भारत सरकार

Government of India

विद्युत मंत्रालय

Ministry of Power

केंद्रीय विद्युत प्राधिकरण

Central Electricity Authority

विद्युत प्रणाली योजना एवं मूल्यांकन प्रभाग- II

Power System Planning & Appraisal Division-II

सेवा में/To

As per list of Addresses

विषय : ट्रांसमिशन पर राष्ट्रीय समिति (एनसीटी) की तेरहवीं बैठक का कार्यवृत – के सम्बन्ध में।

Subject: Minutes of the 13th Meeting of National Committee on Transmission (NCT) – regarding.

महोदया (Madam) / महोदय (Sir),

The 13th meeting of the "National Committee on Transmission" (NCT) was held on 12th May, 2023. Minutes of the meeting are enclosed herewith.

भवदीय/Yours faithfully,

19.05.2023

(ईशान शरण / Ishan Sharan)

मुख्य अभियंता एवं सदस्य सचिव ,एनसीटी

/Chief Engineer & Member Secretary (NCT)

प्रतिलिपि / Copy to:

Joint Secretary (Trans), Ministry of Power, New Delhi

List of Addresses:

1.	Chairperson, Central Electricity Authority Sewa Bhawan, R.K. Puram, New Delhi – 110 066.	2.	Member (Power Systems), Central Electricity Authority Sewa Bhawan, R.K. Puram, New Delhi – 110 066.
3.	Member (Economic & Commercial), Central Electricity Authority Sewa Bhawan, R.K. Puram, New Delhi – 110 066.	4.	Director (Trans), Ministry of Power Shram Shakti Bhawan, New Delhi-110001.
5.	Sh. Dilip Nigam, Scientist 'G', MNRE, Block no. 14, CGO Complex, Lodhi Road, New Delhi – 110003	6.	Chief Operating Officer, CTUIL, Saudamini, Plot No. 2, Sector-29, Gurgaon – 122 001.
7.	Sh. Rajnath Ram, Adviser (Energy), NITI Aayog, Parliament Street, New Delhi – 110 001.	8.	CMD, Grid Controller of India, B-9, Qutub, Institutional Area, Katwaria Sarai, New Delhi – 110010
9.	Dr. Radheshyam Saha, Ex. Chief Engineer, Central Electricity Authority	10.	Ms. Seema Gupta, Ex. Director (Operations), POWERGRID

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Minutes of the 13th meeting of National Committee on Transmission

List of participants is enclosed at Annex-I.

Chairperson, CEA & Chairman, NCT, welcomed the participants and requested Member Secretary, NCT, to take up the agenda items for discussion.

1 Confirmation of the minutes of the 12th meeting of National Committee on Transmission**.**

1.1 The minutes of the 12th meeting of NCT held on 24.03.2023 were issued vide CEA letter no CEA-PS-12-13/3/2019-PSPA-II dated 12/04/2023.

1.2 No comments have been received on the minutes.

1.3 Accordingly, members confirmed the minutes of 12th NCT meeting.

2 Status of the transmission schemes noted/approved/recommended to MoP in the 12th meeting of NCT:

2.1 The status of the transmission schemes noted/approved/recommended in the 12th *meeting of NCT is tabulated below*

Sr. No	Name of the Transmission Scheme	Noted/ Recommended/ Approved	Survey Agency	MoP approval	BPC	Remarks
1.	Transmission system for evacuation of power from RE projects in Solapur (1500 MW) SEZ in Maharashtra	Approved	PFCCL	Not Applicable	PFCCL	TBCB
2.	Provision of Dynamic Reactive Compensation at KPS1 and KPS3	Recommended	Not Applicable	Approved	PFCCL	TBCB
3.	Transmission System for Evacuation of Power from RE Projects in Rajgarh 1000 MW SEZ in Madhya Pradesh - Phase-II	Recommended	RECPDCL	Approved	RECPDCL	TBCB
4.	Eastern Region Expansion Scheme-XXXIV (ERES-XXXIV)	Recommended	CTUIL	Approved	PFCCL	TBCB

2.2 It was informed by Director (Trans), MoP, that the schemes recommended by NCT to MoP for approval have been notified in e-gazette on 12.05.2023.

3 New Transmission Schemes:

3.1 **Establishment of State-of Art Unified Network Management System (U-NMS) for ISTS and State Utility Communication System for Southern Region**

3.1.1 CTUIL informed that Central Electricity Regulatory Commission (Communication System for inter-State transmission of Electricity) Regulations, 2017, provides that CTUIL shall be the Nodal Agency for planning and coordination for development of communication system for Inter-State transmission system. Further, CTUIL has to implement centralized supervision for quick **fault dete**ction and restoration.

3.1.2 The Interstate and Intra-state communication system has evolved over time with modernization of SLDCs/ RLDC. As part of these projects, Network Management Systems (NMS) were also commissioned to support configuration and maintenance of Network Elements (NEs) of communication system. As these projects were implemented in different time frame, multiple NMSs came up in a region and states.

Further, standalone communication equipment has also come up as part of TBCB/Renewable transmission project whose integration with existing NMS is not possible as the same are proprietary and generally support integration of same make equipments only. Thus, centralized supervision of entire state/ regional communication system is not possible as envisaged in CERC regulation for communication system.

3.1.3 Accordingly, communication scheme i.e. Establishment of State-of Art Unified Network Management System (U-NMS) for ISTS and State Utility Communication System for Southern Region has been envisaged. This will facilitate centralized supervision of ISTS as well as Intra state communication system at State level, Regional level and Inter-Regional Communication system at national level. UNMS for Northern, Eastern and North Eastern Regions are being implemented by POWERGRID and are scheduled for commissioning in 2023. UNMS for Western Region is under deliberation.

3.1.4 SRPC has approved implementation of the UNMS project in RTM mode in 44th SRPC meeting.

3.1.5 CERC vide order dated 15.12.2022 (Order in petition No. 728/MP/2020) observed that since CTUIL formation is in nascent stage and that Petitioner (PGCIL) has already taken implementation of the scheme in its capacity as CTU after approval of RPCs, Petitioner may implement the scheme, wherever approved by RPCs. It was also observed that since the UNMS will cover the communication system of various ISTS licensees including Petitioner PGCIL, the operational control of UNMS shall be with CTUIL.

3.1.6 As per clause 5 Category (B) of "Guidelines on Planning of Communication System for Inter-State Transmission System (ISTS)" issued by MoP vide letter dated 09.03.2022, the following is provided:

"Communication Schemes/Packages proposed by CTUIL for upgradation/modification of existing ISTS Communication System, standalone projects, adoption of new technologies shall be put up to RPC for their views. RPC to provide their views on the Schemes/Packages proposed by CTUIL within 45 days of receipt of the proposal from CTUIL.

The Schemes/Packages alongwith the views of RPC shall be approved by NCT."

3.1.7 Representative of CTUIL & GRID India stated that for supervision & operational control and for overviewing ISTS systems (in line with CERC order dated 15.12.2022), a workstation console would be required at CTUIL Headquarter Office & at GRID India Control Centre respective locations.

3.1.8 After detailed deliberations, the scheme was agreed to be implemented under RTM mode by POWERGRID.

3.1.9 Summary of the scheme is as given below:

Sl.No.	Name of the scheme and implementation timeframe	Estimated Cost (₹ Crores)	Remarks
1.	Establishment of State-of Art Unified Network Management System (U-NMS) for ISTS and	90	Approved to be implemented under RTM route by

	State Utility Communication System for Southern Region. Implementation timeframe: 24 months from date of allocation		POWERGRID.

3.1.10 Detailed scope of the scheme is as given below:

Sl. No.	Scope of the scheme	Estimated Cost (₹ Crs)
1.	• Main & Back-up UNMS software and hardware along with required Application software including Video Projection System (VPS), firewall and IDPS. • Remote Workstation for SLDCs. • Video Projection System (VPS), Printer, furniture etc. at main & back-up U-NMS location. • Integration of existing NMS/NEs of ISTS and State Utility in a region in the proposed UNMS. • Integration of upcoming U-NMS for National & other regions and upcoming NMS/NEs of ISTS and State Utility in a region during implementation and AMC period of the project. • Operational support, training & maintenance for proposed UNMS software and hardware. • Auxiliary Power System for U-NMS system. • Workstation console, one each at CTUIL Headquarter and at GRID India Control Centre along with connectivity and associated hardware/software.	90

3.2 **Eastern Region Expansion Scheme-XXXVII (ERES-XXXVII):**

3.2.1 Representative of CTUIL stated that presently, 400/132 kV Lakhisarai (POWERGRID) S/s is having the transformation capacity of 715 MVA (2x200 MVA + 1x315 MVA). About 750 MW new solar generation projects are being taken up by Bihar at Kajra, Pirpainti and surrounding areas, and is planned to be injected into intra-state network in the Gaya (POWERGRID) – Khizersarai (BSPTCL) – Narhat (BSPTCL) – Sheikhpur Sarai (BSPTCL) – Haveli Kharagpur (BSPTCL) – Goradih (BSPTCL) 220 kV link. Accordingly, BSPTCL has requested for creation of 220 kV level in the 400/132 kV Lakhisarai (POWERGRID) ISTS S/s. BSPTCL shall be taking up Lakhisarai (POWERGRID) – Haveli Kharagpur 220 kV D/c line under intra-state**.** This system would also be required to meet power exchange requirement between ISTS and intra-state network during both high solar and non-solar periods.

3.2.2 After detailed deliberations, the scheme was agreed to be implemented under RTM route by POWERGRID.

3.2.3 Summary of the scheme is as given below:

Sl. No.	Name of the scheme and implementation timeframe	Estimated Cost (₹ Crores)	Remarks
1.	Eastern Region Expansion Scheme-XXXVII (ERES-XXXVII) Implementation timeframe: 24 months from date of allocation.	120.61	Approved for implementation through RTM route by POWERGRID, the existing owner of 400/132 kV ISTS S/s at Lakhisarai

3.2.4 Detailed scope of the scheme is as given below:

Sl. No.	**Scope of the Transmission Scheme**	**Capacity/ km**	**Estimated Cost (₹ Cr.)**
1	Creation of 220 kV level in GIS (in Double Main Switching Scheme including 1 no. bus coupler bay) at Lakhisarai (POWERGRID) 400/132 kV S/s along with 2 no. 220 kV line bays *[for termination of Lakhisarai – Haveli Kharagpur 220 kV D/c line to be implemented by BSPTCL under intra-state]*	220 kV level in GIS 220 kV GIS line bays – 2 No. 220 kV GIS bus coupler bay – 1 No.	19.62
2	Installation of 400/220 kV, 2x500 MVA ICTs along with associated bays at Lakhisarai (POWERGRID) 400/132 kV S/s	400/220 kV, 1x500 MVA ICTs – 2 Nos.	100.99

		400 kV ICT bays – 2 Nos. 220 kV ICT bays (in GIS) – 2 Nos.	
Total Estimated Cost:			**120.61**

4 Modifications in the Schemes approved/recommended in the earlier meetings of NCT:

4.1 **Modification in the Eastern Region Expansion Scheme-XXXIV (ERES-XXXIV)**

4.1.1 Transmission scheme Eastern Region Expansion Scheme-XXXIV (ERES-XXXIV) was recommended by NCT to MoP in the 12th meeting of NCT.

4.1.2 CTUIL vide letter dated 03rd May, 2023 had suggested some minor changes in the future space provisions at Paradeep 765/400 kV GIS ISTS S/s i.e.:

Section of Approved scope to be modified	Modifications suggested
Future Provisions: Space for - 765/400 kV, 4x1500 MVA ICTs (13x500 MVA single phase units including one spare) along with associated ICT bays at both voltage levels - 765 kV, 2x330 MVAr (7x110 MVAr single phase units including one spare) bus reactor along with associated bays - 220 kV transfer bus coupler bay: 2 no.	Future Provisions: Space for - 765/400 kV, 4x1500 MVA ICTs (**12**x500 MVA single phase units ~~including one spare~~) along with associated ICT bays at both voltage levels - 765 kV, 2x330 MVAr (**6**x110 MVAr single phase units ~~including one spare~~) bus reactor along with associated bays - ~~**220 kV transfer bus coupler bay: 2 no.**~~

4.1.3 After detailed deliberations, it was opined that the space provisions (Future scope) for ICT and bus reactor as approved in the 12th NCT meeting need not be deleted. The Paradeep (GIS) sub-station has been planned for meeting critical load of green hydrogen and green ammonia manufacturing and the space provisions may be required in future. Only the space provisions for 220 kV transfer bus coupler bay (2 Nos.) may not be required in the Paradeep (GIS) sub-station due to switching scheme to be adopted at 220 kV level.

