सेंट्रल ट्रांसमिशन यूटिलिटी ऑफ इंडिया लिमिटेड
(पावर ग्रिड कॉर्पोरेशन ऑफ इंडिया लिमिटेड के स्वामित्व में)
(भारत सरकार का उद्यम)
CENTRAL TRANSMISSION UTILITY OF INDIA LTD.
(A wholly owned subsidiary of Power Grid Corporation of India Limited)
(A Government of India Enterprise)

Ref: CTU/Special Joint CMETS_Minutes

दिनांक/Date: 26-10-2026

As per Distribution List

Subject: Minutes of Special Joint CMETS Meeting involving Western, Eastern & Northern Region for deliberating 1150 kV Ultra High Capacity Transmission Corridor for interconnection of WR & ER and associated interconnections held on 21.09.2026

Sir/Ma'am,

The Special Joint CMETS Meeting involving Western, Eastern & Northern Region for deliberating 1150 kV Ultra High-Capacity Transmission Corridor for interconnection of WR & ER and associated interconnections was held on 21.09.2026 through video conferencing. In this regard, please find enclosed minutes of the meeting. The same is available on CTUIL website (*www.ctuil.in >> ISTS Planning & Coordination >> Consultation Meetings for ISTS >> Eastern Region, Western Region, Northern Region*)

धन्यवाद/ Thanking you,

भवदीय / Yours faithfully,

26/10/2026

(R V M M Rao)
Chief General Manager (Tr. Plg.)

Encl.: as above

Distribution List of WR:

1. Chief Engineer (PSP&A – I) Central Electricity Authority Sewa Bhawan, R.K. Puram, New Delhi-110 066.	**2. Director (Transmission/GEC)** Ministry of New and Renewable Energy, Block 14, CGO Complex, Lodhi Road, New Delhi-110003
3. Member Secretary Western Regional Power Committee MIDC area, Marol, Andheri East, Mumbai 400 093	**4. Director (Power System)** Solar Energy Corporation of India Ltd. D-3, 1st Floor, A wing, Religare Building, District Centre, Saket, New Delhi-110017
5. Managing Director Gujarat Energy Transmission Corp. Ltd, Sardar Patel Vidyut Bhawan, Race Course, Vadodara -390 007	**6. Director (Operation)** Maharashtra State Electricity Transmission Co. Ltd., 4th Floor, "Prakashganga", Plot No. C-19, E-Block, Bandra – Kurla Complex, Bandra (East), Mumbai- 400051
7. Managing Director Chhattisgarh State Power Transmission Co. Ltd., Dangania, Raipur- 492 013	**8. Chairman & Managing Director** Madhya Pradesh Power Transmission Co. Ltd., Block No. 3, Shakti Bhawan, Rampur, Jabalpur-482 008
9. Executive Engineer Administration of Union Territory of Dadra & Nagar Haveli and Daman & Diu Secretariat, Moti Daman - 395 220	**10.Chief Engineer** Electricity Department The Government of Goa, Panaji
11.Executive Director Western Regional Load Despatch Centre F-3, M.I.D.C. Area, Marol, Andheri East, Mumbai-400 093	**12.Director (SO)** Grid Controller of India Ltd. (Formerly POSOCO) 9th Floor, IFCI Towers, 61, Nehru Place, New Delhi - 110019

Distribution List of ER:

1. Chief Engineer, PSP&A-II Central Electricity Authority Sewa Bhawan, R.K.Puram New Delhi-110066	**2. Member Secretary** Eastern Regional Power Committee 14, Golf Club Road, Tollygunge Kolkata-700033

3. **Director (SO)** Grid Controller of India Limited 9th Floor, IFCI Towers, 61, Nehru Place, New Delhi-110016	4. **Executive Director** Eastern Regional Load Despatch Centre 14, Golf Club Road, Jubilee Park, Golf Gardens, Tollygunge, Kolkata, West Bengal - 700095
5. **CMD** Bihar State Power Transmission Company Ltd. (BSPTCL) Vidyut Bhavan, 4th floor, Bailey Road Patna-800021	6. **Principal Chief Engineer cum Secretary** Power Department Government of Sikkim Gangtok, Sikkim-737101
7. **CMD** Jharkhand Urja Sancharan Nigam Limited (JUSNL) Engineering Building, HEC, Dhurwa Ranchi -834004	8. **Managing Director** West Bengal State Electricity Transmission Company Ltd. (WBSETCL) Vidyut Bhavan, 8th Floor, A-Block Salt Lake City, Kolkata-700091
9. **CMD** Odisha Power Transmission Corporation Ltd. Bhoinagar Post Office, Jan path Bhubaneshwar-751022	10. **CMD** Damodar Valley Corporation DVC Towers, VIP Road Kolkata-700054

Distribution List of NR:

1. **Director (Power System)** Solar Energy Corporation of India Ltd. D-3, 1st Floor, A wing, Religare Building, District Centre, Saket, New Delhi-110017	2. **Director** Ministry of New and Renewable Energy Block 14, CGO Complex, Lodhi Road, New Delhi-110003
3. **Director (SO)** Grid Controller of India Limited (erstwhile POSOCO) 9th Floor, IFCI Towers, 61, Nehru Place, New Delhi-110 016	4. **Executive Director** Northern Regional Load Despatch Centre 18-A, Qutab Institutional Area, Shaheed Jeet Singh Sansanwal Marg, Katwaria Sarai, New Delhi– 110 016
5. **Director (P & C)** HPPTCL, Headoffice, Himfed Bhawan, Panjari, Shimla-171005 Himachal Pradesh	6. **Director(W&P)** UP Power Transmission Company Ltd. Shakti Bhawan Extn, 3rd floor, 14, Ashok Marg, Lucknow-226 001
7. **Director (Technical)** Punjab State Transmission Corporation Ltd. Head Office, The Mall, Patiala 147001, Punjab	8. **Director (Projects)** Power Transmission Corporation of Uttrakhand Ltd. Vidyut Bhawan, Near ISBT Crossing, Saharanpur Road, Majra, Dehradun.

9. Development Commissioner (Power) Power Development Department Grid Substation Complex, Janipur, Jammu	**10. Director (Technical)** Rajasthan Rajya Vidyut Prasaran Nigam Ltd. Vidyut Bhawan, Jaipur, Rajasthan-302005.
11. Member (Power) Bhakra Beas Management Board Sector-19 B, Madhya Marg, Chandigarh - 160019	**12. Superintending Engineer (Operation)** Electricity Circle, 5th Floor, UT Secretariat, Sector-9 D, Chandigarh - 161009
13. Director (Operations) Delhi Transco Ltd. Shakti Sadan, Kotla Road, New Delhi-110 002	**14. Director (Technical)** Haryana Vidyut Prasaran Nigam Ltd. Shakti Bhawan, Sector-6, Panchkula-134109, Haryana

Minutes of the Special Joint CMETS Meeting of Western, Eastern & Northern Region for deliberating 1150 kV Ultra High-Capacity Transmission Corridor for interconnection of WR & ER and associated interconnections held on 21.09.2026

Chief General Manager (Transmission Planning), CTUIL, welcomed all the participants. It was informed that the primary agenda of the meeting is deliberation on 1150 kV Ultra High-Capacity Transmission Corridor for interconnection of WR & ER and associated interconnections. The list of participants is enclosed in Annexure-I.

CTUIL presented the agenda covering the background, planning philosophy, generation and demand assumptions, technology readiness, study methodology, study results, phasing philosophy and implementation aspects of the proposed 1150 kV Ultra High-Capacity Transmission Corridor for interconnection of Western Region and Eastern Region along with HVDC interconnection between NR & WR.

1) Background

CTUIL informed that India is witnessing rapid expansion of renewable generation capacity, development of large thermal generation complexes, large-scale Battery Energy Storage Systems (BESS), Pumped Storage Projects (PSPs), Green Hydrogen/Green Ammonia (GH/GA) projects and industrial electrification. The generation and demand centres envisaged for the future timeframe indicate increasing requirement for bulk transfer of power over long distances across regions.

As per expected generation & load growth in future time frame, it has been observed that substantial generation capacity is likely to be integrated in Rajasthan, Gujarat, Maharashtra, Chhattisgarh and North Eastern Region, whereas major demand growth is inter alia expected in Andhra Pradesh, Odisha and other industrial regions including GH/GA & data centres loads. Accordingly, a requirement was felt to examine the feasibility of development of a future ultra-high-capacity transmission backbone capable of carrying bulk power with optimum utilization of Right-of-Way (RoW) and improved transmission efficiency.

In this regard, studies have been carried out for development of a 1150 kV Ultra High Voltage AC (UHVAC) transmission corridor interconnecting Western Region and Eastern Region along with associated transmission systems and HVDC interconnections from NR to WR. The proposed corridor aims to facilitate transfer of power from various upcoming generation complexes and strengthen East-West power exchanges while also supporting integration of large industrial loads in Eastern India.

2) Salient Features of 1150 kV Transmission System

CTUIL mentioned that the proposed transmission system is based on nominal voltage level of 1150 kV in line with the recommendations of the Technical Committee constituted by CEA for introduction of 1150 kV transmission system in India & latest Manual on Transmission Planning Criteria, 2026.

The proposed 1150 kV Ultra High Capacity Transmission Network offers substantially higher transmission capability compared to the existing 765 kV system. The corridor has a Surge Impedance Loading (SIL) of approximately 5,500 MW and a thermal transfer capability of about 14,000 MVA (Considering Octa Bersimis conductor). The terminal transfer capability is estimated at 9,500 MVA, which is commensurate with the current rating of available associated bay equipment (5000A).

The system facilitates bulk power evacuation and transfer of large upcoming generation with enhanced reliability, lower transmission losses, and improved Right-of-Way (RoW) utilization. The significantly higher power carrying capability of the 1150 kV network also minimizes the need for multiple EHV transmission corridors, resulting in a more efficient and optimized transmission infrastructure.

It was informed that the planning studies have been carried out considering:

- Nominal voltage level of 1150 kV.
- 1150/400 kV and 1150/765 kV ICT: 3000MVA (3x1000MVA single phase)

  For a 1150/400 kV, 3000 MVA ICT, the corresponding ampacity at the 400 kV level is approximately 4.3 kA. Accordingly, the 400 kV bays terminating the ICT shall be designed with a minimum ampacity of about 5 kA (considering overload capacity of 10% in ICT).

- 1200kV, 660MVAr (3x220 MVAr single-phase units)
- Integration of large RE complexes through associated HVDC systems.
- Bulk transfer of power between generation-rich and demand-rich regions.

