भारत सरकार
Government of India
विद्युत मंत्रालय
Ministry of Power
उत्तर क्षेत्रीय विद्युत समिति
Northern Regional Power Committee

Date: 01 December,2025

सेवा में/To,

एनआरपीसी एवं टीसीसी के सभी सदस्य एवं विशेष आमंत्रित (संलग्न सूचीनुसार)
Members of NRPC & TCC & Special Invitees (As per List)

विषय: 56 वीं तकनीकी समन्वय समिति (टीसीसी) और 81 वीं उत्तरी क्षेत्रीय विद्युत समिति (एनआरपीसी) बैठक का कार्यवृत।

Subject: MoM of 56th Technical Co-ordination Committee (TCC) and 81st Northern Regional Power Committee (NRPC) -reg

महोदय/महोदया,

56th meeting of the Technical Co-ordination Committee (TCC) was held on 30.10.2025 (10:30 AM) and 81st meeting of Northern Regional Power Committee (NRPC) was held on 31.10.2025 (10:30 AM) at Srinagar, UT of J&K. Minutes of the meeting is attached herewith.The same is also available on the NRPC Website.

भवदीय,

ऋषिका 1/12/2025

(ऋषिका शरण)
(Rishika Sharan)
सदस्य सचिव
Member Secretary

Copy to:

1. Sh. Shailendra Kumar, IAS, Chairperson, NRPC and Financial Commissioner (Additional Chief Secretary), to Government of J&K, Power Development Department, UT of J&K **(power.department@jk.gov.in)**.
2. Sh. Rudra Goud P.T, IAS, Secretary PDD and NRE, UT Ladakh **(secy.pddnre@gmail.com).**
3. Sh. G.P. Singh Arora, IAS, Chairperson, TCC and Managing Director, JPDCL **(md-jpdcl@jk.gov.in).**

सत्यमेव जयते

उत्तर क्षेत्रीय विद्युत समिति

NORTHERN REGIONAL POWER COMMITTEE

Minutes of

56th Meeting of

Technical Coordination Committee

&

81st Meeting of

Northern Regional Power Committee

Date: 30th & 31st October 2025

Time: 10:00 AM

Contents

MINUTES

OF

56th MEETING OF TECHNICAL COORDINATION COMMITTEE

&

81st MEETING OF NORTHERN REGIONAL POWER COMMITTEE

Time & Date of TCC meeting: 10:30 Hrs. on 30.10.2025

Time & Date of NRPC meeting: 10.30 Hrs. on 31.10.2025

Proceedings of 56th TCC Meeting

1. Chief Engineer, JKPTCL welcomed all delegates to the picturesque city of Srinagar for the 56th TCC and 81st NRPC meeting. She briefed about the existing transmission network of J&K, comprising 17 Nos. of 220/132/33 kV GSS, 65 Nos. of 132/66/33 kV GSS, and transformation capacity of 12,619 MVA. She highlighted the transmission network's vulnerability due to natural calamities (cloud bursts, flash floods, and landslides) in the fragile Himalayan terrain, including recent damages to the 220 kV Kishenpur–Pampore line. This recurring catastrophe necessitates a discussion and suggested ways for a robust and efficient transmission design and long-term strategies to minimize such events in the future.

   She expressed concern over the prolonged non-closure of a project, specifically Zainakote–Alusteng–Mirbazar line, wherein the Alusteng–Mirbazar section is stalled for nearly 15 years due to persistent delays in securing necessary NOCs from the Forest Department. She further requested that the committee be empowered to take up such matters with concerned agencies to ensure time-bound completion.

   She also requested the forum to consider taking up the matter of establishing a new 400/220 kV GSS in Central Kashmir to meet the region's emerging power needs. Furthermore, she also proposed examining the feasibility of establishing a new grid substation in the snowbound Gurez area. Recognizing the rapid climatic changes, she requested the forum to mandate adopting a design more robust than the existing standard for 220 kV Pampore–Kishenpur line to ensure reliable, year-round connectivity in J&K.

2. Member Secretary, NRPC, Smt. Rishika Sharan welcomed all dignitaries and participants and congratulated JKPTCL & Ladakh PDD for hosting the meeting at Srinagar. She informed about two recent important national milestones in power sector—India's installed capacity crossing 500 GW with 51% non-fossil generation on 30th September, 2025 and the achievement of a record 51.5% renewable energy generation share on 29th July 2025.

   She highlighted the increasing challenges of operating the grid safely and reliably with rising RE penetration, while around 77% of the last quarter's grid frequency remained within the band. She pointed out low-frequency incidents on 8–9th September, 2025 and high-frequency incidents, particularly on 2nd October, 2025. She emphasized the need for accurate assessment of demand, including variation due to weather conditions, optimal generation resource planning and maintaining adequate reserves by states. She stressed the intrastate generating units for expediting AGC implementation, ensuring operation of units at the Technical Minimum Level and a mechanism for part-load compensation to be notified by SERCs and the requirement of essential actions for tackling such activities. Further, she added that at the time of low frequency, apart from other suitable measures, generators are to bring their units as soon as possible and also reduce the forced/partial outages due to recurring technical issues.

   Regarding the Northern Region grid operations, she drew attention to winter challenges in the next quarter, such as low hydro availability, high voltages, fog-related trippings, and reactive power issues, mainly in Rajasthan and J&K grids. She urged states to strengthen their networks, install capacitors and enhance reactive power support in their intrastate grid. She also expressed concern over multiple tower collapses during the last quarter, stressing that all utilities must maintain adequate ERS and ensure timely restoration.

   She concluded by thanking all delegates and looked forward to constructive and meaningful discussions.

3. Shri Rajiv Kumar Porwal, Director (System Operation), Grid India focused on operational overview and identified key systemic challenges. He commended all utilities for their active cooperation in managing the grid, citing the effective handling of the recent Cyclone Montha in the Southern and Eastern regions. It was

emphasized that the combined efforts of all utilities are crucial to meeting the increasingly complex challenges faced by the grid.

The imminent winter challenges in the Northern Region were highlighted, specifically the morning peak demand due to heating loads coinciding with reduced solar generation. It was pointed out that significantly greater flexibility from both Hydro and Thermal generation sources would be needed to manage the sudden morning ramp-up during these conditions. He referred to a recent low-frequency event on September 8th and 9th, 2025, noting that necessary actions were not taken because utilities had become complacent about stable frequency and continued to overdraw, assuming grid support would materialize.

The challenges in managing the transition from 65 GW of utility-scale solar generation during the day to zero at night were discussed. He emphasized that this shift requires substantial ramp-up capacity. He also noted the severe constraints on the availability of flexible gas stations, which are limited by scheduling constraints (due to the high cost of Open Cycle operation) and the reluctance of generators to commit to the required minimum schedules during off-peak hours.

The specific issues concerning Jammu & Kashmir (J&K) were raised, particularly regarding the intra-state network and telemetry. It was highlighted that pending intra-state transmission lines (some delayed by 10–15 years) are severely impacting the grid and causing extreme voltage fluctuations, especially during peak loads (e.g., at Pampore). Furthermore, the poor data telemetry from intra-state stations and generating units in J&K was noted; hence, a request to J&K utilities for improved data visibility for secure and safe grid operation. A request was also made to J&K to clear their outstanding regulatory dues.

4. Shri Gurpal Singh, IAS, Chairman TCC, welcomed all delegates to the TCC meeting of NRPC in Srinagar and underscored the need for a robust, reliable, and sustainable power infrastructure to support the region’s diverse and growing population. He mentioned that the evolving challenges in the energy sector also present opportunities for improvement and emphasized collaboration, innovation, and strong technical planning as essential for building a resilient and efficient grid.

   He highlighted that rising renewable energy penetration brings both benefits and operational challenges, calling for the adoption of smart grid technologies, energy storage, and demand-side management to ensure smooth integration without affecting system stability. He also stressed the importance of effective coordination among state utilities, transmission, distribution companies, and regulators to maintain system reliability.