4.1.4 Accordingly, it was decided to remove the Future Space provision for 2 Nos. of 220 kV transfer Bus Coupler Bays from the scope of the transmission scheme.

4.2 **Modification in Transmission System for Rajasthan REZ Phase-III Part C1:**

1.1.1 CTUIL stated that Transmission System for Rajasthan REZ Phase-III Part C1 which mainly involves establishment of 765/400/220 kV Ramgarh Pooling Station & Ramgarh PS - Bhadla-III PS 765 kV D/c line, RE connectivity bays, STATCOM etc. is currently under bidding.

2,600 MW of Connectivity & LTA had been granted at Ramgarh PS (2 nos. 400 kV bays + 4 nos. 220 kV bays) to M/s Adani. Subsequently, M/s Adani vide letter dated 22.02.23 had informed about not opting for conversion of 1,500 MW Connectivity/LTA at Ramgarh PS (1 no. 400 kV bay + 2 nos. 220 kV bays) under GNA. Based on the above, in 12th NCT meeting, 1 no. of 400 kV line bay & 2 no. of 220 kV line bays were deleted from the present scope of Part C1 Package and shifted to future scope.

In the revised GNA transition option submitted M/s Adani in May, 2023, Adani has surrendered additional 600 MW Connectivity/LTA (2 nos. 220 kV bays) making total surrendered quantum as 2,100 MW (1500+600 MW) at Ramgarh PS. For balance 500 MW connectivity/LTA (1 no. 400 kV bay) at Ramgarh, M/s Adani has opted for GNA transition.

Considering additional 600 MW surrendered (2 Nos. 220 kV bays), the remaining connectivity granted at 220 kV becomes NIL as there is no other application left at 220 kV level. Hence, a view needs to be taken regarding implementation of 220 kV level at Ramgarh PS.

1.1.2 Representative of SECI informed that other RE generation developers may apply for connectivity at 220 kV level at Ramgarh PS in near future in view of ongoing bidding process by SECI for setting up of 2000 MW ISTS-connected Solar PV Power Projects. Ramgarh PS is also included in the list of pooling stations to be considered by the bidders for injection of RE generation. Therefore, the 220 kV level as planned earlier in the scope of Ramgarh pooling station may be considered for implementation.

1.1.3 After deliberations, it was decided that bare minimum system may be kept at 220 kV level to facilitate connectivity to RE generation developers. Therefore 2 nos. 220 kV line bays along with 2x500 MVA, 400/220 kV ICTs would be continued under present bid (Rajasthan REZ Phase-III Part C1) to facilitate RE interconnection from upcoming bids.

5 Evaluation of functioning of National Grid.

GRID India made the presentation apprising NCT of the performance of the National Grid and highlighted the following. Copy of presentation is attached at Annex-II.

- Total of 28 nos. of RE generation dip/loss events have occurred in the Northern Region RE complex since January 2022. There were number of actions taken by Grid-India to address the tripping and ensure reliability in the RE complex. The action

taken includes recommending revision in HVRT and LVRT settings at the inverter terminal, disabling over-voltage protection of 220/33 kV ICTs & 400/33 kV ICTs (between IBRs and POI). Further, the over-voltage settings of 765 kV lines in Rajasthan are also being reviewed.

- Currently, 3200 MW RE in Rajasthan is being evacuated through STOA due to delay in commissioning of 400 kV Bikaner-II system. The shutdown of both circuits of 400 kV Bikaner (PG) – Bikaner – RS D/C line is proposed in May, 23 for 15 days for the commissioning of Bikaner-II system. To facilitate this shutdown, ISTS RE curtailment of at least 600-700 MW is envisaged for secure grid operation The detailed study report in this regard has been shared with CEA/CTUIL.

- 01 no. +/- 300 MVAR STATCOM at Bhadla – II is currently under the pre-commissioning (field-testing) phase. The installation of PMUs at the STATCOM station (HV side of coupling transformer) is of utmost importance to monitor dynamic performance of the device. The recommendations of the NPC sub-committee on URTDSM also suggests the installation of PMUs on *"HV side of coupling transformer of SVC/STATCOM for measurement of HV Bus voltage and current of coupling transformer"*. However, the report is under approval. Chairman, NCT, stated that PMUs are essential for monitoring the dynamic performance of FACTS/HVDC and directed that the requirement of installing PMU at these stations shall be included in the substation package (RfP) itself.

- Congestion in the NR – WR corridor (NR export) has been observed on several occasions during solar hours in Q-1 of 2022-23. The need to expedite bypassing of 400 kV Kankroli-Bhinmal-Zerda lines at Bhinmal to form 400 kV Kankroli-Zerda (direct line) & reconductoring of 400 kV Jodhpur (Surpura)(RVPN)-Kankroli-S/C line with twin HTLS conductor to relieve the constraints was emphasized.

  CTUIL informed that the scheme has been awarded to POWERGRID in Nov'22. Schedule for bypassing of 400 kV Kankroli-Bhinmal-Zerda line at Bhinmal is November, 2023; whereas schedule of reconductoring of 400 kV Jodhpur (Surpura) (RVPN)-Kankroli-S/C line is February, 2024 (on best effort basis)/May, 2024 (considering 18 months from award of work).

- High export of power from SR is expected in the high RE injection months of June - October. For relieving the congestion in SR export during this period, reconductoring of 400 kV Kolhapur (PG)-Kolhapur (MS) D/C line and 765 kV D/C line from Narendra – Pune were approved. The reconductoring of 400 kV Kolhapur (PG)-Kolhapur (MS) ckt-1 has been completed and the work of ckt-2 is expected to be completed by May, 2023. The commissioning of 765/400 kV ICTs at Kotra S/S (approved in the 8th NCT meeting) & 765 kV Narendra – Pune D/C line may also be expedited to facilitate high export from SR during high RE period. It was informed

that the Narendra – Pune 765 kV D/c line is already under implementation with timeframe of 18 months.

- Chairman, NCT, stated that the constraints likely to arise in the inter-regional transmission corridors in the next three-four years must be studied regularly and remedial measures like strengthening of the transmission links must be taken up in a timely manner to ensure seamless flow of power.

Summary of the deliberations in the 13th meeting of NCT

1. ISTS Communication schemes approved by NCT:

Sl. No.	Name of the transmission scheme	Implementation Mode	Implementation timeframe	Allocated to	Estimated Cost (Rs crores)
1.	Establishment of State-of Art Unified Network Management System (U-NMS) for ISTS and State Utility Communication System for Southern Region	RTM	24 months	POWER GRID	90

2. ISTS Transmission schemes costing between Rs 100 Crore to Rs. 500 Crores approved by NCT:

Sl. No.	Name of the transmission scheme	Implementation Mode	Implementation timeframe	Allocated to	Estimated Cost (Rs crores)
1.	Eastern Region Expansion Scheme-XXXVII (ERES-XXXVII)	RTM	24 months	POWERGRID (the existing owner of 400/132 kV ISTS S/s at Lakhisarai)	120.61

3. Modifications in the Schemes approved/recommended in the earlier meetings of NCT:

3.1 Modification in the Eastern Region Expansion Scheme-XXXIV (ERES-XXXIV)

It was decided to remove the Future Space provision for 2 Nos. of 220 kV transfer Bus Coupler Bays from the scope of the transmission scheme.

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Annex-I

List of Participants in the 13th meeting of NCT

CEA:

1. Sh. Ghanshyam Prasad, Chairperson, CEA & Chairman, NCT
2. Sh. A. K. Rajput, Member (Power Systems)
3. Sh. Ishan Sharan, Chief Engineer (PSPA-I)
4. Sh. Deepanshu Rastogi, Deputy Director (PSPA-II)
5. Ms. Priyam Srivastava, Deputy Director (PCD)
6. Sh. Prateek Srivastava, Assistant Director (PCD)
7. Sh. Prateek Jadaun, Assistant Director (PSPA-II)

MoP:

1. Sh. Om Kant Shukla, Director (Trans.)

MNRE:

1. Sh. Rohit Thakwani, Scientist-C

Expert Member:

1. Dr. R. Saha
2. Ms. Seema Gupta

SECI:

1. Sh. R.K. Agarwal, Consultant

CTUIL:

1. Sh. P.C Garg, COO
2. Sh. Ashok Pal, Deputy COO
3. Ms. Nutan Mishra, Senior GM
4. Sh. Rajesh Kumar, Senior GM
5. Ms. Sangita Sarkar, Chief Manager
6. Sh. Manish Ranjan Keshari, Chief Manager

GRID India:

1. Sh. S.R. Narasimhan, CMD
2. Sh. Vivek Pandey, GM
3. Sh. Surajit Banarjee, CGM
4. Sh. Priyam Jain, Manager
5. Sh. Raj Kishan, AM

***

13th Meeting of National Committee on Transmission

Grid Performance –4th Quarter (2022-23) & 1st Quarter (2023-24)

Grid Controller of India Limited

formerly Power System Operation Corporation Ltd. (POSOCO)

National Load Despatch Center

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- **Overview of Grid Operation – Q-4 FY 2022-23 & Q-1 FY 2023-24**
  - All India Demand met, Energy consumption
  - Percentage growth in Demand Met & Energy Consumption
  - Load Crash in May’23
  - Frequency profile

- **Reliability issues experienced in NR RE Complexes**
  - Ph-II Transmission System in Rajasthan (Bikaner-II)
  - First Time Charging & Operation of STATCOMs
  - Reliability issues experienced in NR RE Complexes

- **Major Constraints in Inter-regional & Intra-regional Network**
  - Constraints in Inter-regional Corridors
  - Commissioning of Elements Eagerly Awaited
  - Inter-regional constraints
  - Constraint in HVDC flexible operation
  - Augmentation in Maharashtra System to Mitigate Operational Constraints

