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

As per list of Addresses

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

Subject: Minutes of the 11th meeting of National Committee on Transmission (NCT) – regarding.

महोदया (Madam) / महोदय (Sir),

The 11th meeting of the "National Committee on Transmission" (NCT) was held on 28th December 2022 (1st Sitting) and 17th January 2023 (2nd Sitting). Minutes of the meeting are enclosed herewith.

भवदीय/Yours faithfully,

01.02.2023

Encl.: As above.

(ईशान शरण/Ishan Sharan)
मुख्य अभियंता / Chief Engineer

प्रतिलिपि / Copy to:

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

List of Addresses:

1.	Chairperson, Central Electricity Authority Sewa Bhawan, R.K. Puram, New Delhi – 110 066.	2.	Member (Power Systems), Central Electricity Authority Sewa Bhawan, R.K. Puram, New Delhi – 110 066.
3.	Member (Economic & Commercial), Central Electricity Authority Sewa Bhawan, R.K. Puram, New Delhi – 110 066.	4.	Director (Trans), Ministry of Power Shram Shakti Bhawan, New Delhi-110001.
5.	Sh. Dilip Nigam, Scientist 'G', MNRE, Block Nos. 14, CGO Complex, Lodhi Road, New Delhi – 110003	6.	Chief Operating Officer, CTUIL, Saudamini, Plot Nos. 2, Sector-29, Gurgaon – 122 001.
7.	Sh. Rajnath Ram, Adviser (Energy), NITI Aayog, Parliament Street, New Delhi – 110 001.	8.	CMD, Grid Controller of India, B-9, Qutub, Institutional Area, Katwaria Sarai, New Delhi – 110010
9.	Dr. Radheshyam Saha, Ex. Chief Engineer, Central Electricity Authority		

Index

Minutes of the 11th meeting of National Committee on Transmission (NCT) held on 28th December 2022 & 17th January 2023

List of participants is attached as **Annex-I.**

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

1 Confirmation of the minutes of the 10th meeting of National Committee on Transmission.

1.1 The minutes of 10th meeting of NCT held on 07.11.2022 were issued on 12.12.2022 vide letter Nos.CEA-PS-12-13/3/2019-PSPA-II Division. No comments/observations were received on the minutes. The minutes of the 10th meeting were confirmed.

2 Status of the transmission schemes Noted/approved/recommended to MoP in the 10th meeting of NCT:

2.1 The status of the transmission schemes Noted/approved/recommended to MoP in the 10th meeting of NCT is tabulated below:

Sl. No.	Name of the Transmission Scheme	Noted/ Recommended/ Approved	Survey Agency	MoP approval	BPC	Remarks
1.	Transmission Scheme for integration of Renewable Energy Zone (Phase-II) in Koppal-II (Phase-A) and Gadag-II (Phase- A) in Karnataka	Recommended to MoP for implementation through TBCB	RECPDCL	To be approved	To be done by MoP	The two schemes have been clubbed together for bidding purpose with implementation timeframe of 24 months and 36 months respectively
	Transmission Scheme for integration of Renewable Energy Zone (Phase-II) in Koppal-II (Phase-B)					

Sl. No.	Name of the Transmission Scheme	Noted/ Recommended/ Approved	Survey Agency	MoP approval	BPC	Remarks
2.	Transmission scheme for evacuation of 4.5 GW RE injection at Khavda PS under Phase II- Part D	Recommended for implementation through RTM route	Not applicable	Required		As the scheme was originally Notified by MoP for implementation through TBCB route, the scheme needed to be de-Notified by MoP. MoP vide Gazette dated 13.01.2023 has de-Notified the same. Suitable OM allocating the scheme to CTUIL for implementation through RTM route to be issued.

3 New Transmission Schemes submitted by CTUIL:

3.1 Transmission System for Evacuation of Power from RE Projects in Rajgarh 1000 MW Solar Energy Zone (SEZ) in Madhya Pradesh - Phase-II

3.1.1 Following transmission System for 2.5 GW REZ at Rajgarh (MP) had been evolved as part of 66.5 GW REZs in two phases:

- Ph-I of 1.5 GW: The scheme involves establishment of 3x500 MVA, 400/220 kV ICTs at Pachora PS & Pachora – Bhopal 400 kV D/c line (under implementation with SCoD of 30.11.2023) (out of which generation of 1 GW of Agar / Shajapur Solar Parks has been identified)

- Ph-II of 1 GW: As agreed in 4th NCT, the scheme involved augmentation of transformation capacity at Pachora PS by 2x500 MVA, 400/220 kV ICTs (4th & 5th) & Pachora – Shujalpur 400 kV D/c line and was required to be implemented with RE injection beyond 1.5 GW at Pachora PS.

3.1.2 On request of SECI to take up the implementation of Phase-II of the scheme without waiting for connectivity applications beyond 1.5 GW at Pachora PS, the Phase-II of the scheme was submitted by CTUIL for deliberation in the 10th NCT meeting held on 07.11.2022. In the meeting, CTUIL had informed that the scheme was to be reviewed as Shujalpur ICTs & downstream network of MPPTCL were found to be overloaded due to interconnection of Pachora - Shujalpur 400 kV D/c line for evacuation of power from RE Projects in Rajgarh. Accordingly, the scheme was deferred in the 10th NCT meeting with the direction to CTUIL to resolve the issues pertaining to MPPTCL's downstream system.

3.1.3 In view of above, a meeting was held on 01.12.2022 amongst CEA, CTUIL, MPPTCL and GRID-INDIA for finalizing above scheme, wherein, augmentation of transformation capacity at Pachora PS by 2x500 MVA, 400/220 kV ICTs (4th & 5th) & Pachora – Ujjain 400 kV D/c line with total cost of approx. Rs 497 crore was agreed for evacuation of 1 GW power from Pachora PS under Ph-II.

3.1.4 CTUIL informed that to fulfill 'N-1' reliability criteria at Pachora PS, 1x500 MVA (6th ICT) is also required. This would result in the total estimated cost to be greater than Rs 500 Cr. Accordingly, CTUIL will submit the scheme for consideration of NCT in the next meeting after discussion of the scheme in WRPC.

3.1.5 Members Noted the above.

3.2 Transmission system for evacuation of additional 7 GW RE power from Khavda RE park under Phase-III

3.2.1 To enable evacuation of additional 7 GW RE power from Khavda RE park under Phase-III, following system was proposed by CTUIL with estimated cost of Rs 7327 Crore and implementation timeframe of 24 months:

(i). Establishment of 765 kV Halvad switching station with 765 kV, 2x330 MVAr bus reactors [with 110 MVAr single phase reactor unit as spare unit for bus/line reactors at Halvad]

(ii). KPS2- Halvad 765 kV D/c line (~220 km length) with 240 MVAr switchable line reactor at both ends and 80 MVAr single phase spare reactor unit at both ends.

(iii). LILO of Lakadia – Ahmedabad 765 kV D/c line at Halvad (LILO route length~30 km)

(iv). Halvad – Vataman 765 kV D/c line (~170 km length) with 1x330 MVAr switchable line reactor at Vatman end on each ckt.

(v). Establishment of 765 kV switching station near Vataman with 2x330 MVAr, 765 kV bus reactor [with 110 MVAr 765 kV single phase reactor as spare unit for bus/line reactors at Vataman]

(vi). LILO of Lakadia – Vadodara 765 kV D/c line at Vataman 765 kV switching station (~LILO route length 10 km) along with implementation of Inter-tripping scheme on Vadodara – Vataman 765 kV D/c line section (for tripping of the switchable line reactor at Vadodara end along with the main line breaker).

(vii). 240 MVAr, 765 kV switchable line reactor on each ckt at Vataman end of Lakadia – Vataman 765 kV D/c line (~260 km length) with NGR bypassing arrangement and associated 80 MVAr single phase spare reactor unit along with implementation of Inter-tripping scheme (for tripping of the switchable line reactor at either end along with the main line breaker)

(viii). Vataman switching station – Navsari (New) 765 kV D/c line (~200 km length) with 330 MVAr switchable line reactors on each ckt at Navsari (New) end (110 MVAr spare reactor unit at Navsari being implemented by PGCIL, would be used as spare).

(ix). Augmentation of transformation capacity at Navsari (New) 765/400 kV by 1x1500 MVA (ICT-IV)

Note:

i. Transmission system for evacuation of 3 GW RE injection at Khavda is being taken up under Phase-I and 5 GW RE injection is being taken up under Phase-II. Accordingly, Phase-III scheme for evacuation of additional 7 GW RE injection at Khavda is being taken up for evacuation requirement beyond 8 GW from Khavda RE park considering that evacuation requirement has already crossed 8 GW at Khavda (St-II Connectivity: 12.55GW & LTA: 8.682GW as on Nov-22).

ii. 330 MVAr 765 kV switchable line reactors on each ckt at Vadodara end of Lakadia – Vadodara 765 kV D/c line (being LILOed at Vataman) already have NGR bypass arrangement so that they may be utilised as bus reactors under outage of the lines.

3.2.2 Further, following additional space provision for future was proposed at the switching stations:

Future provisions at Halvad 765 kV Switching Station:

Space for

- 765/400 kV ICT along with bays- 6 Nos.
- 765 kV line bays along with switchable line reactors – 6 Nos.
- 765 kV Bus Reactor along with bay: 2 Nos.
- 765 kV Sectionaliser bay: 1 -set
- 400 kV line bays along with switchable line reactor – 12 Nos.
- 400/220 kV ICT along with bays -8 Nos.
- 400 kV Bus Reactor along with bay: 2 Nos.
- 400 kV Sectionalization bay: 1- set
- 220 kV line bays: 16 Nos.
- 220 kV Sectionalization bay: 2 sets
- 220 kV BC and TBC: 3 Nos.
- STATCOM (±300 MVAR) along with MSC (2x125 MVAr) & MSR (1x125 MVAr): 1 Nos.

Future provisions at Vataman 765 kV Switching Station:

Space for

- 765/400 kV ICT along with bays- 6 Nos.
- 765 kV line bays along with switchable line reactors – 6 Nos.
- 765 kV Bus Reactor along with bay: 2 Nos.
- 765 kV Sectionaliser bay: 1 -set
- 400 kV line bays along with switchable line reactor – 12 Nos.
- 400/220 kV ICT along with bays -8 Nos.
- 400 kV Bus Reactor along with bay: 2 Nos.

- 400 kV Sectionalization bay: 1- set
- 220 kV line bays: 16 Nos.
- 220 kV Sectionalization bay: 2 sets
- 220 kV BC and TBC: 3 Nos.
- STATCOM (±300 MVAr) along with MSC (2x125 MVAr) & MSR (1x125 MVAr): 1 Nos.
- ±800 kV 8 GW HVDC (LCC) Converter Station

3.2.3 Route of the proposed transmission lines may infringe some wild life/protected areas as given below:

Sl. No.	Transmission Element	Details w.r.t. Inclusion of any wild life/protected area along the transmission line route
1.	KPS2- Halvad 765 kV D/c line	Route of the line may infringe Kachchh Desert WLS & Wild Ass WLS or its buffer zone in the state of Gujarat. The line may pass through Kachchh Desert WLS & Wild Ass WLS or its buffer zone in the state of Gujarat. However, for details of forest/protected areas survey is required to be done.
2.	LILO of Lakadia – Ahmedabad 765 kV D/ c line at Halvad	Route of the line may infringe Wild Ass WLS or its buffer zone in the state of Gujarat. The line may pass through Wild Ass WLS or its buffer zone in the state of Gujarat. However, for details of forest/protected areas survey is required to be done.
3.	Halvad – Ahmedabad 765 kV D/c line	Route of the line may infringe Wild Ass WLS or its buffer zone in the state of Gujarat. The line may pass through Wild Ass WLS or its buffer zone in the state of Gujarat. However, for details of forest/protected areas survey is required to be done.
4.	Halvad – Vataman 765 kV D/c line	Route of the line may infringe Nal Sarovar WLS or its buffer zone in the state of Gujarat. The line may pass through Nal Sarovar WLS or its buffer zone in the state of Gujarat. However, for details of forest/protected areas survey is required to be done.
5.	LILO of Lakadia – Vadodara 765 kV D/c line at Vataman 765 kV switching station	No major NP, WLS, other protected areas observed. However, for details of other forest/protected areas survey is required to be done.
6.	Vataman switching station – Navsari (New) 765 kV D/c line	No major NP, WLS, other protected areas observed. However, for details of other forest/protected areas survey is required to be done.

3.2.4 Further, following packaging for transmission system was proposed for the scheme:

Package-A: Total Cost: Rs 3036.77 Cr

1. Establishment of 765 kV Halvad switching station with 765 kV, 2x330 MVAr bus reactors [with 110 MVAr & 80 MVAr 765 kV single phase reactor (spare unit for bus/line reactors at Halvad)] – Rs 300.07 Cr *(excluding 2 Nos. 765 kV line bays at Halvad for Halvad – Vataman 765 kV D/c line)*
2. KPS2- Halvad 765 kV D/c line (~220 km length) with 240 MVAr switchable line reactor at both ends and 80 MVAr single phase spare reactor unit at KPS2 end. – Rs 2187.33 Cr.
3. LILO of Lakadia – Ahmedabad 765 kV D/c line at Halvad (LILO length~30 km) – Rs 549.37 Cr. *(corresponding Line Bays included at S. Nos. 1)*

Package-B: Total Cost: Rs 1645.03 Cr

1. Halvad – Vataman 765 kV D/c line (~170 km length) with 1x330 MVAr switchable line reactor at Vatman end on each ckt. (along with line bays at both ends.) – Rs 1645.03 Cr

Package-C: Total Cost: Rs 2644.98 Cr

1. Establishment of 765 kV switching station near Vataman with 2x330 MVAR, 765 kV bus reactor [with 110 MVAr 765 kV single phase reactor (spare unit for bus/line reactor) and 80 MVAr 765 kV single phase spare reactor unit for line reactor] – Rs 391.54 Cr. *(excluding 2 Nos. 765 kV line bays at Vataman for Halvad – Vataman 765 kV D/c line)*
2. LILO of Lakadia – Vadodara 765 kV D/c line at Vataman 765 kV switching station (~10 km LILO length) along with implementation of Inter-tripping scheme on Vadodara – Vataman 765 kV D/c line section (for tripping of the switchable line reactor at Vadodara end along with the main line breaker). – Rs 176.69 Cr. *(corresponding Line Bays included at S. Nos. 1 above for Vataman S/s)*
3. 240 MVAr 765 kV switchable line reactor on each ckt at Vataman end of Lakadia – Vataman 765 kV D/c line (~260 km length) with NGR bypassing arrangement along with implementation of Inter-tripping scheme (for tripping of the switchable line reactor at either end along with the main line breaker) – Rs 52.40 Cr.
4. Vataman switching station – Navsari (New) 765 kV D/c line (~200 km length) with 330 MVAr switchable line reactors on each ckt at Navsari (New) end. – Rs 1965.84 Cr.
5. Augmentation of transformation capacity at Navsari (New) 765/400 kV by 1x1500 MVA (ICT-IV) – Rs 58.52 Cr.

Note: *The 330 MVAr 765 kV switchable line reactors on each ckt at Vadodara end of Lakadia – Vadodara 765 kV D/c line (being LILOed at Vataman) already have NGR*

bypass arrangement so that they may be utilised as bus reactors under outage of the lines.

3.2.5 The scheme was discussed in 45th meeting of WRPC held on 2nd December, 2022, wherein the scheme was in general agreeable to WRPC.

3.2.6 On a query from Chairperson, NCT, regarding connectivity applications from RE generators at Khavda, representative from CTUIL informed that they have received Stage-II connectivity applications for 12.55 GW capacity. Transmission system (phase-I) for evacuation of 3 GW RE power from Khavda RE park is under implementation and transmission system (Phase-II) for evacuation of 5 GW RE power from Khavda RE park is under bidding. The proposed transmission system (Phase III) is for evacuation of additional 7 GW RE power from Khavda RE park.

3.2.7 Representative from MoP suggested that as the route of the transmission system involves wild life/protected forest areas, eco-sensitive zones etc., the transmission system should be mapped on the PM GatiShakti portal developed by BISAG-N to arrive at feasible route of the transmission line. This would also help in identifying the agencies from which clearance would be required for the transmission system. It was agreed that in future, CTUIL would carry out mapping of proposed transmission system on PM GatiShakti portal and the same would be included as check list in the agenda of NCT.

3.2.8 Dr. R. Saha, Expert Member, suggested that rating of STATCOMs should be arrived based on studies. Chairperson, NCT, suggested that with high RE penetration in the grid, dynamic reactive power compensation requirement needs to be assessed. He requested GRID-INDIA and CTUIL to look into the matter. This view was also supported by SECI.

3.2.9 CMD, GRID-INDIA stated that transmission towers in coastal areas should be designed keeping in mind the recommendations given in the report of the task force on 'Cyclone Resilient Infrastructure'. It was informed that the recommendations of the task force have already been incorporated in the technical specifications of transmission lines given in RfP Document.

3.2.10 It was also discussed that presently, space provision for ±800 kV, 8 GW HVDC (LCC) Converter Station at Vataman 765 kV switching station is Not required. The space can be acquired at the time of implementation of HVDC.

3.2.11 Chairperson, NCT, stated that the proposed Package-B comprises of only the Halvad – Vataman 765 kV D/c line along with associated bays, and delay in implementation of the line may lead to Non-utilisation of both switching stations. He suggested for clubbing this package with Package-C. It was also agreed that as Navsari S/stn is already under implementation, the ICT augmentation proposed at Navsari s/s under package-C may be implemented through RTM mode by the developer of Navsari S/stn. Further, the proposed inter-tripping schemes associated with existing transmission lines may also be enabled by the existing owner.

3.2.12 After detailed deliberations, NCT recommended the following packages for "Transmission system for evacuation of additional 7 GW RE power from Khavda RE park under Phase-III" to be implemented under TBCB route:

Sl. No.	Name of the scheme/est. cost	Decision of NCT	Purpose /Justification
1.	Transmission system for evacuation of additional 7 GW RE power from Khavda RE park under Phase-III Part A Est. Cost: Rs 3036.77 Crs Implementation timeframe: 24 months from SPV transfer.	• Recommended for implementation through TBCB route	The schemes have been planned for evacuation of additional 7 GW RE power from Khavda RE park under Phase-III.
2.	Transmission system for evacuation of additional 7 GW RE power from Khavda RE park under Phase-III Part B Est. Cost: Rs 4231.49 Crs Implementation timeframe: 24 months from SPV transfer.	• Recommended for implementation through TBCB route	

Detailed scope of the schemes are as under:

A. Transmission system for evacuation of additional 7 GW RE power from Khavda RE park under Phase-III Part A (Total Cost: Rs 3036.77 Crs)

Sl. No.	Scope of the Transmission Scheme	Capacity / line length km
1.	Establishment of 765 kV Halvad switching station with 765 kV, 2x330 MVAr bus reactors **Future Scope**: Space for • 765/400 kV ICT along with bays- 6 Nos. • 765 kV line bays along with switchable line reactors – 6 Nos. • 765 kV Bus Reactor along with bay: 2 Nos. • 765 kV Sectionaliser bay: 1 set • 400 kV line bays along with switchable line reactor – 12 Nos.	330 MVAR, 765 kV bus reactors - 2 (7x110 MVAr single phase reactor units including 1 spare unit) 765 kV bus reactor bays- 2 765 kV line bays- 6 (for lines at Sl. 2 & 5)

Sl. No.	Scope of the Transmission Scheme	Capacity / line length km
	• 400/220 kV ICT along with bays - 8 Nos. • 400 kV Bus Reactor along with bays: 2 Nos. • 400 kV Sectionaliser bay: 1 set • 220 kV line bays: 16 Nos. • 220 kV Sectionaliser bay: 2 sets • 220 kV BC and TBC: 3 Nos. • STATCOM (±300 MVAr) along with MSC (2x125 MVAr) & MSR (1x125 MVAr) alongwith associated bays: 1 Nos.	
2.	KPS2 (GIS) - Halvad 765 kV D/c line	Route length: 220 km
3.	240 MVAr switchable line reactor on each ckt at both ends of KPS2- Halvad 765 kV D/c line.	• 240 MVAr, 765 kV switchable line reactors- 4 [2 at KPS2(GIS) & 2 at Halvad] • Switching equipment for 765 kV line reactors- 4 [2 at KPS2 (GIS) & 2 at Halvad] • 80 MVAr, 765 kV, single phase spare reactor unit at KPS2 (GIS) • 80 MVAR, 765 kV, single phase spare reactor unit at Halvad S/s
4.	2 Nos. of 765 kV GIS line bays at KPS2 for termination of KPS2 - Halvad 765 kV D/c line	• 765 kV line bays (GIS) – 2 Nos. [for KPS2(GIS) end]
5.	LILO of Lakadia – Ahmedabad 765 kV D/c line at Halvad	LILO route length: 30 km (120 ckm)

Note: Developer of KPS2 to provide space for implementation of 2 Nos. of 765 kV line bays alongwith switchable line reactors for termination of KPS2(GIS) - Halvad 765 kV D/c line

B. Transmission system for evacuation of additional 7 GW RE power from Khavda RE park under Phase-III Part B (Total Cost: Rs 4231.49 Crs)

Sl. No.	Scope of the Transmission Scheme	Capacity / line length km
1. 1.	Establishment of 765 kV switching station near Vataman with 2x330 MVAr, 765 kV bus reactors **Future Scope**: Space for • 765/400kV ICT along with bays- 6 Nos. • 765 kV line bays along with switchable	330 MVAR 765 kV bus reactors-2 (7x110 MVAr single phase reactor units including 1 spare unit for line/bus reactor) 765 kV bus reactor bays- 2

Sl. No.	Scope of the Transmission Scheme	Capacity / line length km
	line reactors – 6 Nos. • 765kV Bus Reactor along with bay: 2 Nos. • 765kV Sectionaliser bay: 1 -set • 400 kV line bays along with switchable line reactor – 12 Nos. • 400/220kV ICT along with bays -8 Nos. • 400 kV Bus Reactor along with bay: 2 Nos. • 400 kV Sectionalization bay: 1- set • 220 kV line bays: 16 Nos. • 220 kV Sectionalization bay: 2 sets • 220 kV BC and TBC: 3 Nos. • STATCOM (±300 MVAr) along with MSC (2x125 MVAr) & MSR (1x125 MVAr) alongwith associated bays: 1 Nos.	765 kV line bays- 8 (for lines at Sl. 2, 5 & 7)
2.	Halvad – Vataman 765 kV D/c line	Route length: 170 km
3.	1x330 MVAr switchable line reactor on each ckt at Vatman end of Halvad – Vataman 765 kV D/c line	• 330 MVAr, 765 kV switchable line reactor- 2 Nos. (6 x 110 MVAr single phase reactor unit) [110 MVAr single phase spare bus reactor unit to be used as spare for line reactor] • Switching equipment for 765 kV line reactor- 2
4.	2 Nos. of 765 kV line bays at Halvad end for termination of Halvad – Vataman 765 kV D/c line	• 765 kV line bays– 2 Nos. (for Halvad end)
5.	LILO of Lakadia – Vadodara 765 kV D/c line at Vataman 765 kV switching station	LILO route length: 10 km (40 ckm)
6. 3.	240 MVAr 765 kV switchable line reactor on each ckt at Vataman end of Lakadia – Vataman 765 kV D/c line with NGR bypassing arrangement	• 240 MVAr, 765 kV switchable line reactor- 2 (7x 80 MVAr single phase reactor units including 1 spare unit) • Switching equipment for 765 kV line reactors- 2
7. 4.	Vataman switching station – Navsari (New) (GIS) 765 kV D/c line	Route length: 200 km.
8. 5.	330 MVAr switchable line reactors on each ckt at Navsari (New) (GIS) end of Vataman switching station – Navsari (New) (GIS) 765 kV D/c line	• 330 MVAr, 765 kV switchable line reactor- 2 Nos. (6 x 110 MVAr single phase reactor unit) [110 MVAr spare reactor unit at Navsari being implemented by PGCIL, would be used as spare] • Switching equipment for 765 kV line

Sl. No.	Scope of the Transmission Scheme	Capacity / line length km
		reactors- 2
9. 6.	2 Nos. of 765 kV GIS line bays at Navsari (New) for termination of Vataman switching station – Navsari (New)(GIS) 765 kV D/c line	• 765 kV line bays (GIS) – 2 Nos. (2 Nos. for Navsari (New) end)

Note:

(1) Developer of Halvad S/s to provide space for implementation of 2 Nos. of 765 kV line bays for termination of Halvad – Vataman 765 kV D/c line

(2) Developer of Navsari (New)(GIS) S/s to provide space for implementation of 2 Nos. of 765 kV line bays alongwith switchable line reactors for termination of Vataman switching station – Navsari (New)(GIS) 765 kV D/c line. Also, developer of Navsari (New)(GIS) S/s to allow the use of 110 MVAr single phase spare reactor unit for 330 MVAr SLR on each ckt at Navsari (New) (GIS) end of Vataman switching station – Navsari (New) (GIS) 765 kV D/c line.

(3) Bay(s) as may be required for completion of diameter (GIS) in one-and-half breaker scheme shall also be executed by the TSP.

(4) Logic for Inter-tripping scheme for tripping of the switchable line reactor alongwith main line breaker at Lakadia and Vadodara end after LILO of Lakadia – Vadodara 765 kV D/c line at Vataman 765 kV switching station shall be enabled by the existing owner of the line (i.e. M/s LVTPL) after LILO of Lakadia – Vadodara 765 kV D/c line at Vataman 765 kV switching station.

3.2.13 The following transmission schemes have been segregated and approved by NCT for implementation through RTM route by the respective asset owner.

Sl. No.	Name of the scheme/est. cost	Decision of NCT	Purpose /Justification
1.	ICT Augmentation associated with integration of additional 7 GW RE power from Khavda RE park under Phase-III (Total Cost: Rs 58.52 Crs) Implementation timeframe: In matching timeframe of Transmission system for evacuation of additional 7 GW RE power from Khavda RE park under Phase-III Part B	Approved for implementation through RTM route by TSP of Navsari (new) S/stn i.e. POWERGRID	The scheme has been planned to enable evacuation of additional 7 GW RE power from Khavda RE park under Phase-III.

Detailed scope of the schemes are as under:

C. ICT Augmentation at Navsari (New) associated with integration of additional 7 GW RE power from Khavda RE park under Phase-III (Total Cost: Rs 58.52 Crs)

Sl. No.	Scope of the Transmission Scheme	Capacity / line length km
1. 7.	Augmentation of transformation capacity at Navsari (New) 765/400 kV by 1x1500 MVA (ICT-IV)	765/400 kV, 1500 MVA ICT – 1 Nos. 765 kV ICT bay – *Not required as ICT to be terminated in existing bay* 400 kV ICT bay – 1 Nos. (GIS)

Note: Bay(s) as may be required for completion of diameter (GIS) in one-and-half breaker scheme, shall also be executed by the TSP.

3.3 **Transmission scheme for injection beyond 3 GW RE power at Khavda PS2 (KPS2)**

3.3.1 CTU proposed augmentation by three (3) Nos. 765/400 kV, 1500 MVA ICTs at KPS2 (3rd & 4th on Bus Section-I and 3rd on Bus Section-II) at estimated cost of Rs 352.06 Crore to cater RE injection requirement at Khavda Pooling Station-2 (KPS2). The proposed time frame of implementation is 21 months from date of allocation/SPV transfer.

3.3.2 It was informed that the transmission scheme "Establishment of KPS2" is under bidding and bid submission is scheduled on 16th January 2023. As the scheme involves ICT augmentation at a S/stn which has Not yet been awarded, NCT decided to defer the scheme at present and the same would be discussed for implementation after award of the work of establishment of KPS2.

3.3.3 The option of incorporating the requirement of additional ICTs in the scope of works of the under bidding scheme was also deliberated. However, in view of the urgency to complete the bid submission of the KPS2 S/stn, it was decided to keep the augmentation works segregated and it was decided that the same would be deliberated in the next meeting of NCT.

3.4 **Transmission scheme for evacuation of power from Dhule 2 GW REZ**

3.4.1 CTUIL proposed following requirement of transmission system for evacuation of power from Dhule 2 GW REZ (1 GW Solar+1 GW Wind) at approx. cost of Rs 637 Crore with implementation timeframe of 24 months from the date of allocation to implementing agency/SPV transfer (as case may be) or matching with scheduled CoD of RE project based on award of first bid of RE project by REIA at Dhule PS (whichever is later). Scope of works is given below:

- Establishment of 4x500 MVA, 400/220 kV Pooling Station near Dhule along with 2x125 MVAr (420 kV) Bus Reactor
- Dhule PS – Dhule (BDTCL) 400 kV D/c Line (Quad ACSR/AAAC/AL59 Moose equivalent) (~ 60 km length)
- 2 Nos. 400 kV line bays at Dhule (BDTCL) for Dhule PS – Dhule (BDTCL) 400 kV D/c Line

3.4.2 The scheme was discussed in 45th meeting of WRPC held on 2nd December 2022 and the scheme was in general agreeable to WRPC.

3.4.3 After detailed deliberations, the transmission scheme was recommended to be implemented through TBCB route.

Sl. No.	Name of the scheme/est. cost	Decision of NCT	Purpose /Justification
1.	Transmission scheme for evacuation of power from Dhule 2 GW REZ Est. Cost: Rs 637 Crs Implementation timeframe: 24 months from date of SPV transfer.	To be implemented though TBCB route	The scheme has been planned to enable evacuation of additional power from Dhule 2 GW REZ, which is part of 181.5 GW REZ planned towards achievement of 500 GW RE capacity by 2030.

Detailed scope of the scheme is as under:

Sl.	Scope of the Transmission Scheme	Capacity /km
1.	Establishment of 4x500 MVA, 400/220 kV Pooling Station near Dhule along with 2x125 MVAr (420 kV) Bus Reactors. **Future provision** Space for ➢ 400 kV line bays along with switchable line reactor – 8 Nos. ➢ 400/220 kV ICT along with bays -6 Nos. ➢ 400 kV Bus Reactor along with bays: 2 Nos. ➢ 400 kV Bus Sectionalization bay: 1- set ➢ 220 kV line bays: 9 Nos. ➢ 220 kV Sectionalization bay: 1 set ➢ 220 kV BC and TBC: 1 Nos.	400/220 kV, 500 MVA ICT – 4 Nos. 400 kV ICT bays – 4 Nos. 220 kV ICT bays – 4 Nos. (2 Nos. on 220 kV bus section 1 and 2 Nos. on 220 kV bus section 2) 400 kV line bays – 2 Nos. 125 MVAr, 420 kV Bus reactor – 2 Nos. Bus reactor bay: 2 Nos. 220 kV Bus coupler bay- 2 Nos. 220 kV Transfer Bus Coupler (TBC) bay - 2 Nos. 220 kV line bays – 7 Nos. (for RE interconnection out of which 4 Nos. would be on 220 kV bus section 1 and 3 Nos. on 220 kV bus section 2) 220 kV Bus Sectionalizer – 1 set
2.	Dhule PS – Dhule (BDTCL) 400 kV D/c line (Quad ACSR/AAAC/AL59 Moose equivalent)	Route length: 60 km.
3.	2 Nos. 400 kV line bays at Dhule (BDTCL) for	400 kV Line bays – 2 Nos.

Sl.	Scope of the Transmission Scheme	Capacity /km
	Dhule PS – Dhule (BDTCL) 400 kV D/c Line	

Note: BDTCL to provide space for 2 Nos. of 400 kV line bays for termination of Dhule PS – Dhule (BDTCL) 400 kV D/c Line

3.5 Scheme for drawal of 4000 MW power by MPSEZ UTILITIES LIMITED (MUL)

3.5.1 CTUIL stated that connectivity application of 4000 MW from MUL has been received in the month of June, 2022 as per details given below:

Application No.	Name of Applicant (Organization)	Connectivity Quantum (MW)	Applicant Type	Project Location	Date from which connectivity required
0030700003	MPSEZ Utilities Limited (MUL)	4000	Distribution Licensee	Kutch, Gujarat	01.09.2024

3.5.2 The above application was deliberated in the 9th Consultation Meeting for Evolving Transmission Schemes (CMETS) in Western Region held on 28.07.2022, wherein MUL projected a requirement of about 10 GW drawal by 2030.

3.5.3 In the 9th CMETS, keeping in view the huge drawal requirement it was planned to supply power to MUL through a new 765/400 kV S/s near Navinal (Mundra), to be established through LILO of Bhuj-II – Lakadia 765 kV D/c line at Navinal (Mundra) (GIS) S/s. Connectivity is to be provided to MUL for two drawl points from Navinal S/s, namely MRSS-1 & MRSS-2 as per the schematic given in the agenda. In 9th WR-CMETS meeting, it was decided that LILO of 2nd circuit of Bhuj-II – Lakadia 765 kV D/c line at Navinal (Mundra) (GIS) S/s and additional 765/400 kV (4th) transformer at Navinal (Mundra) (GIS) S/s shall be planned after receipt of LTA applications beyond 3000 MW at Navinal (GIS) S/s. In this regard, at present, 3050 MW (LTA application) has already been received from MUL. Accordingly, it is proposed to establish the complete scheme which includes LILO of 2nd circuit of Bhuj-II – Lakadia 765 kV D/c line at Navinal (Mundra) (GIS) alongwitth additional 765/400 kV (4th) transformer at Navinal (Mundra) (GIS) S/s.

3.5.4 Scope of the proposed scheme is given below:

Part A (Under ISTS):

Sl. No.	Scope of the Transmission Scheme	Capacity /km

1.	Establishment of 4x1500 MVA, 765/400 kV Navinal (Mundra) S/s (GIS) with 2x330 MVAR, 765 kV & 1x125 MVAr, 420 kV bus reactors [with associated ICT & reactor bays as well as 7x110 MVAR single phase including a spare unit for bus / line reactor as well as 13x500 MVA, 765/400 kV (single phase) including a spare transformer unit] **Future provision for space for:** ➢ 765/400 kV ICT along with bays- 4 Nos. ➢ 765 kV line bays along with switchable line reactors – 6 Nos. ➢ 765 kV Bus Reactor along with bay: 2 Nos. ➢ 765 kV Sectionaliser: 1 -set ➢ 400 kV line bays along with switchable line reactor – 8Nos. ➢ 400/220 kV ICT along with bays -6 Nos. ➢ 400 kV Bus Reactor along with bay: 3 Nos. ➢ 400 kV Sectionalization bay: 1- set ➢ 220 kV line bays: 10 Nos. ➢ 220 kV Sectionalization bay: 1 set ➢ 220 kV BC and TBC: 2 Nos. ➢ STATCOM (±300 MVAR) along with MSC (2x125 MVAr) & MSR (1x125 MVAr): 2 Nos.	765/400 kV, 1500 MVA ICT – 4 Nos. (13x500 MVA single phase units including one spare ICT Unit) 765 kV ICT bays – 4 Nos. 400 kV ICT bays – 4 Nos. 765 kV Line bays – 4 Nos. 1x330 MVAr, 765 kV bus reactor- 2 Nos. (7x110 MVAR single phase reactors including one spare Unit for bus /line reactor) 765 kV Bus reactor bay – 2 Nos. 125 MVAr, 420 kV reactor- 1 No. 400 kV Reactor bay- 1 No.
2.	LILO of Bhuj-II – Lakadia 765 kV D/c line at Navinal (Mundra) (GIS) S/s with associated bays at Navinal (Mundra) (GIS) S/s	Route Length: 70 km (280 ckm)
3.	Installation of 1x330 MVAr switchable line reactor on each ckt at Navinal end of Lakadia – Navinal 765 kV D/c line (formed after above LILO)	1x330 MVAr, 765 kV switchable line reactor – 2 Nos. Switching equipment for 765 kV line reactor – 2 Nos.
Part B (Under MUL Scope#)		
4.	Interconnection of MUL S/s (MRSS1 & 2) with Navinal (Mundra) S/s (GIS) as given below: MUL MRSS-1 – Navinal (Mundra) 400 kV D/ c (Twin HTLS - Quad Moose equivalent) line along with associated line bays Navinal end* (~1-2 km.) MUL MRSS-2 – Navinal (Mundra) 400 kV D/ c (Twin HTLS - Quad Moose equivalent) line along with associated line bays Navinal end* (~1-2km.) *4 Nos. 400 kV Line bays at MUL (MRSS1 & 2) end shall be implemented by MUL	Route Length: 1 km (approx.) 400 kV line bays: 4 Nos.

 # MUL may construct the interconnecting lines either through themselves (if authorized by appropriate authority) or through an ISTS Transmission Licensee with the cost of construction of transmission line & associated transmission charges (as applicable) being borne by MUL. In case the line is to be implemented through an ISTS Transmission Licensee, MUL may need to approach CERC for the same.

3.5.5 Estimated cost of the transmission scheme is Rs 2200 crore and timeframe for implementation is 24 months from the date of allocation to implementing agency/SPV transfer (as case may be). Scheme to be awarded & taken up for implementation after receipt of LTA application from MUL. No major National Park, Wildlife Sanctuary or other protected areas observed. However, for details of forest/protected areas, survey is required to be done.

3.5.6 The scheme was deliberated in the 44th WRPC meeting held on 27.09.2022. Relevant extract is given below:

i. The scheme was agreed technically by WRPC and the STUs of WR. However, a firm commitment by MUL is required for which they will have to apply for LTA for the above quantum to CTUIL on the basis of which the scheme can be taken up for execution.

ii. Regarding the cost sharing aspects by MUL, it shall be sharing the transmission charges as per applicable CERC Regulations.

3.5.7 Representative of GRID India stated that the load of 4,000 MW of MUL can also be served from Mundra UMPP (CGPL) or Adani Mundra Power Plant located in vicinity. Accordingly, the scheme may be relooked. Further, connecting the proposed high load to Mundra UMPP (CGPL) or Adani Mundra Power Plant may also help in forming islanding schemes.

3.5.8 After deliberations, CTUIL was directed to re-examine the scheme based on above suggestions and present the same in the second sitting.

3.5.9 Accordingly, CTUIL organized a meeting on 05.01.2023 for finalization of scheme for drawl of 4000 MW power by MPSEZ Utilities Limited (MUL). In the meeting, CTUIL presented 07 Nos. of alternatives for evolving above scheme. Based on the outcome of the possible alternatives, establishment of Navinal (Mundra) S/s (GIS) along with LILO of Bhuj-II- Lakadia 765 kV D/c line at Navinal (Mundra) (GIS), as proposed earlier, was found to be the best option from techno-economic point of view.

3.5.10 The scheme was subsequently discussed in the 2nd sitting of NCT held on 17.01.2023 wherein CMD, GRID-India, stated that MPSEZ Utilities Limited (MUL) is a special case where a distribution licensee would get connected with ISTS and in future there may be similar cases where electrolyzers would be getting connected at ISTS level. It was discussed that by virtue of their connectivity to ISTS, these entities would be under the jurisdiction of RLDCs for scheduling/metering/accounting however, they would fall under the jurisdiction of State Electricity Regulatory Commission (SERC) for tariff related matters Members opined that the SLDCs as well as RLDCs/NLDC should have visibility of such entities for necessary coordination for resource adequacy. Chairperson, CEA, advised that regulatory provisions with respect to distribution licensee connected to ISTS would have to be clarified.

3.5.11 After detailed deliberations, the following transmission scheme was recommended to be implemented through TBCB route.

Sl. No.	Name of the scheme/est. cost	Decision of NCT	Purpose /Justification

1.	Transmission scheme for drawal of 4000 MW power by MPSEZ Utilities Limited (MUL) Est. Cost: Rs 2200 Cr Implementation timeframe: 21 months from date of SPV transfer.	To be implemented though TBCB route	The scheme has been planned to enable drawl of power by MPSEZ Utilities Limited (MUL)

Detailed scope of the scheme is as under:

Sl. No.	*Scope of the Transmission Scheme*	*Capacity /km*
1.	Establishment of 4x1500 MVA, 765/400 kV Navinal (Mundra) S/s (GIS) with 2x330 MVAR, 765 kV & 1x125 MVAr, 420 kV bus reactors **Future provision (space for):** ➢ 765/400 kV ICT along with bays- 2 Nos. ➢ 765 kV line bays along with switchable line reactors – 4 Nos. ➢ 765 kV Bus Reactor along with bay: 2 Nos. ➢ 765 kV Sectionaliser: 1 -set ➢ 400 kV line bays along with switchable line reactors– 6 Nos. ➢ 400/220 kV ICT along with bays -6 Nos. ➢ 400 kV Bus Reactor along with bays: 3 Nos. ➢ 400 kV Sectionalization bay: 1- set ➢ 220 kV line bays: 10 Nos. ➢ 220 kV Sectionalization bay: 1 set ➢ 220 kV BC and TBC: 2 Nos. ➢ STATCOM (±300 MVAR) along with MSC (2x125 MVAr) & MSR (1x125 MVAr) and associated bays- 2 Nos. ➢	765/400 kV, 1500 MVA ICT – 4 Nos. (13x500 MVA single phase units including one spare ICT Unit) 765 kV ICT bays – 4 Nos. 400 kV ICT bays – 4 Nos. 765 kV Line bays – 4 Nos. 1x330 MVAr, 765 kV bus reactor- 2 Nos. (7x110 MVAR single phase Reactors including one spare Unit for bus /line reactor) 765 kV Bus reactor bay – 2 Nos. 125 MVAr, 420 kV reactor- 1 Nos. 400 kV Reactor bay- 1 No.
2.	LILO of Bhuj-II – Lakadia 765 kV D/c line at Navinal (Mundra) (GIS) S/s with associated bays at Navinal (Mundra) (GIS) S/s	LILO Route length: 70 km (280 ckm)
3.	Installation of 1x330 MVAr switchable line reactor on each ckt at Navinal end of Lakadia – Navinal 765 kV D/c line (formed after above LILO)	1x330 MVAr, 765 kV switchable line reactor– 2 Nos. Switching equipment for 765 kV line reactor – 2 Nos.

Note:

(1) The following scope of works for interconnection of MUL S/s (MRSS1 & 2) with Navinal (Mundra) S/s (GIS) is under the scope of MUL and is required to be implemented in the same time frame.

Sl. No.	Scope of works to be implemented by MUL	Capacity/km
1	Interconnection of MUL S/s (MRSS1 & 2) with Navinal (Mundra) S/s (GIS) as given below: (i). MUL MRSS-1 – Navinal (Mundra) 400 kV D/c (Twin HTLS - Quad Moose equivalent) line along with associated line bays Navinal end* (~1-2 km.) (ii). MUL MRSS-2 – Navinal (Mundra) 400 kV D/c (Twin HTLS - Quad Moose equivalent) line along with associated line bays Navinal end* (~1-2 km.) *4 Nos. 400 kV Line bays at MUL (MRSS1 & 2) end shall be implemented by MUL	Route Length- 1 km (approx.) 400 kV line bays: 4 Nos.

(2) Developer of the transmission scheme (under ISTS) to provide space for 4 Nos. of 400 kV line bays for termination of MUL lines under the present scope of works (in addition to future space provision)

3.6 Western Region Expansion Scheme XXXIII (WRES-XXXIII): Part A

3.6.1 To overcome critical constraint on 400/220 kV, 2x315+1x500 MVA Jabalpur ICTs (POWERGRID), joint studies were carried out and scheme for creation of 220 kV level at 765/400 kV Jabalpur PS with installation of 2x500 MVA, 400/220 kV ICTs along with LILO of Narsinghpur - Jabalpur (MP) 220 kV D/c line at Jabalpur PS was evolved. The scheme is envisaged to relieve high loadings on Jabalpur ICTs which were found to be 'N-1' non-compliant. As such, the transmission scheme is urgently required.

3.6.2 As the estimated cost of the scheme lies between Rs 100 to 500 Crore and in view of the urgency of the works (clause 7.1(7) of Tariff Policy, 2016), NCT approved the scheme for implementation through RTM mode with implementation timeframe of 18 months.

Sl. No.	Name of the scheme/est. cost	Decision of NCT	Purpose /Justification
1.	Western Region Expansion Scheme XXXIII (WRES-XXXIII): Part A Est. Cost: Rs 126.09 Crs Implementation timeframe: 18 months from date of allocation.	Approved for implementation through RTM route by TSP of Jabalpur PS i.e. POWERGRID	To relieve high loadings on Jabalpur ICTs which were found to be 'N-1' non-compliant

Detailed scope of the scheme is as under:

Sl.	*Scope of the Transmission Scheme*	*Capacity /km*
1.	Creation of 220 kV level at 765/400 kV Jabalpur PS with installation of 2x500 MVA, 400/220 kV ICTs along with associated ICT bays	400/220 kV, 500 MVA ICT – 2 Nos. 400 kV ICT bays – 2 Nos. 220 kV ICT bays – 2 Nos.
2.	4 Nos. of 220 kV line bays at Jabalpur PS for LILO of Narsinghpur - Jabalpur (MP) 220 kV D/c line at Jabalpur Pool	220 kV line bays – 4 Nos.

3.7 **Western Region Expansion Scheme XXXIII (WRES-XXXIII): Part B**

3.7.1 Due to high loadings on 3x315 MVA, 400/220 kV Gwalior ICTs which are also 'N-1' Non-compliant, joint studies were carried out and scheme to establish a new Substation in South of Gwalior at Karera was evolved in order to cater to the increased demand in that area, which can also be used for grant of connectivity to M/s Greenko for their proposed 2,520 MW Pumped Storage Plant Project in future. The proposed 765/400 kV, 2x1500 MVA & 400/220 kV, 2x500 MVA Karera (Near Datiya) S/s would be established through LILO of Satna-Gwalior 765 kV S/c line. The following downstream system would be implemented by MPPTCL in matching time-frame of Karera S/s:

Under Intra-state (to be implemented by MPPTCL):

- LILO of both circuits of Bina - Datiya 220 kV line at Karera
- Extension of LILO portion of Datiya 220 kV- Bina 400 kV line (LILOed at Pichhore 220 kV) upto Karera so as to form Karera – Pichhore 220 kV D/c line
- Upgradation of 132 kV Seondha to 220 kV with 2x200 MVA, 220/132 kV ICT
- 220 kV D/C (U/G) line from Karera 765 kV S/s to Seondha 220 kV
- 132 kV DCSS line from Seondha 220 kV to Indergarh S/s

3.7.2 The proposed scheme will have approx. expenditure of Rs 1200 crore and timeframe of implementation will be 24 months from SPV transfer. No major forest, wildlife, other protected areas are observed. However, for details of other forest/protected areas survey is required to be done.

3.7.3 The scheme was discussed in 45th meeting of WRPC held on 2nd December 2022 and the scheme was in general agreeable to WRPC.

3.7.4 After detailed deliberations, the following was recommended by NCT:

Sl. No.	**Name of the scheme/est. cost**	**Decision of NCT**	**Purpose /Justification**
1.	Western Region Expansion Scheme XXXIII (WRES-XXXIII): Part B	To be implemented through TBCB route	To relieve high loadings on Gwalior ICTs which were found to be 'N-1' Non-

	Est. Cost: Rs 1181 Crs Implementation timeframe: 24 months from SPV transfer.		compliant.
2.	Western Region Expansion Scheme XXXIII (WRES-XXXIII): Part B1 Est. Cost: Rs 19 Crs Implementation timeframe: In matching timeframe of Western Region Expansion Scheme XXXIII (WRES-XXXIII): Part B	Under RTM to the owner of Gwalior-Satna 765 kV line i.e. POWERGRID	For reactive power control and reliability of operations

Detailed scope of the schemes are as under:

(1) Western Region Expansion Scheme XXXIII (WRES-XXXIII): Part B

Sl.Nos.	Scope of the Transmission Scheme	Capacity /km
1.	Establishment of 2x1500 MVA, 765/400 kV, 2x500 MVA, 400/220 kV S/s at Karera (near Datiya) along with 1x330 MVAr 765 kV bus reactor & 1x125 MVAr, 420 kV bus reactor **Future provisions:** Space for ➢ 765/400 kV ICT along with bays- 4 Nos. ➢ 765 kV line bays along with switchable line reactors – 8 Nos. ➢ 765 kV Bus Reactor along with bay: 3 Nos. ➢ 765 kV Sectionaliser: 1 set ➢ 400 kV line bays along with switchable line reactor – 10 Nos. ➢ 400/220 kV ICT along with bays -6 Nos. ➢ 400 kV Bus Reactor along with bays- 3 Nos. ➢ 400 kV Sectionalization bay: 1 set ➢ 220 kV line bays: 10 Nos. ➢ 220 kV Sectionalization bay: 1 set ➢ 220 kV BC and TBC: 1 No.	765/400 kV, 1500 MVA ICT – 2 Nos. (7x500 MVA single phase units including one spare ICT unit) 400/220 kV, 500 MVA ICT – 2 Nos. 765 kV ICT bays – 2 Nos. 400 kV ICT bays – 4 Nos. 220 kV ICT bays – 2 Nos. 765 kV Line bays – 2 Nos. 330 MVAr, 765 kV Bus Reactor – 1 No. (4x110 MVAR single phase units including one spare unit) 125 MVAr, 420 kV Bus reactor – 1 No. 765 kV Bus reactor bay: 1 No. 400 kV Bus reactor bay: 1 No. 220 kV Bus coupler bay- 2 Nos. 220 kV Transfer Bus Coupler (TBC) bay - 2 Nos.