He stated that TCC members carry the responsibility of identifying technical issues and contributing practical solutions while anticipating future needs. He thanked all participants for their commitment and expressed confidence that the meeting would contribute meaningfully to strengthening the region's energy future.

5. Thereafter, the agenda for the 56th TCC Meeting was presented & deliberated. The list of participants is attached as **Annexure-P.**

Proceedings of 81st NRPC Meeting

1. JKPTCL and UT of Ladakh representatives extended a warm welcome to all delegates attending the 81st NRPC meeting and conveyed their gratitude for the opportunity to host this edition of the NRPC meeting.
2. MS, NRPC, thanked JKPTCL, Ladakh UT administration, and their entire team for successfully hosting the 81st NRPC meeting, and extended a warm welcome to all dignitaries and delegates. She informed the forum that most of the issues had been thoroughly discussed and concluded in the 56th TCC meeting.

   She informed that Unified Accounting Software (UAS) is being implemented to modernize energy accounting, bringing uniformity and supporting the five-minute scheduling regime. The procurement of the GAMS tool is in progress for deployment across States and UTs to strengthen long-term resource adequacy planning. She stated that, as per CERC directions, NRPC Secretariat has begun computing transmission deviation charges for REGS from October 2023, and regular accounts are now being issued monthly.

   She highlighted that the recent commissioning of major central generating stations—namely Ghatampur TPS, Khurja TPS, Parbati-II HEP, RAPS-7, and Tehri PSP—has led to an increase in the unallocated power pool of Northern Region CGSs , rising from 2,642 MW to 3,033 MW since January 2025. This enhanced capacity is enabling the region to meet winter demand of hydro-rich states like Jammu & Kashmir and Himachal Pradesh during the lean hydro season, as well as supporting

Rajasthan's Rabi season requirements, and will continue to strengthen the power supply position of the Northern Region in the times ahead.

She mentioned that several tower were collapse during the last quarter, compounded by heavy rains, which disrupted transmission corridors. She stressed the importance of maintaining adequate ERS inventories for timely restoration. She also emphasised upon timely completion of diversion works related to highway and infrastructure projects. Additionally, all diversion activities should strictly comply with CEA and BIS standards to maintain quality and safety.

She mentioned that to emphasise IEGC-2023, protection compliance, and the utilities must submit monthly Protection Performance Indices and action plans, where indices fall below unity. She informed that NRPC is initiating a centralized relay settings database, with a pilot study proposed to be taken up. She also informed that the NRPC Secretariat has begun communication system audits as per CERC regulations. She concluded by thanking all delegates and looking forward to the conclusive meeting. Moreover, she thanked the outgoing NRPC Chairperson, Sh. H. Rajesh Prasad, and the outgoing TCC Chairperson, Smt. Raheela Wani, for their cooperation and support during their tenure, as well as for taking the initiative to host this meeting in Srinagar.

3. Shri Hemant Jain, Member (GO&D), CEA, thanked J&K and Ladakh administrations for hosting the 56th TCC and 81st NRPC meetings and appreciated the well-coordinated arrangements made for the event. He emphasized the significance of the RPC forum as a consensus-based platform and urged all members to deliberate with both regional and national interests in mind, prioritizing the collective goals over individual utility or state concerns. It was also emphasized that decisions taken in the RPC forum are considered highly credible within the Government of India, so it was urged that stakeholders engage constructively.

   He also stressed the need for timely decision-making, participation at the appropriate levels, and early consensus, particularly given the long timelines for transmission projects. He underlined the necessity of upgrading protection and communication systems, as well as active participation in RPC-led audits.

   In light of the increasing complexity of grid operations, he emphasized the importance of maintaining adequately trained personnel in SLDCs, limiting frequent transfers, and ensuring continuity of skilled operators to maintain the independent nature of load dispatch.

States were urged to ensure strict compliance with CEA Connectivity for integrated, healthy grid operation, with support from Grid India/CTU wherever needed. Further, he emphasized that reliable evening peak management requires thermal units to remain available and requested states to ensure technical minimum scheduling during the daytime to avoid unnecessary reserve shutdowns.

He raised concerns regarding the delay in completing several PSDF projects, a total of 50 projects sanctioned for the Northern Region (26 completed, 24 under execution). Projects sanctioned between 2016–2019 remain unfinished, limiting the ability to secure fresh funds. He urged all utilities for the timely completion of all pending works. National PSDF initiatives, such as the Security Operations Centre (SOC) and Network Operations Centre (NOC), he requested that states coordinate with NLDC and CEA to ensure the timely preparation and appraisal of Detailed Project Reports (DPRs). He informed that the closing date for the RDSS has been extended to March 31, 2028, and states were urged to expedite tendering and implementation to avoid losing central funding support.

Member(GO&D), CEA emphasized the importance of maintaining an updated DRIPS Portal, noting that it is reviewed at the level of the Hon'ble Prime Minister.

He concluded that the power sector is undergoing a dynamic phase and urged all stakeholders to take timely, consensus-driven decisions in the RPC forum to address the evolving system needs effectively.

4. Sh. Shailendra Kumar IAS, Chairman NRPC, addressed the committee and acknowledged the assistance of the MS, NRPC, in initiating the proceedings promptly. He noted the time constraints due to his attendance at several critical events scheduled for UT Foundation Day. He thanked all participants for their attention and expressed his commitment to continued collaboration, stating his intent to work closely with all stakeholders to achieve the shared goals outlined during the meeting.

5. Thereafter, agenda for the 81st NRPC Meeting were presented & deliberated. The list of participants is attached as **Annexure-Q.**

Agenda for TCC meeting

A.1 Approval of Minutes of the meeting of 55th TCC & 80th NRPC meeting

A.1.1 EE (O), NRPC apprised that the minutes of the 55th TCC & 80th NRPC meeting (held on 17.07.2025 and 18.07.2025 respectively) were issued vide letter dtd. 21.08.2025. No comment has been received as of now.

A.1.2 ***Decision of the Forum:***

Forum confirmed the Minutes of the 55th TCC & 80th NRPC meeting.

A.2 Status of action taken on decisions of 55th TCC & 80th NRPC meeting (Agenda by NRPC Secretariat)

A.2.1 MS, NRPC conveyed that the agenda has been taken to track the status of action taken as per the decision of the last meeting. Accordingly, issues may be resolved at the earliest.

A.2.2 Concerned utilities submitted the status of action taken and the same has been complied below:

S.N.	Agenda	Decision of 55th TCC & 80th NRPC	Status of action taken
A.3	Returning of spare 400/220 kV 315 MVA ICT provided by POWERGRID to DTL & RVPNL (agenda by POWERGRID)	• Considering the prevailing delivery period of transformers, DTL to submit a realistic timeline for the return of diverted ICTs (04 nos.), within 15 days. • *RVPNL will return diverted ICT at 400kV GSS Jodhpur by*	• DTL apprised that they have floated a tender for procurement of 07 No. 500 MVA ICTs and the internal Tender Evaluation Committee has already recommended for consideration of award. The matter is under consideration of

		December 2025.	Board of Directors of DTL and the LoA is likely to be placed by the end of November 2025. As per the delivery schedule specified in the tender, these transformers are to be commissioned in 30-36 months from the date of award. • RRVPNL apprised that new 500 MVA ICT be expected to be commissioned at GSS Jodhpur by Dec'25 and thereafter diverted ICT would be returned back.
A.9	Installation of OPGW on the existing lines of ISTS (Agenda by CTUIL)	CTU to formulate a comprehensive scheme for implementation of OPGW on existing ISTS lines where OPGW is not available.	CTU apprised that a meeting has already been conducted with stakeholders. Comprehensive scheme is expected to be finalized in Nov'25.
A.14	Proposal for Interconnection of 400kV Bikaner (PGCIL) and 400kV	Forum advised the NRPC Secretariat to constitute a committee comprising members	A Committee was constituted under the chairmanship of SE(O), NRPC comprising

