Amendment-14 (dated: 21.04.2025) to RFP Documents "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			
Sl. No.	**Clause No.**	**Existing Clause**	**New/Revised Clause**
1.	Amendment-02, Appendix C.6 Specific Technical Requirement of 2500 MW (2x1250 MW), ±500 kV HVDC of RfP.	Amendment-02, Appendix C.6 3.7 **I/O Driver Development Software and Source Code** The simulator supplier shall supply the **source code and** documented application examples to enable TSP and its suppliers to develop and implement software interface with custom or third-party input-output interface boards used to communicate with other equipment or other real-time simulators. The **source code** example shall enable to implement fast and low latency communication interface with a maximum latency of 10 microseconds to transfer a data packet of 500 bytes in both directions.	Amendment-02, Appendix C.6 3.7 **I/O Driver Development Software and Source Code** The simulator supplier shall supply the documented application examples to enable TSP and its suppliers to develop and implement software interface with custom or third-party input-output interface boards used to communicate with other equipment or other real-time simulators. The example shall enable to implement fast and low latency communication interface with a maximum latency of 10 microseconds to transfer a data packet of 500 bytes in both directions

2.	Appendix C.4 Specific Technical Requirement of 2500 MW (2x1250 MW), ±500 kV HVDC of RfP.	Appendix C.4 of RfP **DEFINITIONS** **OUTAGE TERMS** **…..** **…..** 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.	Appendix C.4 of RfP **DEFINITIONS** **OUTAGE TERMS** **…..** **…..** 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 **as a direct or immediate consequence of a single event.**
3.	Appendix C.2 of RfP Specific Technical Requirement of 2500 MW (2x1250 MW), ±500 kV HVDC of RfP.	Appendix C.2 of RfP **Operator's Control, Monitoring and Support Systems** …… …… **5. Miscellaneous Operator Controls** ……. 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.	Appendix C.2 of RfP **Operator's Control, Monitoring and Support Systems** …… …… **5. Miscellaneous Operator Controls** ……. 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 current to drop to zero.

4.	Annexure C Cl:12. Page No: 145 of 261 of RfP Specific Technical Requirement of 2500 MW (2x1250 MW), ±500 kV HVDC of RfP.	Cl:12. DC power circuit switching requirement: ……………. Page No: 145 of 261 of RfP …….. 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.	Cl:12. DC power circuit switching requirement: ……………. Page No: 145 of 261 of RfP …….. 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 reduction in power transfer to less than the rating of one Pole.
5.	Annexure C Cl:15. Dynamic Performance (b) and (d) Page No: 154 of 261 of RfP Specific Technical Requirement of 2500 MW (2x1250 MW), ±500 kV HVDC of RfP.	Cl:15. Dynamic Performance 15 ……. ……. (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.	Cl:15. Dynamic Performance 15 ……. ……. (b) The HVDC system shall recover to 90% of the pre-fault DC power transfer level consistently **in less than 500 ms** from the instant of fault clearing, without subsequent sustained oscillation for all inverter AC system fault conditions, **except for the case of Islanding at Khavda (rectifier) station].** For all rectifiers AC system fault conditions, the recovery time, to 90% pre-fault power level, shall be **in less than 500 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

		………. ………. (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.	recovery times other than those specified shall also be acceptable, subject to review. ………. ………. (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 **in less than 500 ms** 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.

6.	Annexure C Cl:15. Dynamic Performance (a) Page No: 154 of 261 of RfP Specific Technical Requirement of 2500 MW (2x1250 MW), ±500 kV HVDC of RfP.	Cl: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: ……………….. ……………….. 3. Stabilization of the ac system following major disturbances. …………………….	Cl: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: ……………….. ……………….. 3. Stabilization of the ac system following major disturbances **as per its capability limits.** …………………….
7.	Annexure C Cl:9:.Converters Operating modes Page No: 140 of 261 of RfP Specific Technical Requirement of 2500 MW (2x1250 MW), ±500 kV HVDC of RfP.	Cl:9. Converters Operating modes ………………. The minimum operating modes are as follows: ……………….. 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. …………………….	Cl:9. Converters Operating modes ………………. The minimum operating modes are as follows: ……………….. h. **Black start:** Facility for Black start capability shall be possible for both the stations **at nominal DC Voltage**. 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. …………………….

8.	Annexure C Cl:10: System Studies Page No: 142 of 261 of RfP Specific Technical Requirement of 2500 MW (2x1250 MW), ±500 kV HVDC of RfP.	**10. System Studies** ……………. (bb) Studies of DC Current flowing through Windings of Converter Transformers. …………..	**10. System Studies** ……………. (bb**) deleted.** …………..
9.	Annexure C Cl:18: Page No: 159 of 261 of RfP Specific Technical Requirement of 2500 MW (2x1250 MW), ±500 kV HVDC of RfP.	**18. Converter Station AC Yard, Transformer yard and valve hall** (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. ……………… ………………	**18. Converter Station AC Yard, Transformer yard and valve hall** (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 **and adequate filter shall be provided**. **Suitable redundancy shall be provided in the filters to avoid reduction of transmission capacity of the station.** The AC harmonic filters shall be switched in and out by circuit breakers in FIFO logic to increase lifetime of switchgear. ……………… ………………

