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. No.: CTUIL/OM/19/24th NCT

25th November 2024

As per distribution list

Sub: Implementation of ISTS Transmission/Communication Schemes approved by NCT in its 24th meeting held on 23rd October 2024 under Regulated Tariff Mechanism (RTM).

NCT vide letter dated 22.11.2024 has awarded various ISTS Transmission/Communication schemes for its implementation under RTM mode by the respective implementing agencies as indicated in the table below:

Sl. No.	Transmission Schemes	Implementing Agency
I. ISTS Transmission schemes approved by NCT		
1.	Eastern Region Expansion Scheme-44 (ERES-44)	POWERGRID
2.	Augmentation of transformation capacity at KPS3 (GIS) S/s under Khavda Phase-V Part B3 scheme	M/s Khavda IV A Power Transmission Ltd. (Subsidiary of Adani Energy Solutions Ltd.) (i.e. TSP of KPS3 (Sec-II))
II. ISTS Communication schemes approved by NCT		
1.	Supply and Installation of additional FOTE and Ethernet cards at AGC & Critical Nodes of SR Region	POWERGRID
2.	Requirement of Additional FOTE at various ISTS nodes in ER due to exhaustion of existing capacity	POWERGRID
3.	Deployment of FOTE (SDH Equipment) and amplifier solutions at Alipurduar S/s end for OPGW based communication and Teleprotection for 400kV lines from PHEP-II, PHEP-I and Jigmeling of Bhutan to Alipurduar, India	POWERGRID

Further, NCT also approved the modification in the earlier approved/notified transmission schemes as follows:

1. **Revision in SCOD of 400kV D/c Jhatikara- Dwarka line under REZ Phase-III Part-D Phase-II scheme**

   NCT approved the revised SCOD for 400kV D/c (Twin HTLS) Jhatikara-Dwarka line under "Transmission system for evacuation of 20 GW REZ power from Rajasthan under phase-III, Part-D, Phase-II" scheme as 28th February, 2026 (31st December 2025 on best effort basis)

Copy of NCT letter dated 22.11.2024 is enclosed. The detailed scope of work along with implementation time frame for the above Transmission/Communication Schemes shall be as per the enclosed NCT letter and Minutes of the 24th meeting of NCT.

The implementing agency shall enter into a concession agreement with CTUIL for implementation of the aforementioned Transmission Schemes. However, pending finalization of Concession Agreement, it is requested to initiate necessary actions for implementation of the aforementioned Transmission Schemes.

This is for your kind information and necessary action, please.

Thanking you.

Yours faithfully,

(Partha Sarathi Das)
Sr. General Manager

Encl.: as stated.

Distribution List:

1. The Chairman & Managing Director Power Grid Corporation of India Ltd., Saudamini, Plot No. 2, Sector-29, Gurgaon- 122 001 cmd@powergrid.in	**2. Shri Prashanth Kumar** Authorised Representative, Khavda IV A Power Transmission Ltd. C-105, Anand Niketan, New Delhi 110021 prashant.kumar1@adani.com

सत्यमेव जयते

भारत सरकार
Government of India
विद्युत मंत्रालय
Ministry of Power
केन्द्रीय विद्युत प्राधिकरण
Central Electricity Authority
विद्युत प्रणाली योजना एवं मूल्यांकन प्रभाग-II
Power System Planning & Appraisal Division-II

सेवा में / To,

Chief Operating Officer, CTUIL
Floors No. 5-10, Tower 1, Plot No. 16,
IRCON International Tower, Institutional Area,
Sector 32, Gurugram, Haryana - 122001

विषय: 23.10.2024 को आयोजित एनसीटी की 24वीं बैठक में अनुमोदित आईएसटीएस पारेषण/संचार योजनाओं के कार्यान्वयन के संबंध में

Subject: Implementation of ISTS Transmission/Communication Schemes approved by NCT in its 24th meeting held on 23.10.2024- regarding

महोदय/Sir,

The undersigned is directed to inform that NCT has approved implementation of the following ISTS Transmission and Communication Schemes in its 24th meeting held on 23.10.2024, in line with MoP office order dated 28.10.2021 and MoP Guidelines dated 09th March, 2022, to be implemented through Regulated Tariff Mechanism (RTM) route by agency as indicated below:

I. ISTS schemes costing between Rs. 100 Crs. To Rs. 500 Crs. approved by NCT:

Sl. No.	Name of Transmission Scheme	Implementation Mode	Implementation timeframe	Estimated Cost (₹ Cr)
1.	Eastern Region Expansion Scheme-44 (ERES-44)	RTM through POWERGRID	18 months (15 months on best effort basis) from the date of allocation	385.77
2.	Augmentation of transformation capacity at KPS3 (GIS) S/s under Khavda Phase-V Part B3 scheme	RTM through M/s Khavda IV A Power Transmission Ltd. (Subsidiary of Adani Energy Solutions Ltd.) (i.e. TSP of KPS3 (Sec-II))	24 months from the date of allocation	252

II. Communication schemes approved by NCT:

Sl. No.	Name of Transmission Scheme	Implementation Mode	Tentative Implementation timeframe	Implementing Agency	Estimated Cost (in Rs.)
1.	Supply and Installation of additional FOTE and Ethernet cards at AGC & Critical Nodes of SR Region	RTM	12 months from the date of allocation	POWERGRID	1.02 Cr.
2.	Requirement of Additional FOTE at various ISTS nodes in ER due to exhaustion of existing capacity	RTM	12 months from the date of allocation	POWERGRID	9.78 Cr.
3.	Deployment of FOTE (SDH Equipment) and amplifier solutions at Alipurduar S/s end for OPGW based communication and Teleprotection for 400 kV lines from PHEP-II, PHEP-I and Jigmeling of Bhutan to Alipurduar, India	RTM	6 months from the date of allocation	POWERGRID	65 Lakhs

The above schemes are awarded to CTUIL for implementation under RTM mode. CTUIL is requested to take necessary action for entering into a concession agreement with the respective agency for implementation of the above schemes.

III. Modifications in earlier approved schemes:

1. Revision in SCOD of 400 kV D/C Jhatikara-Dwarka line under REZ Phase-III Part-D Phase-II scheme

NCT approved the revised SCOD for 400 kV D/C (Twin HTLS) Jhatikara-Dwarka line under "Transmission system for evacuation of 20 GW REZ power from Rajasthan under phase-III, Part-D, Phase-II" scheme as 28th February, 2026 (31st December 2025 on best effort basis)

CTU is requested to intimate the implementing Agency. Detailed scope of the schemes are as per minutes of the meeting. Copy of the minutes are enclosed.

Encl.: As above.

भवदीय / Yours faithfully,

22.11.2024

(बी.एस.बैरवा/ B.S.Bairwa)
मुख्य अभियन्ता (इंचार्ज) एवं सदस्य सचिव,एन.सी.टी./
Chief Engineer (I/C) & Member Secretary (NCT)

Copy to:

Joint Secretary (Trans), Ministry of Power, Shram Shakti Bhawan, New Delhi-110001

सत्यमेव जयते

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 चौबीसवीं बैठक के कार्यवृत्त – के सम्बन्ध में ।

Subject: Minutes of the 24th Meeting of National Committee on Transmission (NCT) – regarding.

महोदया (Madam) / महोदय (Sir),

The 24th meeting of the National Committee on Transmission (NCT) was held on 23rd October, 2024, at CEA, New Delhi. Minutes of the meeting are enclosed herewith.

भवदीय/Yours faithfully,

22.11.2024

(बी.एस.बैरवा/ B.S. Bairwa)
मुख्य अभियन्ता (इंचार्ज) एवं सदस्य सचिव,एन.सी.टी./
Chief Engineer (I/C) & Member Secretary (NCT)

प्रतिलिपि / Copy to:

Joint Secretary (Trans), Ministry of Power, New Delhi-110001

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. Lalit Bohra, Joint Secretary Room no 602, Atal Akshay Urja Bhawan Opposite CGO Complex, Gate No. 2, Lodhi Road, New Delhi – 110003	6.	Chief Operating Officer, CTUIL, Floors No. 5-10, Tower 1, Plot No. 16, IRCON International Tower, Institutional Area, Sector 32, Gurugram, Haryana - 122001.
7.	Sh. Rajnath Ram, Adviser (Energy), NITI Aayog, Parliament Street, New Delhi – 110 001.	8.	CMD, Grid Controller of India, B-9 (1st Floor), Qutub Institutional Area, Katwaria Sarai, New Delhi – 110016
9.	Sh. Ravinder Gupta Ex. Chief Engineer CEA		

Table of Agenda

1 Confirmation of the minutes of the 22nd and 23rd meeting of National Committee on Transmission. 1

2 Status of the transmission schemes noted/approved/recommended to MoP in the 22nd and 23rd meetings of NCT:.....1

3 Modifications in the earlier approved/notified transmission schemes:.....2

4 New Transmission Schemes:.....7

5 Grid-India Presentation on Performance of the National Grid in Q1 and Q2 of FY 2024-25.....19

Summary of the deliberations of the 24th meeting of NCT held on 23rd October, 2024.....23

Minutes of the 24th meeting of National Committee on Transmission (NCT)

The 24th meeting of NCT was held on 23rd October, 2024 at CEA, New Delhi. List of participants is enclosed at **Annexure-I**. Agenda wise deliberations are given below:

1 Confirmation of the minutes of the 22nd and 23rd meeting of National Committee on Transmission.

1.1 The minutes of the 22nd meeting of NCT held on 23.08.2024 were issued on 01.09.2024 vide CEA letter No. CEA-PS-12-13/3/2019-PSPA-II. No comments have been received on the minutes.

1.2 The minutes of the 23rd meeting of NCT held on 02.09.2024 were issued on 09.09.2024 vide CEA letter No. CEA-PS-12-13/3/2019-PSPA-II. No comments have been received on the minutes.

1.3 Members confirmed the minutes of 22nd and 23rd meetings of NCT.

2 Status of the transmission schemes noted/approved/recommended to MoP in the 22nd and 23rd meetings of NCT:

2.1 Status of new transmission schemes approved/recommended:

Sr. No	Name of the Transmission Scheme	Noted/ Recommended/ Approved	Mode of Implementation	BPC	Award/ Gazette notification
22nd NCT Meeting					
1.	Transmission system for supply of power to Green Hydrogen/Ammonia manufacturing potential in Mundra area of Gujarat under Phase-I: Part B1 scheme (3 GW at Navinal S/s)"	Recommended	TBCB	PFCCL	Gazette Notified by MoP dated 12.09.2024
2.	Eastern Region Expansion Scheme-43 (ERES-43)	Approved	RTM	Not applicable	Informed to CTUIL vide letter dated 02.09.2024 CTUIL awarded the projects to the implementing agency on 02.09.2024
3.	Additional Transmission System Proposed for redundant power supply to Dholera area	Approved	RTM	Not applicable	
4.	Transmission System for Integration of Anantapur-II REZ - Phase-I (for 4.5 GW)	Recommended	TBCB	PFCCL	Gazette Notified by MoP dated 12.09.2024
5.	Transmission system for proposed Green Hydrogen / Green	Recommended	TBCB	RECPDCL	Gazette Notified by MoP dated 12.09.2024

Sr. No	Name of the Transmission Scheme	Noted/ Recommended/ Approved	Mode of Implementation	BPC	Award/ Gazette notification
	Ammonia projects in Tuticorin area)				
6.	Augmentation of transformation capacity by 3x500 MVA, 400/220 kV ICTs (6th - 8th) and 1x1500 MVA,765/400 kV ICT (4th) at Bidar PS	Approved	TBCB	RECPDCL	Gazette Notified by CEA on 25.09.2024
7.	Scheme for Requirement of Additional FOTE for redundancy at AGC locations in NER: Revised	Approved	RTM	Not applicable	Informed to CTUIL vide letter dated 02.09.2024 CTUIL awarded the projects to the implementing agency on 02.09.2024
8.	Optical Fibre Connectivity for NLDC new building, August Kranti Marg, New Delhi	Approved	RTM	Not applicable	
23rd NCT Meeting					
1.	Transmission System for Integration of Kurnool-IV REZ - Phase-I (for 4.5 GW)	Recommended	TBCB	RECDPCL	Gazette Notified by MoP dated 19.09.2024

2.2 Status of transmission schemes where modifications was suggested by NCT:

S. No.	Scheme where modifications was suggested	Status
1.	Modification in Transmission system for evacuation of power from Luhri Stage-I HEP	Informed to RECPDCL vide letter dated 02.09.2024
2.	Transmission system for evacuation of power from Shongtong Karcham HEP (450 MW) and Tidong HEP (150 MW)	Informed to RECPDCL vide letter dated 02.09.2024
3.	Modification in timeframe of one of the elements in the scope of "Transmission system for offshore windzone phase-1(500 MW VGF off coast of Gujrat for subzone B-3)	Informed to CTUIL vide letter dated 02.09.2024 CTUIL awarded the projects to the implementing agency on 02.09.2024
4.	Time extension for Communication Scheme "Requirement of additional FOTE of STM-16 capacity at Bhuj-II substation to cater connectivity of RE Gencos"	

3 Modifications in the earlier approved/notified transmission schemes:

3.1 Revision in SCOD of 400 kV D/C Jhatikara-Dwarka line under REZ Phase-III Part-D Phase-II scheme

3.1.1 Representative from CTUIL stated that the implementation of the 400 kV D/C Jhatikara-Dwarka line, along with two 400 kV bays each at Jhatikara and Dwarka

under "Transmission system for evacuation of 20 GW REZ power from Rajasthan under phase-III, Part-D, Phase-II" was allocated to POWERGRID under RTM mode with completion schedule of 18 months vide MoP OM Ref. No. 15/3/2018-Trans-Part(5) dated 06.11.2023. POWERGRID vide letter dated 29.12.2023 requested an extension of the implementation timeline to at least 24 months due to technical and execution challenges and proposed changing the conductor configuration from quad to Twin HTLS on Monopole structure.

3.1.2 NCT in its 17th meeting held on 31.01.24 directed CTUIL to re-survey of the scheme through implementing agency so as to arrive at the optimum requirement of monopole/narrow base tower towers, and work out the revised estimated cost. Further, NCT in its 19th meeting held on 29.04.2024 approved the scope modifications in the Jhatikara – Dwarka 400 kV D/c line under Rajasthan REZ Ph-III, Part-D- Ph-II Scheme. Tentative implementation time-frame of 18 months from MOP OM-06/11/23 was unchanged. CTUIL vide letter Ref. No. CTUIL/OM/14/19 NCT dated 29.05.2024 informed that the scope of project was revised and conductor configuration was changed to Twin HTLS, However, the implementation timeline remains unchanged. POWERGRID on 06.06.2024, once again requested an extension of project timelines to at least 24 months from the fresh allocation date of 29.05.2024, instead of 18 months from original allocation date.

3.1.3 Subsequently, in a meeting chaired by Secretary (Power) on 01.07.2024, POWERGRID was advised to proceed with inviting tender based on 18 months' timelines for the implementation of Rajasthan Phase-II, Part-D, Phase-II scheme. In compliance with the directives, POWERGRID floated the tender and the award is expected by November, 2024 with a project completion timeline of February 2026.

3.1.4 Director (SO), Grid-India stated that 765/400 kV Jhatikara ICTs and 400 kV lines from Jhatikara were N-1 non-compliant during summer of 2024. In case of further delay in 400 kV D/C Jhatikara - Dwarka line, severe constraints are expected in the existing 400 kV Jhatikara – Dwarka and 400 kV Jhatikara – Bamnouli lines with further RE capacity addition in Rajasthan etc. The loading of these lines emerged as N-1 non-compliant during high demand season of NR and the same may lead to RE curtailment in future. Requirement of any augmentation in the Delhi intra-state system also needs to be examined. Chairperson, CEA directed that the above issues shall be studied in a holistic manner in the transmission Resource Adequacy Plan of Delhi.

3.1.5 After deliberations, NCT approved the revised SCOD for 400 kV D/C (Twin HTLS) Jhatikara-Dwarka line under "Transmission system for evacuation of 20 GW REZ power from Rajasthan under phase-III, Part-D, Phase-II" scheme as 28th February, 2026 (31st December 2025 on best effort basis).

3.2 Change in scope of Transmission system for evacuation of power from Rajasthan REZ Ph-V (Part-1: 4 GW) [Sirohi/Nagaur] Complex

3.2.1 The transmission system for evacuation of power from Rajasthan REZ Ph-V (Part-1:4 GW) (Sirohi/Nagaur complex) was recommended in the 21st NCT meeting held on 06.08.2024. Subsequently, the scheme was notified by MoP vide Gazette dated

29.08.2024. The scheme involves 5x500 MVA, 400/220 kV ICTs along with 6 Nos. 220 kV line bays at Sirohi S/s for RE interconnection at Sirohi S/s. The scheme is currently under bidding by RECPDCL.

3.2.2 Representative from CTUIL stated that connectivity up to 2100 MW was agreed to be granted at Sirohi S/s. Out of this, 1400 MW was agreed to be granted at 220 kV level through 5 Nos. of 220 kV line bays and balance 700 MW was agreed to be granted at 400 kV level (1 No. bay). It is to mention that out of above 700 MW, earlier 400 MW was agreed to be granted at 220 kV level of Sirohi S/s, however due to additional application of 300 MW, considering cumulative quantum (700 MW), it was proposed to be granted at 400 kV level. Further, it is proposed to add the following transmission element as part of Transmission system for evacuation of power from Rajasthan REZ Ph-V (Part- 1) (Sirohi Complex)

- 1 No. of 400 kV line bay at Sirohi S/s for RE interconnection

3.2.3 As total connectivity granted at Sirohi S/s on 220 kV level is 1400 MW through 5 Nos. of 220 kV line bays (out of 6 Nos.), 1 No. of 220 kV line bay which is part of the above scheme shall remain unutilised. Additionally, for RE evacuation requirement of 1400 MW at 220 kV level, through 4 Nos. of 400/220 kV ICTs (out of 5 Nos.), 1 No. of 400/220 kV ICT which is part of the above scheme shall remain unutilised. In view of the above, it is proposed to delete the following elements from Transmission system for evacuation of power from Rajasthan REZ Ph-V (Part- 1) (Sirohi Complex)

- 1 No. of 220 kV line bay at Sirohi S/s
- 1x500 MVA, 400/220 kV ICT at Sirohi S/s along with transformer bays

3.2.4 The original cost of scheme is Rs 5027.61 Cr. With above modifications of scope, cost shall reduce only by Rs 40.75 Cr which is about (-) 0.81 % of original cost of package.

3.2.5 Representative of RECPDCL stated that NIT for the scheme was issued on 26.09.2024. The bid submission deadline is 29.11.2024 while SPV transfer is targeted in December 2024.

3.2.6 After Deliberations, NCT approved the revised scope of Transmission system for evacuation of power from Rajasthan REZ Ph-V (Part-1: 4 GW) [Sirohi/Nagaur] Complex as follows:

Sl. No.	**Original scope of the transmission scheme**	**Revised scope of the transmission scheme**
1. Transmission system for immediate Evacuation of Power from Sirohi S/s (2 GW)		
1	5x500 MVA, 400/220 kV ICTs at Sirohi S/s along with transformer bays • 400/220 kV 500 MVA ICTs- 5 Nos. • 400 kV ICT bays-5 Nos. • 220 kV ICT bays- 5 Nos.	**4x500 MVA, 400/220 kV ICTs at Sirohi S/s along with transformer bays** • **400/220 kV 500 MVA ICTs- 4 Nos.** • **400 kV ICT bays-4 Nos.** • **220 kV ICT bays- 4 Nos.**
2	6 Nos. 220 kV line bays at Sirohi S/s	**5 Nos. 220 kV line bays at Sirohi S/s**

Sl. No.	Original scope of the transmission scheme	Revised scope of the transmission scheme
	for RE interconnection • 220 kV line bays – 6 Nos.	**for RE interconnection** • **220 kV line bays – 5 Nos.**
3	220 kV Sectionalizer bay (1 set) along with 220 kV BC (2 Nos.) bay and 220 kV TBC (2 Nos.) bay at Sirohi S/s	• 220 kV Sectionalizer bay (1 set) • 220 kV BC (2 Nos.) bay and 220 kV TBC (2 Nos.) bay
4	-	**1 No. 400 kV line bays at Sirohi S/s for RE interconnection** • **400 kV line bay – 1 No.**
	Note: There will be no change in other elements of the transmission scheme w.r.t agreed in the 21st NCT meeting/ MoP Gazette dated 29.08.2024.	

3.3 **Bid process for selection of Bidder as Transmission Service Provider (TSP) to establish "Augmentation of transformation capacity at Bhuj-II PS (GIS)" and "Transmission system strengthening to facilitate evacuation of power from Bhadla/Bikaner complex"**

3.3.1 The transmission scheme "Augmentation of transformation capacity at Bhuj-II PS (GIS)" was agreed in the 16th meeting of National Committee on Transmission held on 30.11.2023 under TBCB route with estimated cost of Rs. 428 crores and implementation timeframe of 21 months. Gazette was notified on 23.01.2024 with PFCCL as BPC. The RFP for the transmission scheme was issued on March 29, 2024. RFP bid submission originally scheduled on May 31, 2024 had been extended to August 20, 2024 on request from the bidders. Out of the two bidders who purchased the RFP documents for the subject transmission scheme, only one bidder i.e. Power Grid Corporation of India Limited submitted the bid on August 20, 2024. The bid was again extended and on August 27, 2024 also only one bidder i.e. Power Grid Corporation of India Limited submitted the bid. As there was only one bid, PFCCL vide letter dated 04.09.2024 sought the guidance from MoP on the matter. MoP vide letter dated 09.10.2024 referred the matter to National Committee on Transmission (NCT) for deliberation in the next NCT meeting and submit the recommendations to the Ministry.

3.3.2 Another transmission scheme "Transmission system strengthening to facilitate evacuation of power from Bhadla/Bikaner complex)" was approved in the 19th meeting of National Committee on Transmission held on 29.04.2024 under TBCB route with estimated cost of Rs. 198.75 crores and implementation timeframe of 18 months. Gazette was notified on 18.06.2024 with PFCCL as BPC. The RfP for the subject transmission scheme was issued on August 01, 2024. RFP bid submission was originally scheduled on October 04, 2024. RfP documents for the subject transmission scheme have been purchased by only one bidder, i.e. Power Grid Corporation of India Limited. Accordingly, bid submission for the project has already been extended three

(03) times and latest date of bid submission is 25th October, 2024. Subsequently, no bid has been received on the due date.

3.3.3 CTU stated that above strengthening schemes are getting delayed due to above bid issues.

3.3.4 As per clause 9.6 of "Tariff based Competitive-bidding Guidelines for Transmission Service" issued by Ministry of Power (MoP) on August 10, 2021, there have to be minimum two qualified bidders for conducting the bid process.

3.3.5 It was mentioned that in case of single bid is received, clarity is not available in TBCB Guidelines. Members opined that to save time of rebidding, certain provisions need to be worked out. It was discussed that whether the project can be awarded in case of single bid if the cost discovered is of the level of estimated tariff.

3.3.6 After deliberations, following was agreed:

A. For the project costing less than Rs. 500 crore

a) In case, no bid or single bid is received, the BPC may extend the bid process for 7 more days. After the extended period, the BPC may open the bid. If single bid is received, steps given in subsequent paragraphs need to be followed.

b) Based on estimated cost by the Cost Committee constituted by CEA and the norms provided in CERC tariff regulations, the levelised tariff for the project shall be calculated by the BPC.

c) If the quoted transmission charges by the bidder are lower than levelised tariff estimated by the BPC, the bidder may be declared as successful bidder and Letter of Intent (LoI) may be issued.

d) In case, the quoted transmission charges by the bidder are higher than the estimated levelised tariff by the BPC, the bidding process may be annulled and matter may be referred by the BPC to the Government. The Government may give exemption to the transmission project from competitive bidding and allocate the same under Regulated Tariff Mechanism (Section-62 of the Electricity Act, 2003).

e) If no bids are received, even after extension, the bidding process may be annulled by BPC and the matter may be referred by the BPC to the Government. The Government may give exemption to the transmission project from competitive bidding and allocate the same under Regulated Tariff Mechanism (Section-62 of the Electricity Act, 2003).

B. For the project with estimated cost of more than Rs. 500 crore, if only one bid is received, BPC may not open the bid and refer the matter to the Government. In case no bids are received, the bid process would be annulled and the matter shall be referred to the Government.

C. For making the enabling provisions, “Tariff based Competitive-bidding Guidelines for Transmission Service-2021” needs to be modified.

3.4 Change in the implementation timeframe of Transmission System for evacuation of RE power from Raghanesda area of Gujarat – 3 GW under Phase-I

3.4.1 Representative from CTUIL stated that Transmission System for evacuation of RE power from Raghanesda area of Gujarat – 3 GW under Phase-I was recommended in the 20th NCT meeting held on 25.06.2024 under TBCB route with PFCCL as BPC and implementation time frame of 30 months from SPV transfer. Applications for cumulative 3050 MW linked with Ph-I 3 GW scheme have been received at Raghanesda S/s, out of 3050 MW applications, start date of connectivity required for 4 nos. of applications (connectivity quantum of 1150 MW) is from Dec'26 (JSW Neo Energy Limited: 400 MW & ACME: 400 MW) to Mar'27 (Sunsure Solarpark RJ One Pvt. Ltd.: 350 MW).

3.4.2 CTUIL proposed to change the implementation timeframe of the subject scheme from 30 months from SPV transfer to 24 months from SPV transfer so that the substation can come up earlier matching with requirement of above RE developers.

3.4.3 Representative of PFCCL informed that the RfP was issued on 14.09.2024 while the bid submission date is 19.11.2024.

3.4.4 After deliberations, it was decided that the implementation timeline of Transmission System for evacuation of RE power from Raghanesda area of Gujarat – 3 GW under Phase-I may be kept as 30 months and need not be changed.

4 New Transmission Schemes:

4.1 Eastern Region Expansion Scheme-44 (ERES-44)

4.1.1 Representative of CTUIL stated that several 220 kV transmission lines and substations were implemented in Indian grid along with cross border lines for importing power from Chukha Hydro Electric Plant in Bhutan. The generating station was commissioned in years 1986-88 and the transmission system is now more than 35 years old. Considering the age of conductors and increase in conductor snapping incidences, reconductoring of these transmission lines has become necessary. The matter was also deliberated in ERPC forum.

4.1.2 As the system involved cross border links also, a meeting was convened by CEA under the chairpersonship of Member (Power System) on 27-08-2024, wherein it was decided that matter of reconductoring of cross border lines will be separately taken up with Bhutan. However, reconductoring of ISTS portion of 220 kV corridor viz. Alipurduar (POWERGRID) – Falakata (WBSETCL) – Birpara (POWERGRID) – Binaguri (POWERGRID) – Siliguri (POWERGRID) – Kishanganj (POWERGRID) – Dalkhola (POWERGRID) – Gazole (WBSETCL) – Malda (POWERGRID), may be taken up under ISTS. Further, reconductoring of intra-state LILO portion of Birpara (POWERGRID) – Alipurduar (POWERGRID) 220 kV D/c line at Falakata (WBSETCL) and Dalkhola – Malda 220 kV D/c line at Gazol (WBSETCL) shall be carried out by WBSETCL matching with HTLS conductor of the main ISTS line in the matching timframe.

4.1.3 Director (SO), Grid-India stated that it is necessary that the intra-state portion of lines (under the jurisdiction of WBSETCL) is also re-conductored in the matching time-frame of that of the ISTS portion. Without the reconductoring of the intra-state portion, the benefits of reconductoring of the ISTS part cannot be realized. He further suggested that as intra-state portion is quite less compared to the inter-state portion, the intra-state part may also be re-conductored under ISTS at the cost of WBSETCL in matching timeframe.

4.1.4 It was suggested that reconductoring of Intra state portion of WBSETCL by an ISTS licensee may lead to commercial complications, therefore, reconductoring of intra state LILO portion may be carried out by the owner of the asset i.e. WBSETCL in matching timeframe.