Sl.Nos.	Scope of the Transmission Scheme	Capacity /km
		220 kV line bays – 8 Nos. (for 220 kV lines to be implemented by MPPTCL#) 220 kV Bus sectionaliser– 1 set.
2.	LILO of Satna-Gwalior 765 kV S/c line at Karera	LILO route length: 70 km (140 ckm)
3.	Installation of 1x330 MVAr, switchable line reactor at Karera end of Karera – Satna 765 kV line	765 kV, 330 MVAr SLR along with switching equipment – 1 No. (3 x 110 MVAr) [110 MVAr single phase reactor unit for bus reactor to be used as spare for line reactor too]

#LILO of both circuits of Bina - Datiya 220 kV D/c line at Karera, Extention of LILO portion of 220 kV Datiya - Bina line for Pichhore 220 kV upto Karera & Karera - Seondha 220 kV D/c line

(2) Western Region Expansion Scheme XXXIII (WRES-XXXIII): Part B1

Sl.	***Scope of the Transmission Scheme***	***Capacity /km***
1.	Conversion of 1x240 MVAr, 765 kV Fixed line reactor at Gwalior end to Switchable line reactor (with NGR bypass arrangement) along with implementation of Inter-tripping scheme (for tripping of the switchable shunt reactor at Gwalior end along with the main line breaker)	• Switching equipment for 765 kV line reactor (with NGR bypass arrangement) – 1 No. • Implementation of inter-tripping scheme for the switchable line reactor at Gwalior end

3.8 Western Region Expansion Scheme XXXIII (WRES-XXXIII): Part C

3.8.1 Joint studies were carried out and a new S/s was proposed at Ishanagar to cater to the electricity demand of proposed Green hydrogen plant in nearby area as well as loads in Chhatarpur, Tikamgarh & Jatara areas. It was also informed that RUMS is in the process of establishing 950 MW solar project in Bijawar area whereas NTPC is in the process of establishing 550 MW solar project in Barethi/Chhatarpur area which has been enhanced to 630 MW. Chhatarpur PS is proposed to be established in Bijawar area near to RUMSL solar site. As it is Not possible for NTPC to construct dedicated transmission line upto the planned Chhatarpur PS on account of the transmission line passing through Panna Tiger Reserve, requirement of a separate pooling station for pooling of RE power of NTPC near Ishanagar/Jatara has been done. MPPTCL would also be able to draw power through downstream system from the planned S/stn at Ishanagar/Jatara. In view of above, the proposed Ishanagar (New) S/s may be used to cater to the electricity demand of proposed Green hydrogen plant in nearby area, loads in Chhatarpur, Tikamgarh & Jatara areas and also for interconnection of 630 MW NTPC Barethi Solar Plant (located ~30-40 km from Ishanagar). The proposed scheme (Western Region Expansion Scheme XXXIII (WRES-XXXIII): Part C) covers establishment of 765/400 kV, 2x1500 MVA ICTs and 400/220 kV, 2x500 MVA ICTs at Ishanagar (New) with LILO of one circuit of Jabalpur - Orai 765 kV D/c line at Ishanagar 765 kV S/s (New). Downstream System (to be implemented by MPPTCL in matching time-frame of Ishanagar S/s): 220 kV Ishanagar 765/400/220 kV - Jatara 220 kV D/C line and LILO of Chhatarpur – Tikamgarh 220 kV 2xS/c line at 765/400/220 kV Ishanagar (Chhatarpur – Tikamgarh 220 kV 2nd ckt is currently under implementation). Tentative cost of transmission system will be Rs 556 crore with implementation timeframe of 24 months from the date of allocation to implementing agency/SPV transfer. No inclusion of any wild life/protected area along the transmission line route is envisaged.

3.8.2 The scheme was discussed in 45th meeting of WRPC held on 2nd December 2022 and the same was in general agreeable to WRPC.

3.8.3 After detailed deliberations, the following packages were recommended by NCT for the overall transmission scheme:

Sl. No.	Name of the scheme/est. cost	Decision of NCT	Purpose /Justification
1.	Western Region Expansion Scheme XXXIII (WRES-XXXIII): Part C Est. Cost: Rs 555 Crs Implementation timeframe: 24 months from date of SPV transfer.	To be implemented through TBCB route.	The proposed Ishanagar (New) S/s may be used to cater to loads in Chhatarpur, Tikamgarh & Jatara areas and additional load of proposed Green hydrogen plants in nearby area as well as for interconnection of 550 MW NTPC Barethi Solar Plant (located ~30-40 km from Ishanagar)

2.	Western Region Expansion Scheme XXXIII (WRES-XXXIII): Part C1 Est. Cost: Rs 0.5 Crs Implementation timeframe: In matching timeframe of Western Region Expansion Scheme XXXIII (WRES-XXXIII): Part C.	To be implemented through RTM route by POWERGRID, the TSP of Jabalpur - Orai 765 kV S/c line.	For reactive power control and reliability of operations

Detailed scope of the scheme is as under:

(1) Western Region Expansion Scheme XXXIII (WRES-XXXIII): Part C

Sl. No.	***Scope of the Transmission Scheme***	***Capacity /km***
1.	Establishment of 2x1500 MVA, 765/400 kV and 2x500 MVA, 400/220 kV S/s at Ishanagar (New) along with 1x330 MVAr, 765 kV & 1x125 MVAr, 420 kV bus reactor **Future provisions:** **Space for** ➢ 765/400 kV ICT along with bays- 4 Nos. ➢ 765 kV line bays along with switchable line reactors – 8 Nos. ➢ 765 kV Bus Reactor along with bay: 3 Nos. ➢ 765 kV Sectionaliser: 1 set ➢ 400 kV line bays along with switchable line reactor – 10 Nos. ➢ 400/220 kV ICT along with bays -7 Nos. ➢ 400 kV Bus Reactor along with bay: 3 Nos. ➢ 400 kV Sectionalization bay: 1- set ➢ 220 kV line bays: 12 Nos. ➢ 220 kV Sectionalization bay: 2 sets ➢ 220 kV BC and TBC: 3 Nos.	765/400 kV, 1500 MVA ICT – 2 Nos. (7x500 MVA 1-phase units including one spare ICT unit) 400/220 kV, 500 MVA ICT – 2 Nos. 765 kV ICT bays – 2 Nos. 400 kV ICT bays – 4 Nos. 220 kV ICT bays – 2 Nos. 765 kV Line bays – 2 Nos. 330 MVAr, 765 kV Bus Reactor – 1 No. (4x 110 MVAr including one spare unit) 125 MVAr, 420 kV Bus reactor – 1 No. 765 kV Bus reactor bay: 1 No. 400 kV Bus reactor bay: 1 No. 220 kV Bus coupler bay- 1 No. 220 kV Transfer Bus Coupler (TBC) bay - 1 No.

Sl. No.	*Scope of the Transmission Scheme*	*Capacity /km*
		220 kV line bays – 6 Nos. (for 220 kV lines to be implemented by MPPTCL#)
2.	LILO of one circuit of Jabalpur - Orai 765 kV D/c line at Ishanagar 765 kV S/s (New)	LILO route length – 5 km (10 ckm)

Note: #220 kV Ishanagar 765/400/220 kV - Jatara 220 kV D/C line and LILO of Chhatarpur – Tikamgarh 220 kV 2xS/c line at 765/400/220 kV Ishanagar (Chhatarpur – Tikamgarh 220 kV 2nd ckt is currently under implementation)

Under Intra-State (by MPPTCL):

- Establishment of 220/132 kV, 2x200 MVA ICT & 132/33 kV 2x50 MVA ICT at Jatara 220 kV S/s
- 220 kV Ishanagar 765/400/220 kV - Jatara 220 kV D/C line
- 2nd circuit stringing of Chhatarpur – Tikamgarh 220 kV DCSS line
- LILO of both circuit of Chhatarpur – Tikamgarh 220 kV DCDS line at 765/400/220 kV Ishanagar
- 132 kV Jatara 220 kV - Jatara 132 kV D/C line (With High Capacity Conductor)
- 132 kV Jatara 220 kV - Nowgaon 132 kV D/C line
- 2nd circuit stringing of Jatara 132 kV - Prithvipur DCSS line
- 2nd circuit stringing of Jatara 132 kV - Tikamgarh DCSS line

MPPTCL shall execute above works in matching time-frame of the ISTS system.

(2) Western Region Expansion Scheme XXXIII (WRES-XXXIII): Part C1

Sl. No.	*Scope of the Transmission Scheme*	*Capacity /km*
1.	Conversion of 1x330 MVAR, 765 kV Fixed line reactor at Orai end of Ishanagar – Orai 765 kV line [formed after LILO of one circuit of Jabalpur - Orai 765 kV D/c line at Ishanagar (New) S/s] to Bus reactor at Orai S/s.	• Shifting of 330 MVAr, 765 kV Line reactor of Orai-Jabalpur line at Orai end and installing the same as Bus Reactor in existing bay (GIS) at Orai.

3.9 **Approval of various transmission elements at 400/220 kV Bikaner-II PS by CTUIL**

3.9.1 Bikaner-II PS along with its interconnections is under implementation by POWERGRID Bikaner Transmission System Limited (PBTSL).

3.9.2 CTUIL vide OM dated 16.11.2021, 26.04,2022 and 25.08.2022 had allocated the work of implementation of ICTs, line bays and bus extension works at Bikaner-II PS to PBTSL under RTM as separate schemes individually costing less than Rs 100 crores. The works were approved to facilitate interconnection of various RE Projects at Bikaner-II PS as well as its further dispersal. Details are as follows:

Sl. No.	Scheme	CTUIL OM (Date)	Scope of the Transmission Scheme	Estimated Cost
1	Implementation of 220 kV bays for RE generators and 400/220 kV ICTs at Bikaner-II PS	16.11.21	• 2x500 MVA, 400/220 kV ICT at Bikaner-II PS • 4 Nos. 220 kV line bays	Rs 70 Cr.
2	1 Nos. of 400 kV line bay at 400/220 kV Bikaner-II S/s for interconnection of 1000 MW Solar Project of SJVN Ltd.	26.04.22	• 400 kV line bay – 1 No.	Rs 11.62 Cr.
3	2 Nos. of 220 kV line bays for interconnection of RE projects and Implementation of 220 kV Bus sectionalizer along with BC and TBC at 400/220 kV Bikaner–II PS	25.08.22	• 220 kV line bay – 2 Nos. • 220 kV Bus Sectionalizer Bay– 1 Set • 220 kV Bus Coupler Bay–1 Nos. • 220 kV Transfer Bus Coupler Bay–1 Nos. • Bus extension works for future Bays (3 Nos. of Line Bays & 3 Nos. of ICT Bays) – 1 Set	Rs 38.56 Cr.

3.9.3 PBTSL had filed petition 137/TL/2022 for grant of separate Transmission License to implement above scope of works. CERC vide order dated 07.10.2022 in above mentioned petition the Commission had observed that since combined cost of the three elements is exceeding Rs 100 crore, the proposal may also be got ratified from the NCT.

3.9.4 Further, in the 9th meeting of NCT held on 28.09.2022, augmentation with 5x500 MVA, 400/220 kV ICTs at Bikaner-II PS was recommended to be implemented under RTM to POWERGRID. Accordingly, CEA vide letter dated 15.11.22 has allocated the implementation of above scheme to POWERGRID under RTM.

3.9.5 CTUIL vide its mail dated 01.12.2022 has informed that since Bikaner-II PS is under implementation by POWERGRID Bikaner Transmission System Ltd. (PBTSL) [100% subsidiary of POWERGRID] under TBCB, the 400/220 kV ICTs augmentation at Bikaner-II PS may be allocated to M/s PBTSL under RTM instead of POWERGRID. Accordingly, the implementing agency for augmentation with 5x500 MVA, 400/220 kV ICTs at Bikaner-II PS is POWERGRID Bikaner Transmission System Ltd. (PBTSL).

3.9.6 NCT ratified and noted the same.

3.10 Transmission system for evacuation of power from Shongtong Karcham HEP (450 MW) and Tidong HEP (150 MW)

3.10.1 Transmission system for evacuation of power from Kaza Solar Power Project (880 MW) was broadly identified as under:

- Kaza-Wangtoo (HPPTCL)-Panchkula 400 kV D/c line
- Establishment of 3x315 MVA (10x105 MVA single phase units including one spare), 400/132 kV substation (GIS) at Kaza
- Associated reactive compensation (Bus+line)

3.10.2 Subsequently, it was envisaged that three hydro-electric power stations (880 MW Jangi Thopan HEP of SJVN, 150 MW Tidong HEP of Statkraft, 450 MW Shongtong Karcham HEP of HPPCL would be connected to the same system near Wangtoo. Hence, this network would be utilised both for solar and hydro projects. However, there is no Stage-II Connectivity/LTA application for Kaza Solar Park yet and commissioning schedule of generation at Kaza had also been revised repeatedly by SJVNL. Kaza Solar park involves conversion of forest land for which permission is yet to be granted. Since, commissioning of Tidong HEP (01st July'26) is ahead of Shongtong HEP (31st July, 2026), the proposed transmission system has been phased as under:

A. Phase-I with Tidong HEP [Schedule: 01st July 2026]

- Establishment of 2x315 MVA (7x105 MVA 1-ph units including a spare unit) 400/220 kV GIS Pooling Station at Jhangi
- 400 kV Jhangi PS – Wangtoo (Quad) D/c line (*capacity shall be 2500 MVA per circuit at Nominal voltage*)
- 1x125 MVAR, 420 kV Bus reactor at Jhangi PS (1-ph units along with one spare unit)
- Tidong HEP- Jhangi PS 220 kV D/C line (along with associated bays at both ends)-

under the scope of applicant/generation developer.

B. Phase-II with Shongtong HEP [Schedule : 31th July, 2026]

- LILO of one circuit of Jhangi PS - Wangtoo (HPPTCL) 400 kV D/c (Quad) line$ at generation switchyard of Shongtong HEP
- Wangtoo (HPPTCL) - Panchkula (PG) 400 kV D/c (Twin HTLS*) line along with 80 MVAr switchable line reactor at Panchkula end on each circuit -210 km

**** with minimum capacity of 2100 MVA on each circuit at Nominal voltage***
$Line capacity shall be 2500 MVA per circuit at Nominal voltage

3.10.3 The above corridors shall be utilised for evacuation of power from Hydro generation of 1,404 MW (Shongtong-450 MW; Tidong-150 MW & Jhangi Thopan -804 MW) as well as Kaza Solar Park (880 MW) after connectivity of Kaza PS with 400 kV Jhangi PS. In this way, the identified corridors shall be utilised for 2,284 MW envisaged RE generation.

3.10.4 The Scheme was deliberated and agreed in the 57th meeting of NRPC held on 31.08.2022. However, it was also opined that CTUIL shall closely monitor progress of Kaza solar park and ensure that transmission system for Kaza Solar Park is planned & implemented matching with the Kaza generation project to meet its evacuation requirement so that there is no loss of RE generation.

3.10.5 Representative from MNRE stated that commissioning of Kaza Solar Park is uncertain due to various issues in environmental/forest clearances.

3.10.6 It was informed that considering the limited corridor in the area, higher capacity of the transmission line has been considered. Further, there is additional Hydro potential in the Satluj basin. Also, as informed by Govt of HP, another solar park of 400 MW is also envisaged in Kinnaur area. Therefore, even if Kaza solar project doesn't materialize, the proposed corridors can be utilized for evacuation of power of those hydro/ Solar generation projects.

3.10.7 After detailed deliberations the transmission scheme was recommended to be implemented through TBCB route.

Sl. No.	Name of the scheme/est. cost	Decision of NCT	Purpose /Justification
1.	Transmission system for evacuation of power from Shongtong Karcham HEP (450 MW) and Tidong HEP (150 MW) Est. Cost: Rs 2286 Crs Implementation timeframe: Progressively from 1st July, 2026	Recommended for implementation through TBCB route	The proposed corridor shall be utilized for evacuation of 2,284 MW envisaged RE generation.

Detailed scope of the scheme is as under:

Sl. No.	*Scope of the Transmission Scheme*	*Capacity /km*
A. Phase-I with Tidong HEP [Schedule: 01st July 2026]		
1.	Establishment of 2x315 MVA (7x105 MVA 1-ph units including a spare unit) 400/220 kV GIS Pooling Station at Jhangi **Future provisions (Space for):** • 5 Nos. of 400 kV line bays • 6 Nos. of 220 kV line bays for future projects (space for 2 bays to be utilized for connectivity to Tidong generation) • 2 Nos. of 400/220 kV Transformer • 1 Nos. 420 kV Bus Reactor along with bay • 220 kV Sectionalization bay: 1 set • Bus Coupler: 1 No.	• 400/220 kV ICTs- 2x315 MVA (7x105 MVA 1-ph units including a spare unit) • 400 kV ICT bays- 2 Nos. • 220 kV ICT bays- 2 Nos. • 400kV line bays (GIS) -2 Nos. (for Jhangi PS – Wangtoo D/c line) • 420 kV Bus reactor -1 No. (4x 41.66 MVA 1-ph units including one spare unit) • 420 kV Reactor bay-1 No.
2	400 kV Jhangi PS – Wangtoo (Quad) D/c line (*Line capacity shall be 2500 MVA per circuit at Nominal voltage*)	Route length-54 km
3	400 kV bays at Wangtoo for termination of 400 kV Jhangi PS – Wangtoo D/c line	400 kV bays – 2 Nos.(GIS)
B. Phase-II with Shongtong HEP [Schedule : 31th July, 2026]		
1.	LILO of one circuit of Jhangi PS - Wangtoo (HPPTCL) 400 kV D/c (Quad) line$ at generation switchyard of Shongtong HEP	LILO route length- 1 km (2 ckm)
2.	Wangtoo (HPPTCL) - Panchkula (PG) 400 kV D/c (Twin HTLS*) line along with 80 MVAr switchable line reactor at Panchkula end on each circuit	Route length- 210 km
3	400 kV bays at Wangtoo S/s (2 Nos.) and Panchkula S/s (2 Nos.) for termination of 400 kV Wangtoo (HPPTCL) - Panchkula (PG) D/c line	400 kV Line bays- 4 Nos. (2 Nos. GIS bays at Wangtoo and 2 Nos. AIS bays at Panchkula)

$ Line capacity shall be 2500 MVA per circuit at Nominal voltage

* with minimum capacity of 2100 MVA on each circuit at Nominal voltage

Note :

i. Tidong HEP- Jhangi PS 220 kV D/C line (along with associated bays at both ends)- under the scope of applicant/generation developer.

ii. Developer of Shongtong HEP to provide 2 Nos. of 400 kV bays at Shongtong switchyard for

LILO of one circuit of Jhangi PS - Wangtoo (HPPTCL) 400 kV D/c (Quad) line at generation switchyard of Shongtong HEP

iii. HPPTCL to provide space for four number of 400 kV line bays (GIS) at Wangtoo substation for termination 400 kV Jhangi PS – Wangtoo D/c line and Wangtoo (HPPTCL) - Panchkula (PG) D/c line

iv. *Powergrid to provide space for 2 Nos. of 400 kV bays at Panchkula S/s for termination of* Wangtoo (HPPTCL) - Panchkula (PG) D/c line

v. The line lengths indicated above are approximate as the actual line length would be obtained after detailed survey.

3.11 **Additional 1x500 MVA 400/220 kV (9th) ICT, for injection from any additional RE project (other than 4000 MW injection under SECI bids upto Tranche IV) at Bhuj PS**

3.11.1 CTUIL stated that the additional 1x500 MVAR, 400/220 kV (9th) ICT at Bhuj PS was planned for injection from any additional RE project (other than 4000 MW injection under SECI bids upto Tranche IV) at Bhuj PS and was allocated for implementation to POWERGRID under RTM route as per MoP OM dated 30.01.2019. As per the OM, the 9th ICT is to be taken up for injection requirement beyond 4,000 MW at 220 kV level of Bhuj PS.

3.11.2 Presently, the total Stage-II connectivity and LTA at Bhuj PS has reached 3366 MW. Considering the large size of the Pooling Station as well as rapid pace of development of RE projects in Gujarat, it is proposed to proceed with implementation of the 9th ICT at Bhuj PS irrespective of Stage-II connectivity/LTA applications. The 9th ICT would also serve the purpose of meeting 'N-1' criteria as soon as RE evacuation requirement crosses 3500 MW at Bhuj PS.

3.11.3 Representative of SECI stated that Govt. of Gujarat is not providing land for additional RE development in Bhuj area, therefore, no additional connectivity applications are anticipated from RE generators CTUIL also informed that as of now, no new connectivity applications have been received.

3.11.4 After detailed deliberations, it was decided to defer the scheme and the same would be taken up upon visibility of additional RE generation at Bhuj PS.

3.12 **Urgent requirement of KPS1 Augmentation and KPS2 / KPS3 establishment schemes**

3.12.1 CTUIL stated that a meeting was held on 28.11.2022 under the Chairmanship of Adviser, MNRE, amongst MNRE, CTU, RECPDCL and SPPDs in Khavda area, to discuss the progress in development of transmission system in Khavda region of Gujarat. During the meeting, it was brought out that the length of transmission lines viz. length of KPS1-KPS2 / KPS2-KPS3 765 kV D/c lines is small (~20 km.). Further, space for establishment of KPS2 / KPS3 has already been earmarked by GPCL.

3.12.2 Accordingly, considering the urgent requirement of KPS1 Augmentation and KPS2 / KPS3 establishment schemes and to ensure matching of associated transmission system with RE generation, it was decided that the time-line of implementation of the following schemes may be reduced from 24 months to 21 months:

a) Establishment of Khavda Pooling Station-2 (KPS2) in Khavda RE Park
b) Transmission scheme for injection beyond 3 GW RE power at Khavda PS1 (KPS1)

c) Establishment of Khavda Pooling Station-3 (KPS3) in Khavda RE Park

3.12.3 During that meeting, the SPPDs noted the latest time-lines of the schemes and expressed no issues with the same. In line with above decision, CTU has already provided inputs towards RfP amendment of the subject schemes to the BPC.

3.12.4 After detailed deliberations, the time-line of implementation of the following schemes from 24 months to 21 months was ratified by NCT:

a) Establishment of Khavda Pooling Station-2 (KPS2) in Khavda RE Park
b) Transmission scheme for injection beyond 3 GW RE power at Khavda PS1 (KPS1)
c) Establishment of Khavda Pooling Station-3 (KPS3) in Khavda RE Park

3.13 Change in scope of the "Transmission scheme for evacuation of 4.5 GW RE Injection at Khavda PS under Phase-II- Part B"

3.13.1 Transmission scheme for evacuation of 4.5 GW RE Injection at Khavda PS under Phase-II- Part B is given below:

- Lakadia PS – Ahmedabad 765 kV D/c line (250 km.)
- 2 Nos. of 765 kV line bays at Lakadia PS for Lakadia PS – Ahmedabad 765 kV D/c line
- 240 MVAr, 765 kV switchable line reactor for each circuit at each end of Lakadia PS – Ahmedabad 765 kV D/c line)

3.13.2 M/s Adani had communicated non-availability of space for 2 Nos. of Switchable Line Reactors at Lakadia S/stn for Lakadia-Ahmedabad 765 kV D/c line. Accordingly, a meeting was convened by CEA on 28.11.2022 with participants from CTUIL and WRLDC to discuss the "Transmission scheme for evacuation of 4.5 GW RE Injection at Khavda PS under Phase-II- Part B". In the meeting, CTUIL had highlighted that the requirement of Switchable Line Reactors at Lakadia S/stn was for interim period. After the planned LILO of the Lakadia-Ahmedabad 765 kV D/c line at Halvad, only the reactors at Ahmedabad end would suffice. After deliberations in that meeting, it was agreed to delete the Switchable Line Reactors at Lakadia S/stn for Lakadia-Ahmedabad 765 kV D/c line and revised scope is given below:

- Lakadia PS – Ahmedabad 765 kV D/c line (200 km.)
- 2 Nos. of 765 kV line bays at Lakadia PS for Lakadia PS – Ahmedabad 765 kV D/c line
- 240 MVAr, 765 kV switchable line reactor for each circuit at Ahmedabad end of Lakadia PS –Ahmedabad 765 kV D/c line)

3.13.3 In line with above, CTUIL has already provided inputs towards RfP amendment of the subject scheme to the BPC.

3.13.4 After detailed deliberations, NCT ratified the revised scope of “Transmission scheme for evacuation of 4.5 GW RE injection at Khavda PS under Phase-II Part B” as given below:

Original Scope	**Revised Scope**
• Lakadia PS – Ahmedabad 765 kV D/c line (250 km.) • 2 Nos. of 765 kV line bays at Lakadia PS	• Lakadia PS – Ahmedabad 765 kV D/c line (200 km.) • 2 Nos. of 765 kV line bays at Lakadia PS

for Lakadia PS – Ahmedabad 765 kV D/c line • 240 MVAr, 765 kV switchable line reactor for each circuit at each end of Lakadia PS –Ahmedabad 765 kV D/c line	for Lakadia PS – Ahmedabad 765 kV D/c line • 240 MVAr, 765 kV switchable line reactor for each circuit at Ahmedabad end of Lakadia PS –Ahmedabad 765 kV D/c line

3.14 **Modifications in the scheme "Transmission scheme for evacuation of 4.5 GW RE injection at Khavda PS under Phase II- Part D".**

3.14.1 In the 10th meeting of NCT held on 07.11.2022 w.r.t. Agenda Item 3.3 (Implementation modalities of Transmission scheme for evacuation of 4.5 GW RE injection at Khavda PS under Phase II- Part D), following was agreed:

- The mode of implementation for the "Transmission scheme for evacuation of 4.5 GW RE injection at Khavda PS under Phase II- Part D" would be changed from TBCB to RTM.
- Further, as implementation of all the transmission packages proposed for evacuation of 4.5 GW RE injection at Khavda RE park under Phase-II (Part A to Part D) needs to be taken up in similar timeframe, accordingly, the implementing agency under RTM would coordinate with the BPC/SPV of Khavda Phase II (Part A – C) schemes to match the commissioning timeframe. This would entail the following:
  i. Denotification of the scheme "Transmission scheme for evacuation of 4.5 GW RE injection at Khavda PS under Phase II- Part D" that was issued by MoP vide Gazette Notification dated 25.09.2020.
  ii. Allocation of the aforesaid scheme to CTUIL for implementation through RTM route by the respective asset owners i.e.
    a. LILO of Pirana (PG) – Pirana (T) 400 kV D/c line at Ahmedabad S/s with twin HTLS conductor alongwith reconductoring of Pirana (PG) – Pirana (T) line with twin HTLS conductor (with OPGW for both main & LILO portion) and Bay upgradation work at Pirana (T) along with requisite FOTE - to be awarded to TPGL.
    b. Bay upgradation work at Pirana (PG) along with requisite FOTE - to be awarded to Powergrid.

3.14.2 CTUIL mentioned that M/s TPGL vide letter dated 20.12.2022 had informed that they are also the owner of 2 Nos. 400 kV line bays at Pirana (PG) S/s. Accordingly, implementation agency for bay work at Pirana (PG) needs to be revised as given below:

Sl. No.	Scope of the Transmission Scheme (Original)	Scope of the Transmission Scheme (Revised)
1.	LILO of Pirana (PG) – Pirana (T) 400 kV D/c line at Ahmedabad S/s with twin HTLS conductor alongwith reconductoring of Pirana (PG) – Pirana (T) line with twin HTLS conductor (with OPGW for both main & LILO portion) and Bay upgradation work at Pirana (T) along with requisite FOTE - to be awarded to TPGL	LILO of Pirana (PG) – Pirana (T) 400 kV D/c line at Ahmedabad S/s with twin HTLS conductor alongwith reconductoring of Pirana (PG) – Pirana (T) line with twin HTLS conductor (with OPGW for both main & LILO portion) and Bay upgradation work at Pirana (T) **and at Pirana (PG)** along with requisite FOTE - to be awarded to TPGL
2.	Bay upgradation work at Pirana (PG) along with requisite FOTE - to be awarded to Powergrid.	

3.14.3 NCT approved the above.

3.15 **Modification in scope of work of "Transmission Network Expansion in Gujarat to increase ATC from ISTS: Part C" scheme**

3.15.1 The Transmission Network Expansion in Gujarat to increase its ATC from ISTS: Part C scheme was agreed in the 7th NCT meeting held on 03.12.2021 with following scope of work:

Sl. No.	Scope of the Transmission Scheme	Capacity /km
1	Augmentation of transformation capacity at 765/400 kV ICT Banaskantha S/S by 1x1500 MVA	765/400 kV, 1500 MVA ICT: 1 No. 765 kV ICT bay – 1 No. 400 kV ICT bay– 1 No.
2	Banaskantha -Sankhari 400 kV 2nd D/c line	Route length: 26 km 400 kV line bays- 4 Nos. (2 Nos. at Banaskantha and 2 Nos. at Sankhari)

3.15.2 Estimated Cost of the scheme was Rs 148 Crore and Implementation Time-frame was in Matching with establishment of Prantij 400/220 kV and Sankhari- Prantij 400 kV D/c line by GETCO (presently expected by March, 2025).

3.15.3 The scheme is presently under implementation by POWERGRID (under RTM) as per NCT letter dated 22.12.2021. Subsequently, in a meeting amongst CTUIL & GETCO on 09.11.2022, GETCO requested CTU to review the Banaskantha -Sankhari 400 kV 2nd D/c line considering the issue of high fault level at 400 kV level of Sankhari (Veloda) S/s (~45 kA in 2026-27 time-frame) as well as RE connectivity to the tune of 700-800 MW which has been granted by GETCO at 220 kV level of Sankhari S/s. Further, the matter was deliberated in meetings held on 16.11.2022 & 18.11.2022 amongst CEA, CTUIL, POSOCO & GETCO wherein following emerged:

- GETCO informed that Sankhari – Prantij 400kV D/c line along with Prantij 400/220kV S/s is currently under tendering stage with target completion by March 2025.
- POWERGRID informed that they have already awarded the Banaskantha – Sankhari 400 kV 2nd D/c line.
- To resolve the issues raised by GETCO, it was decided that instead of establishing Banaskantha -Sankhari 400 kV 2nd D/c line under ISTS and Sankhari – Prantij 400kV D/c (twin AL-59) line under Intra-state, *Banaskantha – Prantij 400 kV D/c direct line (~150 km.) along with 63 MVAr, 420 kV switchable line reactors on each ckt at Prantij S/s end* may be established. This would reduce the fault level at Sankhari to below 40 kA and would also help to feed load in Prantij area directly from Banaskatha (PG) S/s thereby relieving overloading issues on Banaskantha – Sankhari 400 kV D/c line.
- POWERGRID and GETCO were requested to coordinate with each other and confirm the modalities of implementation of Banaskantha – Prantij 400 kV D/c direct line.

3.15.4 In this direction, POWERGRID vide e-mail dated 25.11.2022 informed that although they have awarded transmission Line and S/s Extension packages at both sides (i.e. Banaskantha & Sankhari ends) and construction work is in progress, they are ready to implement Banaskantha – Prantij 400 kV D/c line along with 63 MVAr, 420 kV switchable line reactor on each ckt at Prantij S/s end (instead of earlier scope of Banaskantha – Sankhari 400 kV 2nd D/c line).

3.15.5 Subsequently, GETCO vide e-mail dated 20.12.2022 informed that in order to avoid sectionalisation arrangement at Sankhari or bypassing of lines at later stage (i.e. idle bays at Sankhari substation), it would be advisable to review the planned scheme at this stage itself. In view of the same, GETCO requested that the Bansakantha - Prantij 400 kV D/c line may be implemented under ISTS and 400 kV D/C Sankhari - Prantij line under Intra-State scheme may be dropped.

3.15.6 In view of the above, CTUIL proposed to revise the scheme as per details given below**:**

Sl. No.	**Scope of the Transmission Scheme**	**Capacity /km**
1	Augmentation of transformation capacity at 765/400 kV ICT Banaskantha S/S by 1x1500 MVA	765/400 kV, 1500 MVA ICT: 1 No. 765 kV ICT bay – 1 No . 400 kV ICT bay– 1 No.

2	Banaskantha – Prantij 400kV D/c (Quad ACSR/AAAC/AL59 moose equivalent) line along with 63 MVAr, 420 kV switchable line reactors on each ckt at Prantij S/s end	Route length: 150 km 400 kV line bays- 4 Nos. (2 Nos. at Banaskantha and 2 Nos. at Prantij) 63 MVAr, 420 kV Switchable Line Reactors- 4 Nos. (at Prantij end) along with associated switching equipment.

3.15.7 The estimated Cost of revised scheme is of the order of Rs 840 Cr. as per March 2022, price level. It was discussed that revised scheme proposed by CTUIL has huge change from original scheme in terms of expenditure. It may also necessitate change in implementation mode.

3.15.8 Keeping in view that the scheme allocated to POWERGRID under RTM is already under implementation, NCT gave the direction to review the scheme and come up with an alternate solution in the next sitting.

3.15.9 Accordingly, a meeting was held on 05.01.2023 under the chairmanship of Chairperson, CEA, to discuss the proposal. Representatives of CTUIL, GETCO & POWERGRID participated in the meeting. In the meeting, following was agreed:

i) Banaskantha-Sankhari 400 kV 2nd D/c line (being implemented by POWERGRID under RTM) may not be terminated at Sankhari S/s, instead it may be terminated on the tower outside Sankhari S/s.

ii) GETCO to implement the Prantij-Sankhari 400kV D/c line and connect it with Banaskantha- Sankhari 400 kV 2nd D/c line being implemented by POWERGRID.

iii) 400 kV line bays (2 Nos.) at Sankhari S/s may be deleted from the scope of POWERGRID.

iv) POWERGRID and GETCO would finalize the type of conductor and tower configuration within two weeks to ensure compatibility of the transmission lines being implemented by them.

v) POWERGRID and GETCO would implement the complete scope of work in matching timeframe so that no asset remains unutilized.

3.15.10 CTUIL informed that POWERGRID vide email dated 16.01.2023 has forwarded the Minutes of the meeting held on 10.01.2023 between POWERGID and GETCO in this regard. In the meeting, the implementation modality, location of interconnection and timeframe of the proposed arrangement had been mutually agreed between POWERGRID & GETCO.

3.15.11 NCT noted the same and approved the following revised scope of works of "***Transmission Network Expansion in Gujarat to increase ATC from ISTS: Part C"***

Sl. No.	**Original Scope of the Transmission Scheme**	**Modified scope of the transmission scheme**
1	Augmentation of transformation capacity at 765/400 kV ICT Banaskantha S/S by 1x1500 MVA 765/400 kV, 1500 MVA ICT: 1 Nos.	Augmentation of transformation capacity at 765/400 kV ICT Banaskantha S/S by 1x1500 MVA 765/400 kV, 1500 MVA ICT: 1 Nos.

	765 kV ICT bay – 1 No. 400 kV ICT bay– 1 No.	765 kV ICT bay – 1 No. 400 kV ICT bay– 1 No.
2	Banaskantha -Sankhari 400 kV 2nd D/c line (26 km) Line Length : 26 km 400 kV line bays- 4 Nos. (2 Nos. at Banaskantha and 2 Nos. at Sankhari)	Banaskantha- Sankhari section of Banaskantha – Prantij 400 kV D/c line (Quad ACSR/AAAC/AL59 moose equivalent) Route length: 26 km 400 kV line bays - 2 Nos. (at Banaskantha)

Implementation Time-frame: Matching with establishment of Prantij 400/220 kV S/s and Prantij - Sankhari section of Banaskantha – Prantij 400 kV D/c line (presently expected by March, 2025)

Note:

(i) The downstream system to be implemented by GETCO under intra-state with which the developer (POWERGRID) has to match the SCoD is as follows:

Sl. Nos.	Scope of the Transmission Scheme	Capacity /km
1.	Sankhari – Prantij section of Banaskantha – Prantij 400 kV D/c line along with line bays and 63 MVAr, 420 kV switchable line reactors on each ckt at Prantij S/s end	Route length: 125 km (approx.) 400 kV line bays- 2 Nos. (at Prantij S/s) 63 MVAr, 420 kV Switchable Line Reactors- 2 Nos. at Prantij end along with associated switching equipment

3.16 **Transmission system for evacuation of power from REZ in Rajasthan (20 GW) under Phase-III Part C3 and E3**

3.16.1 Transmission system for additional 20 GW REZ in Northern Region (Phase-III) was agreed in the 3rd NRPC (TP) meeting held on 19.02.2021 and 49th Northern Region Power Committee (NRPC) meeting held on 27.09.2021. Subsequently in the 5th NCT meeting held on 25.08.2021 & 02.09.2021, above scheme was agreed for implementation. As part of above scheme, in 5th NCT meeting, STATCOM along with MSC & MSR each at Ramgarh and Fatehgarh-III PS was also discussed in following two packages:

A. Transmission system for evacuation of power from REZ in Rajasthan (20GW) under Phase-III Part C3

S.Nos.	Scope of the Transmission Scheme	Capacity (MVAr)	Estimated Cost
1	Ramgarh PS: STATCOM	±2x300 MVAr STATCOM,	Rs 300 Cr

	along with MSC+MSR	4x125 MVAr MSC, 2x125 MVAr MSR	

B. Transmission system for evacuation of power from REZ in Rajasthan (20GW) under Phase-III Part E3

S.No.	Scope of the Transmission Scheme	Capacity (MVAr)
1	Fatehgarh – III PS : STATCOM along with MSC+MSR	±2x300 MVAr, 4x125 MVAr MSC, 2x125 MVAr MSR

3.16.2 In the 5th NCT meeting, it was deliberated that Battery Energy Storage System could be treated as an alternative to STATCOM and therefore needs to be explored. However, presently due to cost consideration, BESS technology at Grid scale level in India is yet to evolve. Also, RE penetration (solar/Hybrid) is increasing continuously in western Rajasthan and Phase-III transmission system is also under advance stage of approval by GIB committee

Additionally, in Western Rajasthan many issues related to reactive power management i.e. oscillations, abrupt voltage variations, low voltages in peak solar generation period & high voltage in off solar generation period have been observed which also necessitate urgent deployment of STATCOM to support the grid. In various MOP meetings, need of STATCOMs in RE complexes has already been emphasised by various stakeholders viz. SECI, POSOCO etc. Accordingly, CTUIL proposed that the STATCOMs in Ph-III package C3 & E3 may be taken up for implementation.

3.16.3 After deliberations, it was agreed that ± 2x300 MVAr STATCOMs, 4x125 MVAr MSC, 2x125 MVAr MSR shall be implemented each at Ramgarh PS and Fatehgarh-3 PS. It was also agreed that these STATCOMs will be implemented as part of transmission schemes "Transmission system for evacuation of power from REZ in Rajasthan (20 GW) Phase-III" which are currently at bidding stage and approval from Committee constituted by Hon'ble Supreme Court for implementation of project in GIB area is awaited.

3.16.4 Accordingly, the scope of the two packages i.e. Transmission system for evacuation of power from REZ in Rajasthan (20 GW) under Phase-III Part C1 and Transmission system for evacuation of power from REZ in Rajasthan (20 GW) under Phase-III Part F are to be modified including the space for future scope agreed earlier as under (additional elements shown in bold font):

I. Transmission system for evacuation of power from REZ in Rajasthan (20 GW) under Phase-III Part C1

Sl.No.	Original Scope	Revised Scope
1.	Establishment of 2x1500 MVA, 765/400 kV & 2x500 MVA, 400/220 kV pooling station at Ramgarh along with 2x240 MVAr (765 kV) Bus Reactor & 2x125 MVAr (420 kV) Bus reactor	Establishment of 2x1500 MVA, 765/400 kV & 2x500 MVA 400/220 kV pooling station at Ramgarh along with 2x240 MVAr (765 kV) Bus Reactor & 2x125 MVAr (420 kV) Bus Reactor**, ± 2x300MVAr STATCOM along**

		with MSC+MSR
	Capacity	Capacity
	765/400kV1500 MVA ICTs:2 Nos. *(7x500 MVA including one spare unit)*	765/400 kV 1500 MVA ICTs: 2 Nos. (7x500 MVA including one spare unit)
	765 kV ICT bays –2 Nos.	765 kV ICT bays - 2 Nos.
	400/220 kV, 500 MVA ICT – 2 Nos.	400/220 kV, 500 MVA ICT – 2 Nos.
	400 kV ICT bays – 4 Nos.	400 kV ICT bays – 4 Nos.
	220 kV ICT bays – 2 Nos.	220 kV ICT bays - 2 Nos.
	400 kV line bays - As per connectivity granted to RE developers (2 Nos. of bays considered at present)	400 kV line bays - 2 Nos.
	220 kV line bays -As per connectivity granted to RE	220 kV line bays: 4 Nos.
	developers (4 Nos. of bays considered at present)	765 kV line bays -2 Nos.
	765 kV line bays – 2 Nos.	240 MVAr Bus Reactor-2 Nos.
	240 MVAr Bus Reactor-2 Nos.	(7x80 MVAr considering one spare unit)
	(7x80 MVAr considering one spare unit)	240 MVAr Bus Reactor-2 Nos. (7x80 MVAr, including one spare unit)
	765kV reactor bay- 2 Nos.	765 kV reactor bay- 2 Nos.
	125 MVAr, 420 kV bus reactor – 2 Nos.	125 MVAr, 420kV bus reactor - 2 Nos.
	420 kV reactor bay – 2 Nos.	420 kV reactor bay - 2 Nos.
		400kV Sectionalization bay: 1 set. **
		± 2x300MVAr STATCOM, 4x125 MVAr MSC, 2x125 MVAr MSR along with 2 Nos. of 400 kV bays
	Future provisions: Space for	Future provisions: Space for
	765/400 kV ICTs along with bays: 3 Nos.	**765/400kV ICTs along with bays: 5 Nos.**
	765 kV line bay along with switchable line reactor: 2 Nos.	765 kV line bay along with switchable line reactor: 2 Nos.
	765kV Bus Reactor along with bays: 2 Nos.	765 kV Bus Reactor along with bays: 2 Nos.
	400/220 kV ICTs along with bays: 6 Nos.	**400/220 kV ICTs along with bays: 8 Nos.**
	400 kV line bays along with switchable line reactor: 4Nos.	400 kV line bays along with switchable line reactor: 4 Nos.
	400 kV line bays: 4 Nos.	

	400 kV Bus Reactor along with bays: 2 Nos. 400kV Sectionalization bay: 3 Nos. 220 kV line bays: 8 Nos. 220kV sectionalisation bay: 2 Nos. (Some change in space provision in last NCT)	**400 kV line bays: 2 Nos.** 400 kV Bus Reactor along with bays: 2 Nos. **400 kV Sectionalization bay: 2 sets **** **220 kV line bays: 11 Nos.** 220kV Sectionalization bay: 2 Nos. **
2.	Ramgarh – Bhadla-3, 765 kV D/c line (180 km) along with 240 MVAr switchable line reactor at each circuit at Ramgarh end of Ramgarh – Bhadla-3, 765kV D/c line <u>Capacity/km</u> Length – 180km 765 kV, 240 MVAr switchable line reactor- 2 Nos. Switching equipment for 765 kV 240 MVAR switchable line reactor –2 Nos.	Ramgarh – Bhadla-3, 765 kV D/c line (180 km) along with 240 MVAr switchable line reactor at each circuit at Ramgarh end of Ramgarh – Bhadla-3, 765 kV D/c line <u>Capacity</u> 765 kV, 240 MVAr switchable line reactor- 2 Nos. Switching equipment for 765 kV 240 MVAR switchable line reactor –2 Nos.
3.	2 Nos. of 765 kV line bays at Bhadla-3 <u>Capacity/km</u> 765 kV line bays:- 2 Nos.	2 Nos. of 765 kV line bays at Bhadla-3 <u>Capacity/km</u> 765 kV line bays:- 2 Nos.

Note:

i. Implementation schedule of Phase III –Part C1 package is to match with package Phase III –Part B1 (establishment of Bhadla-3 PS, 765 kV Bhadla-3 PS-Sikar-2 D/c line, 400 kV Bhadla-3 PS-Fatehgarh-2 D/c line)

ii. Developer of Bhadla-3 S/s to provide space for 2 Nos. of 765 kV line bays at Bhadla-3 S/s for termination of Ramgarh – Bhadla-3, 765kV D/c line

iii. The line lengths mentioned above are approximate as the exact length shall be obtained after the detailed survey

iv. Provision of suitable sectionalization shall be kept at Ramgarh at 400 kV & 220 kV levels to limit short circuit level

v. ±300 MVAr STATCOM should be placed in each 400 kV bus section of Ramgarh PS

vi. Implementation of the scheme to be taken up upon receipt of LTA from RE generation developers at Ramgarh PS/Bhadla-3 PS

*** Bus Sectionalization bay shall comprise of bus sectionalization of both Main Bus-I & Main Bus-II.*

Implementation Timeframe: 18 months from date of SPV acquisition.

II. Transmission system for evacuation of power from REZ in Rajasthan (20 GW) under Phase-III Part F

S.No.	Original Scope	Revised Scope

1.	Establishment of 2x1500 MVA, 765/400 kV Substation at suitable location near Beawar along with 2x330 MVAr 765 kV Bus Reactor & 2x125 MVAr 420 kV Bus Reactor <u>Capacity:</u> 765/400kV 1500 MVA ICTs: 2 Nos. (7x500 MVA, including one spare unit) 330 MVAr, 765 kV bus reactor- 2 (7x110 MVAr, including one spare unit) 765kV ICT bays – 2 Nos. 400 kV ICT bays – 2 Nos. 765 kV line bays – 6 Nos. 400kV line bay- 2Nos. 765kV reactor bay- 2 Nos. 125 MVAr, 420kV bus reactor – 2 Nos. 420 kV reactor bay – 2 Nos. <u>Future provisions: Space for</u> 765/400 kV ICTs along with bays: 2 Nos. 765 kV line bay along with switchable line reactor: 6Nos. 765 kV Bus Reactor along with bays: 2 Nos. 400/220 kV ICTs along with bays: 2Nos. 400 kV line bays along with switchable line reactor: 4 Nos. 400 kV Bus Reactor along with bays: 1Nos. 220 kV line bays: 4 Nos.	Establishment of 2x1500 MVA, 765/400 kV Substation at suitable location near Beawar along with 2x330 MVAr 765kV Bus Reactor & 2x125 MVAr 420 kV Bus Reactor. <u>Capacity:</u> 765/400 kV 1500 MVA ICTs: 2 Nos. (7x500 MVA, including one spare unit) 330 MVAr, 765 kV bus reactor- 2 (7x110 MVAr, including one spare unit) 765 kV ICT bays – 2 Nos. 400 kV ICT bays – 2 Nos. 765 kV line bays – 6 Nos. 400 kV line bay- 2Nos. 765 kV reactor bay- 2 Nos. 125 MVAr, 420 kV bus reactor – 2 Nos. 420 kV reactor bay – 2 Nos. **<u>Future provisions: Space for</u>** 765/400 kV ICTs along with bays: 2 Nos. **765 kV line bay along with switchable line reactor: 8 Nos.** 765 kV Bus Reactor along with bays: 2 Nos. 400/220 kV ICTs along with bays: 2 Nos. 400 kV line bays along with switchable line reactor: 4 Nos. 400 kV Bus Reactor along with bays: 1 No. 220 kV line bays: 4 Nos.
2.	LILO of both circuit of Ajmer-Chittorgarh 765 kV D/c at Beawar (45 km)	LILO of both circuit of Ajmer-Chittorgarh 765 kV D/c at Beawar (45 km)
3.	LILO of 400 kV Kota –Merta line at Beawar (20 km)	LILO of 400 kV Kota –Merta line at Beawar (20 km)

4.	Fatehgarh-3– Beawar 765 kV D/c along with 330 MVAr Switchable line reactor for each circuit at each end of Fatehgarh-3– Beawar 765 kV D/c line Capacity/km: Length – 350 km Switching equipment for 765 kV 330 MVAR switchable line reactor –4 Nos. 765 kV, 330 MVAr Switchable line reactor- 4 Nos.	Fatehgarh-3– Beawar 765 kV D/c along with 330 MVAr Switchable line reactor for each circuit at each end of Fatehgarh-3– Beawar 765 kV D/c line Capacity/km: Length – 350 km Switching equipment for 765 kV 330 MVAR switchable line reactor –4 Nos. 765 kV, 330 MVAr Switchable line reactor- 4 Nos.
5.	**In earlier scope, STATCOM at Fatehgarh-3 PS was proposed as part of Phase-III Part E3**	**STATCOM at Fatehgarh-3 PS** **±2x300 MVAr STATCOM along with 4x125 MVAr MSC, 2x125 MVAr MSR along with 2 Nos. of 400 kV bays at Fatehgarh-3 PS**

Note:

i. **POWERGRID shall provide space for 2 Nos. of 765 kV line bays at Fatehgarh-3 S/s for Fatehgarh-3– Beawar 765 kV D/c line along with 765 kV switchable line reactors**
ii. The line lengths mentioned above are approximate as the exact length shall be obtained after the detailed survey
iii. *Scheme to be awarded after SECI/ /REIA awards first bid of RE project* at Fatehgarh-3 (new section and/or Fatehgarh-4).
iv. **±300 MVAr STACOM should be placed in each 400 kV section of Fatehgarh-3 PS (Phase-III Part E1)**
v. POWERGRID shall provide space at Fatehgarh-3 PS for STATCOM along with MSC & MSR **and associated 400 kV bays.**

Implementation Timeframe: 18 months from date of SPV acquisition

4 Communication schemes for existing ISTS

4.1 OPGW installation on existing 400 kV Jallandhar (PG) – Kurukshetra (PG) line which is to be LILOed at 400 kV Dhanansu (PSTCL)

4.1.1 CTUIL stated that a new substation Dhanansu (PSTCL) has been constructed by PSTCL by LILO of one circuit of 400 kV Jallandhar-Kurukshetra D/c line. The 400 kV Jallandhar-Kurukshetra D/c line is owned by POWERGRID. OPGW on the LILO portion is envisaged along with the construction of the LILO lines by PSTCL. There is no other communication connectivity available to Dhanansu substation. CTU proposed that to provide voice and data communication to Dhanansu (PSTCL) substation, OPGW may be installed on the existing 400 kV Jallandhar (PG) – Kurukshetra (PG) line (229 km) by replacing the existing one No.

earthwire in live line installation alongwith terminal equipment. This will also provide additional redundant path to Jallandhar (PG) & Kurukshetra (PG) important substations of Northern region. Estimated cost of the scheme would be Rs 10.3 crore.