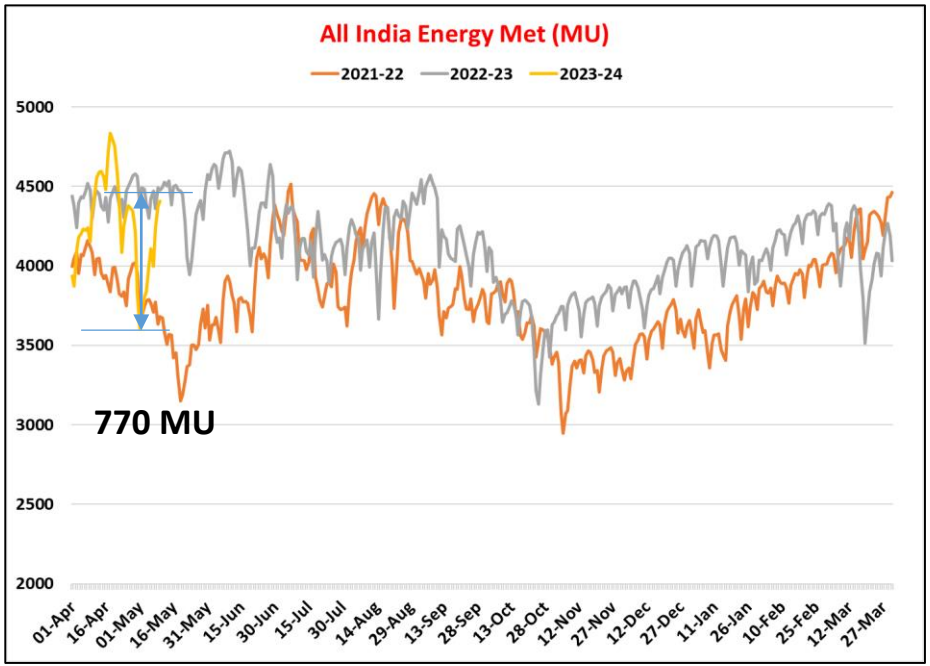
- **High and Low Voltage Nodes**

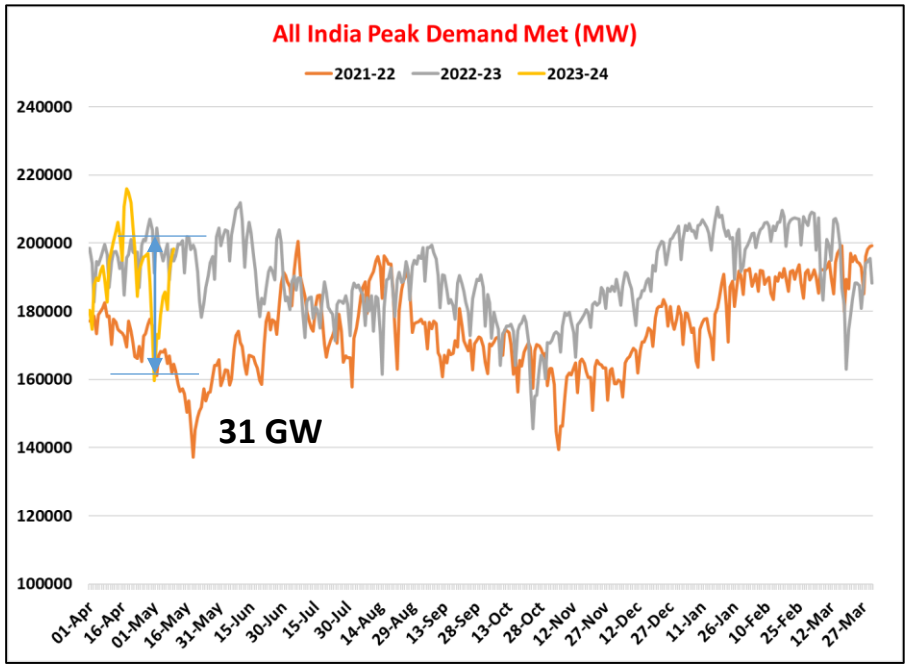
Overview of Grid Operation –Q4 FY 2022-23 & Q-1 FY 2023-24

All India Demand met	2022-23	2023-24
	Q4 (Jan-Mar)	Q1(Apr-June)#
Maximum (MW)	**210618 (18-Jan-2023)**	**215882 (18-Apr-2023)**
Minimum	**125765 (02-Jan-2023)**	**146911 (01-Apr-2023)**

#Upto 10th May 2023

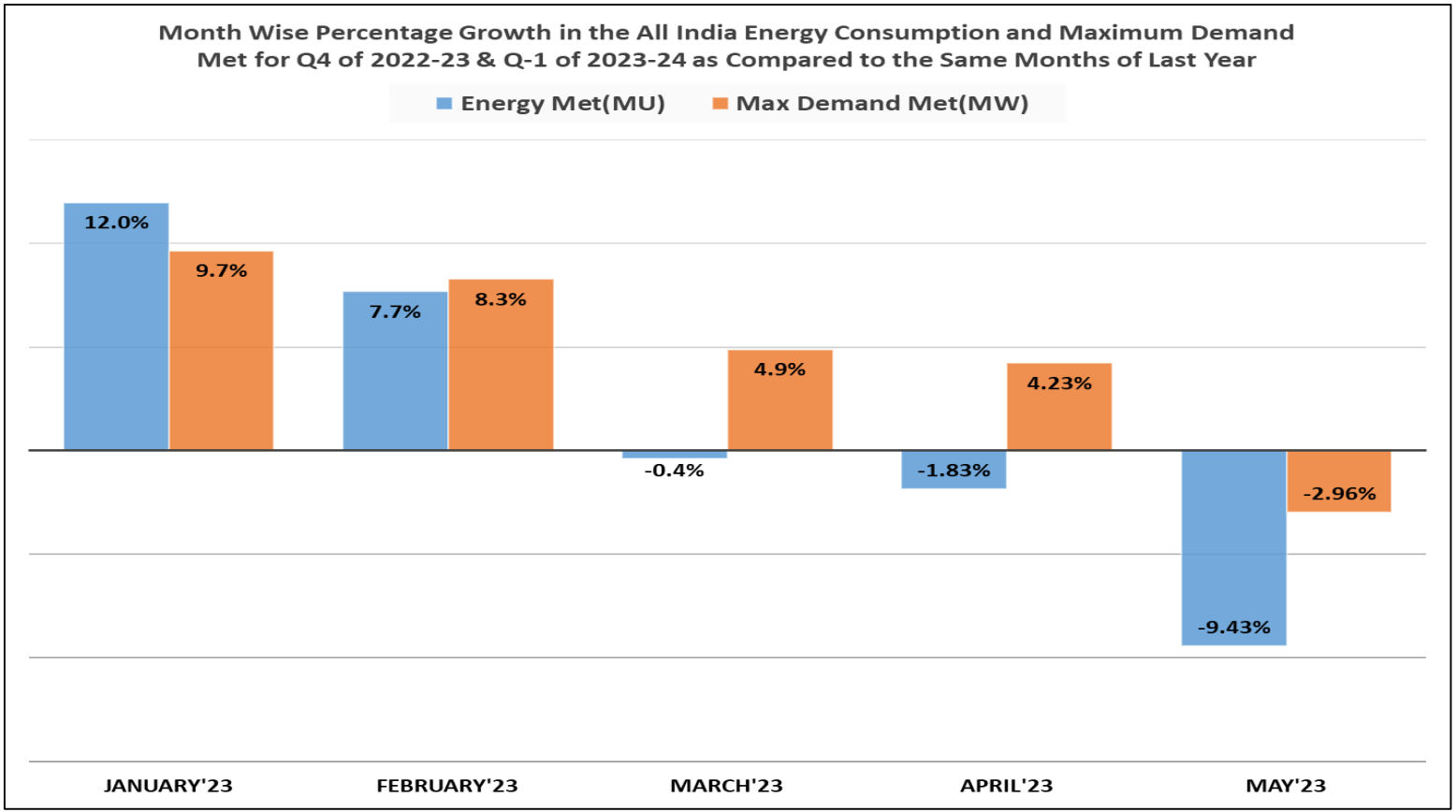
All India Daily Energy Met and Peak Demand
of FY 2023-24, 2022-23 & 2021-22





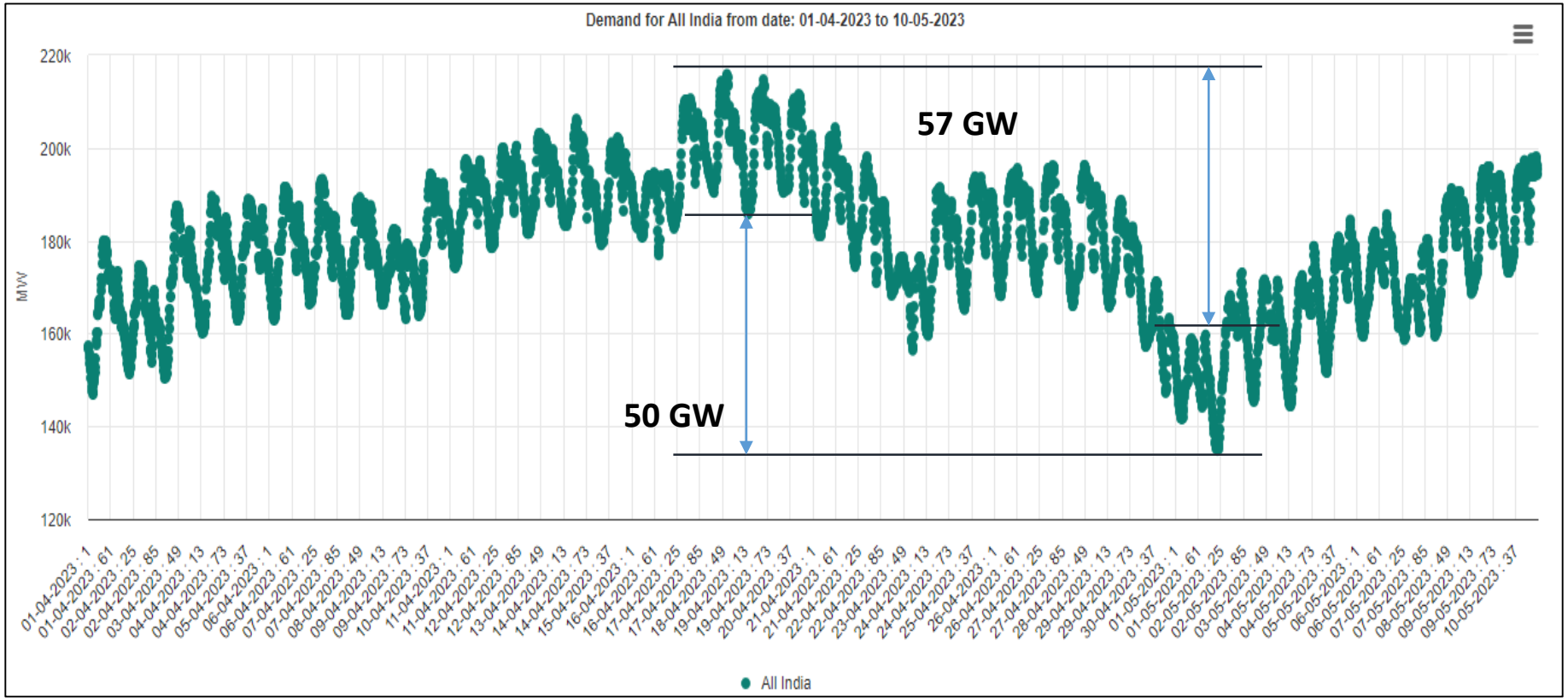
Significant increase in both Maximum Demand and Energy Met in Q4 of FY 2022-23 & Q-1 of FY 2023-24 as compared to same quarter of previous year. However, Inclement weather and widespread rains across the country has led to load crash in the start of May'23

All India Percentage Growth in the Energy Consumption and Maximum Demand Met



Q1 data is upto 10th May 2023

Load Crash in May 2023



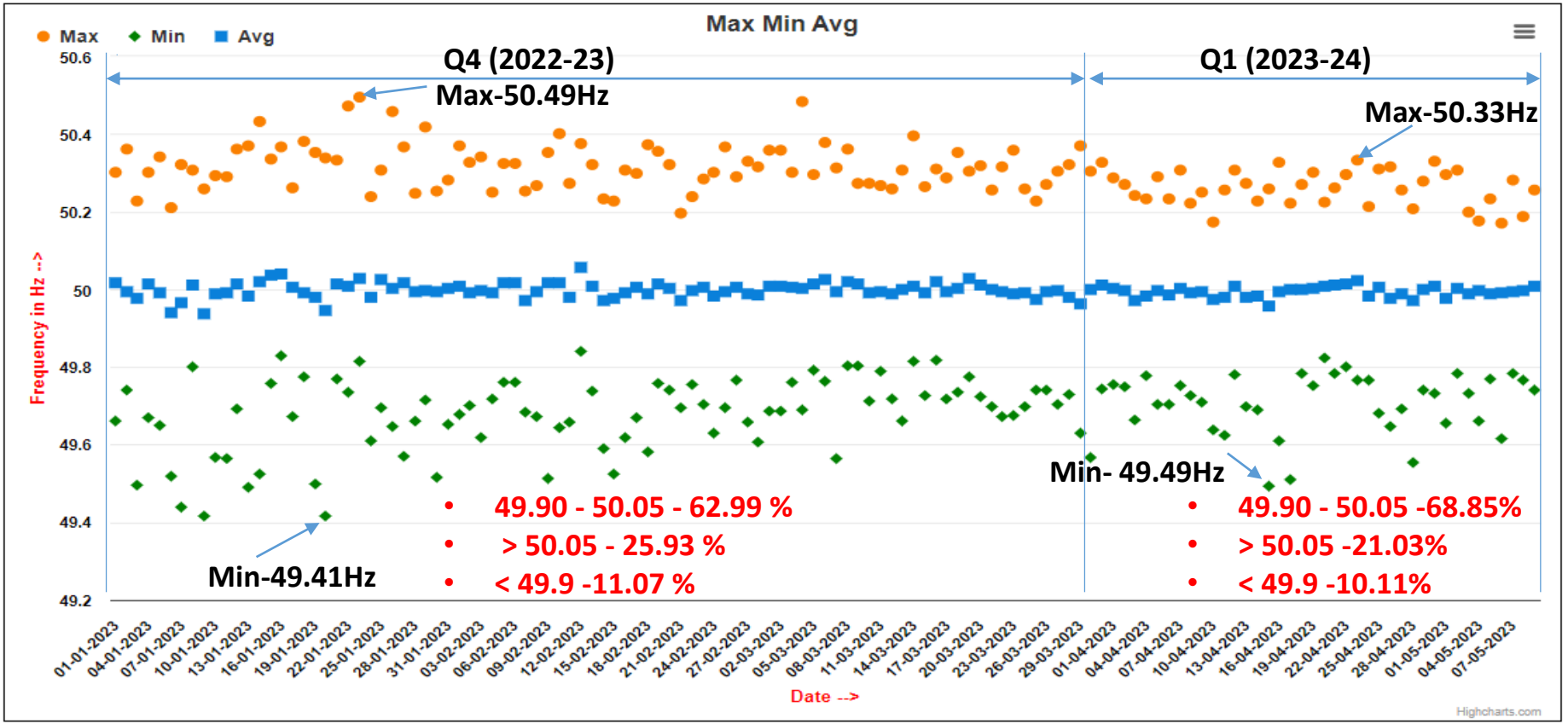
- All time highest Peak Demand of **215823 MW** was recorded **on 18th April 2023**. (Earlier record of **211856 MW was on 10th June 2022).**
- Inclement weather and widespread rains across the country has led to load crash in the start of May'23. The peak demand is recovering to the previous figures.