4.1.5 After deliberations, NCT approved Transmission scheme "Eastern Region Expansion Scheme-44 (ERES-44))" as mentioned below:

4.1.5.1 Summary of the scheme is given below:

Sl. No.	**Name of the scheme and tentative implementation timeframe**	**Estimated Cost (₹ Cr)**	**Remarks**
1.	Eastern Region Expansion Scheme-44 (ERES-44) Tentative implementation timeframe: 18 months (15 months on best effort basis) from the date of allocation of project	385.77	Approved under RTM through POWERGRID

4.1.5.2 Detailed scope of the scheme is given below:

Sl. No.	**Scope of the Transmission Scheme**	**Capacity (MVA) / Circuit km (ckm) / Nos.**
(i)	Reconductoring of ISTS portion of Alipurduar (POWERGRID) – Falakata (WBSETCL) 220 kV D/c line with HTLS conductor of ampacity 1250 A	54 ckm
(ii)	Reconductoring of ISTS portion of Falakata (WBSETCL) – Birpara (POWERGRID) 220 kV D/c line with HTLS conductor of ampacity 1250 A	54 ckm
(iii)	Reconductoring of Birpara (POWERGRID) – Binaguri (POWERGRID) 220 kV D/c line with HTLS conductor of ampacity 1250 A	160 ckm
(iv)	Reconductoring of Binaguri (POWERGRID) – Siliguri (POWERGRID) 220 kV D/c line with HTLS conductor of ampacity 1250 A	12 ckm
(v)	Reconductoring of Siliguri (POWERGRID) – Kishanganj (POWERGRID) 220 kV D/c line with HTLS conductor of ampacity 1250 A	216 ckm
(vi)	Reconductoring of Kishanganj (POWERGRID) – Dalkhola (POWERGRID) 220 kV D/c line with HTLS conductor of ampacity 1250 A	62 ckm
(vii)	Reconductoring of ISTS portion of Dalkhola (POWERGRID) – Gazole (WBSETCL) 220 kV D/c line with HTLS conductor of ampacity 1250 A	195 ckm
(viii)	Reconductoring of ISTS portion of Gazole (WBSETCL) –	33 ckm

Sl. No.	Scope of the Transmission Scheme	Capacity (MVA) / Circuit km (ckm) / Nos.
	Malda (POWERGRID) 220 kV D/c line with HTLS conductor of ampacity 1250 A	
(ix)	Upgradation of associated 220 kV bay equipment at Alipurduar (POWERGRID)	Replacement of Wave Traps of Alipurduar (POWERGRID) – Falakata (WBSETCL) 220 kV D/c line commensurate with rating of HTLS.
(x)	Upgradation of associated 220 kV bay equipment at Birpara (POWERGRID)	Replacement of Wave Traps of Falakata (WBSETCL) – Birpara (POWERGRID) and Birpara (POWERGRID) – Binaguri (POWERGRID) 220 kV D/c lines commensurate with rating of HTLS.
(xi)	Upgradation of associated 220 kV bay equipment at Binaguri (POWERGRID)	Replacement of Wave Traps of Birpara (POWERGRID) – Binaguri (POWERGRID) and Binaguri (POWERGRID) – Siliguri (POWERGRID) 220 kV D/c lines commensurate with rating of HTLS.
(xii)	Upgradation of associated 220 kV bay equipment at Siliguri (POWERGRID)	Replacement of Wave Traps of Binaguri (POWERGRID) – Siliguri (POWERGRID) and Siliguri (POWERGRID) – Kishanganj (POWERGRID) 220 kV D/c lines commensurate with rating of HTLS.
(xiii)	Upgradation of associated 220 kV bay equipment at Dalkhola (POWERGRID)	Replacement of Wave Traps of Kishanganj (POWERGRID) – Dalkhola (POWERGRID) and Dalkhola (POWERGRID) – Gazole (WBSETCL) 220 kV D/c lines commensurate with rating of HTLS.
(xiv)	Upgradation of associated 220 kV bay equipment at Malda (POWERGRID)	Replacement of Wave Traps of Gazole (WBSETCL) – Malda

Sl. No.	Scope of the Transmission Scheme	Capacity (MVA) / Circuit km (ckm) / Nos.
		(POWERGRID) 220 kV D/c line commensurate with rating of HTLS.
(xv)	Supply and installation of OPGW along with terminal equipment at both ends of Siliguri (POWERGRID) – Kishanganj (POWERGRID) 220 kV D/c (HTLS) line	108 km

Note:

(a) WBSETCL shall reconductor their following lines sections under intra-state scheme matching with completion of ISTS scheme namely ERES-44:

- *About 4 km intra-state portion of Alipurduar (POWERGRID) – Falakata (WBSETCL) 220 kV D/c line at Falakata end with HTLS conductor of ampacity 1250 A along with necessary upgradation of associated 220 kV bay equipment at Falakata (WBSETCL) end commensurate with rating of HTLS (1250 A).*
- *About 4 km intra-state portion of Birpara (POWERGRID) – Falakata (WBSETCL) 220 kV D/c line at Falakata end with HTLS conductor of ampacity 1250 A along with necessary upgradation of associated 220 kV bay equipment at Falakata (WBSETCL) end commensurate with rating of HTLS (1250 A).*
- *About 2 km intra-state portion of Dalkhola (POWERGRID) – Gazole (WBSETCL) 220 kV D/c line at Gazole end with HTLS conductor of ampacity 1250 A along with necessary upgradation of associated 220 kV bay equipment at Gazole (WBSETCL) end commensurate with rating of HTLS (1250 A).*
- *About 2km intra-state portion of Gazole (WBSETCL) – Malda (POWERGRID) 220 kV D/c line at Gazole end with HTLS conductor of ampacity 1250 A along with necessary upgradation of associated 220 kV bay equipment at Gazole (WBSETCL) end commensurate with rating of HTLS (1250 A).*

(b) WBSETCL will LILO the Dhalkola – Gazole 220 kV D/c line with 1250 A HTLS under their intra-state scheme for establishment of 220 kV level at their existing 132/33kV Raiganj (WBSETCL) S/s.

(c) ISTS licensee and WBSETCL shall coordinate for reconductoring of their respective portion of the lines matching with completion schedule of this scheme.

4.2 Transmission system for Evacuation of Power from RE Projects in Rajgarh (1500 MW) SEZ in Madhya Pradesh-Phase III

4.2.1 Representative of CTUIL stated that 2.5 GW REZ potential has been identified at Rajgarh (MP).

i. Phase-I of 1.5 GW involves establishment of Pachora PS with 3x500 MVA 400/220 kV ICTs and Pachora PS – Bhopal 400 kV D/c line which has been implementation by M/s G R Infraprojects Ltd. (Commissioned).

ii. Phase-II (1 GW) involves ICT augmentation (4th, 5th & 6th) Pachora PS along with Pachora PS – Ujjan (MPPTCL) 400 kV D/c line which is presently under implementation by M/s G R Infraprojects Ltd. with SCOD of 14.02.2026.

4.2.2 He further stated that in view of applications received for cumulative capacity of ~4000 MW at Pachora PS till July-2024, it was found prudent to expand the substations to its full capacity so as to accommodate applications being received

beyond 2.5 GW at Pachora PS. Out of 1508 MW applications received for Rajgarh Ph-III system, RE projects for 1321 MW have been agreed for grant with start date of March 2027. For additional 187 MW applications received in July 2024 are under process and shall also be granted with start date of March 2027.

4.2.3 To evacuate the power from these areas, CTUIL proposed a transmission scheme broadly consisting of augmentation at Pachora PS and Pachora PS – Rajgarh(PG) 400 kV D/c line. CTUIL also mentioned that with the augmentation at Pachora PS, the substation will be closed for further connectivity.

4.2.4 After deliberations, NCT recommended the transmission scheme "Transmission system for Evacuation of Power from RE Projects in Rajgarh (1500 MW) SEZ in Madhya Pradesh-Phase III" to enable evacuation of upto 4000 MW Power from RE Projects in Rajgarh (i.e. 1500 MW beyond 2500 MW) SEZ in Madhya Pradesh as mentioned below:

4.2.4.1 Summary of the scheme is given below:

Sl. No.	Name of the scheme and tentative implementation timeframe	Estimated Cost (₹ Cr)	Remarks
1.	Transmission system for Evacuation of Power from RE Projects in Rajgarh (1500 MW) SEZ in Madhya Pradesh-Phase III **Tentative implementation timeframe**: Implementation timeframe of elements at Sl. No. 1, 2a, 3 & 4 shall be 24 months from date of SPV Transfer & for element at Sl. No. 2b shall be 31.03.2028 in matching timeframe of RE generator (Purvah Green Power Pvt. Ltd.: 297 MW)	1079	Recommended under TBCB route with RECPDCL as BPC

4.2.4.2 Detailed scope of the scheme is given below:

Sl. No.	Scope of the Transmission Scheme	Capacity
1.	Creation of New 220 kV Bus Section (3rd) with 220 kV Bus Sectionaliser and 400/220 kV, 3x500 MVA ICT augmentation (7th, 8th & 9th) at Pachora PS terminated on 220 kV Bus Section (3rd)	500 MVA 400/220 kV ICT – 3 Nos. 400 kV ICT bay – 3 Nos. (on Section-II) 220 kV ICT bay – 3 Nos. (on Section-III) 220 kV Bus Sectionaliser bays – 1 set 220 kV BC & TBC – 1 Nos. each
2.	**2a**. 3 Nos. 220 kV line bays for RE interconnection on Bus Section (3rd)	3 Nos. on Sec-III
	2b. 1 Nos. 220 kV line bay for RE Interconnection of Purvah Green Power Pvt. Ltd. on Bus Section (3rd)	1 No. on Sec-III
3.	Pachora PS – Rajgarh(PG) 400 kV D/c line (Quad ACSR/ AAAC/ AL59 Moose equivalent) along with associated line bays at both ends and 50 MVAr Switchable Line Reactors (Sw LR) on each ckt at both ends	Line length: 180 km. 400 kV line bays: 4 Nos. (2 at Rajgarh(PG) & 2 at Pachora PS) 420 kV, Switchable Line Reactors (Sw LRs): 4 Nos. (2 at Rajgarh(PG) & 2 at Pachora PS) Switching equipment for 400 kV line reactor – 4 Nos. (2 at Rajgarh(PG) & 2 at Pachora PS)
4.	Installation of 1x125 MVAR, 420 kV bus	125 MVAr, 420 kV Bus reactor – 1 Nos.

Sl. No.	Scope of the Transmission Scheme	Capacity
	reactor at Pachora PS (400 kV Bus Section-II)	400 kV Bus reactor bay: 1 Nos.

4.3 Transmission system for Evacuation of Power from RE Projects in Neemuch (1000 MW) SEZ in Madhya Pradesh-Phase II

4.3.1 Representative of CTUIL stated that applications for cumulative capacity of 1970 MW has been received at Neemuch PS till July 24, it was found prudent to expand the substations to its full capacity so as to accommodate applications being received beyond 1 GW at Pachora PS. CTUIL proposed transmission scheme consisting of augmentation a Neemuch PS, creation of 400/220 kV Handiya substation, Neemuch PS – Pachora PS 400 kV D/c line, Pachora PS – Handiya 400 kV D/c line and LILO of Khandwa(PG) – Itarsi(PG) 400 kV D/c (Twin Moose) line at Handiya S/s etc. CTUIL also mentioned that with the augmentation at Neemuch PS, the substation will be closed for further connectivity.

4.3.2 After deliberations, NCT recommended the scheme "Transmission system for Evacuation of Power from RE Projects in Neemuch (1000 MW) SEZ in Madhya Pradesh-Phase II" to enable Evacuation of upto 2000 MW Power from RE Projects in Neemuch (i.e. 1000 MW beyond 1000 MW) SEZ in Madhya Pradesh as mentioned below:

4.3.2.1 Summary of the scheme is given below:

Sl. No.	Name of the scheme and tentative implementation timeframe	Estimated Cost (₹ Crore)	Remarks
1.	Transmission system for Evacuation of Power from RE Projects in Neemuch (1000 MW) SEZ in Madhya Pradesh-Phase II Implementation timeframe: 24 months from date of SPV transfer	2393	Recommended under TBCB route with PFCCL as BPC

4.3.2.2 Detailed scope of the scheme is given below:

Sl.No.	Scope of the Transmission Scheme	Capacity
1.	Creation of New 220 kV Bus Section-II at Neemuch PS with Augmentation of transformation capacity by 3x500 MVA, 400/220 kV ICTs (3rd, 4th & 5th) at Neemuch S/s along with associated bays.	500 MVA 400/220 kV ICT – 3 Nos. 400 kV ICT bay – 3 Nos. 220 kV ICT bay – 3 Nos. (on Sec-II) 220 kV Bus Sectionaliser bays – 1 set 220 kV BC & TBC – 1 Nos. each
2.	4 Nos. 220 kV Line bays at Neemuch PS for RE interconnection	220 kV Bays – 4 Nos. on Sec-II
3.	Neemuch PS – Pachora PS 400 kV D/c line (Quad ACSR/ AAAC/ AL59 Moose equivalent) along associated Line bays and 50 MVAr Switchable Line Reactor (Sw LR) on each ckt at both ends	Line length: 190km. 400 kV Line bays: 4 Nos. (2 at Neemuch PS & 2 at Pachora PS) 420 kV, Switchable Line Reactors (Sw LRs): 4 Nos. (2 at Neemuch PS & 2 at Pachora PS) Switching equipment for 400 kV

		line reactor – 4 Nos. (2 at Neemuch PS & 2 at Pachora PS)
4.	Establishment of 2x500 MVA, 400/220 kV S/s at Handiya alongwith 2x125 MVAr 420 kV Bus Reactors **Future provision (space for):** ➢ 400 kV line bays along with switchable line reactors– 6 Nos. (Sec-II) ➢ 400/220 kV ICT along with bays - 4 Nos. (1 Nos. on Sec-I & 3 Nos. on Sec-II) ➢ 400 kV Bus Reactor along with bays: 2 Nos. (Sec-II) ➢ 220 kV line bays: 8 Nos. (on Sec-II) ➢ 400 kV Sectionalization bay: 1 set ➢ 220 kV Sectionalization bay: 1 set ➢ 220 kV TBC & BC: 1 Nos.	400/220 kV ICTs: 2 Nos. 400 kV ICT Bays: 2 Nos. 220 kV ICT Bays: 2 Nos. 400 kV Line bays: 6 Nos. 220 kV line bays for MPPTCL – 8 Nos. 125 MVAr, 420 kV Bus reactor – 2 Nos. 400 kV Bus reactor bay: 2 Nos. 220 kV TBC bay – 1 Nos. 220 kV BC bay – 1 Nos.
5.	Pachora PS – Handiya 400 kV D/c line (Quad ACSR/ AAAC/ AL59 Moose equivalent) along with associated bays at Pachora PS end and 50 MVAr Switchable Line Reactor (Sw LR) on each ckt at both *ends*	Line length: 190 km. 400 kV bays: 2 Nos. (at Pachora PS) 420 kV, Sw LRs: 4 Nos. (2 at Handiya & 2 at Pachora PS) Switching equipment for 400 kV line reactor – 4 Nos. (2 at Handiya & 2 at Pachora PS)
6.	LILO of Khandwa(PG) – Itarsi(PG) 400 kV D/c (Twin Moose) line at Handiya S/s	LILO route length : 22 km (88 ckm) The Khandwa(PG) – Itarsi(PG) 400 kV D/c line is of Twin Moose configuration and LILO shall be of similar conductor configuration
7.	Installation of 1x125 MVAR, 420 kV bus reactor (2nd) at Neemuch PS	125 MVAr, 420 kV Bus reactor – 1 Nos. 400 kV Bus reactor bay: 1 Nos.
Note: TSP of Neemuch & Pachora PS shall provide space for above scope of work		

4.4 North Eastern Region Expansion Scheme-XXI Part-B (NERES-XXI Part-B)

4.4.1 Representative from CTUIL stated that the existing 132 kV Badarpur (POWERGRID) switching station was commissioned in 1999 and shall be completing 25 years in service by 2024. POWERGRID the owner of the substation has informed that they are facing issues in O&M of the switching station and to improve the reliability it would be prudent to upgrade the switching station from single main and transfer bus scheme to double main transfer bus scheme by converting from Air Insulated Switchgear (AIS) to Gas Insulated Switchgear (GIS).

4.4.2 Further, towards adoption of new technology in the Indian Grid, it was proposed that the upgradation could be carried out as Green GIS instead of conventional GIS owing to the following benefits:

- Green GIS is a new technology in which Sulfur Hexafluoride (SF_6) gas is not used and this technology is being adopted by several countries in the world.
- This would help in the reduction of usage of Green House Gas and would be a step towards achieving sustainable development targets.

4.4.3 The scheme was taken up for deliberations in the 15th meeting of NCT held on 25-08-2023, wherein it was decided to review the scheme subsequently. The scheme was thereafter discussed in the 16th meeting of NCT held on 30-11-2023, it was decided to defer the scheme at present and take it up after additional discussions on new technology such as major benefits of Green GIS, availability of Green GIS vendors in India, additional cost implication (conventional GIS vis-à-vis Green GIS) etc.

4.4.4 Director (SO), Grid-India suggested that instead of going for green GIS for complete station, some portion of the station (limited number of bays) may be considered for green GIS. Also, stations in other regions where green GIS might be more suitable due to environmental conditions may also be considered as potential candidates for green GIS.

4.4.5 After deliberations, it was decided that a committee with members from CEA, CTUIL and POWERGRID to be constituted to survey the green GIS literature, technical aspects, undertake visit of the substation, exploring possible solutions etc. The committee shall submit its recommendations within 06 months.

4.5 Upgradation of ±800 kV, 6000 MW Raigarh-Pugalur HVDC system for enhancement of reverse power capacity upto 6000 MW from existing 3000 MW

4.5.1 Raigarh-Pugalur ± 800 kV, 6000 MW HVDC system is capable of transferring 6000 MW of power from Raigarh to Pugalur. However, its reverse power capacity i.e. Pugalur to Raigarh is 3000 MW.

4.5.2 Representative of CTUIL stated that enhancement of reverse power capacity upto 6000 MW from existing 3000 MW has been approved in 52nd SPRC meeting held on 03.08.2024 at an indicative cost of Rs 1000 Cr (including cost of system studies) and required AC system strengthening at Pugalur (estimated cost of Rs 400 crores) & Raigarh (estimated cost of Rs 1800 Crores)

4.5.3 Further, SRPC vide letter dated 02.09.2024 recommended CTUIL to take up the matter to NCT at the earliest.

4.5.4 Director (SO), Grid-India stated that until the adequate AC system is available on both ends, the HVDC capacity of 6000 MW in reverse direction can’t be utilized even after the proposed HVDC upgradation.

4.5.5 CTU stated that as confirmed by POWERGRID vide e-mail dated 10.10.2024, there is no space available at both Raigarh (Kotra) and Dharamjaygarh S/s for augmentation of AC system to enable reverse power flow on Raigarh- Pugalur HVDC beyond 3000 MW. AC System augmentation at Raigarh (Kotra) S/s in WR is not possible and if at all reverse flow of more than 3000 MW is required with N-1 compliance, it would require an elaborate exercise of shifting certain Thermal generating stations from Raigarh (Kotra) S/s to a new substation which would be cumbersome and shall entail significant costs as well as consent from thermal generating stations which are already connected at Raigarh (Kotra) S/s. Further, it was also informed that with the reversal

of HVDC from 3000 MW to 6000 MW, no enhancement in TTC/ATC between SR-NEW Grid is expected looking into the very less sensitivity of the HVDC in TTC/ATC. .

4.5.6 After deliberations, it was decided that a committee will be formed comprising members from CEA, CTUIL, POWERGRID, Grid-India, SRPC and WRPC. The committee shall carry out comprehensive study and propose comprehensive plan including AC system strengthening in Southern Region and Western Region along with the total scheme cost. The comprehensive plan may again be put up to SRPC before bringing it to NCT.

4.6 **Augmentation of transformation capacity at KPS3 (GIS) S/s under Khavda Phase-V Part B3 scheme**

4.6.1 Representative from CTUIL stated that KPS3 S/s with 3x1500 MVA ICTs on Section-I is under implementation by M/s KPS3 Transmission Ltd. (Subsidiary of POWERGRID). 1x1500 MVA Addl. ICT at Section-I is also being implemented by M/s POWERGRID (under RTM) under Khavda Ph-IV Part E3 scheme. Further, Section-II of KPS3 is being established by M/s Khavda IV A Power Transmission Ltd. (Subsidiary of Adani Energy Solutions Ltd.) with SCOD of Aug-26 with 3x1500 MVA ICTs and 3 Nos. 400 kV bays at Bus Section-II for RE interconnection. Out of above bays, 2 bays had been allocated to M/s SRPL (1250 MW) & NHPC (600 MW).

4.6.2 Applications for cumulative 3290 MW have been received at KPS3 (Sec-II) which require 3 Nos. 400 kV bays. 1 No. 400 kV bay is already being implemented under Khavda Phase-IV Part A scheme. Balance 2 nos. 400 kV bays along with addl. 1x1500 MVA ICT at KPS3 (Sec-II) are required to be implemented after considering N-1 compliance of already planned 765/400 kV ICTs at KPS3 (Sec-II). The proposed 765/400 kV ICT & 400 kV bays would facilitate immediate injection of power at KPS3 (Section-II). CTUIL also informed that the substation will be closed for further applications.

4.6.3 NCT directed CTUIL to explore the possibility for Battery Energy Storage System (BESS) for optimizing transmission infrastructure at Khavda as well as other RE potential Zones. Consideration of Storage may facilitate integration of additional RE Capacity.

4.6.4 After deliberations, NCT approved the transmission scheme “Augmentation of transformation capacity at KPS3 (GIS) S/s under Khavda Phase-V Part B3 scheme” under RTM mode as follows

4.6.4.1 Summary of the scheme is given below:

Sl. No.	Name of the scheme and tentative implementation timeframe	Estimated Cost (₹ Crore)	Remarks
1.	Augmentation of transformation capacity at KPS3 (GIS) S/s under Khavda Phase-V Part B3 scheme	252	Approved under RTM through M/s Khavda IV A Power

	Implementation timeframe: 24 months from the date of allocation		Transmission Ltd. (Subsidiary of Adani Energy Solutions Ltd.) (i.e. TSP of KPS3 (Sec-II))

4.6.4.2 Detailed scope of the scheme is given below:

S.N.	Scope of the Transmission Scheme	Capacity
1.	Augmentation of transformation capacity at KPS3(GIS) by 1x1500 MVA, 765/400 kV ICT on Bus section-II (8th) along with 1 No. 400 kV line bay for termination of 1st ckt out of 400 kV D/c line being implemented by AGEL (Appl. No. 2200000953) for 1530 MW	• 765/400 kV ICT – 1 (1x1500 MVA) • 765 kV ICT bay – 1 (+1 no. bay for dia completion with Switchable Line Reactor (SLR) provision in future bay) on Bus section-II • 400 kV ICT bay – 1 (+ 1 no. bay for dia completion and termination of the proposed Line for RE interconnection) on Bus section-II
2.	1 Nos. 400 kV line bay on KPS3 400 kV Bus Section-II for termination of 2nd ckt out of 400 kV D/c line being implemented by AGEL (Appl. No. 2200000953) for 1530 MW	400 kV line bays – 1 no. (+ 1 no. bay for dia completion with the provision to terminate future 400/220 kV ICT)
Note: TSP of KPS3 (GIS) shall provide space for above scope of work.		

4.7 Supply and Installation of additional Fiber Optic Test Equipment (FOTE) and Ethernet cards at Automatic Generation Control (AGC) and Critical Nodes of SR Region.

4.7.1 Representative of CTUIL stated that as per CEA, Manual of Communication Planning in Power System Operation 2022, CTU for high availability requirements for Power System Communication, redundancy with route diversity for critical links shall be maintained. Additional FOTE and redundant Ethernet ports are required at all AGC operated generating stations, in view of resource disjoint and criticality of AGC operation for grid operation purpose.

4.7.2 After deliberations, NCT approved the communication scheme “Supply and Installation of additional FOTE and Ethernet cards at AGC & Critical Nodes of SR Region” under RTM mode as follows

4.7.2.1 Summary of the scheme is given below:

SI No.	Name of the scheme and tentative implementation timeframe	Estimated Cost (₹ Cr)	Remarks

1.	Supply and Installation of additional FOTE and Ethernet cards at AGC & Critical Nodes of SR Region Tentative implementation timeframe**:** 12 months from date of allocation of project	1.02	Approved under RTM through POWERGRID

4.7.2.2 Detailed scope of the scheme is given below:

(i) Supply and installation of 3 nos. FOTE with STM 16 capacity at following locations:

SI.No.	Station Name	No of FOTE	Remark
1.	Simhadri-1	1	For AGC purpose
2.	NP KUNTA	1	Shortage of ports
3.	NLC-TPS-2 Stage 1	1	For AGC purpose
Total		**3**	

(ii) Supply and installation of 10 Nos. ethernet cards at following locations:

SI.No.	Station Name	Ethernet Cards required
1	Ramagundam -I	2
2	Ramagundam -II	
3	Ramagundam -III	
4	NTPC Vallur	2
5	NTPL Tuticorin	1
6	NTPC Kudgi	2
7	NLC - TPS 2 Exp	1
8	NLC - TPS 1 Exp	1
9	NNTPS new Neyveli	1
Total		**10**

4.8 Requirement of Additional FOTE at various ISTS nodes in ER due to exhaustion of existing capacity

4.8.1 Representative of CTUIL stated that the transmission scheme “Requirement of Additional FOTE at various ISTS nodes in ER” with capacity utilisation of approximately 90% and above and few other important stations is required.

4.8.2 After deliberations, NCT approved the communication scheme “Requirement of Additional FOTE at various ISTS nodes in ER due to exhaustion of existing capacity” under RTM mode as follows

4.8.2.1 Summary of the scheme is given below:

SI No.	Name of the scheme and tentative implementation timeframe	Estimated Cost (₹ Cr)	Remarks

1.	Requirement of Additional FOTE at various ISTS nodes in ER due to exhaustion of existing capacity Tentative implementation timeframe**:** 12 months from date of allocation of project	9.78	Approved Under RTM through POWERGRID

4.8.2.2 Detailed scope of the scheme is given below:

a) Conversion of 13 nos. STM 16 FOTE to STM 64 FOTE
b) Conversion of 4 nos. STM 4 FOTE to STM 16 FOTE by utilizing four (4) Nos. FOTEs freed from upgradation of STM 16 FOTE to STM 64 FOTE

S. No.	**Node Name(with approx 90% capacity exhausted)**	**Upgradation/replacement required**	**Detail of Card/Equipment required for upgradation**	**Estimated Cost (Rs.)**
1	Kasba	STM 16 to STM 64	Existing Equipment Cannot be upgraded. New STM 64 SDH Equipment Required	74 Lakhs
2	ERLDC	STM 16 to STM 64		74 Lakhs
3	Jeerat	STM 16 to STM 64		74 Lakhs
4	Subhashgram	STM 16 to STM 64		74 Lakhs
5	Farakka	STM 16 to STM 64		74 Lakhs
6	Kahalgaon	STM 16 to STM 64		74 Lakhs
7	Saharsa	STM 16 to STM 64		74 Lakhs
8	Binaguri	STM 16 to STM 64		74 Lakhs
9	Purnea	STM 16 to STM 64		74 Lakhs
10	Kishenganj	STM 16 to STM 64		74 Lakhs
11	Sasaram	STM 16 to STM 64		74 Lakhs
12	AB380 Repeater	STM 16 to STM 64		74 Lakhs
13	Allahabad	STM 16 to STM 64		74 Lakhs
Total Cost for conversion of 13 nos. of STM 16 equipment to STM 64:A				**9.62 Cr**
14	Gaya	STM 4 to STM 16	Upgradation to be done by utilizing four Nos. of STM 16 equipment freed in above list after upgradation to STM 64.	4 Lakhs
15	Essar Chandwa	STM 4 to STM 16		4 Lakhs
16	Darbhanga(KPTL)	STM 4 to STM 16		4 Lakhs
17	Arrah	STM 4 to STM 16		4 Lakhs
Total Cost for conversion of 04 Nos. of STM 4 equipment to STM 16: B				**16 Lakhs**
Total Cost for conversion of 13 Nos. of STM 16 to STM 64 and 04 nos. of STM4 equipment to STM 16: A+B				**9.78 Cr**

4.9 Deployment of FOTE (SDH Equipment) and amplifier solutions at Alipurduar S/s end for OPGW based communication and Teleprotection for 400 kV lines from Punatsangchhu-II Hydroelectric Project (PHEP-II), Punatsangchhu-I Hydroelectric Project (PHEP-I) and Jigmeling of Bhutan to Alipurduar, India

4.9.1 Representative of CTUIL stated that to ensure the accurate coordination of devices between SDH at one end i.e Alipurduar, India and MPLS-TP at other end i.e., Punatsangchhu-II, as well as to cater to cybersecurity issue of the Indian Grid, the proposed scheme for Alipurdwar S/s end needs to be implemented.