	Bikaner (RVPNL) Substations (Agenda by NRLDC)	from CTUIL, CEA, GRID-INDIA, RRVPNL, and POWERGRID to assess the feasibility of proposal in light of upcoming RE generation and the evolving ISTS network in the region.	members from NRLDC, CTUIL, CEA, RRVPNL and POWERGRID. Forum concurred with the committee recommendation which is that interconnection of 400kV Bikaner (PG) and 400kV Bikaner (RVPNL) substations may not be required presently as the reconductoring work of 400kV Bhadla (RVPNL)-Bikaner (RVPNL) is expected to be completed by Dec'25. Director (System Operation), Grid India stated that considering approx. 180 GW planned in coming years in Rajasthan, CTU and STU to plan for the future timeframe and carry out system studies. At that timeframe, the connectivity b/w 400kV Bikaner (PG) and 400kV Bikaner (RVPNL) may be kept in consideration citing improve system strength, enhance fault level and

			short-circuit ratio (SCR). CTU submitted that they are exploring a better alternate arrangement in view of delay in associated transmission lines of RE so that generation can be evacuated under TGNA.

<u>Return of spare 400/220 kV 315 MVA ICT provided by POWERGRID to DTL & RVPNL</u>

<u>TCC Deliberations</u>

A.2.3 Director (SO), GRID INDIA, emphasized that the timely replenishment of transformers diverted from the regional pool is very important. Failure to do so may result in a situation where no spare units are available, making it extremely difficult to address contingency requirements. He also highlighted the desirability of maintaining reserve transformers within the state control area to manage contingencies in the intra-state system.

A.2.4 DTL informed that the tendering process for the transformers is underway and that the LoA is expected to be issued in the last week of November. It was further stated that it will take an additional 36 months from the issuance of the LoA to return the transformers to POWERGRID, as the OEM has specified a 36-month delivery schedule.

A.2.5 Constituents expressed concern over the delay in the tendering process by DTL, noting that the transformers in the DTL control area have been damaged or defective for a long time.

A.2.6 POWERGRID informed that they have been placing transformer orders in advance to anticipate future requirements and to prioritize delivery schedules accordingly. POWERGRID requested that the states similarly place orders well in advance to ensure the timely availability of transformers.

A.2.7 Director (SO), GRID INDIA, suggested that states may approach their respective SERCs regarding the requirement to maintain spare transformers, with reference to applicable CERC regulations. He further suggested that decisions may be taken at the state management level, considering the state's five-year plan and the prevailing delays in transformer delivery.

A.2.8 Director (Technical), PSTCL, informed that delays are being experienced not only in the delivery of transformers, but also in the delivery of circuit breakers, insulators, and other critical equipment.

A.2.9 MD, HPPTCL, requested that the challenges faced by utilities in procuring transmission equipment be brought to the attention of CEA.

A.2.10 TCC Forum suggested that utilities may align their requirements with POWERGRID, and with POWERGRID's consent, these requirements can be clubbed with POWERGRID's own needs. This would allow for bulk orders to be placed, potentially improving procurement efficiency.

A.2.11 CE, RRVPNL, stated that the new 500 MVA ICT for RRVPNL has arrived at the site in Jodhpur, and testing and commissioning are currently underway. The diverted ICT is expected to be returned to POWERGRID by December 2025.

NRPC Deliberation

A.2.12 Member (GO&D), CEA, enquired from DTL about the expected return timeline for the transformers that had been supplied two years ago. He further emphasized that when a utility extends support during contingency situations, it becomes even more important for the borrowing utility to ensure the timely return of the diverted equipment. He expressed serious concern over the delay in returning the ICT, noting that DTL has informed that the LoA for procurement of new ICTs is still in progress and is expected to be issued by the last week of November, with a delivery timeline of 30–36 months.

A.2.13 Director (SO), GRID INDIA, reiterated that the policy for each region requires maintaining adequate spares, which are currently procured by POWERGRID as regional spares. He further noted that the tariff for the useful life of ISTS assets is determined by CERC.

A.2.14 In contingency situations elsewhere, timely restoration of equipment is crucial to ensure availability for other users. Member (GO&D), CEA asked whether the transformer being returned would be the new 500 MVA unit or the old 315 MVA unit. DTL replied that the 315 MVA transformer currently in use would be returned. Member (GO&D), CEA suggested that since DTL will have utilized approximately five years of the operational life of this transformer, the tariff for that period should be recovered from DTL.

A.2.15 Member (GO&D), CEA stated that for ongoing transformer diversion cases—especially where a utility has not returned diverted equipment for over two years—the matter may be referred to the Commercial Sub-Committee for further deliberation on commercial implications.

A.2.16 MD, HPPTCL opined that ICTs that were meant for utilization primarily in ISTS have already been diverted to DTL for more than 2 years. DTL should strive to replenish the ICTs diverted at their sub-station(s) at the earliest. However, if any contingency arises in the ISTS that necessitates the availability of a spare ICT, suitable measures (such as an early recall) to address the situation may be discussed and deliberated in the RPC or relevant sub-forum.

A.2.17 ***Decision of the Forum:***

The forum was of the view that the return of spare transformers provided to DTL had already missed the deadline set in the guidelines for diverting RPC-approved cold spares (transformers and reactors) to regional constituents. Further delays are expected due to the late delivery of DTL's new ICTs. Since the delay may exceed 36 months, the forum has referred the matter to the Commercial Sub-Committee to assess the cost impact of not returning the transformers on time.

<u>Proposal for Interconnection of 400kV Bikaner (PGCIL) and 400kV Bikaner (RVPNL) Substations</u>

<u>TCC Deliberations</u>

A.2.18 SE (O), NRPC, stated that NRLDC's Proposal for Interconnection of 400kV Bikaner (PGCIL) and 400kV Bikaner (RVPNL) Substations was on operational data basis. As discussed and examined the proposal by the Committee, the interconnection would require approximately 30–32 months to complete. In the meantime, RRVPNL is expected to complete the rectification of the 400 kV Bhadla (Raj)–Bikaner (RVPNL) D/C line by December 2025, after which the line will be capable of operating at its rated capacity. In view of this, the Committee has recommended that the interconnection between Bikaner (PG) and Bikaner (RVPNL) may not be required.

A.2.19 Director (SO), GRID INDIA, stated that interconnecting the two stations would improve the SCR. He emphasized that a technical assessment should be undertaken, as the proposed link would be a short line. The connectivity must also be evaluated in the context of the long-term plan for integrating 180 GW of renewable energy. He advised that the CTU may examine the feasibility, considering a 4–5 year planning horizon.

A.2.20 RRVPNL stated that additional intra-state generation at 132 kV and 220 kV level is planned for future commissioning, which is expected to further increase loading on the existing 400 kV transmission lines.

A.2.21 CTU stated that there was a bay issue at Bikaner (RVPNL) and they are planning an alternate or improved arrangement for interconnections. This would facilitate the evacuation of RE power under T-GNA in case of delays in commissioning the associated transmission system.

A.2.22 RRVPNL stated that the terminal equipment at Bhadla (RVPNL) and Bikaner (RVPNL) is not being replaced currently, as there were no participants in the tender process, which has been extended three times. After completion of the rectification work, the capacity of the 400 kV Bhadla (RVPNL)–Bikaner (RVPNL) D/C line is expected to increase to 1300 MW per circuit, compared to the current 750 MW.

A.2.23 CGM (SO), NRLDC, stated that after the rectification work, additional RE power can be accommodated, as this was a major limiting factor for granting NOC to RE plants.