All Time Highest Figures

In Q3, Q4 of FY – 2022-23 & Q-1 of FY-2023-24 (Till 10th May 2023)

Regions	Maximum Demand Met during the day(MW)	Demand Met During Evening Peak hrs(MW)	Energy Met(MU)	Hydro Gen(MU)	Wind Gen(MU)	Solar Gen(MU)
NR	77091 28-06-2022	71909 09-09-2022	1737 28-06-2022	420.3 22-08-2022	78.4 09-06-2022	147.3 10-05-2023
WR	71321 27-12-2022	63593 18-04-2023	1539.2 18-04-2023	167 18-12-2014	271.7 22-05-2022	70.3 10-05-2023
SR	64314 15-03-2023	52366 18-04-2023	1328.9 19-04-2023	208 31-08-2018	296.9 12-07-2022	142.7 21-03-2023
ER	29302 19-04-2023	28579 18-04-2023	631.1 18-04-2023	157.4 14-09-2022	-	6.8 23-03-2023
NER	3603 17-08-2022	3510 12-08-2022	69.2 11-08-2022	40.5 01-08-2022	-	2.4 22-06-2022
All India	215882 18-04-2023	207956 18-04-2023	4836.1 18-04-2023	877.5 30-08-2022	554.8 22-05-2022	351.1 10-05-2023
Previous Record	211856 10-06-2022	204572 17-04-2023	4722.4 10-06-2022			

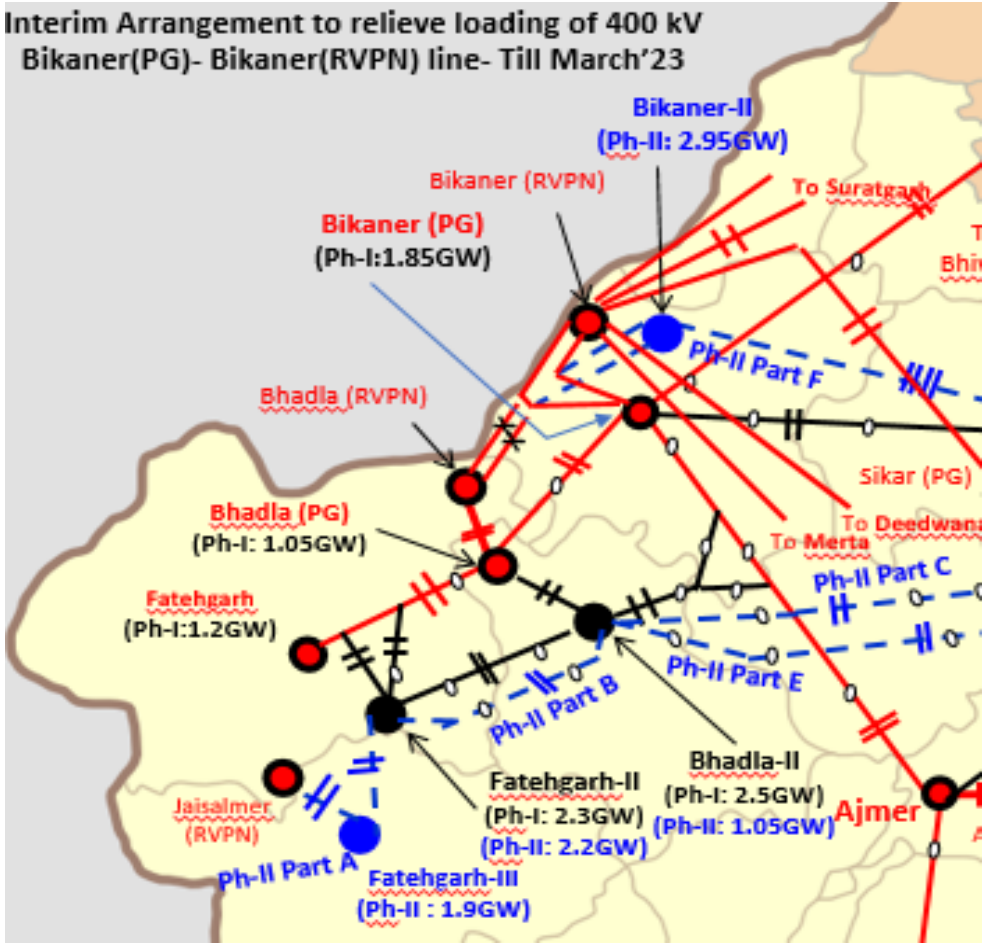
Frequency Profile for Q4 of FY 2022-23 & Q1 of FY 2023-24



Q1 data is upto 10th May 2023

Reliability issues experienced in NR RE Complexes

Ph-II Transmission System in Rajasthan (Bikaner-II)



The Phase-I transmission system has mostly been commissioned whereas transmission elements part of Phase-II transmission scheme are yet to be commissioned. (**Currently, 3200 MW RE in Rajasthan is being evacuated through STOA**)

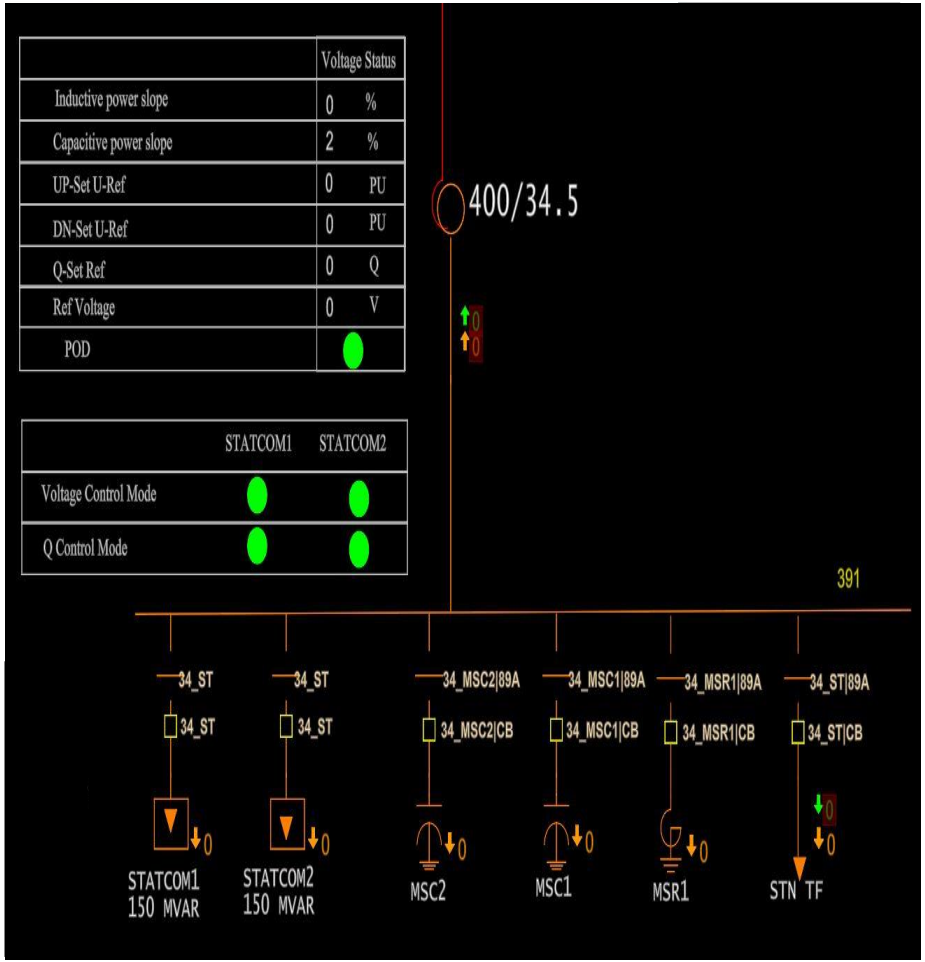
Way Ahead:

- Expedite commissioning of
  - 400kV Bikaner-II (PG) S/s
  - 400kV Bikaner(PG)- Bikaner-II (PG) D/C line
  - 400kV Bikaner-II (PG)-Khetri (PG) lines
  - 400 kV Bikaner-RS – Bhadla-RS D/C will be restored along with above scheme

- **Shutdown of both Circuits of 400 kV Bikaner (PG) – Bikaner – RS D/C is proposed in May for 15 days**
- **With this shutdown, ISTS RE Curtailment of 600-700 MW is envisaged for secure grid operation.**
- **Detailed study for availing the shutdown has been shared with CEA/CTU**

First Time Charging & Operation of STATCOMs

- **Requirement of PMU Placement at FACTS devices:**
  - Recommendations of NPC Sub-committee (10th NCT held on 9th April 2021) on URTDSM suggests installation of PMUs on ***"On HV side of coupling transformer of SVC/STATCOM for measurement of HV Bus voltage and current of coupling transformer"***
  - The requirement of PMU at HVDC and FACTS has been regularly discussed in various RPC for and several communications issued from Grid – India
- **Requirement by OEMs for signing of NDA for Model submission:**
  - RfP documents clearly mention the requirement of submitting the software simulation models (EMT & RMS) by TSP to CEA/CTU/Grid-India.
  - Also, the TSOs/ISOs internationally derive the strength against signing of NDA for sharing of models from respective regulations/rules which categorically mention that the information shared by NSP or Generator with ISO shall be treated as confidential information by all parties.
- **Current Controlled Auto Switching of MSC/MSR in STATCOMs:**
  - Prevents independent switching of MSC/MSR based on grid voltage and setting of switch-in/out voltages by operator. (In SIEMENS STATCOMs)



NLDC SCADA SLD of STATCOM installed at Bhadla - II

First Time Charging & Operation of STATCOMs

RfP document uploaded on REC website for *"Transmission System for Evacuation of Power from REZ in Rajasthan (20 GW) under Phase-III Part F"*

9.6. Software simulation models

The TSP shall provide the latest following PSCAD and PSSE simulation model(s) and parameters to CEA/CTU/GRID-INDIA alongwith detailed documentation for the

purpose of future simulation to adequately represent and model the proposed STATCOM system in the respective software:

a. **Stability model**. TSP should provide a detailed STATCOM system dynamics model for use in (PSCAD and PSSE) powerflow and stability simulation software. The model detail should be appropriate and complete for positive-sequence power system simulation and analysis that is typically performed with powerflow and transient stability programs. All appropriate control features for such analysis will be modeled, and necessary documentation on the theory and use of model should be provided. Stability model should be non-proprietary and freely available for distribution.

b. **Transients model**. TSP should provide a detailed STATCOM transients model for use in PSCAD. The model detail should be appropriate and complete for transient response calculation of the STATCOM system. All appropriate control features for such analysis will be modeled, and necessary documentation on the theory and use of model should be provided.