4.9.2 After deliberations, NCT approved the communication scheme "Deployment of FOTE (SDH Equipment) and amplifier solutions at Alipurduar S/s end for OPGW based communication and Teleprotection for 400kV lines from PHEP-II, PHEP-I and Jigmeling of Bhutan to Alipurduar, India" under RTM mode as follows

4.9.2.1 Summary of the scheme is given below:

SI No.	Name of the scheme and tentative implementation timeframe	Estimated Cost	Remarks
1.	Deployment of FOTE (SDH Equipment) and amplifier solutions at Alipurduar S/s end for OPGW based communication and teleprotection for 400kV lines from PHEP-II, PHEP-I and Jigmeling of Bhutan to Alipurduar, India Tentative implementation timeframe**:** 6 months from date of allocation	₹ 65 lakhs	Approved Under RTM through POWERGRID

4.9.2.2 Detailed scope of the scheme is given below:

a) One (1) set of STM-4 SDH equipment along with panel supporting minimum five directions with MSP (Multiplex Section Protection 1+1) & equipped with E1 and Ethernet interfaces.
b) Six (6) sets of 175 km Amplifiers solutions: 2 directed towards Punatsangchhu-II (PHEP-II), 2 directed towards Punatsangchhu-I (PHEP-I) and 2 directed towards Jigmeling.

Note: POWERGRID to coordinate with Bhutan ends while procuring the equipment to avoid any non-compatibility issues

5 Grid-India Presentation on Performance of the National Grid in Q1 and Q2 of FY 2024-25

5.1.1 Representative of Grid-India made a presentation on performance of the National Grid in Q1 and Q2 of FY 2024-25. Copy of presentation is attached at Annex-II. Major points highlighted during the presentation are given in subsequent paragraphs.

5.1.2 **Large number of generation loss events in NR RE Complex:** NLDC representative informed that there have been more than 55 events between January 2022 and September 2024 involving RE generation loss of more than 1000 MW. Around 13 such generation loss events (>500 MW) have occurred between April – September 2024.

One of the major reasons for these grid events has been the non-compliance of the RE plants against CEA's standards. The details of the non-compliance and measures being taken by Grid-India to address the issues were explained by NLDC representative in the meeting.

5.1.3 **Oscillations in NR RE complex and issues with performance of STATCOMs:** NLDC representative informed that low frequency oscillations (3-4 Hz) are being observed in NR RE complex on a regular basis. The oscillations start during morning hours with increase in solar generation and are mainly observed in voltage and reactive power. The non-standardization of PPC delays is one of the potential reasons for these oscillations.

He further informed that currently 05 Nos. STATCOMs are operational in NR RE complex. These STATCOMs have been installed to provide the fast dynamic reactive power support to the grid during any contingency. The response time of the installed STATCOMs shall be less than 30 ms as per their control manuals.
However, following observations in the performance of STATCOMs (as visible in DR as well as PMU plots) in NR RE complex has been observed:

- High response time (sluggish response) during faults leading to injection of reactive power post clearance of fault
- Automatic gain reduction by stability controller of the STATCOMs on hunting detection, possibly leading to enhancement in magnitude of oscillations

The problem of amplification of oscillations with reduction of STATCOM gain in voltage control mode has been analyzed with measurement (TFR) data and simulation results for a large data set. Detailed analysis in this regard was also shared with CEA, CTUIL, POWERGRID and OEM.

It is observed that oscillations damp out when the STATCOMs are being operated in Fixed 'Q' mode. This mode of operation, however, defeats the purpose of providing STATCOMs for fast dynamic reactive power support.

The performance issues being observed in the current STATCOMs necessitate proper tuning of the STATCOM controllers. Also, necessary modifications in the RfP of upcoming STATCOMs is required based on the current experience.

NCT directed that a committee may be constituted with members from CEA, CTUIL, Grid-India, Power Grid and all the STATCOM OEMs to deliberate the performance

related issues and the possible remedial measures. The matter to be coordinated by GM Division, CEA in consultation with PS Wing, CEA.

5.1.4 **17th June 2024 Load Loss Event in Northern Region and Reactive Power Planning for Bulk Loads (Electrolyzers and Data Centers):** Director (SO), Grid-India explained the 17th June 2024 grid event of simultaneous tripping of both bipoles of the +/-800 kV HVDC Champa (WR) – Kurukshetra (NR) link led to a substantial load reduction (~16.5 GW) in the northern region. The event started with the tripping of the aforementioned HVDC link and triggered a series of events starting from the sudden voltage drop across the stations in the Northern region and subsequent stalling and tripping of certain portion of load.

He further informed that the Ministry of Power constituted a Committee under the Chairmanship of Member (GO&D), CEA to analyze the event. The committee, in its suggestions, recommended the planning of suitable dynamic reactive power compensation near load centers.

He further stated that the event (especially the stalling of load) was replicated in simulation studies with proper load modelling. As the load behavior is changing, the existing philosophy for modelling of loads in the planning and operational studies need to be reviewed. Without proper load modelling in the studies, it would be difficult to capture such phenomenon in the studies. The standards for protection settings of loads, especially 1-ph and 3-ph motor loads, also needs to be reviewed.

Further, as a large quantum of electrolyzer and data center load is also envisaged to be connected at ISTS level in near future, it is important that adequate reactive power compensation is planned nearby such ISTS load feeding stations.

He suggested that the following activities may be taken up on priority:

- Study of load behavior and consideration of same in the simulation studies
- Planning of dynamic reactive power compensation at both inter-state and intra-state level near major load centers
- Review of the standards specifying standards for protection settings of loads, especially 1-ph and 3-ph motor loads
- Planning of suitable reactive power compensation at large ISTS stations being planned for feeding large electrolyzer and data center loads

Chairperson, CEA directed that the reactive power planning study at all the major load centers shall be taken up on priority. Grid India was advised to identify important BIS standards/committees in this regard and CEA/Stakeholders may take up with BIS.

He further directed that two separate committees comprising of members from CEA, CTUIL and Grid-India may be constituted for comprehensive study of performance, control strategy, reactive power requirements etc. of electrolyzer and data center loads respectively so that suitable reactive power compensation could be planned. The characteristics and load pattern/behaviour of electrolysers would be coordinated by ET&I Division, CEA and of data centres would be coordinated by PDM&LF Division, CEA.

5.1.5 **Evacuation of large quantum of RE under T-GNA:** NLDC representative informed that a large quantum of RE generation (~5700 MW) is being evacuated under T-GNA due to the delay in the commissioning of associated transmission system. There is possibility of certain RE curtailment if the commissioning of the associated transmission system is not expedited.

5.1.6 **Flexibility and Ramping Requirement:** NLDC representative informed that persistent high frequency was observed in the India's grid during solar hours on few days in the month of August 2024. The high RE generation and the limited flexibility to further reduce the thermal generation to accommodate the RE generation was one of the major factors for this high frequency operation. Further, as the thermal generating units are required during non-solar hours, these units cannot be taken out of service during the high frequency operation period.

Another challenge is being faced in meeting the ramping requirement during evening hours where the flexibility requirements have increased significantly due to the increasing demand ramp up coupled with the simultaneous decline in solar generation. There is an urgent requirement of fast ramping resources in the grid to meet the flexibility requirements in coming days.

5.1.7 **Constraints in Maharashtra system during high export from Southern Region:** Director (SO), Grid-India stated that the congestion is being faced in export of power from SR during high RE periods. To relieve the congestion, 765 kV Narendra – Pune D/C was planned with commissioning schedule of July 2024. However, the line is delayed and revised date of commissioning is December2024.

He further stated that even after commissioning of 765 kV Narendra – Pune D/C, constraints in western Maharashtra would still remain in export of power from SR. There is an urgent requirement for expediting the planned transmission system augmentation in western Maharashtra area.

Chairperson, CEA directed that the augmentation works in Maharashtra and other critical areas shall be monitored on priority.

Summary of the deliberations of the 24th meeting of NCT held on 23rd October, 2024

I. Modification in the earlier approved/notified transmission schemes:

1. Revision in SCOD of 400 kV D/C Jhatikara-Dwarka line under REZ Phase-III Part-D Phase-II scheme

NCT approved the revised SCOD for 400 kV D/C (quad) Jhatikara-Dwarka line under "Transmission system for evacuation of 20 GW REZ power from Rajasthan under phase-III, Part-D, Phase-II" scheme as 28th February, 2026 (31st December 2025 on best effort basis).

2. Change in scope of Transmission system for evacuation of power from Rajasthan REZ Ph-V (Part-1: 4 GW) [Sirohi/Nagaur] Complex

NCT approved the revised scope of Transmission system for evacuation of power from Rajasthan REZ Ph-V (Part-1: 4 GW) [Sirohi/Nagaur] Complex as follows:

Sl. No.	Original scope of the transmission scheme	Revised scope of the transmission scheme
1. Transmission system for immediate Evacuation of Power from Sirohi S/s (2 GW)		
1	5x500 MVA, 400/220 kV ICTs at Sirohi S/s along with transformer bays • 400/220 kV 500 MVA ICTs- 5 Nos. • 400 kV ICT bays-5 Nos. • 220 kV ICT bays- 5 Nos.	**4x500 MVA, 400/220 kV ICTs at Sirohi S/s along with transformer bays** • **400/220 kV 500 MVA ICTs- 4 Nos.** • **400 kV ICT bays-4 Nos.** • **220 kV ICT bays- 4 Nos.**
2	6 Nos. 220 kV line bays at Sirohi S/s for RE interconnection • 220 kV line bays – 6 Nos.	**5 Nos. 220 kV line bays at Sirohi S/s for RE interconnection** • **220 kV line bays – 5 Nos.**
3	220 kV Sectionalizer bay (1 set) along with 220 kV BC (2 Nos.) bay and 220 kV TBC (2 Nos.) bay at Sirohi S/s	• 220 kV Sectionalizer bay (1 set) • 220 kV BC (2 Nos.) bay and 220 kV TBC (2 Nos.) bay
4	-	**1 No. 400 kV line bays at Sirohi S/s for RE interconnection** • **400 kV line bay – 1 No.**
	Note: There will be no change in other elements of the transmission scheme w.r.t agreed in the 21st NCT meeting/ MoP Gazette dated 29.08.2024.	

II. ISTS Transmission schemes, costing between Rs 100 Crore to Rs 500 Crore, approved by NCT:

1. The transmission schemes approved by NCT under RTM route is given below:

Sl. No.	Name of Transmission Scheme	Implementation Mode	Implementation timeframe	Estimated Cost (₹ Cr)

1.	Eastern Region Expansion Scheme-44 (ERES-44)	RTM through POWERGRID	18 months (15 months on best effort basis) from the date of allocation	385.77
2.	Augmentation of transformation capacity at KPS3 (GIS) S/s under Khavda Phase-V Part B3 scheme	RTM through M/s Khavda IV A Power Transmission Ltd. (Subsidiary of Adani Energy Solutions Ltd.) (i.e. TSP of KPS3 (Sec-II))	24 months from the date of allocation	252

The broad scope of above schemes are given below

Sl. No.	**Name of Scheme & Tentative implementation timeframe**	**Broad Scope**
1.	Eastern Region Expansion Scheme-44 (ERES-44) **Implementation timeframe: 18 Months (15 months on best effort basis) from the date of allocation of project**	1. Reconductoring of ISTS portion of Alipurduar (POWERGRID) – Falakata (WBSETCL) 220 kV D/c line with HTLS conductor of ampacity 1250 A (54 ckm) 2. Reconductoring of ISTS portion of Falakata (WBSETCL) – Birpara (POWERGRID) 220 kV D/c line with HTLS conductor of ampacity 1250 A (54 Km.) 3. Reconductoring of Birpara (POWERGRID) – Binaguri (POWERGRID) 220 kV D/c line with HTLS conductor of ampacity 1250 A (160 ckm) 4. Reconductoring of Binaguri (POWERGRID) – Siliguri (POWERGRID) 220 kV D/c line with HTLS conductor of ampacity 1250 A (12 ckm) 5. Reconductoring of Siliguri (POWERGRID) – Kishanganj (POWERGRID) 220 kV D/c line with HTLS conductor of ampacity 1250 A. (216 ckm) 6. Reconductoring of Kishanganj (POWERGRID) – Dalkhola (POWERGRID) 220 kV D/c line with HTLS conductor of ampacity 1250 A (62 ckm) 7. Reconductoring of ISTS portion of Dalkhola (POWERGRID) – Gazole (WBSETCL) 220 kV D/c line with HTLS conductor of ampacity 1250 A (195 ckm) 8. Reconductoring of ISTS portion of Gazole (WBSETCL) – Malda (POWERGRID) 220 kV D/c line with HTLS conductor of ampacity 1250 A (33 ckm) 9. Upgradation of associated 220 kV bay equipment at

		Alipurduar (POWERGRID) 10. Upgradation of associated 220 kV bay equipment at Birpara (POWERGRID) 11. Upgradation of associated 220 kV bay equipment at Binaguri (POWERGRID) 12. Upgradation of associated 220 kV bay equipment at Siliguri (POWERGRID) 13. Upgradation of associated 220 kV bay equipment at Dalkhola (POWERGRID) 14. Upgradation of associated 220 kV bay equipment at Malda (POWERGRID) 15. Supply and installation of OPGW along with terminal equipment at both ends of Siliguri (POWERGRID) – Kishanganj (POWERGRID) 220 kV D/c (HTLS) line (108 km)
2.	Augmentation of transformation capacity at KPS3 (GIS) S/s under Khavda Phase-V Part B3 scheme **Implementation timeframe:** 24 months from the date of allocation	1. Augmentation of transformation capacity at KPS3(GIS) by 1x1500 MVA, 765/400 kV ICT on Bus section-II (8th) along with 1 Nos. 400 kV line bay for termination of 1st ckt out of 400 kV D/c line being implemented by AGEL (Appl. No. 2200000953) for 1530MW *2.* 1 No. 400kV line bay on KPS3 400 kV Bus Section-II for termination of 2nd ckt out of 400 kV D/c line being implemented by AGEL (Appl. No. 2200000953) for 1530 MW Note: TSP of KPS3 (GIS) shall provide space for above scope of work.

(Detailed scope as approved by 24th NCT and subsequent amendments thereof)

III. ISTS Transmission schemes, costing greater than ₹ 500 Crore, recommended by NCT to MoP:

The ISTS transmission schemes recommended by NCT to MoP are given below:

Sl. No.	Name of Transmission Scheme	Implementation Mode	Tentative Implementation timeframe	BPC	Estimated Cost (₹ Crs)
1.	Transmission system for Evacuation of Power from RE Projects in Rajgarh (1500 MW) SEZ in Madhya Pradesh-Phase III	TBCB	Implementation timeframe of elements at Sl. No. 1, 2a, 3 & 4 shall be 24 months from date of SPV transfer & for element at Sl. No. 2b shall be 31.03.2028 in	RECPDCL	1079

			matching timeframe of RE generator (Purvah Green Power Pvt. Ltd.: 297 MW)		
2.	Transmission system for Evacuation of Power from RE Projects in Neemuch (1000 MW) SEZ in Madhya Pradesh-Phase II	TBCB	24 months from date of SPV transfer	PFCCL	2393

The broad scope of the above ISTS schemes to be notified in Gazette of India is as given below:

Sl. No.	**Name of Scheme & Tentative implementation timeframe**	**Broad Scope**	**Bid Process Coordinator**
1.	Transmission system for Evacuation of Power from RE Projects in Rajgarh (1500 MW) SEZ in Madhya Pradesh-Phase III **Implementation timeframe:** Implementation timeframe of elements at Sl. No. 1, 2a, 3 & 4 shall be 24 months from date of SPV transfer & for element at Sl. No. 2b shall be 31.03.2028 in matching timeframe of RE generator (Purvah Green Power Pvt. Ltd.: 297 MW)	1. Creation of New 220 kV Bus Section (3rd) with 220 kV Bus Sectionaliser and 400/220 kV, 3x500 MVA ICT augmentation (7th, 8th & 9th) at Pachora PS terminated on 220 kV Bus Section (3rd) 2. **2(a)** 3 Nos. 220 kV line bays for RE Interconnection on Bus Section (3rd) **2(b)** 1 Nos. 220 kV line bay for RE Interconnection of Purvah Green Power Pvt. Ltd. on Bus Section (3rd) 3. Pachora PS – Rajgarh(PG) 400 kV D/c line (Quad ACSR/ AAAC/ AL59 Moose equivalent) along with associated line bays at both ends and 50 MVAr Switchable Line Reactors (Sw LR) on each ckt at both ends (180 Km) 4. Installation of 1x125 MVAR, 420 kV bus reactor at Pachora PS (400 kV Bus Section-II)	RECPDCL
2.	Transmission system for Evacuation of Power from RE Projects in Neemuch (1000 MW) SEZ in Madhya Pradesh-Phase II	1. Creation of New 220 kV Bus Section-II at Neemuch PS with Augmentation of transformation capacity by 3x500 MVA, 400/220 kV ICTs (3rd, 4th & 5th) at Neemuch S/s along with associated bays. 2. 4 Nos. 220 kV Line bays at Neemuch	PFCCL

	Implementation timeframe: 24 months from date of SPV transfer	PS for RE interconnection 3. Neemuch PS – Pachora PS 400 kV 400 kV D/c line (Quad ACSR/ AAAC/ AL59 Moose equivalent) along with associated line bays and 50 MVAr Switchable Line Reactors (Sw LR) on each ckt at both ends (190 km) 4. Establishment of 2x500 MVA, 400/220 kV S/s at Handiya with 2x125MVAr 420 kV Bus Reactors **Future provision (space for):** • *400 kV line bays along with switchable line reactors– 6 Nos. (Sec-II)* • *400/220 kV ICT along with bays - 4 Nos. (1 Nos. on Sec-I & 3 Nos. on Sec-II)* • *400 kV Bus Reactor along with bays: 2 Nos. (Sec-II)* • *220 kV line bays: 8 Nos. (on Sec-II)* • *400 kV Sectionalization bay: 1 set* • *220 kV Sectionalization bay: 1 set* • *220 kV TBC & BC: 1 Nos.* 5. Pachora PS – Handiya 400 kV 400 kV D/c line (Quad ACSR/ AAAC/ AL59 Moose equivalent) along with associated bays at Pachora PS end and 50 MVAr Switchable Line Reactors (Sw LR) on each ckt at both ends (190 km) 6. LILO of Khandwa(PG) – Itarsi(PG) 400 kV D/c (Twin Moose) line at Handiya S/s (22 km) 7. Installation of 1x125 MVAR, 420 kV bus reactor (2nd) at Neemuch PS *Note: TSP of Neemuch & Pachora PS shall provide space for above scope of work*	

(Detailed scope as approved by 24th NCT and subsequent amendments thereof)

IV. ISTS communication schemes approved by NCT:

Sl. No.	Name of Transmission Scheme	Implementation Mode	Implementation timeframe	Estimated Cost (₹)
1	Supply and Installation of additional FOTE and Ethernet cards at AGC & Critical Nodes of SR Region	RTM through POWERGRID	12 months from the date of allocation	1.02 Cr
2	Requirement of Additional FOTE at various ISTS nodes in ER due to exhaustion of existing capacity	RTM through POWERGRID	12 months from date of allocation	9.78 Cr
3	Deployment of FOTE (SDH Equipment) and amplifier solutions at Alipurduar S/s end for OPGW based communication and Teleprotection for 400 kV lines from PHEP-II, PHEP-I and Jigmeling of Bhutan to Alipurduar, India	RTM through POWERGRID	6 months from date of allocation	65 Lakhs

(Detailed scope as approved by 24th NCT and subsequent amendments thereof)

Annexure-I

List of participants of the 24th meeting of NCT

CEA:

1. Sh. Ghanshyam Prasad, Chairperson, CEA & Chairman, NCT
2. Sh. Ajay Talegaonkar, Member (E&C)
3. Sh. A.K. Rajput, Member (Power Systems)
4. Sh. Ishan Sharan, Chief Engineer (PSPA-I)
5. Sh. Y.K. Swarnkar, Chief Engineer (PSPM)
6. Sh. B.S. Bairwa, Chief Engineer (I/C) (PSPA-II)
7. Sh. Rahul Raj, Director (PSPA-II)
8. Sh. B.S. Meena, Director (PSPM)
9. Sh. Pranay Garg, Deputy Director (PSPA-II)
10. Sh. Manish Maurya, Deputy Director (PSPA-II)
11. Sh. Manish Kumar Verma, Assistant Director (PSPA-II)

MoP:

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

MNRE:

1. Sh. Himanshu Prabhakar, Under Secretary

SECI:

1. Sh. Vineet Kumar, DGM
2. Sh. R.K. Agarwal, Consultant

CTUIL:

1. Sh. P C Garg, COO
2. Sh. Ashok Pal, Deputy COO
3. Sh. K K Sarkar, Sr GM
4. Sh. P.S. Das, Sr GM
5. Sh. Rajesh Kumar, Sr GM
6. Sh. Anil Kumar Meena, GM
7. Sh. Kashish Bhambhani, GM
8. Sh. Bhaskar Wagh, DGM
9. Sh. Pratyush Singh, DGM
10. Sh. Venkatesh Gorli, Chief Manager
11. Sh. Anupam Kumar, Manager

GRID India:

1. Sh. Rajiv Porwal, Director (SO)
2. Sh. Rahul Shukla, Chief Manager
3. Sh. Priyam Jain, Chief Manager
4. Sh. Raj Kishan, Deputy Manager
5. Sh. Gaurab Dash, Deputy Manager

RECPDCL

1. Sh. Satyabhan Sahoo, GM (Tech)

PFCCL

1. Sh. Deepak Kumar, AM

Expert Member

1. Sh. Ravinder Gupta, Ex Chief Engineer, CEA

POWERGRID

1. Sh. Anand Shankar, CGM
2. Sh. Sanjeev Kr. Chaudhary, Sr. GM
3. Sh. YKPN Singh, GM

***

24th Meeting of National Committee on Transmission

Grid Performance – 1st & 2nd Quarter (2024-25)

23rd Oct 2024

Grid Controller of India Limited

formerly Power System Operation Corporation Ltd. (POSOCO)

National Load Despatch Center

CONTENTS

- **Overview of Grid Operation**
  - All India Maximum & Minimum Demand Met
  - All India Demand met, Energy consumption
  - Percentage growth in Demand Met & Energy Consumption
  - All India Demand Diversity Factor
  - Frequency profile
  - GD-GI Summary
- **Reliability issues experienced in NR RE Complexes**
  - RE Generation Loss Events and Performance of RE Plants
  - Oscillations observed in NR RE Complexes and issue in STATCOM performance
  - Evacuation of large quantum of RE under T-GNA
- **Major Grid Disturbances leading to transmission constraints**
  - NR load loss event – 17th June 2024
- **Major Constraints in Inter-regional Network**
  - Constraints in Inter-regional Corridors
  - Commissioning of Elements Eagerly Awaited
  - Constraint in HVDC flexible operation
  - Augmentation in Maharashtra System to Mitigate Operational Constraints
- **Major Constraints in Intra-regional Network**

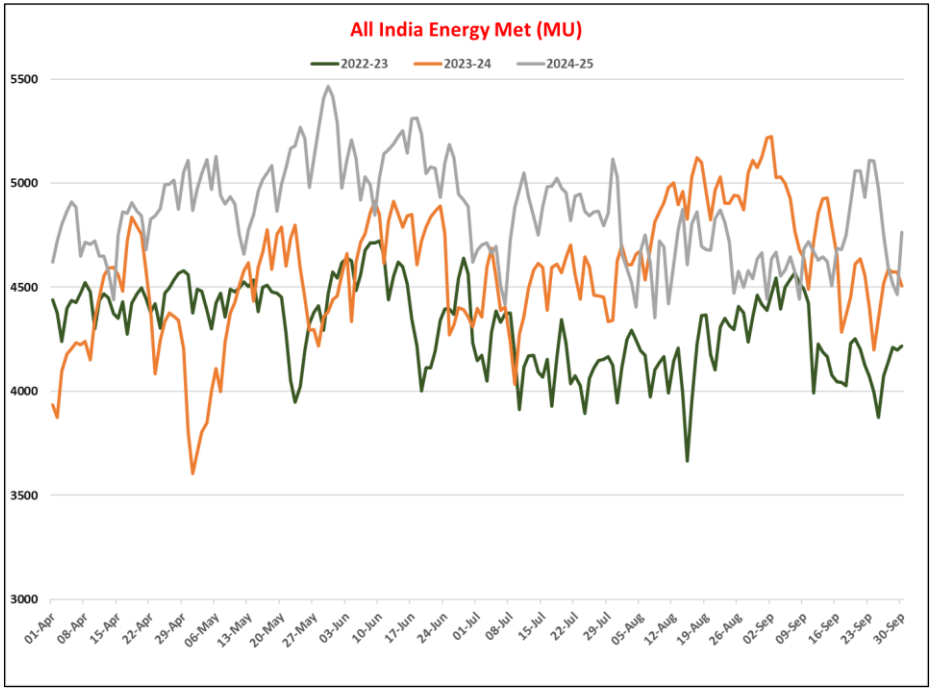
Overview of Grid Operation – Q1 & Q2 - FY 2024-25

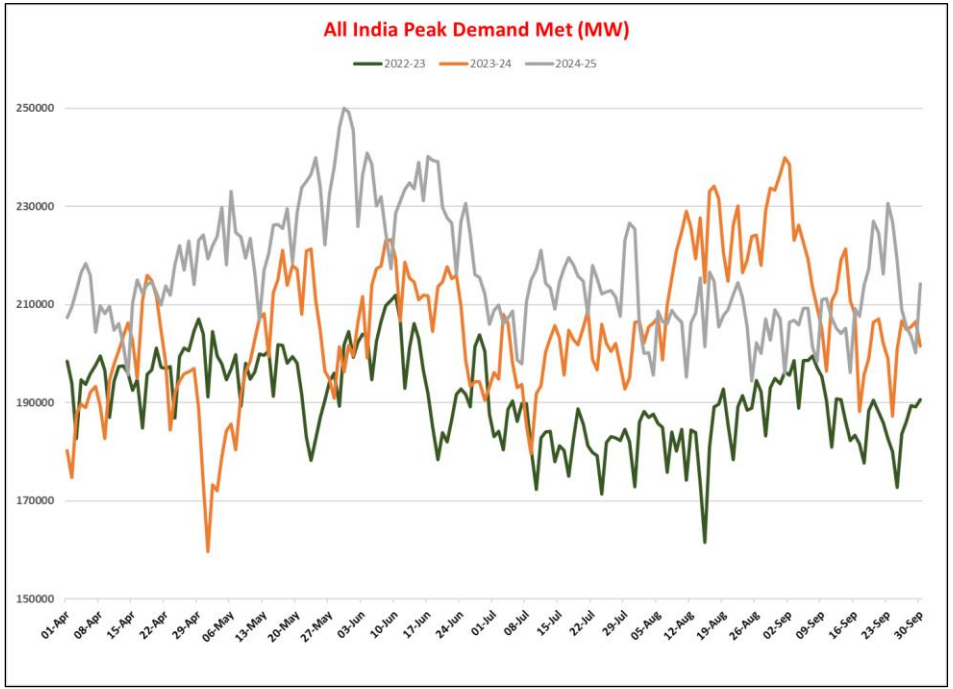
All India Demand met			
	Q1 (Apr-June)	Q2 (July-Sep)	Q3 (Oct-Dec)*
Maximum (MW)	**250070 (30-May-2024)**	**230568 (23-Sept-2024)**	**219356 (03-Oct-2024)**
Minimum	**175349 (14-Apr-2024)**	**167667 (27-Aug-2024)**	**157806 (13-Oct-2024)**