10.	Annexure C Cl:9:.Converters Operating modes Page No: 140 of 261 of RfP Specific Technical Requirement of 2500 MW (2x1250 MW), ±500 kV HVDC of RfP.	**9. Converters Operating modes** The minimum operating modes are as follows: ……………….. f. Reactive Power and AC voltage control mode ……………………. Any oscillations of power and voltage at the HVDC converter shall be well damped and eliminated. g. STATCOM MODE…………	**9. Converters Operating modes** The minimum operating modes are as follows: ……………….. f. Reactive Power and AC voltage control mode ……………………. Any oscillations of power and voltage at the HVDC converter shall be well damped and eliminated **as per its capability.** g. STATCOM MODE…………
11	Appendix C.3, Clause 1 (Page No. 208) of Specific Technical Requirement of 2500 MW (2x1250 MW), ±500 kV HVDC of RfP.	**1. General** …………………………… …………………………… TFR shall also have facility for harmonic analysis upto 100th harmonics, inter-harmonics of waveforms. …………………………… ……………………………	**2. General** …………………………… …………………………… TFR shall also have facility for harmonic analysis upto **50th** harmonics, inter-harmonics of waveforms. …………………………… ……………………………

12	Annexure C Cl:15: Page No: 154 of 261 of RfP Specific Technical Requirement of 2500 MW (2x1250 MW), ±500 kV HVDC of RfP.	**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: ………………… ………………… 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.	**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: ………………… ………………… 6. Control of power levels depending on the system configuration. Such a control may require Run Back control features.
13.	Annexure C Cl:18: Page No: 160 of 261 of RfP Specific Technical Requirement of 2500 MW (2x1250 MW), ±500 kV HVDC of RfP.	**18. Converter Station AC Yard, Transformer yard and valve hall** **(d)** …………… …………… 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**	**18. Converter Station AC Yard, Transformer yard and valve hall** **(d)** …………… …………… 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 **except the reduced DC line voltage mode.**

		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.	
14	Annexure C Cl:45: Page No: 188 of 261 of RfP Specific Technical Requirement of 2500 MW (2x1250 MW), ±500 kV HVDC of RfP.	**46. Performance Guarantee for Converter Station (excluding HVDC line)** ……. ……. 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^	**46. Performance Guarantee for Converter Station (excluding HVDC line)** ……. ……. d. 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^

		Table - 10	**Table - 10**

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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 year	Not more than 8 (with average outage duration of 7.5 hours)
5	Bipole outage per year	Not more than 0.2 (with average outage duration of 8 hours)
6	No-load losses (kW)	0.2 % of Bipole Rating per station
7	Equivalent load loss (kW)$	**Max 1.0 % of Bipole Rating per station**

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7	Equivalent load loss (kW)$	**Max 1.1 % of Bipole Rating per station**

15	Annexure C Cl:8: Page No: 139 of 261 of RfP Specific Technical Requirement of 2500 MW (2x1250 MW), ±500 kV HVDC of RfP.	**8. Reduced DC Line Voltage** ……... 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.**	**8. Reduced DC Line Voltage** ……... 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.
16	Appendix C.4 of Specific Technical Requirement of 2500 MW (2x1250 MW), ±500 kV HVDC of RfP.	Appendix C.4 Definitions 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.	Appendix C.4 Definitions 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. **The end of an outage is typically the last switching action related to return of the equipment to operational readiness.**

17.	Annexure-C of RFP Cl:10. System studies (k) Page No: 141 of 261 Specific Technical Requirement of 2500 MW (2x1250 MW), ±500 kV HVDC of RfP.	Annexure-C Page No: 141 of 261 **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.	Annexure-C Page No: 141 of 261 **TSP shall consider at least 02nos. cases i.e peak load and light load/extremely weak cases for network reduction.** 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.
18.	Annexure-C of RFP Cl:41 Page No: 141 of 261 Specific Technical Requirement of 2500 MW (2x1250 MW), ±500 kV HVDC of RfP.	**41. DC Line Faults** ………….. ………….. 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. ……………. …………….	**41. DC Line Faults** ………….. …… b) Maximum cooling period between two consecutive DC line auto-restart sequence shall be 60 minutes in case successful auto-restart operation, and 120 minutes in case unsuccessful auto-restart operation, during which tripping may be allowed. ……………. …………….

19	Clause 13 (c) on Page 146 of RfP	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.	The tripping action on Over Voltage for lines shall be as per the Regional Over Voltage Protection Philosophy specified by the RPC. In genera or the default tripping action should initiate if the fundamental frequency over voltage exceeds 1.1 pu for 10 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.
20	Clause 13 (i) on Page 151 of RfP	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. ...	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 upto 1.3 pu. …
21	Clause 34 (a) on Page 181 of RfP	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.	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. **Additionally, one more 33 kV supply from independent source shal be arranged and connected to 33 kV Bus at both KPS3 HVDC and South Olpad Stations.** 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.

22	Clause 37 Para 4 on Page 184 of RfP	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.	**Reactive current** 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.
23	Clause 41 Para 2 on Page 186 of RfP	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.	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. **Upon failure of both the attempts converter shall go into STATCOM mode. This constitutes one complete auto-restart sequence.** **All equipment shall be dimensioned considering the above auto-restart sequence.**
24	"Specific Requirement for Phasor Measurement Units (PMUs)" mentioned on Pae No 248 of RfP	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. ...	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 "Guidelines on Unified Philosophy for placement of PMUs in Indian Grid" issued vide CEA letter No. CEA-PS-14-12/9/2024-PSETD Division dated 19.03.2025 for the scope of this RfP. ...

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