Technical Specification – STATCOM at Bhadla-II

9. Engineering studies

The TSP shall carry out studies as brought out in this section with a model of the STACOM in PSSE and PSCAD and documentation of the same shall be preserved & to be submitted to CEA/CTU/POSOCO, as per their request. The objective of these studies is to verify the steady state requirement of reactive power under normal and contingent operating conditions for peak and light loads conditions in the network.

Status of Models Submission and PMU of STATCOMs in India

Region	Name	Make	RMS Model Submission	EMTP Model Submission	PMU Availability
Eastern Region	Rourkela	SIEMENS	-	-	Yes
	Kishanganj	SIEMENS	-	-	Yes
	New Ranchi	SIEMENS	-	-	Yes
	Jeypore	SIEMENS	-	-	Yes
Western Region	Satna	RXPE	Submitted	Submitted	No
	Aurangabad	RXPE	Submitted	Submitted	No
	Solapur	RXPE	Submitted	Submitted	No
	Gwalior	RXPE	Submitted	Submitted	No
Southern Region	NP Kunta	HYOSUNG	Submitted	-	No
	Trichy	HYOSUNG	Submitted	-	Yes
	Hyderabad	HYOSUNG	Submitted	-	Yes
	Udumalpet	HYOSUNG	Submitted	-	Yes
Northern Region	Nallagarh	RXPE	Submitted	Submitted	No
	Lucknow	RXPE	Submitted	Submitted	No

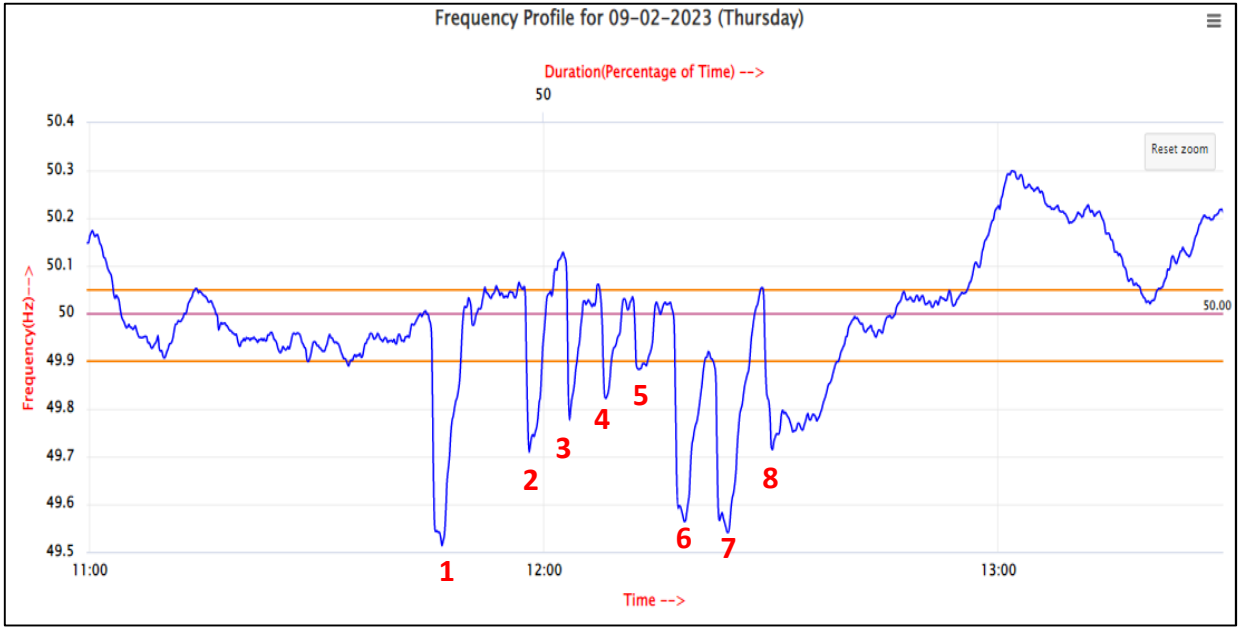
Reliability issues experienced in NR RE Complexes

- **The grid events in NR RE Complex can be classified into following major categories:**
  1. Over voltage during switching operations
     - Total 10 nos. of events since Jan'22; last occurred on 01st May'23
  2. Fault in the vicinity of RE complex
     - Total 14 nos. of events since Jan'22, last occurred on 28th Feb'23
  3. Low Frequency Oscillations in NR RE Complex
     - During high solar generation period
- Heavy reactive drawal by load (~ 0.7 pf) as well as RE stations
- Low voltage in Rajasthan (Alwar, Hindaun voltage ~ 340 kV)
- N-1 non-compliance of STU network of RRVPNL
  - 400/220 kV ICTs at Ajmer, Bikaner_RJ, Hindaun, Merta, Chittorgarh

Multiple events of RE Generation Loss Events on 09th Feb'23

Time	Loss of RE Generation
11:45 Hrs	4459 MW
11:57 Hrs	3678 MW
12:03 Hrs	2993 MW
12:08 Hrs	1444 MW
12:12 Hrs	1288 MW
12:17 Hrs	3379 MW
12:23 Hrs	2273 MW
12:30 Hrs	3055 MW

~ Reference contingency of 4500 MW



8 consecutive events

- Outage of 7 nos of 765 kV EHV line on Over Voltage Stage – 1 protection
- Complete outage of 765 kV Fatehgarh – II SS

Actions taken by NRLDC/NLDC to ensure reliability in the RE complex in Rajasthan

- Change in HVRT settings and LVRT settings recommended at the inverter terminal (in coordination with POI) as below

Change in HVRT settings

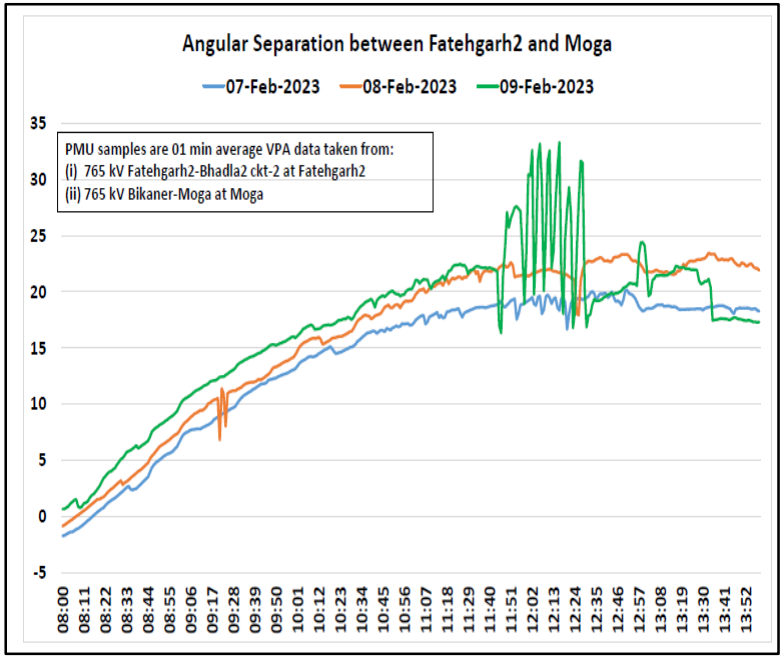
Description	Earlier (Default)		Revised		Remarks
	Voltage (in pu)	Time (in sec)	Voltage (in pu)	Time (in sec)	
HVRT Triggering threshold	1.1		1.15		Out of 44 RE plants in NR, 32 Plants implemented the revised OV settings
OV Stage-1 Voltage (in pu)	1.1	2	1.15	10	
OV Stage-2 Voltage (in pu)	1.2	0.2	1.2	2	
OV Stage-3 Voltage (in pu)	1.3	0	1.3	0.1	

Change in LVRT settings

Description	Earlier (Default)		Revised		Remarks
	Voltage (in pu)	Time (in sec)	Voltage (in pu)	Time (in sec)	
LVRT Triggering threshold	0.9		0.85		Out of 44 RE plants only changes have been done in 2 plants to observe the impact of far end fault
UV Stage-1 Voltage (in pu)	0.9	10	0.85	10	
UV Stage-2 Voltage (in pu)	0.85	3	0.8	3	
UV Stage-3 Voltage (in pu)	0.15	0.3	0.15	0.3	

- Out of 44 RE plants in NR, 39 RE plants have increased the HVRT settings.
- LVRT K-factor of RE plants connected at Fatehgarh-II (PG) and Fatehgarh-I were tuned.
- Over-voltage protection of 220/33kV ICTs & 400/33kV ICTs was disabled for most of the plant.
- The overvoltage of 220kV dedicated lines of RE plants was disabled or increased to comply with the standards at POI.
- Communications/detailed analysis reports of each event were issued.
- Several meetings were held and recommended action points and probable remedial measures were issued.
- A committee was constituted by CMD, Grid India to analyze the frequent grid events related to VRE and observation of low-frequency oscillations in the grid. The committee members and other representatives from CEA, CTUIL, and POWERGRID visited the VRE complex in Rajasthan from 03rd March to 06th March.
- Over voltage settings of 765 KV lines in Rajasthan are being reviewed based on the time grading.

High Voltage Angle Separation between RE plants & 765 kV buses in Rajasthan



Steady State Voltage Angle Difference of RE Plant Buses (220 kV & 400 kV) with Major 765 kV Buses in Rajasthan
(Reference Bus: 400 kV Korba - NTPC, Rajasthan ISTS Solar Gen: 11900 MW, Rajasthan Demand: 16900 MW)

ISTS Pooling Station (Plant Capacity Commissioned)	Plant	Plant Capacity (MW)	Plant Bus Voltage Level Considered for the Study	Angular Difference (in Degrees) with 765 kV Khetri Bus	Angular Difference (in Degrees) with 765 kV Moga Bus	Angular Difference (in Degrees) with 765 kV Jhatikara Bus	Angular Difference (in Degrees) with 765 kV Chittorgarh Bus	Angular Difference (in Degrees) with 765 kV Banaskantha Bus
Fatehgarh-II(PG) (3180 MW)	Renew Sun Bright (RSEJ4L)	300	220 kV	34.0	34.1	37.9	39.2	46.1
	ReNew Solar Energy (Jharkhand Three) Private Limited	300	220 kV	31.9	32.0	35.8	37.1	44.0
Fatehgarh-I (Adani Pooling) (996 MW)	Adani Hybrid Energy Jaisalmer Four Ltd.	700	220 kV	33.8	34.0	37.7	39.0	45.9
Bhadla-II(PG) (1720 MW)	ACME Heeragarh powertech Pvt. Ltd	300	220 kV	23.2	23.3	27.1	28.4	35.3
	ABC Renewable Pvt. Ltd	300	220 kV	23.1	23.3	27.0	28.3	35.2

- Exploring the possibility of **load anchoring** at various intermediate substations
- Specific equipment design starting from 33/220 kV ICTs, the 220 kV evacuation line to pooling stations, the 220/400 kV ICTs at pooling station, the 400/765 kV ICTs and the 765 kV lines
  - **Low impedance transformers**
  - **High SIL Transmission Lines**

Low SCR at Pooling Stations

SCR of ISTS RE pooling station								
Sl. No.	Region	Voltage level	Station Name	3-ph fault current (kA)	3-Ph fault MVA	Generation being pooled (MW)	SCR	Min desirable SCR
1	NR	220	Fatehgarh-II_A	21	7850	2490	3.15	5
2		400	Fatehgarh-II	21	14150	4180	3.39	5
3		220	Bhadla	33	12636	3080	4.10	5
4		220	AREPRL	12	4723	1000	4.72	5
5		220	Bhadla-II	24	9262	1620	5.72	5
6		220	Fatehgarh-II_B	14	5100	690	7.39	5
7		220	Bikaner	16	6180	738	8.37	5
8		400	AREPRL	14	9880	1000	9.88	5
9		400	Fatehgarh-I	14	9836	1000	9.84	5

SCR is an established screening metric to identify weak system before allowing interconnection. Same needs to be honored religiously while allowing connectivity to new RE plants. Remedial measures for meeting minimum SCR needs to be analyzed and implemented based on merit