4.1.2 The scheme was deliberated in the 57th NRPC meetings held on 31.08.2022 wherein NRPC had concurred the scheme.

4.1.3 Regarding timeframe for implementation CTUIL stated that as general consideration, for length less than 200 km, implementation time frame is 18 months and for length greater than 200 km, implementation time frame is 24 months.

4.1.4 After deliberations the scheme was approved by NCT for implementation of OPGW on existing 400 kV Jallandhar (PG) – Kurukshetra (PG) line (229 km) alongwith terminal equipment under RTM route by owner of the line i.e. POWERGRID with implementation timeframe of 24 months.

4.2 **OPGW installation on existing 400 kV Koldam (Indigrid) – Ludhiana (PG) line which is to be LILOed at 400 kV Ropar (PSTCL)**

4.2.1 CTUIL stated that a new substation Ropar (PSTCL) has been constructed by PSTCL by LILOing both circuits of 400 kV Koldam (Indigrid) – Ludhiana (PG) line (150 kms.). Owner of 400 kV Koldam (Indigrid) – Ludhiana (PG) line is IndiGrid. There is no other communication connectivity available to Ropar substation. CTU proposed that to provide voice and data communication to Ropar (PSTCL) substation, OPGW may be installed on the existing 400 kV Koldam (Indigrid) – Ludhiana (PG) line (150 km) by replacing the existing one Nos. earthwire in live line installation alongwith terminal equipment. This will also provide additional redundant path to Koldam (Indigrid) & Ludhiana (PG), important substations of Northern region. Estimated cost of the scheme would be Rs 6.7 crore with implementation timeframe of 18 months.

4.2.2 The scheme was deliberated in the 57th NRPC meetings held on 31.08.2022 wherein NRPC had concurred the scheme.

4.2.3 After deliberations, the scheme was approved by NCT for implementation of OPGW on existing 400 kV Koldam (Indigrid) – Ludhiana (PG) line (150 km) alongwith terminal equipment under RTM route by owner of the line i.e. IndiGrid with implementation timeframe of 18 months.

4.3 **OPGW installation on existing 400 kV Kota – Merta line which is to be LILOed at 765/400 kV Beawar (ISTS) S/s**

4.3.1 CTUIL stated that a new substation Beawar (ISTS) is proposed to be constructed under TBCB route by LILO of 400 kV Kota – Merta line (256 km). Owner of 400 kV Kota – Merta line is POWERGRID. OPGW on the LILO portion is envisaged along with the construction of the proposed LILO lines under "Transmission system for evacuation of power from REZ in Rajasthan (20 GW), phase III –Part F" under TBCB. CTU proposed that to provide additional redundant path to Beawar (New) S/s, OPGW may be installed on the

existing 400 kV Kota – Merta line (256 km) by replacing the existing one No. earthwire in live line installation alongwith terminal equipment.

4.3.2 Estimated cost of the scheme would be Rs 11.5 crore with implementation timeframe of 24 months from date of allocation. The scheme was deliberated in the 57th NRPC meetings held on 31.08.2022 wherein NRPC had concurred the scheme.

4.3.3 Director (PSPA-II), CEA, stated that 400 kV Kota – Merta line is already LILOed at Shree Cement TPS and there is no OPGW in that LILO portion. In the 57th meeting of NRPC, it was discussed that without decision of installation of OPGW on the LILO portion, there is no point in laying OPGW on main line. NRPC forum had approved the proposal for OPGW alongwith terminal equipment on 400 kV Kota – Merta S/C line (256 kms), however, for 400 kV LILO of Kota – Merta line at Shree Cement (55 kms), forum decided that decision may be taken in upcoming NRPC meetings after receiving inputs from Shree Cement.

4.3.4 CTUIL stated that Shree Cement was asked for the installation of OPGW on the LILO portion (owned by them) but they stated that OPGW link cannot be commissioned by them. Further, if OPGW in the LILO portion of Shree Cement is not implemented, OPGW on 400 kV Kota – Merta line can be completed with bypassing LILO at Shree Cement.

4.3.5 It was opined that implementation of OPGW while bypassing LILO at Shree Cement is not desirable. Further, as per MoM of 57th meeting of NRPC, the matter is to be re-deliberated in NRPC forum. Hence, it was decided to defer the scheme and the matter would be taken up in NCT once the same is finalized in NRPC forum.

4.4 **OPGW replacement on existing 400 kV Agra – Ballabhgarh**

4.4.1 CTUIL stated that OPGW on 400 kV Agra-Ballabhgarh line (181 km) (line owned by POWERGRID) was commissioned in the year 2004 and has completed its useful life of 15 years Physical condition of OPGW is deteriorating due to higher deposition of pollutants/contaminants as line is passing through industrial area. Further, higher downtime has been observed due to water ingress and low tensile strength on OPGW and associated hardware fittings. Agra-Ballabhgarh OPGW link is an important ISTS communication link for Northern region as well as for inter-regional data traffic coming from WR, SR, ER, NER towards NR and onwards to NLDC/NRLDC. It was proposed to replace existing OPGW with new OPGW (181 km) in live line condition alongwith terminal equipment. Estimated cost of the scheme would be Rs 9.05 crore with implementation timeframe of 18 months.

4.4.2 The scheme was deliberated in the 57th NRPC meetings held on 31.08.2022 wherein NRPC has concurred the scheme.

4.4.3 After deliberations, the scheme was approved by NCT for replacement of old OPGW and terminal equipment on existing 400 kV Agra – Ballabhgarh line (181 km) with new OPGW and terminal equipment under RTM route by owner of the line i.e. POWERGRID with implementation timeframe of 18 months.

4.5 **OPGW replacement on existing 400 kV Kishenpur – Wagoora line**

4.5.1 CTU stated that OPGW on OPGW on 400 kV Kishenpur – Wagoora line (183 km) (owned by POWERGRID) was commissioned in 2005 and has completed its useful life of 15 years.

Design system attenuation of this link was ≤ 45.91 dB whereas attenuation presently is around ≥ 80 dB. This line is further LILOed at New Wanpoh, therefore link become Kishenpur-New Wanpoh-Wagoora. OPGW on LILO portion was installed in the year 2015 (around 3 kms.) Kishenpur-New Wanpoh-Wagoora link provides backbone connectivity to important hydro stations and several sub-stations of J&K to SLDC/NRLDC/NLDC such as Uri-1, Uri-2, Kishenganga HEP, Baglihar HEP, Amargarh, Wagoora Ramban, New Wanpoh, Alsuteng-Leh Transmission system etc. In view of above constraints and critical nature of the link, replacement of old OPGW on 400 kV Kishenpur-Wagoora line with new OPGW (183 km) except LILO portion at New Wanpoh (3 km) in live line installation alongwith terminal equipment has been proposed with estimated cost of Rs 9.15 Crore and implementation timeframe of 18 months.

4.5.2 The scheme was deliberated in the 57th NRPC meetings held on 31.08.2022 wherein NRPC had concurred the scheme.

4.5.3 After deliberations, the scheme was approved by NCT for replacement of old OPGW alongwith terminal equipment on 400 kV Kishenpur-Wagoora line with new OPGW (183 km) except LILO portion at New Wanpoh (3 km) and terminal equipment under RTM route by owner of the line i.e. POWERGRID with implementation timeframe of 18 months.

4.6 **Redundant communication System for Bhinmal (PG) and Kankroli (PG) ISTS stations**

4.6.1 CTU stated that OPGW on 400 kV Jodhpur (Surpura) – Kankroli line was approved in 9th NCT alongwith re-conducting work. To utilise this link for ISTS communication redundant path and to make one additional redundant path over RVPNL communication links e.g. Bhinmal- Barmer-Jaiselmer-II-Jodhpur (Kankani)-Jodhpur (Surpura) additional FOTE are required at following RVPNL stations:

i. Barmer
ii. Jaisalmer-II
iii. Jodhpur (Kankani)
iv. Jodhpur 220 kV
v. Merta
vi. Ratangarh
vii. Ratangarh Sub-LDC
viii. Beawar

4.6.2 Further, 5 km OPGW is to be installed on 400 kV Jodhpur (Surpura) – Merta line (RVPNL) upto LILO point at 400 kV Bhadla S/s by replacing one number existing earthwire. The line also belongs to RVPNL.

4.6.3 Estimated cost of the scheme is Rs 2.55 crore and implementation timeframe is 18 months.

4.6.4 The scheme was deliberated in the 57th NRPC meetings held on 31.08.2022 wherein NRPC had concurred the scheme.

4.6.5 On being enquired about the implementation of OPGW and terminal equipment on state transmission licensee assets, CTUIL stated that as the communication link is to be utilized for ISTS Communication, accordingly the same has been considered for implementation under ISTS by POWERGRID

4.6.6 After deliberations, the scheme was approved by NCT for implementation of OPGW (5 km) on 400 kV Jodhpur (Surpura) – Merta line (RVPNL) upto LILO point of 400 kV Bhadla alongwith terminal equipment at Barmer, Jaisalmer-II, Jodhpur (Kankani), Jodhpur 220 kV, Merta, Ratangarh, Ratangarh Sub-LDC and Beawar under RTM route by POWERGRID with implementation timeframe of 18 months.

4.7 **OPGW installation on 220 kV Anta (NTPC) - Bhilwara Line**

4.7.1 CTU stated that presently Anta (NTPC) is connected with RLDC using Anta (NTPC) -Bassi line (link belongs to PowerTel). This OPGW is old and has lived its useful life. To provide alternate reliable path for Anta (NTPC), OPGW on 220 kV Anta (NTPC)-Bhilwara (187 km) line is proposed. It may also be mentioned that one alternate path over Anta (NTPC) – RAPP-C is already approved under exiting OPGW based communication package NROSS. It was proposed to replace existing earthwire with OPGW in live line condition. Estimated cost of the scheme would be Rs 9.35 crore with implementation timeframe of 18 months.

4.7.2 The scheme was deliberated in the 58th NRPC meetings held on 30.09.2022 wherein NRPC had concurred the scheme.

4.7.3 After deliberations, the scheme was approved by NCT for implementation of OPGW on existing 220 kV Anta (NTPC) – Bhilwara line (187 km) alongwith terminal equipment under RTM route by owner of the line i.e. POWERGRID with implementation timeframe of 18 months.

5. Evaluation of functioning of National Grid.

GRID-India presented the functioning of national grid in Q2 and Q3 of 2022-23. Copy of presentation is at **Annex- II.** Following points were highlighted during the presentation:

i. The frequency excursions have increased post CERC's DSM regulation (Notified on 5th December 2022).
ii. Under frequency relay (UFR) based load shedding got triggered on two occasions in December 2022.
iii. Power number was observed to be in the range of 10,000 MW/Hz during grid events.
iv. Grid Inertia as estimated during grid events was varying between 5.2 sec to 7.4 seconds.
v. Maintaining resource adequacy is challenging. Lowest wind generation (34.8 MU) in entire calendar year was recorded on 30th Aug'22 during high wind season when all-India electricity demand was 194.7 GW while the highest instantaneous RE penetration of 31.8% was recorded on 22nd May when all-India electricity demand was low (182.4 GW).
vi. Several EHV lines had to be switched manually for voltage regulation, particularly in RE pockets. Transmission utilities often express concerns regarding frequent switching of GIS circuit breakers and isolators.
vii. Several areas in Rajasthan and Maharashtra experience high voltage as well as low voltage.
viii. 'N-1' insecure operation was observed in intrastate system of Rajasthan.
ix. There was no RE curtailment in Bikaner complex post implementation of interim arrangement at Bikaner.

x. Intermittent low frequency (2.5 - 3 Hz) oscillations are being experienced during Solar hours.
xi. HVDC Raigarh-Pugalur and HVDC Mundra-Mahendragarh were utilized in forward as well as reverse directions for regulating flow on inter- regional AC links. HVDC Mundra-Mahendragarh requires more than 4 hours for reversal as compared to HVDC Raigarh-Pugalur and HVDC Balia-Bhiwadi which takes around 30-45 minutes.
xii. Operation of HVDC Vindhyachal back to back from WR to NR direction is constrained due to overloading of 400 kV Anpara-Obra line on account of prolonged outage of 765 kV Anpara D – Obra - Unnao line since 8th Feb'22, due to Non-availability of line reactor in the Obra-Unnao section at Obra end.
xiii. RE generation loss in Rajasthan RE complex occurred on 14th January 2023 due to tripping of multiple EHV lines as a result of kite flying on Makar Sankranti Festival.

Members appreciated the operational feedback shared by Grid-India. Based on the discussions, following actions points have been decided:

i. A reasonable time for power reversal on HVDC system needs to be established in consultation with the Transmission utility, CTUIL, CEA & GRID India so that adequate flexibility is available in real-time operations.
ii. Grid India shall issue advisory to all transmission utilities regarding the need to sensitize the general public regarding safety concerns associated with kite flying near EHV lines which also threaten the security of the grid if metallic threads are used for kite flying.
iii. GRID-India to share brief Note with CEA regarding intrastate transmission constraints in Rajasthan for taking up with Energy Secretary, Govt. of Rajasthan.
iv. GRID-India shall share brief Note with CEA for taking up the revival of 765 kV Anpara_D - Unnao transmission line with Energy Secretary, Govt. of Uttar Pradesh.
v. RPCs shall advise SLDCs to share the quarterly operational feedback with RLDCs/RPCs/STU/CTUIL/CEA.
vi. The progress of following elements needs to be closely monitored by PSPM Division, CEA, for strengthening the Inter-regional (IR) corridors:
    a. 3x1500 MVA 765/400 kV ICTs at Kotra S/S
    b. 765/400 kV ICT-3 at Nizamabad
    c. 765 kV Warora-Warangal D/C line
    d. 765 kV Hyderabad-Kurnool D/C line
    e. 765 kV Narendra-Pune D/c line
    f. Bypassing of 400 kV Kankroli – Bhinmal - Zerda lines at Bhinmal to form 400 kV Kankroli - Zerda (direct line) and reconductoring of 400 kV Jodhpur (Surpura) (RVPN)-Kankroli-S/C line with twin HTLS conductor.

6. Comprehensive presentation by CTU apprising NCT of measures taken for ensuring development of an efficient, co-ordinated and economical ISTS for smooth flow of electricity.

7. Five-year rolling plan for ISTS capacity addition.

CTUIL made combined presentation on the agenda items Nos. 6 and 7. Copy of presentation is at **Annex- III.** It was mentioned that as per MoP Electricity Rules published in October, 2021, CTUIL is drawing plan for Inter-State Transmission System (ISTS) for up to next five years on Rolling basis every year, identifying specific transmission projects which are required to be taken up along with their implementation time lines. CTU has already published ISTS Planning Procedure, prepared in consultation with STU, CEA, GRID-India, on CTU's website in Dec'2021. As per this procedure, the entire process for transmission planning was decided to be undertaken on continuous basis, involving two cycles i.e. from April to September and October to March. Accordingly, Rolling Plan reports are brought out by CTUIL on half-yearly basis in the months of September and March in every financial year. In this direction, three reports have already been published by CTUIL viz. Network Plan (2024-25) in Dec'21, Rolling Plan (2026-27) in March'22 and Interim Rolling Plan (2027-28) in September'22.

Presentation also covered the Rolling Plan (2026-27) report published by CTUIL in March, 22. It was mentioned that RE Installed Capacity (IC) is expected to increase from 106 GW (27% of total IC) as on Jan'22 to 225 GW (40% of total IC) by 2026-27. CTUIL explained that strong transmission system was planned and implemented in last decade considering the power flow pattern from conventional thermal generation majorly located in eastern part of the country to the other parts of the country. With the advent of the large RE integration in Rajasthan, western region and southern region, power flow patterns on the transmission lines are expected to change depending upon the generation and demand of a region in different seasons as well as during the day. To understand the seasonal and daily power flow patterns on transmission lines, three seasons viz. Monsoon (August), Summer (June) and Winter (February) along with three points on daily load curves i.e. Solar max (afternoon), Peak load (evening) and off-peak load (night) for each season were identified resulting in nine study scenarios. Accordingly, load generation balance (LGB) prepared for the following nine scenarios were presented:

- Aug'26: Solar max (Scenario-1), Evening Peak (Scenario-2) and Night off-peak (Scenario-3)
- June'26: Solar max (Scenario-4), Evening Peak (Scenario-5) and Night off-peak (Scenario-6)
- Feb'27: Solar max (Scenario-7), Evening Peak (Scenario-8) and Night off-peak (Scenario-9)

LGB for critical scenarios i.e., Scenario -5 with maximum demand, Scenario -9 with minimum demand & Scenario -1 with maximum RE generation were discussed in detail. Surplus generation of 33 GW (considering 40% dispatch as technical minimum for thermal generation) indicated the need for storage in solar max scenarios. Regional surplus/deficit and inter regional flows in different scenarios were also presented. It was pointed out that NR shall be importing power during evening peak and night off peak period whereas it shall be exporting power in Solar max scenarios resulting bidirectional power flow on WR-NR and ER-NR corridors It was also informed that as per present market inputs congestion has remained insignificant.

Based on simulation studies of nine scenarios, transmission line flows, transformer loading, voltage and short circuit levels of buses at all- India level for ISTS as well intra state network were analyzed and expected violations were indicated.

Meeting ended with thanks to chair.

*****

Summary of the deliberations of the 11th NCT meeting held on 28.12.2022 and 17.01.2023.

(1) ISTS schemes costing less than Rs100 Crs approved by NCT:

Sl. No.	Name of Transmission Scheme	Implementation Mode	Implementation timeframe	Allocated to	Estimated Cost (Rs Crs)
1.	ICT Augmentation associated with integration of additional 7 GW RE power from Khavda RE park under Phase-III	RTM route by TSP of Navsari (new) S/s i.e. POWERGRID	In matching timeframe of Transmission system for evacuation of additional 7 GW RE power from Khavda RE park under Phase-III Package B	POWERGRID	58.52
2.	Western Region Expansion Scheme XXXIII (WRES-XXXIII): Part B1	Under RTM to the owner of Gwalior-Satna 765 kV line i.e. Powergrid	In matching timeframe of Western Region Expansion Scheme XXXIII (WRES-XXXIII): Part B	POWERGRID	19
3.	Western Region Expansion Scheme XXXIII (WRES-XXXIII): Part C1	RTM route by POWER GRID, the TSP of Jabalpur - Orai 765 kV S/c line.	In matching timeframe of Western Region Expansion Scheme XXXIII (WRES-XXXIII): Part C	POWERGRID	0.5

(2) ISTS Communication schemes approved by NCT under RTM route:

Sl. No.	Name of Transmission Scheme	Implementation Mode	Implementation timeframe	Allocated to	Estimated Cost (Rs Crs)
1.	Supply and Installation of OPGW on existing **400 kV Jallandhar (PG) – Kurukshetra (PG) line** which is to be LILOed at 400 kV Dhanansu (PSTCL) **(229 km)**	RTM	24 months	POWERGRID	10.3
2.	Supply and Installation of OPGW on existing **400** kV **Koldam (Indigrid) – Ludhiana (PG) line** which is to be LILOed at 400 kV Ropar (PSTCL) **(150 km)**	RTM	18 months	INDIGRID	6.7
3.	Supply and Installation of OPGW on existing **400** kV **Agra – Ballabhgarh line (181 km) - Replacement**	RTM	18 months	POWERGRID	9.05
4.	Supply and Installation of OPGW on existing **400** kV **Kishenpur – Wagoora line (183 km) - Replacement**	RTM	18 months	POWERGRID	9.15
5.	Redundant communication System for **Bhinmal (PG) and Kankroli (PG) ISTS stations**	RTM	18 months	POWERGRID	2.55
6.	Redundant communication Path for Anta (NTPC) in view of AGC operation (Supply and Installation of OPGW on existing **220 kV Anta (NTPC) – Bhilwara line (187 km)**	RTM	18 months	POWERGRID	9.35

(3) ISTS Transmission schemes, costing between Rs 100 Crore to Rs 500 Crore, approved by NCT:

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

Sl. No.	Name of Transmission Scheme	Implementation Mode	Implementation timeframe	Allocated to	Estimated Cost (Rs Crs)
1.	Western Region Expansion Scheme XXXIII (WRES-XXXIII): Part A	RTM	18 months	POWERGRID	126.09

4. ISTS Transmission schemes costing greater than Rs 500 Crores, recommended by NCT to MoP:

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

Sl. No.	Transmission Scheme	Implementation Mode	Implementation timeframe	Survey Agency	Estimated Cost (Rs Crs)
1.	Transmission system for evacuation of additional 7 GW RE power from Khavda RE park under Phase-III Part A	TBCB	24 months from SPV transfer	RECPDCL	3036.77
2.	Transmission system for evacuation of additional 7 GW RE power from Khavda RE park under Phase-III Part B	TBCB	24 months from SPV transfer	PFCCL	4231.49
3.	Transmission scheme for evacuation of power from Dhule 2 GW REZ	TBCB	24 months from SPV transfer	PFCCL	637
4.	Western Region Expansion Scheme XXXIII (WRES-XXXIII): Part B	TBCB	24 months from SPV transfer	RECPDCL	1200
5.	Western Region Expansion Scheme XXXIII (WRES-XXXIII): Part C	TBCB	24 months from SPV transfer	RECPDCL	555
6.	Transmission system for evacuation of power from Shongtong Karcham HEP (450 MW) and Tidong HEP (150 MW)	TBCB	Progressively from 1st July, 2026	CTUIL	2286

7.	Transmission scheme for drawal of 4000 MW power by MPSEZ Utilities Limited (MUL)	TBCB	21 months from SPV transfer	CTUIL	2200

4.2 The broad scope of ISTS schemes recommended by NCT to MoP for implementation through TBCB mode, to be notified in Gazette of India is as given below:

Sl. No.	Name of Scheme & Implementation timeframe	Broad Scope	Bid Process Coordinator
1)	Transmission system for evacuation of additional 7 GW RE power from Khavda RE park under Phase-III Part A Implementation timeframe: 24 months	(i) Establishment of 765 kV Halvad switching station with 765 kV, 2x330 MVAr bus reactors (ii) KPS2(GIS) - Halvad 765 kV D/c line (iii) 240 MVAr switchable line reactor on each ckt at both ends of KPS2- Halvad 765 kV D/c line. (iv) 2 Nos. of 765 kV GIS line bays at KPS2 for termination of KPS2 - Halvad 765 kV D/c line (v) LILO of Lakadia – Ahmedabad 765 kV D/c line at Halvad **(Detailed scope as approved by 11th NCT and subsequent amendments, if any)**	To be decided by MoP.
2)	Transmission system for evacuation of additional 7 GW RE power from Khavda RE park under Phase-III Part B Implementation timeframe: 24 months	(i) Establishment of 765 kV switching station near Vataman with 2x330MVAr, 765 kV bus reactor (ii) Halvad – Vataman 765 kV D/c line (iii) 1x330 MVAr switchable line reactor on each ckt. at Vatman end of Halvad – Vataman 765 kV D/c line (iv) 2 Nos. of 765 kV line bays at Halvad end for termination of Halvad – Vataman 765 kV D/c line (v) LILO of Lakadia – Vadodara 765 kV D/c line at Vataman 765 kV	

Sl. No.	Name of Scheme & Implementation timeframe	Broad Scope	Bid Process Coordinator
		switching station (vi) 240 MVAr 765 kV switchable line reactor on each ckt at Vataman end of Lakadia – Vataman 765 kV D/c line with NGR bypassing arrangement (vii) Vataman switching station – Navsari (New)(GIS) 765 kV D/c line (viii) 330 MVAr switchable line reactors on each ckt at Navsari (New) (GIS) end of Vataman switching station – Navsari (New) (GIS) 765 kV D/c line (ix) 2 Nos. of 765 kV GIS line bays at Navsari (New) for termination of Vataman switching station – Navsari (New)(GIS) 765 kV D/c line **(Detailed scope as approved by 11th NCT and subsequent amendments, if any)**	
3)	Transmission scheme for evacuation of power from Dhule 2 GW REZ Implementation timeframe: 24 months	(i) Establishment of 4x500 MVA, 400/220 kV Pooling Station near Dhule along with 2x125 MVAr (420 kV) Bus Reactor (ii) Dhule PS – Dhule (BDTCL) 400 kV D/c Line (Quad ACSR/AAAC/AL59 Moose equivalent) (60 km) (iii) 2 Nos. 400 kV line bays at Dhule(BDTCL) for Dhule PS – Dhule (BDTCL) 400 kV D/c Line **(Detailed scope as approved by 11th NCT and subsequent amendments, if any)**	To be decided by MoP.
4)	Western Region Expansion Scheme XXXIII (WRES-XXXIII): Part B Implementation timeframe: 24 months	**(i)** Establishment of 2x1500 MVA, 765/400 kV, 2x500 MVA, 400/220 kV, S/s at Karera (near Datiya) along with 1x330 MVAr 765 kV bus reactor & 1x125 MVAr, 420 kV bus	To be decided by MoP.

Sl. No.	Name of Scheme & Implementation timeframe	Broad Scope	Bid Process Coordinator
		reactor. **(ii)** LILO of Satna-Gwalior 765 kV S/c line at Karera **(iii)** Installation of 1x330 MVAr, switchable line reactor at Karera end of Karera – Satna 765 kV line **(Detailed scope as approved by 11th NCT and subsequent amendments, if any)**	
5)	Western Region Expansion Scheme XXXIII (WRES-XXXIII): Part C Implementation timeframe: 24 months from date of allocation.	(i) Establishment of 2x1500 MVA, 765/400 kV and 2x500 MVA 400/220 kV S/s at Ishanagar (New) along with 1x330 MVAr 765 k) & 1x125 MVAr, 420 kV bus reactors (ii) LILO of one circuit of Jabalpur - Orai 765 kV D/c line at Ishanagar (New) 765 kV S/s **(Detailed scope as approved by 11th NCT and subsequent amendments, if any)**	To be decided by MoP.
6)	Transmission system for evacuation of power from Shongtong Karcham HEP (450 MW) and Tidong HEP (150 MW) Implementation timeframe: Progressively from 1st July, 2026	(i) Establishment of 2x315 MVA 400/220 kV GIS Pooling Station at Jhangi (ii) 400 kV Jhangi PS – Wangtoo (Quad) D/c line (***Line capacity shall be 2500 MVA per circuit at Nominal voltage***) (iii) 1x125 MVAR, 420 kV Bus reactor at Jhangi PS (iv) LILO of one circuit of Jhangi PS - Wangtoo (HPPTCL) 400 kV D/ c (Quad) line$ at generation switchyard of Shongtong HEP (v) Wangtoo (HPPTCL) - Panchkula (PG) 400 kV D/c (Twin HTLS*) line along with 80 MVAr switchable line reactor at Panchkula end on each circuit -	To be decided by MoP.

Sl. No.	Name of Scheme & Implementation timeframe	Broad Scope	Bid Process Coordinator
		210 km **$ Line capacity shall be 2500 MVA per circuit at Nominal voltage** *** with minimum capacity of 2100 MVA on each circuit at Nominal voltage** **(Detailed scope as approved by 11th NCT and subsequent amendments, if any)**	
7)	Transmission scheme for drawal of 4000 MW power by MPSEZ UTILITIES LIMITED (MUL)	(1) Establishment of 4x1500 MVA, 765/400 kV Navinal(Mundra) S/s (GIS) with 2x330 MVAR, 765 kV & 1x125 MVAr, 420 kV bus reactors (2) LILO of Bhuj-II – Lakadia 765 kV D/c line at Navinal(Mundra) (GIS) S/s with associated bays at Navinal(Mundra) (GIS) S/s (3) Installation of 1x330 MVAr switchable line reactor on each ckt at Navinal end of Lakadia – Navinal 765 kV D/c line (formed after above LILO) **(Detailed scope as approved by 11th NCT and subsequent amendments, if any)**	To be decided by MoP.

5. Modification in the scope of works of Transmission Scheme approved/ recommended in previous meetings of NCT:

(i). The time-line of implementation of the following schemes may be reduced from **24 months to 21 months**:

a) Establishment of Khavda Pooling Station-2 (KPS2) in Khavda RE Park
b) Transmission scheme for injection beyond 3 GW RE power at Khavda PS1 (KPS1)
c) Establishment of Khavda Pooling Station-3 (KPS3) in Khavda RE Park

(ii). Change in scope of the "Transmission scheme for evacuation of 4.5 GW RE Injection at Khavda PS under Phase-II- Part B"

ii.1 Revised scope of "Transmission scheme for evacuation of 4.5 GW RE injection at Khavda PS under Phase-II Part B" as given below:

- Lakadia PS – Ahmedabad 765 kV D/c line (200 km.)
- 2 Nos. of 765 kV line bays at Lakadia PS for Lakadia PS – Ahmedabad 765 kV D/c line
- 240 MVAr, 765 kV switchable line reactor for each circuit at Ahmedabad end of Lakadia PS –Ahmedabad 765 kV D/c line)

(iii). Modifications in the scheme "Transmission scheme for evacuation of 4.5 GW RE injection at Khavda PS under Phase II- Part D".

S.No.	Scope of the Transmission Scheme (Original)	Scope of the Transmission Scheme (Revised)
1.	LILO of Pirana (PG) – Pirana (T) 400 kV D/c line at Ahmedabad S/s with twin HTLS conductor alongwith reconductoring of Pirana (PG) – Pirana (T) line with twin HTLS conductor (with OPGW for both main & LILO portion) and Bay upgradation work at Pirana (T) along with requisite FOTE - to be awarded to TPGL	LILO of Pirana (PG) – Pirana (T) 400 kV D/c line at Ahmedabad S/s with twin HTLS conductor alongwith reconductoring of Pirana (PG) – Pirana (T) line with twin HTLS conductor (with OPGW for both main & LILO portion) and Bay upgradation work at Pirana (T) **and at Pirana (PG)** along with requisite FOTE - to be awarded to TPGL
2.	Bay upgradation work at Pirana (PG) along with requisite FOTE - to be awarded to Powergrid.	

(iv). Transmission system for evacuation of power from REZ in Rajasthan (20GW) under Phase-III Part C1:

Sl.Nos.	Original Scope	Revised Scope
4.	Establishment of 2x1500 MVA, 765/400kV & 2x500 MVA, 400/220 kV pooling station at Ramgarh along with 2x240 MVAr (765kV) Bus Reactor & 2x125 MVAr (420kV) Bus reactor Capacity 765/400 kV1500 MVA ICTs:2 Nos. *(7x500 MVA including one spare unit)*	Establishment of 2x1500 MVA, 765/400kV & 2x500 MVA 400/220 kV pooling station at Ramgarh along with 2x240 MVAr (765kV) Bus Reactor & 2x125 MVAr (420kV) Bus Reactor**, ± 2x300MVAr STATCOM along with MSC+MSR** Capacity 765/400 kV 1500 MVA ICTs: 2 Nos. (7x500 MVA including one spare unit)

	765kV ICT bays –2 Nos. 400/220 kV, 500 MVA ICT – 2Nos. 400 kV ICT bays – 4 Nos. 220 kV ICT bays – 2 Nos. 400 kV line bays - As per connectivity granted to RE developers (2 Nos. of bays considered at present) 220 kV line bays -As per connectivity granted to RE developers (4 Nos. of bays considered at present) 765 kV line bays – 2 Nos. 240 MVAr Bus Reactor-2 Nos. (7x80 MVAr considering one spare unit) 765kV reactor bay- 2 Nos. 125 MVAr, 420kV bus reactor – 2 Nos. 420 kV reactor bay – 2 Nos. <u>Future provisions: Space for</u> 765/400 kV ICTs along with bays: 3Nos. 765 kV line bay along with switchable line reactor: 2Nos. 765 kV Bus Reactor along with bays: 2 Nos. 400/220 kV ICTs along with bays: 6 Nos. 400 kV line bays along with switchable line reactor: 4Nos. 400 kV line bays: 4 Nos. 400 kV Bus Reactor along with bays: 2 Nos. 400 kV Sectionalization bay: 3 Nos. 220 kV line bays: 8 Nos. 220 kV sectionalisation bay: 2 Nos.	76 5kV ICT bays - 2 Nos. 400/220 kV, 500 MVA ICT – 2 Nos. 400 kV ICT bays – 4 Nos. 220 kV ICT bays - 2 Nos. 400 kV line bays - 2 Nos. 220 kV line bays: 4 Nos. 765 kV line bays -2 Nos. 240 MVAr Bus Reactor-2 Nos. (7x80 MVAr considering one spare unit) 240 MVAr Bus Reactor-2 Nos. (7x80 MVAr, including one spare unit) 765kV reactor bay- 2 Nos. 125 MVAr, 420kV bus reactor - 2 Nos. 420 kV reactor bay - 2 Nos. **400 kV Sectionalization bay: 1 set. **** **± 2x300 MVAr STATCOM, 4x125 MVAr MSC, 2x125 MVAr MSR along with 2 Nos. of 400 kV bays** <u>Future provisions: Space for</u> **765/400 kV ICTs along with bays: 5 Nos.** 765kV line bay along with switchable line reactor: 2Nos. 765 kV Bus Reactor along with bays: 2 Nos. **400/220 kV ICTs along with bays: 8 Nos.** 400 kV line bays along with switchable line reactor: 4 Nos. **400 kV line bays: 2 Nos.** 400 kV Bus Reactor along with bays: 2 Nos. **400 kV Sectionalization bay: 2 sets **** **220 kV line bays: 11 Nos.**

	(Some change in space provision in last NCT)	220 kV Sectionalization bay: 2 Nos. **
5.	Ramgarh – Bhadla-3 765 kV D/c line (180 km) along with 240 MVAr switchable line reactor at each circuit at Ramgarh end of Ramgarh – Bhadla-3 765kV D/c line 765 kV, 240 MVAr switchable line reactor- 2 Nos. Switching equipment for 765 kV 240 MVAR switchable line reactor –2 Nos.	Ramgarh – Bhadla-3 765 kV D/c line (180 km) along with 240 MVAr switchable line reactor at each circuit at Ramgarh end of Ramgarh – Bhadla-3 765 kV D/c line 765 kV, 240 MVAr switchable line reactor- 2 Nos. Switching equipment for 765 kV 240 MVAR switchable line reactor –2 Nos.
6.	2 Nos. of 765 kV line bays at Bhadla-3, 765 kV line bays:- 2Nos.	2 Nos. of 765 kV line bays at Bhadla-3, 765 kV line bays:- 2Nos.

Note:

vii. Implementation schedule of Phase III –Part C1 package is to match with package Phase III –Part B1 (establishment of Bhadla-3, PS, 765 kV Bhadla-3 PS-Sikar-2 D/c line, 400 kV Bhadla-3 PS-Fatehgarh-2 D/c line)

viii. Developer of Bhadla-3 S/s to provide space for 2 Nos. of 765 kV line bays at Bhadla-3 S/s for termination of Ramgarh – Bhadla-3, 765 kV D/c line

ix. The line lengths mentioned above are approximate as the exact length shall be obtained after the detailed survey

x. Provision of suitable sectionalization shall be kept at Ramgarh at 400kV & 220kV level to limit short circuit level

xi. ±300 MVAr STATCOM should be placed in each 400 kV bus section of Ramgarh PS

xii. Implementation of the scheme to be taken up upon receipt of LTA from RE generation developers at Ramgarh PS/Bhadla-3 PS

** *Bus Sectionalization bay shall comprise of bus sectionalization of both Main Bus-I & Main Bus-II.*

Implementation Timeframe: 18 months from date of SPV acquisition.

(v). Transmission system for evacuation of power from REZ in Rajasthan (20 GW) under Phase-III Part F

S.Nos.	Original Scope	Revised Scope
6.	Establishment of 2x1500 MVA, 765/400 kV Substation at suitable location near Beawar along with 2x330 MVAr 765 kV Bus Reactor & 2x125 MVAr 420kV Bus Reactor <u>Capacity:</u> 765/400kV 1500 MVA ICTs: 2 Nos. (7x500 MVA, including one spare unit) 330 MVAr, 765 kV bus reactor- 2 (7x110	Establishment of 2x1500 MVA, 765/400 kV Substation at suitable location near Beawar along with 2x330 MVAr 765kV Bus Reactor & 2x125 MVAr 420 kV Bus Reactor. <u>Capacity:</u> 765/400 kV 1500 MVA ICTs: 2 Nos. (7x500 MVA, including one spare unit) 330 MVAr, 765 kV bus reactor- 2 (7x110

	MVAr, including one spare unit) 765 kV ICT bays – 2 Nos. 400 kV ICT bays – 2 Nos. 765 kV line bays – 6 Nos. 400 kV line bay- 2 Nos. 765 kV reactor bay- 2 Nos. 125 MVAr, 420 kV bus reactor – 2 Nos. 420 kV reactor bay – 2 Nos. <u>Future provisions: Space for</u> 765/400 kV ICTs along with bays: 2 Nos. 765 kV line bay along with switchable line reactor: 6 Nos. 765 kV Bus Reactor along with bays: 2 Nos. 400/220 kV ICTs along with bays: 2 Nos. 400 kV line bays along with switchable line reactor: 4 Nos. 400kV Bus Reactor along with bays: 1 No. 220 kV line bays: 4 Nos.	MVAr, including one spare unit) 765kV ICT bays – 2 Nos. 400 kV ICT bays – 2 Nos. 765 kV line bays – 6 Nos. 400kV line bay- 2 Nos. 765kV reactor bay- 2 Nos. 125 MVAr, 420kV bus reactor – 2 Nos. 420 kV reactor bay – 2 Nos. **<u>Future provisions: Space for</u>** 765/400 kV ICTs along with bays: 2 Nos. **765kV line bay along with switchable line reactor: 8Nos.** 765kV Bus Reactor along with bays: 2Nos. 400/220 kV ICTs along with bays: 2Nos. 400 kV line bays along with switchable line reactor: 4 Nos. 400 kV Bus Reactor along with bays: 1 No. 220 kV line bays: 4 Nos.
7.	LILO of both circuit of Ajmer-Chittorgarh 765 kV D/c at Beawar (45km)	LILO of both circuit of Ajmer-Chittorgarh 765 kV D/c at Beawar (45km)
8.	LILO of 400 kV Kota –Merta line at Beawar (20 km)	LILO of 400 kV Kota –Merta line at Beawar (20 km)
9.	Fatehgarh-3– Beawar 765 kV D/c along with 330 MVAr Switchable line reactor for each circuit at each end of Fatehgarh-3– Beawar 765 kV D/c line <u>Capacity/km:</u> Line Length – 350 km Switching equipment for 765 kV 330 MVAR switchable line reactor –4 Nos.	Fatehgarh-3– Beawar 765 kV D/c along with 330 MVAr Switchable line reactor for each circuit at each end of Fatehgarh-3– Beawar 765 kV D/c line <u>Capacity/km:</u> Line Length: 350 km Switching equipment for 765 kV 330 MVAR switchable line reactor –4 Nos.

	765 kV, 330 MVAr Switchable line reactor- 4 Nos.	765 kV, 330 MVAr Switchable line reactor- 4 Nos.
10.	**In earlier scope, STATCOM at Fatehgarh-3 PS was proposed as part of Phase-III Part E3**	**STATCOM at Fatehgarh-3 PS** **±2x300 MVAr STATCOM along with 4x125 MVAr MSC, 2x125 MVAr MSR along with 2 Nos. of 400 kV bays at Fatehgarh-3 PS**

Note:

vi. **POWERGRID shall provide space for 2 Nos. of 765 kV line bays at Fatehgarh-3 S/s for Fatehgarh-3– Beawar 765 kV D/c line along with 765 kV switchable line reactoRs**

vii. The line lengths mentioned above are approximate as the exact length shall be obtained after the detailed survey

viii. *Scheme to be awarded after SECI/ /REIA awards first bid of RE project* at Fatehgarh-3 (new section and/or Fatehgarh-4).

ix. **±300 MVAr STACOM should be placed in each 400 kV section of Fatehgarh-3 PS (Phase-III Part E1)**

x. POWERGRID shall provide space at Fatehgarh-3 PS for STATCOM along with MSC & MSR **and associated 400 kV bays.**

Implementation Timeframe: 18 months from date of SPV acquisition

(vi). **Transmission Network Expansion in Gujarat to increase ATC from ISTS: Part C"**

Sl. No.	**Original Scope of the Transmission Scheme**	**Modified scope of the transmission scheme**
1	Augmentation of transformation capacity at 765/400 kV ICT Banaskantha S/S by 1x1500 MVA 765/400 kV, 1500 MVA ICT: 1 Nos. 765 kV ICT bay – 1 No. 400 kV ICT bay– 1 No.	Augmentation of transformation capacity at 765/400 kV ICT Banaskantha S/S by 1x1500 MVA 765/400 kV, 1500 MVA ICT: 1 Nos. 765 kV ICT bay – 1 No. 400 kV ICT bay– 1 No.
2	Banaskantha -Sankhari 400 kV 2nd D/c line (26 km) Line Length : 26 km 400 kV line bays- 4 Nos. (2 Nos. at Banaskantha and 2 Nos. at Sankhari)	Banaskantha – Sankhari section of Banaskantha – Prantij 400 kV D/c line (Quad ACSR/AAAC/AL59 moose equivalent) Line Length : 26 km 400 kV line bays- 2 Nos. (at Banaskantha)

Implementation Time-frame: Matching with establishment of Prantij 400/220 kV S/s and Prantij - Sankhari section of Banaskantha – Prantij 400 kV D/c line (presently expected by March, 2025)

*****

Annex-I

List of participants of the 11th meeting of NCT held on 28th December, 2022 (1st Sitting) and 17th January' 2023 (2nd Sitting)

CEA:

1. Sh. Ghanshyam Prasad, Chairperson, CEA & Chairman, NCT
2. Sh.A. K. Rajput, Member (PS**)**
3. Sh. Ishan Sharan, Chief Engineer (PSPA-I)
4. Sh. B.S. Bairwa, Director (PSPA-II)
5. Smt. Manjari Chaturvedi, Director (PSPA-I)
6. Sh. J. Ganeswara Rao, Deputy Director (PSPA-I)
7. Ms. Priyam Srivastava, Deputy Director (PSPA-I)
8. Sh. Vikas Sachan, Deputy Director (PSPA-I)
9. Sh. Suyash Ayush Verma, Deputy Director (PSPA-II)
10. Sh. Deepanshu Rastogi, Deputy Director (PSPA-II)
11. Sh. Nitin Deswal, Assistant Director (PSPA-I)
12. Sh. Kanhaiya Kushwaha, Assistant Director (PSPA-I)
13. Sh. Ajay Malav, Assistant Director (PSPA-II)
14. Sh. Prateek Jadaun, Assistant Director (PSPA-II)

MoP:

1. Sh. Goutam Ghosh, Director (Trans.)

MNRE:

1. Sh. Dilip Nigam, Adviser

Expert Member:

1. Dr. R. Saha

SECI

1. Sh. S.K. Mishra, Director
2. Sh. R.K. Agarwal, Consultant

NITI Aayog

1. Sh. Manoj Kr. Upadhyay

CTUIL:

1. Sh. P.C. Garg, COO
2. Sh. Ashok Pal, Deputy COO
3. Sh. P.S. Das, Sr.GM
4. Sh. V. Thiagarajan, Sr. GM
5. Sh. Kashish Bhambhani, GM
6. Sh. Pratyush Singh, Manager

7. Sh. Chinmay Sharma, Manager
8. Sh. Shashank Shekhar, Dy. Manager
9. Miss Namrata Singh, Engineer

GRID India:

1. Sh. S.R. Narasimhan, CMD
2. Sh. Surajit Banerjee, CGM
3. Sh. Vivek Pandey, GM
4. Sh. Priyam Jain, Manager
5. Sh. Prabhankar Porwal, Dy. Manager

11th Meeting of National Committee on Transmission

(Second Sitting)

Grid Performance – 2nd & 3rd Quarter (2022-23)

Grid Controller of India Limited

formerly Power System Operation Corporation Ltd. (POSOCO)

National Load Despatch Center

CONTENTS

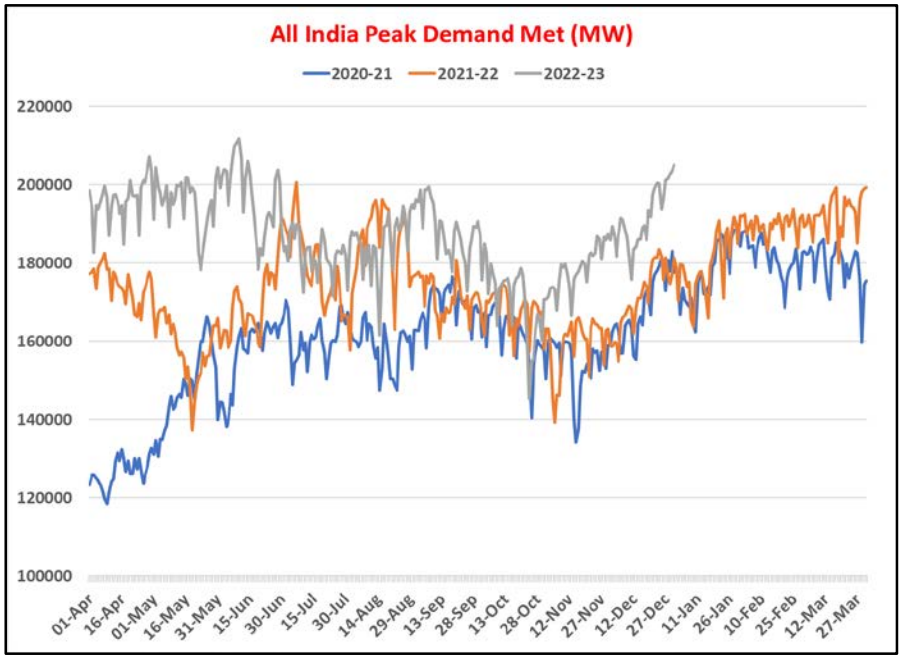
- **Overview of Grid Operation –Q2 & Q3 FY 2022-23**
  - All India Demand met, Energy consumption
  - Frequency profile
  - Primary Response and Inertia
- **Reliability issues experienced in NR RE Complexes in Q2 and Q3 of 2022**
  - N-1 Non-compliance of 400kV Bikaner(PG)-Bikaner(RS) line
  - Low Frequency Oscillations in Rajasthan RE Complex
- **Constraints in Inter-regional Corridors**
- **High and Low Voltage Nodes**
- **Major elements Commissioned – Q2 & Q3 FY 2022-23**
- **Other operational issues**
  - Constraint in HVDC flexible operation
  - Transmission Line and ICT Constraints
  - Important Elements under Construction
  - AGC Performance