*Upto 18th October 2024

Projections as per 20th EPS for 2024-25	
All India Peak Demand	**230144 MW**

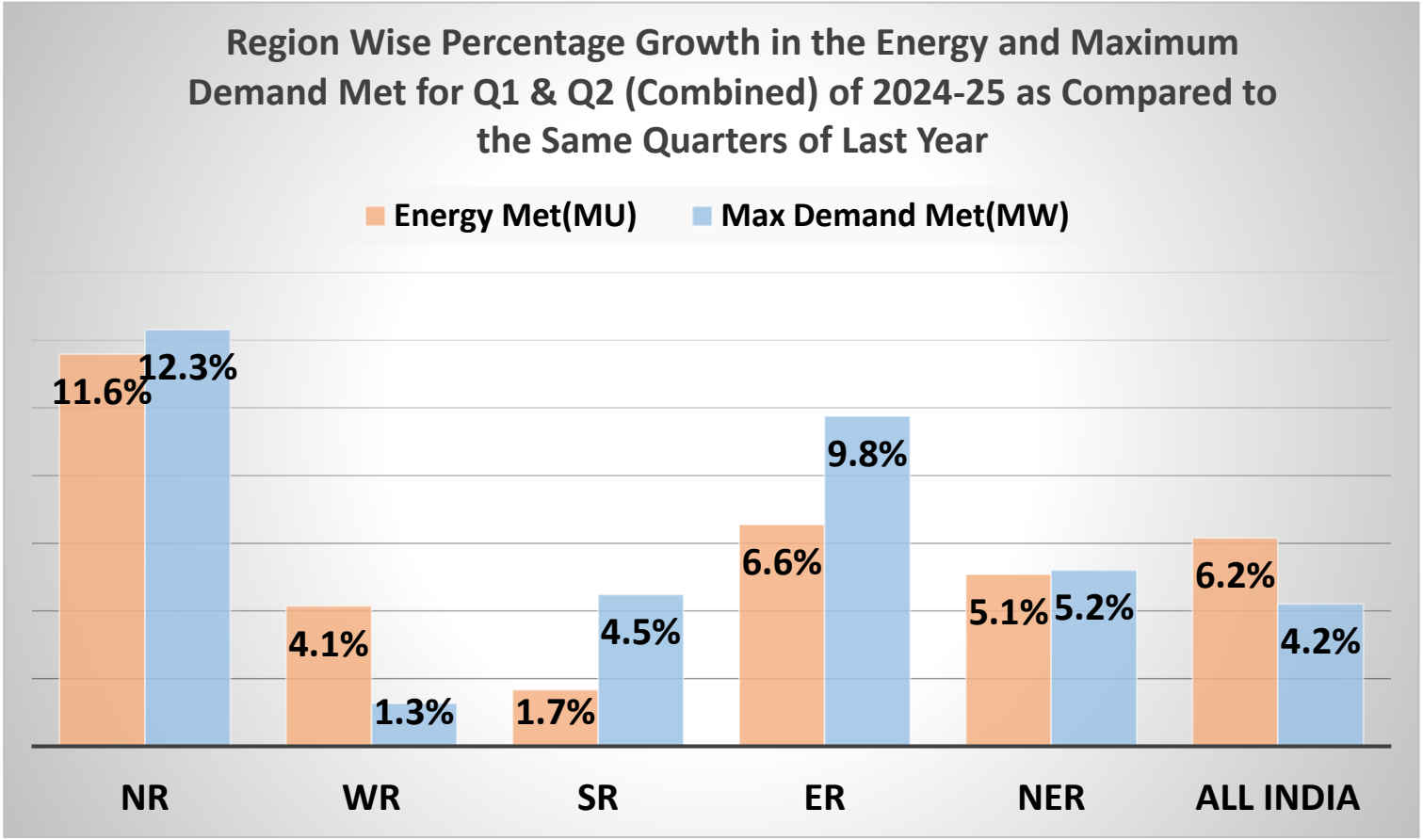
All India Daily Energy Met and Peak Demand of FY 2024-25, 2023-24 & 2022-23



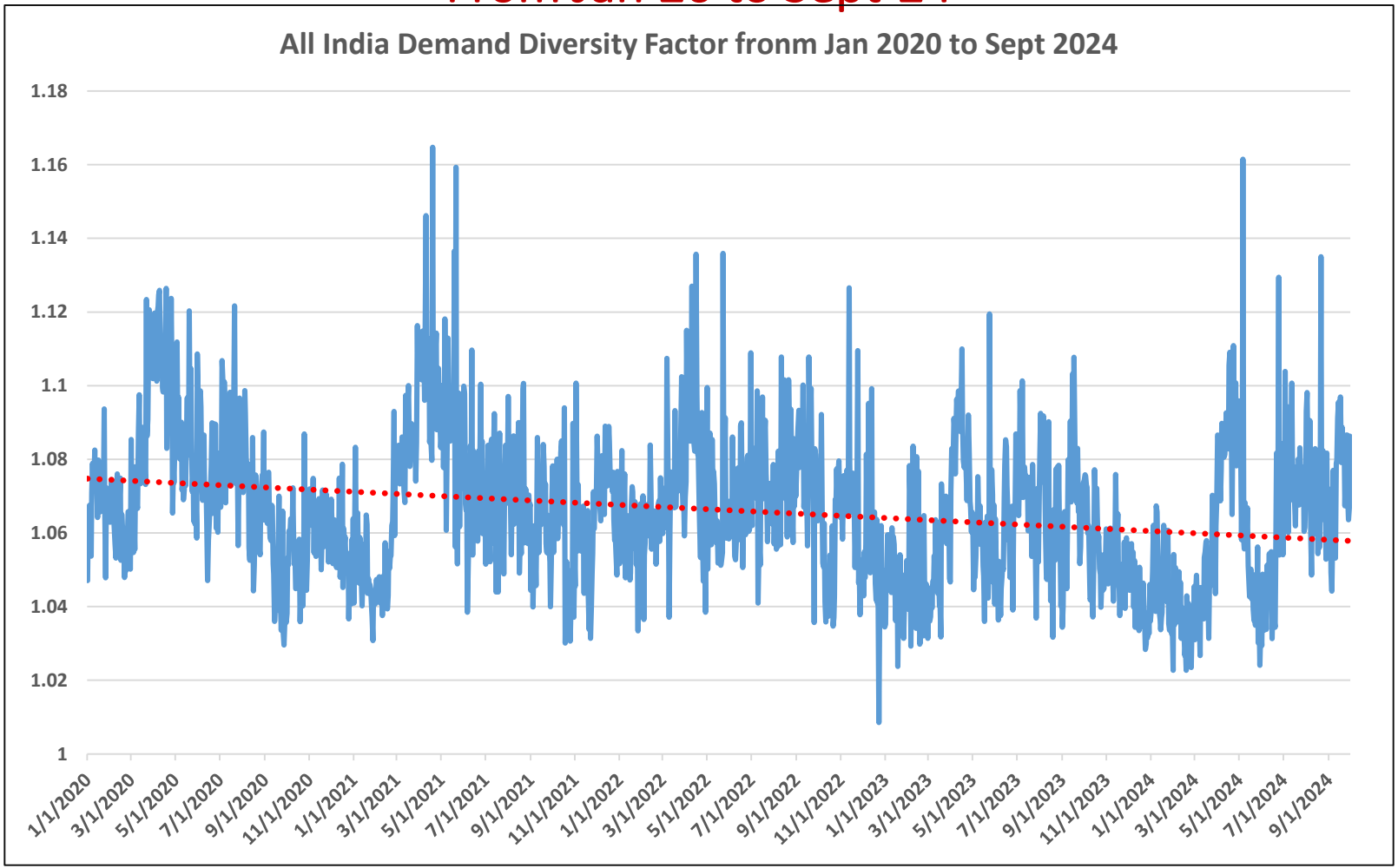


Significant increase in both Maximum Demand and Energy Met in FY 2023-24

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



All India Maximum Demand Diversity Factor From Jan'20 to Sept'24



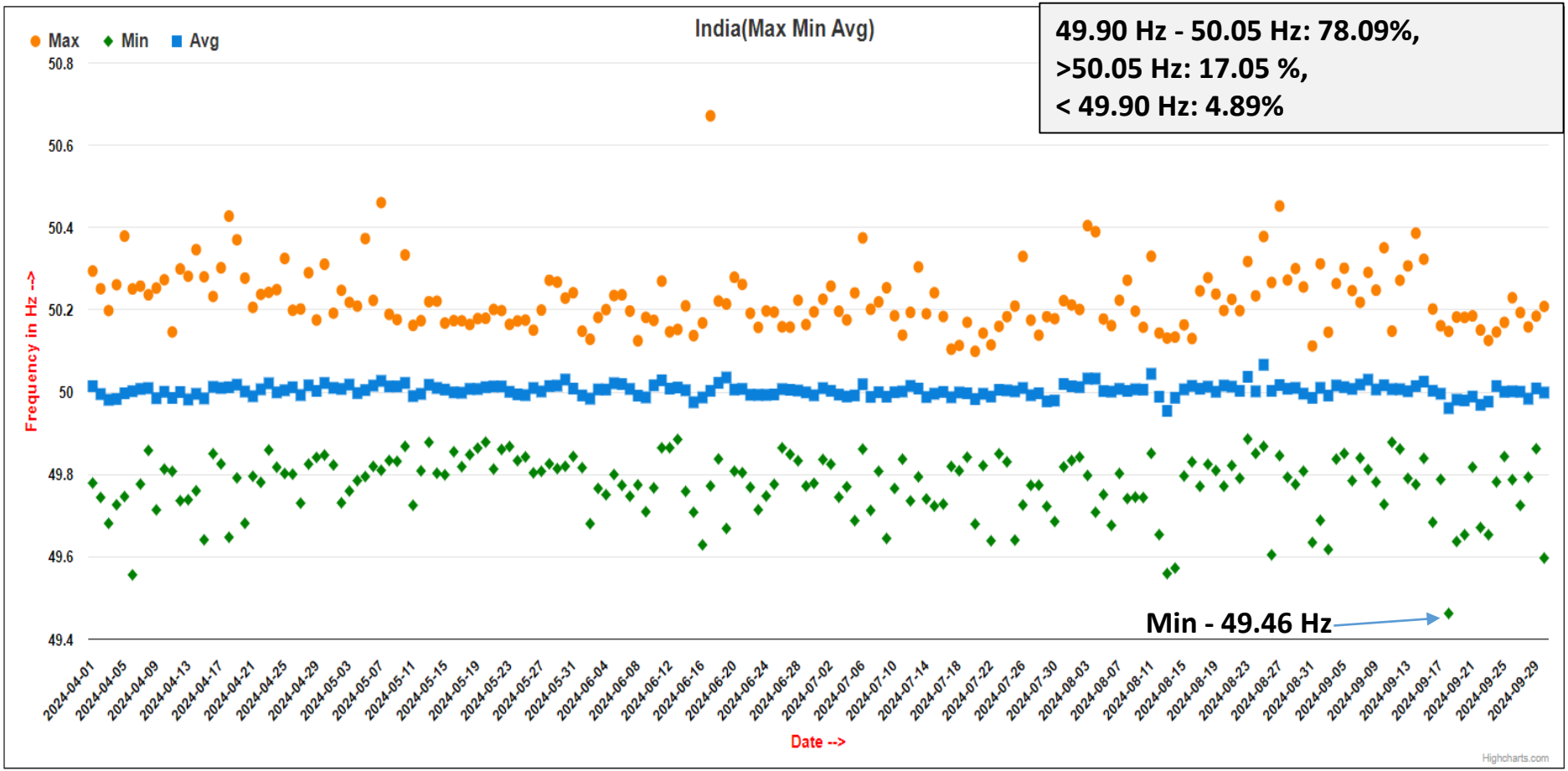
All Time Highest Figures (In – 2024-25)

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	91215 19-06-2024	82312 23-07-2024	1990 18-06-2024	442.6 01-08-2023	85.7 07-08-2023	185.7 01-05-2024
WR	74974 01-06-2024	67482 30-05-2024	1648 06-05-2024	167 18-12-2014	310.2 28-05-2024	102.9 30-04-2024
SR	68735 13-03-2024	54798 29-04-2024	1415.8 05-04-2024	208 31-08-2018	323 26-07-2024	148.7 31-03-2024
ER	32531 10-06-2024	29695 29-05-2024	692 10-06-2024	157.4 14-09-2022	-	9.1 15-08-2024
NER	3905 19-09-2024	3787 19-09-2024	80.3 20-09-2024	166.2 06-11-2023	-	3.5 08-09-2024
All India	250070 30-05-2024	227354 29-05-2024	5466.1 30-05-2024	877.5 30-08-2022	619.4 28-05-2024	426.5 30-04-2024

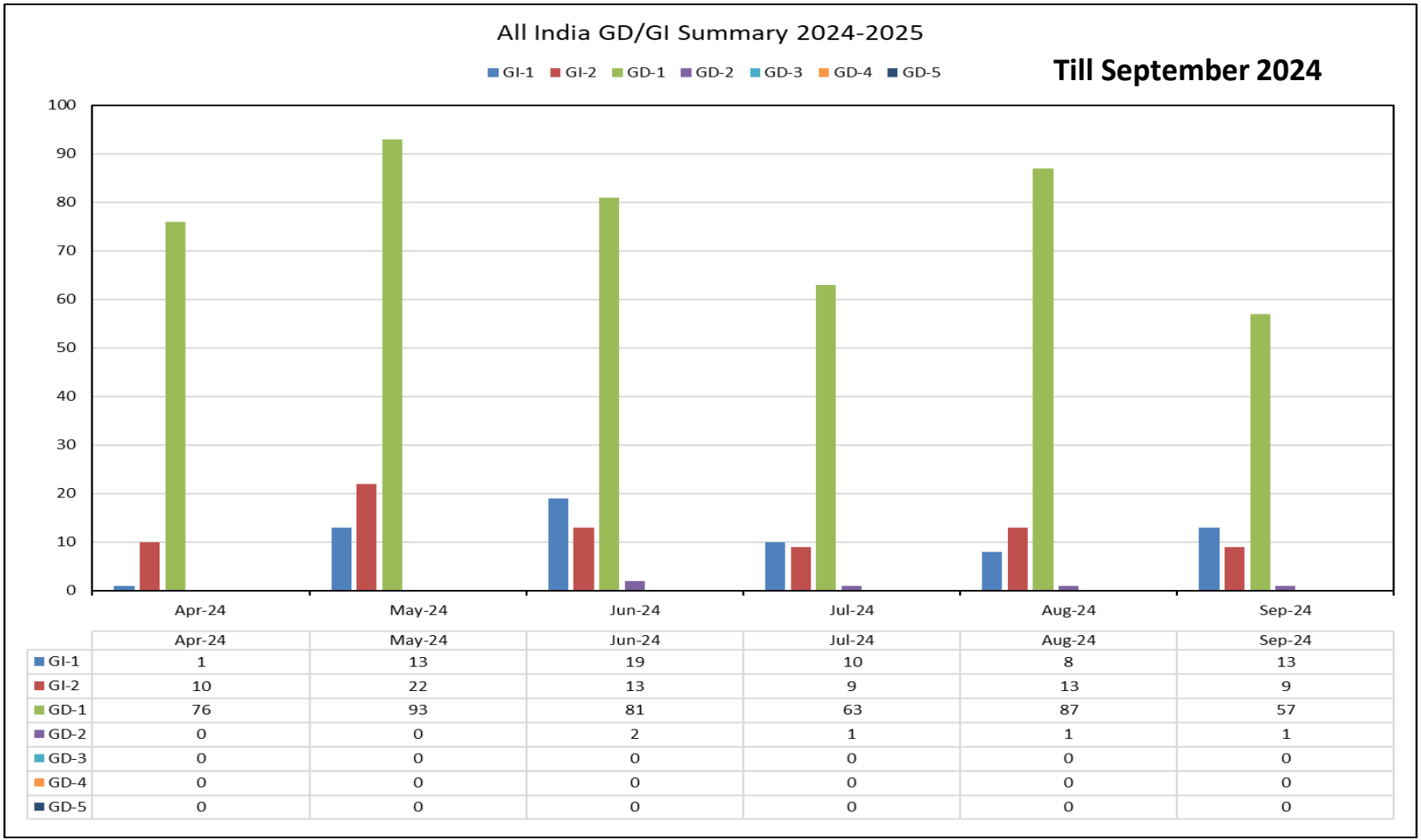
Maximum Figures in Q1, Q2 of 2024-25		
All India Peak Demand	250070	30-05-2024
All India Energy Met	5466.1	30-05-2024

Previous All-Time Highest Figures		
All India Peak Demand	239978	01-09-2023
All India Energy Met	5223.9	02-09-2023

Frequency Profile for Q2 & Q3 of FY – 2024-25



All India Grid Incidents/Disturbances in FY 2024-25



	Apr-24	May-24	Jun-24	Jul-24	Aug-24	Sep-24
GI-1	1	13	19	10	8	13
GI-2	10	22	13	9	13	9
GD-1	76	93	81	63	87	57
GD-2	0	0	2	1	1	1
GD-3	0	0	0	0	0	0
GD-4	0	0	0	0	0	0
GD-5	0	0	0	0	0	0

Reliability Issues Experienced in NR RE Complexes

Reliability issues experienced in NR RE Complexes

1. RE Generation Loss Events and Performance of RE Plants
2. Oscillations observed in NR RE Complexes and issue in STATCOM performance
3. Evacuation of large quantum of RE under T-GNA

RE Contingencies in 2024-25

S. No	Date	Time	Event
1	06-04-2024	11:24:00	400kV Bhadla(RS)-Bikaner(RS) Ckt-1 tripped due to R-Y fault respectively from Bhadla(RS) resulting in total NR RE generation loss of **4870 MW** (~3884MW ISTS RE generation and ~986 MW Rajasthan RE generation). Frequency dropped by **0.49 Hz** (from 50.029Hz to 49.539 Hz.
2	07-04-2024	10:24:00	400 KV Abdullapur-Kurukshetra (PG) Ckt-2 tripped on Y-N phase to earth fault. At the same time, 220/33 kV 100 MVA ICT 3 at RSDCL(PSS4)_SL_BHD2_PG also tripped due to over-flux protection operation resulting in total NR RE generation dip of **~1680 MW**
3	25-05-2024	12:46:00	Y-B fault converted into R-Y-B after ~220msec occurred on 220 KV Hissar(BBMB)-Hissar IA(HV) (HVPNL) Ckt-1. At the same time, line CB at Hissar(BBMB) end of 220 KV Hissar (BBMB)-Hissar IA(HV) (HVPNL) Ckt-2 also opened. On this fault, generation reduction at reduction of **~1100 MW** RE generation at Rajasthan occurred
4	30-05-2024	10:16:00	400 KV Sikar(PG)- Ratangarh (RS) (PG) Ckt-1 tripped on R-Y-N fault, 220kV Ratangarh (RS)-Khetri(RS) Ckt-2 tripped during the same time resulting in total NR RE generation drop/loss was **~1290 MW.**
5	01-06-2024	13:26:00	765 kV Meerut- Bhiwani (PG) Ckt-1 tripped from Bhiwani (PG) end only on R-N phase to earth fault with fault current of 4.679 kA and fault distance of 148.715 km from Bhiwani (PG) end resulting in dip in NR total solar generation of **~1695 MW** (ISTS Solar: ~1695 MW)
6	01-06-2024	13:43:00	400 KV Bawana-Mundka (DV) Ckt-1 & 2 tripped from Mundka(DV) end only on R-B phase to phase fault resulting in dip NR total solar generation of ~**3120 MW** (ISTS Solar: ~2710 MW, Rajasthan Solar: ~410 MW)
7	09-06-2024	11:21:00	R-phase conductor of 400 KV Akal-Jaisalmer2 (Bhainsra) (RS) Ckt broke at location no. 134 which caused R-B phase to phase fault on 400 KV Akal-Jaisalmer2 (Bhainsra) (RS) Ckt. During the same time, tripping of 400 KV Barmer(RS)-Rajwest(RW) (RS) Ckt on R-B phase to phase fault , 220kV Akal-Bhensra (Suzlon) , 400 KV Barmer(RS)-Jaisalmer2(Bhainsra) (RS) Ckt on R-B phase to phase fault resulting in dip in total RE generation of **~2625 MW** (ISTS Solar: ~1910 MW, Rajasthan Solar: ~715 MW
8	17-06-2024	13:53:00	Tripping of all four poles of HVDC Champa – Kurukshetra carrying ~4500MW from the Western Region to Northern Region resulting in dip of NR RE (Solar) of **~2800 MW**, however 1500 MW was generation was restored with 04 minutes.
9	19-06-2024	12:42:00	Low voltage scenario was prevailing in mainly Rajasthan, Delhi and UP control area. The voltage at 400kV Bikaner(RS), Bhadla(RS), Bhinmal(RS) and Kankani(RS) were 377kV, 382kV, 379kV and 375kV respectively. 3-phase to ground fault observed at Bhadla-II leading to loss of total NR RE generation of ~**4930 MW**

Total 13 RE generation loss event(>500 MW) in Rajasthan complex since Apr 2024

RE Contingencies in 2024-25

S. No	Date	Time	Event
10	06-07-2024	05:26:00	R-phase conductor of 220 KV Akal-Akal(Suzlon) (RS) ckt-2 brooked which caused R-N phase to earth fault and subsequently 220 KV Akal-Akal (Suzlon) (RS) ckt-2 tripped on zone-1 distance protection from Akal(RS) end. At the same time, 220 KV Akal-Akal(Suzlon) (RS) Ckt-1 and 220 KV Akal- Mulana (RS) Ckt also tripped from Akal(RS) end. During this event, dip in Rajasthan wind generation of **~1800 MW** observed
11	13-09-2024	02:49:00	Y-phase jumper of 220kV bus-1 of 220kV Akal-Bhensara Ckt-1 and R-phase jumper of 220kV bus-2 of 220kV Akal-Bhensara Ckt-2 snapped which created bus fault on both 220kV buses at Akal(RS). 400/220 kV 500 MVA ICT-1, ICT-2 tripped on earth fault protection and 400/220 kV 315 MVA ICT-3 & 500 MVA ICT-4 tripped on over current protection at Akal(RS) S/s. 220kV lines from Akal(RS) to Giral & Amarsagar tripped on zone-4 distance protection from Akal(RS) end. 220kV Akal-Bhensara Ckt-1 & 2 tripped. Due to tripping of all four ICTs at Akal(RS), evacuation path lost for all the wind power plants connected at 220kV bus-1 & bus-2 at Akal(RS). During this event, dip in Rajasthan wind generation of **~1295 MW** is observed out of which approx.
12	13-09-2024	13:15:00	220 kV Bhadla(PG)-Azure Power 34 Solar(APTFL) (APTFL) Ckt tripped due to B-N phase to earth fault (B phase jumper broken. Due to tripping of 220 kV Bhadla(PG)-Azure Power 34 Solar(APTFL) (APTFL) Ckt, Azure Power 34 (APTFL) (IP) S/s lost its connectivity from grid and blackout occurred at 220/33kV Azure Power 34 (APTFL) (IP) S/s. This led to loss of solar generation of ~**770 MW**
13	20-09-2024	12:00:00	Y-phase jumper of 220kV Jaisalmer -Akal Ckt-2 broke at Jaisalmer end. At the same time, bus bar protection operated at 220kV level of Jaisalmer and all the elements connected at 220kV level of Jaisalmer tripped and both the 220kV buses became dead. During this event, as per SCADA, solar generation loss of **~1070 MW** observed in Rajasthan control area.

Total 13 RE generation loss event(>500 MW) in Rajasthan complex since Apr 2024

RE Contingencies in 2024-25

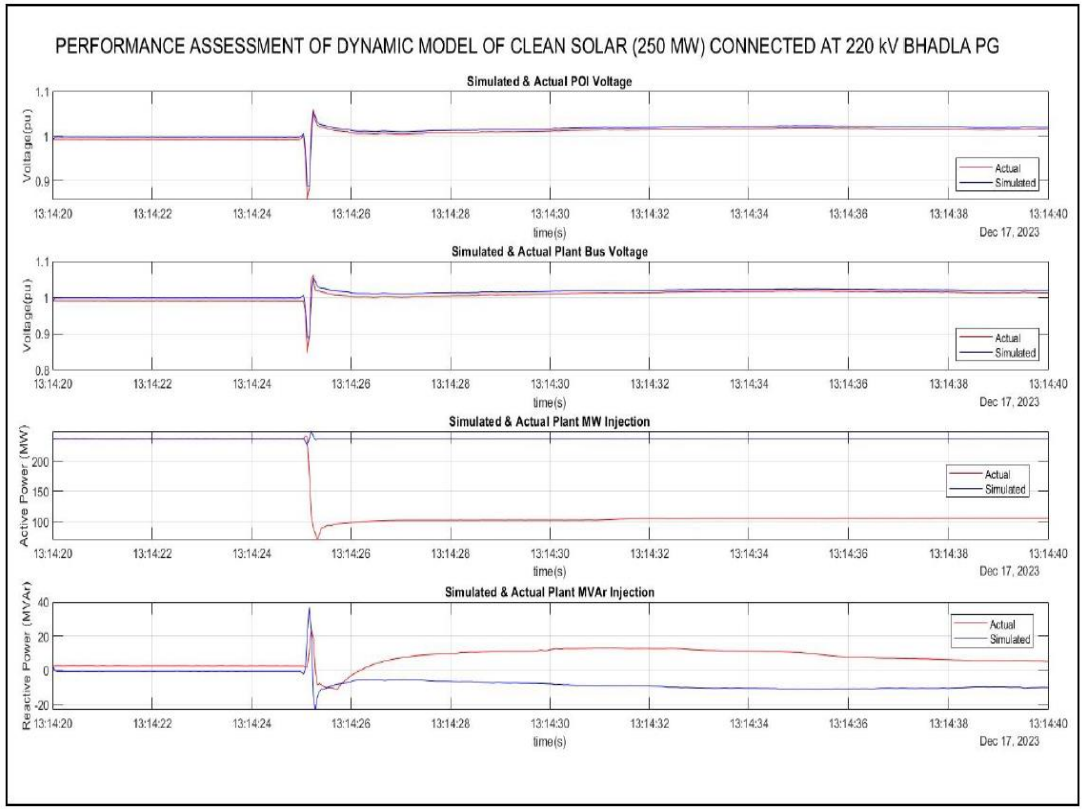
Major Observations:

- Plants entering into LVRT mode even when POI voltage is > 0.9 pu
- Opposite/insignificant reactive power injection observed by plants during faults
- Delayed recovery of active power by RE plants post fault clearance
- Partial recovery of active power after clearance of fault in the system
- Inadequate capacitive support from RE plants in intra-state
- No issues observed in the submitted dynamic models of the RE plants. Real-time behavior completely in variance with the models submitted during FTC

Non-compliance Summary

Compliance summary Apr 24 - June 24				
Date & Time of event	PMU data Reporting	Type of Compliance	Reactive Power Support during fault condition (partially, fully, non-complaint)	Active Power (MW) - Recovery/LVRT Compliance
		CEA Technical Standard to the connecticity regulation Clause	B(2) -1	B (2) -3
Compliance status Based on 06 Apr 24 Event(11:24 hrs)	No. of plants with data reporting - 35	Complied	13	9
		Non-Complied	22	26
Compliance status Based on 07 Apr 24 Event(10:24 hrs)	No. of plants with data reporting - 35	Complied	21	11
		Non-Complied	14	24
Compliance status Based on 19 Apr 24 Event(10:24 hrs)	No. of plants with data reporting - 37	Complied	32	3
		Non-Complied	5	34
Compliance status Based on 02 May 24 Event(14:40 hrs)	No. of plants with data reporting - 45	Complied	30	10
		Non-Complied	15	35
Compliance status Based on 01 Jun 24 Event(13:26 hrs)	No. of plants with data reporting - 29	Complied	22	2
		Non-Complied	7	27
Compliance status Based on 01 Jun 24 Event(13:43 hrs)	No. of plants with data reporting - 27	Complied	21	7
		Non-Complied	6	20
Compliance status Based on 04 Jun 24 Event(10:26 hrs)	No. of plants with data reporting - 37	Complied	33	7
		Non-Complied	4	30
Compliance status Based on 04 Jun 24 Event(12:35 hrs)	No. of plants with data reporting - 40	Complied	32	9
		Non-Complied	8	31
Compliance status Based on 09Jun 24 Event(10:21	No. of plants with data reporting - 40	Complied	22	15
		Non-Complied	17	27
Compliance status Based on 17 Jun 24 Event(13:53 hrs)	No. of plants with data reporting - 44	Complied	33	10
		Non-Complied	11	34
Compliance status Based on 19 Jun 24 Event(12:42 hrs)	No. of plants with data reporting - 47	Complied	20	10
		Non-Complied	27	37