1. Synchronous Condenser Installation (widely used practice for increasing SCR/fault level of weak grids)
2. Additional Transmission Lines (only marginal increase in fault level in case of sources being far away from POI)
3. Low impedance X'mers/Lines

Major Constraints in Inter-regional & Intra-regional Network

Constraints in Inter-regional Corridors

Sl No	Corridor	TTC (MW)	ATC (MW)	Constraints Observed in Operation
1	**NR Import**	25800	24400	• **N-1 of 765 kV Vindhyachal – Varanasi D/C will overload the other circuit** • **Non-compliance of 400/220 kV, 500 MVA ICTs at Kurukshetra when HVDC Champa - Kurukshetra power order is above 5000 MW** • **Constraint in increasing the HVDC Mundra-Mahendergarh link, due to the loading of 400 kV SSP-ASOJ**
2	**NR Export**	4000	3500	• **N-1 non-compliance observed in Rajasthan to Gujarat corridor during high solar hours of 400 kV Kankroli-Zerda & 400 kV Bhinmal-Zerda**
3	**SR Import**	17300	16300	• **N-1 non-compliance of 2x1500 MVA, 765/400 kV ICTs at Nizamabad**
4	**SR Export**	6350	5700	• **N-1 non-compliance 400 kV Kolhapur-Kolhapur D/C (Reconductoring of 400 kV Kolhapur (PG) – Kolhapur (MS) – 1 is completed and the reconductoring of the 2nd circuit is going on)**

Commissioning of Elements Eagerly Awaited

➢ For Enhancement in SR Import

- 765/400 kV ICT-3 at Nizamabad **(SR Import ATC Constraint)**
- 765 kV Warora-Warangal D/C **(Will Enhance SR Import Transfer Capability) – ROW Issues (SCOD: Dec'2019)**
- 765 kV Hyderabad-Kurnool D/C **(Will Enhance SR Import Transfer Capability) – ROW Issues (SCOD: Feb'2020)**

➢ For Enhancement in SR Export

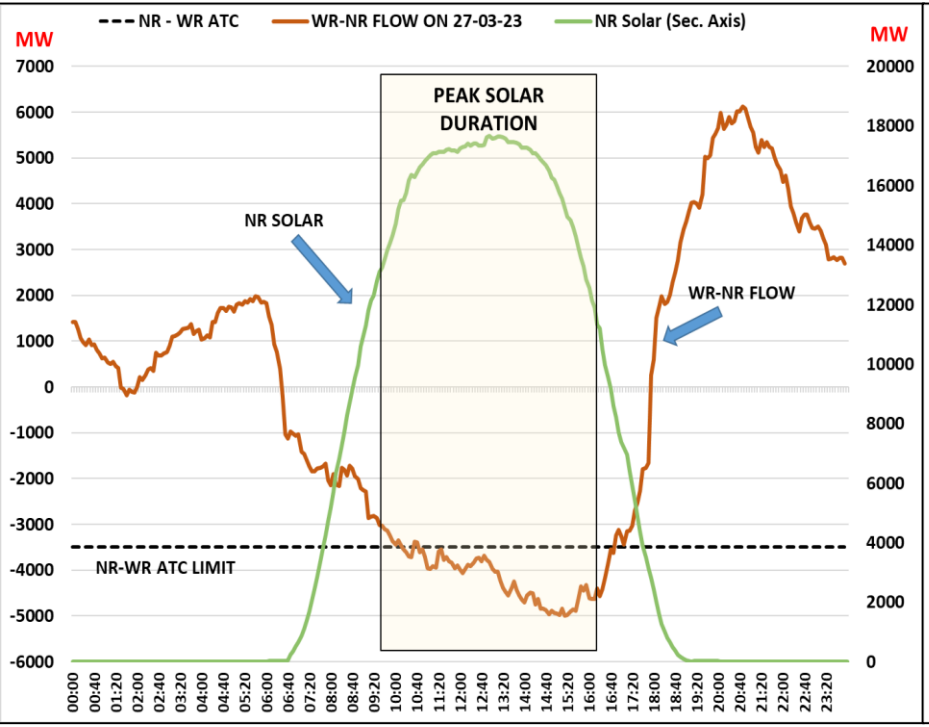
- 765/400 kV ICTs at Kotra S/S (approved in 8th NCT meeting)
  - **Section – A (1 No of ICT)**
  - **Section – B (2 No of ICTs)**

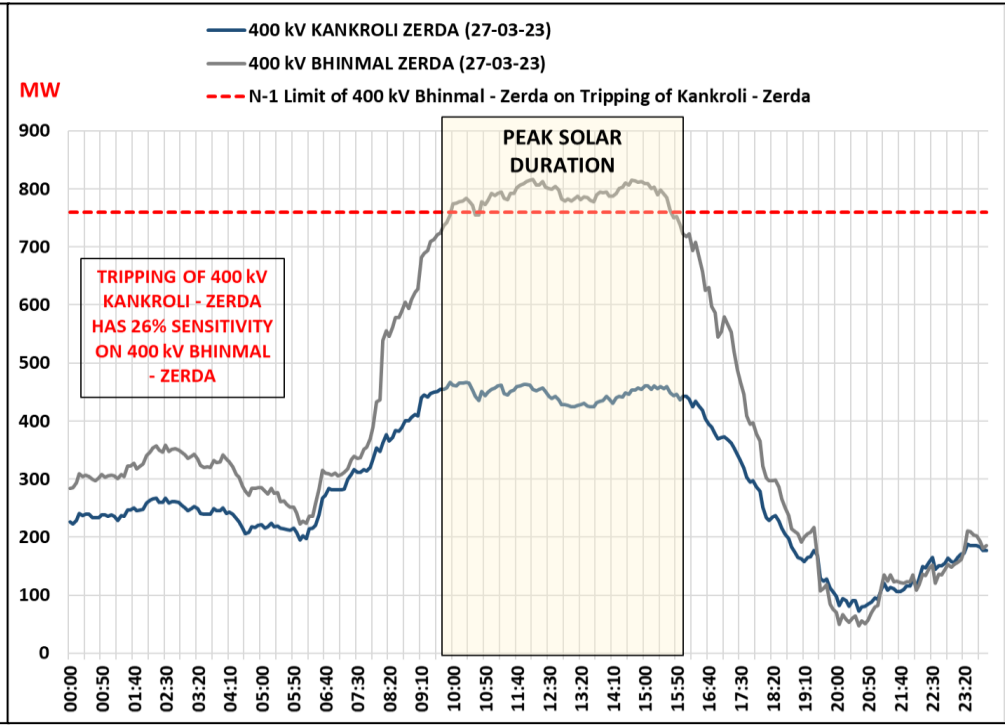
  (Till the commissioning of ICTs, maximum flow on HVDC will depend upon the generation that is being pooled at Raigarh PS in both the sections)
- 765 kV Narendra – Pune D/C **(Will Enhance SR Export Transfer Capability) – (SCOD: July'2024)**

➢ For Enhancement in NR Export

- Bypassing of 400 KV Kankroli – Bhinmal - Zerda lines at Bhinmal to form **400 kV Kankroli - Zerda (direct line)** and **reconductoring of 400 KV Jodhpur (Surpura) (RVPN)-Kankroli-S/C** line with twin HTLS conductor approved under 5th CMETS-NR.

NR Export Constraints



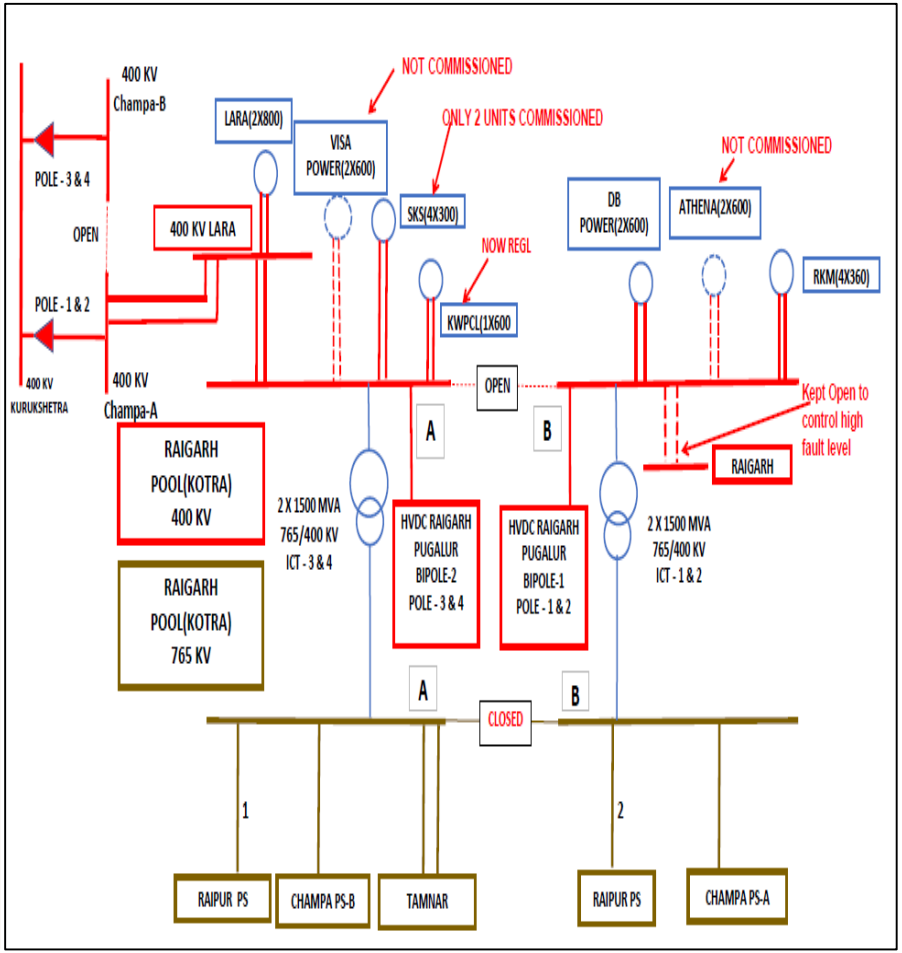


Schemes approved in the 9th NCT meeting under the Scheme to relieve high loading of WR-NR inter-regional corridor need to be expedited:

- Bypassing of 400 KV Kankroli-Bhinmal-Zerda lines at Bhinmal to form 400 KV Kankroli-Zerda (direct line)
- Reconductoring of 400 KV Jodhpur (Surpura)(RVPN)-Kankroli-S/C line with twin HTLS conductor.