3) Generation and Demand Considered in Studies

3.1 Additional Generation Considered

It was informed that in addition to the generation considered under Rolling Plan studies for 2031-32 timeframe, the following major generation sources have been considered for evolution of the corridor:

a) Thermal Generation in Chhattisgarh

Chhattisgarh: about 7GW (identified by CEA)

Out of the above, about 5.2 GW generation at Raigarh Kotra-III 1150/400kV S/s has been considered in studies. (Godna TPS: 1600MW, Akaltara: 1800MW & KSK Mahanadi: 1800 MW). No applications for Connectivity under GNA received at Raigarh Kotra-III S/s.

b) Renewable Generation in Rajasthan

The studies have considered:

- 6 GW RE generation at Bhadla-IV
- 6 GW RE generation at Ramgarh-II (including 1GW RE generation from Ramgarh-I PS)

along with associated 2685 MW BESS at Ramgarh-II & 3390MW BESS at Bhadla-IV location for providing flexibility and facilitating enhanced utilization of transmission infrastructure.

c) Hydro, Thermal and PSP Development in NER

The studies have also incorporated the potential and application received in NER to assess long-term transfer requirements from North Eastern Region to the rest of the country as per details given below:

- 4.63 GW Hydro generation in Arunachal Pradesh
- 3.2 GW Thermal generation in Assam

- 5.8 GW (Injection)/6.815 GW (Drawal) PSP in Assam

d) Renewable Integration at Solapur

Applications for ~5.5GW have been received at Solapur PS. 3.5GW capacity has been accommodated at Solapur PS (under implementation/approval). For balance ~2GW and additional capacity, New PS at Solapur-II for 3 GW capacity is being planned.

3.2 Additional Demand Considered

It was informed that, apart from the demand projections considered in the 20th EPS, substantial industrial demand expected to arise in Odisha has also been considered in the studies. The demand comprises Green Hydrogen, Green Ammonia, steel, petrochemical, PV manufacturing and EV manufacturing loads. The studies have considered:

Location	Potential Demand	Applications
Paradeep	6 GW	5.35 GW
Gopalpur	6 GW	3.575 GW
Jeypore	2.9 GW	NIL

CTUIL stated that these demand centres significantly influence the power flow pattern across Eastern Region and were considered as one of the principal drivers for evolution of the proposed 1150 kV corridor. Moreover, the entire upcoming bulk demand in eastern part of Odisha in ISTS and intra-state are dependent on Angul S/s for supply of power. There is a need to provide additional corridor for these demand centres (about 8-9GW in ISTS and 1.5-2GW in intra-state) for reliable power supply.

4) Evolution of the Proposed 1150 kV Corridor

CTUIL informed that based on the above generation and demand assumptions, an 1150 kV transmission backbone extending from Maharashtra through Chhattisgarh to Odisha and West Bengal has been evolved:

The key nodes proposed under the corridor include:

- Aurangabad (New)
- Wardha (New)
- Rajnandgaon
- Raigarh Kotra-III
- Bolangir (New)
- Begunia
- Chaibasa (New)
- Basantpur
- Jeypore-2

The corridor is proposed to be supported through a series of 1150 kV D/c transmission lines, 1150/400 kV and 1150/765 kV ICTs, bus reactors, line reactors and associated 765 kV & 400 kV interconnections.

Summary of proposed 1150kV scheme is as under:

Major System (only 1150kV S/s and lines)	No of lines	Ckm	No of S/s	MVA
✓ Aurangabad (New), Wardha (New) & Rajnandgaon 1150kV S/s ✓ Aurangabad (New) – Wardha (New) upgradation as 1150kV S/c line ✓ Wardha (New) - Rajnandgaon 1150kV D/c line	1+1 (upgradation)	610	3	21000
✓ Raigarh Kotra-III, Bolangir, Begunia, Chaibasa, Basantpur 1150kV S/s ✓ Rajnandgaon - Raigarh Kotra-III – Bolangir – Begunia 1150kV D/c line ✓ Raigarh Kotra-III - Chaibasa - Basantpur 1150kV D/c line	5	2600	5	39000

✓ Jeypore-II 1150kV S/s ✓ Bolangir (New) – Jeypore- II 1150kV D/c line	1	540	1	6000
Total	**7 (new) +1 (upgradation)**	**3750**	**9**	**66000**

±800kV, 6000MW HVDC from Ramgarh-II to Aurangabad (New) and ±800 kV, 6000 MW Bhadla-IV – Raigarh Kotra-III HVDC (in matching timeframe of 1150kV scheme)

Details of the complete evolved scheme is given below (Schematic attached):

1) Creation of 1150kV level at Aurangabad (New) S/s* with 1150/400kV, 3x3000MVA ICTs along with 2*660MVAr, 1200kV Bus reactor
2) Augmentation of Aurangabad (New) with 5x1500MVA, 765/400kV ICTs
3) Establishment of Wardha (New) S/s* with 1150/400kV, 2x3000MVA ICTs along with 2*660MVAr, 1200kV Bus reactor
4) Operation of Wardha – Aurangabad 400kV D/c existing line as Wardha – Aurangabad 1150kV S/c line and termination of the line to Aurangabad (New) (~5km) & Wardha (New) (~5km) (total line length ~360km) along with adequate reactive power compensation at both end(s).
5) LILO of Wardha-Warora 400kV D/c line at Wardha (New) (~20km)
6) Aurangabad (New) – Parli (New) 765kV D/c line (~200km) along with adequate reactive power compensation at both end(s).
7) Creation of 1150kV level at Rajnandgaon S/s with 1150/765kV, 2x3000MVA ICTs along with 2*660MVAr, 1200kV Bus reactor
8) Wardha (New) – Rajnandgaon 1150kV D/c line (~300km) along with adequate reactive power compensation at both end(s).

9) Creation of 1150kV level at Raigarh Kotra-III S/s with 1150/400kV, 4x3000MVA S/s ICTs along with 2*660MVAr, 1200kV Bus reactor
10) Rajnandgaon – Raigarh Kotra -III1150kV D/c line (~230km) along with adequate reactive power compensation at both end(s).
11) Establishment of 1150/400kV, 2x3000MVA S/s at Bolangir (New) along with 2*660MVAr, 1200kV Bus reactor & 2*125MVAr, 420kV Bus reactor
12) Establishment of 1150/400kV, 2x3000MVA and 765/400kV, 2x1500MVA S/s at Begunia along with 2*660MVAr, 1200kV Bus reactor, 2*330MVAr, 765kV Bus reactor & 2*125MVAr, 420kV Bus reactor
13) Bolangir (New) – Begunia 1150kV D/c line (~250km) along with adequate reactive power compensation at both end(s).
14) Bolangir (New) – Bolangir 400kV D/c (Quad) line (~10km)
15) Begunia – Paradeep 765kV D/c line (~120km) along with adequate reactive power compensation at Paradeep end.
16) Begunia – Gopalpur 765kV D/c line (~150km) along with adequate reactive power compensation at Gopalpur end.
17) Begunia – Khuntuni (OPTCL) 765kV D/c line (~70km)
18) Begunia – Mendhasal (OPTCL) 400kV D/c (Quad) line (~50km)
19) Establishment of 1150/400kV, 2x3000MVA S/s at Chaibasa (New) along with 2*660MVAr, 1200kV Bus reactor & 2*125MVAr, 420kV Bus reactor
20) Establishment of 1150/400kV, 3x3000MVA at Basantpur along with 2*660MVAr, 1200kV Bus reactor & 2*125MVAr, 420kV Bus reactor
21) Chaibasa (New) – Basantpur 1150kV D/c line (~270km) along with adequate reactive power compensation at both end(s).
22) Chaibasa (New) – Chaibasa 400kV D/c (Quad) line (~10km)
23) Basantpur – Chanditala (WBSETCL) or suitable point nearby point 400kV D/c (Quad) line (~20km)
24) Basantpur – Subashgram or suitable point nearby point 400kV D/c (Quad) line (~60km)

25) Raigarh Kotra -III– Bolangir (New) 1150kV D/c line (~200km) along with adequate reactive power compensation at both end(s).

26) Raigarh Kotra -III– Chaibasa (New) 1150kV D/c line (~350km) along with adequate reactive power compensation at both end(s).

27) Establishment of 1150/400kV, 2x3000MVA S/s at Jeypore-2 along with 2*660MVAr, 1200kV Bus reactor & 2*125MVAr, 420kV Bus reactor

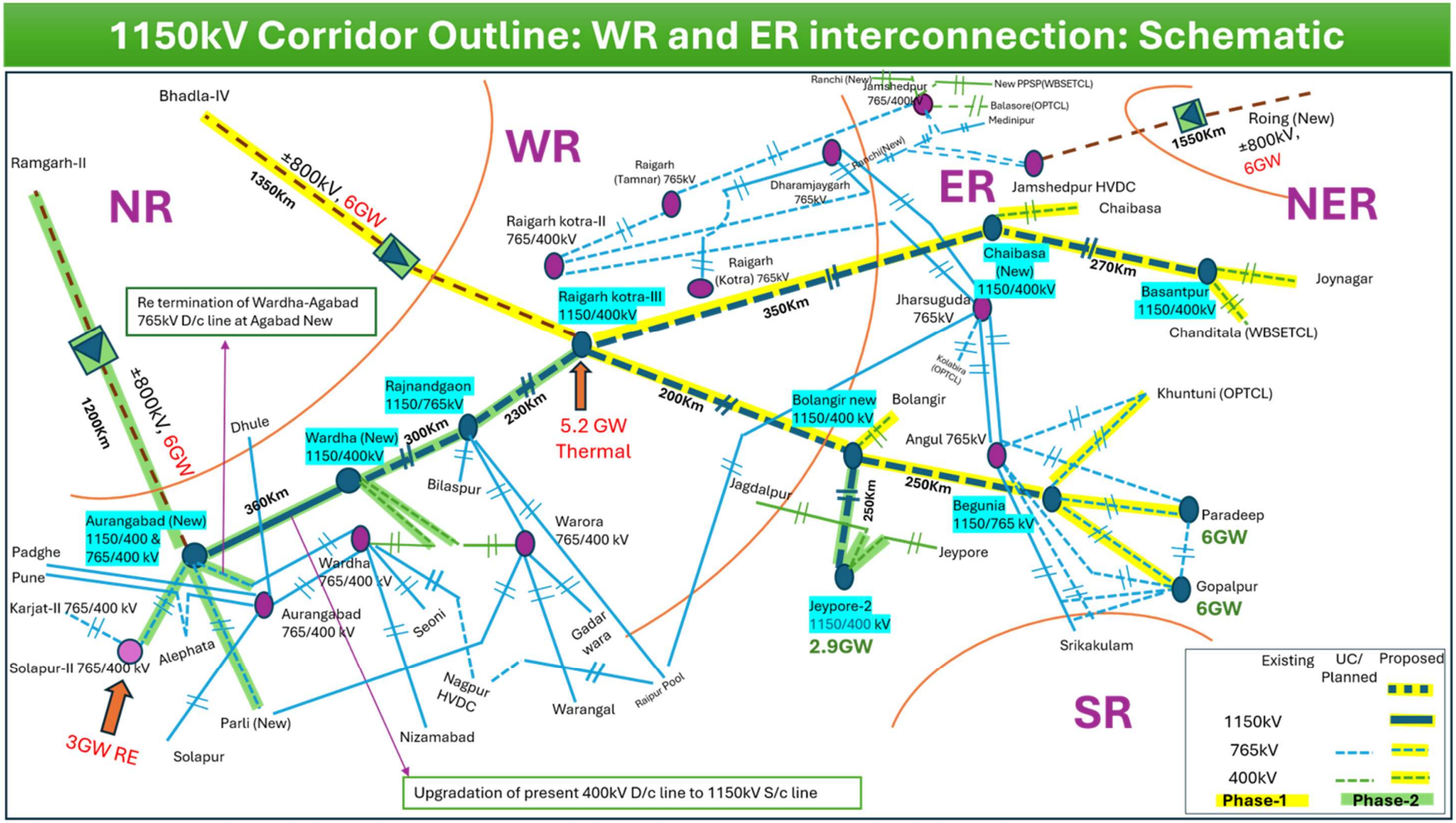
28) LILO of Jeypore – Jagdalpur 400kV D/c HTLS line at Jeypore-2 (~10km)