Constraints in carrying out the studies at RLDC/NLDC



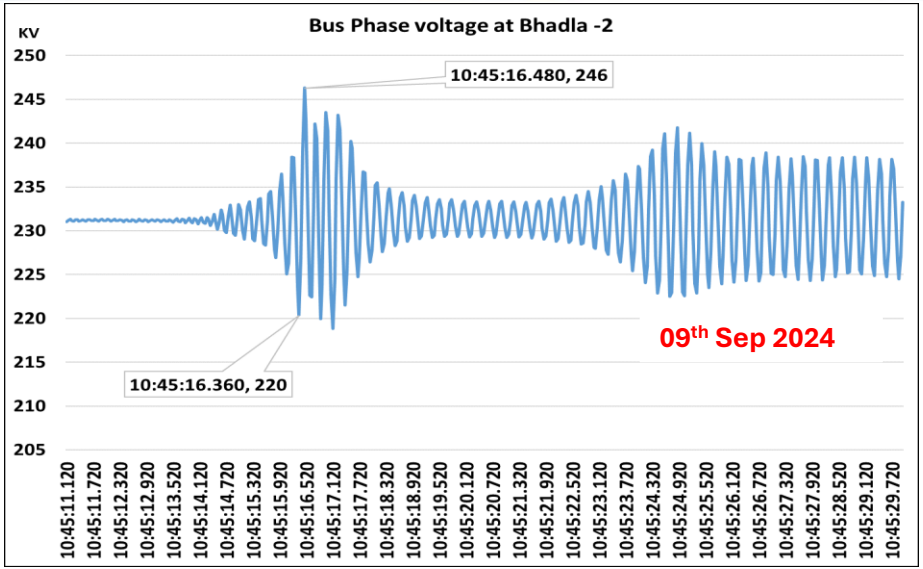
Accurate model with all control and protection settings to be prepared and submitted before interconnection

Inaccurate models submitted by OEMs :- Mismatch in performance of **submitted dynamic models** by RE developers for ISTS-connected plants in Rajasthan vis-à-vis actual performance of plants in real-time during faults

Observed deficiencies in submitted models

- High consideration of Short Circuit ratio (SCR) by RE Developers.
- Improper modelling - Post fault characteristics, Collector System Network etc.
- Consideration of different LVRT/HVRT K-factors in models in place of implemented value at site.
- No/incorrect modelling of relay in simulation model for IBRs, Collector system etc.
- Non-consideration of communication delays, polling rates/update rates of equipment in modelling

Oscillations Observed in NR RE Complex



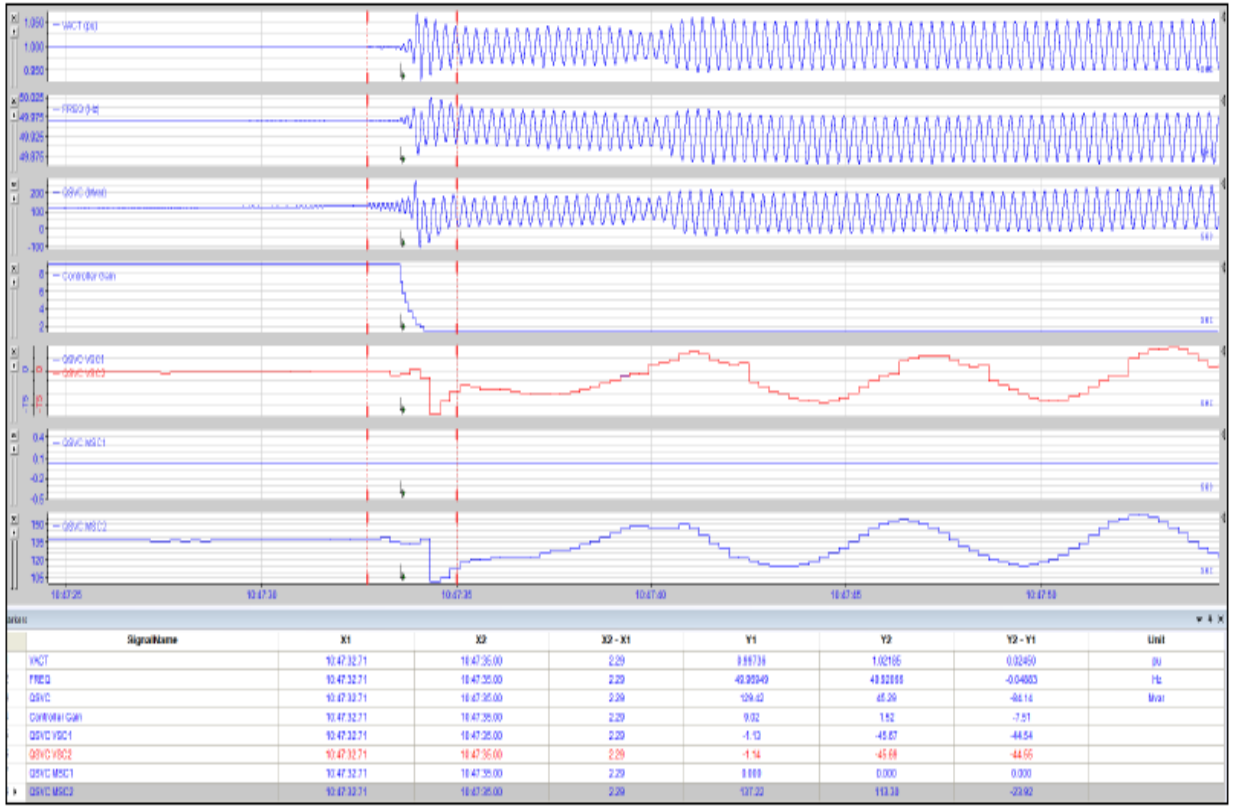
- No triggering event (reactor switching, line charging etc.)
- Frequency of oscillation observed in the range of 3 to 6 Hz.
- Primarily observed in voltage and reactive power.

Actions taken to minimize the issue of voltage oscillation in RE pocket of NR (Rajasthan RE complex):

1. Detection of source and sink of oscillation, their modes and damping factor through OSLp tool in real-time operation
2. The observations and possible measures were communicated to plant having issue of oscillatory response and momentarily sharp reduction in voltage
3. Changing the mode of control for a few RE plants from Voltage control to Fixed PF and Fixed Q
4. Tuning of few parameters of their PPCs like Proportional gain (Kp), Integral time constant (Ti) and change in Voltage dead-band (Vdb) (changed from 1% to 2%) for identified RE Plants connected at Fatehgarh-II(PG) and Fatehgarh-I.
5. Studies for IBRs interaction with STATCOM need to be carried out by the OEM in consultation with CTUIL and Grid-India.

Oscillations Observed in NR RE Complex (STATCOM Behaviour)

Measurement (TFR) based Analysis of Bhadla-II STATCOM-1



SignalName	X1	X2	X2 - X1	Y1	Y2	Y2 - Y1	Unit
VACT	10:47:32.71	10:47:35.00	2.29	0.99734	1.02165	0.02430	pu
FREQ	10:47:32.71	10:47:35.00	2.29	49.99349	49.92666	-0.04683	Hz
QSVC	10:47:32.71	10:47:35.00	2.29	109.62	65.29	-86.14	Mvar
Controller Gain	10:47:32.71	10:47:35.00	2.29	9.02	1.52	-7.51	
QSVC VSC1	10:47:32.71	10:47:35.00	2.29	-1.13	-45.67	-44.54	
QSVC VSC2	10:47:32.71	10:47:35.00	2.29	-1.14	-45.68	-44.55	
QSVC MSC1	10:47:32.71	10:47:35.00	2.29	0.000	0.000	0.000	
QSVC MSC2	10:47:32.71	10:47:35.00	2.29	137.22	113.38	-23.92	

Observations on response time:

Measured w.r.t Qmax.

- Fault case: **60 ms**
- Oscillations case: **80 ms**

Measured w.r.t Id act. (max.)

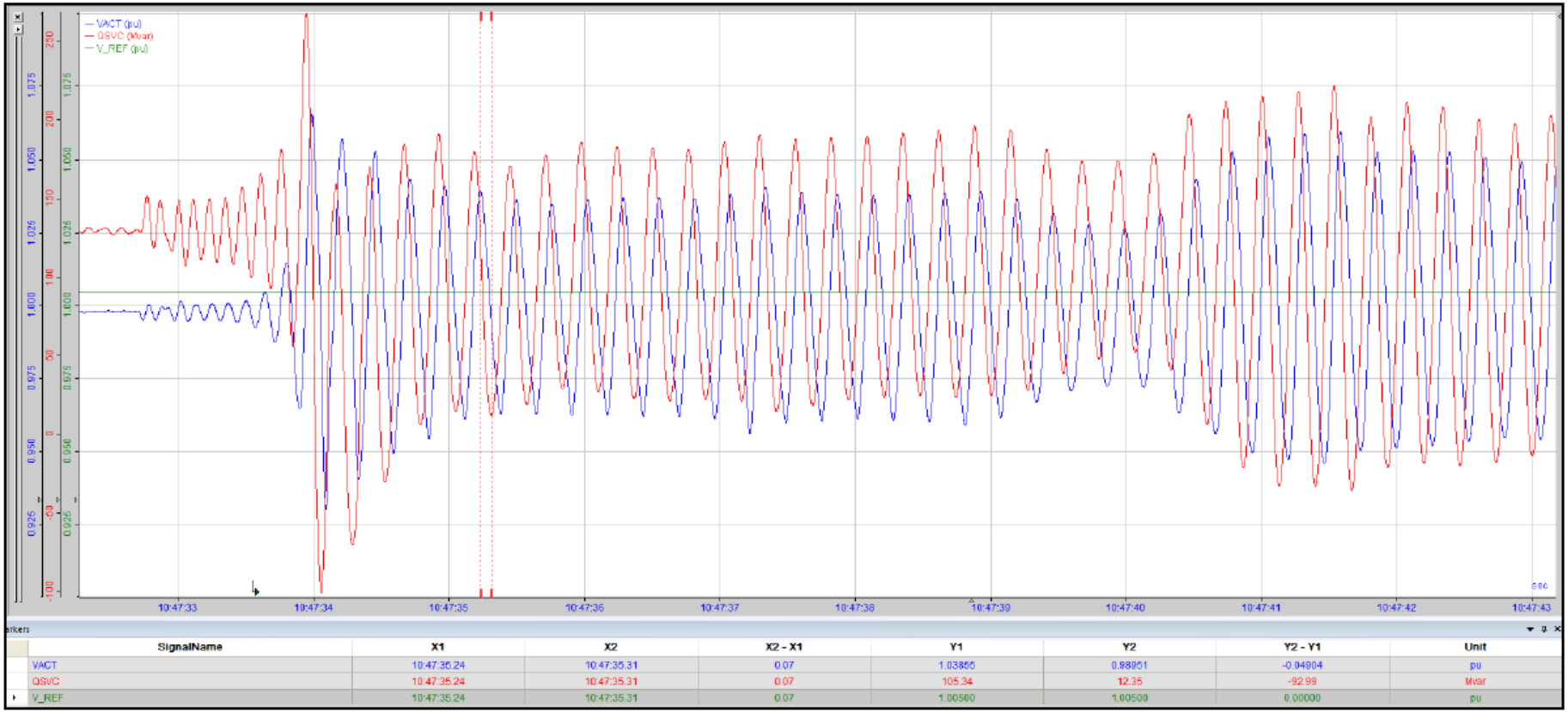
- Fault case: **50 ms**
- Oscillations case: **70 ms**

- **High response time (sluggish response)** during faults leading to injection of reactive power post clearance of fault
- **Automatic gain reduction by stability controller of the STATCOMs on hunting detection, possibly leading to enhancement in magnitude of oscillations**

A meeting may be convened by CEA with the STATCOM OEMs POWERGRID, CTUIL and Grid-India on priority to deliberate the highlighted issues and potential remedial measures. (Detailed analysis shared with CEA, CTUIL & Asset owner)

Oscillations Observed in NR RE Complex (STATCOM Behaviour)

Measurement (TFR) based Analysis of Bhadla-II STATCOM-1



SignalName	X1	X2	X2 - X1	Y1	Y2	Y2 - Y1	Unit
VACT	10:47:35.24	10:47:35.31	0.07	1.03855	0.98951	-0.04904	pu
QSVC	10:47:35.24	10:47:35.31	0.07	105.34	12.35	-92.99	Mvar
V_REF	10:47:35.24	10:47:35.31	0.07	1.00500	1.00500	0.00000	pu

Measured w.r.t Qmax.

- Fault case: **60 ms**
- Oscillations case: **80 ms**

Measured w.r.t Id act. (max.)

- Fault case: **50 ms**
- Oscillations case: **70 ms**

Simulation based Analysis of Bhadla-II STATCOM-1

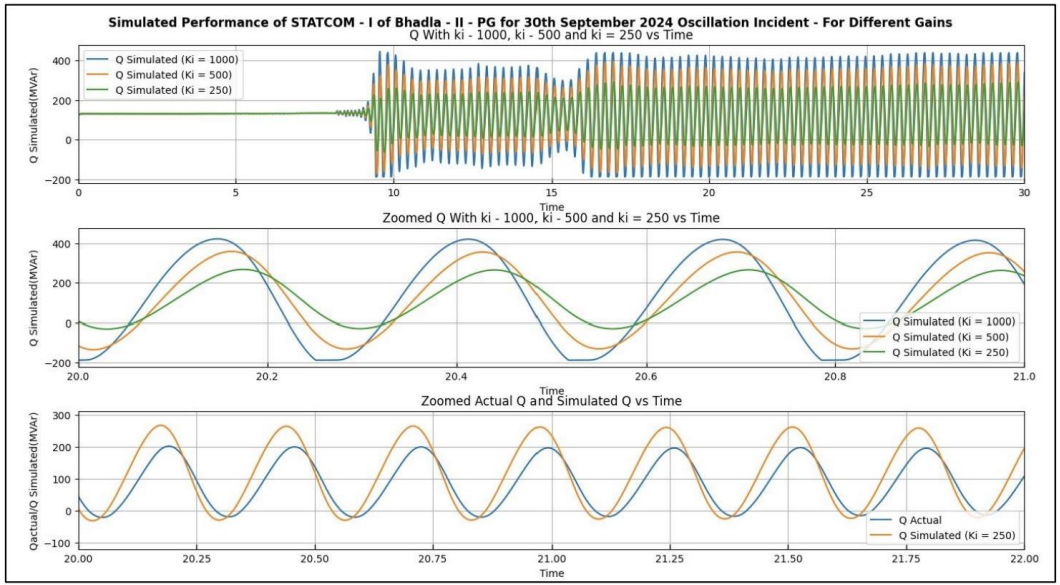


Figure 22: (a) Qsim. (ki = 1000, 500 & 250) (b) Zoomed Version - Qsim. (ki = 1000, 500 & 250) (c) Qact. & Qsim. (ki = 250)

Date	Event Type	Antecedent Conditions and Control Modes of STATCOM	Observations	
			From Transient Fault Recorder (TFR)	RMS Simulation
20 Sep 2024	Fault Case	➢ Mode: Voltage Control ➢ Vref: 402 kV or 1.005 pu ➢ Droop: 3% ➢ MVAR Injection: ~160 MVAr ➢ VSC 1 + VSC 2: ~20 MVAr ➢ MSC 1: 0 MVAr ➢ MSC 2: ~140 MVAr ➢ MSR: 0 MVAr	➢ Controller gain during the event = ~5 ➢ Max STATCOM MVAr Injection: **480 MVAr** ➢ Time taken to reach max. MVAR : **60 ms**	➢ Max STATCOM MVAr Injection: a) **Kp = 1, Ki = 1000 - 490 MVAr** b) **Kp = 1, Ki = 500 - 443 MVAr** c) **Kp = 1, Ki = 250 - 327 MVAr** ➢ Time for reaching max. MVAR: **57 ms**
30 Sep 2024	Low Frequency Oscillation Case	➢ Mode: Voltage Control ➢ Vref: 402 kV or 1.005 pu ➢ Droop: 3% ➢ MVAR Injection: ~130 MVAr ➢ VSC 1 + VSC 2: ~(-)7 MVAr ➢ MSC 1: 0 MVAr ➢ MSC 2: ~137 MVAr ➢ MSR: 0 MVAr	➢ Controller gain during the event = ~1.5 ➢ Osc. Peak-to-Peak STATCOM MVAr Injection/Absorption for a selected cycle: **+221/-36 MVAr** ➢ Time Difference Between Bus Voltage (min or max) and STATCOM-Q (max or min): **70 ms**	➢ Osc. Peak-to-Peak STATCOM MVAr Injection/Absorption for the selected cycle: a) **Kp = 1, Ki = 1000 - +438/-187 MVAr** b) **Kp = 1, Ki = 500 - +394/-166 MVAr** c) **Kp = 1, Ki = 250 - +290/-48 MVAr** ➢ Time Difference Between Bus Voltage (min or max) and STATCOM-Q (max or min): a) **Kp = 1, Ki = 1000 – 35 ms** b) **Kp = 1, Ki = 1000 – 50 ms** c) **Kp = 1, Ki = 1000 – 70 ms**

RMS Simulations

- Output of the STATCOM is getting delayed with **reduction in gain**
- The reduction in gain not only impacts the response time but also the **max. output of the STATCOM** within a certain interval.

Simulation based Analysis of Bhadla-II STATCOM-1

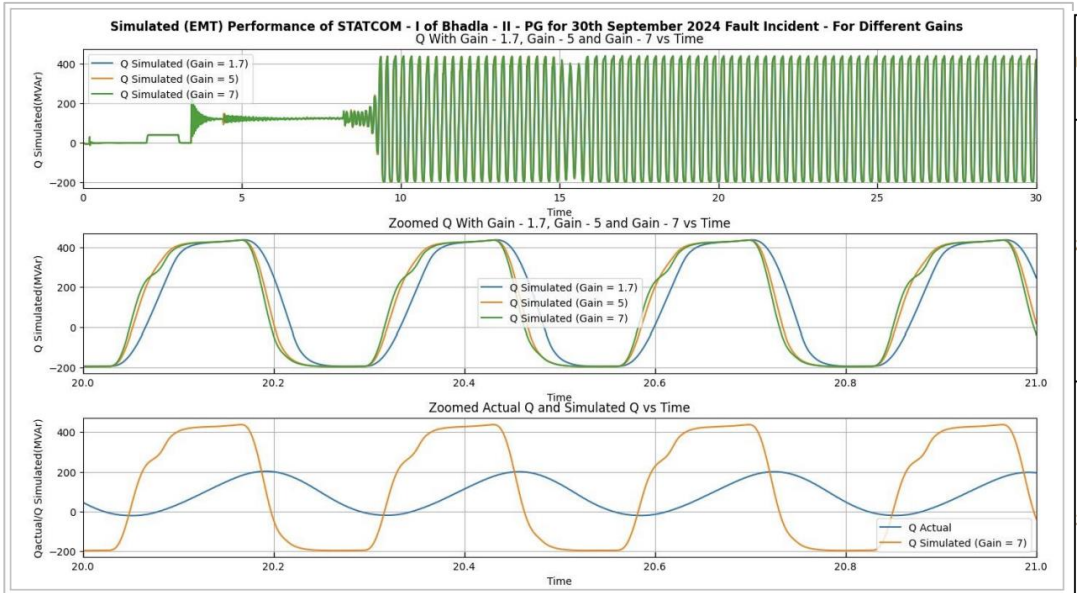


Figure 37: (a) Qsim (Gain = 1.7, 5, 7) (b) Zoomed Qsim. (Gain = 1.7, 5, 7) (c) Zoomed Qact v/s Qsim (Gain = 7)

Date	Event Type	Antecedent Conditions and Control Modes of STATCOM	Observations	
			From Transient Fault Recorder (TFR)	EMT Simulation
20 Sep 2024	Fault Case	➢ Mode: Voltage Control ➢ Vref: 402 kV or 1.005 pu ➢ Droop: 3% ➢ MVAR Injection: ~160 MVAr ➢ VSC 1 + VSC 2: ~20 MVAr ➢ MSC 1: 0 MVAr ➢ MSC 2: ~140 MVAr ➢ MSR: 0 MVAr	➢ Controller gain during the event = ~5 ➢ Max STATCOM MVAr Injection: **480 MVAr** ➢ Time taken to reach max. MVAR : **60 ms**	➢ Max STATCOM MVAr Injection: **a) Gain = 1.5 and 5 - 454 MVar** **b) Gain = 7 and beyond - Unstable response** ➢ Time for reaching max. MVAR: **60 - 66 ms**
30 Sep 2024	Low Frequency Oscillation Case	➢ Mode: Voltage Control ➢ Vref: 402 kV or 1.005 pu ➢ Droop: 3% ➢ MVAR Injection: ~130 MVAr ➢ VSC 1 + VSC 2: ~(-)7 MVAr ➢ MSC 1: 0 MVAr ➢ MSC 2: ~137 MVAr ➢ MSR: 0 MVAr	➢ Controller gain during the event = ~1.5 ➢ Osc. Peak-to-Peak STATCOM MVAr Injection/Absorption for a selected cycle: **+221/-36 MVAr** ➢ Time Difference Between Bus Voltage (min or max) and STATCOM-Q (max or min): **70 ms**	➢ Osc. Peak-to-Peak STATCOM MVAr Injection/Absorption for the selected cycle: **Gain = 1.7, 5, 7 - +439/-195 MVAr**

EMT Simulations

- Delay in providing reactive power response increases with reduction in gain.
- The reduction of gain by the stability controller, therefore, might be one of the reasons for not getting adequate and fast reactive power support by the STATCOM during oscillations.

STATCOMS in Indian Power System and YTC

Region wise List of STATCOMs						YTC (in Lakhs)
Region	Name	VSC	MSC	MSR	Make	
Eastern Region	Rourkela	2X150	Nil	2X125	Siemens	757.6
	Kishanganj	2X100	Nil	2X125	Siemens	757.6
	Ranchi (New)	2X150	Nil	2X125	Siemens	757.6
	Jeypore	2X100	2X125	2X125	Siemens	757.6
Western Region	Satna	2X150	1X125	2X125	RXPE	3265.63
	Aurangabad	2X150	1X125	2X125	RXPE	3265.63
	Solapur	2X150	1X125	2X125	RXPE	3265.63
	Gwalior	2X100	1X125	2X125	RXPE	3265.63
Southern Region	NP Kunta	2x50	-	-	Hyosung	175.447
	Trichy	2x100	1 x 125	2 x 125	Hyosung	1008.82
	Hyderabad	2x100	1 x 125	2 x 125	Hyosung	1012.38
	Udumalpet	2x100	1 x 125	2 x 125	Hyosung	1232.86
Northern Region	Nallagarh	2X200	2 x 125	2 x 125	RXPE	2799.9
	Lucknow	2X300	2 x 125	2 x 125	RXPE	3593.8
	Fatehgarh-II	2X150	2 x 125	1 x 125	Siemens	2099.9
	Fatehgarh-II	2X150	2 x 125	1 x 125	Siemens	2099.9
	Bhadla-II	2X150	2 x 125	1 x 125	Siemens	2099.9
	Bhadla-II	2X150	2 x 125	1 x 125	Siemens	2099.9
	Bikaner-II	1x300	2 x 125	1 x 125	Siemens	2099.9
North Eastern Region	No Statcom					
Total YTC						36415.52

Technical Specifications of STATCOM of Bikaner-II

6.2.1. STATCOM Station Functions and Applications

6.2.1.1. Voltage Control mode (Automatic and Manual)

Control of the positive sequence component of the fundamental frequency voltage in steady state and dynamic operation, with slope in the range as specified at clause 6.1 c) above.

6.2.1.2. Fixed Reactive Power Mode

In this mode, the reactive power output of the STATCOM as well as switching of MSRs and MSCs, should be manually controlled, by direct operator action. This feature is normally utilized for testing purpose.

6.2.1.3. Steady State Condition

The STATCOM Station (STATCOM along with MSCs and MSRs) shall provide necessary reactive power support to the 400 kV bus (PCC) to compensate for voltage variation under steady state.

6.2.1.4. Dynamic Over-voltage Control Performance

The STATCOM shall be required to provide necessary reactive power support with fast and smooth variation so that over-voltages under dynamic conditions are controlled. STATCOM shall smooth out the step caused by switching of MSCs and MSRs.

The operation of each STATCOM over its range of MVAR from full capacitive to full Inductive capacity and vice-versa shall be on the basis of smooth variation.

6.2.1.5. Transient and Dynamic Stability Performances

The STATCOM Station shall provide necessary reactive power so that transient and dynamic stability of the Owner's system are enhanced.

6.2.1.6. Damping of Power Oscillations

The STATCOM shall provide necessary damping to power oscillations by modulating its output in its entire range based on measured rate of change of power/frequency at the 400kV bus. The

6.2.1.9. Gain Supervision and Control

To control regulator gain in order to prevent oscillations and excessive overshoot in the STATCOM response, a gain supervision function shall be implemented.

This shall be an essential function for supervision of stability of the closed loop voltage control. The function of this controller is that when the supervision of the gain in the voltage regulator detects oscillations in the voltage controller output, the gain shall gradually be reduced until stability is reached. Normally it is a changed condition in the transmission system contribution to the closed loop gain that results in the instability. The reduction in the voltage regulator gain shall only balance the external change. The control should be adaptive in order to maximize its effectiveness. Gain reductions should be indicated and the reduction of the gain shall be able to be reset to nominal value by means of commands from the operator interface or automatically. A relative gain factor shall also be able to be changed from a gain optimizer.

6.2.1.10.Coordinated reactive power control of external devices

To optimize the use of dynamic vars versus steady state vars, control of externally connected shunt capacitor or reactor banks shall be implemented. Such banks will be connected locally to a HV bus or/and at MV bus. For simultaneous control with the supplementary VSC current controller, coordination for the two functions shall be provided. External devices like mechanically switched capacitor (MSC)/mechanically switched reactor (MSR) can be switched ON or OFF to position the steady state operating point of the VSC so as to extend its dynamic range.

6.2.1.11.Supplementary VSC current controller

To optimize the use of dynamic vars versus steady state vars, a control function that slowly reduces or offsets the STATCOM point of operation shall be implemented. By deliberately adjusting the voltage reference setting within a narrow window the STATCOM system output is pushed toward either a specific point or toward a window to preserve dynamic range. This slow operating function is meant to provide for slower controllers, such as externally connected shunt bank to operate and meet the slower long term voltage variations caused by daily or weekly load variations. Rapid changes in the system voltage that call for dynamic compensation will have priority over this type of controller.

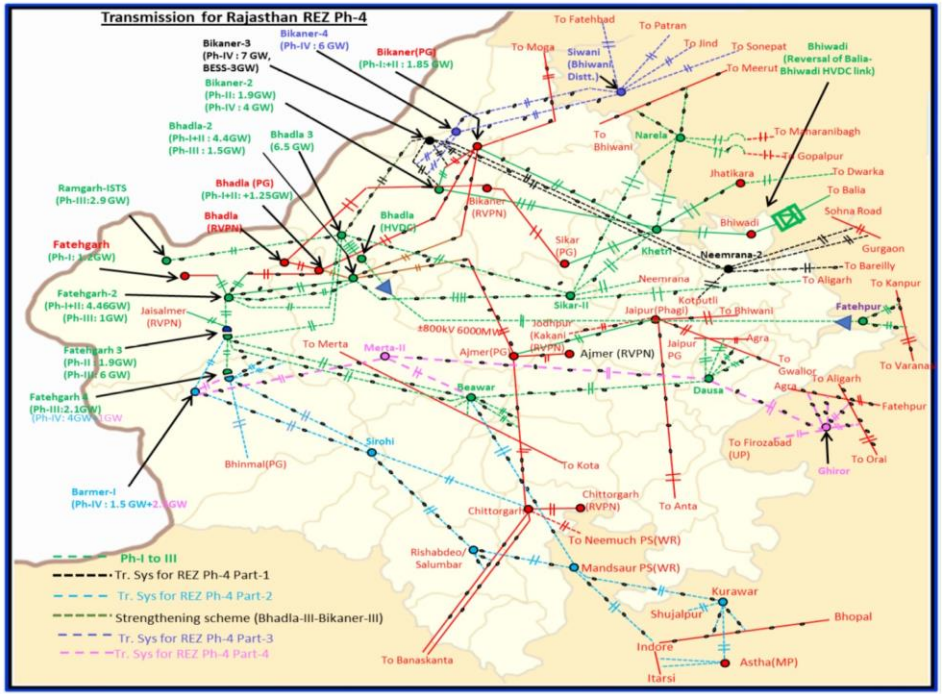
6.2.1.12.Gain optimization

To provide operation at optimal regulator gain, a fully automatic optimizing function shall be implemented. This function operates by inducing a small change in the STATCOM output. The gain is adjusted based on the network response signal.