Inadequate reactive compensation: Constraint in utilization of HVDC

- High SR Import during morning hours necessitates the operation of HVDC Raigarh – Pugalur at a high power order in WR – SR direction
- The loading on 400 KV Lara-Kotra-D/C is restricting further increase in power order of HVDC Raigarh - Pugalur(WR-SR)
- Due to the bus split at Champa, sensitivity of HVDC Champa - KKR Bipole - II has negligible sensitivity on 400 kV Lara - Kotra loading. However, 100 MW increase in HVDC Champa - KKR Bipole – I (i.e Pole-1 & 2 connected to 400 KV Champa PS_A bus) power order will reduce the loading of Lara – Kotra(each ckt) by 12 MW
- However, **the voltages at 765kV & 400 kV buses of Champa - A remain above 780 kV & 412 kV for all the time and this prevents the deblocking of HVDC Champa – Kurukshetra Bipole- 1 inspite of VAR absorption by Units at Champa & Raigarh (Kotra).**
- This creates issue in the flexible operation of both the HVDCs
- Additional reactive compensation to be planned at Champa-PS



Augmentation in Maharashtra System to Mitigate Operational Constraints

- High loading is observed near the Mumbai area during peak demand periods

- During those periods, any constraint in HVDC Pagdhe power order have also created alarming situations in real time as it leads to further increase in the line loadings

- High loading is observed in,
  - 400 kV Padghe-Kalwa D/C
  - 400 kV Pune(PG)- Kharghar
  - 400 kV Pune(PG)- Kalwa S/C line
  - 400 kV Pune GISPune PG Q/C
  - 400 kV Kudus-Kala D/C corridor
  - 400 kV Chandrapur-Chandrapur-II D/C **(Reconductoring to be expedited)**
  - 400 kV Parli(PG)- Parli(MS) D/C line **(Bypassing of 400 kV Parli(PG)- Parli(MH)-D/c and 400 kV Parli(New)-Parli(PG)_D/c at outskirts Parli(PG) S/s completed, Reconductoring to be expedited)**

Details of Transmission schemes impacting Maharashtra ATC (up to 2023-24)

Sl.	Element	Intra-state / ISTS	Implementing Agency	Expected COD (as per CTU report)	Latest Status
1.	Bypassing of Parli(PG) – Parli(M) 400kV D/c line (~5km.) and Parli(PG) – Parli(New) 400kV D/c (quad) line (~18km.) at the outskirts of the Parli(PG) S/s so as to form Parli(M) – Parli(New) 400kV D/c direct line	ISTS	POWERGRID (Awarded on 25.08.2022)	Dec'22 (Original SCOD: Aug'23)	Bypassing work completed
2.	Reconductoring of C'pur(II) – C'pur(I) 400kV D/c line (~1 km) with equivalent high capacity twin HTLS conductor	Intra-state	MSETCL	Mar'23	Tender uploaded on Jan'23 and MSETCL to update
3.	Load Trimming Scheme (LTS) at 220kV Talegaon (Urse/Sahara/Chinchwad): 260MW & 400kV Lonikand/Theur: 280MW	Intra-state	MSETCL in coordination with POWERGRID	Mar'23	Load Trimming Scheme (LTS) implemented
4.	Load Trimming Scheme with total 1850MW loading on Ektuni 765/400kV ICTs	Intra-state	MSETCL	Mar'23	MSETCL to update

Details of Transmission schemes impacting Maharashtra ATC (up to 2023-24)

Sl.	Element	Intra-state / ISTS	Implementing Agency	Expected COD (as per CTU report)	Latest Status
5.	Installation of 1x500MVA, 400/220kV ICT at Akola(MSETCL) S/s	Intra-state	MSETCL	Mar'23	MSETCL to update
6.	Babhleswar – Kudus 400kV D/c (Quad) line and Kudus Downstream System	Intra-state	MSETCL	Jun'23	Expected completion by Jun'23.
7.	Reconductoring of Parli(PG) – Parli(M) 400kV D/c line section with twin HTLS conductor	ISTS	POWERGRID (Awarded on 25.08.2022)	May'23 (to be preponed from SCOD of Aug'23)	May'23 on best effort basis
8.	Addl. Feed to Navi Mumbai (Part System): • 220kV Apta-Taloja LILO at Navi Mumbai • 220kV Apta-Kalwa LILO at Navi Mumbai	ISTS	Sterlite (Awarded on 23.06.2020)	Jun'23	Expected completion by Sep'23.
9.	Installation of 2x500MVA, 400/220kV ICTs at Warora(MSETCL) S/s	Intra-state	MSETCL	Dec'23	Dec'23

Details of Transmission schemes impacting Maharashtra ATC (up to 2024-25)

Sl.	Element	Intra-state / ISTS	Implementing Agency	Expected COD (as per CTU report)	Latest Status
1.	Western Region Expansion Scheme XXXI (WRES-XXXI): Part C • Augmentation of ICT at Pune (GIS) 765/400 kV substation by 1x1500 MVA ICT (3rd)	ISTS	POWERGRID (Awarded on 28.11.2022)	Jun'24 on best effort basis	Jun'24 on best effort basis
2.	Addl. Feed to Navi Mumbai(WRSS-XIX): • Padghe(PG)(GIS) – Khargar/Vikroli 400kV D/c line along with LILO of Padghe-Vikhroli LILO at Navi Mumbai	ISTS	Sterlite (Awarded on 23.06.2020)	Jun'24	Expected completion by Jun'24
3.	Khed City – Pune(GIS) 220kV D/c line and Ranjangaon – Pune(GIS) 220kV D/c line with high capacity conductor	Intra-state	MSETCL	Jun'24	Jun'24
4.	Creation of 220kV level at Pune(PG)(GIS) and Installation of 2x500MVA, 400/220kV ICTs at Pune(PG)(GIS)	ISTS	POWERGRID (Awarded on 03.02.2022)	Jun'24	Jun'24

High & Low Voltage Nodes

High Voltage & Low Voltage Nodes in NR

HV Nodes:

Suratgarh, Shree Cement, Rajwest, Barmer, Akal, Jodhpur, Jaipur South, Muktsar

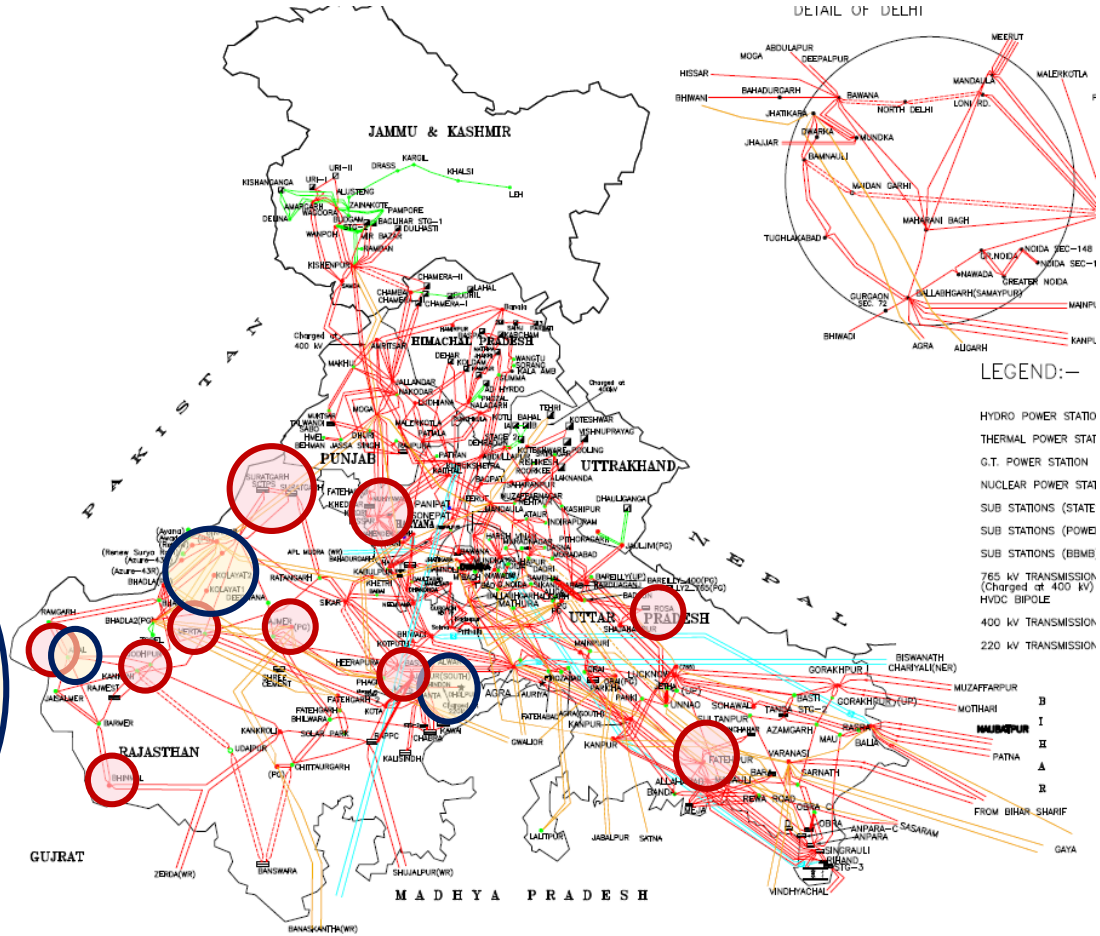
Mahendragarh, MGTPS Jhajjar, CCGT Bawana

Fatehpur, Rosa,

LV Nodes:

Hindaun, Alwar **(Establishing Additional 400 kV Connectivity with Alwar from Bhiwadi/Bassi/Phagi to be expedited)**

Bhadla-I (PG), Fatehgarh-II Fatehgarh-I (PG) **(STATCOM Commissioning to be expedited, reactive support from RE Plants to be mandated),** Akal (Raj), Bhadla(RJ), Ramgarh, Kankani **(Rajasthan SLDC to direct RE Generators for Reactive Support)**



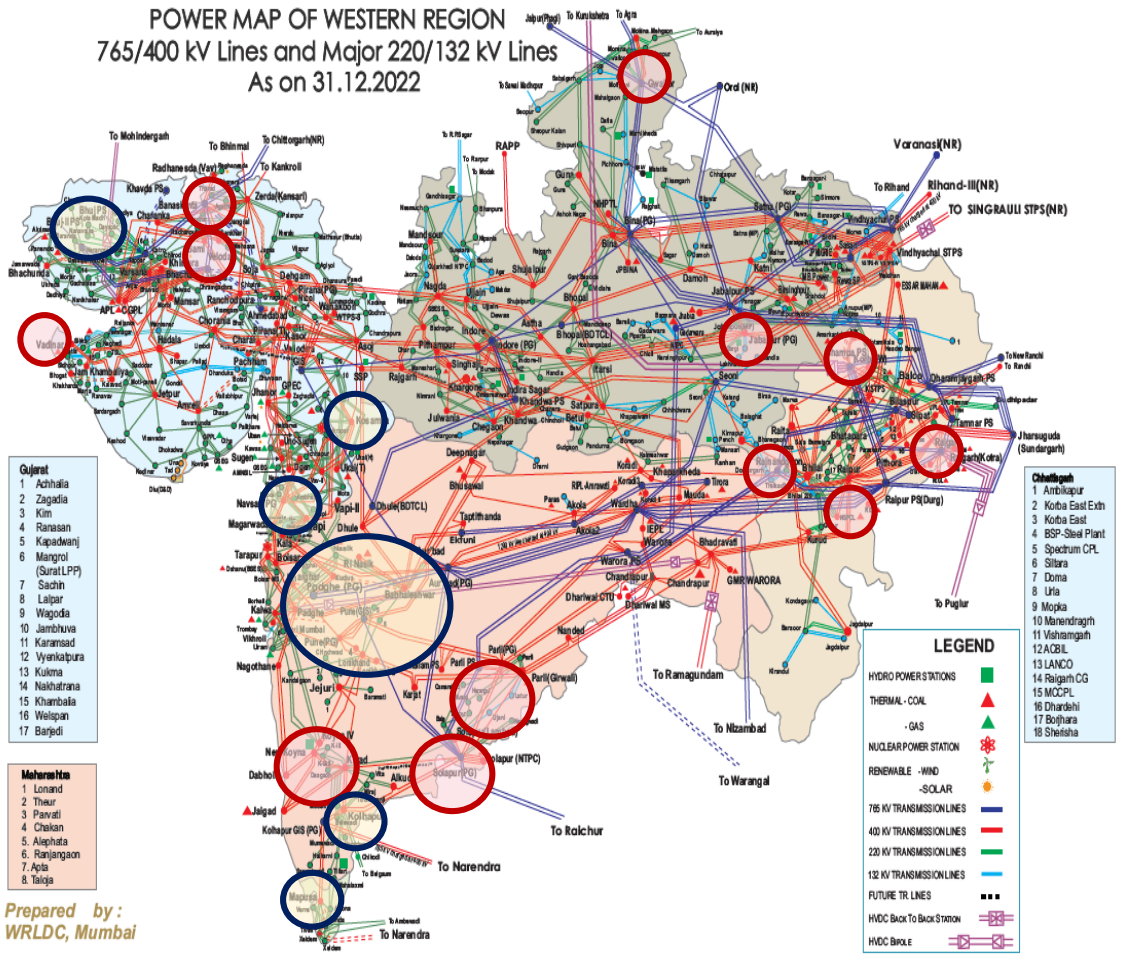
High Voltage & Low Voltage Nodes in WR

HV Nodes: New Parli, Padghe GIS, Solapur-PG, Wardha-PG, New Koyna,

Banaskantha, Sami, Essar Vadinar,

Jabalpur-PS, Gwalior-PG,
765kV Champa-PS Section-A, 765 kV Rajnandgaon, 765 kV Raigarh (Kotra), **400kV Korba West (Reactor Planned and to be expedited)**, 400kV NSPCL