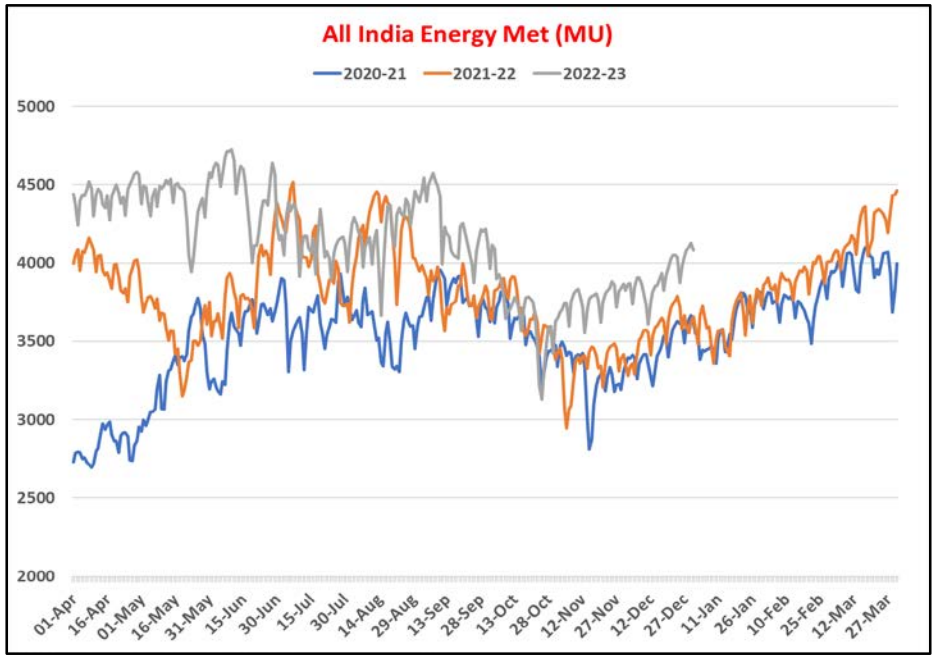
Overview of Grid Operation –Q2 & Q3 FY 2022-23

All India Demand met	2022-23	
	Q2(July-Sep)	Q3(Oct-Dec)
Maximum (MW)	**199 472 (07-Sep-2022)**	**205 031 (31-Dec-2022)**
Minimum	**142 665 (16-Aug-2022)**	**107 792 (25-Oct-2022)**

(Sitrang cyclone)

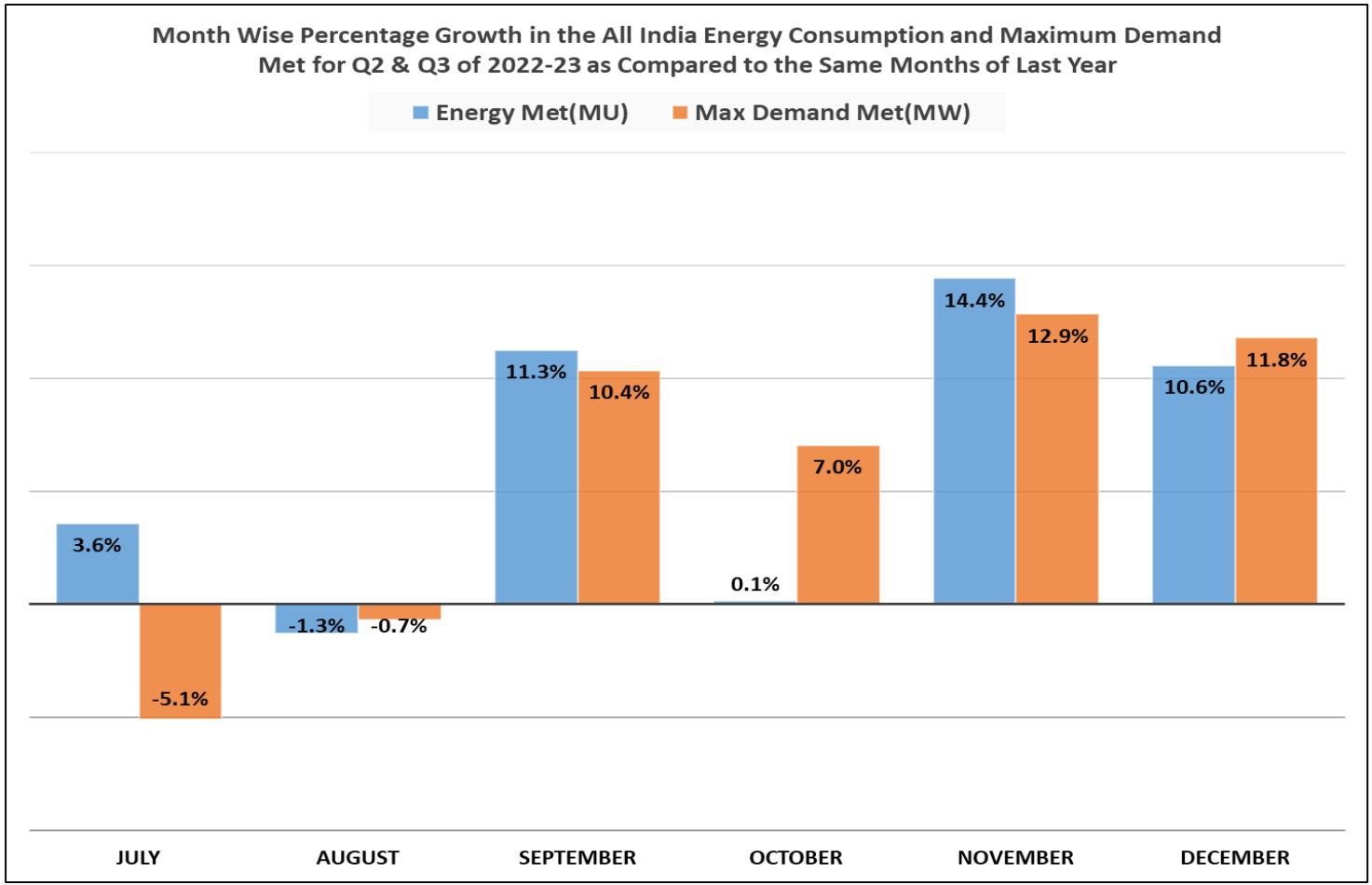
All India Daily Energy Met and Peak Demand
of FY 2022-23, 2022-21 & 2020-21





Significant increase in both Maximum Demand and Energy Met in Q2 & Q3 of FY 2022-23 as compared to same quarter of previous year

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



All Time Highest Figures

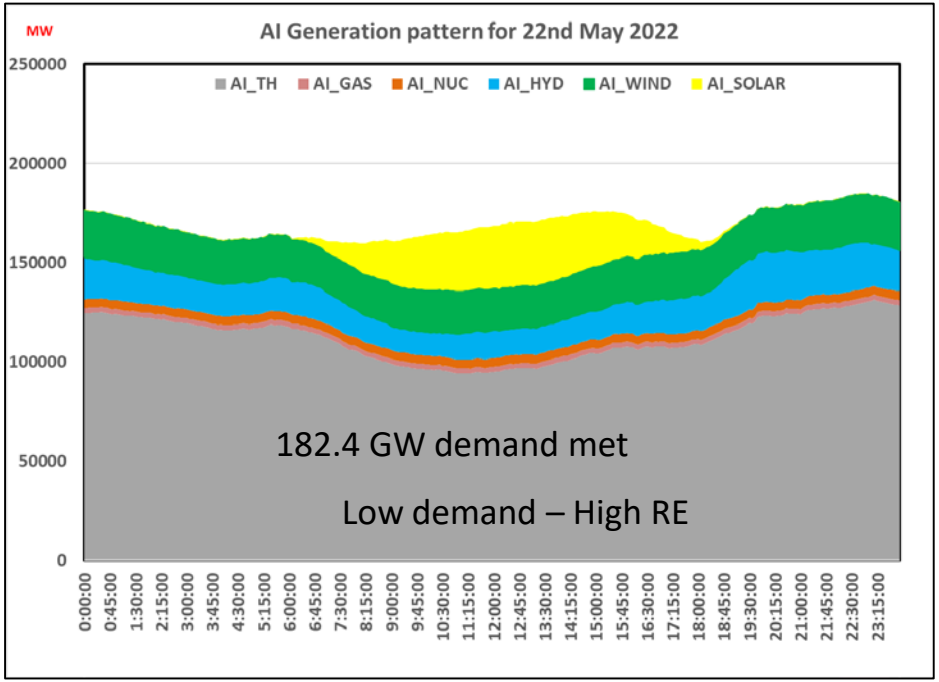
In Q2 & Q3 of FY – 2022-23 (Till 16th Jan 2023)

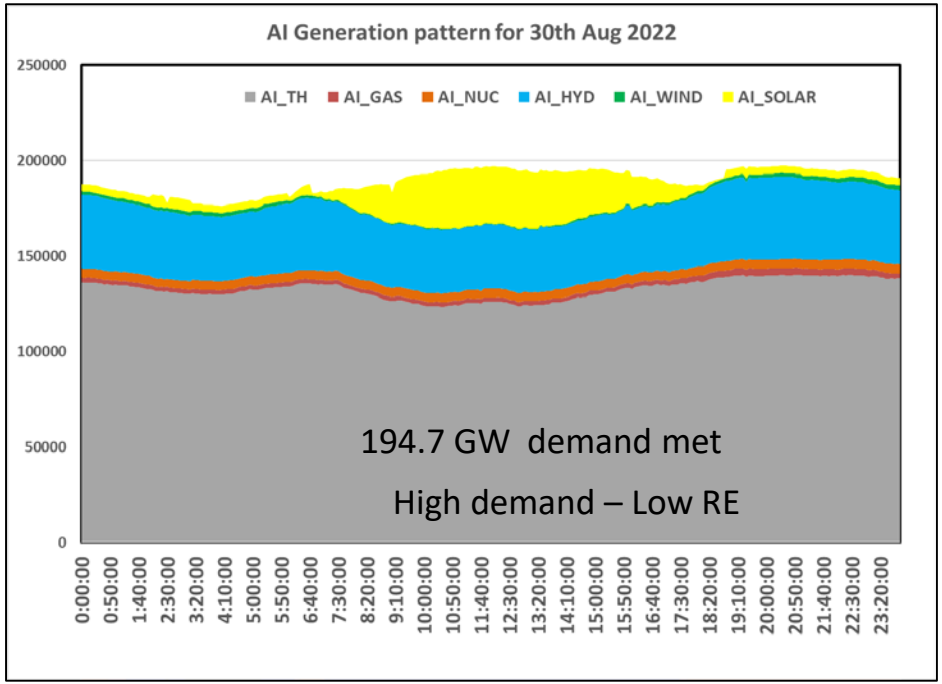
Regions	Maximum Demand Met during the day(MW)	Demand Met During Evening Peak hrs(MW)	Energy Met(MU)	Hydro Gen(MU)	Wind Gen(MU)	Solar Gen(MU)
NR	77091 28-06-2022	71909 09-09-2022	1737 28-06-2022	420.3 22-08-2022	78.4 09-06-2022	124.8 03-10-2022
WR	73004 03-01-2023	62370 20-04-2022	1531 29-04-2022	167 18-12-2014	271.7 22-05-2022	58.5 16-01-2023
SR	60814 01-04-2022	50436 24-02-2020	1255.1 03-04-2021	208 31-08-2018	296.9 12-07-2022	140.5 01-09-2022
ER	27430 05-08-2022	26837 30-09-2022	597.6 18-08-2022	157.4 14-09-2022	-	6.3 10-06-2022
NER	3596 17-08-2022	3510 12-08-2022	69.2 11-08-2022	40.5 01-08-2022	-	2.4 22-06-2022
All India	211856 10-06-2022	197630 28-06-2022	4722.4 10-06-2022	877.5 30-08-2022	554.8 22-05-2022	314.4 16-01-2023

All India Thermal (MW)	All India Hydro (MW)	All India Wind (MW)	All India Solar (MW)
152203 31-12-2022	43252 30-08-2022	24585 22-05-2022	42457 16-01-2023

Resource Adequacy Challenge

- Challenges in resource adequacy due to variability of RE
- Reserve requirement and system constraints would vary
- Planning studies for 8760 hrs. essential





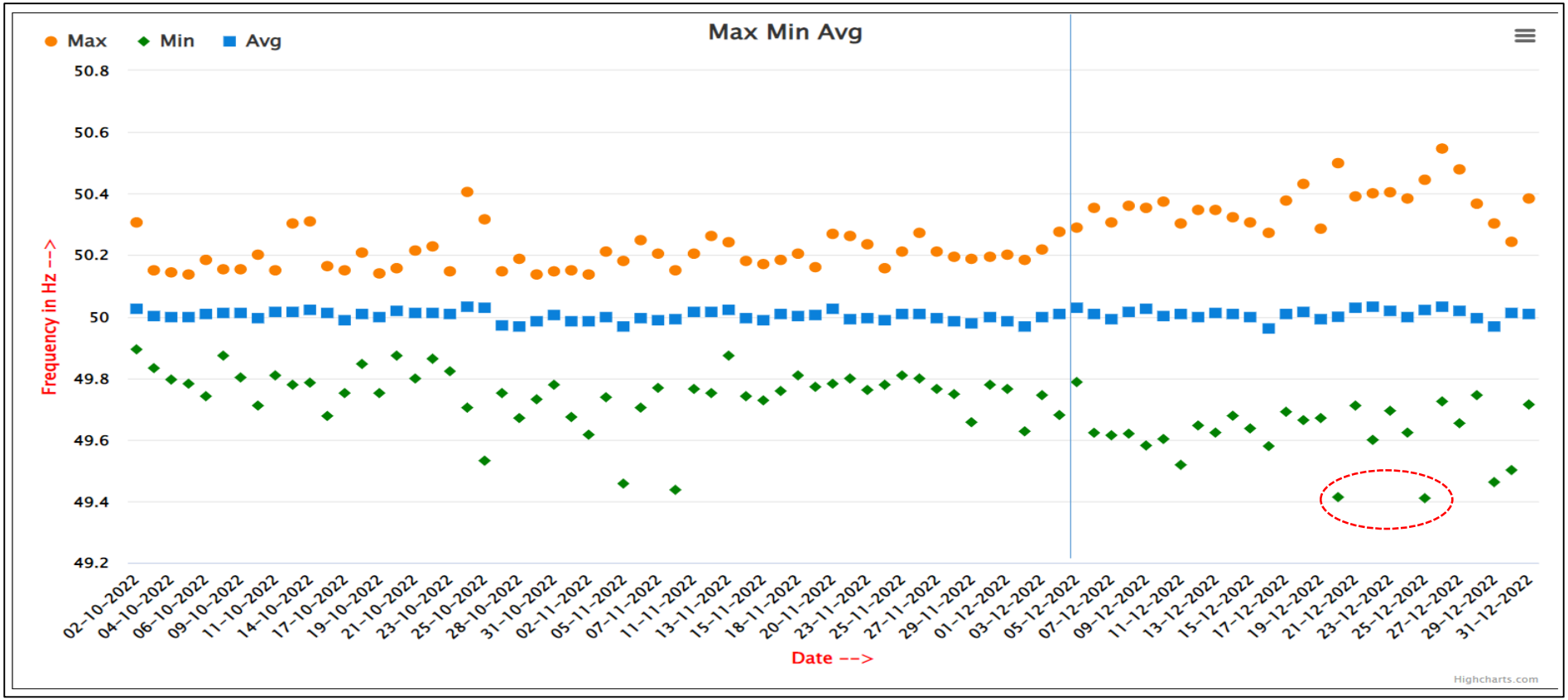
Highest Instantaneous RE penetration (in Q1 FY 2022-23) of ~31.8 % was recorded on 22nd May 2022 (Sunday)

Lowest wind generation (34.8 MU) in entire calendar year was recorded on 30th Aug'22 (Tuesday).

Frequency (Q2 & Q3 of 2022-23)

Range	Q2(July-Sep)	Q3(Oct-Dec)
49.90 - 50.05	76.6 %	69.88 %
> 50.05	15.7 %	21.67 %
< 49.9	7.7 %	8.45 %
< 49.7	0.4 %	0.48 %
Maximum	50.31 (15-Aug-2022)	50.55 (26-Dec-2022)
Minimum	49.42 (18-Jul-22)	49.41 (25 - Dec-22)

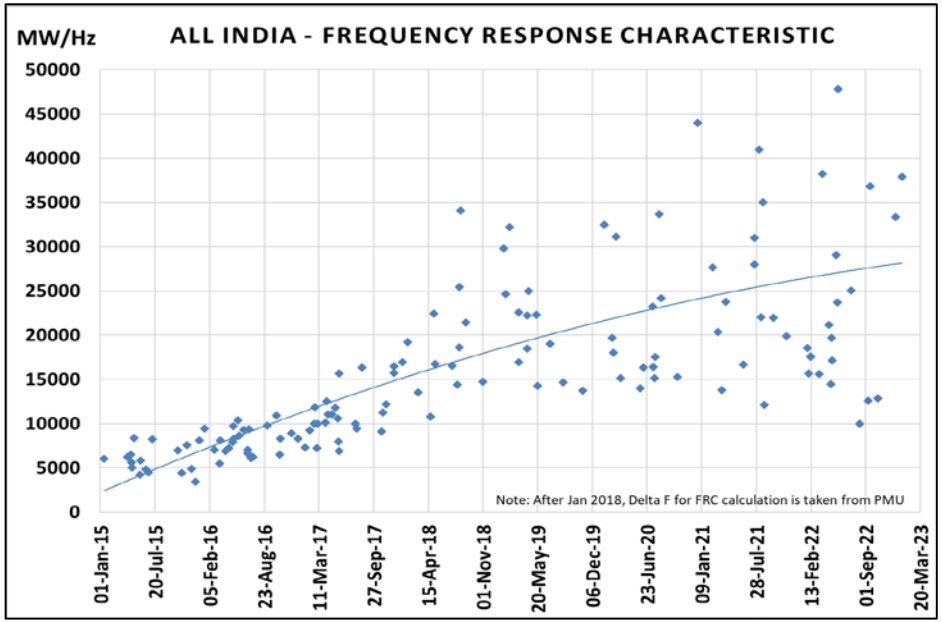
Frequency Profile for Q3 of FY 2022-23

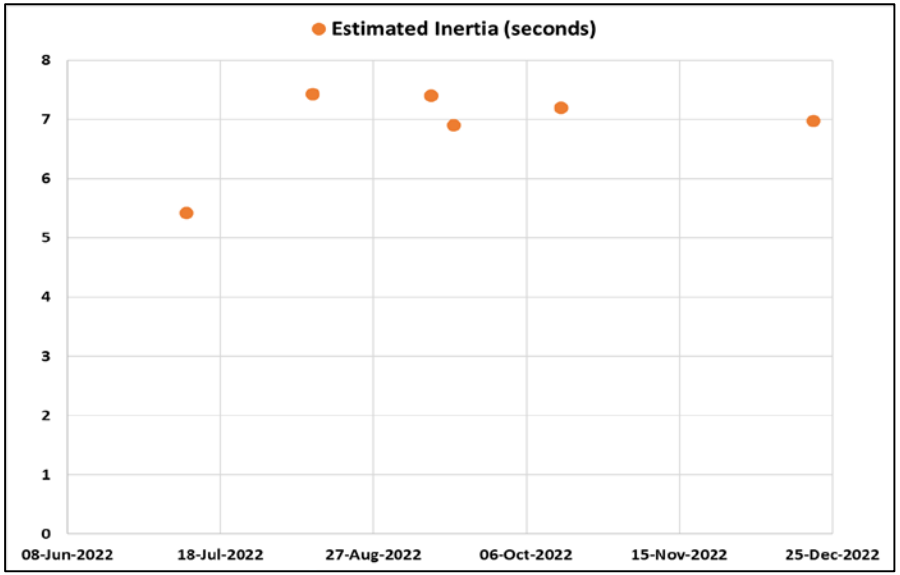


UFR triggered **on 20th Dec 2022** in **WR (446 MW), SR (6.83 MW)** & **NR (294 MW) &** on **25th Dec 2022** in **SR (411 MW) & NR (705 MW)**

Frequency Response Characteristics for Contingencies Q2 & Q3 of FY 2022-23

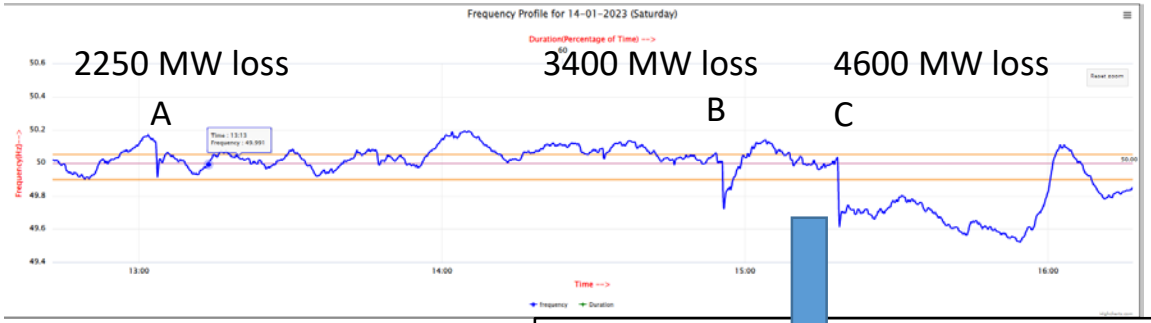
Date (DD-MMM-YY)	Time (HH:MM)	Event Location	Total Generation loss (MW)	All INDIA FRC (MW/HZ)	Power Number (MW/HZ)	Estimated Inertia (s)
9-Jul-22	13:42	Rajasthan Renewable Generation Complex	3507	25050	8812	5.4
11-Aug-22	11:22	Rajasthan Renewable Generation Complex	6157	10013	7724	7.4
11-Sep-22	12:22	Rajasthan Renewable Generation Complex	3800	12583	8768	7.4
17-Sep-22	12:22	Rajasthan Renewable Generation Complex	2333	36825	9113	6.9
15-Oct-22	11:23	Rajasthan Renewable Generation Complex	3150	12859	9323	7.2
20-Dec-22	6:48	Jhajjar TPS (APCPL)	1400	33333	10219	6.9





Details of FRC Events

~4600 MW RE Generation Loss Event on 14 Jan 2023



6 lines of 765 kV tripped
7 lines of 400 kV tripped

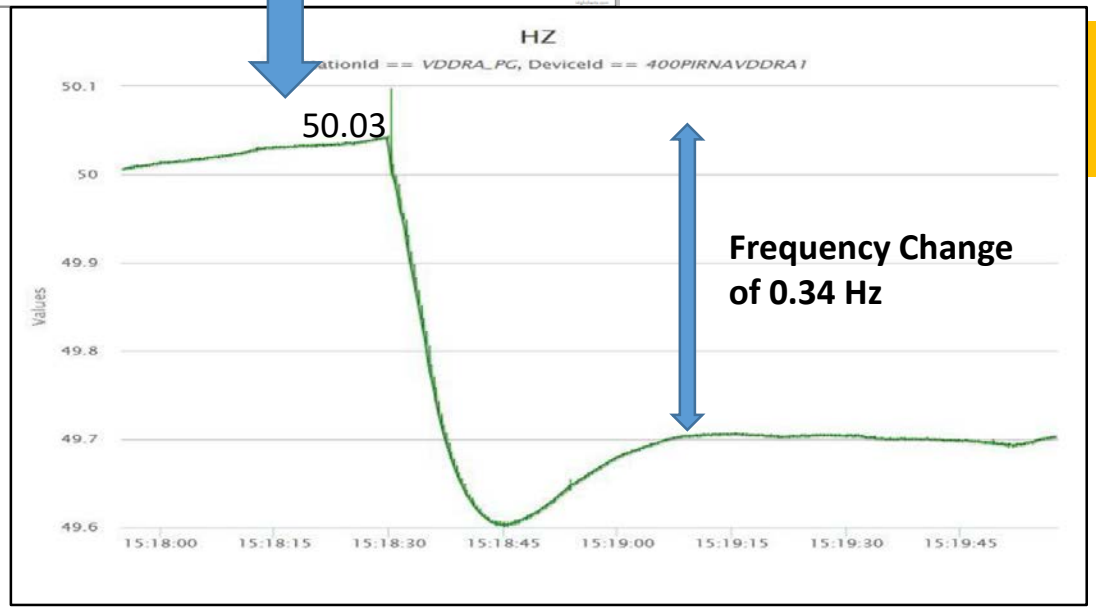
SPS operation at Bikaner
for Overloading of 400 kV Bikaner_PG-Bikaner_RJ

Makar Sankranti Day

Kite Flying

3 consecutive events

Outage of EHV line on fault followed by multiple line tripping on Over voltage



> Reference contingency of 4500 MW

FRC 13500 MW/Hz

Reliability issues experienced in NR RE Complexes

- Frequent events involving RE Generation loss
- Low frequency (2.5-3 Hz) low amplitude oscillations during Solar hours
- Heavy reactive drawal by load (~ 0.7 pf) as well as RE stations
- Low voltage in Rajasthan (Alwar, Hindaun voltage ~ 340 kV)
- N-1 non-compliance of STU network of RRVPNL
  - 400/220 kV ICTs at Ajmer, Bikaner_RJ, Hindaun, Merta, Chittorgarh

RE Contingencies for Q2 & Q3 FY 2022-23

S. No	Date	Time	Event	All INDIA FRC(MW/HZ)	Power Number (MW/HZ)
1	09-Jul-22	13:42	Solar generation loss of 3507 MW observed in NR/Rajasthan	**25050**	**8812**
2	11-Aug-22	11:22	RE Generation loss of 6157MW at Bhadla(PG), Bhadla2(PG), Fatehgarh2(PG) & Bikaner(PG) and load shedding of around 850 MW (400MW in UP, 200MW in Punjab & 150MW in Haryana control area) occurred post fault on 220kV Bhadla-Clean Solar Jodhpur Ckt (Y-B Fault), Multiple 765kV lines and 220kV lines to RE stations tripped due to over voltage.	**10013**	**7724**
3	11-Sep- 22	12:22	RE Generation loss of 3800 MW occurred at Fatehghar & Bhadla post tripping of 220kV Bhadla – CSP Jodhpur on phase to phase fault. Four number of 765kV lines emanating from solar complex also tripped.	**12583**	**8768**
4	17-Sep- 22	10:44	RE generation loss of 2122 MW occurred at Fatehgarh& Bhadla generation complex post tripping of 220kV Fatehgarh2-AHEJ2L ckt due to R-phase CT blast at Fatehgarh2 end. After nearly 5sec,765kV Fatehgarh2-Bhadla ckt-2 tripped on over voltage. Voltage of 822kV observed from PMU data at Fatehgarh2 end.	**53050**	**8488**
5	15-Oct-22	11:23	At 11:23 hrs 765 KV Phagi(RS)-Bhiwani(PG) Ckt-1 tripped along with 765 kV Bus-1 at Bhiwani (PG), At the same time Renewable generation reduction of around 3150 MW reported in Rajasthan Renewable generation complex of Northern Region	**12859**	**9323**

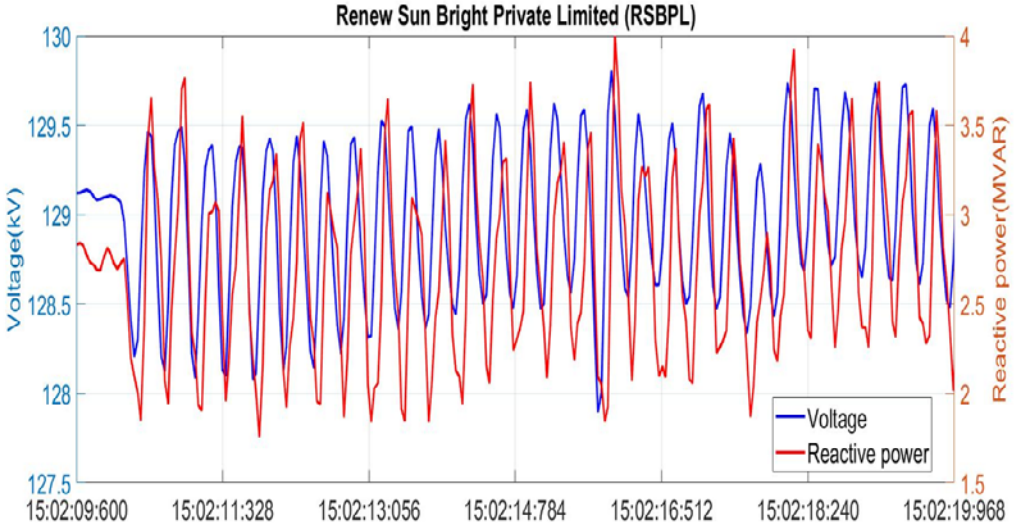
Large RE Generation Loss Events in 2022

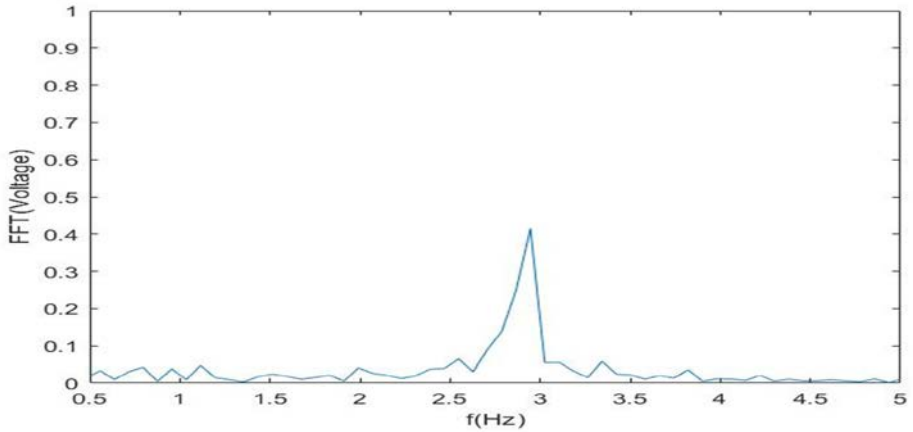
Consecutive Generation Loss Events in Rajasthan on 14th Jan 2023

Event Time	Approx. Solar Generation Loss	Elements Tripped
11:22 Hrs	420 MW	1. 220 KV Fatehgarh_II(PG)- ASEJOL_HB FTGH2 CKT-1
13:03 Hrs	2250 MW	1. 765 kV Ajmer-Bhadla_2 (PG) CKT-2 (R-N Fault) 2. 220 KV Fatehgarh_II (PG)- Asejol_Hybrid Ckt1 (Overloading) & 2 (OV)
14:55 Hrs	3398 MW	1. 400 kV Bassi-Heerapura ckt-1 (Y-N Fault) 2. 765 kV Ajmer-Bhadla 2 ckt 1 (OV) 3. 765 kV Fatehgarh 2-Bhadla ckt 1 (OV) 4. 765 kV Fatehgarh 2 -Bhadla 2 ckt 1 (OV) 5. 400 kV Adani Fatehgarh – Fatehgarh 2 (PG) ckt 1 (OV) 6. 400 kV Kolayat NTPC 1– Kolayat NTPC 2 ckt 1 (OV) 7. 400 kV Bhadla – Bhadla 2 ckt 1 (OV)
15:18 Hrs	4600 MW	1. 400 kV Phagi-Heerapura ckt-1 (R-Y Fault) 2. 765kV Bikaner-Moga ckt 1 & ckt 2(OV) 3. 765kV Bikaner- Khetri Ckt 1(OV) 4. 765kV Bikaner-Bhadla ckt 1(OV) 5. 765kV Bikaner-Bhadla2 ckt 1(OV) 6. 765kV Fatehgarh-Bhadla ckt 2(OV) 7. 400kV Adani Fatehgarh – Fatehgarh 2 (PG) ckt 2(OV) 8. 400kV Bhadla – Bhadla 2 ckt 1 & 2 (OV) 9. 400kV Bhadla –Merta(OV) 10. 400kV Bhadla – Ramgarh ckt 1 & 2 (Distance Protection) **SPS at Bikaner_PG acted**

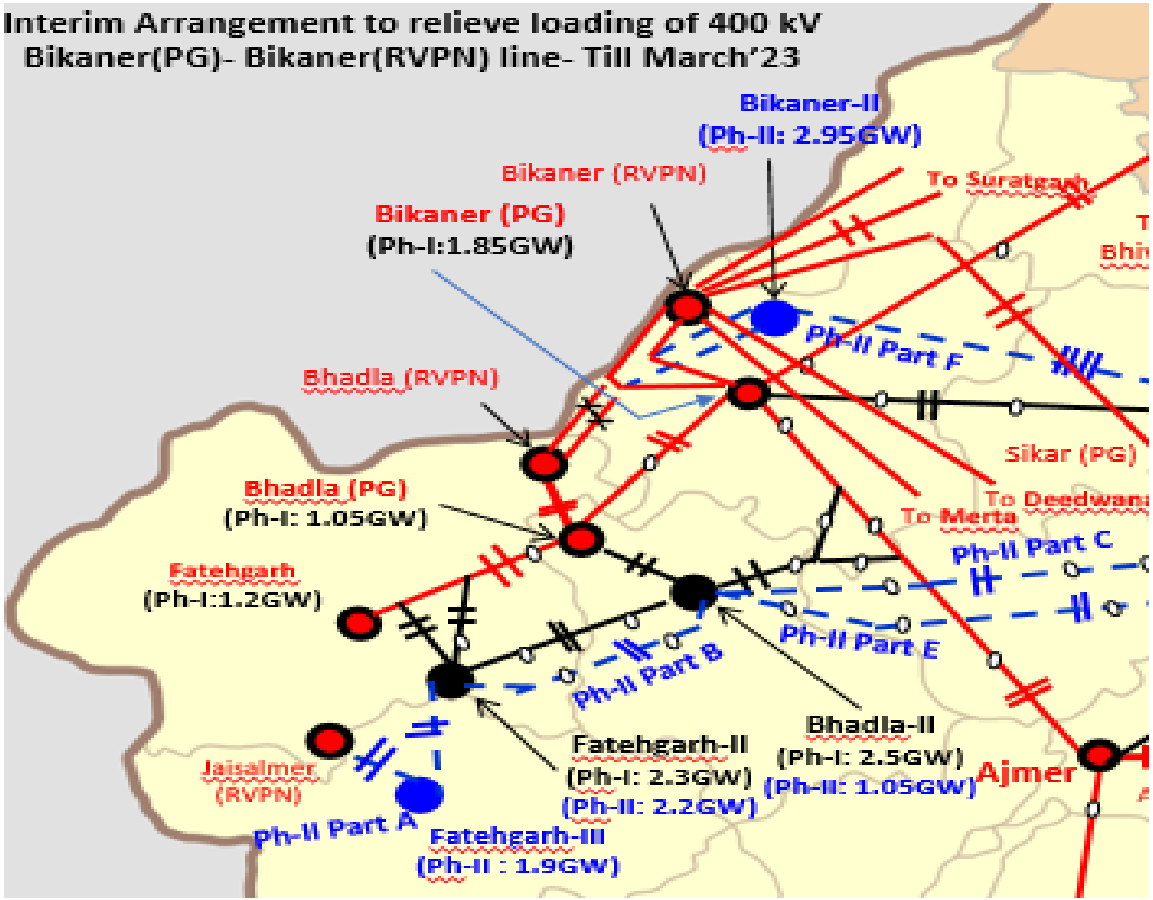
Low-Frequency Oscillations Observed in Rajasthan RE Complex

- The low-frequency oscillations (2.5 to 3 Hz) were observed during the solar hours on regular occasions with 15-25 occurrences of per day since mid- December.
- Intermittent oscillations during solar hours.
- Voltage oscillation magnitude (peak to peak 1.5kV)
- Time period of oscillation varied from 260ms to 400ms.
- Predominant at 400kV Fatehgarh(Adani), 400kV Fatehgarh(PG) , Bikaner, Bhadla and Bhadla-2 stations.
- Low short circuit level





Interim arrangement for evacuation of RE generation at Bikaner



Transmission Constraints leading curtailment of total 298MW STOA *(10% of total approved STOA (2839MW), 2.6% of total approved LTA/MTOA/STOA (11399MW)*) quantum RE resources in the complex for peak solar hour (10:30 hrs - 14:00 hrs).

INTERIM ARRANGEMENT for partial relief in constraint

Bypassing of 400 kV Bikaner (PG) – Bhadla (RS) and 400 kV Bikaner(RS)-Bhadla (RS) at 400 kV Bhadla (RS) to create direct 400 kV Bikaner(PG)-Bikaner (RS)-2

Implemented from 23.12.2022

No curtailment at present, all RE generation is being harnessed

400kV Bikaner(PG)-Bikaner(RS) D/C SPS

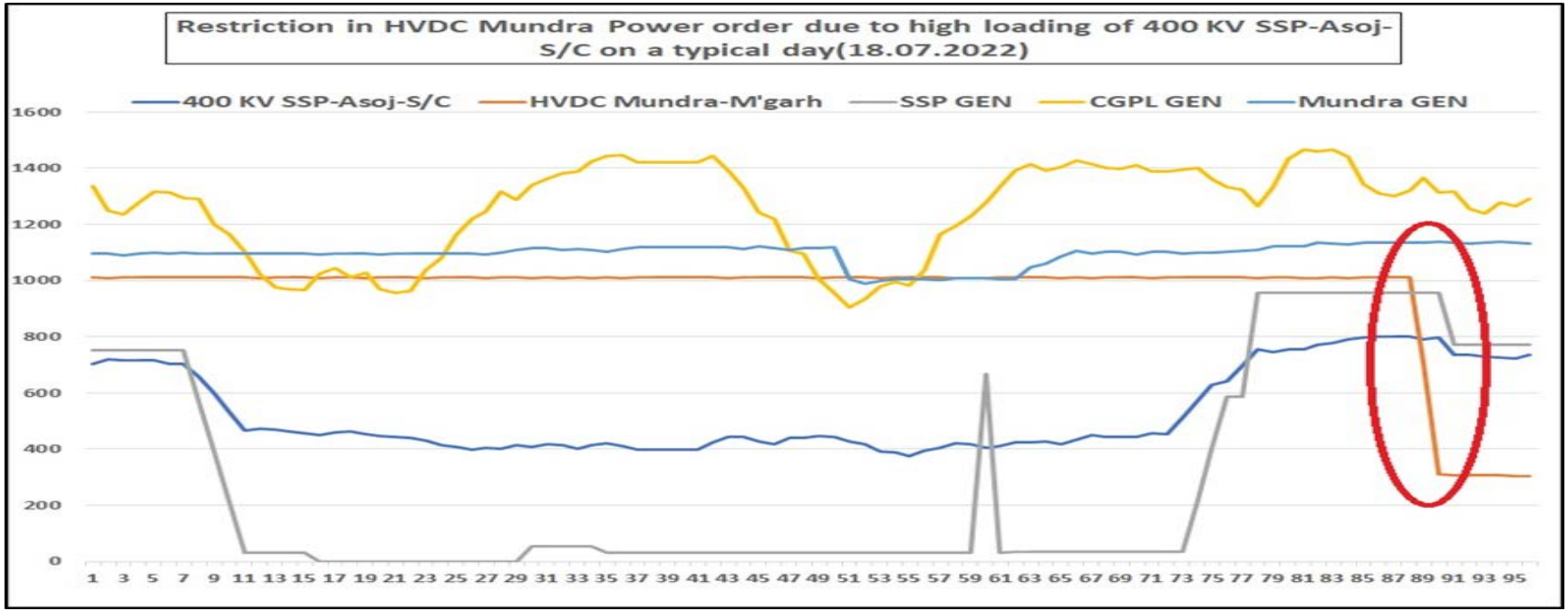
Antecedent Condition	SPS Action
Loading on any circuit of 400kV Bikaner (PG)-Bikaner (RVPN) D/c line exceeds 1450 MW	Stage – 1: Tripping of RE Generations connected at 220kV Bikaner(PG) [Existing-737.5 MW] : Relieve the loading 400kV Bikaner(PG)-Bikaner(RS) line by 219 MW **(Implemented)**
	Stage – 2: Tripping of RE Generation [Renew] connected at 400kV Bikaner(PG): would relive the loading 400kV Bikaner(PG)-Bikaner(RS) line by 120MW **(Implemented)**
	Even after above trip, in case of loading of 400kV Bikaner (PG)-Bikaner (RVPN) line >1450 MW, 400kV Bikaner (RVPN)-Sikar (PG) line (in service) shall be tripped **(3rd Stage is tested at PG end and yet to be tested at Rajasthan end).**

Way Ahead:

- Expedite commissioning of
  - 400kV Bikaner-II (PG) S/s
  - 400kV Bikaner(PG)- Bikaner-II (PG) D/C line
  - 400kV Bikaner-II (PG)-Khetri (PG) lines
  - 765/400kV, 1500MVA ICT-3 at 765kV Bikaner(PG)
- Commissioning of balanced Phase-II system commensurately to meet the planned cumulative capacity of Phase-I & Phase-II.

Constraints in Flexible Operation of HVDC

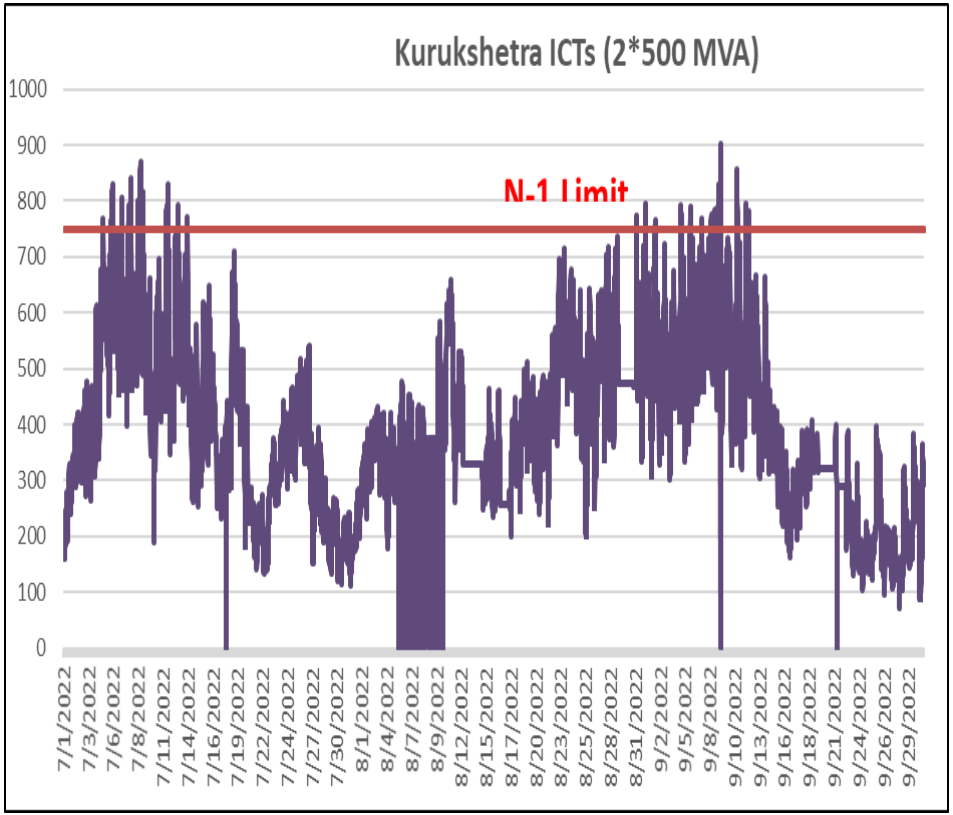
HVDC Mundra – Mahendragarh



- At the time of low generation in CGPL and APL Mundra generation complexes along with high power order on HVDC Mundra-Mahendergarh link, it has been observed that loading of 400 kV SSP-ASOJ is very high
- SSP generation and HVDC Mundra power order have 31% and 4 % sensitivity respectively on loading of 400 kV SSP-Asoj
- **As per discussion in 522nd WRPC OCC meeting, high Loading on 400 kV SSP-Asoj can be reduced if SSP-Asoj and Asoj – Chorania lines are bypassed at Asoj to make 400 kV SSP- Chorania**

Constraint in HVDC Champa-Kurukshetra

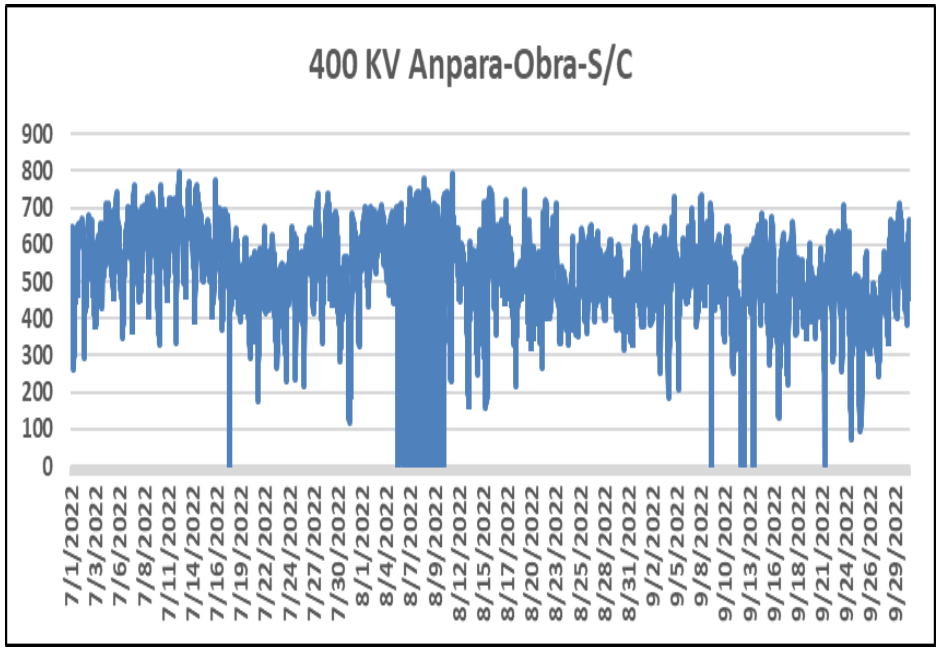
- At the time of high import of NR, HVDC Champa Kurukshetra (4x1500 MW) is required to be operated at its rated capacity of 6000 MW.
- However, at Kurukshetra end, there is only two 400/220 kV, 500 MVA ICTs which becomes N-1 non-compliant if HVDC power order is above 5000 MW.
- HVDC Champa Kurukshetra power order has 6.5 % sensitivity on Kurukshetra ICTs loading.
- **Commissioning of New 500MVA ICT approved in 4 NRPCTP held on 05.10.2021 to be expedited.**



400/220kV Kurukshetra ICT loading for Q2 2022-23

Constraint in HVDC Vindhyachal flexible operation

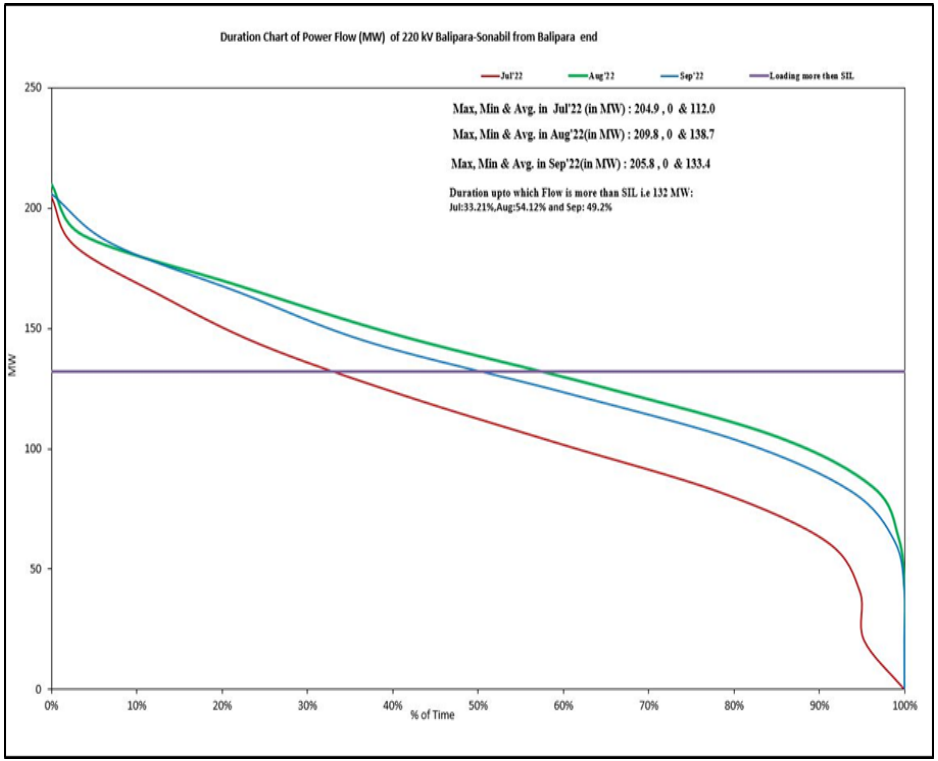
- At the time of high demand in UP and during high import of NR, 765kV Vindhyachal(WR)-Varanasi(NR) D/C line gets heavily loaded
- HVDC Vindhyachal is being operated towards WR due to constraints on NR side(High loading of 400 kV Anpara-Obra line). This is being done even under heavy import of NR i.e. greater than 20500 MW.
- Due to outage of 765kV Anpara D-Unnao line, constraints were observed at 400kV Anpara-Obra line.
- HVDC Vindhyachal has 10 % sensitivity (if operated towards WR-NR) on loading of 400 kV Anpara-Obra line
- **It is important that revival of 765 kV Anpara D - Unnao line is expedited which is under outage since 8th February 2022**.