29) Bolangir (New) – Jeypore-2 1150kV D/c line (~270km) alon gwith adequate reactive power compensation at both end(s).

** Due to space constraints at existing Wardha & Aurangabad S/s for upgrading it to 1150kV level, Wardha (New) & Aurangabad (New) S/s have been proposed along with associated interconnections. Aurangabad (New) 765kV switching station along with associated 765kV interconnections is to be taken up for catering to Solapur applications.*

In addition to the above, the following HVDC systems have been considered for facilitating transfer of bulk power into the proposed AC system:

- ±800 kV, 6000 MW Ramgarh-II – Aurangabad HVDC
- ±800 kV, 6000 MW Bhadla-IV – Raigarh Kotra-III HVDC
- ±800 kV, 6000 MW Roing – Jamshedpur HVDC



5) Study Cases Examined earlier for evolution of complete 1150kV scheme

It was informed that to evaluate robustness of the proposed corridor under different levels of generation and demand realization, four distinct study cases were considered:

Base Case

Complete 1150 kV corridor with all proposed generation and demand assumptions.

Case-1

Generation and GH/GA demand considered only to the extent of applications received, including reduction in demand at Paradeep and Gopalpur and exclusion of thermal generation at Kotra-II.

Case-2

Base case without Bhadla-IV – Kotra-II HVDC system.

Case-3

Case with both reduced GH/GA demand and exclusion of Bhadla-IV – Kotra-II HVDC system.

Each case was studied under nine operating scenarios considering seasonal variations, renewable generation patterns, thermal dispatch conditions and hydrogen demand variations.

6) Observations Raised by GRID-INDIA

It was further informed that the study files and study results were subsequently shared with GRID-INDIA for technical examination. GRID-INDIA examined the study results and communicated detailed observations.

a) Nominal Voltage and Equipment Modelling

GRID-INDIA observed that the studies have been carried out considering operation of the proposed transmission corridor at 1100 kV, whereas Manual on Transmission Planning Criteria-2026 and recommendations of the Technical Committee constituted by CEA envisage development of the transmission system at nominal voltage level of 1150 kV with 1200 kV as maximum system voltage. Clarification was sought regarding operation of 1150/400 kV and 1150/765 kV ICTs at 1100 kV and consequent adequacy of the equipment modelling adopted in the studies.

b) Dependency of the Proposed Corridor on Other Planned Systems

It was observed that the effectiveness of the corridor is dependent upon implementation of a number of associated schemes including the 6000 MW Ramgarh-II–Aurangabad HVDC, 6000 MW Bhadla-IV–Raigarh Kotra-III HVDC, Solapur transmission systems and NER transmission systems including Roing-Jamshedpur HVDC. In addition, realization of Green Hydrogen and Green Ammonia loads in Odisha remains uncertain. Accordingly, a phased implementation strategy and assessment of alternate evolution paths was suggested.

c) Load Generation Balance (LGB)

GRID-INDIA observed that the demand assumptions considered in several scenarios require review and alignment with 20th Electric Power Survey projections and practical demand growth trajectories. It was further observed that renewable energy curtailment necessary for balancing the system under solar peak conditions had not been explicitly brought out in the studies. Revision of LGB considering realistic demand growth, generation dispatch and storage deployment was suggested.

d) Thermal Generation Dispatch

It was observed that thermal generating stations in a large number of study cases were operating below the practical technical minimum limit of 40%. It was suggested that thermal generation dispatch be reviewed in accordance with practical operational considerations and merit-order principles.

e) Modelling of PSPs, Wind Generation and BESS

Observations were made regarding low PSP dispatch in certain cases, PSP operation in generating mode during solar hours, lower wind generation dispatch assumptions vis-à-vis Draft Amendment-II and inadequate representation of envisaged BESS capacities. It was suggested to revise dispatch assumptions to appropriately capture renewable integration and system flexibility requirements.

f) Voltage Profile and Reactive Power Issues

Significant voltage violations have been observed in various scenarios. During evening peak and off-peak conditions, severe low voltages and high voltages were reported at several 400 kV and 765 kV buses, indicating requirement of comprehensive reactive power planning and review of compensation philosophy.

g) Thermal Loading of Elements

It was observed that a number of transmission elements exceeded permissible loadings or thermal ratings under normal and contingency conditions. Validation of ratings and review of transmission strengthening measures was suggested.

h) Angular Separation and Stability

High angular separation has been observed across several corridors under N-1 contingency conditions. In particular, the Aurangabad-Wardha corridor and Raigarh Kotra-III – Chaibasa corridor were highlighted wherein angular separation exceeded planning limits. Further transient stability and dynamic simulation studies were suggested.

i) Reactor Modelling, Line Charging and EMT Assessment

Observations were raised regarding modelling of 660 MVAr reactors, charging performance of the Aurangabad-Wardha 1150 kV corridor and associated temporary over-voltage issues. Requirement of detailed EMT studies, switching overvoltage studies, ferro-resonance studies, NGR sizing and TOV studies was highlighted.

7) Revised Studies

CTUIL informed that revised studies were carried out after incorporating the observations received from GRID-INDIA. The following major changes have been made:

a) Adoption of Nominal 1150 kV Planning Philosophy

All proposed 1100 kV equipment, transmission lines and ICTs have been reviewed considering planning at nominal 1150 kV level in accordance with Manual on Transmission Planning Criteria-2026 and recommendations of the Technical Committee constituted by CEA.

b) Revision of Regional Load Generation Balance

The All-India Load Generation Balance (LGB) has been revised considering the envisaged generation capacity and anticipated demand for the FY 2031-32 timeframe along with BESS capacities of around 124 GW granted/agreed under ROFR/non-ROFR framework along with PSPs of around 42 GW. In addition, the incremental generation and demand specifically considered for the 1150 kV system studies have also been incorporated into the revised LGB, including:

5.2 GW Thermal Generation at Raigarh Kotra-III S/s, Additional RE generation in Rajasthan & Paradeep demand (6 GW), Gopalpur demand (6 GW).

c) Revision of Thermal Generation Dispatch

Thermal generating units have been reviewed to ensure that dispatch does not violate practical technical minimum limits, and revised generation schedules have been evolved accordingly.

The thermal generation dispatch framework has been adopted to ensure that state thermal plants serve the load, in proportion to their installed capacities relative to central sector generation, while strictly adhering to merit order dispatch within the state. To meet the balance load requirements, central sector and Independent Power Producer (IPP) thermal plants are deployed, with merit order dispatch carried out region-wise to determine the minimum number of thermal units to be kept on-bar. Subsequently, an all-India merit order dispatch is applied to thermal plants, bringing additional units on-bar wherever necessary to further optimize grid operations while meeting demand and ensuring optimal utilization of the transmission system and available generation resources across the country.

d) Revision of Wind Generation and PSP Assumptions

Solar & Wind generation dispatch has been revised in accordance with Draft Amendment-II dispatch factor and PSP operating schedules have been reviewed considering generation and pumping characteristics under various scenarios.

Region	Scenario No & Name	Hydro	Nuclear	Solar	Wind	BESS	PSP	Gas
NR	4-Jun Solar Max	70%	80%	90%	50%	-100%	-100%	0%
	5-Jun Peak Load	95%	80%	0%	70%	50%	50%	50%
	6-Jun Night Off Peak	70%	80%	0%	60%	0%	100%	50%
WR	4-Jun Solar Max	40%	80%	85%	55%	-100%	-100%	0%
	5-Jun Peak Load	70%	80%	0%	75%	50%	50%	50%
	6-Jun Night Off Peak	40%	80%	0%	65%	0%	100%	50%
SR	4-Jun Solar Max	40%	80%	85%	55%	-100%	-100%	0%
	5-Jun Peak Load	70%	80%	0%	75%	50%	50%	50%
	6-Jun Night Off Peak	40%	80%	0%	65%	0%	100%	50%
ER	4-Jun Solar Max	70%	0%	85%	0%	-100%	-100%	0%
	5-Jun Peak Load	90%	0%	0%	0%	50%	50%	50%
	6-Jun Night Off Peak	70%	0%	0%	0%	0%	100%	50%
NER	4-Jun Solar Max	70%	0%	85%	0%	-100%	-100%	0%
	5-Jun Peak Load	90%	0%	0%	0%	50%	50%	50%
	6-Jun Night Off Peak	70%	0%	0%	0%	0%	100%	50%

Green hydrogen demand at Paradeep & Gopalpur considered in various conditions (as per information provided by one of the green hydrogen developers)

	Sc-1	Sc-2	Sc-3	Sc-4	Sc-5	Sc-6	Sc-7	Sc-8	Sc-9
Demand Factors	100%	15%	30%	100%	15%	30%	100%	15%	30%

e) Validation of Thermal Ratings and Transmission Loading

Transmission elements identified by GRID-INDIA under high-loading conditions have been examined and loading levels have been reviewed based on actual ratings and revised network conditions.

f) Review of Voltage Profile and Reactive Power Planning

Voltage performance under revised LGB has been assessed and compensation requirements have been examined especially at substations proposed under the subject 1150kV scheme.