A.2.24 Director (SO), GRID INDIA, reiterated that the CTU should undertake a comprehensive study in coordination with the STU/RRVPNL, taking into account all intra- and inter-state RE generation expected by 2030. Such an assessment would facilitate informed decision-making regarding the interconnection of the Bikaner (PG) and Bikaner (RVPNL) substations. He added that the same approach may be adopted for system improvement if the study indicates tangible benefits.

A.2.25 MS, NRPC, stated that, for the time being, the Committee's recommendation may be accepted. However, Rajasthan may submit all generation and load data, including lower voltage levels, to CTU, and based on the study results, the interconnection can be reconsidered.

NRPC Deliberations

A.2.26 MS, NRPC MS, NRPC, stated that Grid-India has indicated that although interconnection may not be required at present, the proposal could be reconsidered in the future to enhance system strength. CTU informed that they are exploring alternative arrangements for the Bikaner complex, considering the 2030 time frame, to avoid renewable generation curtailment arising from delays in the execution of the associated transmission system. The alternative path would enable the evacuation of some power under T-GNA.

A.2.27 Member (GO&D), CEA, opined that any actions undertaken under T-GNA should align with the overall plan. CTU agreed to consider all relevant dimensions.

A.2.28 ***Decision of the Forum:***

I. *Forum concurred with the Committee's recommendation, which is that interconnection of 400kV Bikaner (PG) and 400kV Bikaner (RVPNL) substations may not be required presently as the reconductoring work of 400kV Bhadla (RVPNL)-Bikaner (RVPNL) is expected to be completed by Dec'25.*

II. *CTU may carry out a comprehensive study in coordination with STU/RRVPNL, considering all intra- and inter-state RE generation expected by the 2030 time frame.*

A.3 Disaster Preparedness of Transmission Infrastructure: Procurement of 20 sets (300 Towers) of Emergency Restoration System under Make in India (Agenda by POWERGRID)

A.3.1 EE (O), NRPC apprised that following a high-level meeting chaired by the Secretary (Power) on 10.05.2025 to review transmission infrastructure disaster preparedness, POWERGRID has communicated that the Ministry of Power (MoP), through its letter No. 34/7/2025-TRANSMISSION dated 11.05.2025, directed POWERGRID to place an order for 20 sets comprising 300 towers of the Emergency Restoration System (ERS).

A.3.2 Subsequently, the Ministry of Power (MoP), vide letter ref. No. 34/7/2025-TRANSMISSION dated 19.08.2025, has conveyed in-principle approval to POWERGRID for the procurement of 20 sets (300 towers) of the Emergency

Restoration System (ERS) under Public Procurement (Preference to Make in India) through the Regulated Tariff Mechanism (RTM)."

A.3.3 POWERGRID will procure 20 sets of ERS towers (300 towers) through emergency procurement processes to address potential requirements across the states. The procured ERS will be stored and maintained at suitable locations to support stakeholders during contingencies and will be treated as spares under a common pool.

A.3.4 As per preliminary estimates, the total expenditure for the said procurement is expected to be approximately ₹440 Cr. Out of the 20 sets of ERS towers (300 towers) suitable for 400 kV transmission lines, 4 sets (60 towers) will be allocated to the Northern Region, with an estimated expenditure of ₹88 Cr.

A.3.5 In view of the above, POWERGRID plans to procure the proposed ERS and subsequently approach CERC through a tariff petition for recovery of the expenditure in accordance with the CERC Tariff Regulations, 2024.

TCC Deliberation

A.3.6 MD, HPPTCL, mentioned that since the procurement is being undertaken under the RTM mode, the cost will be included in the pool, and inquired whether the STU can utilize the ERS if required.

A.3.7 POWERGRID clarified that these ERS sets can also be utilized by States once ISTS requirements are met, in which case the transportation costs to be borne by the respective States. Additionally, any costs related to damage or replacement during operation, supervision charges, and operational expenses will also be the responsibility of the concerned borrower States. POWERGRID further informed that States were also advised during the aforesaid MoP meeting to procure ERS for their own systems.

A.3.8 Rajasthan enquired whether the locations for these ERS sets have already been identified, and if so, requested POWERGRID to share the details.

A.3.9 POWERGRID informed that the ERS sets will be deployed and kept at critical locations based on assessed requirements.

A.3.10 MS, NRPC, suggested that the respective STUs of the Northern Region may coordinate with POWERGRID regarding the locations for placements of the aforesaid four sets. She asked POWERGRID to deliberate on the proposed ERS locations in the OCC meeting.

A.3.11 Director(SO), GRID-INDIA, mentioned that the inventory of ERS towers is to be maintained by all the States and transmission utilities as per the CEA guidelines. This year large number of tower collapses have occurred due to natural calamities. Further, every year, almost 02 cyclones hit the Southern and Western parts of the country. These 20 sets would be over and above the inventory to be maintained by the transmission utilities and can be utilized in case of Contingencies.

A.3.12 Punjab mentioned that, in compliance with the Ministry's directions, they have procured ERS for their own intra-state network. Punjab also suggested that all the STUs may be directed by the forum to procure ERS sets for their respective intra-state network as per Government government-specified norms. Punjab further requested POWERGRID's support to conduct training on ERS handling.

A.3.13 MS, NRPC highlighted that the importance of maintaining adequate ERS availability has been reiterated by MoP and CEA, particularly in the context of disaster preparedness and rapid grid restoration. As per MoP Guidelines, the ERS requirement is linked to the circuit kilometer (ckm) of transmission lines operated by a licensee:

- < 500 ckm: May either procure ERS on its own or enter into a mutual agreement with another transmission licensee for ERS sharing.
- 500-5,000 ckm: Minimum 1 ERS sets to be maintained.
- 5,000-10,000 ckm: Minimum 2 ERS sets to be maintained.
- >10,000 ckm: Minimum 3 ERS sets to be maintained.

Additional considerations include line criticality, vulnerability to tower failures (cyclones, landslides), and geographical constraints.

In view of the above, she advised all the non-compliant utilities to initiate procurement of ERS as per the specified Government norms or enter into formal ERS-sharing with the complaint licensee.

A.3.14 Chairperson TCC stated that all states should procure the desired number of ERS towers as per the CEA guidelines.

A.3.15 The proposal was recommended by the TCC forum.

NRPC Deliberation

A.3.16 NRPC forum noted the deliberation held in the TCC meeting and the Forum was in consonance with the same.

A.3.17 Member (GO&D), CEA, enquired whether the locations for storing these 20 ERS tower sets had been finalized. MS, NRPC, informed that the locations would be decided in the OCC meeting. It was also noted that the locations should be strategic, ensuring coverage for the entire region in case of an emergency.

A.3.18 Director (Technical), PSTCL, was of the view that if these ERS towers are used for the state network, a mechanism similar to the guidelines for transformer diversion to regional constituents may also be framed.

A.3.19 Member (GO&D), CEA, opined that the diversion of ERS towers during contingencies should not be compared with the diversion of transformers. ERS towers are intended for short-term use to address emergencies in a particular state.

A.3.20 Director (SO), GRID-INDIA, stated that from a national perspective, in emergencies, commercial considerations should not override technical requirements. Ensuring the safety and protection of the system is always paramount.

A.3.21 Punjab requested Powergrid to arrange ERS deployment training for utility staff.

A.3.22 Member (GO&D), CEA mentioned that one such training was recently conducted with support from PGCIL in the Northern Region. He suggested that, if required, utilities may approach POWERGRID bilaterally for training assistance. Such programs can be organized at locations where ERS is deployed, enabling state personnel to gain practical, hands-on experience.