High Loading of 400 kV Anpara-Obra in Q2

Constraint in HVDC BNC-Agra

- The power order on HVDC in NR-NER direction is restricted due to overloading of 220 kV Balipara-Sonabil
- High loading in 220 kV Balipara- Sonabil S/C has led to opening of 220 kV Samaguri- Sonabil D/C lines even before peak hours.
- It is observed that there is 5% sensitivity of HVDC BNC-Agra power order on the loading of 220 kV Balipara – Sonabil. Hence, for every 100 MW increase in power order of HVDC BNC-Agra in reverse direction (i.e. from NR to NER), loading on 220 kV Balipara-Sonabil gets increased by about 5 MW.
- **Early commissioning of 2nd circuit of 220 kV Balipara - Sonabil will enhance the utilization of ER-NER corridor. As per 194th OCCM, the construction of the line is completed and OEM is awaited for SAS integration**



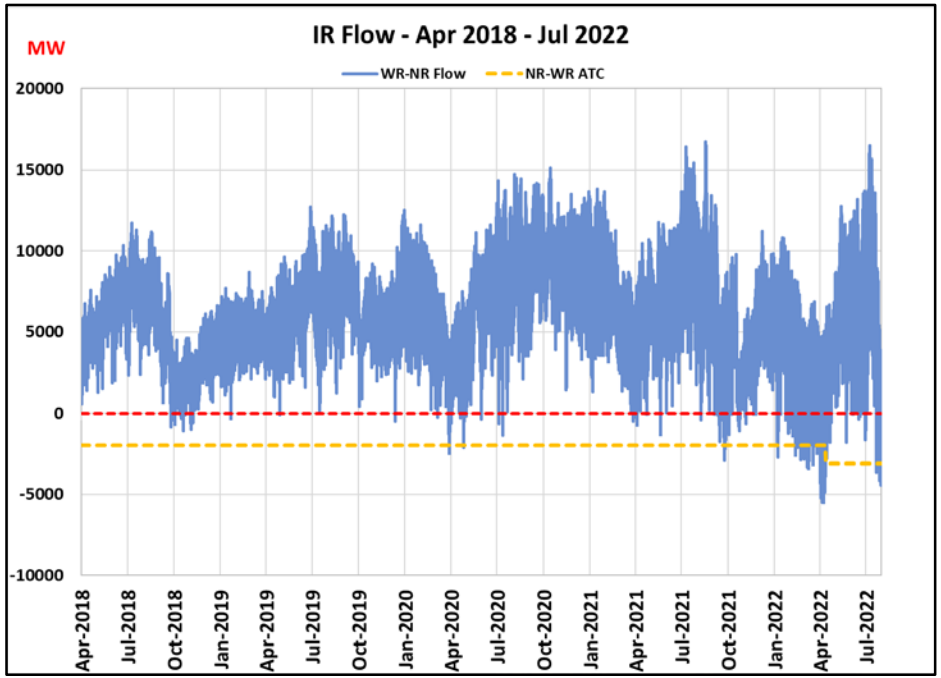
Duration Chart of 220 kV Balipara-Sonabil lines

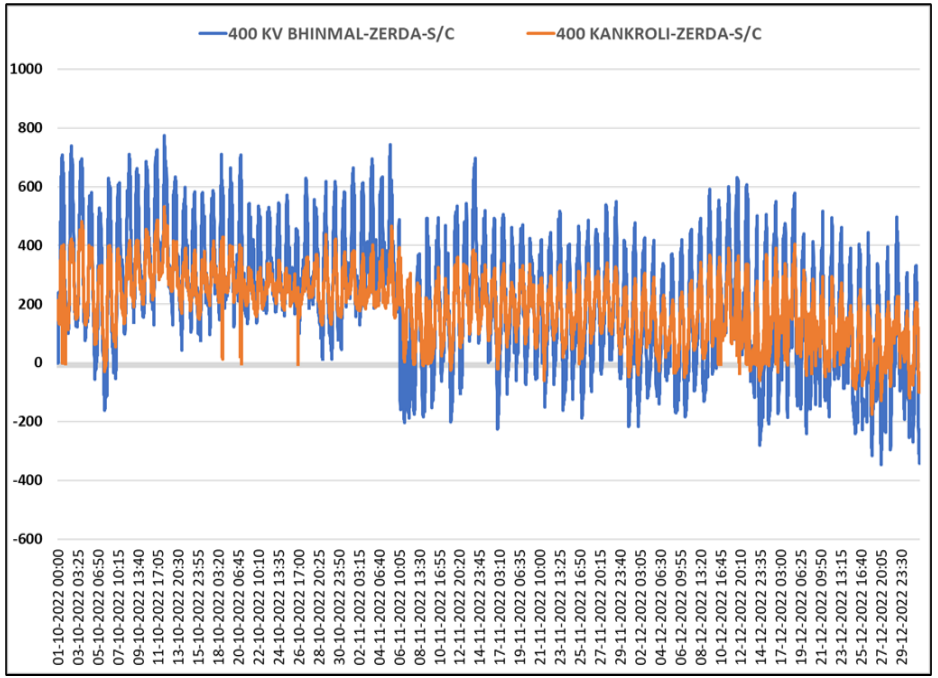
Constraints in Inter-regional Corridors

Constraints in Inter-regional Corridors

S.No.	Corridor	TTC (MW)	ATC (MW)	Constraints Observed in Operation
1	**NR Import**	25800	24400	• Constraint in HVDC Vindhyachal flexible operation due to overloading of Anpara – Obra 400 kV line, • Non-compliance of 400/220 kV, 500 MVA ICTs at Kurukshetra when HVDC Champa - Kurukshetra power order is above 5000 MW • Constraint in increasing the HVDC Mundra-Mahendergarh link, due to the loading of 400 kV SSP-ASOJ
2	**NR Export**	4000	3500	• N-1 non-compliance observed in Rajasthan to Gujarat corridor during high solar hours of 400 kV Kankroli-Zerda & 400 kV Bhinmal-Zerda
3	**SR Import**	17300	16300	• **N-1 non-compliance of 2x1500 MVA, 765/400 kV ICTs at Nizamabad**
4	**SR Export**	6350	5700	• **N-1 non-compliance 400 kV Kolhapur-Kolhapur D/C**

NR to WR constraint

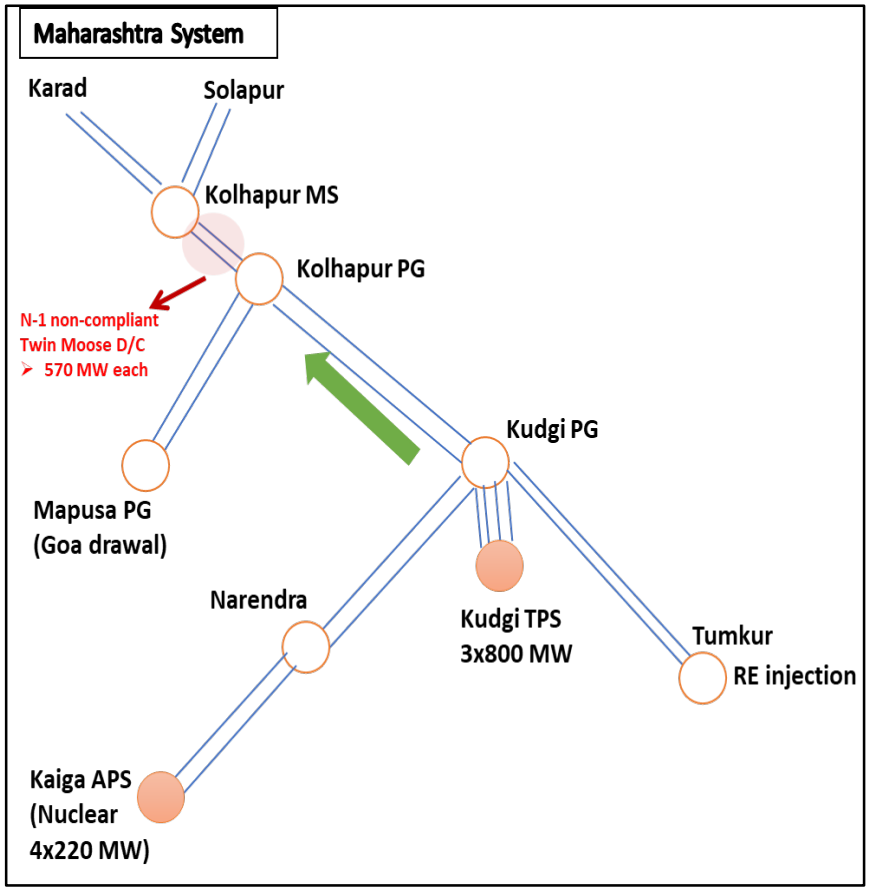




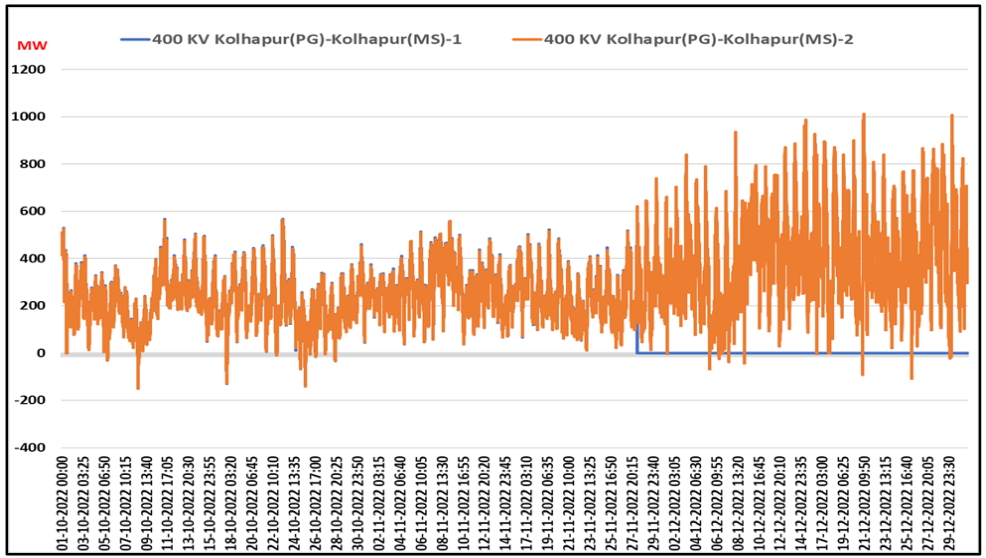
- N-1 non-compliance observed in Rajasthan to Gujarat corridor during high solar hours
- Bypassing of 400 KV Kankroli-Bhinmal-Zerda lines at Bhinmal to form 400 KV Kankroli-Zerda (direct line) and reconductoring of 400 KV Jodhpur (Surpura)(RVPN)-Kankroli-S/C line with twin HTLS conductor approved under 5th Consultation Meeting for Evolving Transmission Schemes in NR are to be expedited.
- The critical loading of the 400 kV Banaskantha – Veloda D/C line is relieved to some extent after the commissioning of LILO of 400 kV Zerda – Ranchodpura at Banaskantha.

Constraint in SR export

Congested network during high SR Export Period

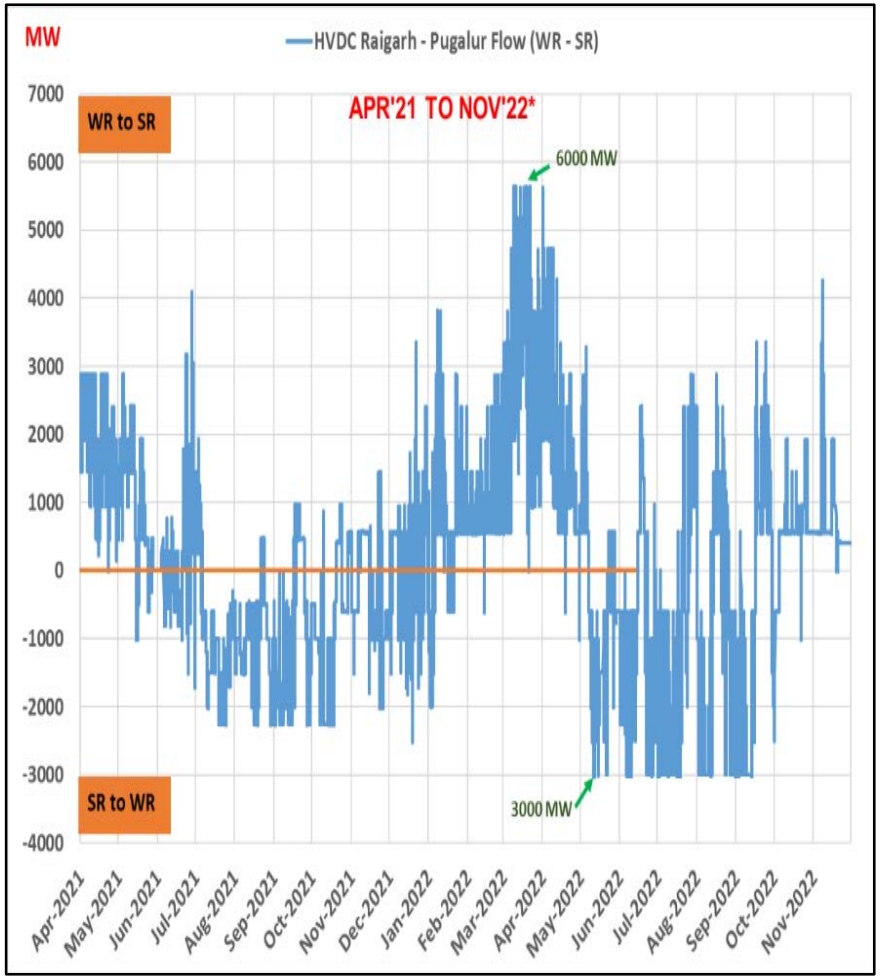


Kolhapur-Kolhapur Oct – Dec 2022

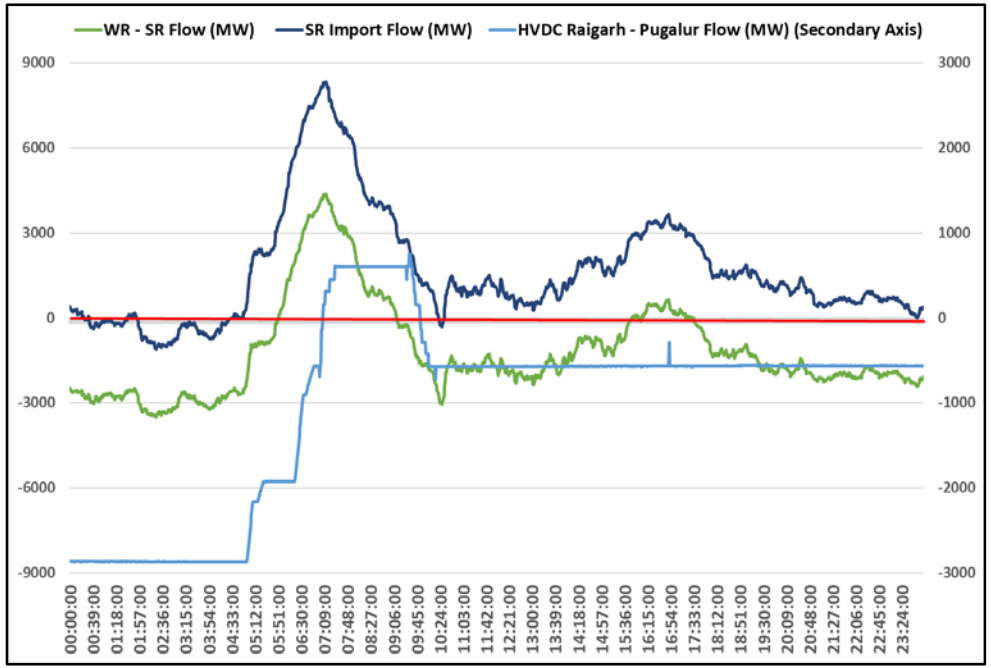


- With Tripping of 400 kV Kolhapur-Kolhapur D/C lines
  - Critical loading on Pune GIS-PunePG-Lonikhand-Karad-Kolhapur
  - Reduced reliability to Goa and South/West Maharashtra system
- Reconductoring of 400 kV Kolhapur (PG) – Kolhapur (MS) D/C (Moose conductor) with HTLS conductor now going on.
- 400KV-Kolhapur-MS-Kolhapur GIS-1 is currently under long shutdown for reconductoring work.

HVDC Raigarh – Pugalur Flow 2021-22 & 2022 - 23

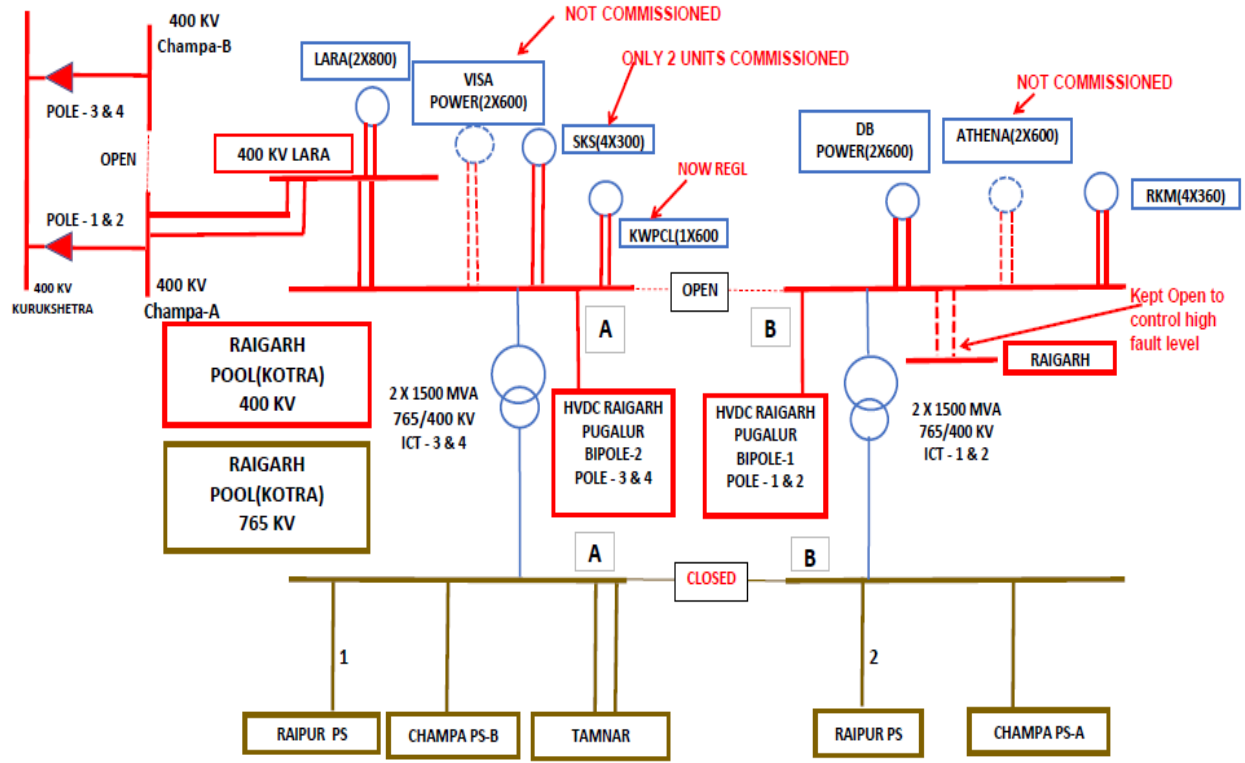


HVDC Raigarh – Pugalur Flow for 13th August 2022



- Requirement of bi-directional operation of HVDC Raigarh – Pugalur due to changing flow patterns in SR – WR corridor even on a single day.
- However, there is resistance from the site to avoid frequent changes in the direction of the operation of HVDC citing concern over the adverse effect on the life of the equipment and even premature failures.

Constraint in HVDC Raigarh-Pugalur flexible operation



Generation (MW)	Bus – Section - A	Bus – Section - B
Total Planned	4600	3840
Total Commissioned	2800 (including Lara TPS)	2640

- **400 kV Bus – Sectionalizer is to be opened** and **765 kV Bus – Sectionalizer to be kept under closed** condition **as an interim arrangement** at Raigarh PS as approved in the Joint Study meeting with CTU.
- HVDC Power Order to be determined based on the generation dispatches at Kotra – PS **till the commissioning of 765/400 kV ICTs at Kotra Section – A & B.**
- The restriction on the HVDC link will have an impact on the SR Import and Export TTC.
- Healthiness of the 'Emergency Power Control' settings implemented at Raigarh PS (Kotra) end in the Raigarh - Pugalur HVDC Bipole during reverse power order (i.e., SR-WR), when the 400kV side Bus Sectionliazer at Raigarh PS (Kotra) is under open condition, to be ensured to prevent ICT overloading in case of any contingency.

Commissioning of Elements Eagerly Awaited

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

  (Till the commissioning of ICTs, maximum flow on HVDC will depend upon the generation that is being pooled at Raigarh PS in both the sections)
- 765/400 kV ICT-3 at Nizamabad **(SR Import ATC Constraint)**
- 765 kV Warora-Warangal D/C **(Will Enhance SR Corridor Transfer Capability) – ROW Issues (SCOD: Dec'2019)**
- 765 kV Hyderabad-Kurnool D/C **(Will Enhance SR Corridor Transfer Capability) – ROW Issues (SCOD: Feb'2020)**
- Bypassing of 400 KV Kankroli – Bhinmal - Zerda lines at Bhinmal to form **400 KV Kankroli - Zerda (direct line)** and **reconductoring of 400 KV Jodhpur (Surpura) (RVPN)-Kankroli-S/C** line with twin HTLS conductor approved under 5th CMETS-NR.

High Voltage & Low Voltage Nodes in NR

HV Nodes:

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

Mahendragarh, MGTPS Jhajjar,

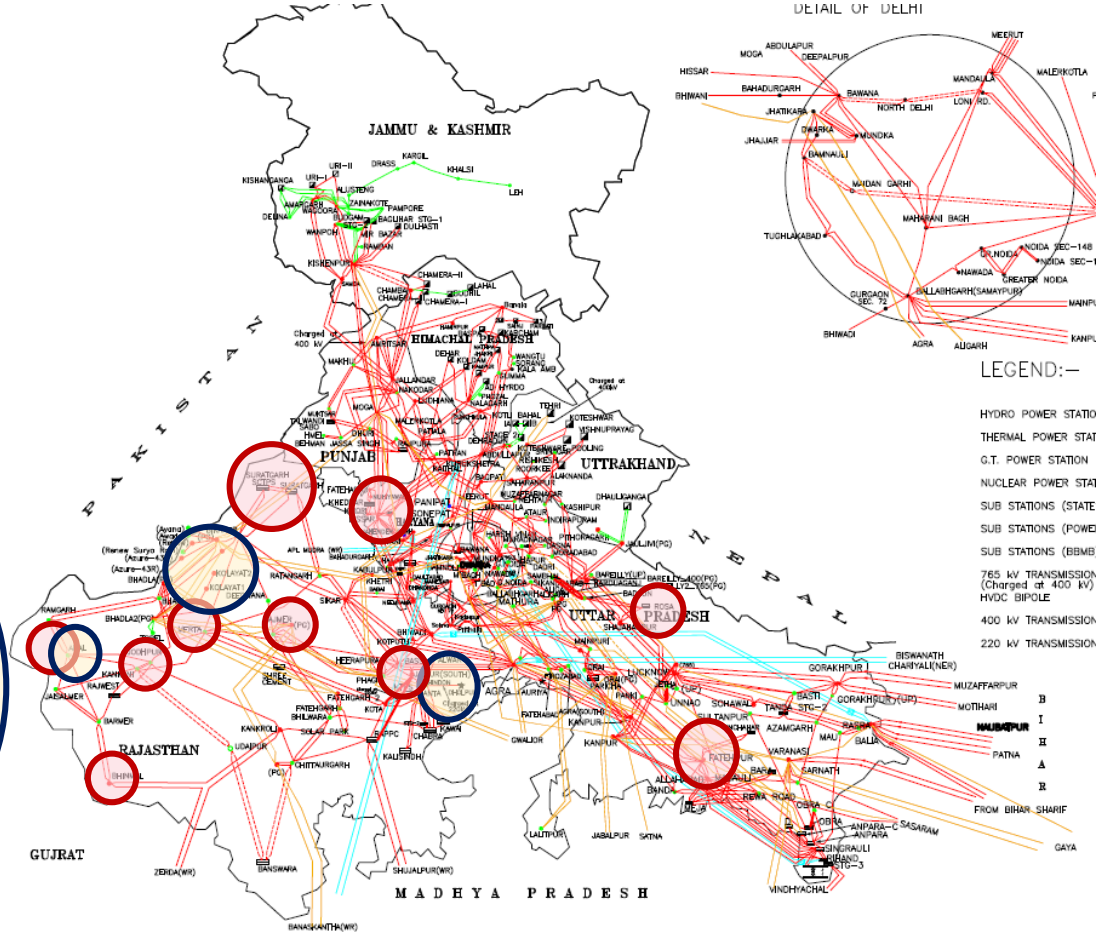
Fatehpur, Rosa,

LV Nodes:

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

Bhadla-I (PG), Fatehgarh-II (PG) **(STATCOM Commissioning to be expedited, reactive support from RE Plants to be mandated)**

Akal (Raj), Bhadla(RJ), Ramgarh, Akal, Kankani **(Rajasthan SLDC to direct RE Generators for Reactive Support)**



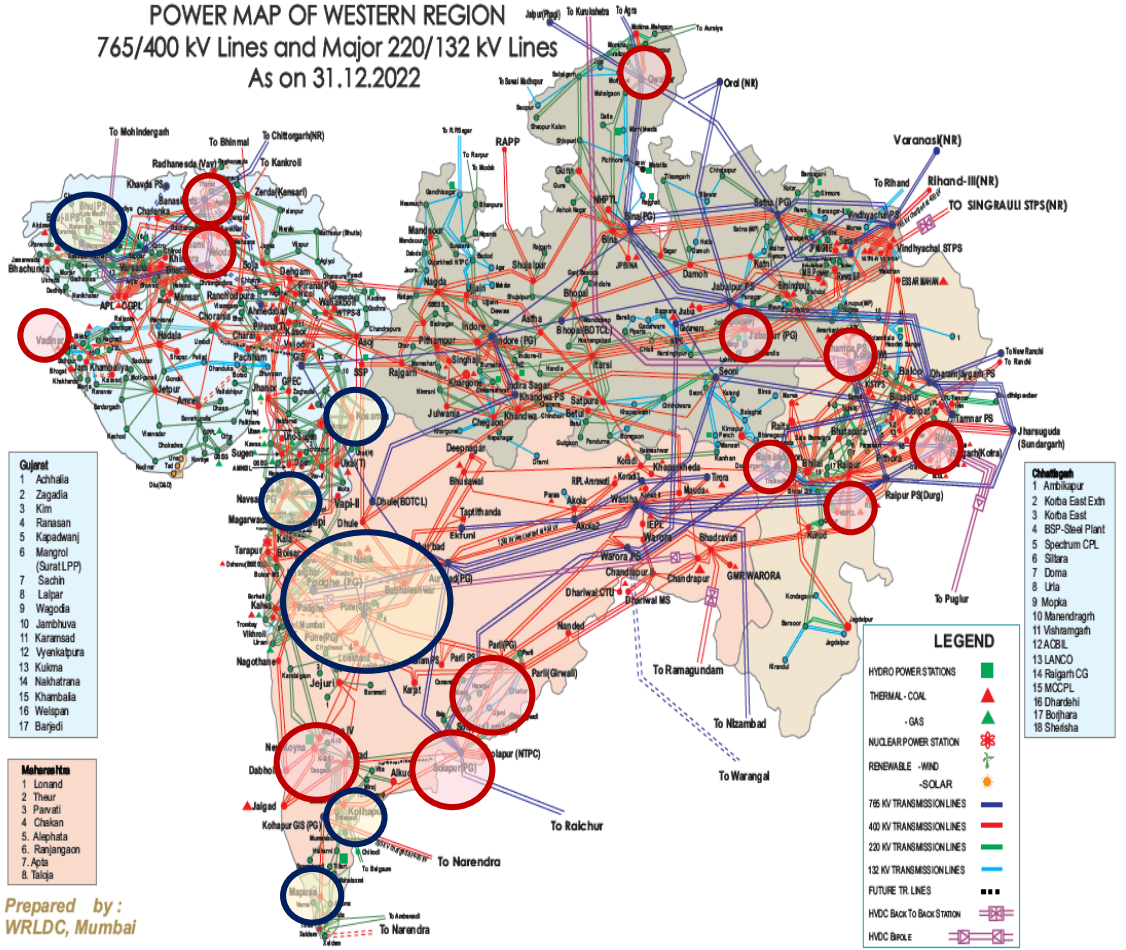
High Voltage & Low Voltage Nodes in WR

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

Banaskantha, Sami, Essar Vadinar,

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

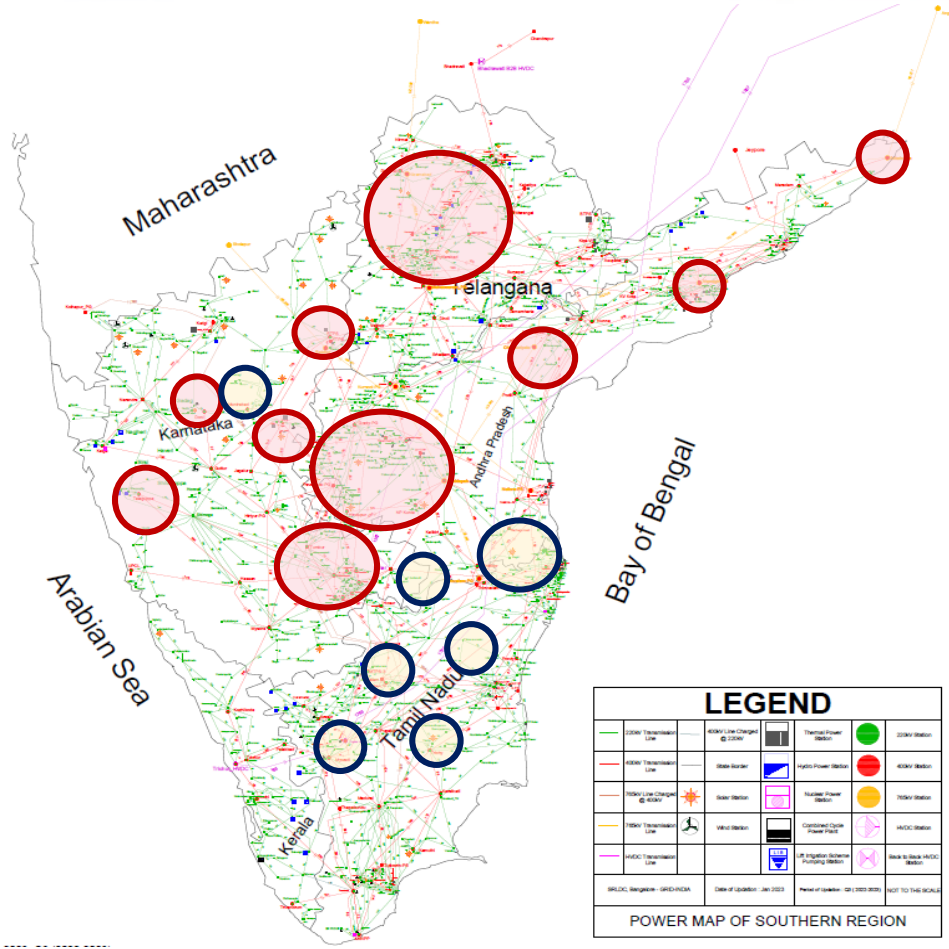
LV Nodes: Padghe, Kharghar Kalwa, **(Padghe (GIS)-Navi Mumbai-Vikhroli line to be expedited)** Pune PG & Chakan, Jejuri, Lonikhand, Lonikhand-II, Solapur **(Capacitor Bank at LV by MSETCL)** Bableshwar, Kolhapur GIS, Solapur(MH), Alkud, Boisar,
Mapusa, Bhuj-PS, Hazira, Vapi, Vav, Kosamba, Janor, Magarwada



High Voltage & Low Voltage Nodes in SR

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

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



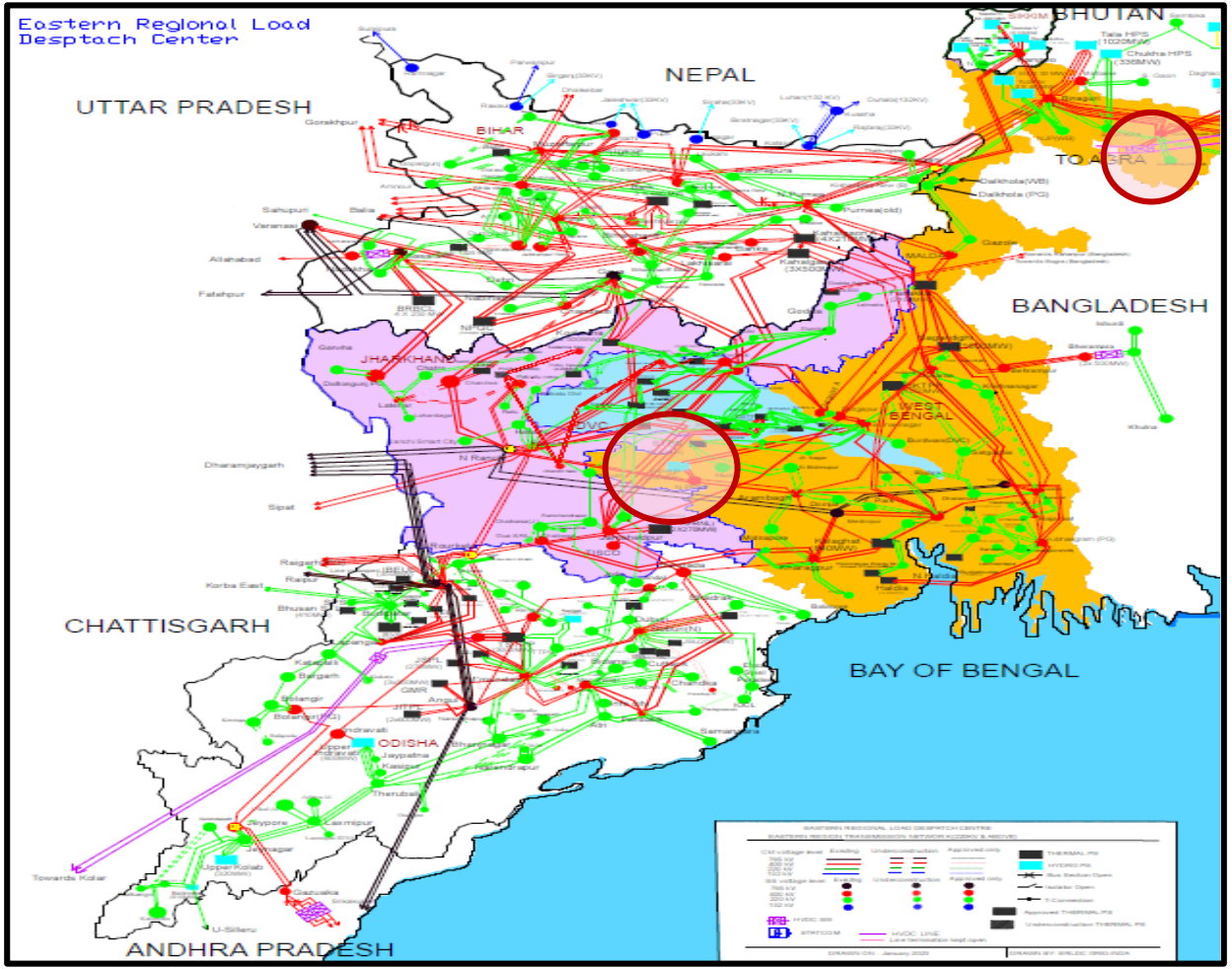
High Voltage & Low Voltage Nodes in ER

HV Nodes:

- **New Purulia PSP:**

2x 125 MVAR BR commissioning needs to be expedited

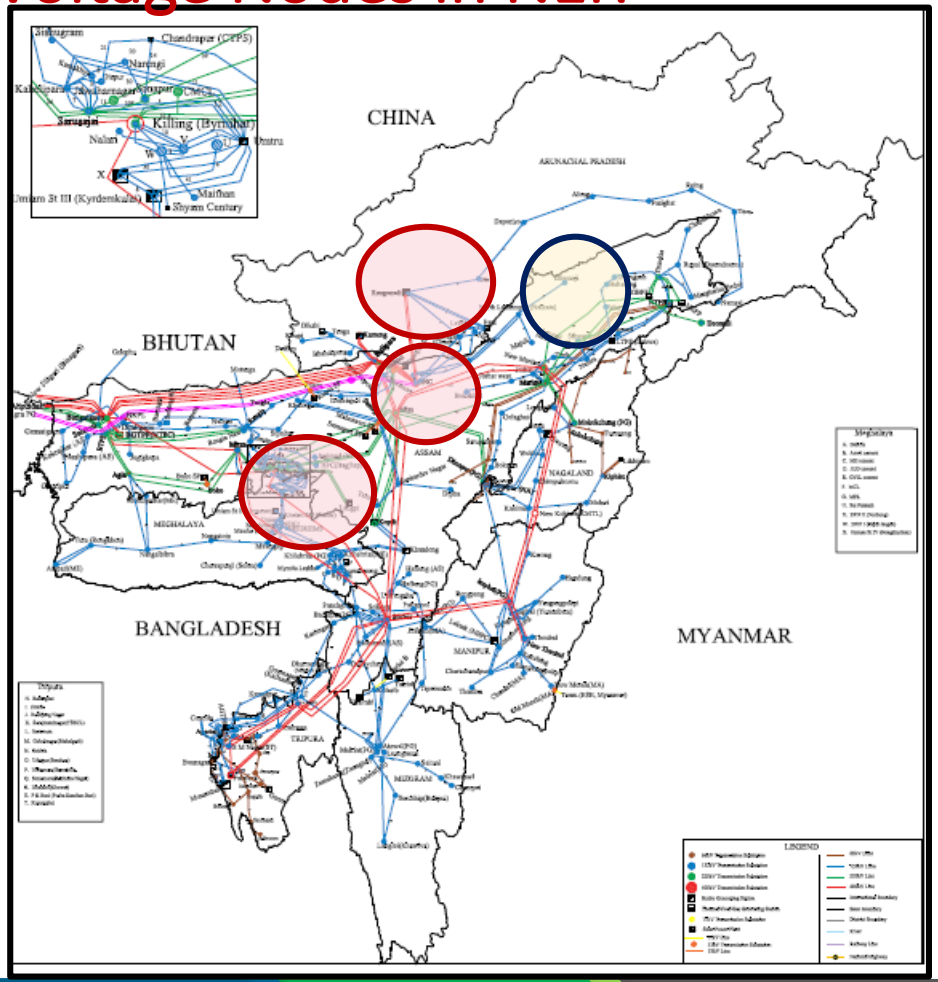
- **400kV Alipurduar**:



High Voltage & Low Voltage Nodes in NER

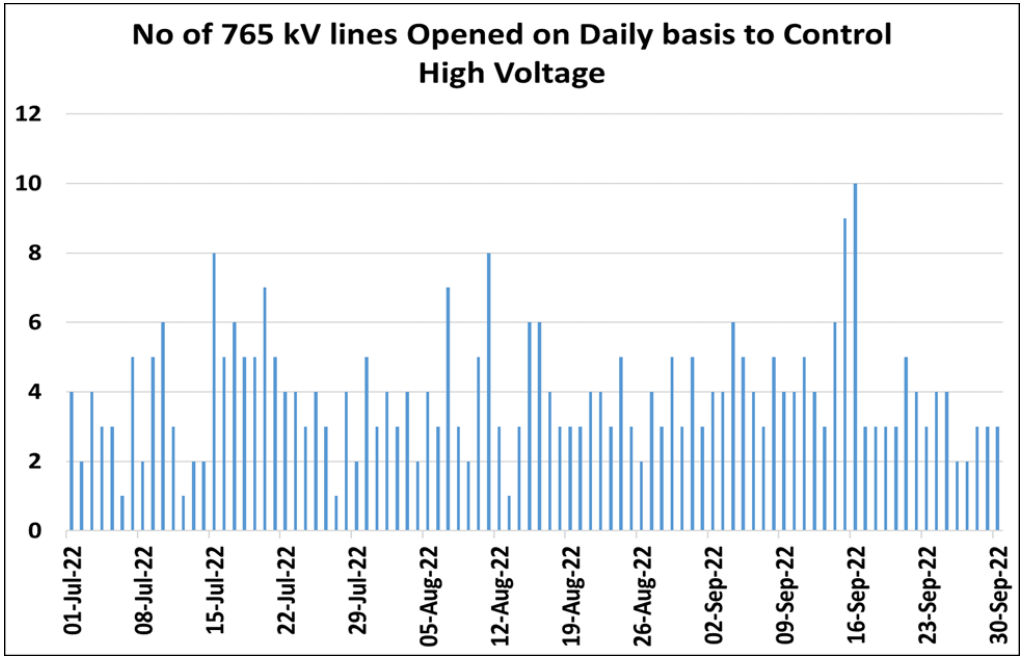
HV Nodes: 400 kV Ranganadi, Balipara, Misa, Biswanath Chariali, Byrnihat. **(Installation of 420 kV, 80 MVAR B/R by NEEPCO at Ranganadi Bus, 80 MVAR bus Reactor at Byrnihat to be expedited)**

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



765 Lines Opened on High Voltage – Q2 FY 2022-23

SL. No.	Line Name	No. of times opened
1	765 kV Bikaner-Moga (PG) -2	45
2	765 kV Bikaner-Moga (PG) -1	44
3	765 kV Ajmer-Bhadla_2 (PG) -2	38
4	765 kV Ajmer-Bhadla_2 (PG) -1	36
5	765 kV Ajmer-Chittorgarh (PG) -1	21
6	765 kV Ajmer-Chittorgarh (PG) -2	19
7	765KV-NIZAMABAD-MAHESHWARAM_PG-2	18
8	765 kV Phagi(RS)-bhiwani(PG) (PG) -2	11
9	765KV-NIZAMABAD-MAHESHWARAM_PG-1	10
10	765 kV Solapur-Parli -I	8
11	765 kV Solapur-Parli -II	8
12	765 kV Orai-Aligarh (PG) -2	5
13	765 kV Phagi(RS)-Bhiwani(PG) (PG) -1	5
14	765 kV Wardha-Aurangabad -II	5
15	765 kV Agra-Fatehpur (PG) -2	4
16	765 kV Agra-Fatehpur (PG) -1	4
17	765 kV Orai-Aligarh (PG) -1	4
18	765 kV Raipur-Jharsuguda-I	4
19	765 kV Moga-Meerut (PG) -1	3
20	765KV-JHARSUGUDA-RAIPUR PS (DURG)-2	3
21	765KV-CUDDAPAH-THIRUVALAM-2	3



Total = 298

No. of time 400 & 765 kV Lines opened

Details available at: https://posoco.in/download/nldc-operational-feedback_july_2022/?wpdmdl=46648

Thank you !!

Major Elements Commissioned in Q2 & Q3 FY 2022-23

Major Elements Commissioned in Q2 & Q3 FY 2022-23

S. No.	Agency/Owner	Element	First time Charging / Synchronization Date /COD
1	UPPTCL	500 MVA, 400/220/33 kV ICT – 3 at Aligarh(UP)	18.07.2022
2	NTPC_KOLAYAT SL	150 MVA, 400/33 kV ICT – 1 at Kolayat Solar NTPC_1 (NTPC_KOLAYAT SL)	23.07.2022
3	NTPC_KOLAYAT SL	150 MVA, 400/33 kV ICT – 2 at Kolayat Solar NTPC_1 (NTPC_KOLAYAT SL)	24.07.2022
4	PBTL	500 MVA, 400/220 kV ICT – 4 at Bhuj - II	20.07.2022
5	MPPTCL	315 MVA, 400/220 kV ICT – 2 at Indore	19.07.2022
6	NTPC_KOLAYAT SL	400 kV Bhadla_2 (PG)-Kolayat Solar NTPC_1 (NTPC_KOLAYAT SL)-1	23.07.2022
7	MPPTCL	500 MVA, 400/220 kV ICT – 1 at Bhopal MP	30.08.2022
8	GETCO	315 MVA, 400/220 kV ICT – 2 at Ranchodpura	23.08.2022
9	PMJTL	400 kV Subhashgram-New Jeerat Transmission Line-1	22.08.2022
10	PMJTL	400 kV Subhashgram-New Jeerat Transmission Line-2	24.08.2022
11	POWERGRID	400/220/33 kV, 500 MVA, 6th ICT at Bhadla-II	01.09.2022

Major Elements Commissioned in Q2 & Q3 FY 2022-23

S. No.	Agency/Owner	Element	First time Charging / Synchronization Date /COD
12	MPPTCL	400/220 kV, 500 MVA, ICT – 1 & 2 at Guna (PBGTL) S/S MP	03.09.22 & 16.09.22
13	POWERGRID	400/220/33 kV, 500 MVA, 9th ICT at Fatehgarh-II	30.09.2022
14	MPPTCL	400 kV Bina- Guna(PBGTL) 1 & 2	29.09.2022
15	NTPC Kolayat	400kV Kolayat Solar NTPC_1 Kolayat Solar NTPC_2	09.09.2022
16	WRSS XX1(A) TL	400 kV Bhachau-Lakadia-1 {LILO of Bhachau - EPGL 400kV D/c (triple) line IN at Lakadia PS Line In CKT-1}	21.09.2022
17	WRSS XX1(A) TL	400 kV Bhachau-Lakadia-2 {LILO of Bhachau - EPGL 400kV D/c (triple) line IN at Lakadia PS Line In CKT-2}	21.09.2022
18	WRSS XX1(A) TL	400 kV Lakadia-Jam Khambaliya-1 {LILO of Bhachau - EPGL 400kV D/c (triple) line OUT from Lakadia PS Line In CKT-1}	28.09.2022
19	POWERGRID	1500 MVA, 765/400/33 kV ICT – 3 at Bhadla_2 (PG)	02.10.2022
20	WRSS XX1(A) TL	1500 MVA, 765/400 kV ICT – 1 at Lakadia	07.10.2022
21	WRSS XX1(A) TL	1500 MVA, 765/400 kV ICT – 2 at Lakadia	06.10.2022
22	POWERGRID	400/220 kV, 500 MVA, ICT – 3 at Hiriyur	29.10.2022

Major Elements Commissioned in Q2 & Q3 FY 2022-23

S. No.	Agency/Owner	Element	First time Charging / Synchronization Date /COD
23	LBTL	765kV Lakadia PS-Banaskantha PS line-1	13.10.2022
24	LBTL	765kV Lakadia PS-Banaskantha PS line-2	13.10.2022
25	NKTL	400 kV North Karanpura(NTPC)-Chandwa(PG) D/C Line-1	15.10.2022
26	NKTL	400 kV North Karanpura(NTPC)-Chandwa(PG) D/C Line-2	15.10.2022
27	PBTL	1500 MVA, 765/400 kV ICT – 1 at Bhuj - II	12.11.2022
28	UPPTCL	400kV Varanasi(PG)-Jaunpur (UP)-2 (Charged on no load)	18.11.2022
29	POWERGRID	400 kV Jauljivi (PG)-Bareilly_2(PG)-2 *{1.6KM at Jauljivi(PG) AND 7.866KM at Bareilly_2(PG) end}*	18.11.2022
30	MSETCL	400KV Karad-Jejuri-1 *(LILO of 400KV Karad-Lonikhand Line)*	03.11.2022
31	MSETCL	400KV Lonikhand-Jejuri-2 *(LILO of 400KV Karad-Lonikhand Line)*	04.11.2022

Transmission Line and ICT Constraints

S. No	Region	Element	Description of the constraints
1	Northern Region	400kV Bhinmal(PG)-Zerda(PG) and Kankroli(PG)-Zerda(PG)	During high wind generation in Rajasthan and high demand in WR (Gujrat), line loading of 400kV Bhinmal-Zerda is reaching 600-800MW and line loading of 400kV Kankroli-Zerda is reaching 350-450MW. **(North-West Inter-regional system strengthening scheme approved during 5th CMETS - NR meeting needs to be expedited)**
2		400kV Barmer(RS)-Bhinmal(PG) ckt-1 & ckt-2	During high wind generation at Rajasthan, wind power gets pooled at 400kV Barmer from 400kV Akal (RS) and 400kV Bhensra(RS) and gets evacuated through 400kV Barmer(RS)-Bhinmal(PG) ckt-1 & ckt-2. **(upgrading of 400kV Jodhpur (kankani) to 765kV needs to be expedite by RVPN)**
3		3x500 MVA, 400/220 kV ICTs at Bhadla (Raj) and Fatehgarh-II	During high solar generation, loading of ICTs are N-1 non-compliant for considerable duration. New ICTs need to be expedited.
4		2X315 MVA, 400/220kV ICTs at Deepalpur, Rajpura, Nakodar, Kurukshetra, and Chhittorgarh (Raj), Merta, Bikaner (Raj), Ajmer	Augmentation/new ICT needs to be planned/expedited at these locations.