8) Observations from studies

It was informed that power flow on the proposed 1150 kV corridor was observed to be within permissible limit. In Scenario-4 of the base case, the maximum loading was observed on the Raigarh Kotra-III – Bolangir (New) 1150 kV D/c line, with a power flow of about 3400 MW per circuit under normal operating conditions and about 5660 MW on the remaining circuit under N-1 outage of one circuit. Out of the eight 1150 kV transmission lines, power flow on four lines was observed to be above 4000 MW.

9) Phasing of proposed 1150kV transmission system:

Considering relatively lower utilization of the evolved Phase-2 scheme, the transmission system has been planned for implementation in phases, commensurate with the anticipated growth in generation and load in Maharashtra and Odisha. Further, the 1150 kV corridor is proposed to be progressively integrated with the Southern Region to cater to emerging bulk loads, including data centre loads, thereby ensuring optimal utilization of the transmission infrastructure.

It was informed that the complete 1150 kV network has been proposed for implementation in two phases. Phase-I consists primarily of Raigarh Kotra-III, Bolangir, Begunia, Chaibasa and Basantpur substations together with associated 1150 kV corridors and ±800 kV Bhadla-IV–Raigarh HVDC. Phase-II includes Aurangabad (New), Wardha (New), Rajnandgaon, Jeypore-II and associated lines along with Ramgarh-II–Aurangabad HVDC.

Phase-1

Major System (only 1150kV S/s and lines)	No of lines	Ckm	No of S/s	MVA
✓ Raigarh Kotra-III, Bolangir, Begunia, Chaibasa, Basantpur 1150kV S/s ✓ Raigarh Kotra-III – Bolangir – Begunia 1150kV D/c line ✓ Raigarh Kotra-III - Chaibasa - Basantpur 1150kV D/c line	4	2140	5	39000

- ±800 kV, 6000 MW Bhadla-IV – Raigarh Kotra-III HVDC shall also be required in Phase-1.

Phase-2

Major System (only 1150kV S/s and lines)	No of lines	Ckm	No of S/s	MVA
✓ Aurangabad (New), Wardha (New) & Rajnandgaon 1150kV S/s ✓ Aurangabad (New) – Wardha (New) upgradation as 1150kV S/c line ✓ Wardha (New) – Rajnandgaon - Raigarh Kotra-III 1150kV D/c line	2+1 (upgradation)	1070	3	21000
✓ Jeypore-II 1150kV S/s ✓ Bolangir (New) – Jeypore- II 1150kV D/c line	1	540	1	6000
Total	**3 (new) +1 (upgradation)**	**1610**	**4**	**27000**

- ±800 kV, 6000 MW Ramgarh-II – Aurangabad HVDC shall also be required in Phase-2.

10) Various stakeholders provided their observations/comments on the above proposed system in the meeting. Stakeholder Comments / Observations w.r.t. proposed scheme:

1. CEA

CEA PSPA-I has made the following observations:

- CEA observed that the proposed Phase-I comprises ±800 kV, 6000 MW Bhadla-IV–Raigarh Kotra-III HVDC and downstream evacuation through Raigarh Kotra-III–Chaibasa–Basantpur and Raigarh Kotra-III–Bolangir–Begunia 1150 kV D/c corridors. The loading and utilization of downstream corridors may be examined further.
- Requirement of the proposed Chaibasa–Basantpur 1150 kV D/c corridor may be reviewed considering the presently visible demand scenario in West Bengal.
- Raigarh Kotra-III–Bolangir–Begunia corridor has largely been evolved to cater to proposed GH/GA loads at Paradeep and Gopalpur. However, despite considering about 12 GW GH/GA demand, the corridor loading is observed to be around 3–3.5 GW. Further, Southern Region has been observed to be surplus in the study scenarios and power flow in Angul–Srikakulam corridor appears contrary to present operating trends. Accordingly, Southern Region LGB assumptions may be revisited.
- Load Generation Balance (LGB) of all operating scenarios may be comprehensively validated before finalization of the corridor.
- In Scenario-5, Northern Region has been observed as deficit while power transfer through Bhadla-IV–Raigarh HVDC has been considered. The possibility of loop flows may therefore be examined.
- Since significant changes in power flow patterns are observed through ER–SR interconnections, participation and inputs from Southern Region stakeholders may also be considered.
- The proposed augmentation of Raigarh–Pugalur HVDC for enhancement of reverse power flow capability up to 6000 MW may also be incorporated in the studies.
- Variation in thermal generation dispatch between Scenario-4 and Scenario-5 was observed, particularly with respect to thermal generation in Chhattisgarh. Since the proposed corridor is closely linked with generation at Raigarh (Kotra-II), the impact of thermal dispatch assumptions on corridor utilization may be reviewed.
- Study files corresponding to night/off-peak scenarios may also be shared to enable assessment of reactive compensation requirements and high-voltage conditions under light-loading scenarios.

CTUIL informed that the observations of CEA were noted. It was further informed that additional study files corresponding to night, winter and other operating scenarios would be shared with stakeholders for detailed examination. Regarding the power flow on Bhadla-IV–Raigarh Kotra-III HVDC during Scenario-5 (NR deficit case), CTUIL clarified that about 3390 MW of BESS applications for non-solar hour access have been received/under various stage of grant at Bhadla-IV. Accordingly, a forward power flow of about 3000 MW on the proposed Bhadla-IV–Raigarh Kotra-III HVDC has been considered during evening peak conditions as well, considering discharge of BESS proposed at Bhadla-IV PS. Also, Bhadla and surrounding areas are expected to be surplus which may require the HVDC to evacuate power in this scenario.

The study file considers the Raigarh-Pugalur HVDC link with a reverse power flow of 3000 MW. In addition, sensitivity studies were carried out considering a reverse power flow of 6000 MW on the HVDC link. The results indicate only a marginal variation in the loading of the Raigarh Kotra-III - Bolangir (New) 1150 kV D/c line and Raigarh Kotra-III - Chaibasa (New) 1150 kV D/c line, primarily because there is no direct interconnection between Raigarh Kotra-I/II and Raigarh Kotra-III substations. As the HVDC power order at Raigarh Kotra increases, the additional power is predominantly evacuated through the Raigarh Kotra - Champa PS - Dharamjaigarh 765 kV D/c corridor and the Raigarh Kotra - Tamnar/Dharamjaigarh 765 kV lines, from where it gets dispersed towards the Eastern Region through the Ranchi, Jharsuguda and Jamshedpur corridors. Correspondingly, a reduction in power flow is observed in the downstream network beyond Champa PS due to the increased in-feed at Raigarh Kotra substation. The study results therefore indicate that an increase in reverse power flow on the Raigarh-Pugalur HVDC link does not materially impact the loading of the proposed 1150 kV corridor, as the additional power is largely redistributed through the existing 765 kV transmission network rather than being transferred through the proposed 1150 kV system.

With regard to Chaibasa – Basantpur 1150kV, CTU stated that the load of West Bengal is increasing at a rapid phase and old thermal generations of Kolaghat are expected to be retired in coming years. Currently, there is only one 765kV source viz. Jeerat New 765kV S/s which feeds the majority demand of Kolkata and nearby areas. Thus, another 1150kV S/s would help in meeting the long-term power requirement in Kolkata and nearby areas. The power flow on this corridor is more than 4000MW which is expected to increase rapidly with the rapid power demand growth in Kolkata and nearby areas.

The general tendency of power flow is from ER to SR in the present condition. However, with the increase in the bulk consumers in at Paradeep and Gopalpur and increase in the RE generations in Southern Region, this trend is expected to change and the power flow is expected to be from SR to ER during most of the scenarios. In winter case (Sc-7, 8 & 9), the flow is expected to be from ER to SR, however, the quantum is expected to be on the lower side as majority of their drawal requirement is expected to be met through the WR -> SR corridors.

2. GRID-INDIA

GRID-INDIA has made the following observations:

- Detailed examination of all operating scenarios, including winter scenarios and off-peak conditions, would be necessary before finalization.
- Power flow assumptions on bidirectional HVDC systems, especially Roing-Jamshedpur HVDC and proposed Rajasthan-Chhattisgarh HVDC links, need further review under varying hydro and RE conditions.
- An additional case comprising of high hydro despatch in NER along with injection from PSPs may also be studied for Sc-4 (solar hours).
- Additional analysis may be required for line switching requirements, reactor switching philosophy, restoration scenarios, contingency handling and equipment operating flexibility.
- Complete study files including Scenario-7, Scenario-8 and Scenario-9 should be shared for independent verification of assumptions relating to hydro generation, PSP operation, storage deployment and inter-regional transfers.
- Operational implications of high-voltage network switching and frequent reactor operations may need to be examined and suitably incorporated during design development.

CTUIL informed that in the connectivity intimations for PSPs, the injection during the Solar hours is entirely based on the margin in the network. If constraint is observed in the network, necessary backdown of the PSP injection needs to be carried out by the grid operator. It was agreed to circulate the updated study files and invite comments from stakeholders before finalization of meeting minutes.

3. WBSETCL

WBSETCL made the following observations:

- Requirement of the proposed Basantpur node and associated 1150 kV corridor may be further assessed considering projected load growth in West Bengal.
- Clarification was sought regarding implementation timeframe and downstream integration of the proposed transmission system.

CTUIL clarified that the proposal has been evolved considering long-term load growth, future industrial demand and emerging data-centre loads in Eastern Region. It was further informed that implementation of the proposed system has been envisaged in phases, commensurate with future generation and demand growth. Further, WBSETCL may suggest the location of Basantpur S/s considering their demand growth, availability of Land / RoW and integration of the 1150kV corridor to their intrastate network. Due to space constraints at Subhasgram (POWERGRID) S/s for line termination, Basantpur - Subhasgram 400kV D/c (Quad) Line has been modified to Basantpur - Joynagar 400kV D/c (Quad) line.

4. OPTCL

OPTCL made the following observations:

- Demand assumptions for Paradeep, Gopalpur and Jeypore may be reviewed considering actual load development.
- Review of requirement of Begunia – Mendhasal (OPTCL) 400kV D/c (Quad) line considering the implementation of Khuntuni (OPTCL) - Mendhasal (OPTCL) 400kV D/c (Quad) line under intra state.