A.3.23 ***Decision of the Forum:***

I. *Forum approved the procurement of 4 sets of ERS (60 towers) for the Northern Region (with estimated expenditure of Rs 88 Cr) through the Regulated Tariff Mechanism (RTM).*

II. *Further, Forum directed POWERGRID to submit the details of suitable strategic locations for placement of the aforesaid four sets of ERS to the OCC forum.*

A.4 The demolition and reconstruction of residential and non-residential buildings within the Hissar substation premises are proposed under the Moga Bhiwani Transmission System through Additional Capitalisation in the 2024-29 Tariff Block. (Agenda by POWERGRID)

A.4.1 POWERGRID apprised that the residential and non-residential buildings at Hissar substation were constructed under the Moga Bhiwani Transmission System between 1992 -1993 and are currently in service. These assets would complete more than 30 years of useful service life during the 2024-29 Tariff Block.

A.4.2 The demolition and reconstruction of residential and non-residential buildings within the substation premises at Hissar Substation was discussed during the 216th OCC meeting held on February 14, 2024.

A.4.3 During the said meeting, MS, NRPC, recommended that:

QUOTE

"*He suggested that structural assessment of these projects may be carried out by an appropriate agency, such as NCCBM. Subsequently, the proposal may be taken up for approval in the NRPC meeting*."

UNQUOTE

A.4.4 NCCBM carried out an assessment at the Hissar substation, covering the residential quarters, transit camp, and recreation center. The final assessment report was submitted to POWERGRID on August 22, 2025. Based on the findings of the detailed report, NCCBM has provided its recommendations for the Hissar Substation.

QUOTE

"The buildings were constructed around 1992-1993 since then, the Indian standards for reinforcement concrete design and construction, seismic compliance of buildings, etc., have been revised & upgraded and also considering the buildings are load-bearing structures, the building is not safe for living in its present condition. Also, if the repair of this building is done, it will not increase the service life of the structure.

UNQUOTE

A.4.5 In view of the above, Powergrid has proposed to demolish the old and deteriorated residential quarters and non-residential buildings (Transit Camp and Recreational Centre) at the Hissar station and rebuild them under the Moga Bhiwani Transmission System through Additional Capitalization in the 2024-29 Tariff Block with an estimated cost of ₹25.86 crore including of GST.

Tentative cost estimate for demolition and reconstruction of residential and non-residential buildings at Hissar SS		
Description	**No of quarter**	**Estimated cost in crore (Inclusive of GST)**
Construction of colony quarters (Total 17 Nos.) D Type – 01 No. B2 Type-08 Nos. B3 Type-08 Nos.	17 Nos.	25.86 crore (Inclusive of GST)
Construction of Transit camp	1 No.	
Construction of Recreation center	1 No.	
Dismantling of existing building	1 LS	
Total		**25.86 Crore (inclusive of GST)**

TCC Deliberation

A.4.6 POWERGRID informed that there are currently 63 residential quarters at Hissar. However, due to reduced manpower requirements, only 17 quarters are now proposed.

A.4.7 EE(O), NRPC enquired about the current staff strength posted at Hisar Substation and the residential accommodation requirement. POWERGRID informed that approximately 25 personnel, including the substation and transmission line group, are presently posted at Hisar. A total of 17 quarters would be required to meet the accommodation needs.

A.4.8 SE(O), NRPC stated that if the asset life has already been completed, there is no need to bring the matter to the forum. He further enquired about the per-square-foot construction cost. POWERGRID informed that the project would be executed through a tendering process, and the final cost may vary. The current estimate is based on CPWD rates.

A.4.9 EE(C), NRPC mentioned that, since the substation is located near a major city (approximately 15 km away), employee accommodation at the site may not be essential. He further suggested that a better reference point for cost estimation would be recently executed residential projects of a similar nature. POWERGRID replied that most of their employees are posted from across India and prefer to stay at the substation for operational convenience and better O&M response. It was further informed that the proposal is based on actual occupancy data from the past 4–5 years.

A.4.10 CGM(SO), NRLDC enquired about the methodology for cost sharing. MS, NRPC stated that cost sharing will be governed by CERC (Sharing of ISTS Charges and Losses) Regulation and is not under the purview of the forum.

A.4.11 MS, ERPC stated that, in their region, for a similar nature of proposal, POWERGRID is required to provide the original design life as per the initially approved scheme. He also raised questions regarding the expected life of civil structures and why the related expenditure could not be met through POWERGRID's O&M charges. Additionally, he mentioned that in ERPC, additional capitalization (ADD-CAP) is permitted only when it involves a new investment or scheme—such as bay extension or the establishment of a new substation.

A.4.12 MS, NRPC stated that POWERGRID has submitted a report indicating that the existing quarters are not safe for living, thereby establishing the technical requirement for reconstruction. However, she advised that the cost estimates may be further reviewed.

NRPC Deliberation

A.4.13 NRPC forum noted the deliberation held in the TCC meeting and the Forum was in consonance of the same.

A.4.14 Member (GO&D), CEA mentioned that, since this is a tariff-related matter and the mandate for tariff determination falls under the jurisdiction of CERC, it would not be appropriate for the NRPC Forum to take a decision on it unless the matter is specifically referred to the Forum by CERC. He further stated that CERC follows a judicious process, which involves obtaining the views of all stakeholders in such cases.

A.4.15 MS, NRPC stated that, based on the technical report submitted by POWERGRID, the TCC Forum has examined the matter. The TCC Forum is of the view that there is a technical requirement for reconstruction, as the existing quarters are not safe for occupancy. However, cost sharing will be governed by the CERC (Sharing of ISTS Charges and Losses) Regulations and is not under the purview of the Forum. The NRPC Forum may give technical agreement for the proposal of reconstruction.

A.4.16 POWERGRID informed that, in similar matters pertaining to other regions, they had approached CERC, which had asked for the submission of a third-party audit report and RPC approval.

A.4.17 Member (GO&D), CEA stated that unless mandated by the CERC regulation/ order, such matters may not be placed before the NRPC Forum.

A.4.18 MD, HPPTCL stated that since the States are stakeholders, the views/consent recorded in RPC meetings are duly considered by CERC. He added that sometimes stakeholders are unable to present their views directly before CERC. POWERGRID also mentioned that the RPC Forum serves as a platform to obtain the views of stakeholders.

A.4.19 It was also deliberated that such proposals should first be discussed in the appropriate sub-committee of NRPC for detailed examination.

A.4.20 ***Decision of the Forum:***

I. *Forum, technically agreed with the proposal placed by POWERGRID; however, the mode of the cost recovery mechanism shall be decided by CERC.*

II. *POWERGRID shall not bring such proposals directly to the RPC Forum and should first discuss in the commercial Sub-Committee for detailed examination.*

A.5 Replacement of existing 2 x 500KVA DG sets at HVDC Dadri & Rihand with 2 x 1010 kVA DG sets to meet the essential auxiliary power of Rihand-Dadri HVDC Link (Agenda by POWERGRID)

A.5.1 EE (O), NRPC apprised that as submitted by POWERGRID, Rihand-Dadri HVDC link of (+/-) 500 KV, 1500 MW Rihand is a very critical link for the supply of power from thermal generating stations of Eastern UP to Delhi NCR. The HVDC Link was commissioned in 1991 and retrofitment of HVDC Control & Protection, Valve cooling system was carried out in 2021 under additional capitalization.

A.5.2 At both HVDC terminals, 415V LT auxiliary supply is provided to critical HVDC loads through 2 no. incomer feeders coming from 6.6KV feeders from NTPC Dadri & Rihand stations respectively. The critical auxiliary supply load includes fans of transformers and reactors, valve cooling fans and fine water motors, battery chargers etc.

A.5.3 As per original auxiliary load calculations, 01 no. 500 KVA DG set is provided in each pole at Rihand & Dadri (total 04 DG sets of 500 kVA capacity) to feed auxiliary power supply to critical auxiliary loads of the HVDC station.