Synchronous Condensers committee

- Committee of members from CEA, NRPC, NRLDC, NTPC, BHEL, CTU and STUs constituted under chairmanship of MS, NRPC to do futuristic analysis for requirement of Synchronous Condensers based on the inertia considerations for Northern Region.
- Committee conducted **4 nos of meetings** wherein deliberations on the requirements of Synchronous Condenser including other available technologies were done.
- During the Committee meetings, presentation by different OEMs viz **BHEL, Hitachi & Andritz Hydro** was also made highlighting various technological options available and its suitability under different system requirements.
- **CTUIL and CEA** to carry out system study for requirement of synchronous condenser as already mentioned in 500 GW RE report for every two-year time frame till year 2030
- **Detailed study submitted by Grid India on impact of installing synchronous condenser in the present scenario at Fatehgarh complex**
- **Observations based on study results**
  - Enhanced System Strength / Short Circuit Ratio (SCR)
  - Fast Reactive Power Support during Faults/Transients
  - Increased Inertia and Frequency Response
  - Damping of Low Frequency Oscillations.
  - Steady-state Reactive Power Support
- **Inputs given by Grid-India on Compensation Mechanism for Synchronous Condenser Facilities**

Evacuation of large quantum of RE under T-GNA



Pooling station	GNA Non-effective (Complete ATS not yet commissioned)
Bhadla(PG)	0
Bikaner(PG)	663
Fatehgarh-II(PG)	420
Bhadla-II(PG)	2132
Fatehgarh-I_Adani Pooling	0
Bikaner-II PS	1322
Fatehgarh-III PS	1180
Total	**5717**

- The phase-I & II transmission system has mostly been commissioned whereas transmission elements part of Phase-III transmission scheme are yet to be commissioned. (765 kV Bhadla-II – Sikar-II 2xD/C, 765 kV Khetri – Narela D/C, 765 kV Sikar-II – Narela, LILO of 765 kV Meerut – Bhiwani at 765 kV Narela etc.)
- Currently, 5717 MW RE in Rajasthan is being evacuated through T-GNA. The associated transmission schemes needs to be expedited as large quantum of RE is being evacuated through T-GNA.

Issues with evacuation of large quantum of RE under T-GNA

- As of now system is N-1 secure in steady state in terms of loading and angular separation with ~5GW of TGNA using NRLDC NOC.

Most credible contingency are given below

- N-1 contingency of 765kV Bhadla-II(PG)-Ajmer(PG) D/C line
- N-1 contingency of 400kV Bhadla(RS)-Bikaner(RS) D/C line
- N-1 contingency of 765kV Bikaner(PG)-Khetri D/C line

Limiting Constraint:

- **Angular separation exceeding 30°** under **N-1 contingency of 765kV Bhadla-II(PG)-Ajmer(PG) D/C** line if pre-contingency loading remains 2400MW each ckt.

765kV Bhadla-II(PG)-Ajmer(PG) D/C line			
Basecase		N-1 contingency	
Loading (MW)	Angular seperation (°)	Loading (MW)	Angular seperation (°)
2371	20.47	3230	28.59

- SPS implemented for 765kV Bhadla-II(PG)-Ajmer(PG) contingency.
- Despite being Quad moose line (due to poor condition of conductor), loading on 400kV Bhadla(RS)-Bikaner(RS) D/C line needs to be kept below 700MW each ckt to ensure N-1 compliance.

High frequency oscillation (>4Hz) observed during peak solar generation

- STATCOMs being kept in manual fixed 'Q' mode during peak solar period to address the issue of oscillation

- **NO further additional NOC shall be granted for RE generation evacuation from the complex till the charging of 765kV Bhadla-II-Sikar-II D/C line**

Present practice for curtailment is given below;

Infirm (Bilateral) > GNA Not effective (Bilateral) > GNA effective being scheduled in T-GNA (Bilateral) > GNA effective (Bilateral) > Collective.

Major Grid Disturbances leading to transmission constraints

Grid Event in Northern Region on 17 June 2024: Event Overview

1. Tripping of both Bipoles of **+/-800 kV HVDC Champa (WR) – Kurukshetra (NR) carrying 4,500 MW** from WR to NR

2. Sharp grid **voltage decline** and Northern Region **demand reduction by around 16.5 GW**.

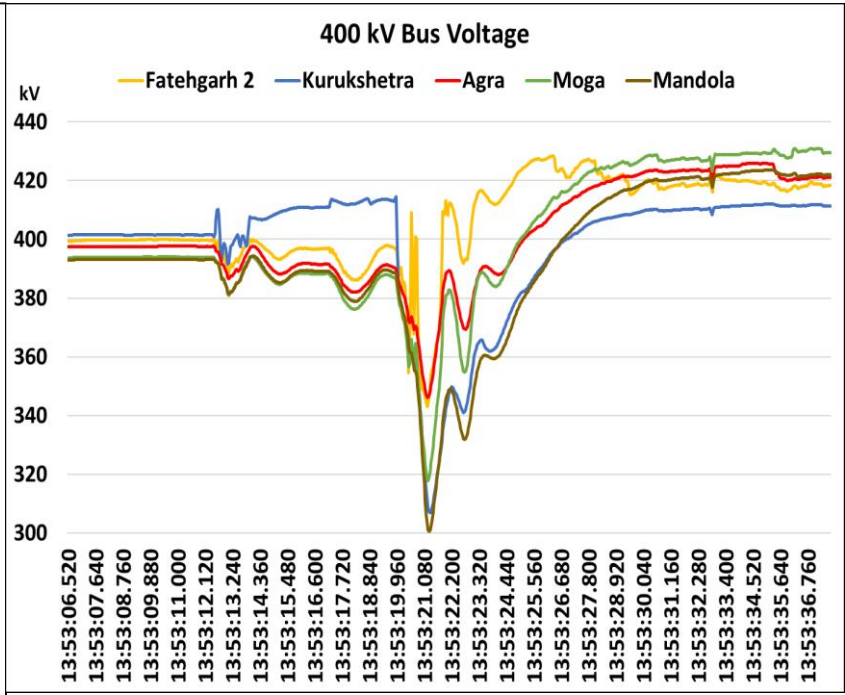
   - Reduction in **NR RE generation of approx. 2870 MW.**
   - **12 conventional units tripped**, aggregating gen is **6775 MW,** majorly on over frequency.

3. High voltage scenario due to offloading of transmission network.

   - A **total of 23 (nos) transmission lines** (765kV and 400kV) **tripped on OV**, causing a partial blackout at the 765/400kV Aligarh(PG) S/s.

4. Load that reduced during the **low voltage at 13:53 hrs** began to recover gradually, the grid experienced another **low voltage scenario at 14:05 hrs**.

5. Frequency rise from **50.03 Hz to 50.68 Hz**, recovered back to 50.00 Hz within **~ 6 minutes**



Voltage touched 300 kV

- A Committee (CEA, NRPC,GRID-INDIA, CTUIL, POWERGRID) was constituted by MOP to look into the issues of this multiple tripping incidents.
- The committee has submitted the detailed analysis report to MOP

Major Observations

HVDC Link Vulnerability (N-4 Scenario):

- Tripping of +/-800 kV HVDC Champa-Kurukshetra link (4500 MW) triggered load loss event.
- Localized storm caused jumper swing and flashover.
- No redundancy in DMR.

Protection Philosophy Review:

- Over 30 trippings of HVDC link from Jan-Jun 2024. Detailed fault analysis and remediation needed to enhance reliability.

Voltage Collapse and Reactive Power Drawl:

- Significant voltage drops across Northern Region.
- Reactive power absorption increased, exacerbating voltage issues.

Load Behavior Analysis:

- Voltage reduction caused stalling of induction motors: total 16.5 GW load Reduced in NR.
- Stalling of motors at comparatively higher voltages (~0.85 - 0.9 p.u. voltage).

Outage of Generating Stations:

- Approximately 2800 MW of RE generation was reduced with around 1500 MW recovering within 4 minutes
- 16 Conventional Generating Units tripped, majorly on over frequency.

Reactive Power Support:

- Heavy reactive power drawl by loads are observed.
- Many RE plants have opposite response

High Voltage Scenario:

- Total 23 (no.) of transmission lines (765kV and 400kV) tripped on OV, causing a partial blackout at the 765/400kV Aligarh(PG) S/s.

Frequency Response :

- Inadequate Response:
  - More than 50% capacity in inter-state generators
  - more than 85% capacity of the intra-state generators

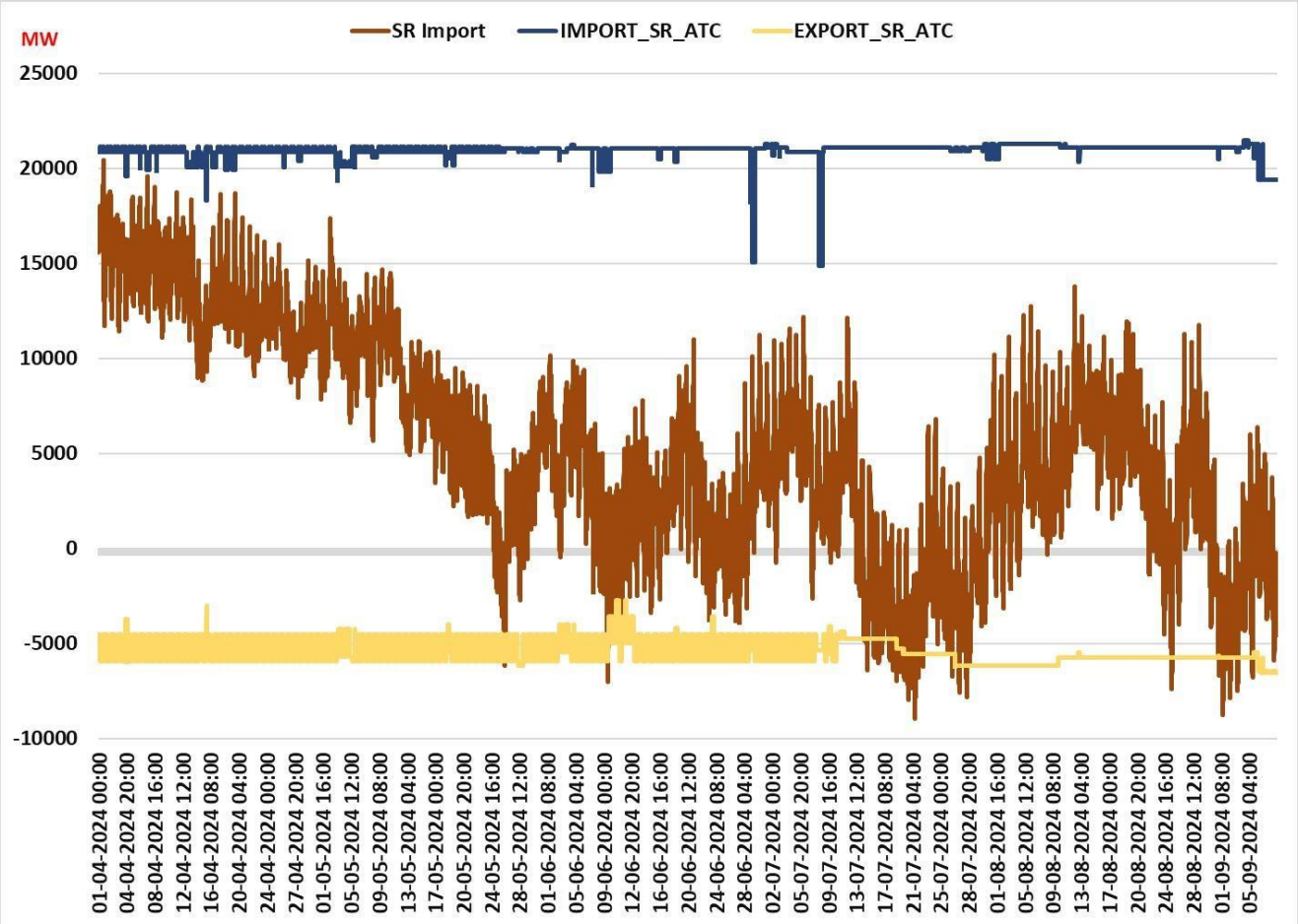
Coordination and Communication: Timely report submissions and communication are essential.

Recommendations of the Committee

- **Reduced reliability of HVDC Link:** Review of protection schemes and filter switching logic
- **Fault in HVDC Lines:** Review of transmission line design including cross arms, jumpers, etc.
- **Load Behaviour:**
  - Sudden voltage drop caused stalling of induction motor loads led to a reduction in active power transfer to key load centers in the Northern region (also validated using dynamic simulation studies).
  - The stalling of motors at high voltage (0.85-0.9 pu) is to be investigated and the motors serving load shall be compliant with IS/IEC.
- **Planning for dynamic reactive power sources near load centers based on load composition**
- **Frequency Response by Generating Units & Importance of non-pit-head-based generators near load centers for providing grid support during such events**
- **Compliance of CEA Standards by Renewable Generating Plants**
- **Reactive Power Management by SLDC and DISCOMs**
- **Review of Overvoltage gradings of EHV transmission lines**
- **Amendments in Existing Regulations :**Provisions related to different emerging types of loads (Electrolysers etc.)

Major Constraints in Inter-regional Network

Export by Southern Region (SR Import)



Constraint in SR Export Corridor

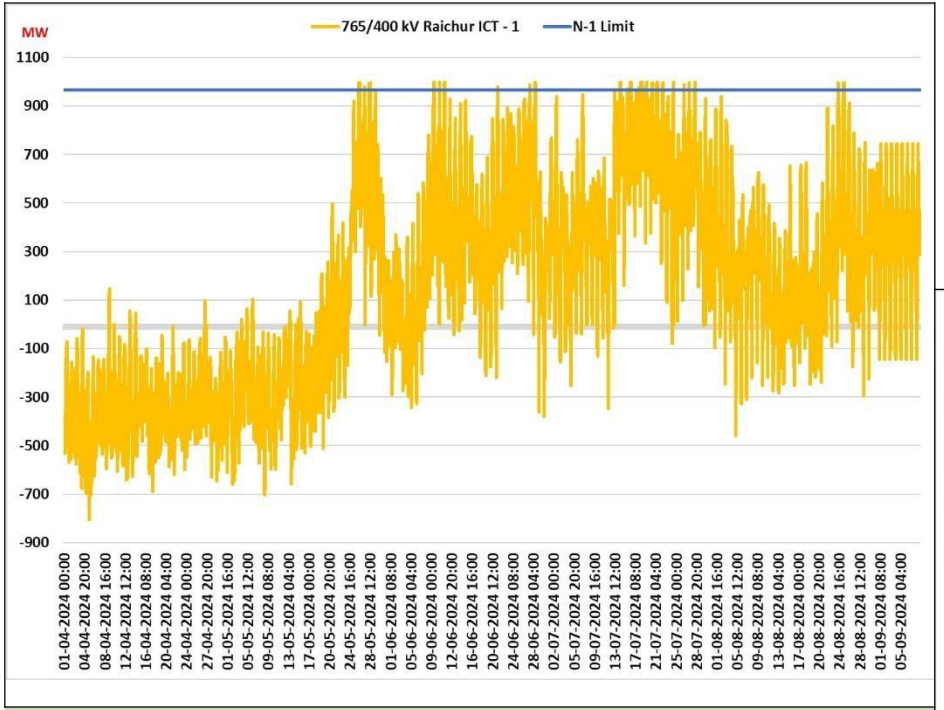
Sl No	Corridor	Time	TTC (MW)	ATC (MW)	Limiting Constraint
1	SR-WR	00 – 06 Hrs & 18 – 24 Hrs	7200	6550	➢ Angular separation between Kudgi & Kolhapur (PG) under N-1 touches 30 deg. ➢ N-1 Contingency of 765/400 kV, 1500 MVA ICTs at Raichur - PG will overload the other circuit. ➢ N-1 Contingency of 400 kV Kolhapur – Karad D/C will overload the other circuit. ➢ N-1 non-compliance of 2*1500 MVA, 765/400 kV ICTs at Section– B at Raigarh – PS (Kotra) with operation of HVDC Raigarh – Pugalur Bipole – 1 in SR-WR direction ➢ Restriction in power order of HVDC Gazuwaka(SR to ER) to maximum set point of 700 MW for solar hrs and 500 MW for non-solar hrs against the rated capacity of 1000 MW
		06 – 18 Hrs	7100	6450	
2	SR Export	00 – 06 Hrs & 18 – 24 Hrs	6400	5750	
		06 – 18 Hrs	6400	5750	

TTC/ATC for SR – WR & SR Export corridor is being regularly reviewed by NLDC and the figures are updated with any change in LGB or network topology including planned and forced shutdowns.

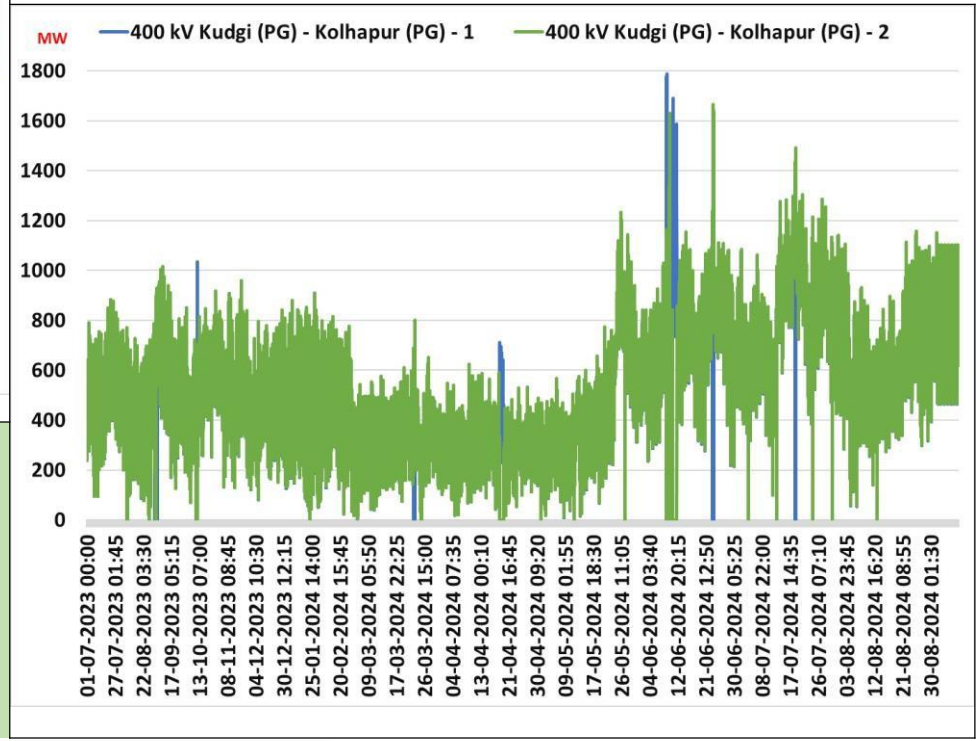
https://posoco.in/en/market/monthly-atc-inter-regional/inter-regional-2024-25/

Page 34

Inter-regional Transmission Constraints for SR Export Corridor



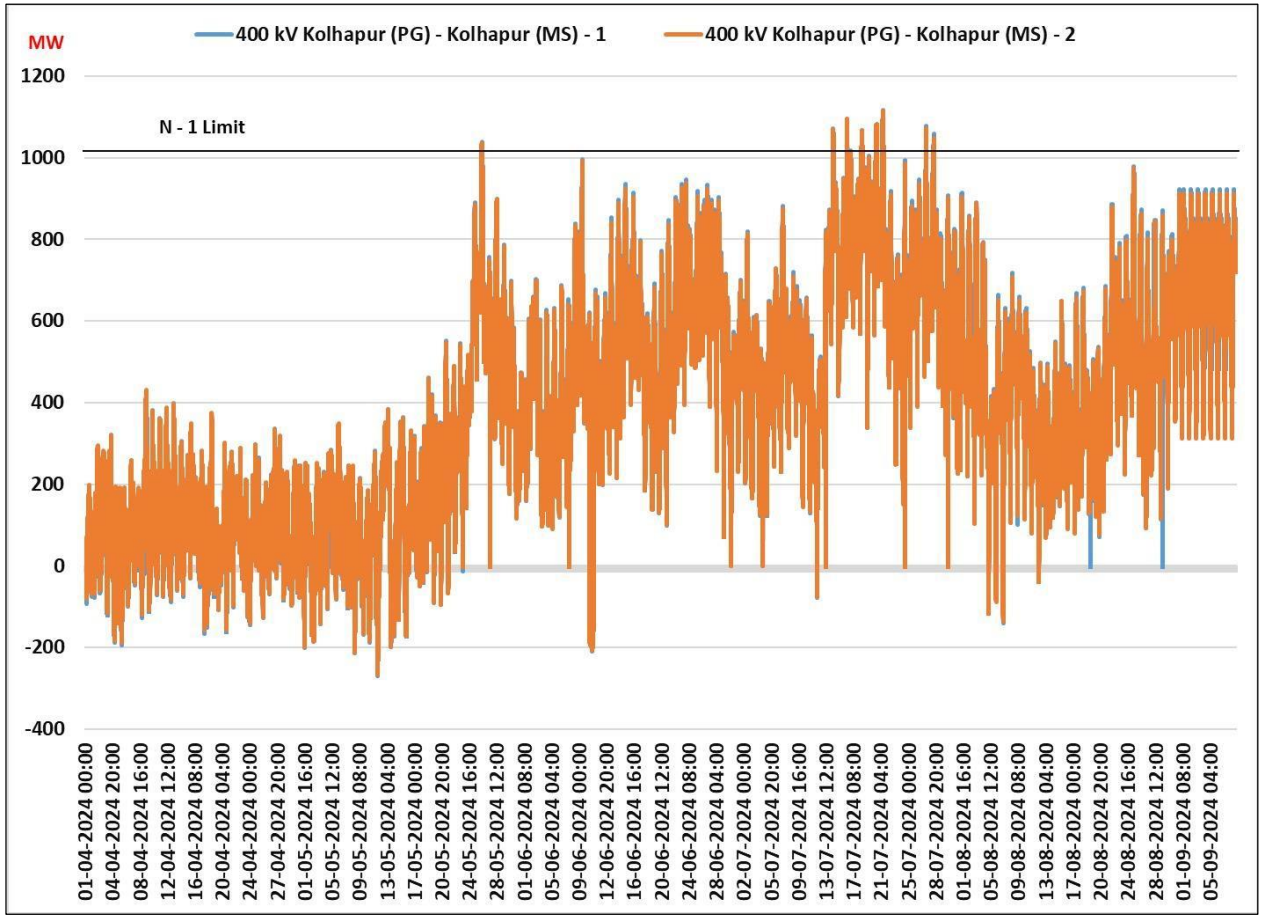
*Up to 8th September 2024



- **2x1500 MVA, 765/400 kV ICTs at Raichur – PG remain critically loaded and N-1 non compliant during peak SR Export Periods**
- **400 kV Kudgi (PG) – Kolhapur (PG) (Quad Moose) also remain loaded above 1100 MW on a continuous basis with angular separation crossing 20-25 degrees under N condition.**

Page 35

Maharashtra Network Constraints in SR Export Corridor

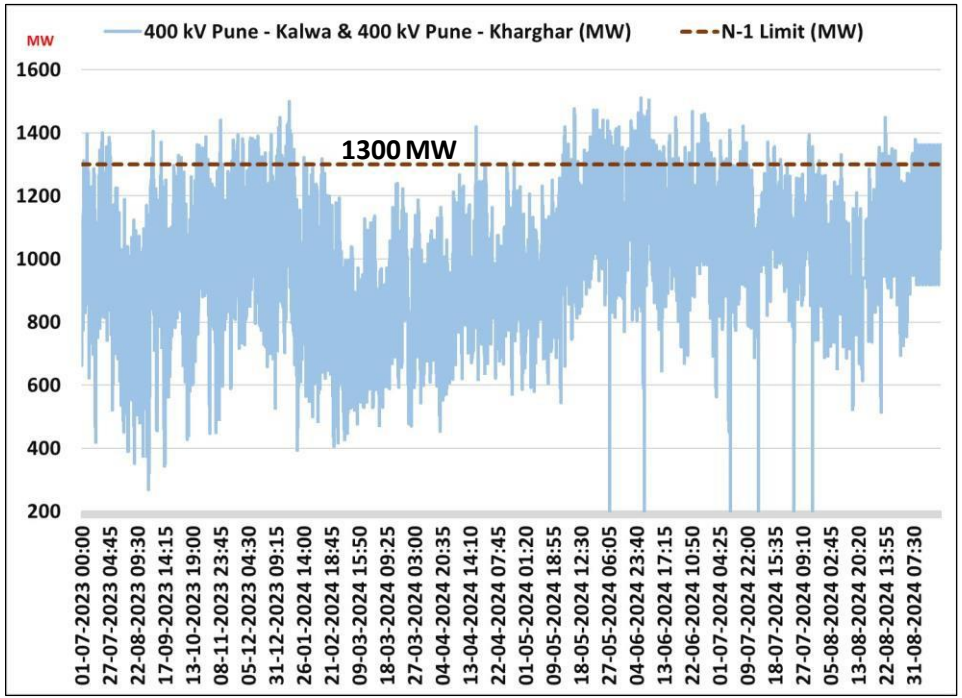


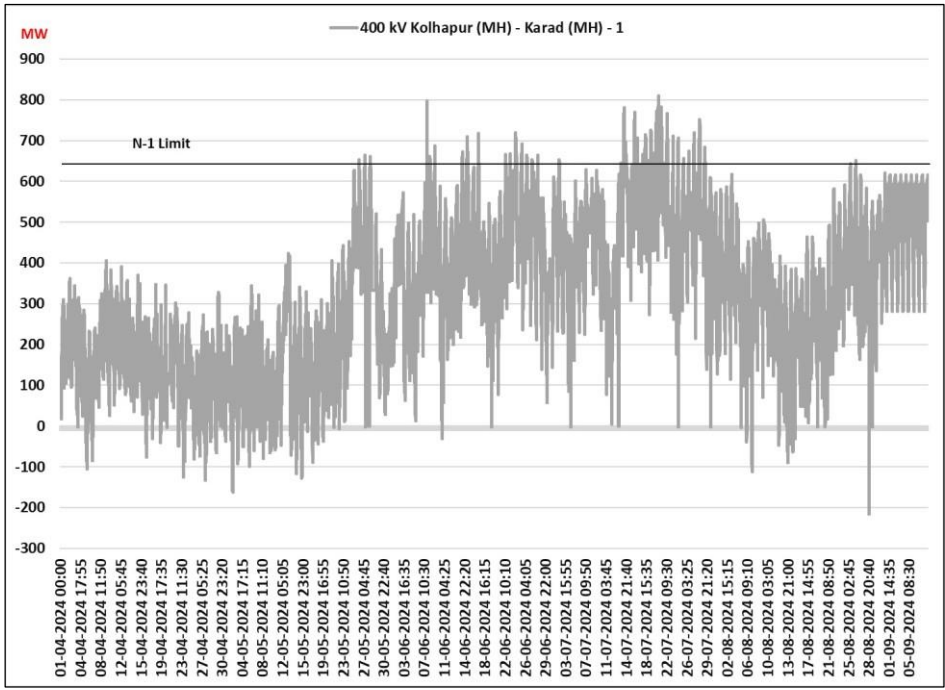
*Up to 8th September 2024

Heavy Loading of 400 kV Kohapur (PG) – Kolhapur (MH) D/C Under Peak SR Export Periods