CTUIL clarified that the proposed demand centres have been considered based on available applications as well as green hydrogen / green ammonia projections. CTUIL informed that considering the implementation of Khuntuni (OPTCL) - Mendhasal (OPTCL) 400kV D/c (Quad) line under intra state, the 400kV Begunia – Mendhasal (OPTCL) 400kV D/c (Quad) can be dropped at this stage. Thus, 765/400kV transformers at Begunia are also not required at this stage.

5. GETCO

GETCO representative welcomed the concept of a high-capacity transmission backbone for future generation & bulk load integration. However, it was emphasized that:

- Large dependence on projected Green Hydrogen loads, storage systems and future generation must be validated.
- Operational aspects associated with extensive storage integration should be further studied.
- Methodology for classification of proposed transmission scheme into various components (NC/RC/TC/ACC component) in accordance with the provisions of the CERC Sharing Regulations, 2020, may be clearly identified and established.

- Parallel utilization and interactions with underlying 765 kV and 400 kV transmission networks should be examined from operational and planning perspectives.

CTUIL stated that the studies have been carried out considering projected generation, storage and demand growth scenarios; and the issue of transmission system categorization would be addressed in accordance with the applicable regulatory framework and decisions of the competent authority.

6. ERLDC

ERLDC sought clarification regarding:

- Demand assumptions at Paradeep and Gopalpur and relationship with bulk consumer systems.
- Reactive power management philosophy for bulk consumer loads.
- Proposed transformer arrangements between 1150 kV, 765 kV and 400 kV levels.
- Anticipated utilization levels of the proposed UHVAC system during initial years.
- Treatment of HVDC contingencies and operating assumptions for bidirectional HVDC systems.
- Additional studies required for winter and hydro-rich operating conditions.

CTUIL clarified that bulk consumers have been modelled at unity power factor in accordance with CEA Technical Standards for Connectivity to the Grid and corresponding reactive compensation requirements would be met by the consumers themselves. It was also stated that HVDC systems are planned with bidirectional operating capabilities.

ERLDC requested that stakeholders be provided sufficient time for detailed examination of study files after circulation. CTUIL agreed to circulate the updated study files and invite comments from stakeholders before finalization of meeting minutes and future processing.

11) After detailed deliberations, the following was agreed:

1. Stakeholders generally noted the long-term planning rationale for development of a 1150 kV transmission backbone interconnecting WR and ER and recognized the need to evaluate future ultra-high-capacity transmission corridors.

2. CTUIL would circulate updated study files, including additional operating scenarios (Scenario-6, Scenario-7 & Scenario-8), to all stakeholders for examination.
3. Stakeholders would furnish detailed comments and observations after examination of the revised study results.
4. Comments received from stakeholders, GRID-INDIA, CEA, RLDCs, RPCs and State Utilities would be incorporated in the final minutes and study files.
5. The proposal, along with study assumptions, phasing strategy and stakeholder comments, would be further processed after receipt of feedback and completion of additional studies.

12) Subsequently, as decided in the meeting, the study files for Scenario- 4, 5 & 6 (Summer Afternoon Peak, Evening Peak & Night Off peak) & Scenario - 7 & 8 (Winter Afternoon Peak & Evening Peak) along with results were shared with all the stakeholders including CEA and GRID-INDIA for review & comments.

13) <u>Observations of stakeholders on the PSSE files circulated:</u>

A. PSPA-I Division, CEA, vide email dated 29.09.2026, has reiterated the comments/observations that were already submitted during the meeting. Accordingly, the same have been duly captured under the “Stakeholder Comments/Observations of CEA” section pertaining to the proposed scheme.

B. ERLDC vide email dated 16-10-2026 has submitted the following observations:

1. The base case is modelled with 765kV Gopalpur-Paradeep D/C and LILO of 765kV Angul-Srikakulam D/C at Gopalpur, whose implementation modality is yet to be finalized.
2. ACME is modelled with 4300MW at Paradeep as well as 2000MW at Gopalpur. As deliberated in 59th ER-CMETS meeting, ACME applied quantum for GNA-RE is 3200MW against 2000MW modelled at Gopalpur. It appears that the load of ACME applied at Paradeep and Gopalpur are duplicate in nature. The same may be clarified from the GNA requestee. Besides, an additional load of 2425MW has been modelled at Gopalpur 400kV bus. The same may be clarified.

3. The bulk loads have been modelled with unity power factor. The reactive power exchange with the grid has so far not shared by any of these bulk loads. Hence, the bulk loads need to be modelled with realistic reactive power requirements.
4. Basantpur is connected to Chanditala and Subhasgram. Subhasgram does not have any bays left for termination of line from Basantpur. Besides, Basantpur-Chanditala connectivity not yet discussed/ agreed by WB STU.
5. Laxmikantpur S/s plan has been scratched. Instead, Joynagar S/s with connectivity from Medinipur and LILO of 400kV N. Jeerat-Subhasgram has already been agreed. However, these are not modelled in the basecase.

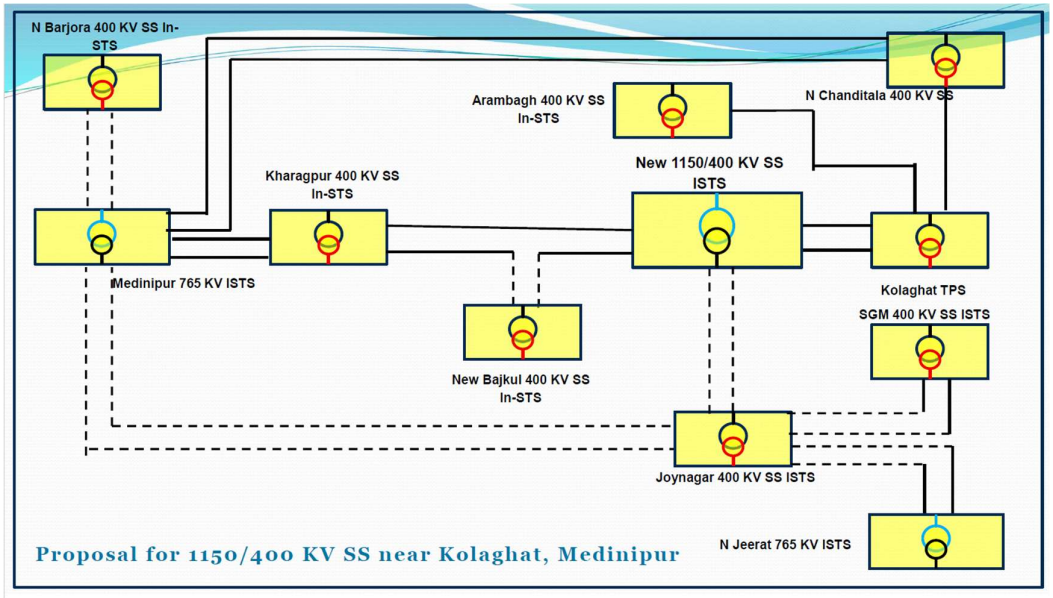
Further analysis can be done only after these aspects are finalized and taken care of.

C. Regarding the above comments of ERLDC, the pointwise reply of CTUIL is given below:

1. Implementation modalities of the augmentation identified for the bulk loads shall be in accordance with Regulations 12.5 of CERC GNA Regulations.
2. The additional load of 2425MW comprise of the balance quantum for completion of 6GW drawal at Gopalpur. Similarly, 650MW has been modelled at Paradeep for completion of 6GW. Now, ACME has withdrawn 4300MW GNA_{RE} application at Paradeep and simultaneously applied for 3.2GW at Gopalpur and revised study of the same shall be discussed in the upcoming CMETS-ER for the balance loads.
3. Reactive compensation devices shall be installed and maintained at applicant facility by the applicant itself to ensure compliances to CEA Technical Standards for Connectivity to the Grid Regulations, 2007 and amendments thereof including advisories [inter alia advisory no. CEA-GO-12-2/3/2018-GM Division-Part(3) [229-237] dated 19-08-2026].
4. Due to space constraints at Subhasgram (POWERGRID) S/s for line termination, Basantpur - Subhasgram 400kV D/c (Quad) Line has been modified to Basantpur - Joynagar 400kV D/c (Quad) line.
5. The modifications in the system has been incorporated in the revised studies in line with discussion in the ER Joint Study meeting.

D. WBSETCL vide email dated 14-10-2026 has submitted the following observations:

1. From the Special CMETS held on 21/09/2026 and subsequent study meeting held on 25-26/09/2026 at Patna, Bihar regarding establishment of proposed 1150 kV Ultra High- Capacity Transmission Corridor for interconnection of WR & ER, it is understood that the proposal has been recommended by a Technical Committee constituted by CEA for introduction of 1150 kV transmission system in India considering future time frame chiefly for evacuation of green energy from WR. It is also informed in the special CMETS that the entire project cost will come under National Component for Tariff determination.
2. It is observed from the PSSE study files received from CTUIL that the load-generation scenario of 2031-32 has been considered. Since the proposed 1150 KV corridor is a part of the long-term plan [10-15 years of time frame approx.] and that the Resource Adequacy Plan for all the states up to 2034-35 has been completed, the studies may be conducted considering the load-generation scenario of 2034-35 at least. Even 2036-37 data would be preferable, if possible, for better understanding of the actual requirements.
3. It would be more realistic if the proposed 800 KV DC link from Bhutan / NER to West Bengal be considered in the studies for a clear scenario.
4. Load flow of existing, proposed and under construction 765 KV and high ampacity 400 KV lines may be verified for proper utilization before finalization of the scheme.
5. CTU had considered tentatively one 1150/400 KV SS near Basantpur, Hoogly District, WB with 1150 KV D/C Line from proposed New Chaibasa 1150 KV SS and with 400 KV D/C connectivity with New Chanditala and Subhasgram / Joynagar (prop) for carry out preliminary network studies.
6. WBSETCL however studied the requirements and explored few more suggestive options for establishment of new 1150/400 KV SS based on the study files received from CTUIL. Based on the same, revised proposal of WBSETCL with network configuration is as follows: “Establishment of 1150/400 KV SS near Kolaghat, Medinipur(E) under ISTS with 1150 KV D/C Line from proposed New Chaibasa 1150 KV SS and with 400 KV D/C LILO of Kharagpur-KTPS 400 KV D/C line [Twin Moose] at the new 1150/400 KV SS [Twin Moose conductor to be replaced by Twin HTLS towards KTPS side] and drawl of 400 KV D/C line from the new SS to proposed Joynagar 400 KV SS, ISTS.”



7. Detailed studies may be conducted considering the load-generation scenario of 2036-37 [or 2034-35] and techno-commercial aspects prior to finalization of the entire proposal.