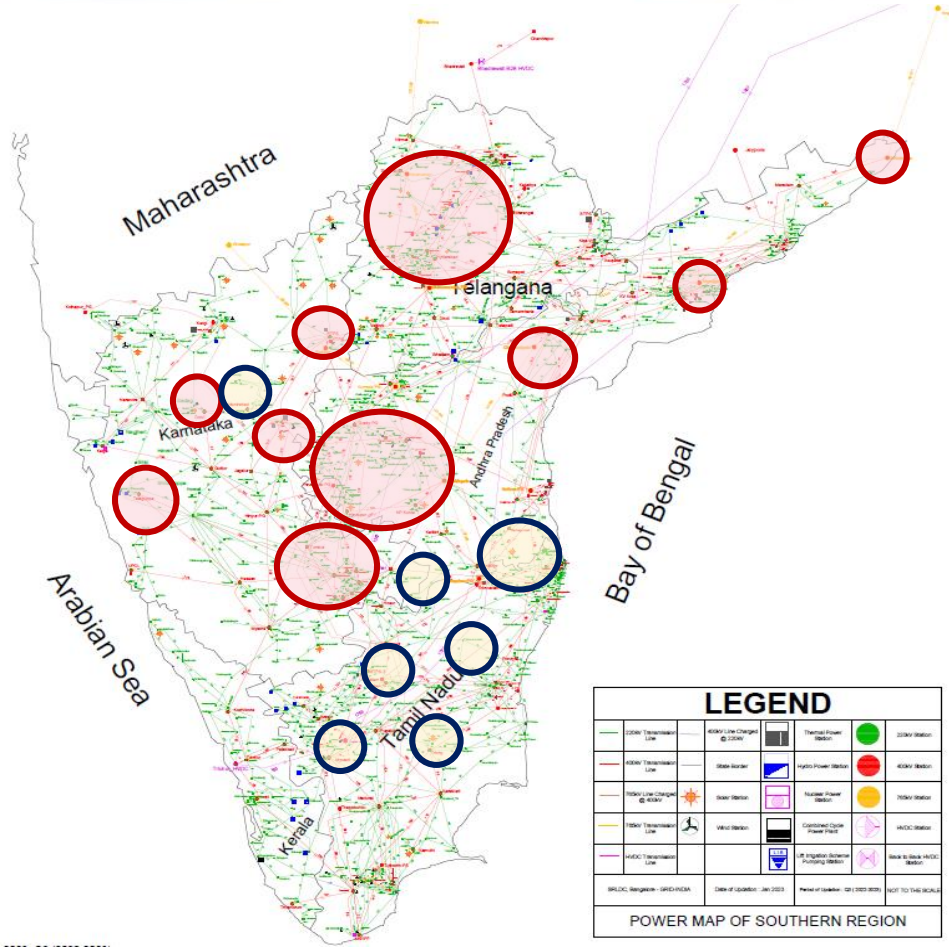
LV Nodes: Padghe, Kharghar Kalwa, **(Padghe (GIS)-Navi Mumbai-Vikhroli line to be expedited)** Pune PG & Chakan, Jejuri, Lonikhand, Lonikhand-II, Solapur **(Capacitor Bank at LV by MSETCL)** Bableshwar, Kolhapur GIS, Solapur(MH), Alkud, Boisar, 400 kV Kolhapur-GIS, 400 kV Kolhapur MS, Mapusa, Bhuj-PS, Hazira, Vapi, Vav, Kosamba, Janor, Magarwada



High Voltage & Low Voltage Nodes in SR

HV Nodes: 400 kV Chilakaluripeta, 400 kV Cuddapah-Pg, 400 kV Ghani, 400 kV Gooty, 400 kV Hindupur, 400 kV Hinduja, 400 kV Jamalamadugu, 400 kV Kalikiri, 400 kV Kurnool-Ap, 400 kV Kurnool-Pg, 400 kV KV Kota, 400 kV Np Kunta, 400 kV Podili, 400 kV RyTPS Stg V, 400 kV Sattenapalli, 400 kV Tallapalli, 400 kV Talarichervu, 400 kV Uravakonda, 400 kV Vemagiri-Pg, 400 kV VTS_Ag, 765 kV Chilakaluripeta, 765 kV Cuddapah-Pg, 765 kV Vemagiri-Pg, 400 kV Asupaka, 400 kV Chandulapur, 400 kV Dichipalli, 400 kV Gajwel, 400 kV Dindi, 400 kV Jangoan, 400 kV Julurpadu, 400 kV Kakatiya Tps, 400 kV Kethireddypalli, 400 kV Khammam

LV Nodes: Doni, Hoody, Hosur, Kalivendpattu, Kudgi, Manali, Munirabad, Puducherry, Salem, SV Chatram, Sholinganallur, Trichur, Trichy, Udmalpet



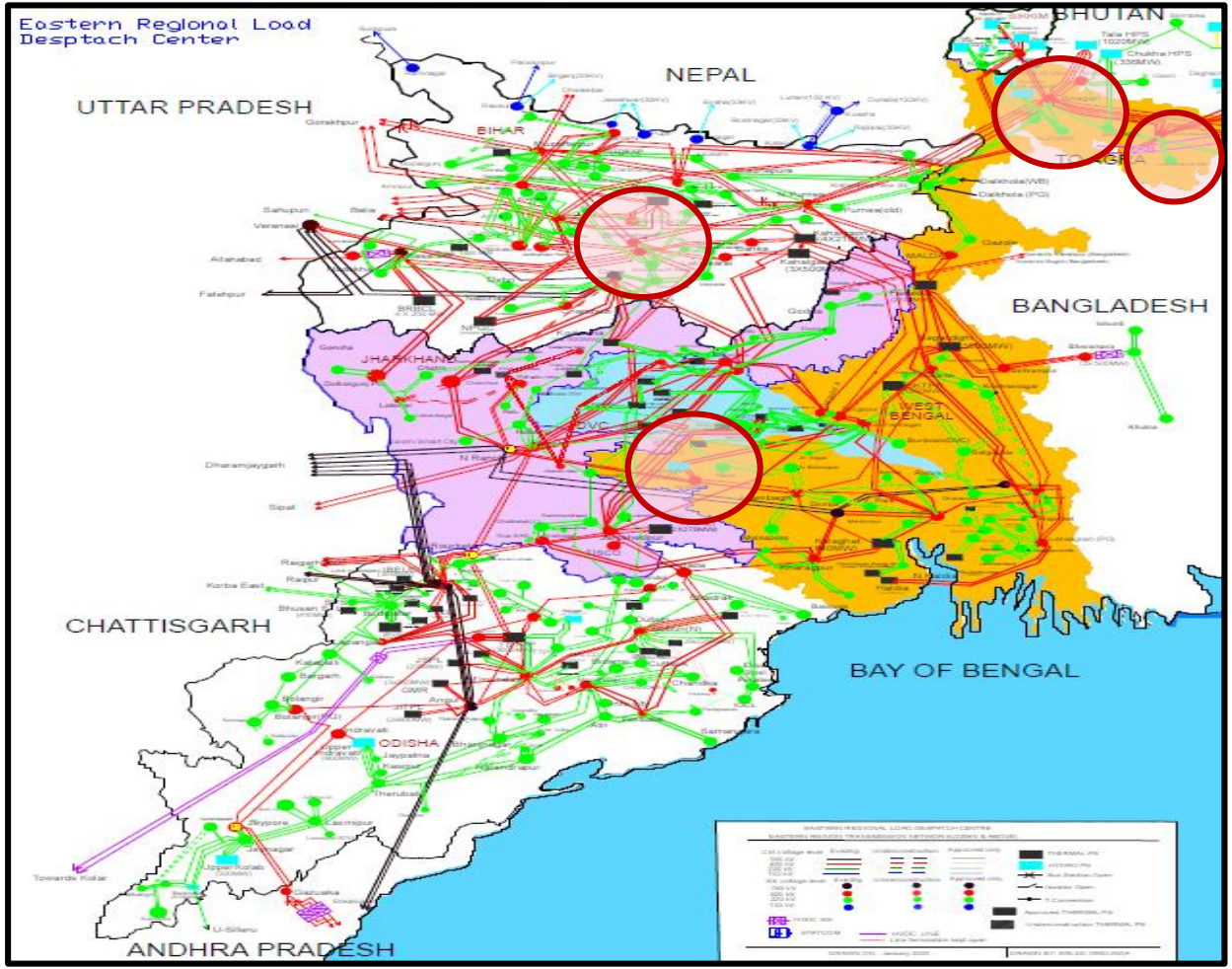
High Voltage & Low Voltage Nodes in ER

HV Nodes:

- **New Purulia PSP:**

2x 125 MVAR BR commissioning needs to be expedited

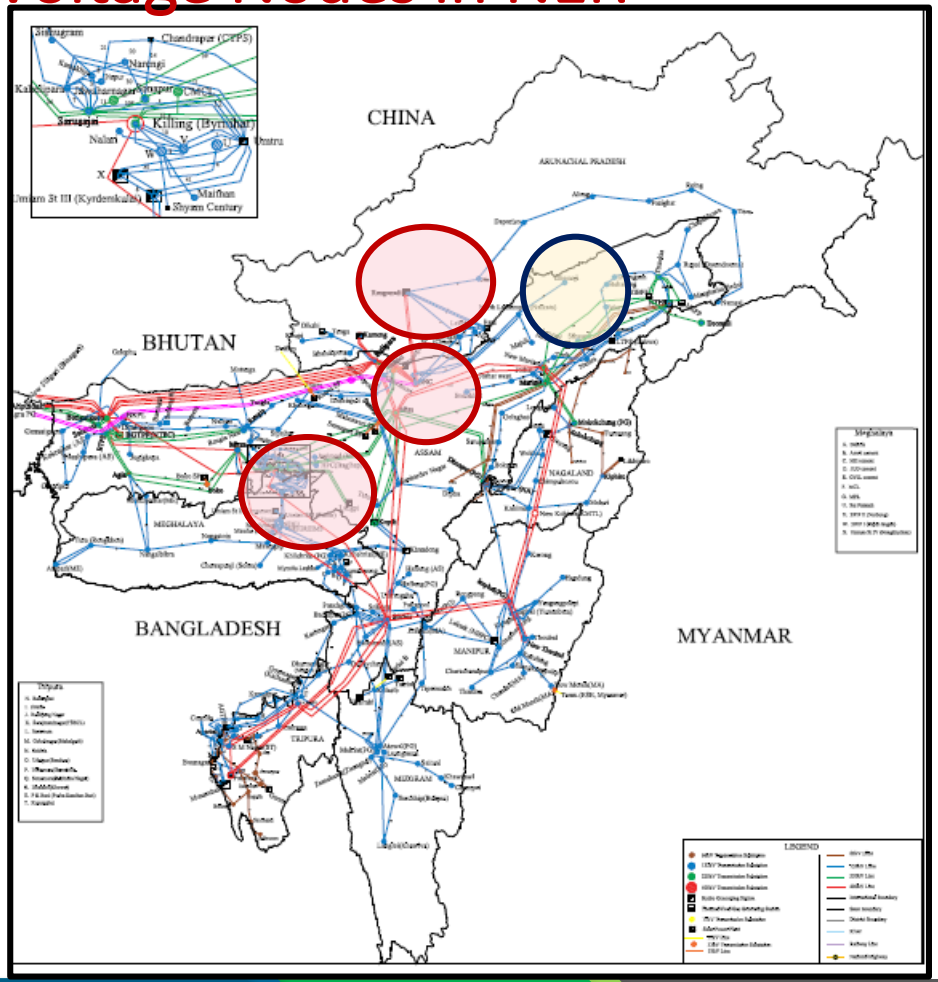
- 400 KV Alipurduar,Rangpo Teesta V, Binguri , 400 kV Saharsha, 400 kV Biharshariff



High Voltage & Low Voltage Nodes in NER

HV Nodes: 400 kV Ranganadi, Balipara, Misa, Biswanath Chariali, Byrnihat. **(Installation of 420 kV, 80 MVAR B/R by NEEPCO at Ranganadi Bus, 80 MVAR bus Reactor at Byrnihat to be expedited)**

LV Nodes : 132 KV Dhemaji kV (Biswanath Chariali – Itanagar D/C approved by Joint Standing Committee of ER and NER)



Thank you !!