Page 36

Maharashtra Network Constraints in SR Export Corridor





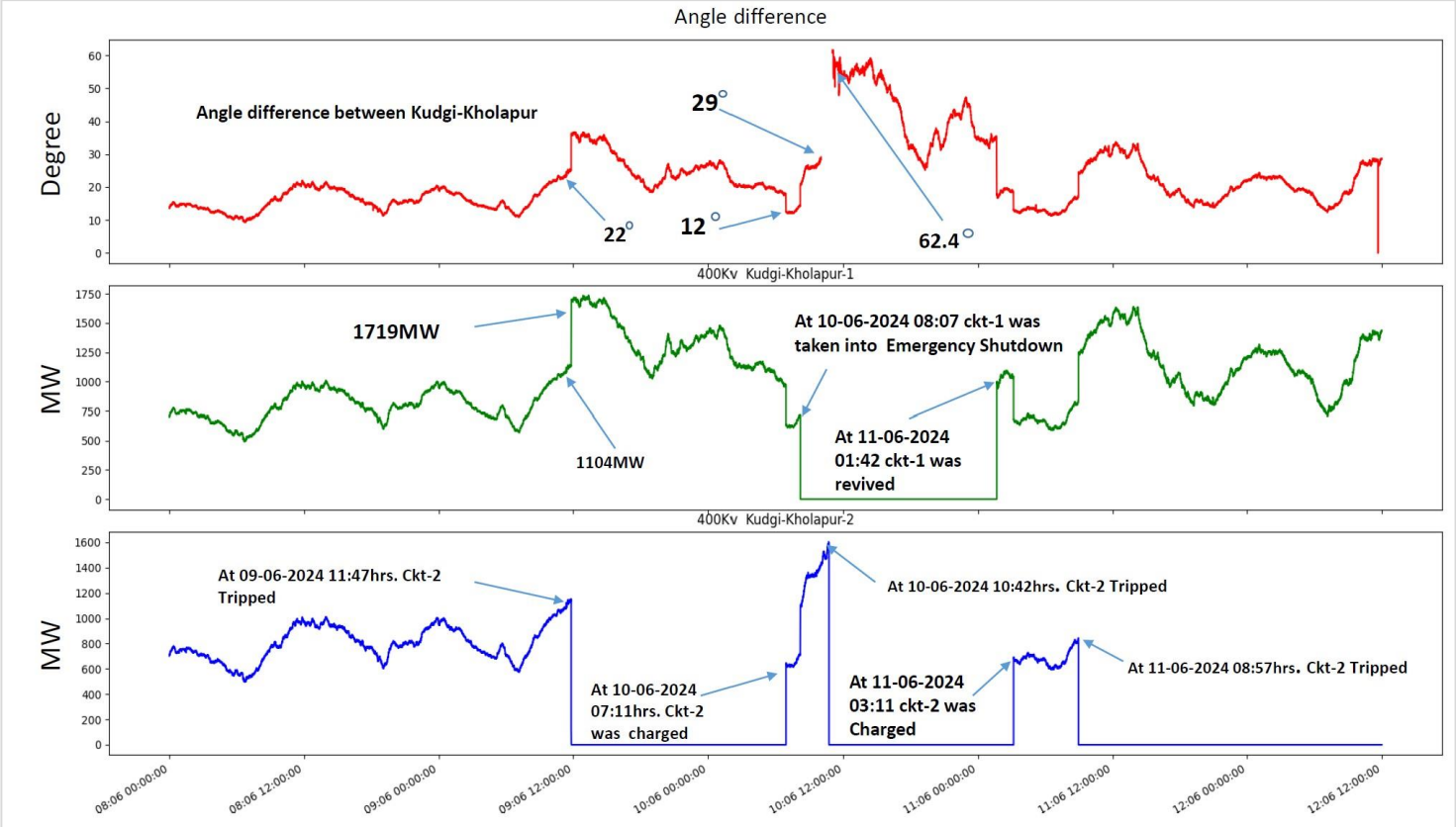
*Up to 8th September 2024

400 kV Kolhapur – Karad D/C, 400 kV Pune – Kalwa & Pune – Kharghar and other lines in the Western Maharashtra remain critically loaded and N-1 non compliant during peak SR Export Periods

Page 37

Real-Time Angular Difference Between Kudgi (PG) and Kolhapur(PG)

Plot of the Angular difference between Kudgi (PG) and Kolhapur (PG) on 9th,10th , 11th June 2024 during the outage of 400 kV Kudgi (PG) – Kolhapur (PG) - DC



Steps Taken by NLDC/SRLDC/WRLDC to Control Real Time Congestion

- Regulating the HVDC links in WR-SR/ER-SR corridors to control the loading of highly loaded lines
- Issue of under-drawl and over-drawl violation messages to states in the Southern Region and Western Region by NLDC/SRLDC/WRLDC and continuous follow-up by RLDCs with SLDCs for adhering to the schedule.
- During real-time violation of TTC/ATC in the SR Export corridor, real-time system operators in the NLDC control room take the following action points through ancillary services.
  - **User ATC limits in SCED for SR Export Corridor by NLDC Control Room**
  - **Exclusion of SR Plants from the SCED portal to prevent any SCED up instruction**
  - **Exclusion of SR Plants from the TRAS portal while giving TRAS up instruction by NLDC control room.**
  - **Tie line bias (TLB) mode of operation of AGC**
- Generation reduction in ISGS (particularly in SR) thermal power stations to minimum turn down level during Solar hours/high RE injection
- Issuance of congestion warning notices to the concerned constituents

Page 39

Challenges and Way Forward for Managing SR Export Congestion

➢ **Constraints in the Operation of Several HVDC Links**

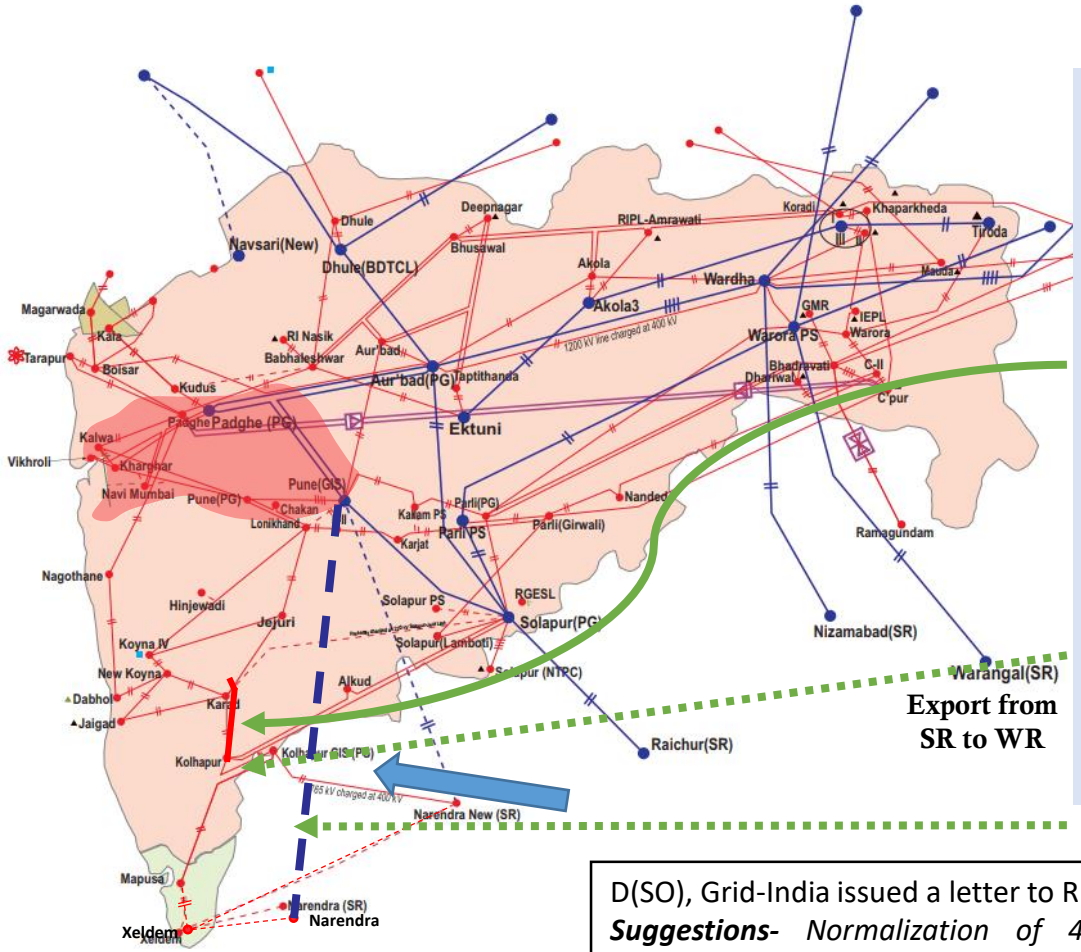
- **HVDC Raigarh – Pugalur in SR-WR direction**: Constraint in ICTs at Raigarh (Kotra) End.
- **HVDC Talcher – Kolar at minimum power order:** Constraint in the Loading of 400 kV Talcher – Meramundali – 1 & 2
- **HVDC Gazuwaka in SR – ER direction at max power order**: Constraint in 220 kV Network in Odisha
- **Delay in the commissioning of 765 kV Narendra (PG) – Kolhapur (PG) – D/C and constraints in Western Maharashtra due to significant delay in commissioning of planned intra-state transmission system**

➢ **Flexible operation of intra-state thermal power plants in Southern Region**

State	Technical Minimum	Regulations/ Data Source	Remarks
Karnataka	55%	KERC (Merit Order Despatch and Optimization of Power Purchase Cost) Regulations, 202410	Includes compensation mechanism for part load operation Two units operating with Technical minimum of 40% (intimated in 210th SR OCC meeting)
Andhra Pradesh	520 MW & above: 55% Upto 500 MW: 71.4%	Minutes of 210th Meeting of Southern Region Operation Coordination Committee (OCC)	-
Tamil Nadu	600 MW: 60%, 210 MW: 80%	Minutes of 210th Meeting of Southern Region OCC	-
Telangana	58-67% for different units	Minutes of 210th Meeting of Southern Region OCC	-

➢ **CTUIL may Share the dynamic model for Raichur-Pugalur HVDC reverse flow studies (upgradation of HVDC reverse capacity from 3000MW to 6000MW).**

Maharashtra constraints leads to congestion in IR:



Large-scale integration of RE generation, mainly in the Gadag/ Koppal area in Karnataka and in the Southern Region.

Constraints observed

- Kolhapur(PG) – Kolhapur (MSETCL) – Karad (MSETCL)

To relieve constraints

- Reconductoring of 400 kV Kolhapur(PG) – Kolhapur (MSETCL) 400kV D/c line with HTLS: Completed on 31st Aug'23.
- Expedition of planned intra-state transmission system
- Narendra – Pune 765kV D/c : Dec'24

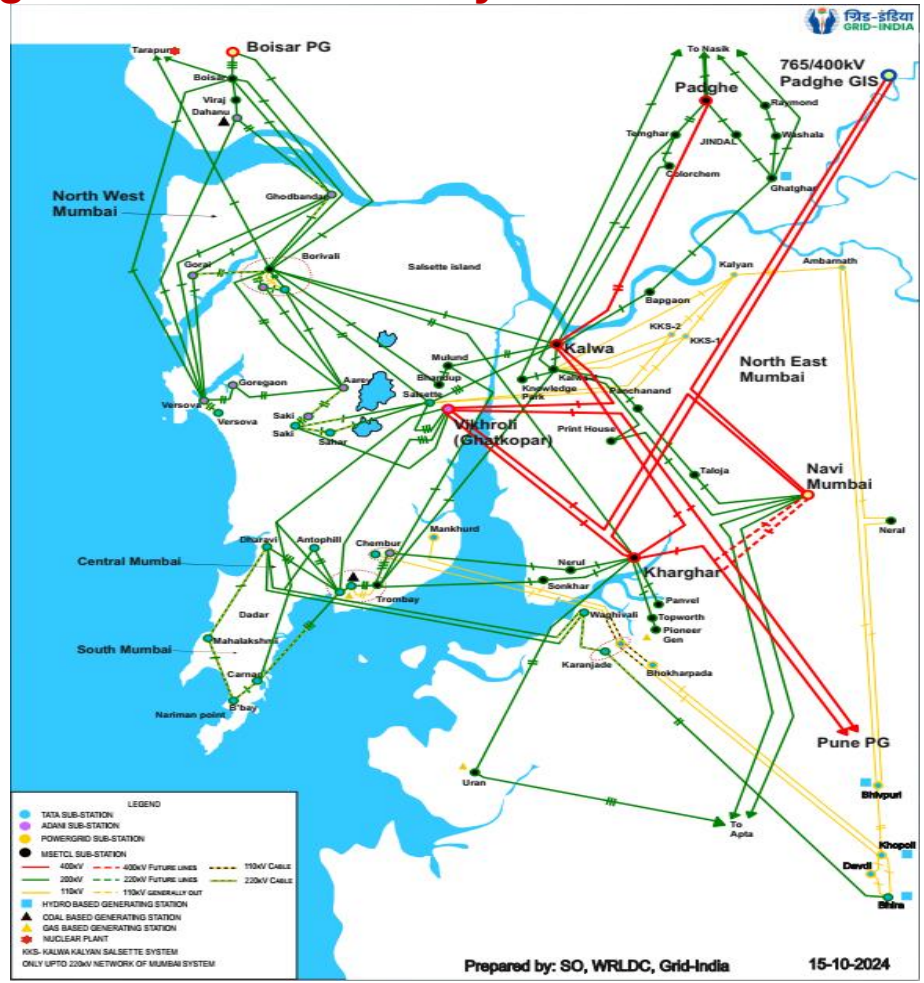
D(SO), Grid-India issued a letter to RPCs/CTUIL/POWERGRID/MSETCL/ATL on 31.8.23:-
Suggestions- *Normalization of 400 kV Solapur-Karad-S/c, charging of 220 kV Talangade/Mudshingi-Chikkodi lines & consideration of dynamic line ratings*

Observations post charging of Mumbai infeed system

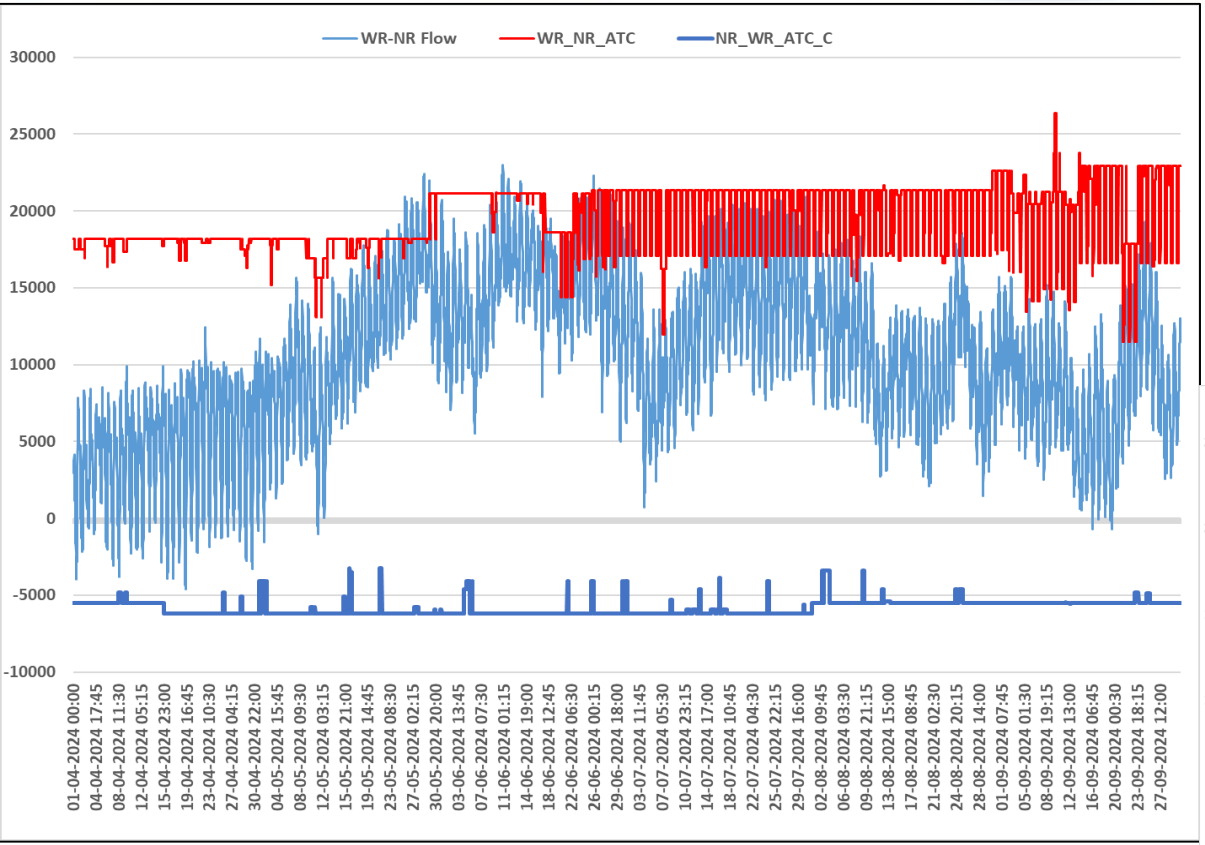
- Loading on critical corridor (Pune(GIS) -> Pune (PG) -> Mumbai Metropolitan Region (MMR) area & Padghe (Mh)-> MMR area) reduced
- Loading on Padghe(PG)-Kudus-Kala corridor also reduced
- Voltage profile in MMR area and Pune area improved
- Joint studies for reviewing of Maharashtra & Mumbai import capability was initiated (E-mailed to SLDC & STU, MSETCL)

Ongoing Works

- LILO works of 400 kV Pune(PG)-Kharghar-S/c at Navi Mumbai also in process.

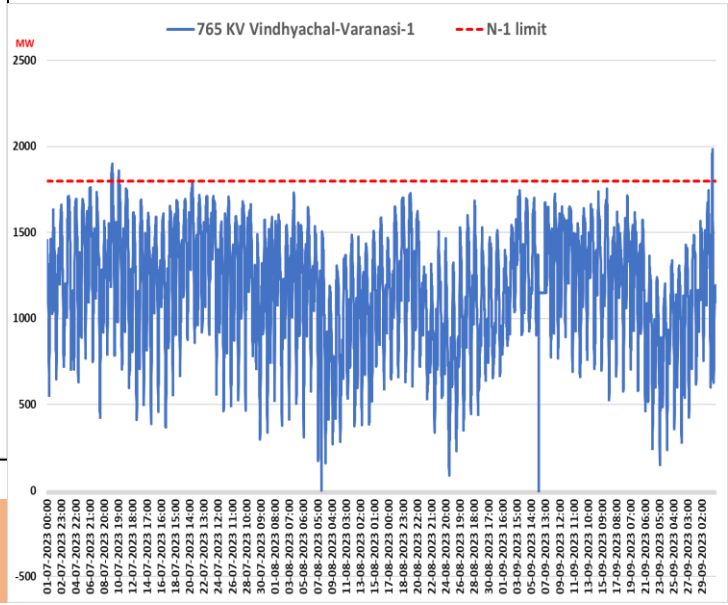


NR Import Constraints



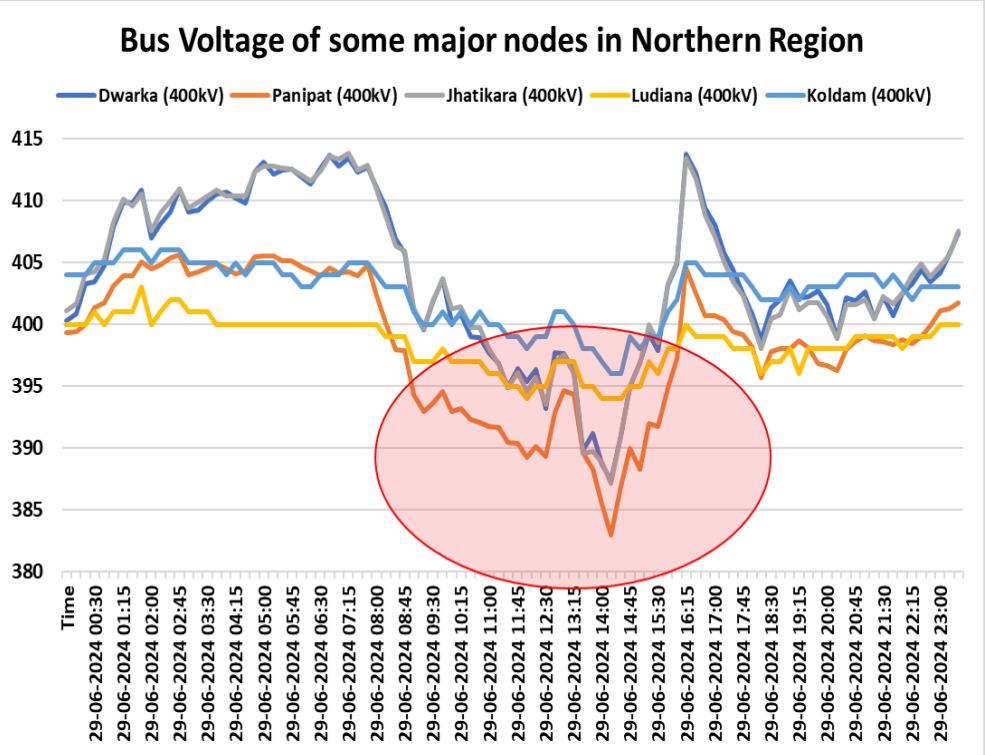
1. High WR-NR/NR Import flow has been observed in 2023-24 specially in the month of July and September

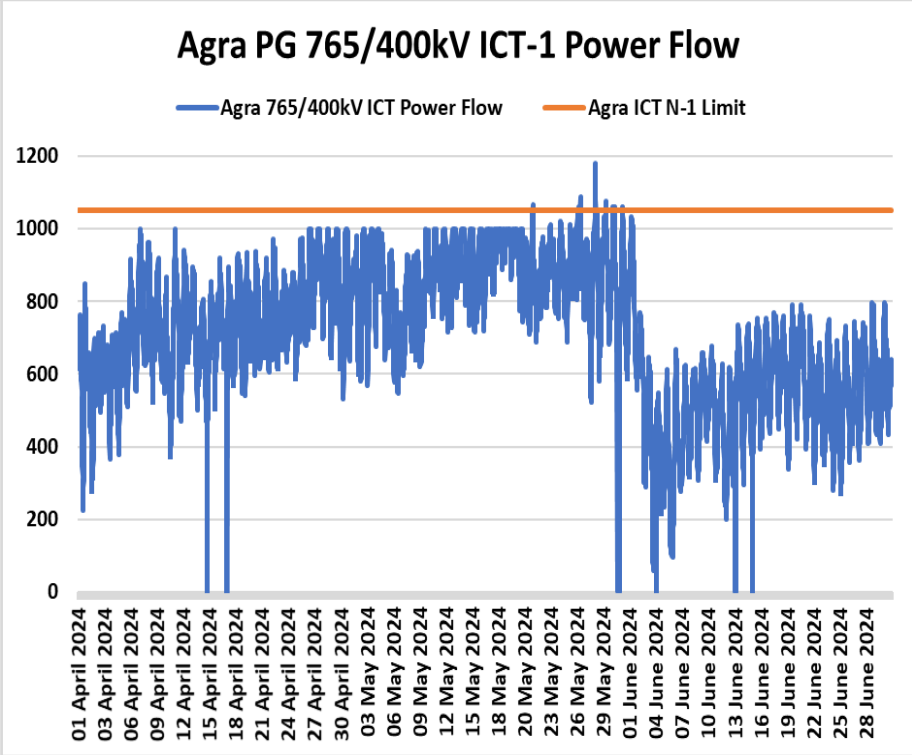
2. The loading on 765 KV Varanasi-Vindhyachal also remained high (also exceeded its N-1 limit) during high NR Import period



HVDC Vindhyachal could not be operated from WR to NR direction for considerable period of time due to high loading of 400 KV Anpara-Obra-S/C.

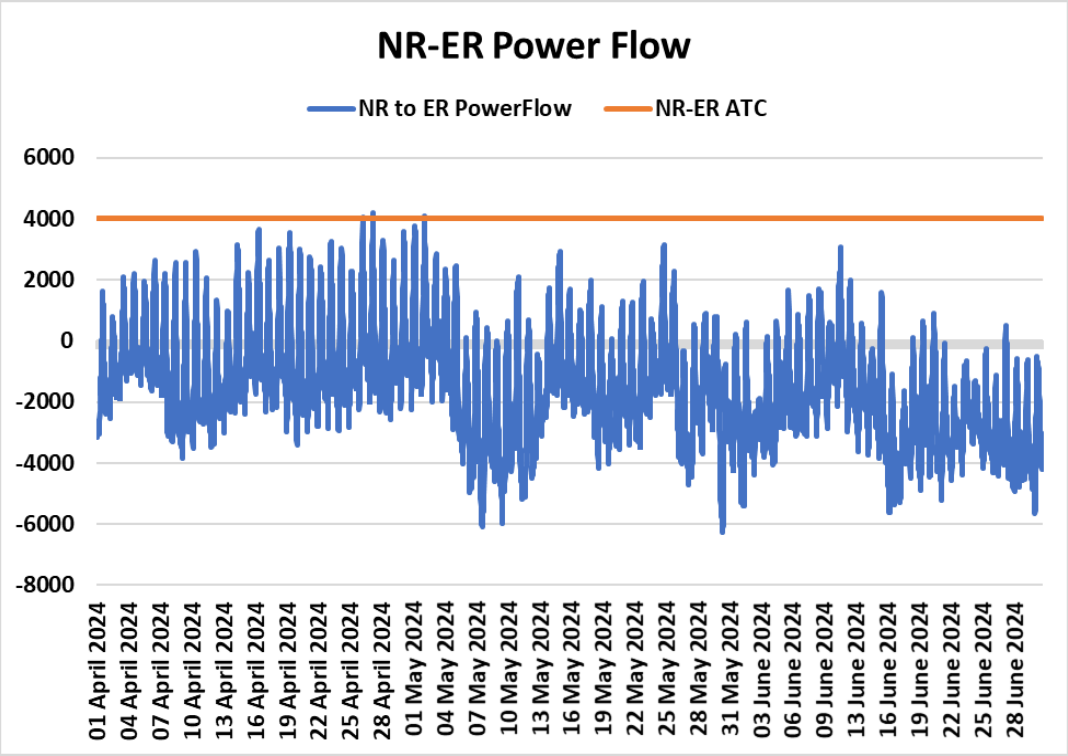
NR Import Constraints





- Low voltage were observed at major load centre points during solar hrs.
- Lack of static/dynamic reactive power support at the intra-state level.
- TTC/ATC figure of WR-NR/NR Import corridor is being declared separately for solar hrs considering the constraints of low voltage.
- The loading of 2*1500 MVA ICT at Agra were N-1 non compliant during high NR Import period. The loading reduced after reversal of HVDC BNC-Agra (from NR->NER to NER->NR). This was done based on real time grid conditions

NR Import Constraints



- High NR to ER flow observed in the month of April particularly during solar hours primarily due to high RE in NR and back down of thermal generation in the Eastern Region during peak solar hours.
- This has aggravated the constraints in the Eastern Region (400 kV Kahalgaon – Farakka D/c & 400 kV Farakka – Sagardighi D/c).

➢ With reduced power flow from Eastern to Northern Region, the WR-NR corridor was observed to be stressed during non-solar peak demand hours.