E. Regarding the above comments of WBSETCL, the pointwise reply of CTUIL is given below:

1. The Transmission charges of 1150kV transmission system shall be as per CERC Sharing Regulation.
2. The PSSE files for all India are available for 2031-32 timeframe as per CTUIL Rolling plan studies. Accordingly, the same has been considered in this study.
3. 800 kV DC link from Bhutan / NER to West Bengal is yet to be planned. Accordingly, the same shall be deliberated subsequently.
4. The loading on the existing, proposed and under construction has been reviewed and the power flow on these lines are generally in order.

5. & 6. The modifications in the location from Basantpur 1150/400kV S/s to Kolaghat 1150/400kV S/s alongwith 400kV drawal lines has been studied and found to be in order. Accordingly, the same is modified in the final scope of works.

7. The system requirement for future timeframe including 2036-37 [or 2034-35] shall be assessed taking into account implementation of the planned 1150kV corridor.

F. NLDC vide email dated 21-10-2026 has submitted the following observations:

1. Network Elements

a. LILO of the 2nd 765 kV Angul–Srikakulam D/C line at 765 kV Gopalpur has also been considered, although it is yet to be approved in the SR joint study/SRPC meeting. Data centre loads near Hyderabad, connected at 765 kV Elikatta, have also been considered.

b. Major generation and load projects, along with their associated transmission infrastructure and assumed HVDC power flows, have been considered for the development of the proposed corridor and will significantly influence its utilisation

2. Loading and Angular Separation

a. The details of line loadings and angular separation under N-1 for the 1150 kV corridor are tabulated below (Summer solar peak, scenario – 4)

Sl No	Line	Length/ ckt (km)	Loading/ckt in Base Case (MW)	Loading under N-1 (MW)	Angular Separation Under N-1 (degrees)
1	1150 kV Raigarh Kotra II – Bolangir D/c	200	1740	3115	7.3
2	1150 kV Raigarh Kotra II – Chaibasa D/c	350	2385	3930	16.2
3	1150 kV Chaibasa - Basantpur D/c	270	1715	2870	8.9
4	1150 kV Bolangir - Begunia D/c	250	1525	2575	7.5

b. The loading of the 1150 kV lines and angular separation under N-1 contingency are observed to remain within the steady-state operating limits for the considered LGB scenario, as shown above

3. <u>Voltage Profile</u>

a. Several shunt components, including filters associated with HVDC converter stations, have been modelled as FACTS devices, providing dynamic voltage support under both solar and non-solar scenarios. **For instance, the large FACTS device modelled at the Jamshedpur HVDC station helps maintain the voltage at the 400 kV and 765 kV Jamshedpur buses at around 1.0 p.u. under evening peak scenarios. However, when it is replaced with a filter bank sized to correspond to the HVDC power order, the bus voltages drop to around 0.97 p.u.**

b. **Capacitive filter banks have been modelled at some bulk load buses (e.g., 225 MVAr at ACME Paradeep and 125 MVAr at ACME Gopalpur),** providing additional reactive power support and resulting in a more optimistic voltage profile at these load centres.

c. All bulk loads have been assumed to be operating under unity power factor.

d. As per CEA Transmission Planning Criteria, 2026, loss of the largest radial load should be considered as a credible contingency. The relevant clause in this regard is provided below.

"The transmission system shall be stable after it is subjected to one of the following outage / loss:
k) Loss of largest radial load, connected at single point."

e. In this regard, it is requested to plan the required dynamic reactive power compensation to account for any such outage and take care of the sudden over-voltage in the grid.

For instance, under **the outage of radial load at Paradeep (4300 MW - ACME Paradeep)**, severe steady-state over-voltages are observed in the nearby buses in the Winter solar peak scenario.

1150 kV Begunia : 1201 kV (1.04 p.u.)
765 kV Paradeep: 820 kV (1.07 p.u)
765 kV Gopalpur: 812 kV (1.06 p.u.)
765 kV New Duburi: 812 kV (1.06 p.u)

The transient over-voltages seen in this case will be even more severe.

4. Line-reactor sizing and charging study

a. The reactor sizing may be confirmed. As per the CTUIL agenda, 3 × 220 MVAr single-phase line reactors (L/R), rated at 1200 kV, have been considered. At an operating voltage of 1150 kV, the total reactive power absorption of a 660 MVAr reactor bank would reduce to approximately 606 MVAr, assuming constant capacitance.

Line-charging Study: 1150 kV Basantpur–Chaibasa D/C line - 270 km		
Pre-Charging Voltage at 1150 KV Chaibasa: 1164 kV, Pre-Charging Voltage at 1150 KV Basantpur: 1127 kV	**Line charging from 1150 kV Chaibasa end up to L/R at another end**	**Line charging from 1150 kV Basantpur end up to L/R at another end**
Rise in Voltage at the charging substation	11 kV	21 kV
Rise in Voltage along the line	11 kV	11 kV
Total rise in voltage	**22 kV**	**32 kV**

Line-charging Study: 1150 kV Raigarh Kotra II –Chaibasa D/C line - 350 km		
Pre-Charging Voltage at 1150 KV Raigarh Kotra II: 1118 kV, Pre-Charging Voltage at 1150 KV Chaibasa: 1165 kV	**Line charging from 1150 kV Raigarh Kotra II end up to L/R at the other end**	**Line charging from 1150 kV Chaibasa end up to L/R at the other end**
Rise in Voltage at the charging substation	11 kV	35 kV
Rise in Voltage along the line	35 kV	34 kV
Total rise in voltage	**46 kV**	**70 kV**

b. As per the CEA Transmission Planning Criteria, 2026, the maximum and minimum voltage limits for 1150 kV are 1185/1115 kV (1.03/0.97 p.u.) for the planning horizon and 1200/1090 kV (1.04/0.95 p.u.) for steady-state operation. From the simulation study, it is observed that, during line charging, the voltage at one or more terminal substations exceeds 1200 kV, even with the proposed line reactors installed at both ends of the line. **For instance, in the Winter Evening Peak scenario (Scenario 8), during the charging of the 1150 kV Chaibasa–Raigarh (Kotra-II) line, the voltage at the Chaibasa end appears to exceed 1230 kV, while the open-end voltage crosses approximately 1260 kV.**

c. The above line-charging study was carried out for Scenario 6 (Summer Off-Peak) as the other off-peak cases were not shared. To comprehensively assess the overvoltage concerns, it is requested that the line-charging and voltage profiles also be examined under lower demand cases like Scenario 3 (Monsoon off-peak) and Scenario 9 (Winter Off-Peak), particularly considering the prevailing voltage conditions around the proposed 1150 kV corridor.

d. Several shunt components, including filters associated with HVDC converter stations, have been modelled as FACTS devices, thereby providing significant dynamic voltage support under both solar and non-solar scenarios. The modelling assumptions and the representation of these components may therefore be reviewed to ensure a realistic assessment of the voltage profile

e. **The following inputs regarding the reactor sizing may also be considered.**

- **Switching Overvoltage (SOV) studies** is critical to accurately determine the optimal reactor rating. These studies assess the overvoltage magnitudes and transient behaviours resulting from key switching operations, such as line energization, re-energization, and fault clearing, to ensure system reliability and insulation coordination. The EMT studies may also be carried out by the OEMs in co-ordination with CTUIL.
- **Ferroresonance Studies and Mitigation Schemes:** In scenarios where the percentage of line compensation exceeds 50%, the likelihood of ferroresonance phenomena increases, which can lead to significant overvoltage, abnormal current flows, and system instability. Detailed ferroresonance studies may be conducted to evaluate potential resonant conditions, and effective mitigation schemes, such as damping resistors or optimized reactor configurations, should be developed to prevent such occurrences.
- **Neutral Grounding Reactor (NGR) Sizing:** The sizing of Neutral Grounding Reactors (NGRs) must be carried out based on EMT studies. This is to ensure that the Single-Phase Auto-Reclose (SPAR) functionality operates correctly, maintaining system stability and minimizing transient disturbances following fault clearance.
- **Transient Overvoltage (TOV) Studies:** Transient Overvoltage (TOV) studies are necessary to evaluate the potential impacts of operating scenarios where a reactor is taken out of service while the transmission line remains energized. These studies help in determining appropriate operational limits and protective measures to mitigate risks associated with temporary overvoltage.
- **Losses** in line reactors are critical factors that must be considered during sizing and design to ensure optimal performance and efficiency.

5. <u>Other General Comments</u>

a. **The loading and utilisation of the proposed 1150 kV corridors would depend on several factors**, including the evolution of generation and demand patterns, commissioning timelines of associated transmission infrastructure, and changes in power transfer requirements. Uncertainties in the commissioning of generation projects, development of major load centres, BESS/PSP facilities and associated HVDC systems could significantly alter the expected power flows and corridor utilisation.

b. Significant RE penetration is anticipated in the near future. The generation is also being evacuated through large EHV lines, including the 1100 kV corridor. Therefore, **dynamic simulation studies** may be carried out to assess the stability of the planned system.

c. **Dynamic reactive compensation** devices may also be planned at suitable locations to provide the required reactive power compensation.

G. Regarding the above comments of NLDC, the pointwise reply of CTUIL is given below:

1. The planned system in various CMETS have been considered in the study files which are expected prior to the completion of the 1150KV transmission system.
2. The angular difference in base case as well as N-1 are well within the permissible limit.
3. The additional capacitors at Paradeep and Gopalpur have been modified with STATCOMs as per the technical requirement. Bulk load has been considered at unity power factor in line with CEA Technical Standards for Connectivity to the Grid Regulations, 2007 and amendments thereof including advisories [inter alia advisory no. CEA-GO-12-2/3/2018-GM Division-Part(3) [229-237] dated 19-08-2026]. Dynamic reactive compensation devices to be installed at load end as per CEA's advisory should be planned such that any tripping of load should not isolate the dynamic reactive compensation device(s) so that system survives during load throw-off and also facilitates restoration/revival of power supply to load.
4. The line reactor at Raigarh (Kotra-III) end of Raigharh Kotra-III – Chaibasa 1150kV D/c line has been modified to 780MVAr (3x260MVAr single phase units) to ensure the line rise within permissible limit. (reactive compensation ~65%)
5. The planning of the system has been carried out based on the certain assumptions. The scheme may be reviewed and mid course corrections, if required, may be carried out to take care of abnormal uncertainties in the load and generation projections.

