(viii) 2 sets of 48 V battery banks for PLCC and communication equipment shall be provided at each new Substation with at least 10 hours battery backup and extended backup, if required.

Annexure-G

Frequently Asked Queries:

1.0 Transmission Line:

1.1 Please clarify that whether shutdowns for crossing of existing transmission lines of POWERGRID/STUs/ Power Evacuation Lines from Generation Plants/ Any other Transmission Licensee will be given to TSP on chargeable basis or free of cost.

Reply: Shutdowns for crossing of existing transmission lines of POWERGRID/ STUs/ Power Evacuation Lines from Generation Plants/ Any other Transmission Licensee will be given to TSP by the concerned owner of the lines as per their own terms and conditions. As far as shutdown of ISTS lines are concerned the same can be availed by approaching respective Regional Power Committee.

1.2 We understand that the suggested swing angle criteria are applicable for Suspension Insulator in Suspension Tower. Further, you are requested to provide similar swing angle and clearance criteria for Pilot Insulator with Jumper and Jumper.

Reply: It is clarified that the swing angle criteria (as mentioned in RFP) for transmission lines is applicable for Suspension Insulator in Suspension Tower. Further, as per Clause 3.0 of Specific Technical Requirements for transmission lines, Transmission service Provider (TSP) shall adopt any additional loading/design criteria for ensuring reliability of the line, if so desired and /or deemed necessary.

1.3 We request you to kindly allow that use of diamond configuration at Power line crossings and the existing owner of the lines may be directed to allow the same for the successful bidders.

Reply: Power line crossing including Diamond configuration is responsibility of the TSP. TSP shall formally submit the profile of the crossing section to the owner of the existing line suggesting proposed crossing alternatives. The crossing will have to be carried out as per approval of owner of the existing line.

1.4 It is requested you to kindly provide present status of Forest Clearances if any transmission line corridor area falling in wildlife forest / reserve forest/ mangroves.

Reply: Based on the preliminary route survey, the process of initiation of forest clearance for the forest stretches, if any, enroute the proposed line alignment will be initiated by way of writing letters to the concerned authority(ies). However, it may be noted that it will be the responsibility of TSP for obtaining forest clearance for the forest stretches as provided in the survey report and also for any forest area encountered during detailed survey.

2.0 Substation

2.1 We understand that space for storage of O&M spare shall be provided by existing owner within the station boundary without any cost. Kindly confirm.

Reply: Space for storage of O&M spares shall be arranged by TSP on its own.

2.2 We presume that the O&M for the end Termination bays will be in the scope of the TSP and TSP shall not be liable for any payment towards O&M to the existing owner of the substation. Kindly confirm.

Reply: Operation and maintenance of the bays is solely responsibility of the TSP. TSP shall follow CEA,s " Operation and Maintenance (O&M) guidelines and Standard Format for Memorandum of Understating between New TSP and Existing TSP" issued by CEA vide its letter No. I/28514/2023 dated 22.06.2023. Copy of the guideline is available on CEA website at following link:

https://cea.nic.in/wp-content/uploads/pse___td/2023/06/om_guidelines.pdf

2.3 With reference to subject scheme of existing sub-station, we assumed following scope of work:

(a) We assumed internal road is available and need not to consider in the present scope of work.

(b) Drainage is available and need not to consider in the present scope of work.

(c) Cable trench extension in adjacent to Main cable trench only under present scope of work.

(d) Levelled area being provided by developer for bay extension.

Reply: Regarding requirement of internal road, drainage, cable trench, leveling of the bay extension area, bidder is advised to visit site and acquaint themselves with the provisions/facilities available at substation.

2.4 Kindly provide the soil investigation report of soil parameters of existing substation.

Reply: Bidder is advised to visit the substation site and ascertain the requisite parameters.

2.5 Kindly confirm, energy accounting of aux. power consumption. Whether it will be on chargeable basis or part of transmission loss.

Reply: It will be on chargeable basis.

2.6 We understand that VMS requirement is for unmanned stations only. For Manned stations VMS is not compulsory.

Reply: VMS shall be provided in line with requirements of RfP document.

2.7 It is understood that Construction water and power shall be provided free of cost to TSP by respective substation owner for construction of new bays.

Reply: Arrangement of construction power and water is in the scope of TSP.

2.8 It is understood that existing fire hydrant system shall be extended by the TSP for bay extension.

Reply: Existing fire hydrant system shall be extended from existing system (if required)

2.9 Please clarify that Status of land acquisition for Substations. Whether the lands have been acquired by BPC and will be transferred to TSP.

Reply: The acquisition of land for substation is in the scope of TSP.

2.10 We understood that no any dedicated metering CT and CVT required for Line/feeders. Further, we understood that requisite Energy meters for various 765 kV, 400 kV and 220 kV Feeders shall be provided and installed by CTU free of cost to TSP.

Reply: Dedicated metering CT and CVT are not required for line/feeders. Metering core of existing CT/CVT can be used provided accuracy class is matching with metering requirement. Requisite Special Energy Meters shall be provided and installed by CTU at the cost of TSP in C&P panel subject to space availability, else, in separate metering panel (to be provided by TSP at its cost).

3.0 Communication

3.1 What are the usage of OPGW, FOTE, PMU etc. under communication requirement of RFP?

Reply: User shall be responsible for providing compatible equipment along with appropriate interface for uninterrupted communication with the concerned control center and shall be responsible for successful integration with the communication system provided by CTU.

Communication systems e.g. OPGW, FOTE, PMU etc. are required for grid operation through RLDC/SLDC, speech communication, tele-protection and tele-metering.

3.2 Is space for installation of communication panels are provided to TSP in existing Substations incase new bays are in the scope of TSP?

Reply: The space related issues are deliberated in the RFP itself. TSP to carry out survey of the existing substation for physical space requirement. In case space is not available in the existing substation then TSP shall accommodate the same in the respective bay SPR (Switchyard Panel Room)/Bay Kiosk/ Relay panel room in case of GIS s/s. Further, TSP to connect and integrate the proposed FOTE with the existing FOTE in the control room.

In Case 132 kV Substation TSP shall accommodate the said panels either by extension of existing control room or other arrangements.

3.3 How is the OPGW laying done in case of LILO lines?

Reply: In case LILO lines are on same towers (e.g. both Line in and Line Out portion are on same towers, generally done LILO of S/C lines). Then 2x24F OPGW shall be required to install by TSP on both earthwire peak on 400 kV and 765 kV lines where two E/W peaks are available. On 220 kV and 132 kV lines where only one E/W peak is available TSP to install one no. 48F OPGW.

Incase LILO lines are on different towers (e.g. both Line In and Line Out portion are on different towers, generally done LILO of D/C lines). Then 1x24F OPGW shall be required to install by TSP on one earthwire peak, on both Line in and Line Out portions of 400 kV and 765 kV lines. On 220 kV and 132 kV lines where only one E/W peak is available TSP to install one no. 24F OPGW in place of conventional earthwire.

3.4 How is the OPGW laying done in case Multi circuit Towers?

Reply: In case two different lines are using common multi circuit portion for some distance (originating from different stations, may be terminating on same or on different stations). Two No. 24F OPGW to be installed on both E/W peaks for common M/C portion of 765 kV and 400 kV lines.

Incase 220/132 kV lines using multi circuit portion where single E/W peak is available one no. 48F may be installed for common multi circuit portion.