Shifting of Rihand stage-III generating station (2x500 MW) to Northern region

In order to relieve the loading of 765 kV Vindhyachal-Varanasi and facilitate higher import by NR, following interim network rearrangement was carried out

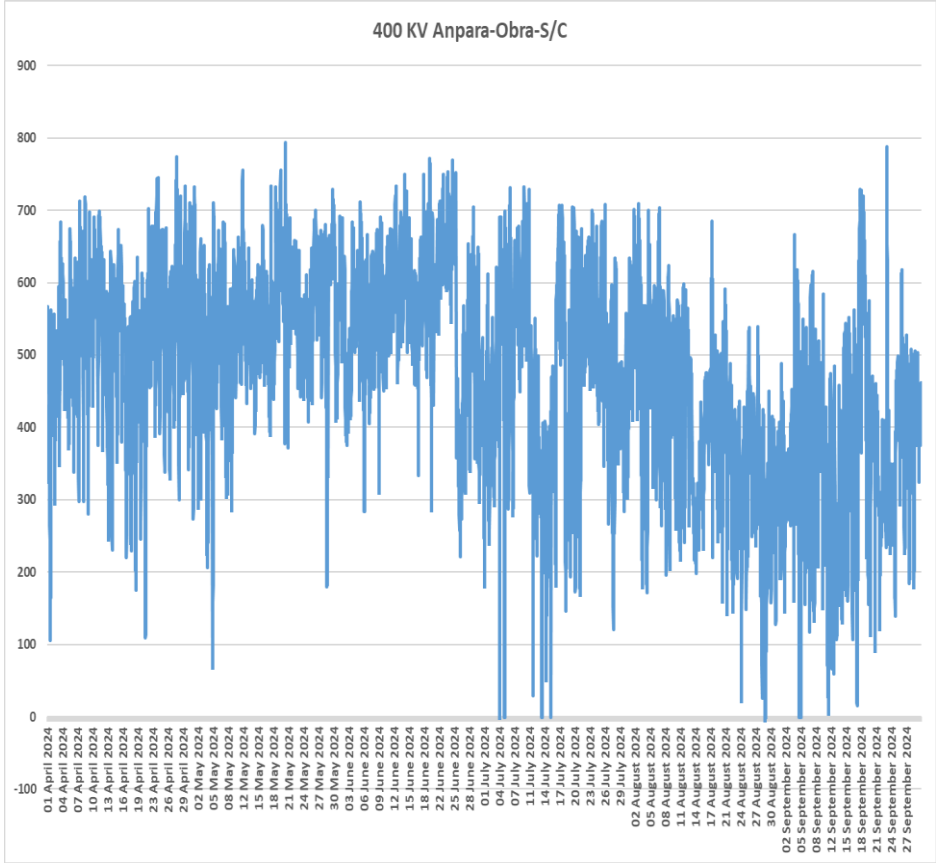
- **Shifting of Rihand stage-III generating station (2x500 MW) to NR** by closing the bus coupler between Rihand-III and Rihand-I & II and disconnecting Rihand-III from WR by opening 400 kV Rihand stage-III - Vindhyachal PS D/C .
- **Opening of 400 kV Singrauli-Anpara S/C** (also, as per the recommendations of the 1st Meeting of Northern Regional Power Committee (Transmission Planning) to control the high fault levels in Anpara – Singrauli – Rihand complex)

Post shifting observations

- Relief of ~250 MW in loading of each circuit of 765 kV Vindhyachal - Varanasi D/C observed.
- Increment in WR-NR TTC/ATC of the order of ~2450 MW after the implementation of above arrangement

Constraint in HVDC Vindhyachal B2B

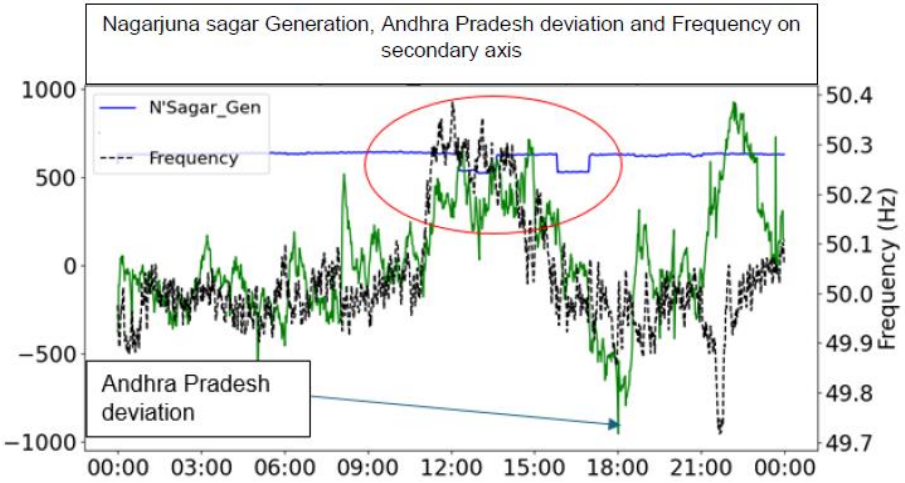
- It is observed that due to high loading of lines in Anpara complex, particularly 400 kV Anpara – Obra S/C (loading more than 700 MW), real-time constraint is faced in increasing the power order of HVDC B2B V'chal in WR to NR direction.
- UPPTCL needs to explore the possibility by shifting some load, keeping generation at 220kV Obra or by reconfiguration of existing network to mitigate this constraint.
- Also, as per the recommendations of the 1st Meeting of Northern Regional Power Committee (Transmission Planning) (NRPCTP), 400 kV Singrauli – Anpara opened to control the high fault levels in Anpara – Singrauli – Rihand complex.
- Rihand-III units are also shifted to the northern region to relieve constraints in WR-NR corridor (765 KV Vindhyachal-Varanasi)
- Even after opening of this line the loading of 400 kV Anpara – Obra remains on the higher side.

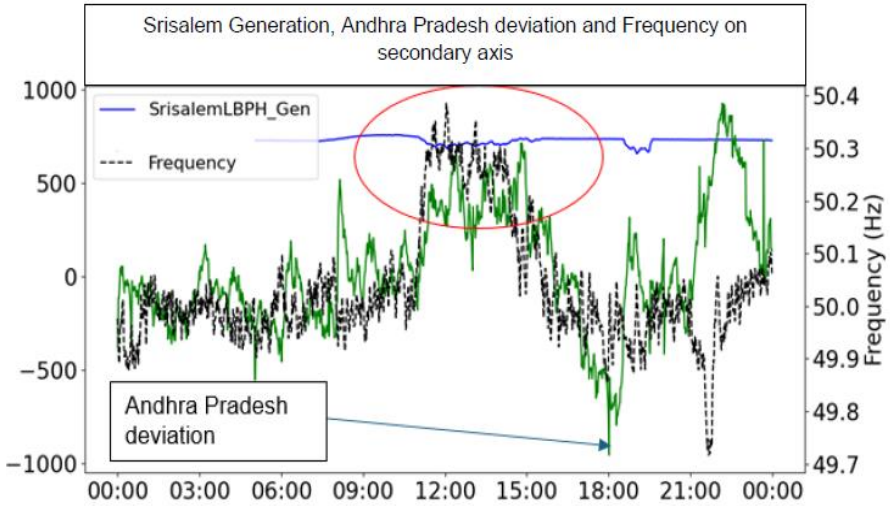


Constraint in HVDC Mundra-Mahendragarh:

- HVDC Mundra - Mahendragarh needs to be operated at maximum capacity **(2500 MW)** in WR to NR direction during high NR import period to relieve loading on ac lines .
- Due to issue in DC CMD (current measurement device) of pole-2, HVDC Mundra – Mahendragarh Pole-2 power order was restricted to a max. 500 MW for over a month.
- This had resulted in restriction in total HVDC power order to 1750 MW.
- Apart from this, there have been multiple outages of the HVDC in the last 2-3 months due to various reasons.
- Restriction in max. power order of HVDC Mundra – M'garh has also resulted in reduction in WR-NR and NR Import TTC/ATC.

- Increased reservoir heads in Nagarjun Sagar and Srisailam resulted in inflexibility to use the power plants for pumping during Solar hours, as they have to be kept in majority generating mode.
- Even during the congestion periods from Southern Region to the Western Region, the pumped hydro stations had to be operated in generating mode, and created grid security challenges



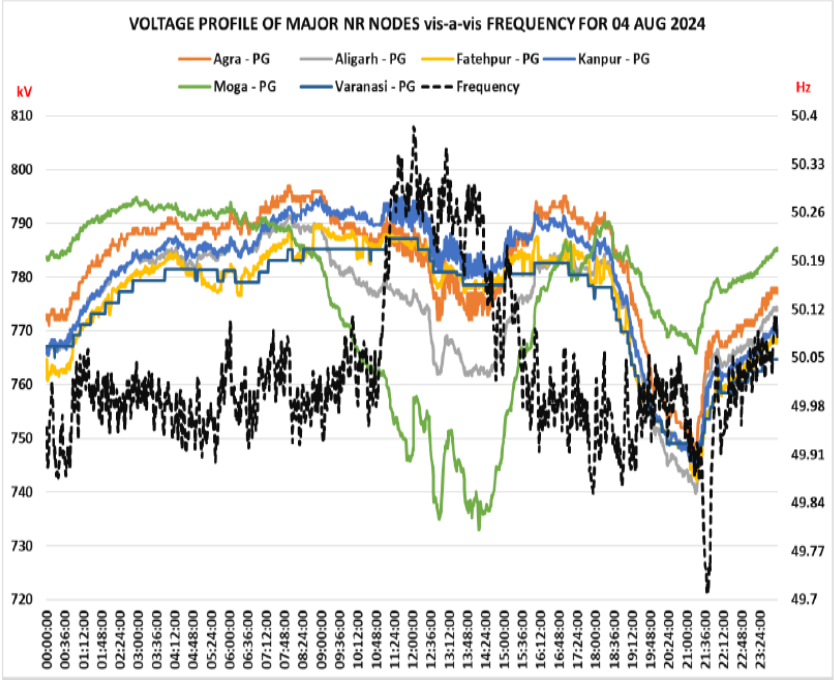


PSP Plants Generation at on Nagarjuna sagar, Srisalem day 04th –August 2024

PSP not working in Pumping mode

SCHEMES	STATE	INSTALLED CAPACITY
Kadana	Gujarat	4x60
Sardar Sarovar Project	Gujarat	6x200

- Backing down of intra-state generation in few states like Punjab may have been constrained on account of intrastate transmission constraints since actual drawl was around ATC limit for Punjab import. I
- During the peak solar hours, voltage levels at major load centers within the NR were observed to be on the lower side.
- This was primarily due to heavy reactive power drawl by states and inadequate static and dynamic reactive power support at the intra-state level.
- Specifically, the voltage at the 765 kV bus at Moga station in Punjab dropped to 730-740 kV. Punjab continued to under-draw from the grid during periods of high frequency.
- A reduction in internal generation by Punjab could have raised concerns about increased power drawl from the Inter-State Transmission System (ISTS) grid, which could exacerbate voltage dips at critical buses.



Report link

https://posoco.in/en/download/report-on-high-frequency-operation-for-4th-11th-and-25th-aug-2024/?wpdmdl=59532

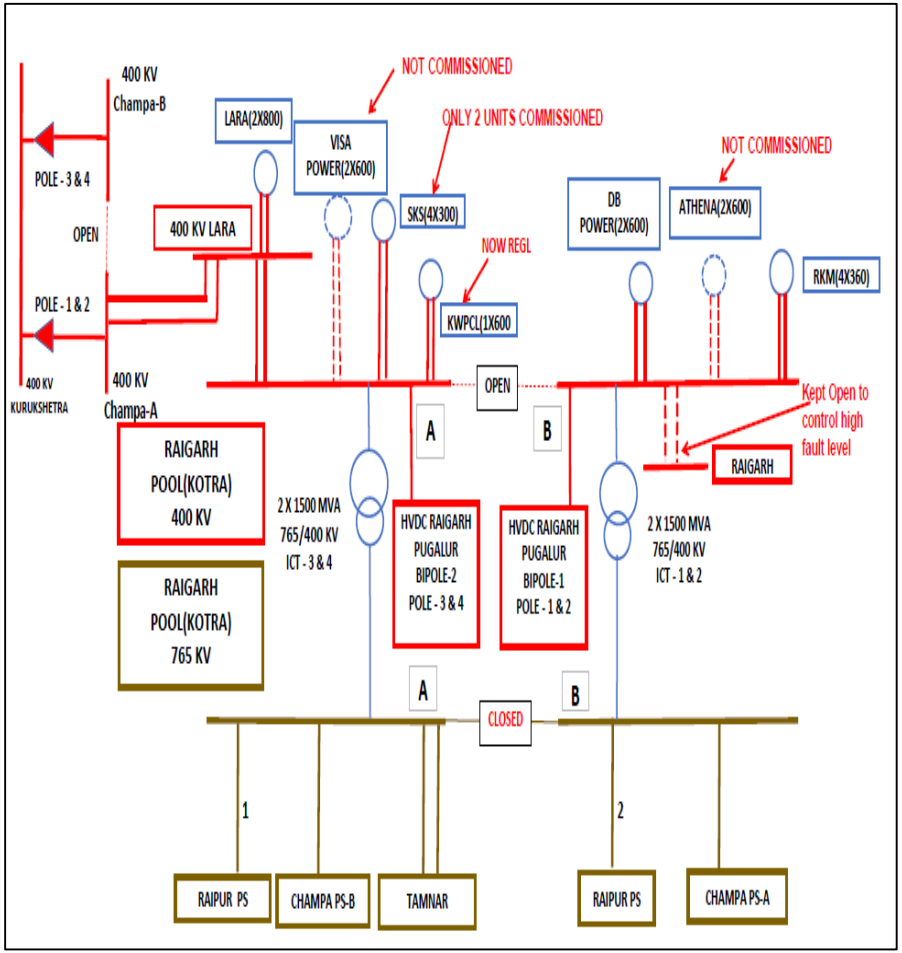
Thank you !!

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.
- N-1 violation observed in,
  - 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 of Ckt – 1 completed & Ckt – 2 completed)**
  - 2x1500 MVA, 765/400 kV Ektuni ICTs **(Inter trip scheme implemented. Installation of 1x1500MVA ICT-III at Ektuni to be expedited)**
  - 400 kV Pune (GIS)-Pune (PG)-Q/c lines
    - **220kV level at Pune (PG)(GIS) and Installation of 2x500MVA, 400/220kV ICTs at Pune (PG)(GIS) & LILO of both ckts of 220kV Khed City – Ranjangaon D/c line at Pune GIS with high capacity conductor**
    - **LILO of one ckt of Lonikand-I–Jejuri 400 kV D/c line at Pune (PG)(GIS) with high capacity conductor along with reconductoring of Lonikand-I –Jejuri line section**
  - 400kV Pune(PG)-Kharghar & 400kV Pune(PG)-Kalwa S/C line & 400 kV Padghe- Kalwa D/C
  - **3x500 MVA, 400/220kV ICTs, 400 kV Kharghar-Vikhroli-D/c & LILO of 220 kV Trombay - Salsette-D/c at Vikhroli completed**
  - **Commissioning of remaining planned system at 400/220 kV Navi Mumbai & Vikhroli completed**
  - 400 kV Pune(PG)-Chakan S/C

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). (1st WRPC(TP): Reconductoring with quad moose ampacity conductor is agreed with connectivity of Lara Stage-II)**
- 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



Intra-state Constraints in Rajasthan Network

- N-1 Constraints in several ICTs
- Severe low voltage & huge MVAR drawl at RVPN during winter months (even below 0.8 at number of 400/220kV ICTs)
- **37 Nos.** of Grid disturbances/incidents in 2023 in Rajasthan (intra-state) network
- **23 Nos. of load loss events & 12 Nos. of generation loss events in 2023.**

ICT Constraints

N-1 Contingency of 3*315 MVA ICT at Chittorgarh	3rd 315MVA ICT at Chittorgarh first time charged on 06.01.2024. Even after capacity augmentation at Chittorgarh, 3*315MVA ICTs are near to N-1 non-compliance. Rajasthan STU has planned and implemented SPS at these locations. (except Bhilwara) New 1*500MVA ICT under bidding at these S/s by RVPNL. As per latest information shared by RVPN, bids for new 500MVA transformers at Ajmer, Bikaner, Hindaun, Merta, Babai and Jaisalmer-2 substations will be opened on 22.01.2024.
N-1 Contingency of 2*315+1*500 MVA ICT at Bassi	
N-1 Contingency of 2*315 MVA ICT at Jodhpur	
N-1 Contingency of 2*315 MVA ICT at Bhinmal	
N-1 Contingency of 2*315 MVA ICT at Ajmer	
N-1 Contingency of 2*315 MVA ICT at Bikaner	
N-1 Contingency of 2*315 MVA ICT at Merta	
N-1 Contingency of 2*315 MVA ICT at Hindaun	
N-1 Contingency of 1*315+1*500 MVA ICT at Bhilwara	

Low Voltage Issues

Low voltage issues at Hindaun , Alwar, Bhinmal Voltages reaching 310kV at Alwar (400kV), 360 KV(Bhinmal) and 325kV at Hindaun (400kV). Similar poor profile at 220kV side also.	New 400/220kV Dholpur S/s likely to provide some relief, however approved by CEA on 27th Jan 2023, so issue likely to persist for next 1-2 winter seasons.
	Other immediate measures required by RVPN. 400kV Bharatpur is under internal approval with LILO of 400kV Agra-Sikar.
	Severe issues observed during Dec 2022-Jan 2023 months. As discussed in 70 NRPC meeting, RVPN is being asked to run Dholpur generation, however, same is not being done by RVPN. Communications sent from NRLDC side in this regard.
Low voltage issues in RE generation pockets	Additional reactive power support devices for maintaining grid voltages within IEGC prescribed limits to be expedited (STATCOMs approved in intrastate network). Intrastate RE generators to support the grid by operating in voltage control mode.

N-1 contingency of 2x1500 MVA, 765/400 kV Ektuni ICTs	1x1500MVA ICT-III at Ektuni along with scheme to control fault level at A'bad-I / A'bad-II / A'bad-III **Interim Measures:** To control ICTs loadings, Inter trip scheme implemented at Ektuni on 16th Oct 23 involving tripping of transmission lines (Tripping of 400 kV Ektuni-Tatpitanda D/C) and manual Generation backing down at APML Tiroda, Koradi & Ratan India by SLDC. **Permanent Solution:** Installation of 1x1500MVA ICT-III at Ektuni
N-1 contingency of 400 kV Pune (GIS)-Pune (PG)-Q/c lines	**Interim Measures**: Presently managed with load trimming scheme for overloading of any of the 4 ckts above 1300 A. **Permanent Solution:** Creation of 220kV level at Pune (PG)(GIS) and Installation of 2x500MVA, 400/220kV ICTs at Pune (PG)(GIS) & LILO of both ckts of 220kV Khed City – Ranjangaon D/c line at Pune GIS with high capacity conductor. ACOD: Dec'24 **(SCOD-June'24)** LILO of one ckt of Lonikand-I–Jejuri 400 kV D/c line at Pune (PG)(GIS) with high capacity conductor along with reconductoring of Lonikand-I –Jejuri line section. **SCOD: Apr'25.**
400kV Pune (PG)-Kharghar & 400kV Pune (PG)-Vikhroli-Kalwa S/C line	**Presently managing with LTS.** **Remedial Action:** Keeping all the generation on-bar in MMR irrespective of MOD order, facilitating outage only during holidays & load staggering days, import capability monitoring of Mumbai. Commissioning of 400/220kV Vikhroli & Navi Mumbai substations along with associated transmission system would relieve the loading on these lines and will improve reliability of power supply to Mumbai area. **Present Status:-** 220 KV Feeders from 400/220 KV Navi Mumbai charged. (220 KV N.Mumbai-Apta-D/C, 220 KV N.Mumbai-Taloja-D/C, 220 KV N.Mumbai-Print house-D/C.

Contd.

400 kV Padghe-Kalwa D/C	**Presently managing with LTS**. **Remedial Action:** Re-conductoring of 400 kV Kalwa-Padghe-D/c with HTLS was planned by MSETCL, ckt-2 re-conductoring completed and ckt-1 work is in progress. **Commissioning of 400/220kV Vikhroli & Navi Mumbai substations along with associated transmission system would relieve the loading on these lines and will improve reliability of power supply to Mumbai area.** **Status:- 220 KV Feeders from 400/220 KV Navi Mumbai charged. (220 KV N.Mumbai-Apta-D/C, 220 KV N.Mumbai-Taloja-D/C, 220 KV N.Mumbai-Printhouse-D/C**
400 kV Pune (PG)-Chakan S/C	**Presently managing with LTS.** **Remedial Measure:** 400kV Pune PG-Lonikhand S/c line LILO at Chakan would improve reliability of power supply. MSETCL may explore this option to relieve constraints.
Low voltages at Kalwa/Padghe/Pune/Chakan/Lonikhand/Solapur	Strengthening of transmission system in south-west Maharashtra is much needed.
220 kV Pune (PG)-Talegaon D/C	**Remedial Action:** - As per CTU Report on Transmission Network adequacy for the state of Maharashtra Nov-22, LILO of both ckts of 220 kV Khed City – Ranjangaon-D/c line at Pune GIS with high capacity conductor and 2x500 MVA, 400/220 kV ICTs at Pune(GIS) are expected in Dec'24**(SCOD-June'24).**

Contd.

REMEDIAL ACTION TO MITIGATE THE MAHARASHTRA CONSTRAINTS

220 kV Bableshwar-Nashik D/C line	**Remedial Action:** MSETCL to expedite commissioning of 220kV Bableshwar-Nashik D/c LILO at Sinner (SCOD- Mar-20), 2x500MVA S/s along with Nashik S/s (SCOD- Mar-21)- Work progress to be given by MSETCL 400/220 kV Pimpalgaon S/s along with transmission system was planned by MSETCL. SCOD: Apr'24
400kV Parli MH-Karjat D/c	LILO of one ckt of Lonikand-I–Jejuri 400 kV D/c line at Pune (PG)(GIS) with high capacity conductor along with reconductoring of Lonikand-I –Jejuri line section. **SCOD: Apr'25.**
400 kV Karjat-Lonikhand-II DC	LILO of one ckt of Lonikand-I–Jejuri 400 kV D/c line at Pune (PG)(GIS) with high capacity conductor along with reconductoring of Lonikand-I –Jejuri line section. **SCOD: Apr'25.**
400 kV Solapur-Alkud & Solapur-Kholapur lines	400 kV Solapur-PG-Karad presently charged as 220 kV Solapur-Jeur to be restored.
N-1 contingency of 2x315+2x500 MVA Boisar-PG ICTs	**Remedial measure:** Commissioning of 500 MVA, 400/220 kV ICT (5th). SCOD: Jan'26

BACK

Constraint in Generation Evacuation from Talcher Complex

- The generation from Talcher Super Thermal Power Plant Stage – I (1000 MW) & Stage – II (2000 MW) is evacuated through the following transmission lines,
    - 400 kV Talcher – Meramunadli – Short Line
    - 400 kV Talcher – Angul – Meramundali (Bypassed at Angul) – Long Line
    - 400 kV Talcher – Rengali D/C
    - 400 kV Talcher – Rourkela D/C
    - HVDC Talcher – Kolar Bipole (2000 MW from ER to SR)
- It may be noted that due to frequent outage of HVDC Talcher – Kolar or any other transmission element in the complex on forced outages/tripping/maintenance activities, constraints in evacuating Talcher Stages I & II generation are being faced in the lines emanating from Talcher-I particularly 400 kV Talcher – Meramundali lines.

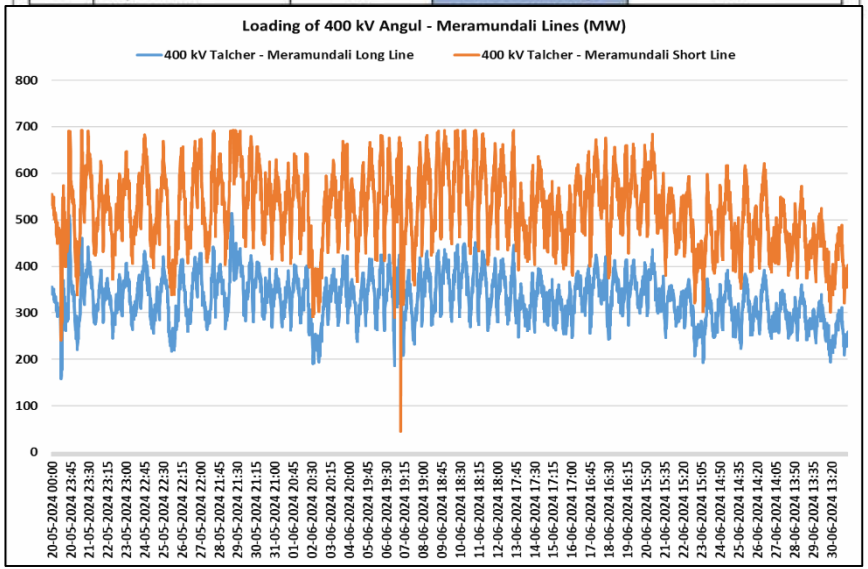
The same is handled with the help of Generation restriction at Talcher - I & II & network rearrangements in nearby stations.

- The permissible line loading limit based on the seasonal Imax setting of 400 KV Talcher - Meramundli – 1 & 2 are as follows

Reconductoring of 400 kV Talcher – Meramundali Lines D/C lines has been approved in 22nd NCT Meeting

IMAX Setting for 400 kV Talcher Meramundali circuits based on seasonal thermal rating Confirmed by PGCIL in 175th OCC of ER

Sl.No.	Months	Ambient Temperature consideration (oCelsius)	IMAX: Ampacity for 75 oCelsius conductor temperature	Line Loading (MVA) = (1.73X400X IMAX)/1000
1	November- February	40	2 X 714=1428 Amp	989
2	March-June	50	2 X 516=1032 Amp	714
3	July-October	45	2 X 631=1262 Amp	874

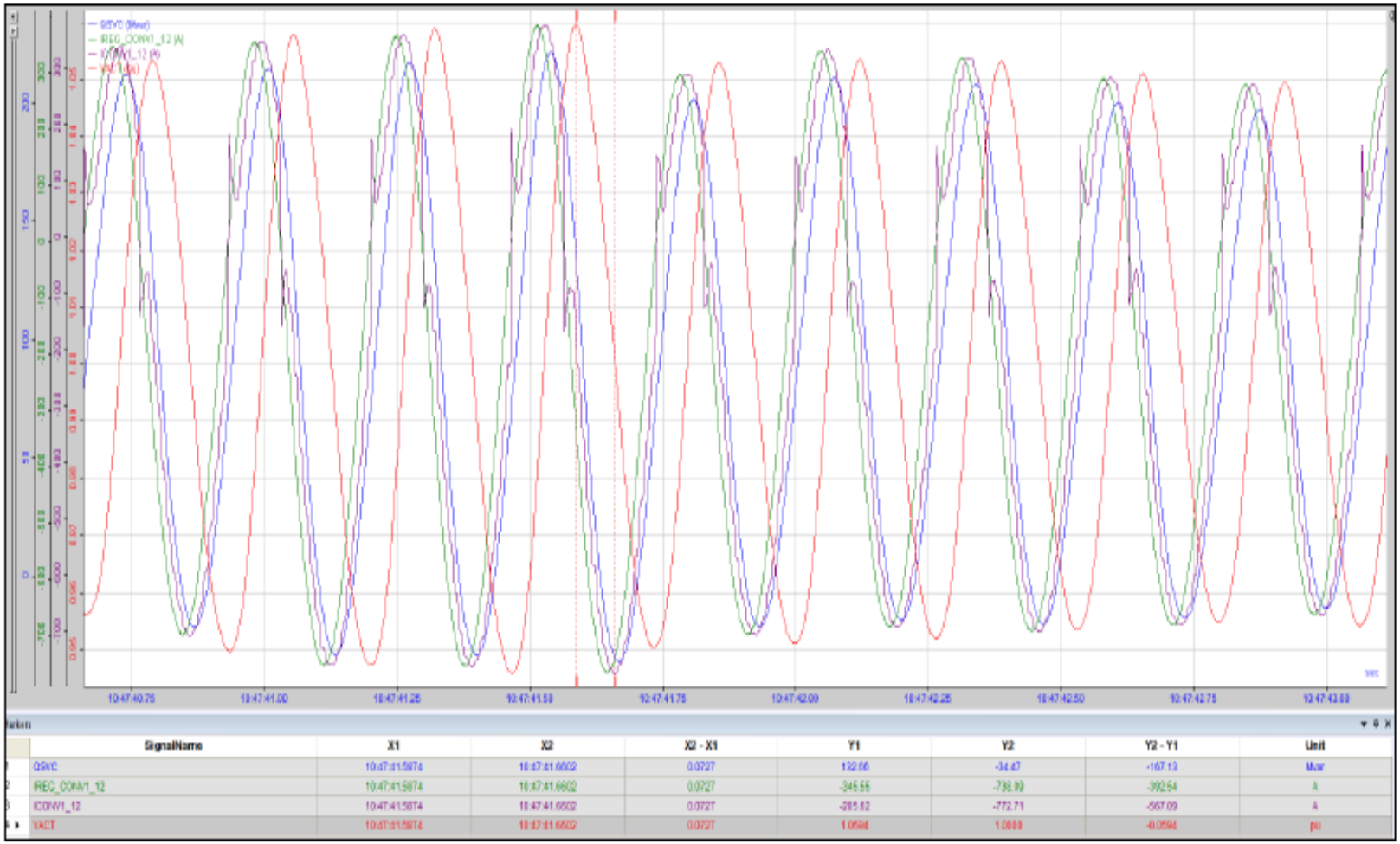


Constraint in Reverse Operation of HVDC Gazuwaka

- Presently HVDC Gazuwaka is operated in the reverse direction (SR to ER) direction during SR Export hours. However, the same cannot be maximized to operate at full capacity i.e. 1000 MW because of N-1 violation of a few critical lines in the 220 kV intra-state network of Odisha.
  - 220 kV Jaynagar-Lakshmipur
  - 220 kV Lakshmipur-Therubali
  - 220 kV Therubali-Bhanjanagar

Oscillations Observed in NR RE Complex (STATCOM Behaviour)

Measurement (TFR) based Analysis of Bhadla-II STATCOM-1



	SignalName	X1	X2	X2 - X1	Y1	Y2	Y2 - Y1	Unit
1	QSVC	10:47:41.5874	10:47:41.6602	0.0727	132.66	-34.47	-167.13	Mvar
2	IREG_CONV1_12	10:47:41.5874	10:47:41.6602	0.0727	-345.55	-738.89	-392.54	A
3	ICONV1_12	10:47:41.5874	10:47:41.6602	0.0727	-285.62	-772.71	-567.09	A
4	VACT	10:47:41.5874	10:47:41.6602	0.0727	1.0594	1.0889	-0.0594	pu