14) The studies indicate that the proposed 1150 kV corridor remains adequately utilized under various generation-demand scenarios and facilitates substantial bulk power transfer between the Western Region and Eastern Region. The studies indicate significant loading on several sections of the proposed corridor under both solar-max and evening-peak scenarios, thereby establishing the long-term requirement for a transmission network of such capacity. The loading on various 1150kV lines in the base case of Phase-1 is attached at Annexure-II.

Considering relatively lower utilization of the evolved Phase-2 scheme, the transmission system has been planned for implementation in phases, commensurate with the anticipated growth in generation and load in Maharashtra and Odisha. Further, the 1150 kV corridor is proposed to be progressively integrated with the Southern Region to cater to emerging bulk loads, including data centre loads, thereby ensuring optimal utilization of the transmission infrastructure.

Thus, the 1150kV corridors connecting WR to ER, and further to SR in future, shall serve long term bulk power exchange requirement between the regions facilitating future integration of renewable generation, thermal generation, BESS, PSPs and industrial loads across regions while strengthening inter-regional transfer capability and enhancing system reliability and flexibility.

15) CTU stated that generally the 1150kV substations shall comprise of 4 nos. of 3000MVA, 1150/400kV or 1150/765kV transformers, 10 nos. 1150kV line bays alongwith line reactor and 4 nos. 1200kV bus reactors at each Kotra-III, Chaibasa (New), Kolaghat (New), Bolangir and Begunia 1150kV substations.

Considering the requirement for establishment of testing facilities and readiness of the manufacturing ecosystem for 1150 kV equipment within the initial 2-3 years of award, total implementation time-frame of the scheme is planned to be kept as 60 months from the date of allocation.

Accordingly, Phase-1 of the evolved transmission system is proposed for implementation at this stage and the detailed scope of the same is as given below:

Scope of Works: 1150 kV Ultra High Voltage AC Transmission Corridor for Interconnection of Western Region (WR) and Eastern Region (ER) and associated interconnections (Phase-1). The schematic of the scheme is given at **Exhibit-I.**

Sl. No.	Scope of the Transmission Scheme	Capacity (MVA)/ Line length (km)/ Nos.
1.	Establishment of new 1150/400 kV substation at **Raigarh Kotra-III** in Chhattisgarh	• 1x3000 MVA, 1150/400 kV ICT: 4 no. (13 x 1000 MVA single phase units including one spare unit) • 1150 kV ICT bays: 4 no. • 400 kV ICT bays: 4 no. • 1x660 MVAr, 1200 kV Bus Reactor: 2 no. (7x220 MVAR single phase units including one spare unit) • 1150 kV Bus Reactor Bay: 2 no. • 1x125 MVAr, 420kV Bus Reactor: 2 no. • 400 kV Bus Reactor Bay: 2 no. • 1150 kV line bays: 4 no. (*for termination of Raigarh Kotra-III – Bolangir (New) & Raigarh Kotra-III – Chaibasa (New) 1150kV D/c lines*) • 1200 kV, 660 MVAr (3x220 MVAR single phase units) switchable line reactor along with associated switching equipment in both circuits of Raigarh Kotra-III – Bolangir (New) 1150 kV D/c line at Raigarh Kotra-III end • 1200 kV, 780 MVAr (3x260 MVAR single phase units) switchable line reactor along with associated switching equipment in both circuits of Raigarh Kotra-III – Chaibasa (New) 1150 kV D/c line at Raigarh Kotra-III end
2.	Establishment of new 1150/400 kV substation at **Bolangir (New)** in Odisha	• 1x3000 MVA, 1150/400 kV ICT: 2 no. (7 x 1000 MVA single phase units including one spare unit) • 1150 kV ICT bays: 2 no. • 400 kV ICT bays: 2 no.

Sl. No.	Scope of the Transmission Scheme	Capacity (MVA)/ Line length (km)/ Nos.
		• 1x660 MVAr, 1200 kV Bus Reactor: 2 no. (7x220 MVAR single phase units including one spare unit) • 1150 kV Bus Reactor Bay: 2 no. • 1x125 MVAr, 420kV Bus Reactor: 2 no. • 400 kV Bus Reactor Bay: 2 no. • 1150 kV line bays: 4 no. (*for termination of Raigarh Kotra-III – Bolangir (New) & Bolangir (New) – Begunia 1150kV D/c lines*) • 400 kV line bays: 2 no. *(for termination of Bolangir (New) – Bolangir 400kV D/c (Quad) line)* • 1200kV, 660MVAr (3x220 MVAR single-phase units) switchable line reactor along with associated switching equipment in both circuits of Raigarh Kotra-III – Bolangir (New) 1150kV D/c line at Bolangir (New) end
3.	Establishment of new 1150/765kV, substation at **Begunia** in Odisha	• 1x3000MVA, 1150/765kV ICT: 3 no. (10 x 1000 MVA single phase units including one spare unit) • 1150kV ICT bays: 3 no. • 765kV ICT bays: 3 no. • 1x660MVAr, 1200kV Bus Reactor: 2 no. (7x220MVAR single phase units including one spare unit) • 1150kV Bus Reactor bay: 2 no. • 1x330MVAr, 765kV Bus Reactor: 2 no. (7x110MVAR single phase units including one spare unit) • 765kV Bus Reactor bay: 2 no.

Sl. No.	Scope of the Transmission Scheme	Capacity (MVA)/ Line length (km)/ Nos.
		• 1x125MVAr, 420kV Bus Reactor: 2 no. • 400kV Bus Reactor bay: 2 no. • 1150kV line bays: 2 no. (*for termination of Bolangir (New) – Begunia 1150kV D/c line*) • 765kV line bays: 6 no. *(for termination of Begunia – Paradeep, Begunia – Gopalpur & Begunia – Khuntuni (OPTCL) 765kV D/c lines)* • 1200kV, 660MVAr (3x220 MVAR single- phase units) switchable line reactor along with associated switching equipment in both circuits of Bolangir (New) – Begunia 1150kV D/c line at Begunia end
4.	Establishment of new 1150/400kV substation at **Chaibasa (New)** in Jharkhand	• 1x3000MVA, 1150/400kV ICT: 2 no. (7 x 1000 MVA single phase units including one spare unit) • 1150kV ICT bays: 2 no. • 400kV ICT bays: 2 no. • 1x660MVAr, 1200kV Bus Reactor: 2 no. (7x220MVAR single phase units including one spare unit) • 1150kV Bus Reactor bay: 2 no. • 1x125MVAr, 420kV Bus Reactor: 2 no. • 400kV Bus Reactor bay: 2 no. • 1150kV line bays: 4 no. (*for termination of Chaibasa (New) – Kolaghat (New) & Raigarh Kotra-III – Chaibasa (New) 1150kV D/c lines)* • 400kV line bays: 2 no. *(for termination of Chaibasa (New) – Chaibasa 400kV D/c (Quad) line)*

Sl. No.	Scope of the Transmission Scheme	Capacity (MVA)/ Line length (km)/ Nos.
		• 1200kV, 660MVAr (3x220 MVAR single phase units) switchable line reactor along with associated switching equipment in both circuits of Raigarh Kotra-III – Chaibasa (New) 1150kV D/c line at Chaibasa (New) end • 1200kV, 660MVAr (3x220 MVAR single phase units) switchable line reactor along with associated switching equipment in both circuits of Chaibasa (New) – Kolaghat (New) 1150kV D/c line at Chaibasa (New) end
5.	Establishment of new 1150/400kV substation at **Kolaghat (New)** in West Bengal	• 1x3000MVA, 1150/400kV ICT: 2 no. (7 x 1000 MVA single phase units including one spare unit) • 1150kV ICT bays: 2 no. • 400kV ICT bays: 2 no. • 1x660MVAr, 1200kV Bus Reactor: 2 no. (7x220MVAR single phase units including one spare unit) • 1150kV Bus Reactor bay: 2 no. • 1x125MVAr, 420kV Bus Reactor: 2 no. • 400kV Bus Reactor bay: 2 no. • 1150kV line bays: 2 no. (*for termination of Chaibasa (New) – Kolaghat (New) 1150kV D/c line)* • 400kV line bays: 6 no. *(4 nos. for termination of LILO of Kolaghat (WBPDCL) – Kharagpur (WBSETCL) 400kV D/c line & 2 nos. for termination of Kolaghat (New) – Joynagar 400kV D/c (Quad) line)*

Sl. No.	Scope of the Transmission Scheme	Capacity (MVA)/ Line length (km)/ Nos.
		• 1200kV, 660MVAr (3x220 MVAR single phase units) switchable line reactor along with associated switching equipment in both circuits of Chaibasa (New) - Kolaghat (New) 1150kV D/c line at Kolaghat (New) end
6.	Raigarh Kotra-III – Bolangir (New) 1150kV D/c line	200km
7.	Bolangir (New) – Begunia 1150kV D/c line	250km
8.	Raigarh Kotra-III – Chaibasa (New) 1150kV D/c line	350km
9.	Chaibasa (New) – Kolaghat (New) 1150kV D/c line	250km
10.	Begunia – Paradeep 765kV D/c line	120km
11.	Begunia – Gopalpur 765kV D/c line	150km
12.	Begunia – Khuntuni (OPTCL) 765kV D/c line	70km
13.	Bolangir (New) – Bolangir 400kV D/c (Quad) line	10km
14.	Chaibasa (New) – Chaibasa 400kV D/c (Quad) line	10km
15.	LILO of Kolaghat (WBPDCL) – Kharagpur (WBSETCL) (one circuit via proposed New Bakjul (WBSETCL)) 400kV D/c line at Kolaghat (New) a) Kolaghat (New) to LILO section towards New Bakjul / Kharagpur	Loop in 10km and Loop out 10km

Sl. No.	Scope of the Transmission Scheme	Capacity (MVA)/ Line length (km)/ Nos.
	needs to be implemented with Twin Moose b) Kolaghat (New) to LILO section towards Kolaghat needs to be implemented with Twin HTLS (ampacity of single HTLS as 1574A at nominal voltage)	
16.	Kolaghat (New) – Joynagar 400kV D/c (Quad) line	80km
17.	Extension at Bolangir (POWERGRID) substation	400kV line bays: 2 no. *(for termination of Bolangir (New) – Bolangir 400kV D/c (Quad) line)*
18.	Extension at 765/400kV Paradeep GIS (ISTS) substation	• 765kV GIS line bays: 2 no. *(for termination of Begunia – Paradeep 765kV D/c line)* • 765kV, 240MVAr (3x80MVAR single phase units) switchable line reactor along with associated switching equipment in both circuits of Begunia – Paradeep 765kV D/c line at Paradeep end
19.	Extension at 765/400kV Gopalpur GIS (ISTS) substation	• 765kV GIS line bays: 2 no. *(for termination of Begunia* – Gopalpur *765kV D/c line)* • 765kV, 240MVAr (3x80MVAR single phase units) switchable line reactor along with associated switching equipment in both circuits of Begunia – Gopalpur 765kV D/c line at Gopalpur end
20.	Extension at 765/400kV Khuntuni GIS (OPTCL) substation	765kV GIS line bays: 2 no. *(for termination of Begunia – Khuntuni (OPTCL) 765kV D/c line)*
21.	Extension at 400/220kV Chaibasa (POWERGRID) substation	400kV line bays: 2 no. *(for termination of Chaibasa (New) – Chaibasa 400kV D/c (Quad) line)*
22.	Extension at Joynagar GIS (ISTS) substation	400kV GIS line bays: 2 no. *(for termination of Kolaghat (New) – Joynagar 400kV D/c (Quad) line)*