A.5.4 As per the detailed present load calculation sheet submitted by POWERGRID, considering the Control room C&P essential air conditioners requirement, the total essential load comes out to be approximately 650 KW. It is to mentioning here that in the Refurbished Valve Cooling system, 60 fans (having 3.6 KW each rating) in each pole have been added, due to which the auxiliary load requirement has increased. Further, it is pertinent to mention here that the inrush current/starting current of these fans may draw 2-3 times of full load current, which may also impact the performance of the DG set.

A.5.5 On 21.05.2025, HVDC Dadri tripped on “Commutation Failure” due to persistent AC Voltage fluctuations and tripping of lines. The Auxiliary Supply to HVDC Dadri also tripped from NTPC Dadri due to tripping of NTPC Dadri Generating Units. The HVDC Dadri Pole#2 was attempted to energize with the available 500 kVA DG Set, but Pole#2 tripped due to the tripping of the DG Set on O/L or U/V protection. On analysis, it was found that after the upgradation of HVDC Rihand -Dadri, the load of the Valve Cooling System has increased from approx. 100 kW to approx. 284 kW per Pole and hence DG Set could not meet the overall aux. power requirement.

A.5.6 Further, Pole-2 DG set at Dadri was refurbished with a Cummins make DG set in 2016 along with 02 number DG sets at Rihand and Pole-1 DG set at Dadri was replaced with a Kirloskar make DG set in 2020. The above refurbishment was carried out due to breakdown and unavailability of service/spare support of old Wartsila make DG sets installed since the commissioning of HVDC Dadri substation.

A.5.7 Upgradation/ refurbishment of HVDC Rihand -Dadri system was done in 2021. Upgradation/refurbishment of control & protection, SCADA, Valve cooling, valve hall ventilation, AC/DC breaker replacement was done, including replacement of converter transformer bushings. The works were carried out by multiple vendors and the impact of the upgradation/ refurbishment on the auxiliary system was not envisaged at that time.

A.5.8 It is very much evident from the above incident that the existing capacity of DG sets at Rihand & Dadri HVDC is not sufficient to take the minimum auxiliary loading and needs to be replaced with 2 x1010 kVA DG sets to meet the essential auxiliary power of Rihand-Dadri HVDC Link. Apart from DG set, suitable power cables as per the increased capacity are required to be laid from DG set to LT distribution room.

A.5.9 Powergrid has submitted that the total cost estimate for supply, installation and retrofitting of 1010 KVA DG set (each for Pole-1&2) at both sites with financial implication of Rs. 11,36,28,525/- only (Eleven crore thirty-six lakhs twenty-eight thousand five hundred twenty-five only) including GST and freight and insurance charges.

As per records, the current book value of DG sets is as follows:

<table>
<tr><th>Equipment</th><th>Location</th><th>Gross value (Rs.)</th><th>Depreciation (Rs.)</th><th>Current book value (Rs.)</th></tr>
<tr><td>Pole 1 500KVA DG SET</td><td>Dadri</td><td>39,31,694</td><td>4,74,336</td><td>34,57,358</td></tr>
<tr><td>Pole 2 500KVA DG SET</td><td>Dadri</td><td rowspan="3">2,20,00,000</td><td rowspan="3">92,10,912</td><td rowspan="3">1,27,89,088</td></tr>
<tr><td>Pole 1 500KVA DG SET</td><td>Rihand</td></tr>
<tr><td>Pole 2 500KVA DG SET</td><td>Rihand</td></tr>
</table>

Proposal

A.5.10 Considering the importance of Rihand-Dadri HVDC link for reliable power transmission to Delhi NCR, proposal is for replacement of existing 2 x 500KVA DG sets at HVDC Dadri & Rihand with 2 x1010 kVA DG sets to meet essential auxiliary power of Rihand-Dadri HVDC Link at an estimated cost of Rs. 11,36,28,525/- (including GST) less the current book value of existing DG sets under additional capitalization.

TCC Deliberation

A.5.11 EE(O), NRPC stated that this agenda item was also discussed in the 236th OCC meeting, wherein *OCC Forum approved the proposal of replacement of existing 2 x 500KVA DG sets at HVDC Dadri & Rihand with 2 x 1010 kVA DG sets to meet essential auxiliary power of Rihand-Dadri HVDC Link under additional capitalisation subject to the adjustment of the residual value of the existing DG sets against the cost of the new DG sets. Further, OCC forum decided that the matter may be taken up in the upcoming NRPC meeting for approval under ADDCAP.*

A.5.12 In 236th OCC, the forum enquired Powergrid as to why the replacement of the DG sets was not carried out during the retrofitting of the HVDC system. Powergrid replied that the review and retrofitting of the auxiliary supply were not included within the scope of work during the retrofitting of the HVDC Control & Protection and Valve Cooling systems.

A.5.13 In the OCC meeting, NRLDC enquired whether Powergrid had explored the possibility of enhancing the existing DG capacity by installing additional 250 kVA DG sets. Powergrid informed that they had consulted the OEMs of the existing DG sets regarding augmentation of capacity through the installation of additional DG sets; however, the OEMs indicated that synchronization of the existing DG sets with new DG sets would not be feasible.

A.5.14 MS, NRPC, enquired whether POWERGRID intended to opt for a buy-back arrangement, capitalize the existing DG set, or utilize it elsewhere. POWERGRID responded that the existing DG set is not very old and will be deployed at another suitable location.

A.5.15 SE (O), NRPC noted that there have been issues related to auxiliary power supply at the Vindhyachal HVDC line. Although dual supply from NTPC Vindhyachal is available, However, frequent tripping has been observed. He suggested that the DG set proposed for replacement could be deployed at Vindhyachal to address this requirement. POWERGRID was requested to consider this suggestion as well.

NRPC Deliberation

A.5.16 NRPC forum noted the deliberation held in TCC meeting and the Forum was in consonance of the same.

A.5.17 Member (GO&D), CEA enquired from POWERGRID if additional allocation has been sought in view of an increase in the auxiliary power requirement at HVDC stations, as the POWERGRID proposal was regarding replacement with higher capacity DGs in view of the higher auxiliary power requirement. PGCIL submitted that the present allocation is adequate.

A.5.18 ***Decision of the Forum:***

I. *Forum, technically approved the proposal submitted by POWERGRID for replacement of existing 2 x 500KVA DG sets at HVDC Dadri & Rihand with 2 x1010 kVA DG sets to meet the essential auxiliary power of Rihand-Dadri HVDC Link under additional capitalization subject to the adjustment of the residual value of the existing DG sets against the cost of the new DG sets.*

II. *Furthermore, POWERGRID will de-cap these assets from the HVDC Rihand-Dadri link and book in another suitable project as per its requirement.*

A.6 URTDSM Phase-II Project (ISTS Portion) – Implementation through RTM route (Agenda by POWERGRID)

A.6.1 POWERGRID apprised that the WAMS system installed under the URTDSM Phase-I project comprises of 1400+ PMUs and 32 Control centres. This project was implemented with 70% of the project cost as a PSDF grant and 30% was through POWERGRID Equity (RTM for 30% portion and no tariff for 70% grant portion).

A.6.2 The URTDSM Phase-I project is proving its significance and usefulness to the Grid Operators for wide area monitoring of the Grid and Event Analysis. Further, the expanding Indian Power Grid with increased penetration of renewable energy sources and Govt of India’s plan to achieve 500GW RE power by 2030, needs Smart Grid tools to proactively monitor, manage, and operate the Grid.

A.6.3 The URTDSM Phase-I Control centres at SLDCs, RLDCs and NLDCs (32 No’s) are nearing their Operational life and are becoming technically obsolete. Hence, to keep the WAMS URTDSM Control centres functional, the URTDSM Phase-II project which includes replacement of existing control centres, is to be implemented on priority.

URTDSM Phase-II project also envisages advanced WAMS analytics for Oscillation monitoring, Disturbance analysis, inertia monitoring, measurement of RE generator(inverter) response, which shall enhance the Grid observability for efficient and safe operation of the Grid.