Transmission Line and ICT Constraints

S. No.	Region	Element	Description of the constraints
1	Western Region	400 kV Kudus-Kala D/C	**Remarks:** Commissioning of 400 kV Padghe (GIS) –Kharghar and Padghe (GIS)-Vikhroli line would relieve loading of Kudus-Kala D/C.
2		400 kV Padghe- Kalwa D/C	**Remarks:** Commissioning of 400kV Vikhroli S/s and Padghe (PG)-Kharghar, Padghe (PG)-Navi Mumbai-Vikhroli and Kharghar-Vikhroli would give additional infeed to Mumbai and relieve loading of Padghe-Kalwa D/C. SCOD: Sep-23 Revised schedule-June'24
3		400 kV Lonikhand - Jejuri S/C & Low Voltages at Jejuri	**Remarks:** 400kV Pune GIS - Lonikand-II & Pune GIS - Jejuri S/c lines along with reconductoring of Lonikand-I – Jejuri line section. Expected by Jun'25
4		400 kV Chandrapur-Chandrapur (II) D/C	Reconductoring with HTLS – Expected by Apr'23 as informed by MSETCL
5		400kV Parli(PG) - Parli(MS) D/C	Bypassing of Parli(PG) – Parli(M) 400kV D/C line and Parli(PG) – Parli(New) 400kV D/C (quad) line at Parli(PG) S/s at outskirts of the S/s so as to form Parli(M) – Parli(New) 400kV D/C direct line (**Completed in Dec'22**) and Reconductoring of Parli(PG) – Parli(M) 400kV D/C line with twin HTLS conductor was approved in 08th CMETS-WR. Expected: Mar'23
6		400 kV Tarapur - Boisar D/c line	When full generation at Tarapur, High HVDC Chandrapur-Padghe flow, Less generation in Mumbai.
7		400 kV Kolhapur (MS) – Kolhapur (PG) D/C	Lines are N-1 non-compliant during high generation at Kudgi TPS as well during high in SR. Reconductoring of the lines is under implementation.

Transmission Line and ICT Constraints

S. No	Region	Element	Description of the constraints
8	Western Region	400kV Pune(PG)-Kharghar & 400kV Pune(PG)-Kalwa S/C line	During less internal generation in Mumbai, Tarapur NPS, less flow or tripping of HVDC Chandrapur-Padghe bipole link and during morning peak demand of Mumbai, high loading is observed. Commissioning of 400/220kV Vikhroli & Navi Mumbai substations to be expedited.
9		2x315MVA+ 1x500MVA 400/220 kV Dhule MSETCL ICTs	Augmentation work of 400/220KV ICT-II from 315 MVA to 500MVA under progress
10		400 kV Lara –Raigarh D/C	Lines are N-1 non-compliant in case of reverse power flow on HVDC Raigarh – Pugalur with high generation in Raigarh complex and low generation at Lara TPS. **1st WRPC(TP):** Reconductoring with quad moose ampacity conductor is agreed with connectivity of Lara Stage-II.
11		400 kV SSP-Asoj S/c line	During high generation at SSP. Can be relived if SSP-Asoj and Asoj –Chorania lines are bypassed at Asoj and made SSP- Chorania.
12		400 kV Pirana (PG)-Pirana DC line	Most of the time line is highly loaded.
13		400 kV Soja-Kansari	During high wind generation at Bhuj(PS) & Solar generation in Rajasthan. Less internal generation in Gujarat
14		765kV Sasan-Vindhyachal PS D/c line	Loop flow from 400kV Vindhyachal PS-Sasan D/c to Sasan & via 765kV it flows back to Vindhyachal PS (After commissioning of 765kV Vindhyachal PS - Varanasi D/c lines)
15		2x1500 MVA 765/400kV Ektuni (MSETCL) ICTs, 2x1500 MVA Pune GIS (Shikarapur) ICTs and 1x1500 MVA Tirora ICT	Augmentation/new ICT needs to be planned/expedited at these locations. (ICT-III at Ektuni by Jun'24. Load Trimming Scheme with total 1850MW loading on Ektuni 765/400kV ICTs by Mar'23 by MSETCL)
16		400/220 kV ICTs at Akola, Alkud, Bableshwar, Lonikhand, Wardha, Sugen, Wanakbori, Itarsi, Jabalpur, Moprena, satna, Bhatapara, Korba West, Kurud, Raigarh (PG), Magarwada.	Augmentation/ new ICT needs to be planned/expedited at these locations.

Transmission Line and ICT Constraints

S. No	Region	Element	Description of the constraints
1	Southern Region	Constraints in Nagjheri PH evacuation	KPTCL to expedite reconductoring of emanating 220 kV lines
2		Tamilnadu 230 kV System	Several 230 kV lines in TN intra-state network are heavily loaded. (Details available at https://posoco.in/download/nldc-operational-feedback_oct_2022/?wpdmdl=48526
3		Downstream network of Mysore 400/220 kV SS	220 kV outlets from Mysore are heavily loaded particularly during peak demand scenario of Karnataka.
4		220 kV Bangalore Metro Network	Most of the 220 kV network in Bengaluru is radialised during peak season to prevent overloading of lines. The radialisation of lines decreases the reliability of supply & thus results in Low Voltage situation during peak period and High Voltage during Off-Peak period of the day
5		Andhra Pradesh 220 kV Network	Several 220 kV lines in AP intra-state network are heavily loaded. (Details available at https://posoco.in/download/nldc-operational-feedback_oct_2022/?wpdmdl=48526
6		Downstream network of UPCL 400/220kV SS	220 kV UPCL - Kemar D/C is heavily loaded during UPCL full generation and Peak demand scenario of Karnataka
7		765/400 kV Nizamabad ICTs, 400/220 kV ICTs at Kolar, Kaiga, Mysore, Hoody Cochin, Narendra, Neyveli II TPS, Hassan, Ramagundam, Somanhalli, Tiruvallam, UPCL, Allundur SS, Jindal SS, Cochin	Most of the constraint observed during high demand period of SR. Some even observed for whole year. (Details available at https://posoco.in/download/nldc-operational-feedback_oct_2022/?wpdmdl=48526
8		Kerala 220 kV Network	During Non-solar hours, 220 kV Areakode - Kanhirode & 220 kV Areacode-Orkkattery are parallel and tripping of one line overloads the other one
9		Telangana 220kV Network	Several 220 kV lines in Telangana intra-state network are heavily loaded. (Details available at https://posoco.in/download/nldc-operational-feedback_oct_2022/?wpdmdl=48526

Transmission Line and ICT Constraints

S. No	Region	Element	Description of the constraints
1	Eastern Region	400/220 kV 2 X 315 MVA ICTs at Bidhannagar, New Dubri, DSTPS, Subhasgram	Augmentation/new ICT needs to be planned/expedited at these locations.
2		400/220 kV Ranchi 2 X 315 MVA ICTs	Additional ICT at 400/220 kV Ranchi has been agreed in 3rd ERPCTP meeting. To be expedited.
3		220 kV DSTPS-Waria D/C	During less Generation at 220 kV Mejia and Waria. 3rd ICT at Bidhannagar to be expedited.
4		220 kV Maithon Dumka D/C	High loading Jharkhand area and outage of 220 kV Farakka Lalmatia S/C. Early restoration of 220 kV Farakka - Lalmatia S/C is required for decongesting 220 kV Maithon Dumka D/C & 400/220 kV S/S at Dumka and 400 kV Dumka Dhanbad D/C transmission lines (5th CMETS-ER)
5		2 X 315 MVA Gokarna ICTs and 315 MVA ICT at Sagardighi	Constraint observed during peak demand of West Bengal, Low generation at Bakreswar and High generation at Sagardighi. ICTs to be planned
1	North-Eastern Region	220/132 kV, 2 x100 MVA ICT at Rangia	During lean/ Normal Hydro/ Heavy demand in Rangia areas of Assam. Affecting reliability of Rangia evacuation. Upgradation/Addition is required
		220/132 kV, 2 x160 MVA ICT at BTPS(AS)	During Lean/ Normal Hydro/ Heavy demand in BTPS(AS) areas of Assam. Upgradation/Addition is required
2		220 kV BTPS - Salakati I & II lines	Upgradation of the 220 kV BTPS-Salakati I & II lines with HTLS conductor to be expedited (2nd Meeting of NERSCT). 7th NER SCM: 400/220 kV Rangia S/S may be established through LILO of both circuits of 400 kV Balipara- Bongaigaon D/C.
3		220 kV Misa- Samaguri DC	Lean/ Normal Hydro / Heavy demand in Capital areas of Assam. Early commissioning of 2nd circuit of 220 kV Balipara – Sonabil need to expedited & reconducting of 220 kV Misa- Samaguri DC to be planned.

Important Grid Elements under Construction (NR)

S. No.	Name of the transmission element (Line / ICT)	Implementing agency	Remarks
1	765kV Bara -Mainpuri ckt-2 and 2nd 765/400 kV ICT at Mainpuri	UPPTCL	Early commissioning of 765kV Bara-Mainpuri ckt-2 and 2nd 765/400kV ICT at Bara & Mainpuri would strengthen the evacuation of Bara TPS generation in case of N-1 contingency of 765kV Bara-Mainpuri ckt-2.
2	400/220kV Chittorgarh	(RRVPNL)	RVPNL deliberated in "Intra-State/Inter-State Transmission Expansion Plan for the State of Rajasthan" meeting held under chairmanship of Member (Power System), CEA on 22nd March'22
			The 315 MVA ICT to be installed at Chittorgarh is to be diverted from Kalisindh TPS. The NIB issuance is under process. The likely timeline of completion is Nov,23. Limiting TTC/ATC of Rajasthan
3	400/220kV Merta	(RRVPNL)	Technical proposal for new ICT at Merta has been approved and is under process for Administrative & Financial Sanction. Likely completion November, 2023. Limiting TTC/ATC of Rajasthan
4	400/220kV Kurukshetra	POWERGRID	500MVA ICT at Kurukshetra. (Awarded to POWERGRID under RTM) HVPN & POWERGRID to plan & implement SPS at Kurukshetra(PG) till commissioning of additional ICT. Approved in 4 NRPCTP held on 05.10.2021. Expected till Feb'23.
5	400/220kV Deepalpur	JKTPL	500MVA ICT at Deepalpur. HVPN has implemented SPS at Deepalpur till commissioning of additional ICT. Approved in 4 NRPCTP held on 05.10.2021.
7	Addition of new 1x315 MVA(or 1x500 MVA if possible), 400/220kV ICT at Amargarh.	STERLITE	Approved in 3 NRPCTP held on 19.02.2021
8	400kV Lahal-Chamera Pool D/C	HPPTCL	Line is delayed due to Covid & forest clearance issues. Necessary for safe evacuation of power from Bajoli Holi HEP and other SHEP connected at Lahal.

Important Grid Elements under Construction (WR)

S. No.	Name of Element	Agency	Remarks
1	400kV Padghe PG-Navi Mumbai-Vikhroli, 400kV Padghe PG-Kharghar, 400kV Kharghar-Vikhroli line along with Vikhroli S/s.	VNLTL, KVTPL,POWERGRID,MSETCL	Above scheme was finalized in 42nd SCM of WR dtd 17th Nov 2017. Commissioning of this network would relieve the constraints in Mumbai system. Expected by: Jun'24
2	220kV Apta-Taloja and 220kV Apta-Kalwa LILO at Navi Mumbai	Sterlite (Awarded on 23.06.2020)	Addl. Feed to Navi Mumbai (Part System). Expected by Jun'23
3	LILO of 220kV Padghe-Wada & Kolshet-Wada at Kudus.	MSETCL	For relieving constraint at Padghe & Boisar area.
4	LILO of 220kV Tarapur-Borivali & Boisar-Ghodbandar at Kudus.		
5	765/400kV Navsari New along with 765kV Padghe GIS-Navsari D/c, 400kV Navsari New-Kala D/c, 400kV Navsari New-Magarwada D/c lines	POWERGRID	For Gujarat Import TTC improvement (Jun-2023 time frame)
6	220kV Rewa-Rewa D/C & 220kV Rewa-Sidhi D/C	MPPTCL	To relieve loading on Satna ICTs & increase import TTC/ATC of MP. **220kV Rewa-Rewa(MP) D/C commissioned on 21.9.2022. Around 80MW total relief observed in 2x315MVA+1x500MVA Satna ICTs.**

Important Grid Elements under Construction (WR)

S. No.	Name of Element	Agency	Remarks
7	400/220 kV Guna substation along with associated transmission system (ATS)	PBGTL	To relieve loading on Bina PG ICTs & increase import from ISTS by MP. 400/220kV Guna S/s alongwith 400kV Bina-Guna D/c **commissioned on 29.9.2022.**
8	400/220 kV Kirnapur 3rd ICT	PPTCL	To relieve loading on existing ICTs & increase import TTC/ATC of MP
9	400/220kV Dardehi S/s along with 220kV outlets	CSPTCL	Would relieve congestion in CSPTSL system for drawl of more power from the Grid.
10	400/220kV Bhatapara PG 3rd ICT along with 220kV outlets	POWERGRID, CSPTCL	To increase import from ISTS by Chhattisgarh.
11	400/220kV Xeldem Substation, 400kV Mapusa-Xeldem D/c line & 400kV Narendra-Narendra one ckt LILO at Xeldem along with downstream network at Xeldem	GTTPL	It helps in additional infeed to Goa and will improve the reliability.
12	400/220kV Vapi-II substation along with 220kV outlets for DNH	VNLTL	Would relieve loading of 220kV Kala-Khadoli D/c lines and thus would increase the import capability of DNH

Important Grid Elements under Construction (SR)

S. No.	Name of Element	Agency	Remarks
1	765/400kV Nizamabad ICT-3	POWERGRID	Enhances NEW-SR import TTC/ATC
2	765kV Warora – Warangal – Maheswaram – Kurnool D/C	WKTL	Will enhance import of SR
3	400kV Kadakola SS and Associated system	KPTCL	Will relieve over loading on Mysore ICTs and downstream
4	400kV Kottayam SS and Associated system	KSEBL	Will enhance the TTC/ATC of S3 (KERALA)
5	400/220kV Cochin ICT-3	Powergrid	Will enhance the TTC/ATC of S3 (KERALA)
6	400/230kV Vellalavididi SS	TANTRANSCO	Enhances S1-(S2 and S3) and Tamil Nadu control area TTC/ATC
7	400/230kV Thiruvallam ICT-3	TANTRANSCO	Enhances S1-(S2 and S3) and Tamil Nadu control area TTC/ATC

Important Grid Elements under Construction (NER)

S. No.	Name of Element	Agency	Remarks
1	New 132 kV Loktak- Ningthoukhong D/C	MSPCL	Enhance transfer capability of Manipur Power System. As per 191th OCCM, work delayed due to RoW issues target date is Jul'22. Ckt – 1 is commissioned and circuit – 2 is to be expedited.
2	132 kV Monarchak – Surjamaninagar D/C	TSECL	Enhance reliable evacuation of Monarchak Power Station. As per minutes of special meeting with Tripura held held on 19th May, timeline for commissioning of 132 kV Monarchak – SM Nagar D/C was Oct'22 subject to resolution of RoW issue. RoW issue due to unduly high compensation demand by owners of the lands.

Number of Grid Incidents/Disturbances in Q2 FY 2022-23

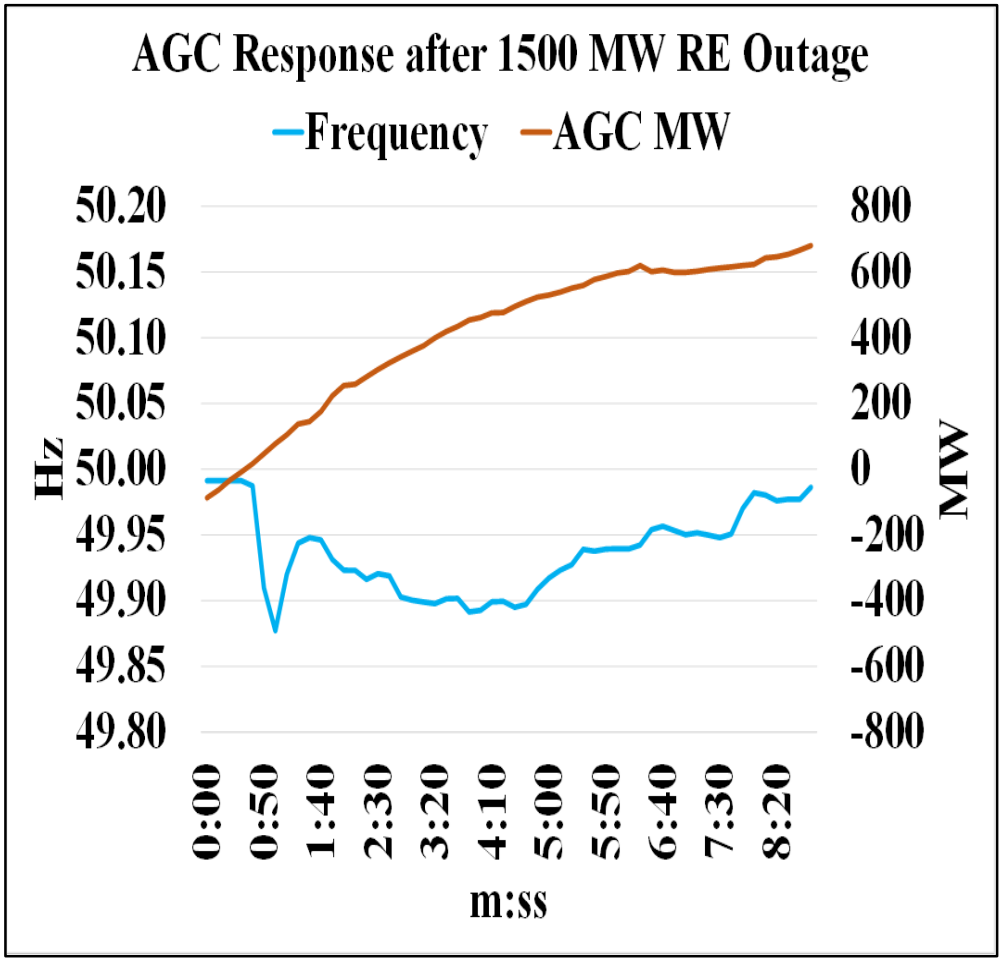
Region	Grid incidents		Grid Disturbances					Total
	GI-1	GI-2	GD-1	GD-2	GD-3	GD-4	GD-5	
NR	0	11	47	0	0	0	0	58
WR	8	12	16	0	0	0	0	36
SR	13	3	26	0	0	0	0	42
ER	1	0	20	0	0	0	0	21
NER	4	15	74	0	0	0	0	93
All India	26	41	183	0	0	0	0	250

Automatic Generation Control (AGC) Summary

- ❑ Frequent communication issues with
  - Bongaigaon (750 MW), Loktak (105)
  - Anta (419 MW)
  - Dulhasti (390), Bairasiul (180)
- ❑ Intermittent fluctuations in communication
  - Tehri (1000 MW)
  - Mauda-I&II (2320 MW)
- ❑ Last mile connectivity issue
  - RGPPL

Present AGC status

- ➢ **64937 MW wired,**
- ➢ **68 plants**
- ➢ **Thermal – 56100 MW**
- ➢ **Hydro – 5622 MW, two shifting**
- ➢ **Gas – 3214 MW**

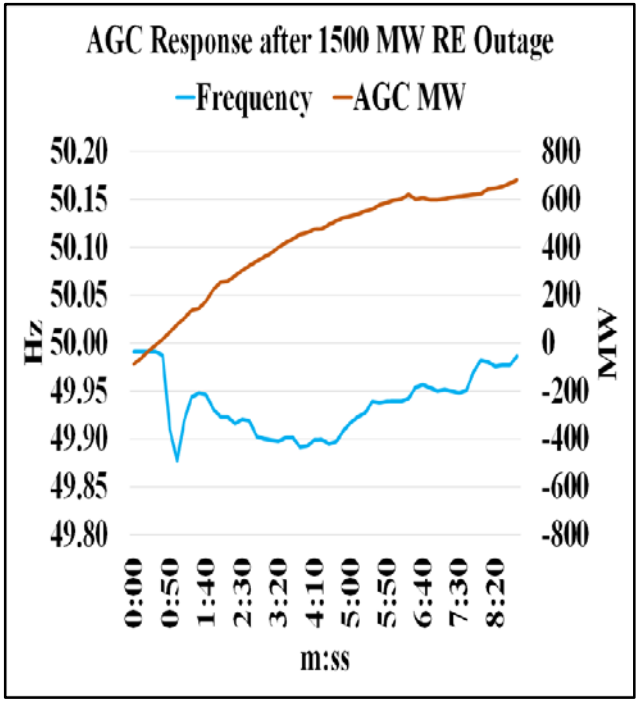


Frequency Control with High RE

Automatic Generation Control (AGC) Summary

Plants which completed closed loop testing

NR		WR		SR		ER		NER	
Koteshwar	400	Mauda-2	1320	Simhadri-2	1000	Barh-2	1320	Bongaigaon	750
Nathpa Jhakri	1500	CGPL	4150	Simhadri-1	1000	MPL	1050	Loktak	105
Chamera-3	231	Sipat-2	1000	NTECL Vallur	1500	Kahalgaon-2	1500		
Dulhasti	390	Vindhyachal-2	1000	Ramgundam-II	1500	Teesta-V	510		
Tehri	1000	Korba-1&2	2100	Ramgundam-III	500	Rangit	66		
Rihand-I	1000	Korba-3	500	NTPL	1000	NPGCL	1980		
Riahnd-II	1000	Sipat-1	1980	Kudgi	2400	Farakka-II	1000		
Rihand-III	1000	Vindhyachal-4	1000	Neyveli TPS 1 (Expn.)-NLC	420	Farakka-III	500		
Anta	419.3	Vindhyachal-3	1000	NLC-II stg-II	840	MTPS Stg-II	390		
Chamera-2	300	Vindhyachal-5	500	NLC-II stg-I	630	Talcher-II	2000		
Chamera-1	540	Solapur	1320	NNTPP	1000	Talcher-I	1000		
Dhauliganga	280	Gandhar	657	Neyveli TPS 2 (Expn.)-NLC	500	Barh-1	660		
Unchahar-III	210	NSPCL	500						
Unchahar-IV	500	Mauda-1	1000						
Auraiya	652	Lara	1600						
Bairasiul	180	Gadarwara	1600						
Tanda-2	1320	Kawas	656						
Unchahar-II	420	Khargone	1320						
Singrauli	1000								
IGSTPS	1500								
Dadri Gas	830								
Dadri-2	980								
Dadri-1	840								
Sewa-II	120								
NR Total	16612	WR Total	23203	SR Total	12290	ER Total	11976	NER Total	855



Frequency Control with High RE

Total 64937 MW, as on 31st December'22

Development of an Efficient, Coordinated and Economical ISTS for Smooth Flow of Electricity - Rolling Plan (2026-27)

Central Transmission Utility of India Ltd.

17th Jan 2023

Outline of Presentation

- Background
- Power Scenario FY 2021-22 vs 2026-27
- Study Scenarios and LGB
- System Studies and Result Analysis
- Summary

NCT Terms of Reference (ToR)

(ii) The CTU, as mandated under the Electricity Act, 2003, is to carry out periodic assessment of transmission requirement under ISTS.

The CTU shall also make a **comprehensive presentation before the NCT every quarter** for ensuring development of an efficient, co-ordinated and economical ISTS for smooth flow of electricity.

The CTU, in the process, may also take inputs from the markets to identify constraints and congestion in the transmission System.

- Quarterly

(iv) As per provision of Electricity (Planning, Development and Recovery of ISTS charges) Rules 2021 , the CTU shall also prepare a five-year rolling plan for ISTS capacity addition every year.

The **Annual Plan shall be put up to the NCT** six months in advance, e.g. The Annual Plan for FY 2023-24 will be put up before the NCT by 30th September 2022.

- Annually

Rolling Plan Background

Electricity Rules
- Oct'2021 by MoP

ISTS Planning Procedure
- Dec'2021 by CTU
- In consultation with stakeholders

Rolling Plan (2024-25)
- Dec'2021

Rolling Plan (2026-27)
- Mar'2022

Rolling Plan(2027-28)*
- Sep'2022(*interim)

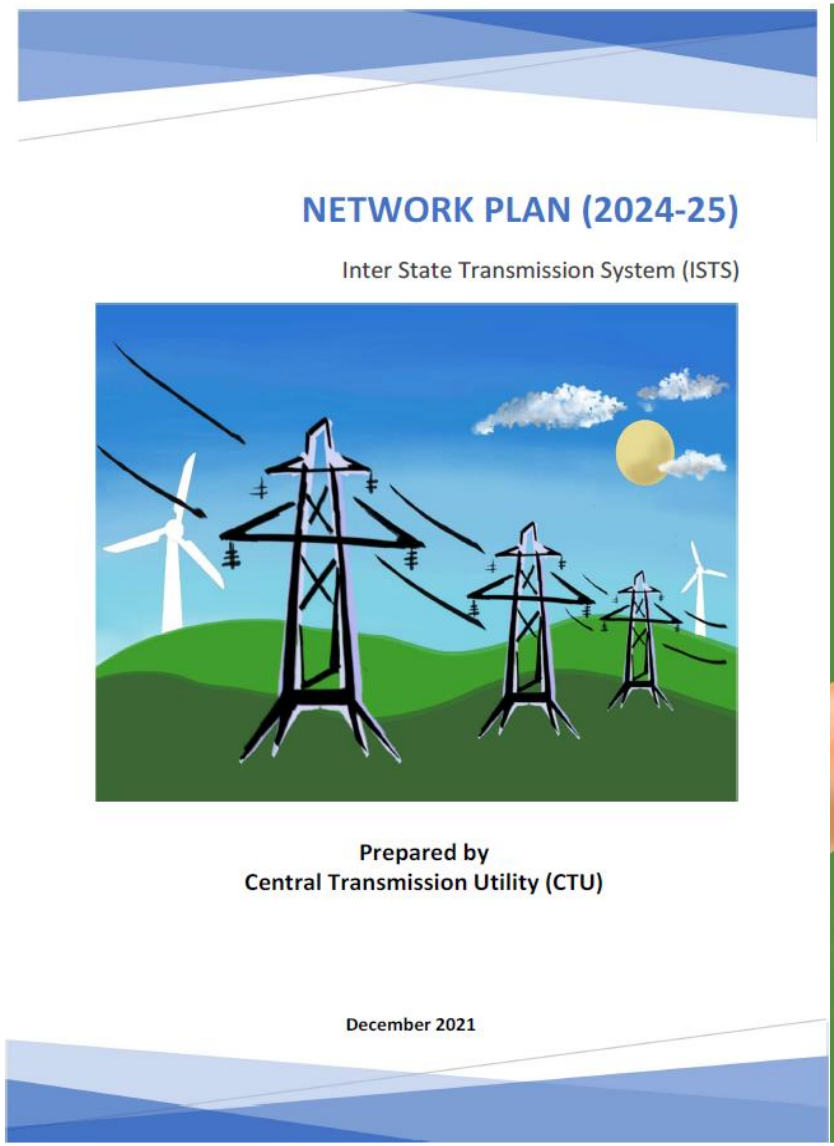
Rolling Transmission Plan

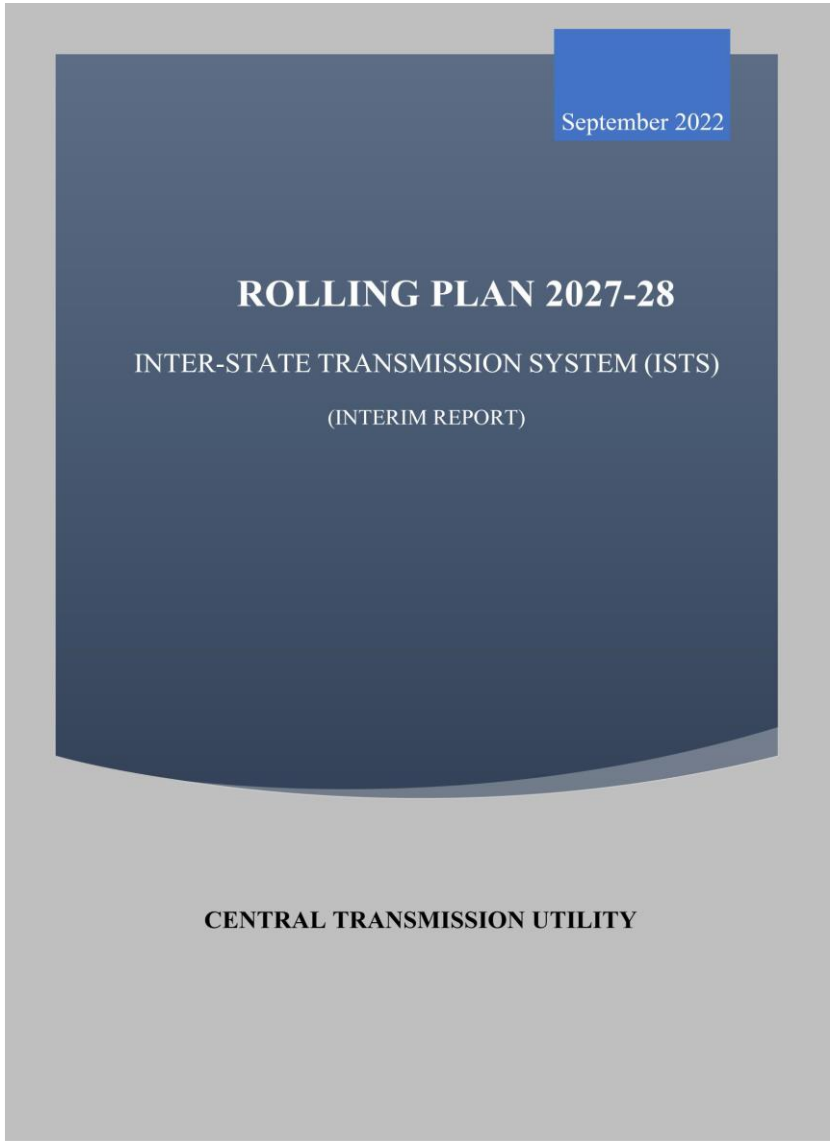
Undertaken on continuous basis, twice a year

(Apr-Sep Cycle) & (Oct-Mar Cycle)

- Data Collection & Validation
- Preparation of Scenarios/LGBs
- System Studies
- Preparation of preliminary proposals seeking stakeholder comments
- **Final report** (based on comments received)

Rolling Plan Reports

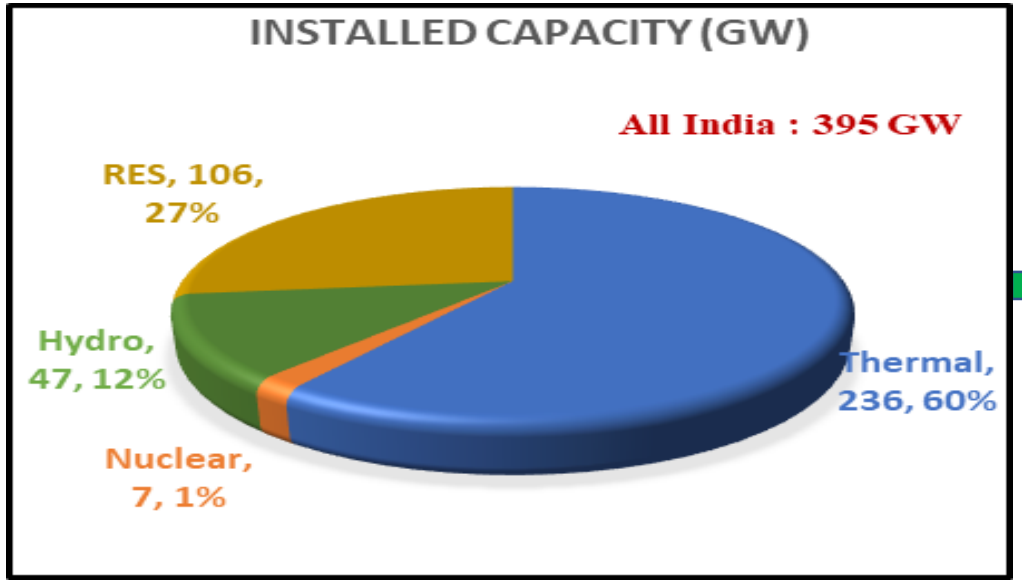




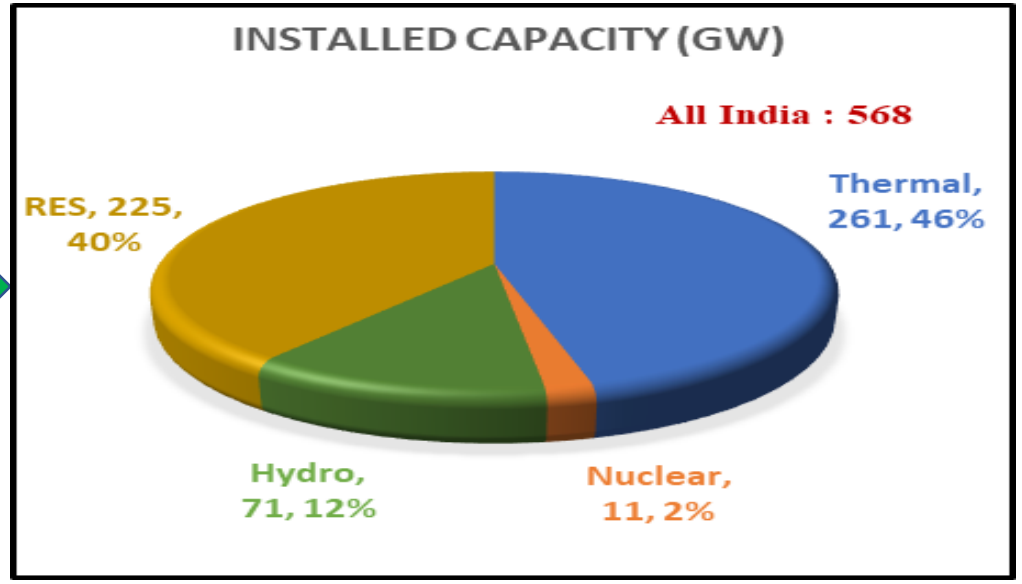
https://www.ctuil.in/u/menuitem.aspx?d=7VuBIu93RgU=

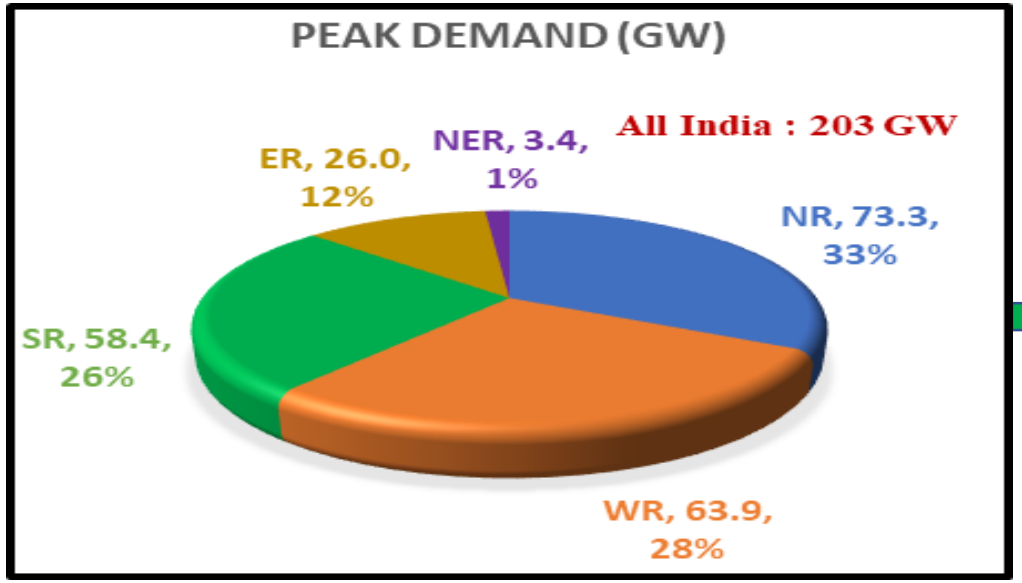
Power Scenario FY 2021-22 vs FY 2026-27

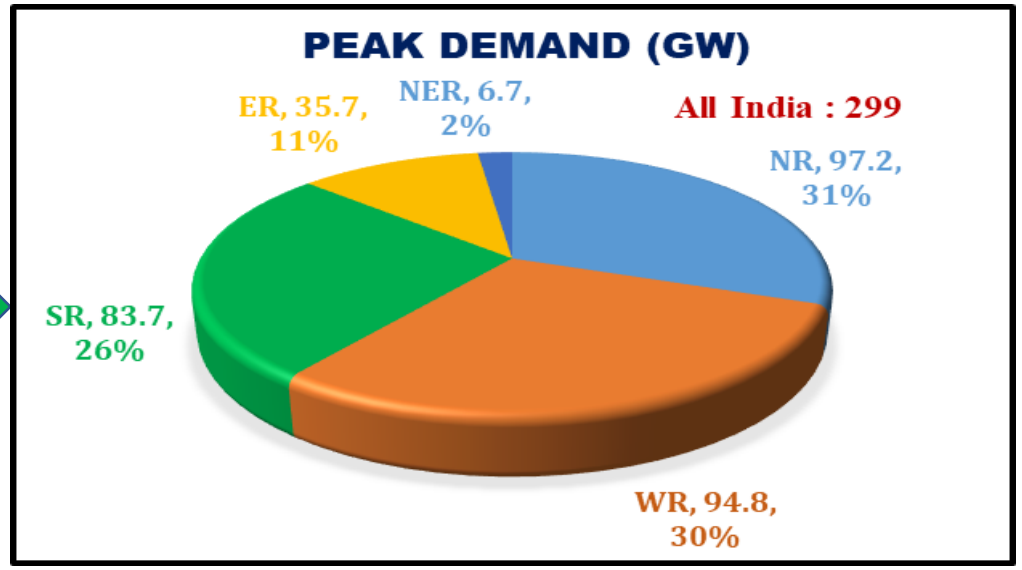
As on Jan'22



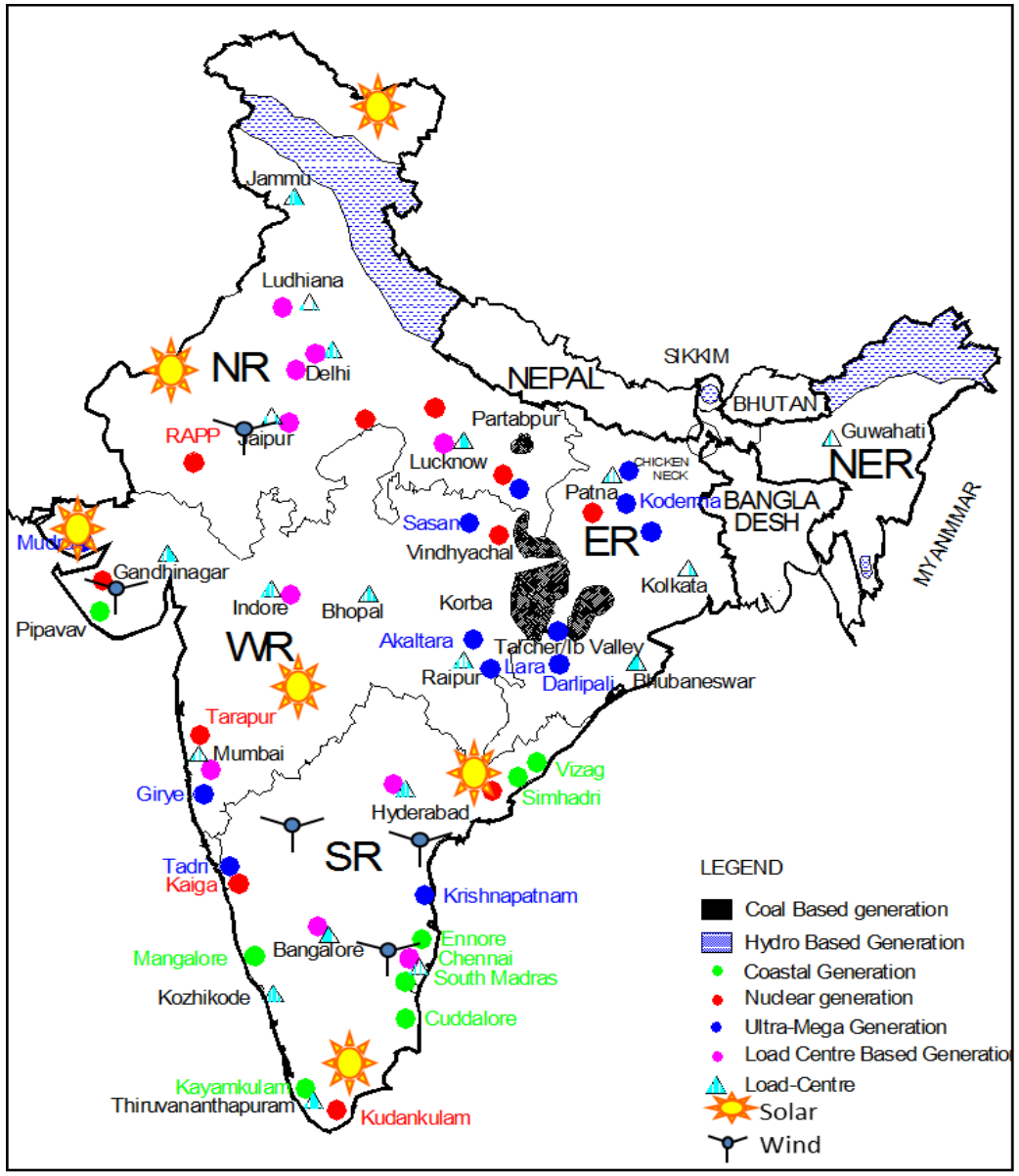
2026-27







Change in Generation-Resource Mix



- Planning based on thermal resources
  - Load centers are distributed across country
  - Conventional Generation in Eastern part
  - Strong backbone network planned and implemented
- Planning based on renewable resources
  - RE in western and southern part
  - New system is being planned and implemented
  - Power flow on transmission lines is also changing

Important to understand diurnal and seasonal regional exchanges

Scenarios Considered

Seasons Considered

Diurnal Cases

Monsoon

Summer

Winter

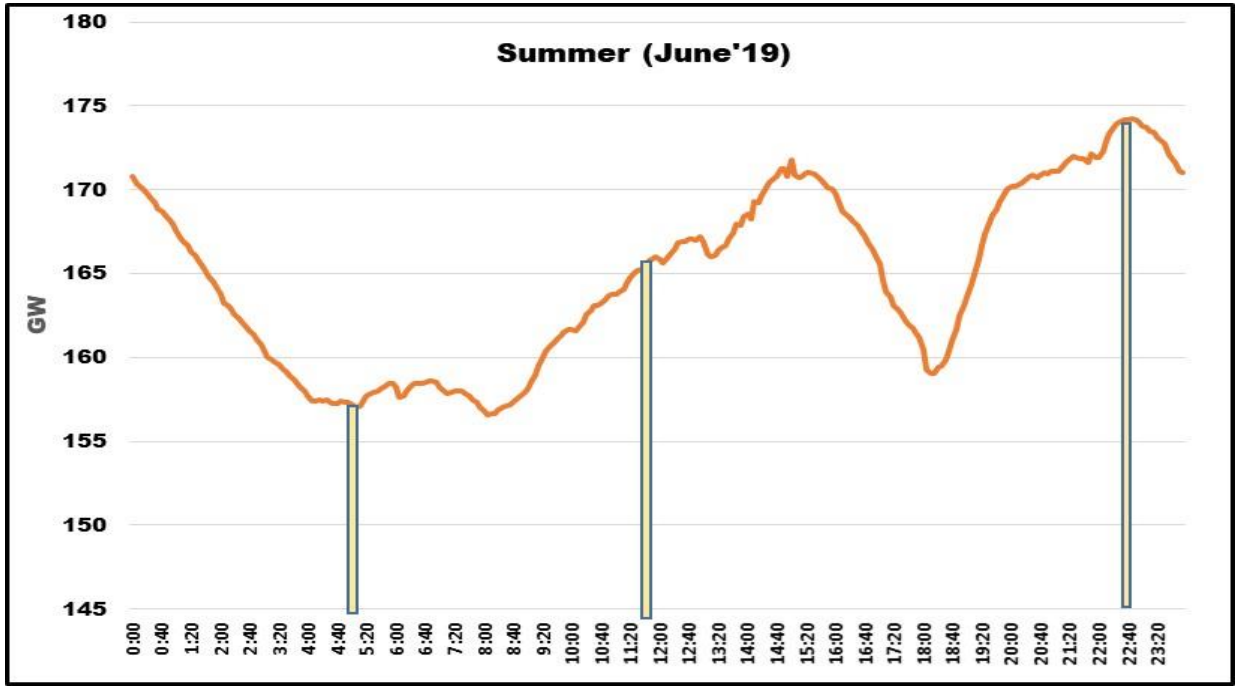
Solar Max (around 12 PM)