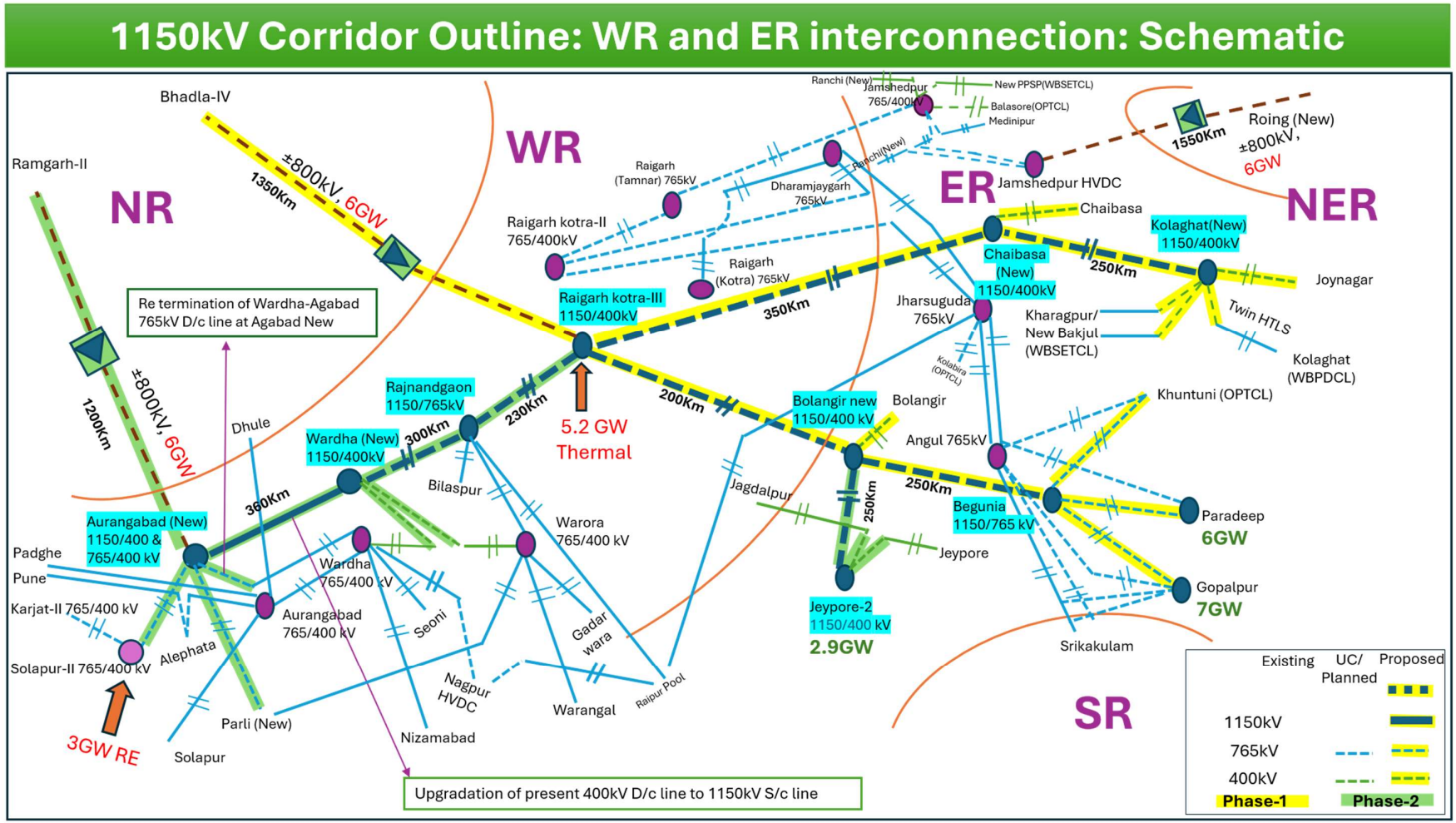
Sl. No.	Scope of the Transmission Scheme	Capacity (MVA)/ Line length (km)/ Nos.
23.	Establishment of 400/220 kV, 2x500 MVA S/s at suitable location near Bhadla (Bhadla-IV Substation)	• 2x500MVA, 400/220kV ICT • 400kV ICT bays: 2 nos. • 220kV ICT bays: 2 nos. • 2x125MVAr, 420kV Bus Reactor: 2 nos. • 400kV Bus Reactor bay: 2 nos. • 400kV Line bays: 08 nos. • 220kV Line bays: 02 nos. • 4 Nos. of Syncon* units at 400 kV level of Bhadla-IV PS **1 No. of SynCon unit comprises dynamic support of +300 MVAr/-200 MVAr (Minimum) & Short circuit contribution at PCC of 1200 MVA (Minimum)*
24.	Bhadla IV – Bhadla III (POWERGRID) 400kV D/c (Quad) line	40Km
25.	Extension at Bhadla III (ISTS) substation	400kV line bays: 2 no. *(for termination of Bhadla IV – Bhadla III (POWERGRID) 400kV D/c (Quad) line)*
26.	Establishment of ±800kV, 6000MW LCC based HVDC Bipole terminal (4x1500 MW) at **Bhadla-IV Station**	• ±800 kV, 6000 MW Bhadla-IV – Raigarh (Kotra-III) HVDC with 33% continuous overload and 100% reverse power flow capability • 400/33 kV, 2x50 MVA transformers for exclusively supplying auxiliary power to HVDC terminal.
27.	Establishment of ±800kV, 6000MW LCC based HVDC Bipole terminal (4x1500 MW) at **Raigarh Kotra-III Station**	• ±800 kV, 6000 MW Bhadla-IV – Raigarh (Kotra-III) HVDC with 33% continuous overload and 100% reverse power flow capability • 400/33 kV, 2x50 MVA transformers for exclusively supplying auxiliary power to HVDC terminal.
28.	Raigarh Kotra-III – Bhadla-IV ±800 kV HVDC line	1350km

Note: *Line length is tentative.*

1. *WBSETCL to reconductor LILO point to Kolaghat line section of Kolaghat (WBPDCL) – Kharagpur (WBSETCL) (one circuit via proposed New Bakjul (WBSETCL)) 400kV D/c line with Twin HTLS (ampacity of single HTLS as 1574A at nominal voltage level)*
2. *WBPDCL to upgrade the terminal Bay equipment at Kolaghat end for Kolaghat (WBPDCL) – Kharagpur (WBSETCL) 400kV D/c line matching with the ampacity of the Twin HTLS (ampacity of single HTLS as 1574A at nominal voltage level)*
3. *TSP of Bolangir (POWERGRID), Paradeep (Tata Power), Gopalpur (Tata Power), Khuntuni (OPTCL), Chaibasa (POWERGRID), Joynagar (ISTS), Bhadla-III (POWERGRID) to provide space free of cost for implementation of the 400kV or 765kV line bays at their respective substation.*

Implementation timeframe: 60 months from the date of allocation (Considering the requirement for establishment of testing facilities and readiness of the manufacturing ecosystem for 1150 kV equipment within the initial 2-3 years).

Exhibit-I


1150kV Corridor Outline: WR and ER interconnection: Schematic
NR
WR
ER
NER
SR
Bhadla-IV
Ramgarh-II
±800kV, 6GW
1350Km
1200Km
Re termination of Wardha-Agabad 765kV D/c line at Agabad New
Dhule
Aurangabad (New) 1150/400 & 765/400 kV
Padghe
Pune
Karjat-II 765/400 kV
Solapur-II 765/400 kV
3GW RE
Alephata
Solapur
Parli (New)
Aurangabad 765/400 kV
Wardha (New) 1150/400kV
360Km
Wardha 765/400 kV
Seoni
Nizamabad
Rajnandgaon 1150/765kV
300Km
230Km
Bilaspur
Nagpur HVDC
Warora 765/400 kV
Gadarwara
Warangal
Raipur Pool
Raigarh kotra-III 1150/400kV
5.2 GW Thermal
Raigarh kotra-II 765/400kV
Raigarh (Tamnar) 765kV
Raigarh (Kotra) 765kV
350Km
200Km
Ranchi (New)
Jamshedpur 765/400kV
New PPSP(WBSETCL)
Balasore(OPTCL)
Medinipur
Dharamjaygarh 765kV
Jamshedpur HVDC
Chaibasa
Chaibasa (New) 1150/400kV
Jharsuguda 765kV
Kolabira (OPTCL)
Bolangir new 1150/400 kV
Bolangir
Angul 765kV
Jagdalpur
250Km
Jeypore-2 1150/400 kV
2.9GW
Jeypore
Begunia 1150/765 kV
Paradeep
6GW
Gopalpur
7GW
Srikakulam
1550Km
Roing (New)
±800kV, 6GW
Kolaghat(New) 1150/400kV
250Km
Joynagar
Twin HTLS
Kharagpur/ New Bakjul (WBSETCL)
Kolaghat (WBPDCL)
Khuntuni (OPTCL)
Upgradation of present 400kV D/c line to 1150kV S/c line
Existing
UC/ Planned
Proposed
1150kV
765kV
400kV
Phase-1
Phase-2

Annexure-II

The loading on various 1150kV lines in the base case of Phase-1 is given below:

Tr line	Sc-4	Sc-5	Sc-6	Sc-7	Sc-8
Raigarh Kotra-III-Chaibasa 1150kV D/c line	4486	4980	3256	2756	2634.8
Raigarh Kotra-III-Bolangir 1150kV D/c line	3768	2587.2	4262	5510	4962.2
Chaibasa-Kolaghat 1150kV D/c line	3058	3101	1894	1924	1178.8
Bolangir-Begunia 1150kV D/c line	3306	1988.4	3370	4800	3912.4

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