1. Previous Deliberations for Approval of URTDSM Phase-II Project:

S No	NPC/ RPC Meeting	Date of Meeting	Meeting Outcome	Remarks // Actions taken
i.	13th NPC Meeting	05.07.2023	"The DPR of URTDSM project phase-II in accordance with the recommendation of the committee may be prepared by the POWERGRID within three months. PSDF funding for URTDSM project phase-II may also be sought subsequently. RPCs were requested to provide full cooperation in preparation of DPR"	POWERGRID Prepared DPR for URTDSM Phase-II Project, which included 4000PMUs (new) and 34 control centres proposed with funding pattern of 70% PSDF grant and 30% POWERGRID equity in line with Phase-I. DPR with an estimate of Rs.3922 Crores, was submitted to NPC/CEA on 11.03.2024.
ii.	14th NPC Meeting	03.02.2024	"PGCIL may revise the scope of DPR in line with above suggestions ((d) to (h)) and submit the DPR by March 2024"	POWERGRID presented Various options for optimization and discussed with GRID-INDIA. These Options were presented to NPC on 30.05.2024 for further deliberations.
iii.	Email from NPC reg PSDF	18.04.2024	"In accordance with the decision of the 22nd Monitoring Committee meeting, funding for the DPR regarding URTDSM project	Hence, POWERGRID proposed to implement the URTDSM Phase-II Project on RTM basis (70% debt and 30% equity) and approached the Constituents in all the five RPCs for concurrence of the RTM proposal.

S No	NPC/ RPC Meeting	Date of Meeting	Meeting Outcome	Remarks // Actions taken
			Phase II will not be provided through PSDF as of now. **POWERGRID is hereby requested to explore alternative funding sources for URTDSM project Phase II".**	
iv.	Various RPC meetings		SLDCs of all Regions have expressed in-principle technical acceptance for implementation of the URTDSM Phase-II Project, but the RTM proposal was not concurred by States due to funding constraints	The initial DPR prepared by POWERGRID was based on the sub-committee recommended philosophy of PMU placement. However, CEA was preparing a revised PMU placement philosophy to bring clarity in various regulation/guideline/recommendation. The new guidelines for unified philosophy of PMU placement in Indian Grid were published in March 2025, which will supersede all existing guidelines and sub-committee report etc.
v.	15th NPC Meeting	14.11.2024	"PowerGrid is to submit the revised proposal in consultation with Grid India, only for the existing network after segregating the PMUs and control centers under ISTS and STUs system. The proposal may also be revised to optimized number of control centers and PMUs at ISTS & STUs system	Accordingly, POWERGRID prepared DPR for URTDSM Phase-II ISTS portion (upgradation of control centres at NLDCs, RLDCs and installation of new PMUs for Central Sector stations as per latest CEA guidelines) at an estimated cost of Rs. 1124 Crores & discussed the same in **16th NPC** Phase-II project for ISTS portion comprises of control centres (7 nos.) of NLDC and RLDCs and PMUs at central sector stations (1070 nos.) Tentative cost and BOQ for STUs portion (Control centers of SLDCs

S No	NPC/ RPC Meeting	Date of Meeting	Meeting Outcome	Remarks // Actions taken
			separately. The revised proposal for ISTS portion may be put up to the NCT for further consideration".	across India and new PMUs for State sector substations) is also prepared by POWERGRID for further deliberations in NPC at a cost of Rs. **2550 Crores** for **26** SLDC portion and 1210 PMUs
vi.	16th NPC	04.07.2025	The16th NPC recommended following actions: "URTDSM project phase-II proposal may be put up in RPC forum for further discussion" "The mode of implementation of the URTDSM project phase-II may be put up in upcoming NCT meeting for deliberation and approval"	Accordingly, POWERGRID is taking up the URTDSM Phase-II ISTS proposal for discussion in RPC Meetings.
vii.	52nd TCC & 55th SRPC Meeting	25.07.2025 & 26.07.2025	"SRPC approved the proposal for Unified Real time Dynamic State Measurement System (URTDSM) Phase-II Project with an estimated cost of Rs. 1122 Crores, for ISTS portion comprising of control centres (7 nos.) of NLDC and RLDCs and PMUs at central sector stations (1070 nos.) under RTM"	SRPC Approved
viii.	56th TCC & WRPC meeting	26.09.2025 & 27.09.2025	WRPC Members deliberated & agreed for the ISTS proposal	WRPC Approved (Minutes awaited)
ix.	28th NR TeST Meeting	23.07.2025	"MS, NRPC mentioned that in view of	POWERGRID submission in reference to 28th NR TeST minutes decision –

S No	NPC/ RPC Meeting	Date of Meeting	Meeting Outcome	Remarks // Actions taken
			requirement, proposal may be agreed technically, however, issues raised by NRLDC and higher cost, cost estimate for WAMS System under URTDSM phase-II may first be prepared for Northern Region to check exact cost implications between common PDC for entire Northern Region vis-à-vis PDC at respective State SLDCs. Accordingly, agenda will be put up for upcoming NRPC meeting.”	a. Based on discussion in NR TeST meeting, POWERGRID proposes the following strategy for State Sector portion of URTDSM Phase-II Project for NR: i. Considering the constraint for funding, only separate PDCs for each SLDC of those States having more than 50 PMUs of State Sector (existing and new requirement combined). Such SLDC shall comprise of a limited setup with non-redundant PDC Server, Firewall, LAN switch and Remote console. Tentative cost at SLDC shall be around **Rs.3.5Crores** (approximately) (for Supply Services, AMC) ii. No dedicated PDCs at the SLDCs where State Sector PMUs are less than 50 nos. Shared PDC for such states will be provided at RLDC. **RLDC may confirm.** For the states having less than 50 PMUs, only remote consoles with firewall and LAN switch will be supplied at each SLDC premises, cost of which is not included in the present proposal. It will be around Rs. 3 Crores per SLDC. iii. Few States (such as UPSLDC and RVPNL) have proposed a full-fledged control centre replacement under URTDSM Phase-II. Tentative Cost for each SLDC for a full-fledged setup for WAMS based

S No	NPC/ RPC Meeting	Date of Meeting	Meeting Outcome	Remarks // Actions taken
				PDC and associated IT/Networking items shall be Rs. **95 Crores** (approximately). The average cost for 1 set of PMUs is around Rs. 38 lakhs including AMC. The same can be implemented as part of URTDSM Phase-II ISTS scheme under 100% RTM route (as done under NR ULDC-III project), subject to concurrence of respective States and RPC. iv. The PMU quantity proposed under the ISTS portion for NR is as per revised CEA guidelines only.
x.	229th OCC Meeting of ERPC	25.07.2025	**“ERPC OCC Decision”** OCC agreed with the proposal of POWERGRID regarding implementation of URTDSM Phase-II system	To be taken up in next ERPC.
xi.	29th NERPC	17-18th July 2025	Forum noted that the matter needs to be discussed in detail and referred it to sub-committee for further deliberation.	To be taken up in next TeST meeting

<u>POWERGRID Proposal for URTDSM Phase-II ISTS Portion:</u>

“To take up URTDSM Phase-II Project (for ISTS portion) on pan pan-India basis, on cost cost-sharing mechanism (100% RTM route with 70:30 Debt Equity ratio) to be implemented by POWERGRID at a DPR cost of Rs.1124.00 Crores”.

URTDSM Phase-II ISTS proposal is approved by SRPC, and WRPC (minutes awaited).

Upon Approval in all RPCs, POWERGRID will put up the proposal in NCT for final approval.