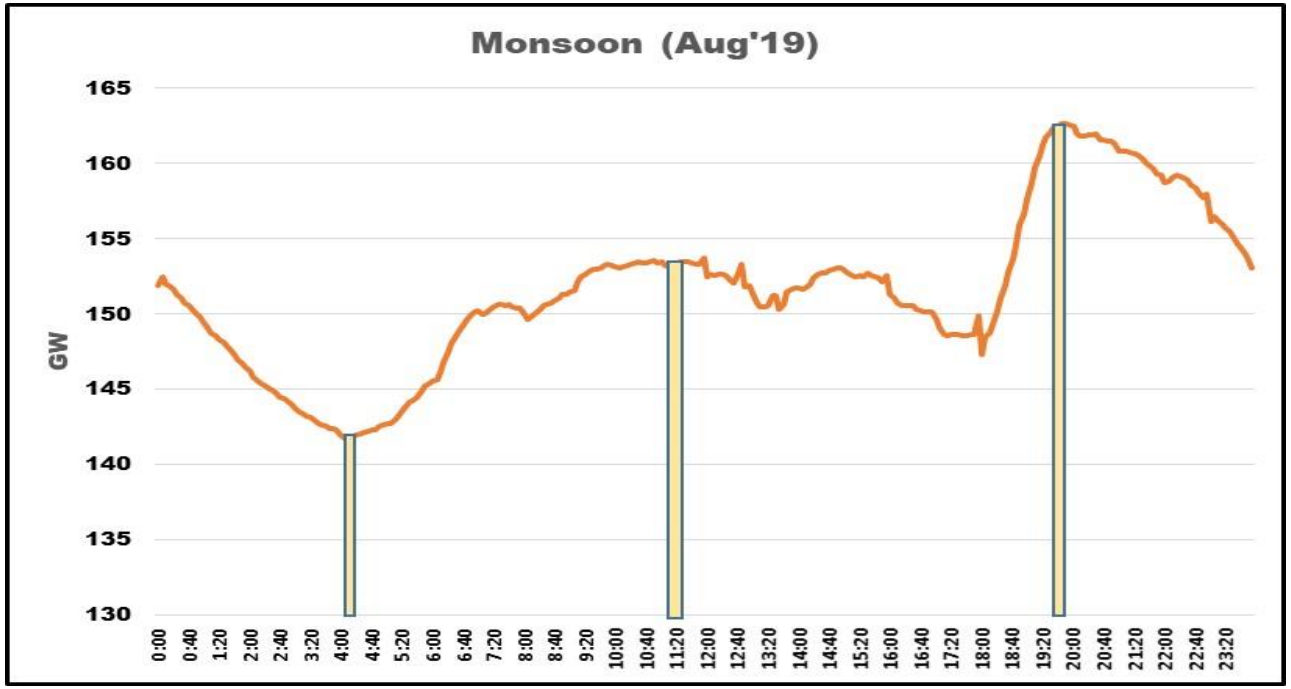
Evening Peak (b/w 6 to 11 PM)

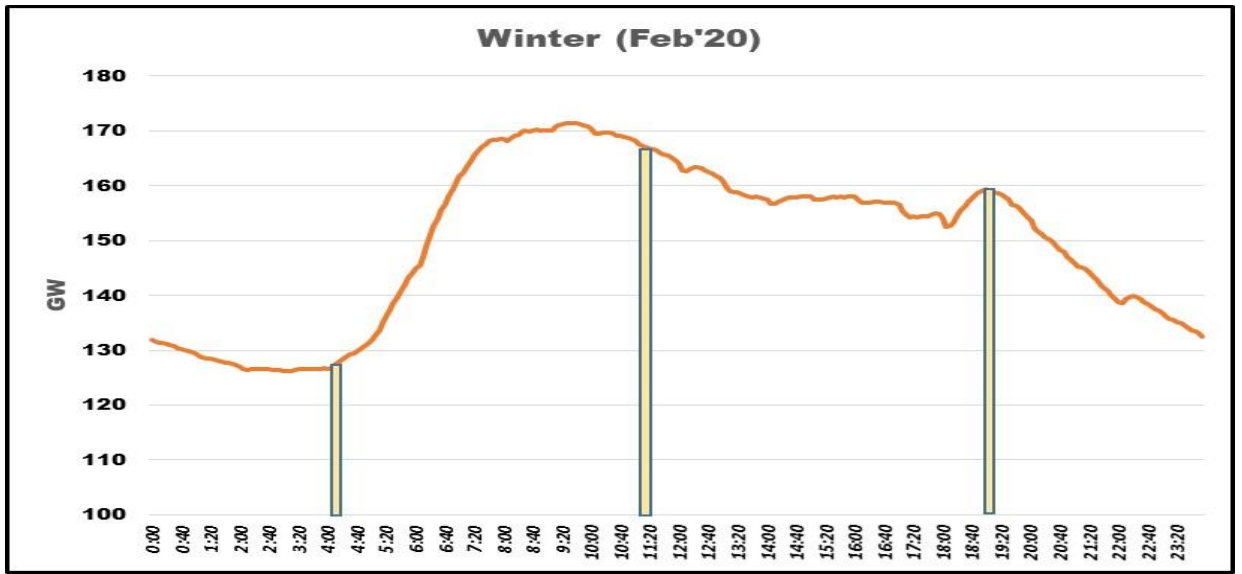
Night Off Peak (b/w 12 to 6 AM)

- Monsoon (Aug'26)
  - Solar max (Sc-1)
  - Evening peak (Sc-2)
  - Night off peak (Sc-3)
- Summer (Jun'26)
  - Solar max (Sc-4)
  - Evening peak (Sc-5)
  - Night off peak (Sc-6)
- Winter (Feb'27)
  - Solar max (Sc-7)
  - Evening peak (Sc-8)
  - Night off peak (Sc-9)

Load Curves



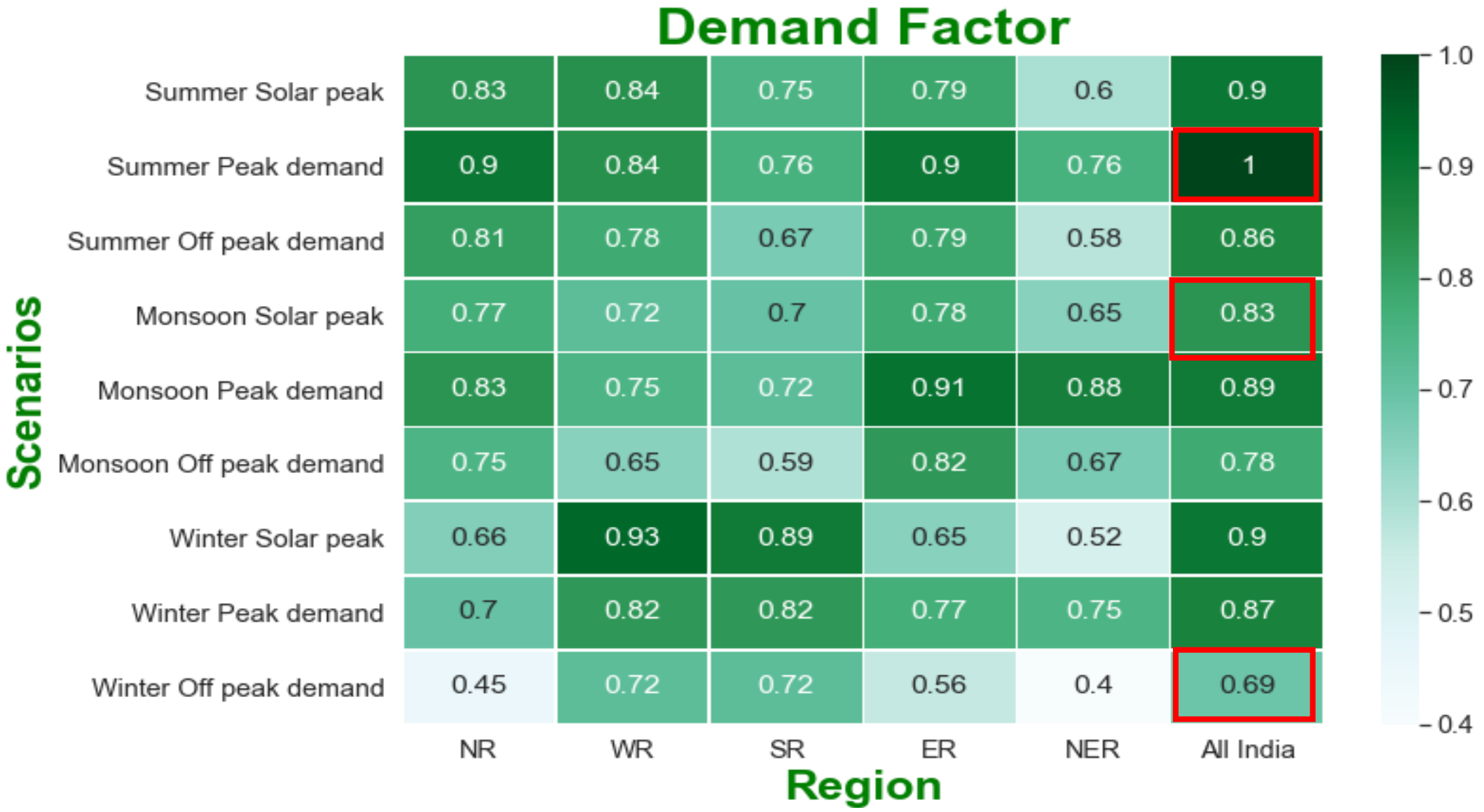




Observations

- Peak Demand in June around 10:30 PM
- Peak Demand in August around 08:00 PM
- Peak Demand in February around 10:00 AM
- Off peak demand in all months around 04:00 AM

Demand Factors Considered



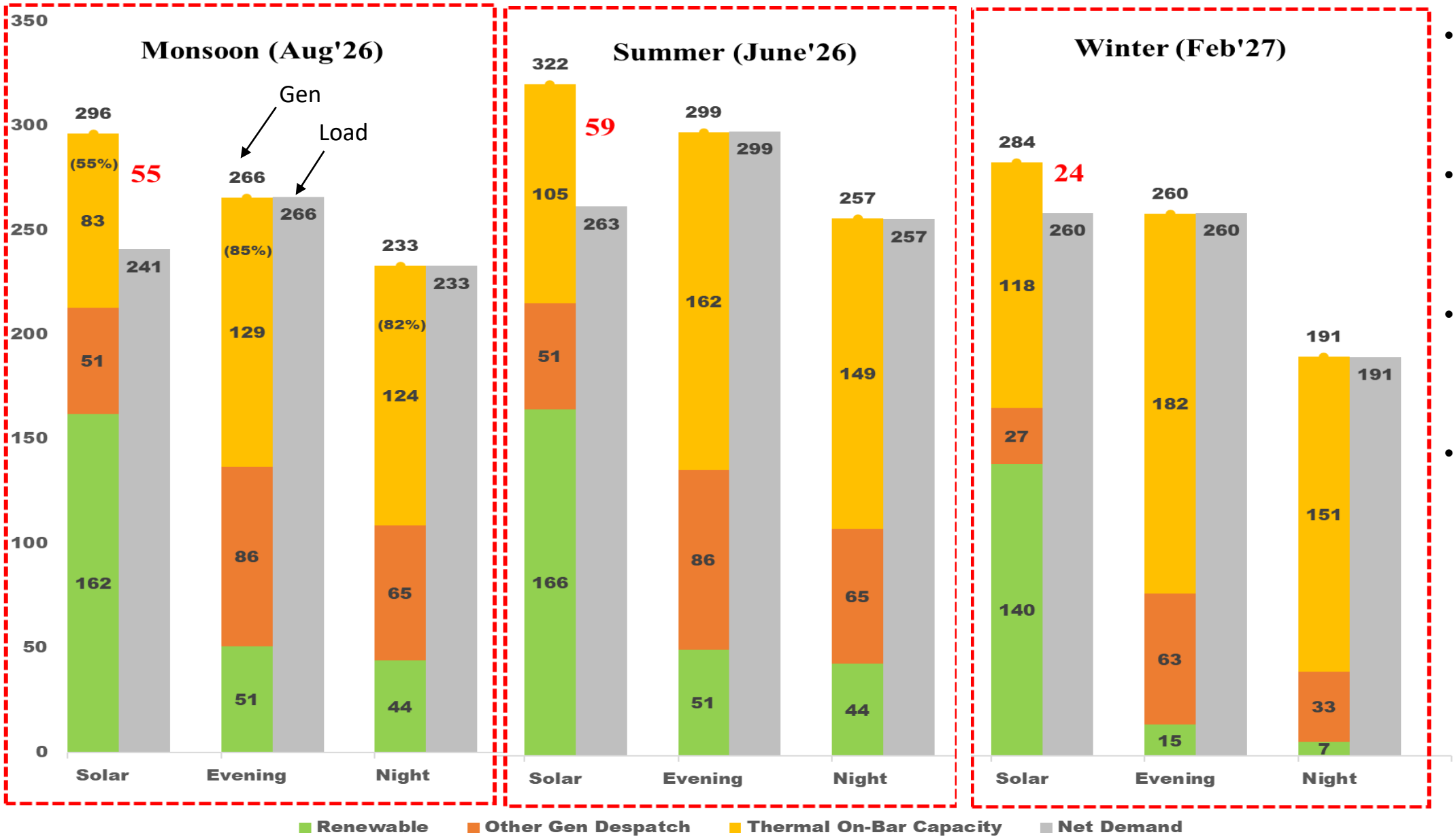
Generation Despatch Considerations

- Despatch of Hydro, Nuclear, Solar, Wind and Gas generation is set as below

Scenario No & Name	Hydro	Nuclear	Solar	Wind	Gas
1-Monsoon Solar Max	40%	80%	80%	55%	0%
2-Monsoon Peak Load	70%	80%	0%	75%	85%
3-Monsoon Night Off Peak	40%	80%	0%	65%	65%
4-Summer Solar Max	40%	80%	85%	55%	0%
5-Summer Peak Load	70%	80%	0%	75%	85%
6-Summer Night Off Peak	40%	80%	0%	65%	60%
7-Winter Solar Max	20%	80%	90%	10%	0%
8-Wiinter Peak Load	40%	80%	0%	20%	85%
9-Winter Night Off Peak	20%	80%	0%	20%	30%

- RE generation is distributed among regions to meet RE RPO
- Balance is met through thermal generation operated between 55% & 85%
- Merit Order Despatch considered for thermal plants
- State sector thermal generation apportioned in terms of their installed capacity

LGB & Energy Storage Requirement (Considering Thermal Tech Min@55%)

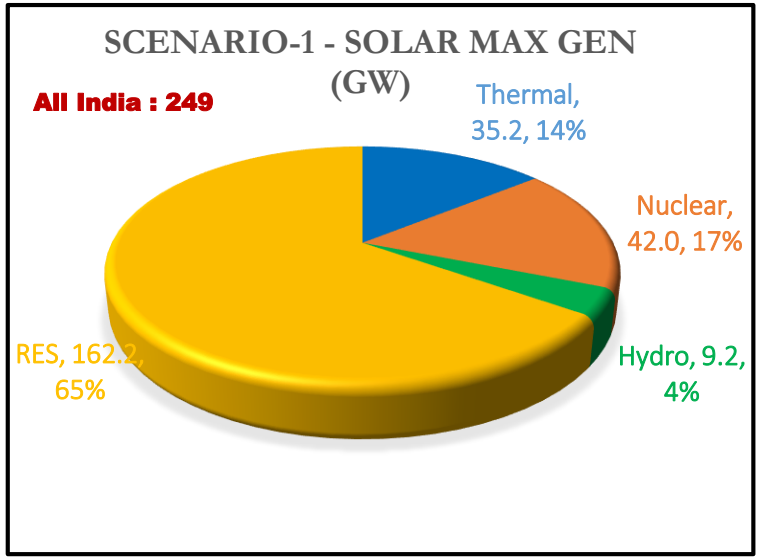


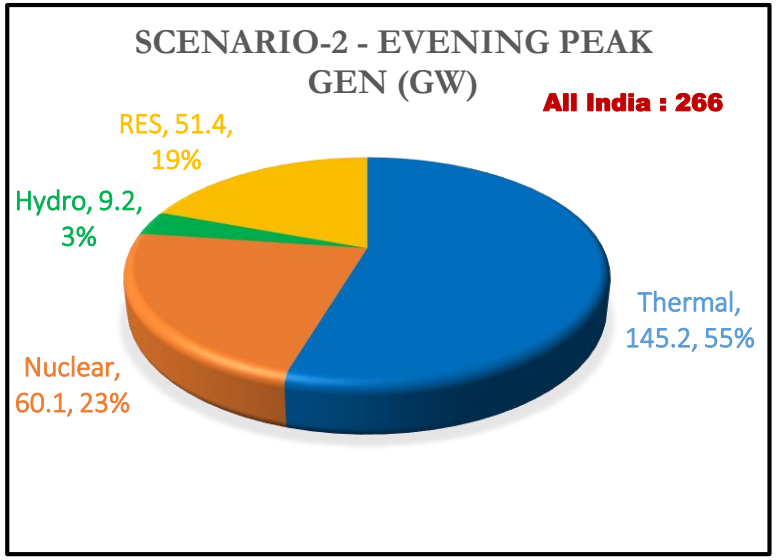
- Thermal despatch @85% in evening peak
- Thermal despatch @55% in Solar max
- Thermal despatch between 85-55% in night off peak
- Results in surplus generation of 55 GW, 59 GW & 24 GW in Aug, Jun and Feb solar max scenarios while keeping same number of thermal units on bar

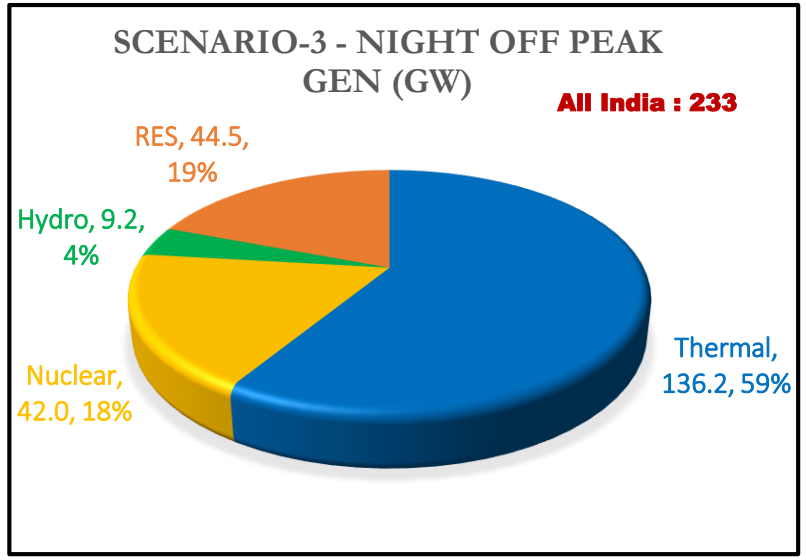
LGB & Energy Storage Requirement (Considering Thermal Tech Min@40%)

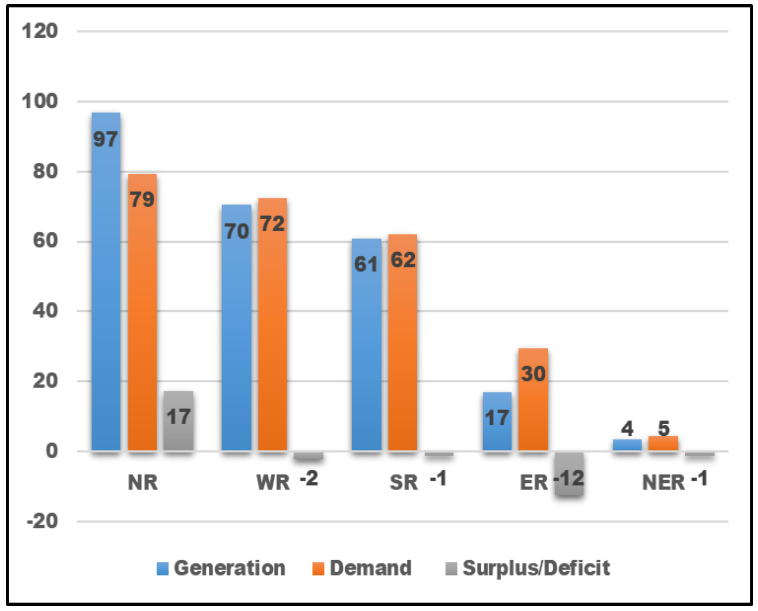
- Thermal despatch @85% in evening peak
- Thermal despatch @40% in Solar max
- Thermal despatch between 85-40% in night off peak
- Results in surplus generation of 33 GW, 30 GW & 9 GW in Aug, Jun and Feb solar max scenarios while keeping same number of thermal units on bar

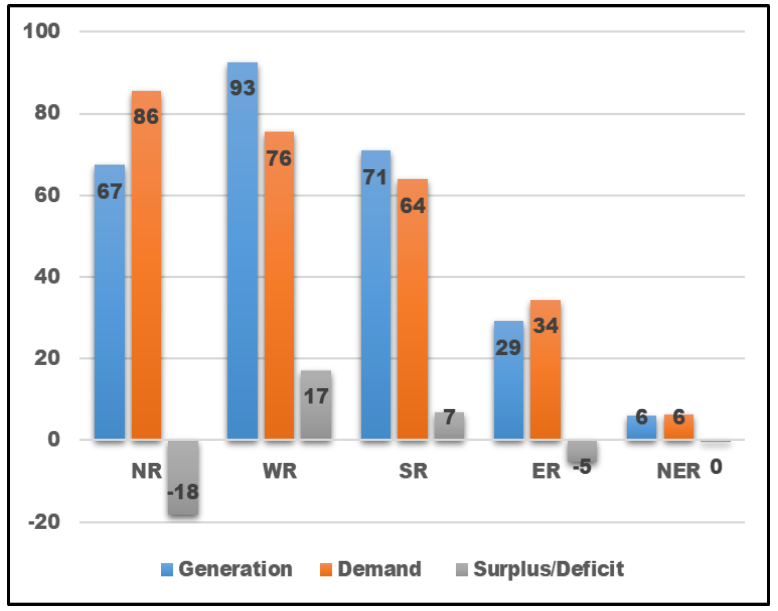
LGB of Monsoon (Aug'2026)

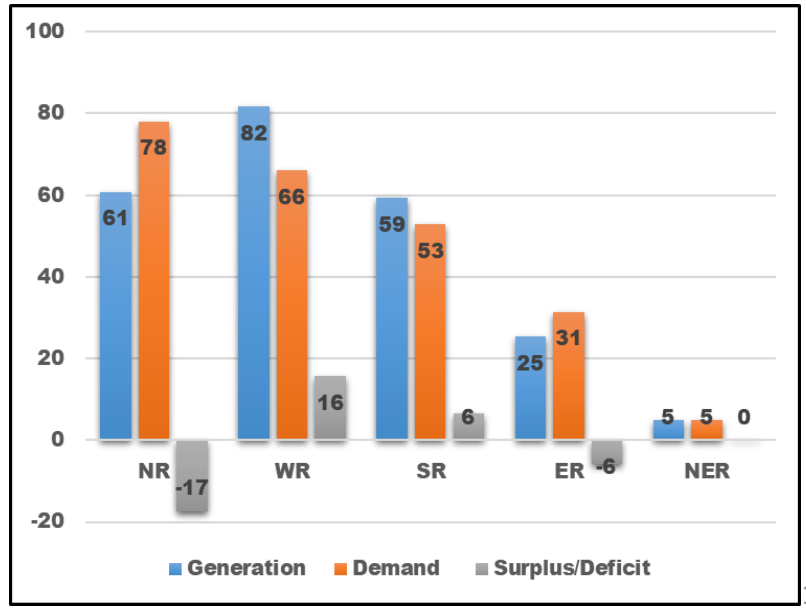




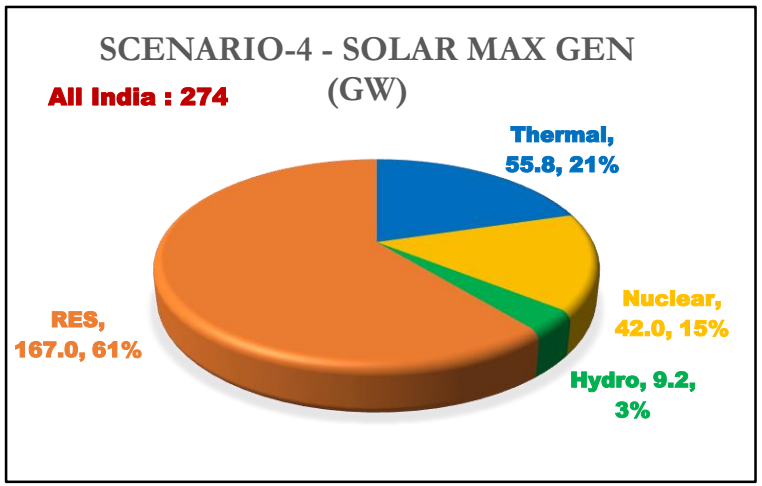


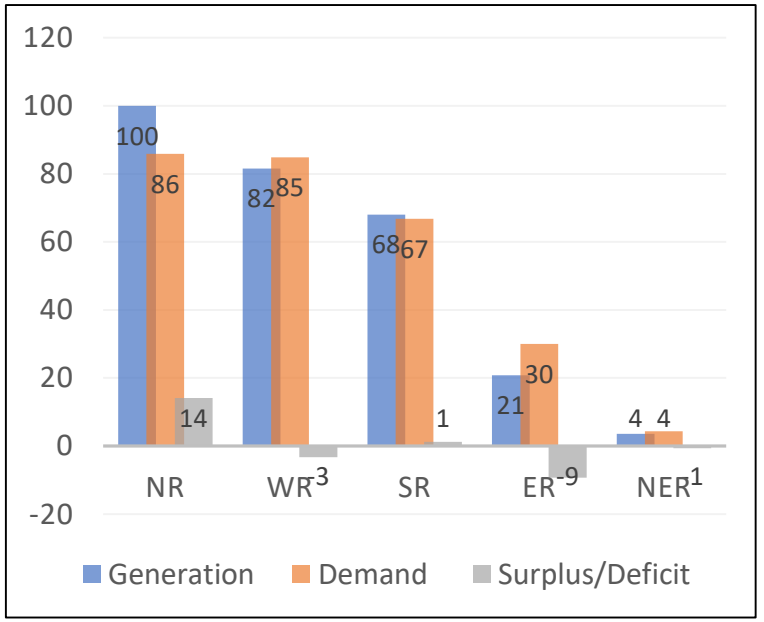


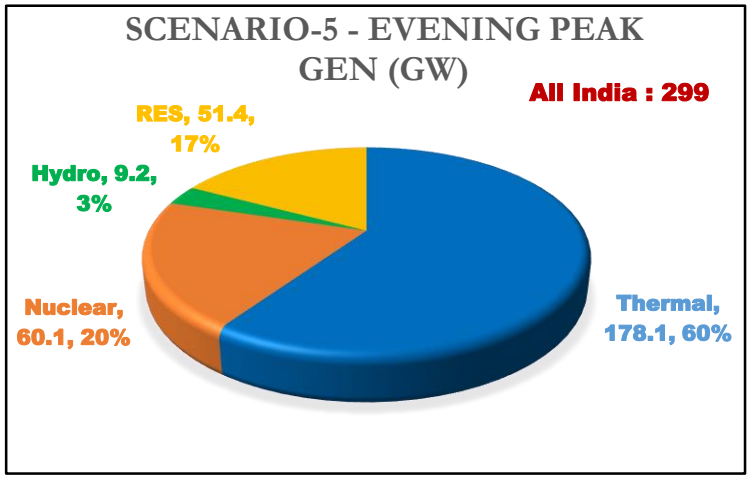


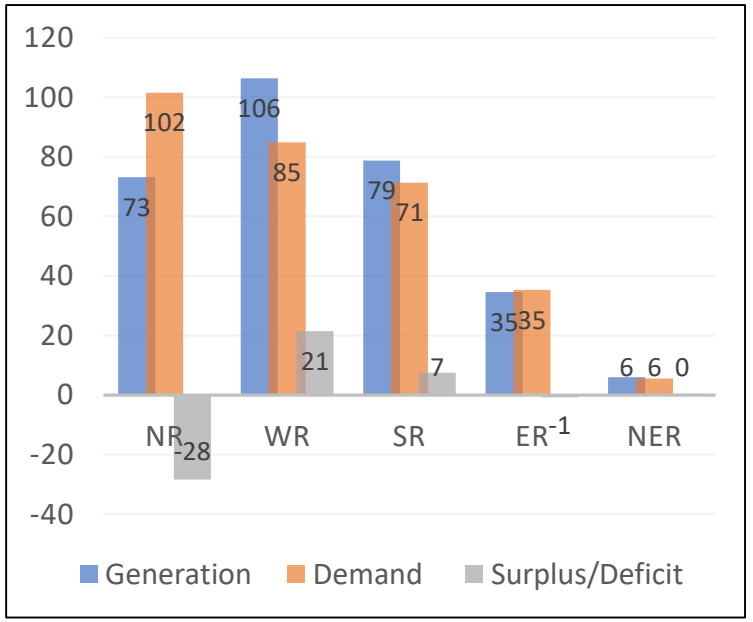


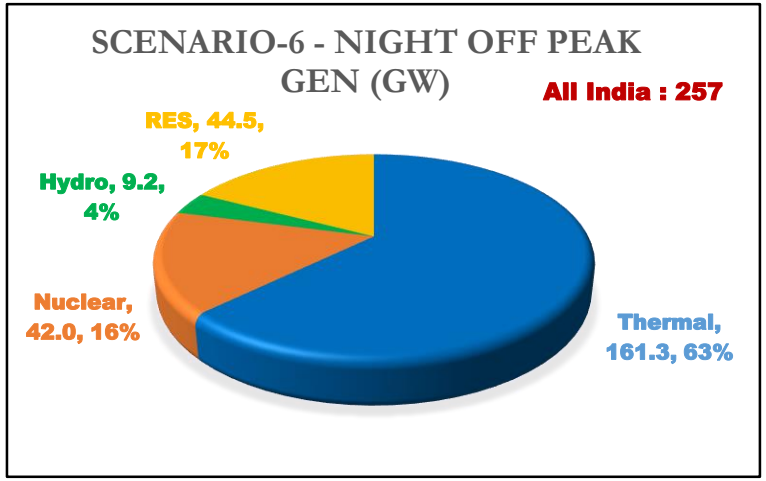
LGB of Summer (June'2026)

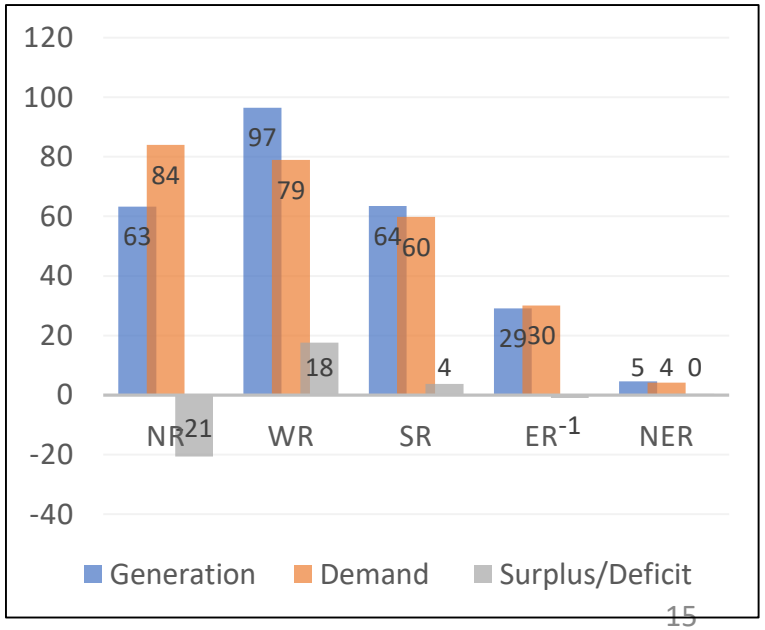






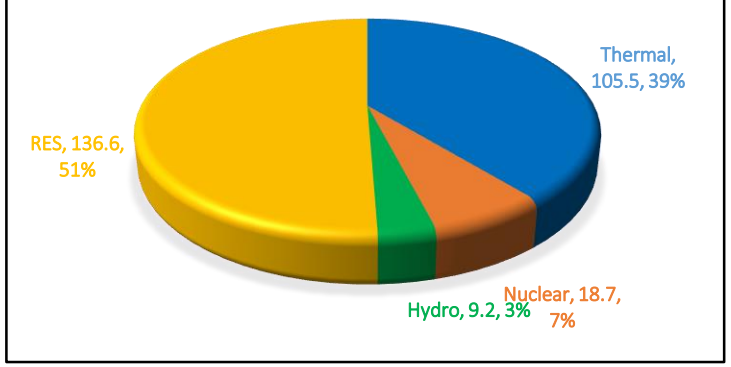


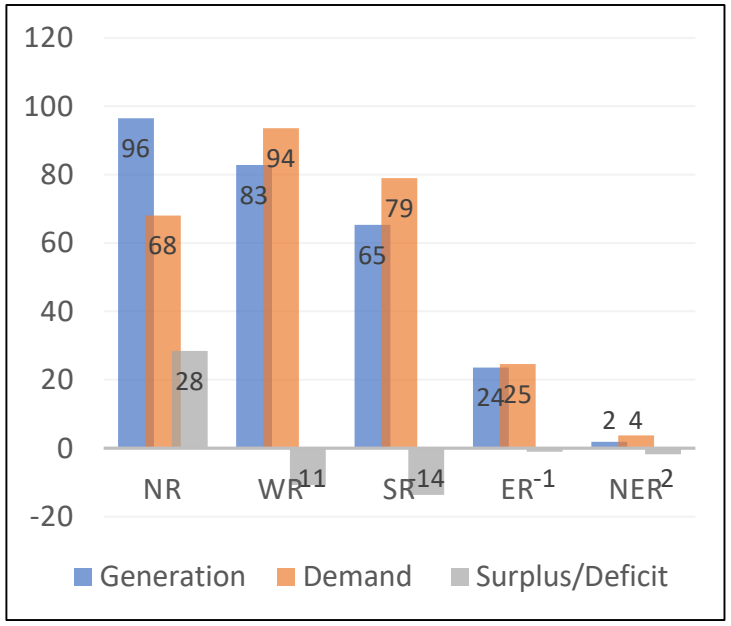




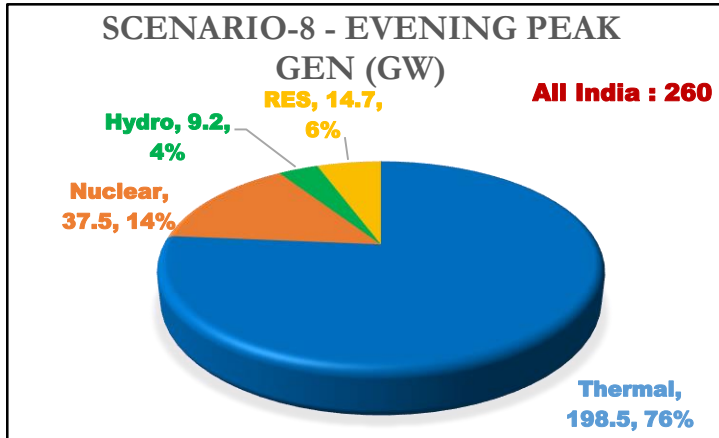
LGB of Winter (Feb'2027)

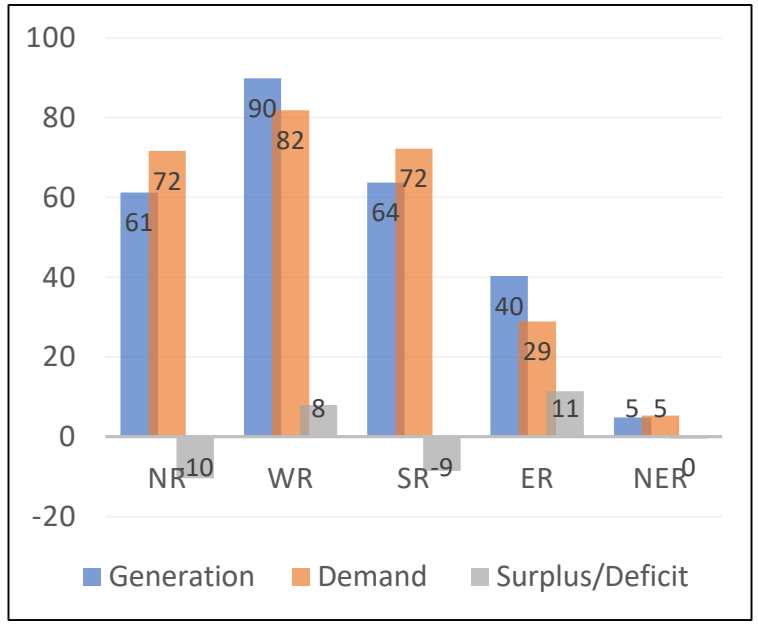
SCENARIO-7 -SOLAR MAX GEN (GW)



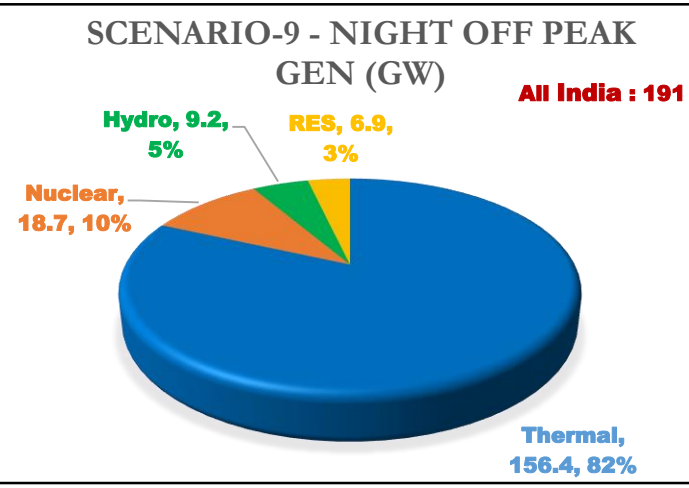


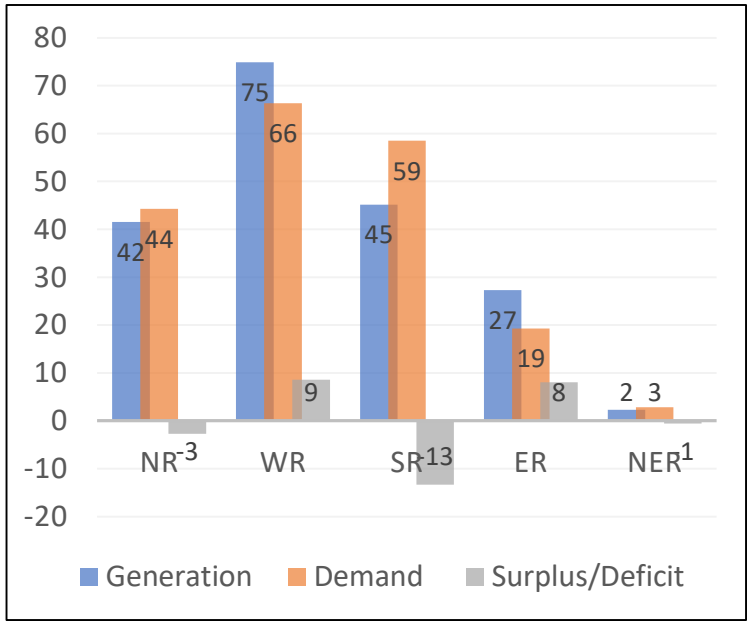
SCENARIO-8 - EVENING PEAK GEN (GW)



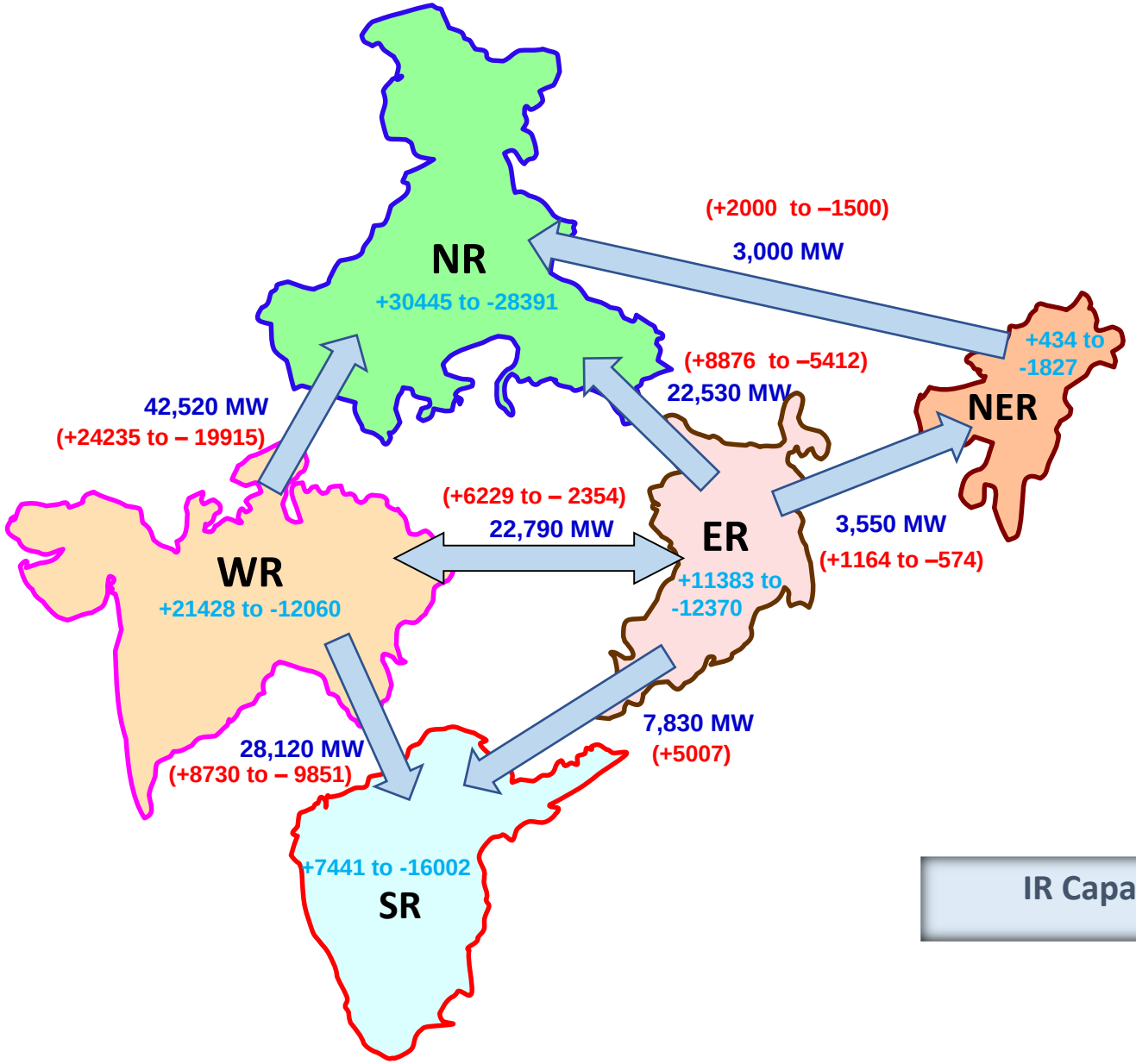


SCENARIO-9 - NIGHT OFF PEAK GEN (GW)





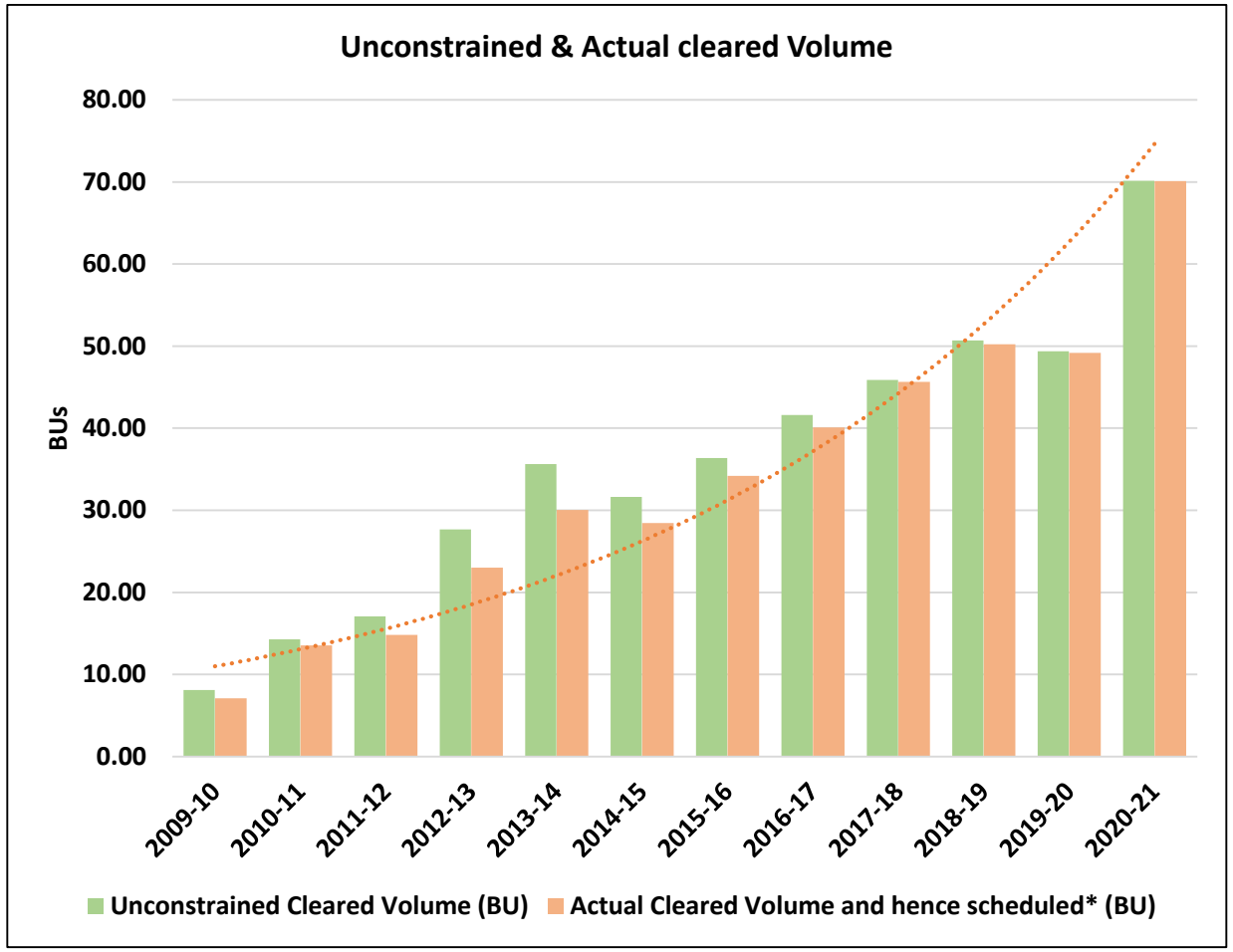
Inter Regional Corridor Capacity by 2026-27

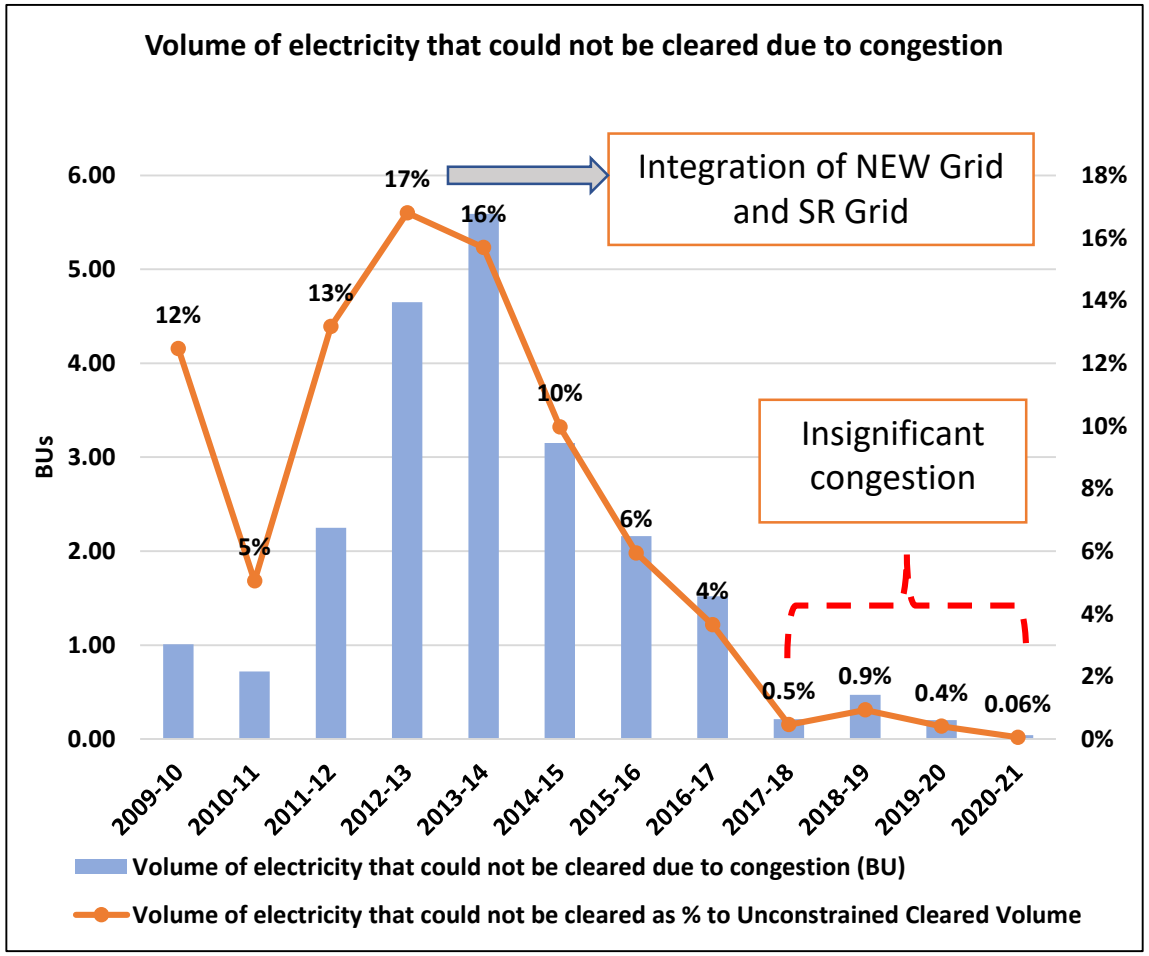


IR Capacity: 130,340 MW

+ Surplus (MW)
- Deficit (MW)

Market Inputs for Transmission Constraints and Congestion





From 2017-18 onwards, the volume of electricity that could not be cleared as % to unconstrained cleared volume was consistently less than 1%, which shows that the congestion remained insignificant

Source: CERC Market Monitoring Report

ISTS Expansion Plan evolved from Nov 21 to Feb 22

- **Northern Region**
  - Kaza Solar Power Project (880 MW)
  - Luhri Stage-I (210 MW) of SJVN
  - Hydro Electric Projects (1474 MW) in J&K
  - ICT augmentation and bays at ISTS S/s for HVPNL
  - ICT augmentation at Bhinmal S/s
- **Eastern Region**
  - Installation of Bus Reactor at Alipurduar (PG) S/s
  - Installation of SLR in both circuits of Kahalgaon – Durgapur 400kV D/c line
- **North Eastern Region**
  - Transmission system for Dibang HEP(2880 MW)
  - Establishment of 400/220/132 kV S/s in Gogamukh

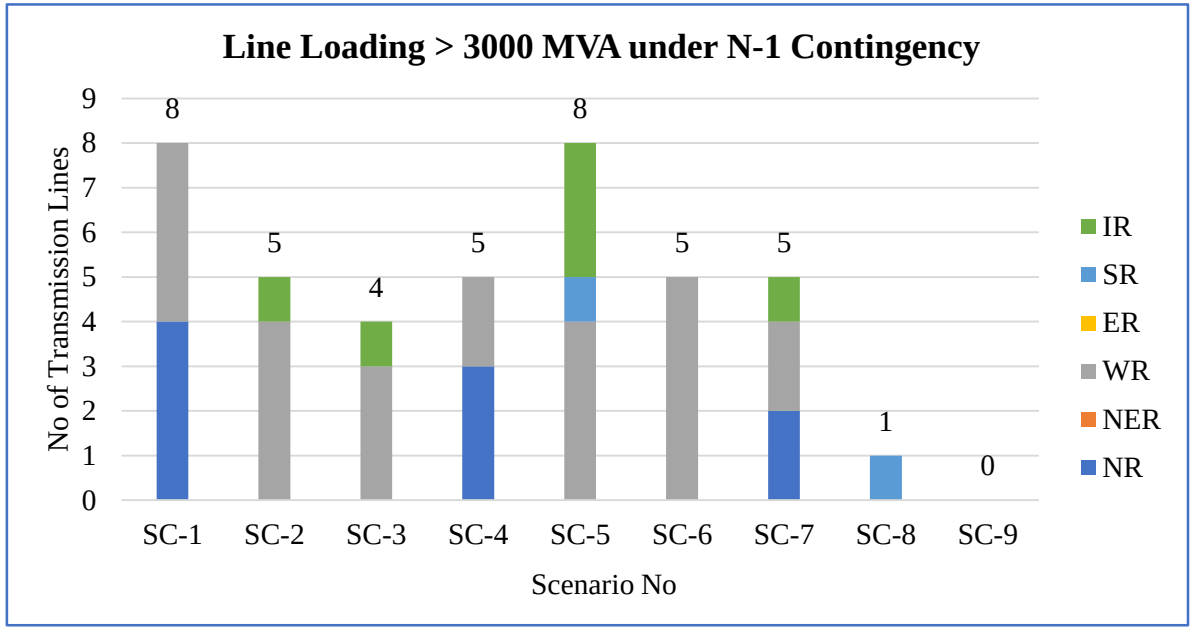
ISTS Expansion Plan evolved from Nov 21 to Feb 22

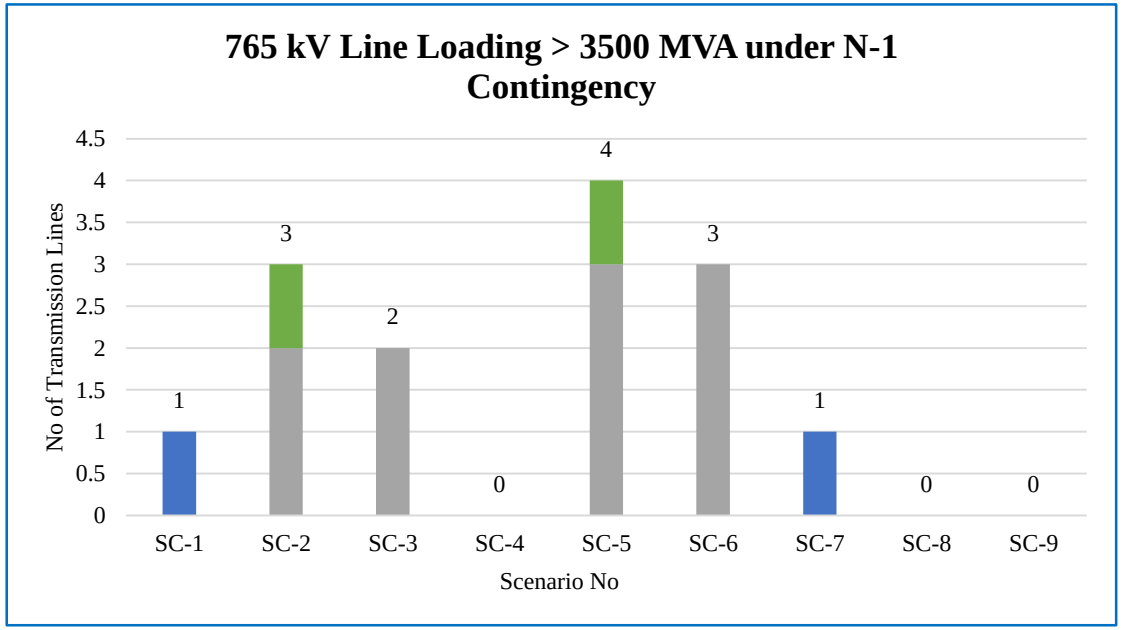
- **Western Region**
  - Transmission Network Expansion in Gujarat to increase its ATC from ISTS
  - Integration of RE projects from Khavda potential RE zone
  - Scheme for fault level control at Dehgam (PG), Ranchodpura (GETCO) and Indore(PG) S/s
  - Raipur PS – Dhamtari 400kV D/c line & Jeypore - Jagdalpur 400kV D/c line
  - Creation of 220 kV level at Raipur PS, Dharamjaigarh and Pune (GIS) S/s
  - ICT augmentation at Raigarh(Kotra)
  - Upgradation of 40% FSC associated with Wardha – Aurangabad 400kV D/c line at Wardha S/s from 40kA to 50kA short circuit level
- **Southern Region**
  - Transmission system for export of surplus power during high RE scenario in Southern Region

Summary of System Evolved		
Ckm	MVA	Estimated Cost(Rs. Cr)
3772	32,490	14,646

765 kV Transmission Lines Flow Analysis: Base Case and Contingency

- **About 318 nos. of transmission lines (ISTS and Intra-state)**
- All lines loaded below 70% of thermal limit

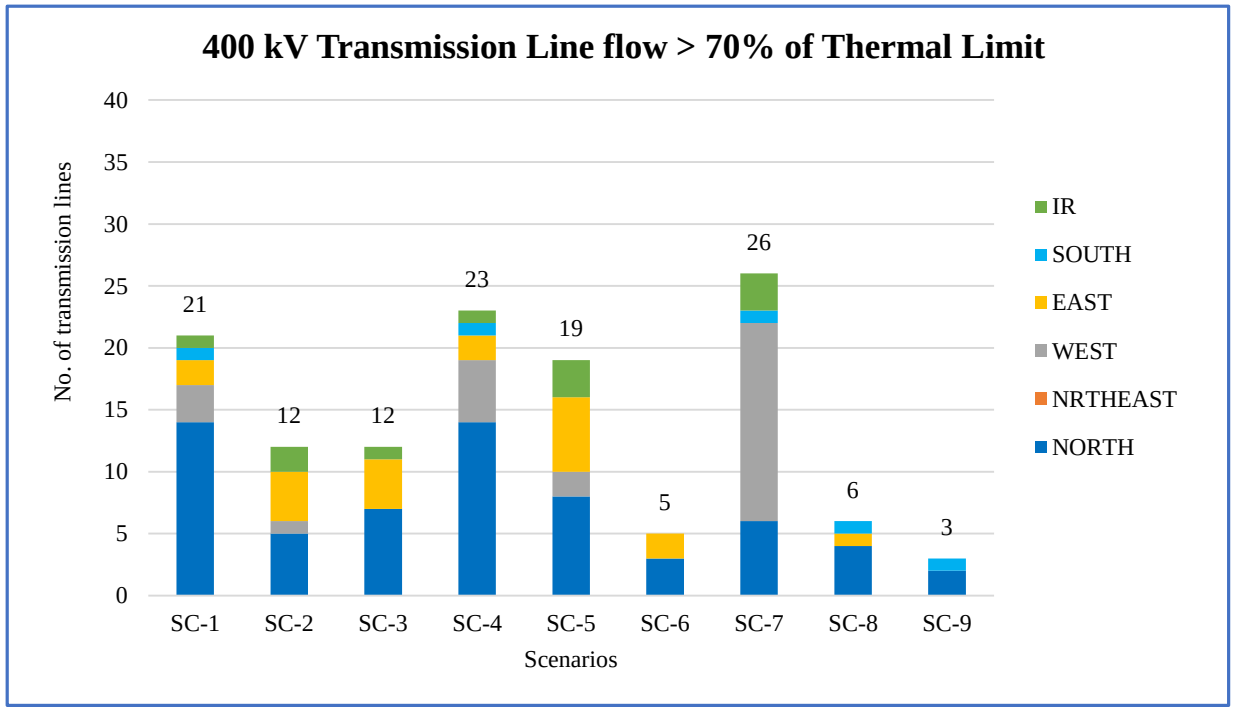


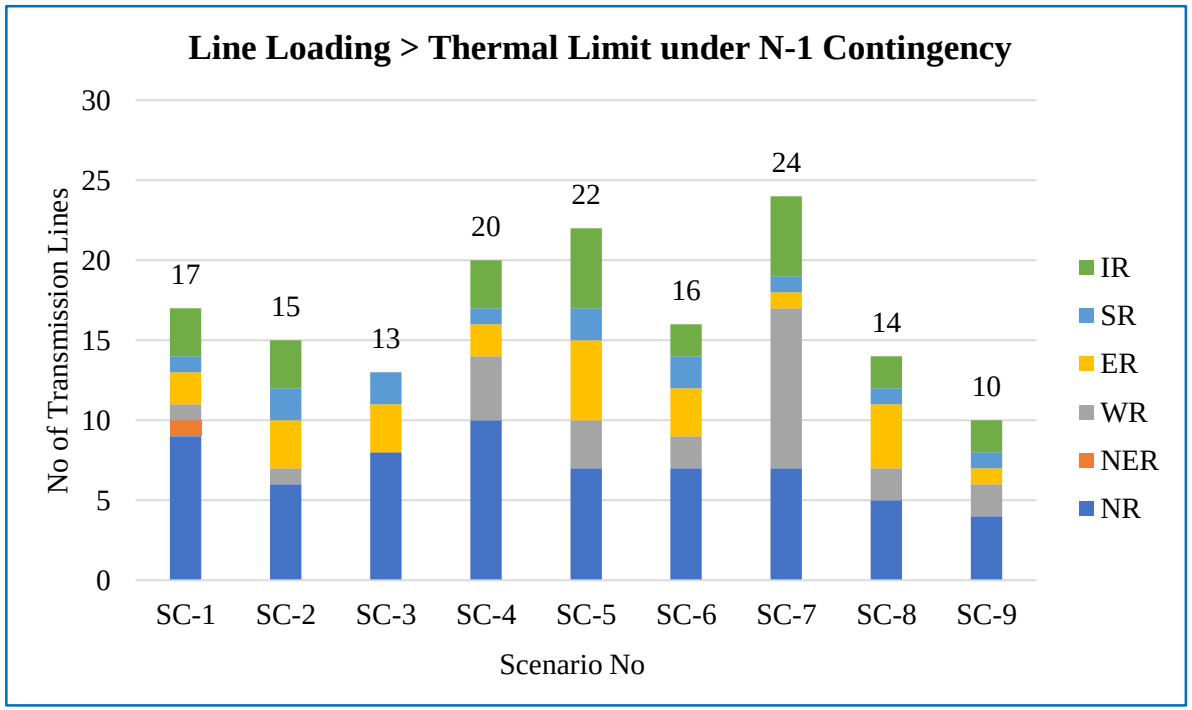


- Maximum loadings occurs during evening peak and solar scenarios.
- Three maximum loaded 765 kV ISTS lines
  - Tamnar-Dharamjaygarh – 4132 MVA
  - Champa-Kotra - 3689 MVA
  - Sasan-Vindhyachal Pool – 3271 MVA

400 kV Transmission Lines Flow Analysis: Base Case and Contingency

400 kV Transmission Line: About 2281 nos. (ISTS and Intra-state)



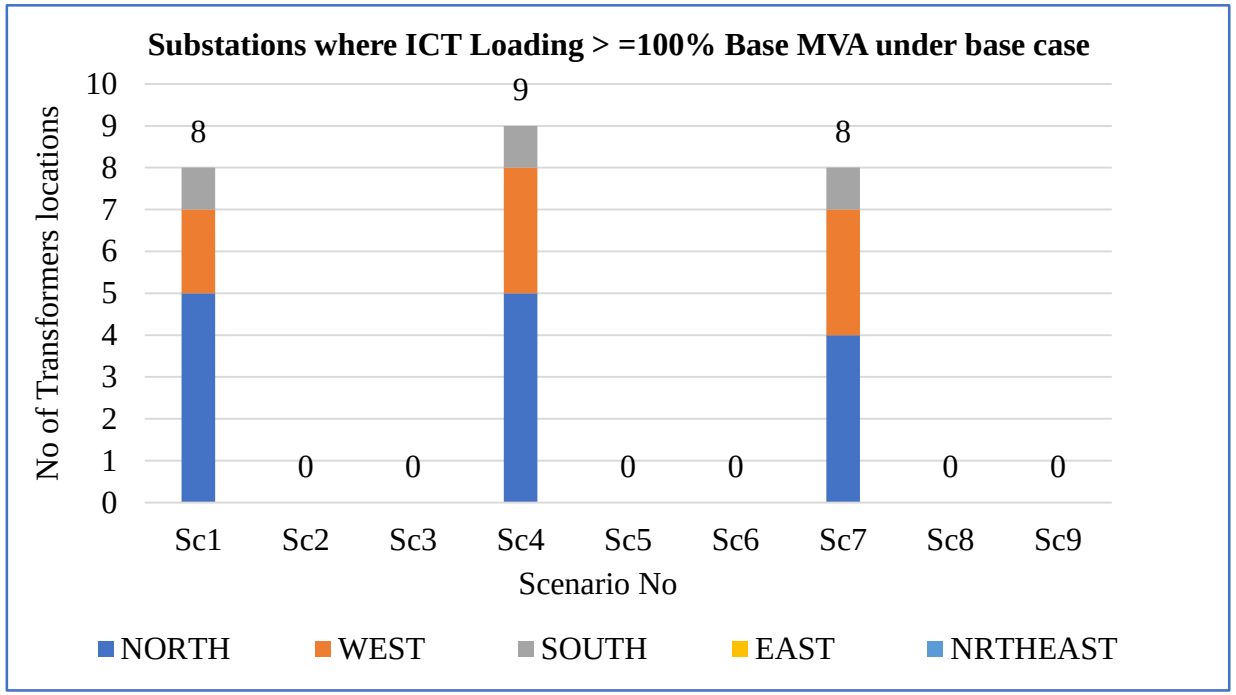


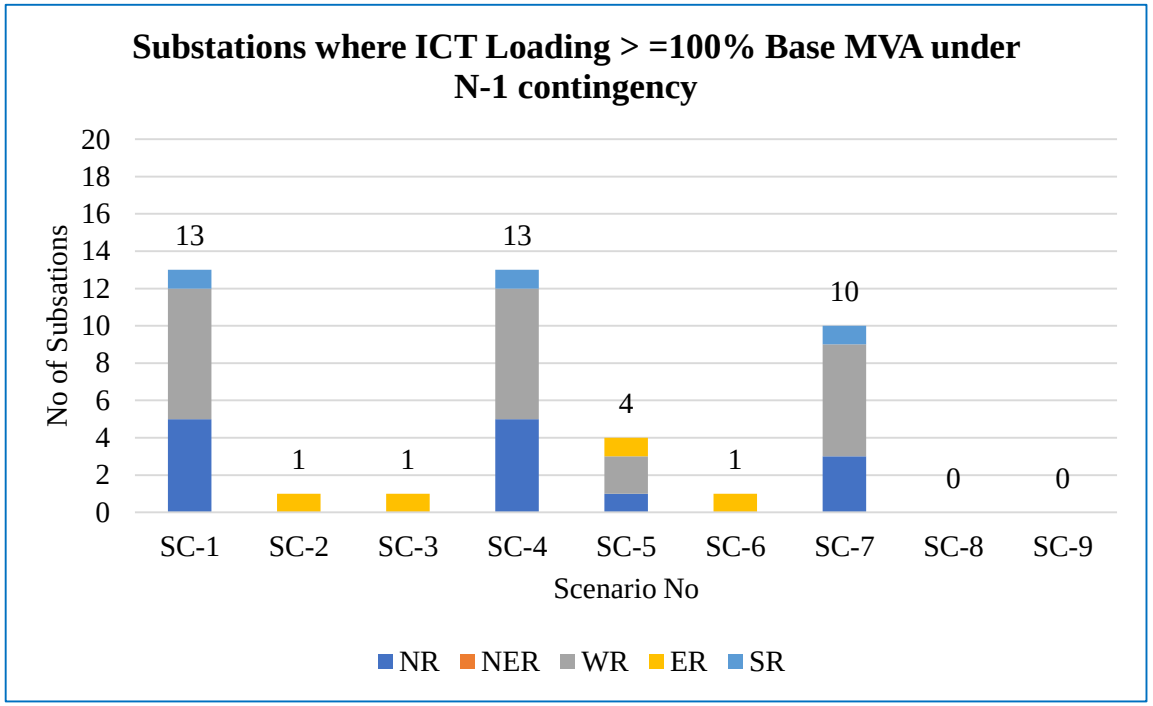
- Some lines are loaded beyond limit
- Most of case occurring in Solar max scenarios

- Max no. of lines loadings corresponds to Solar max scenarios (i.e. Scenario-7)
- Around 30 distinct lines are loaded beyond thermal limit under N-1 contingency
- Some of these lines are STU lines

765/400 kV Transformer Loading Analysis: Base Case and Contingency

765/400kV Transformers: About 294 nos. at 119 nos. of substations(ISTS and Intra-state)

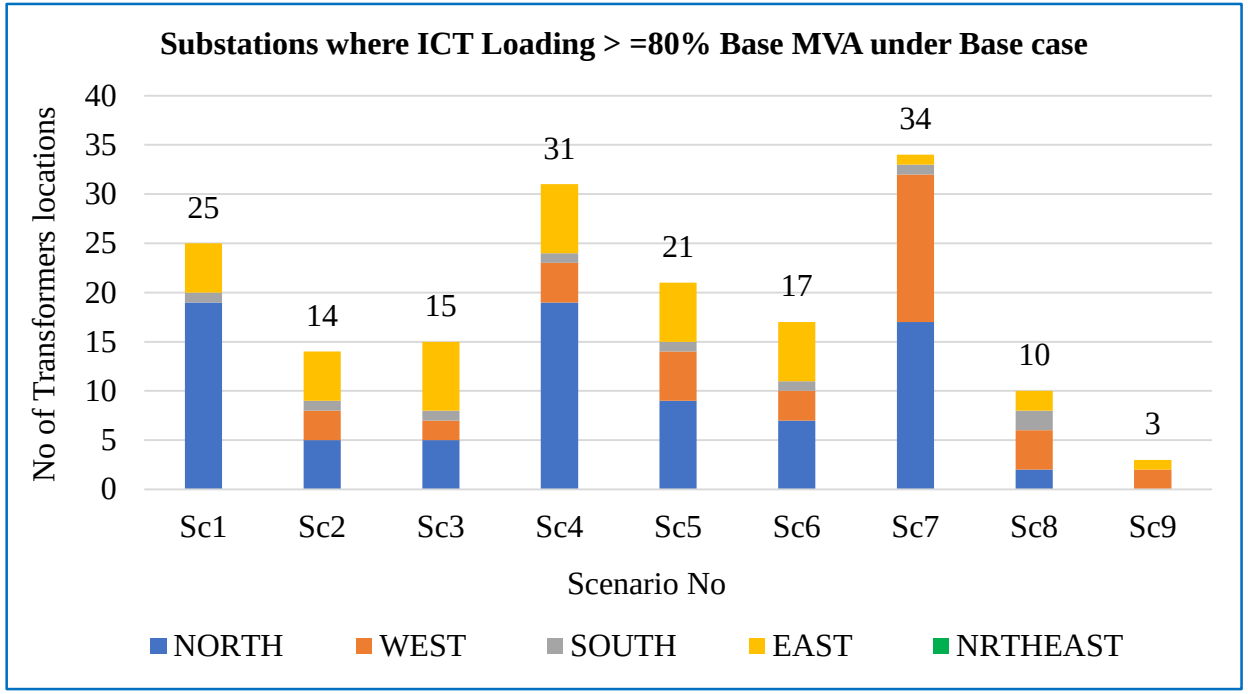


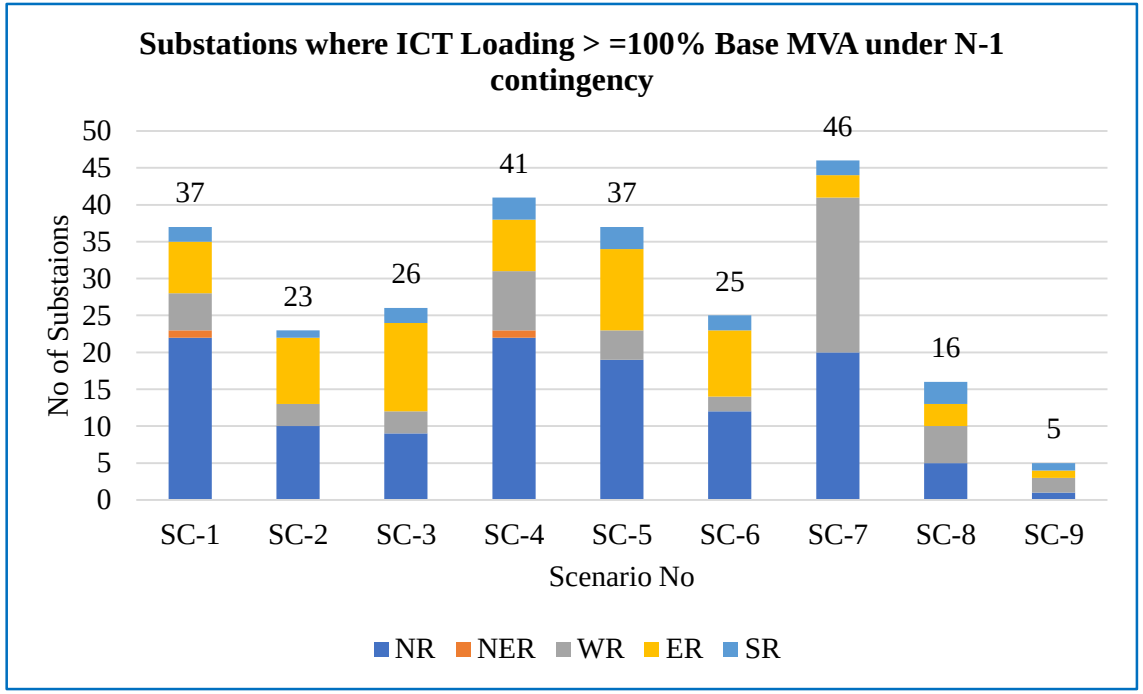


- Loading above limit- solar max scenarios
- S/s located in NR, WR and SR
- Transformers augmentation taken up based on RE potential materialisation//requirement under LTA
- 13 S/s names corresponding to Scenario-4: Bhiwani (PG), Khavda-I, II & III, Padghe(GIS), Navsari(New), Pune(PG), Kurnool, Bhadla-2 & 3, Fatehgarh-II, Bhiwani(SR) & Fatehpur-2

400/220 kV Transformer Loading Analysis: Base Case and Contingency

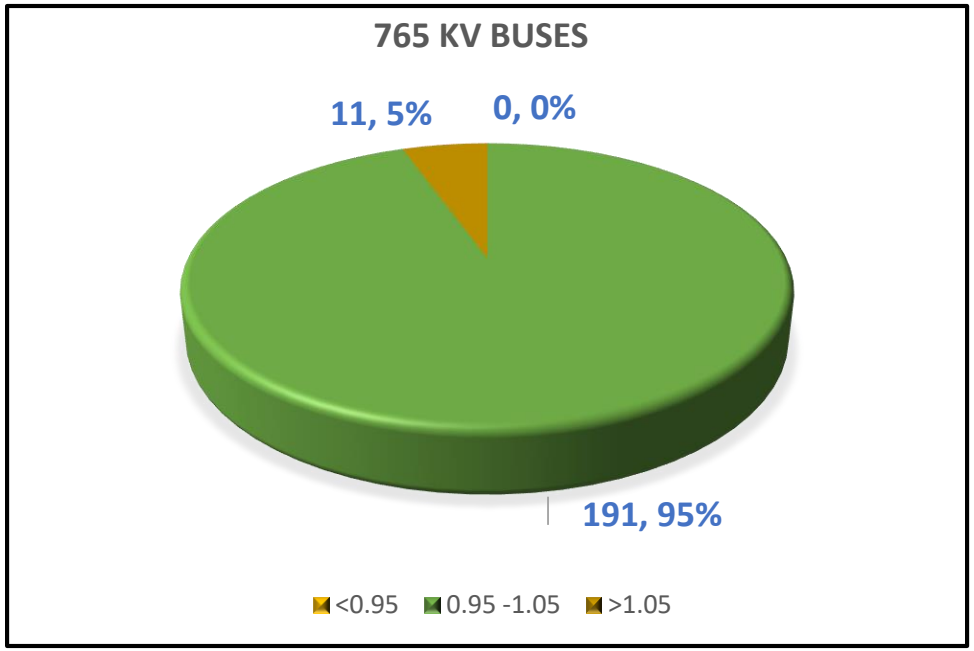
400/220kV Transformers: About 1401 nos. at 549 nos. of Substations (ISTS and Intra-state)

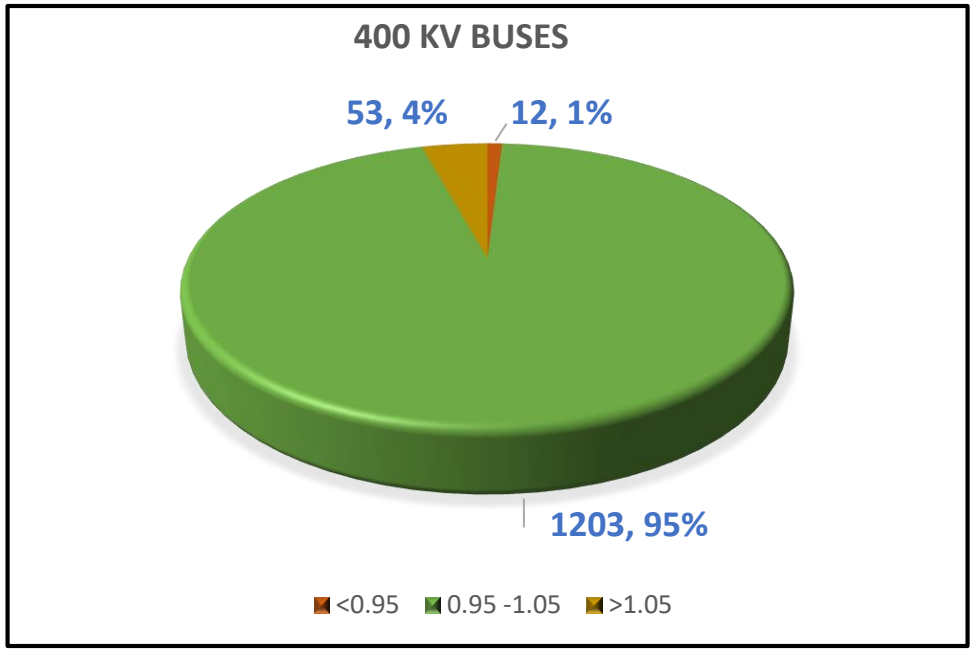




- Transformers loading greater than MVA occurs in solar max and evening peak scenarios
- Non-availability of transformers under N-1 contingency at RE pooling stations
- Generally the cases pertaining to STUs
- Others transformers are being further examined in details for augmentation

Voltage Profile Analysis

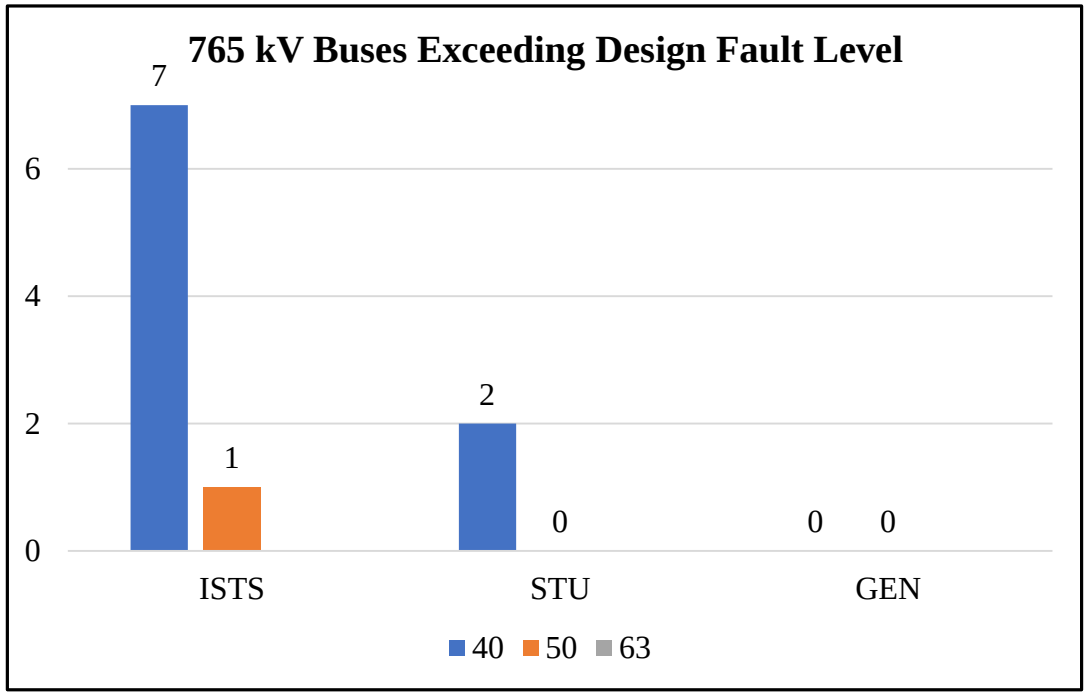


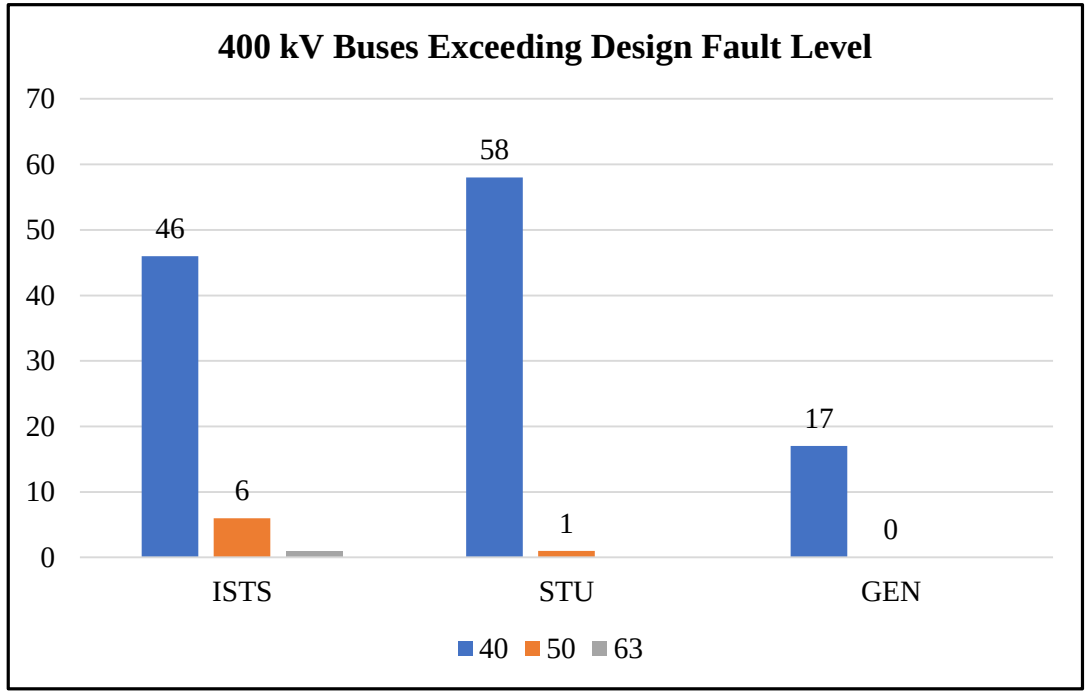


- 95% of the bus voltage are within range of 0.95 to 1.05 pu in base case scenarios.
- 11 nodes having voltage beyond 1.05 pu in one of the scenarios.
- No node is having voltage below 0.95 pu

- 95% of the bus voltages are within range of 0.95 to 1.05 pu in base case scenarios.
- 53 nodes having voltage beyond 1.05 pu in one of the scenarios.
- 12 nodes facing low voltage in one of the scenarios.

Short Circuit Analysis





- **765 kV ISTS**
  - Bilaspur WR (40kA): 44kA
  - Jabalpur Pool (50kA): 52kA
- **765 kV STU**
  - Jaipur (40kA): 41kA

- **400 kV ISTS**
  - Meerut (40kA): 64kA
  - Padghe (50kA): 60kA
- **400 kV STU**
  - Kudus(40kA): 62KA
  - Maheshwaram-TS(50kA): 68kA

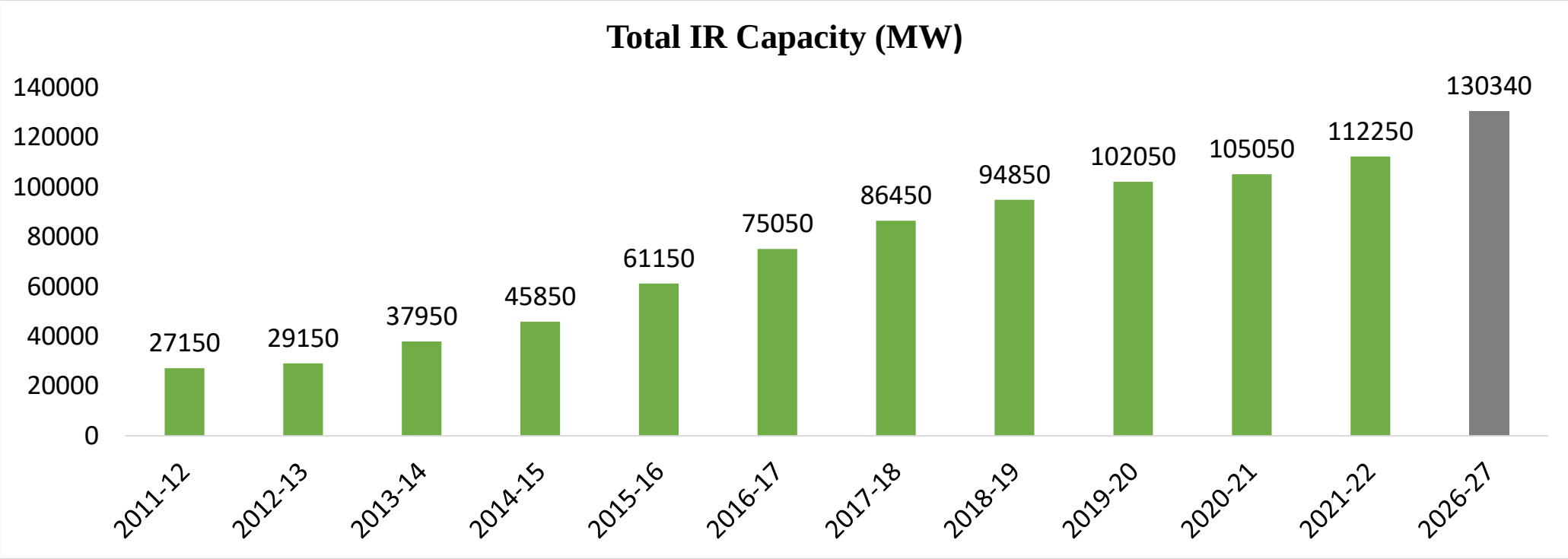
ISTS Expansion Plan evolved from Mar'22

- **Northern Region**
  - Scheme to relive high loading of 400 kV Bhinmal-Zerda line
  - Integration of RE projects from Rajasthan REZ Ph-IV(Bikaner Complex)
  - Augmentation of ICT to take care N-1 contingency at RE pooling stations
  - Requirement of reactive compensation at various S/s
- **Western Region**
  - Transmission Network Expansion in Maharashtra to increase its ATC from ISTS (Part-A to C)
  - Integration of RE projects in Neemuch, Solapur, Dhule, Kallam potential RE zone
  - Scheme for fault level control at Padghe (PG), Padghe (MH), Kudus(MH), Kalwa(MH), Lonikhand-I & II S/s
  - ICT Augmentation at Raigarh(PG) S/s
  - WRES XXX(Line bypassing at Parli(PG)
- **North Eastern Region**
  - Reconductoring of few132 kV Lines

ISTS Expansion Plan evolved from Mar'22

- **Southern Region**
  - Integration of RE projects from Gadag, Koppal, Davangere, Bijapur and Bellary potential RE zone
  - ICT Augmenetation at Pavagada, Arasur, Hosur S/s
  - Scheme for fault level control at Maheshwaram (TS), Maheshwaram (PG) and Kurnool(PG) S/s
- **Eastern Region**
  - Establishment of 400/220 kV S/s in DVC area and Joda(Odisha)
  - Reconductoring of Jharsuguda-Rourkela 400kV 2XD/c line
  - ICT augmentation at Bokaro, Durgapur, Subhashgram
  - Scheme for fault level control at Patna (PG) S/s
  - Reconductoring of Rangpo-Gangtok 132kV 2XD/c line
  - Installation of Bus Reactor at Biharsharif (PG) and Jamshedpur (PG) S/s
  - Installation of SLR in both circuits of Maithon – Kahalgaon 400kV D/c line

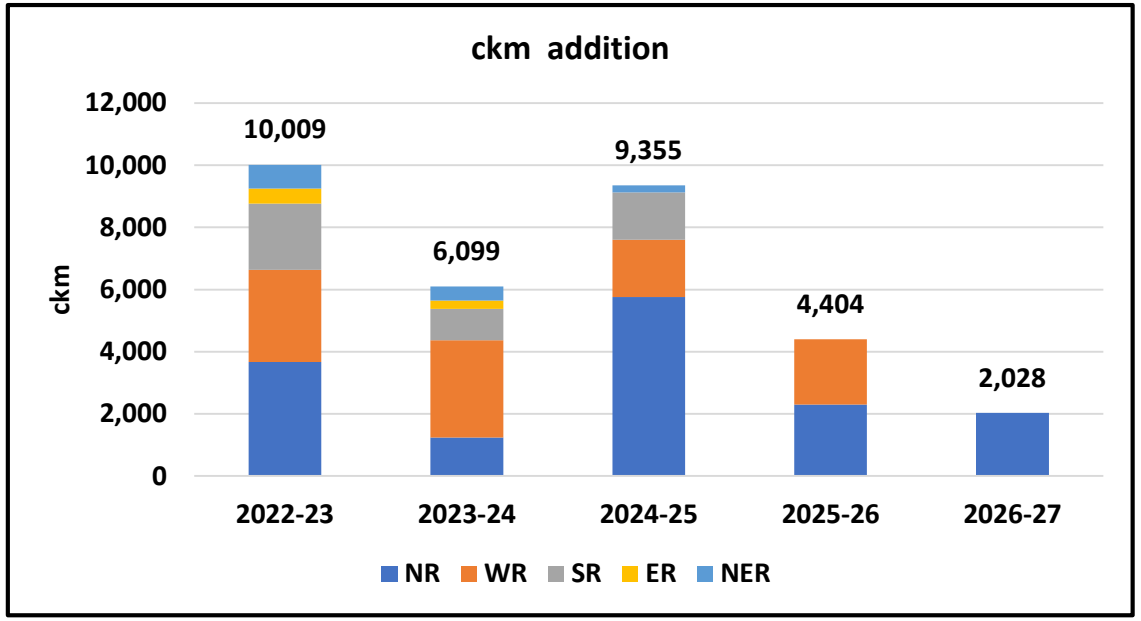
Growth in IR Capacity (MW)

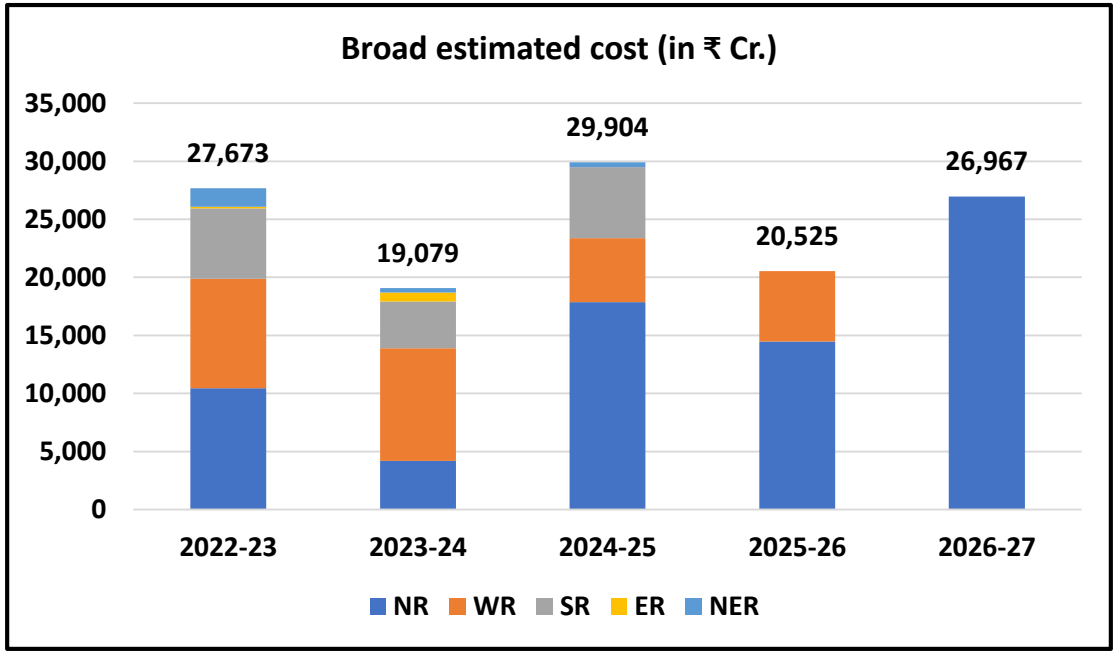


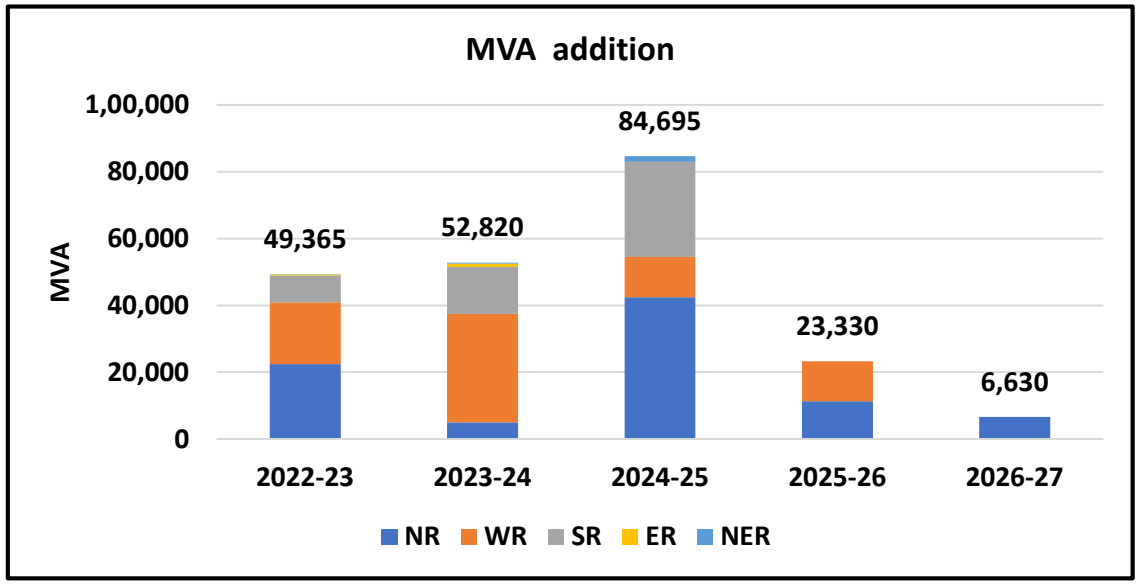
IR lines under implementation:

- Warora-Warangal 765kV D/c line : 4200 MW
- LILO of Narendra - Narendra (New) 400kV (Quad) line at Xeldam (Goa) :1600 MW
- Neemuch-Chittorgarh 400 kV D/c :1600 MW
- Jypore-Jagdalpur 400 kV D/c : 1600 MW
- Narendra-Pune 765 kV D/c : 4200 MW
- Chittorgarh-Indore 765 kV D/c : 4200 MW
- Reconductoring of Siliguri - Bongaigaon 400kV D/c & Birpara/Alipurduar - Salakati 220kV D/c : 690 MW

ISTS Expansion upto 2026-27: ckm, MVA addition and Broad estimated cost (in ₹ Cr.)







Total Ckm addition till 2026-27: **31,895**

Total MVA addition till 2026-27: **2,16,840**

Total estimated cost (in **₹ Cr.**): **1,24,148**

Summary

- Studies has been carried out for 2026-27 timeframe
  - Peak Demand: 299 GW (19th EPS)
  - Total Envisaged Installed Capacity: 568 GW (RE : 225 GW)

Report on the findings is published in Mar'22

- Major Observations
  - **Load Generation Balance (LGB):** Surplus generation of about 33 GW (with 40% thermal technical minimum in Aug'26) & 59 GW (with 55% thermal technical minimum in June'26) .
  - **Critical loading of Lines/ICTs:** Some over loadings observed. Regular analysis and remedial actions are taken up
  - **Fault level at STU and ISTS Stations:** Measures like splitting of bus, series reactor, rearrangements of lines etc. to be taken by respective entities
  - **Violation of Voltage:** Adequate reactive power control devices to be planned and installed mainly at STU systems

- Simultaneous development/strengthening of ISTS as well as Intra state network is essential for Reliable and Economical Network.

Thank You !!!