TCC Deliberation

A.6.4 POWERGRID informed that there is no replacement of the existing PMUs under the proposed scheme. However, since the life of the Control Centres is up to 2027 and the AMC will also expire around the same time, the scheme includes their replacement along with the installation of new PMUs (1,070 Nos). As advised in the NPC meeting, cost optimization was suggested by implementing the scheme only for the ISTS portion. However, a few States, such as Rajasthan and Uttar Pradesh, have proposed a full-fledged Control Centre replacement under URTDSM Phase-II. POWERGRID has also proposed tentative cost estimates for these States as well as for other cases, as indicated in the above-mentioned table.

A.6.5 MS, NRPC sought the views of the constituents.

A.6.6 Representative from Rajasthan informed that the proposal is under consideration by their management, and the final decision will be communicated once approval is obtained.

A.6.7 Representative from UP mentioned that the ISTS portion of the scheme may be considered, while the State portion could be discussed separately. He further informed that, in accordance with the Central Electricity Authority (Technical Standards for Construction of Electrical Plants and Electric Lines) Regulations, 2022, upcoming substations are already being equipped with PMUs to ensure compliance with these regulations.

A.6.8 ED, NRLDC stated the following:

a. The proposed scheme for the ISTS portion is acceptable and may be approved for the regional level.
b. The proposal for any number of PMUs less than 50 installed in the state control area/jurisdiction and directly reporting to NRLDC for the sake of cost optimization was not acceptable to NRLDC. Further, the O&M of the state system is the responsibility of STU/SLDCs and it would be needed for fault analysis and remedial action.
c. Operation hierarchy would be overreached if state data directly reports to RLDC instead of SLDCs. Cybersecurity concerns are also to be considered.

A.6.9 Director(SO), GRID-INDIA stressed the importance of PMU and stated the following:

a. PMU was a very good system and can be used for real-time monitoring of the power system. It would also be very useful for the assessment of system reliability and power system analysis. Hence, a few PMUs along with PDC at the Control centre in SLDC/STU should be installed at some locations in the intra-state network.

b. STU/SLDC would also need to ensure that data comes at their control centres so that a lot of analysis can be done using PMUs at the state level by utilizing the various features related to power system protection etc.

A.6.10 POWERGRID representative stated that existing PMUs will not be replaced, and the old PMUs will continue to function. However, if the Control Centres are not maintained under AMC and become obsolete, the PMUs will lose their operational utility. Therefore, States were advised to plan accordingly.

A.6.11 TCC forum was of view that proposal for ISTS portion may be approved.

<u>NRPC Deliberation</u>

A.6.12 NRPC forum noted the deliberation held in the TCC meeting and the Forum was in consonance of the same.

A.6.13 ***Decision of the Forum:***

I. *Forum technically agreed with the proposal for implementation of the URTDSM Phase-II Project (ISTS portion) on a pan-India basis, to be executed by POWERGRID under a cost-sharing mechanism via the 100% Regulated Tariff Mechanism (RTM) route, with a 70:30 Debt-Equity ratio, at a Detailed Project Report (DPR) cost of ₹1,124.00 crore.*

II. *STUs to discuss their requirement with POWERGRID bilaterally for inclusion in this project.*

A.7 Replacement of SCADA at various substations of POWERGRID, NR-2 under ADD-CAP (Agenda by POWERGRID)

<u>TCC Deliberation</u>

A.7.1 EE (C), NRPC apprised that the SCADA systems at various POWERGRID NR-2 substations are over seven years old and have reached the end of their useful life. The operating systems in these SCADA setups are outdated and not cyber security compliant. Additionally, these systems are facing numerous issues and require upgrades to ensure smooth operation and monitoring of the substations. A total of seven stations—Kaithal, Patiala, Amritsar, Ludhiana, Panchkula, Hamirpur, and Samba—are proposed for replacement.

A.7.2 POWERGRID informed that the substations at Ludhiana, Patiala, Kaithal, and Amritsar are equipped with conventional IEDs and SCADA systems that have completed their regulatory life of 15 years. For the Panchkula, Hamirpur, and Samba substations, the IEDs are based on BCU architecture. In the first category, both the IEDs and SCADA systems are proposed to be replaced, whereas in the latter category, only the SCADA systems are proposed for replacement. It was further noted that in both this case, the existing SCADA systems are Windows 7-based and are no longer supported.

A.7.3 On enquiry of members regarding cost estimates, POWERGRID informed that the estimated cost for replacing both the IEDs and SCADA in four substations and only SCADA in the remaining three is ₹15 crores.

NRPC Deliberation

A.7.4 NRPC forum noted the deliberation held in TCC meeting and the Forum was in consonance of the same.

A.7.5 Member (GO&D), CEA enquired whether the AMC component is included in the cost estimate. POWERGRID informed that the AMC component is not included in the cost estimate as the Substation SCADA is being maintained by POWERGRID itself.

A.7.6 ***Decision of the Forum:***

Forum technically agreed with the proposal for the replacement of both the IEDs and SCADA in four substations, namely Ludhiana, Patiala, Kaithal, and Amritsar and only SCADA in the remaining three substations, namely Panchkula, Hamirpur, and Samba.

A.8 Methodology for FOTE replacement/upgradation at ISTS substations (Agenda by CTUIL)

<u>TCC Deliberation</u>

A.8.1 EE (C), NRPC apprised that scheme for FOTE replacement for Alusteng, Drass, Kargil, Khalasti, Leh S/s approved in the 53rd TCC & 78th NRPC Meeting held on 16-17 March 2025.

Subsequently, CTU took up the scheme for approval in 33rd NCT Meeting held on 16th Sept'25, wherein followings deliberations were held.

"*This matter was again deliberated in a meeting held amongst CEA (PCD), CTU and POWERGRID on 09.07.2025 wherein it was discussed that these FOTE were originally procured under substation packages and are part of Substations. The treatment of replacement of these FOTE can be considered like other Substation elements as per CERC Tariff Regulation and TSPs are eligible to file for cost recovery before CERC, after RPCs approval. It was agreed in that meeting that in the matter of FOTE replacement / upgradation following philosophy can be adopted for future requirements:*

I. *For FOTE implemented under CTU-planned separate communication schemes (executed by POWERGRID or any TSP) - the replacement or upgradation of FOTE to be planned by CTU.*

II. *Replacement / Upgradation of FOTE supplied and installed under RTM substation project may be taken up directly by TSP to CERC after RPC approval for cost recovery.*

III. *Replacement / Upgradation of FOTE for the substation under TBCB project shall be taken care by TSP as per CERC regulations, during the lifetime of the project.*

NCT opined that there is modification in the proposal recommended by the RPC and advised CTU to approach NRPC with the modified proposal."

A.8.2 EE(C), NRPC secretariat requested forum to take a note the philosophy of FOTE replacement/ upgradation recommended in 33rd NCT meeting and apprised that the same philosophy will be followed henceforth.

In view of aforementioned revised philosophy, he requested forum to deliberate on whether POWERGRID needs to approach NRPC again with the proposal of replacement of FOTE at Alusteng, Drass, Kargil, Khalasti, Leh S/s, or in-principle approval could be accorded in this meeting itself since the scheme was already approved earlier by this forum in 78th NRPC meeting.

A.8.3 Members expressed the view that the approval accorded to CTU for replacement of these 5 nos. of FOTE, in 78th NRPC meeting, may deemed be accorded to POWERGRID in line with above methodology and POWERGRID may directly approach CERC for cost recovery.

<u>NRPC Deliberation</u>

A.8.4 NRPC forum noted the deliberation held in TCC meeting and Forum was in consonance of the same.

A.8.5 ***Decision of the Forum:***

I. *Forum noted the Methodology for FOTE replacement/upgradation to be adopted for all future scenarios as per minutes of 33rd NCT Meeting.*

II. *In accordance with the above methodology, Forum granted approval for the replacement of five FOTEs at the Alusteng, Drass, Kargil, Khalasti, and Leh substations. POWERGRID shall submit the proposal for FOTE replacement directly to CERC for cost recovery.*

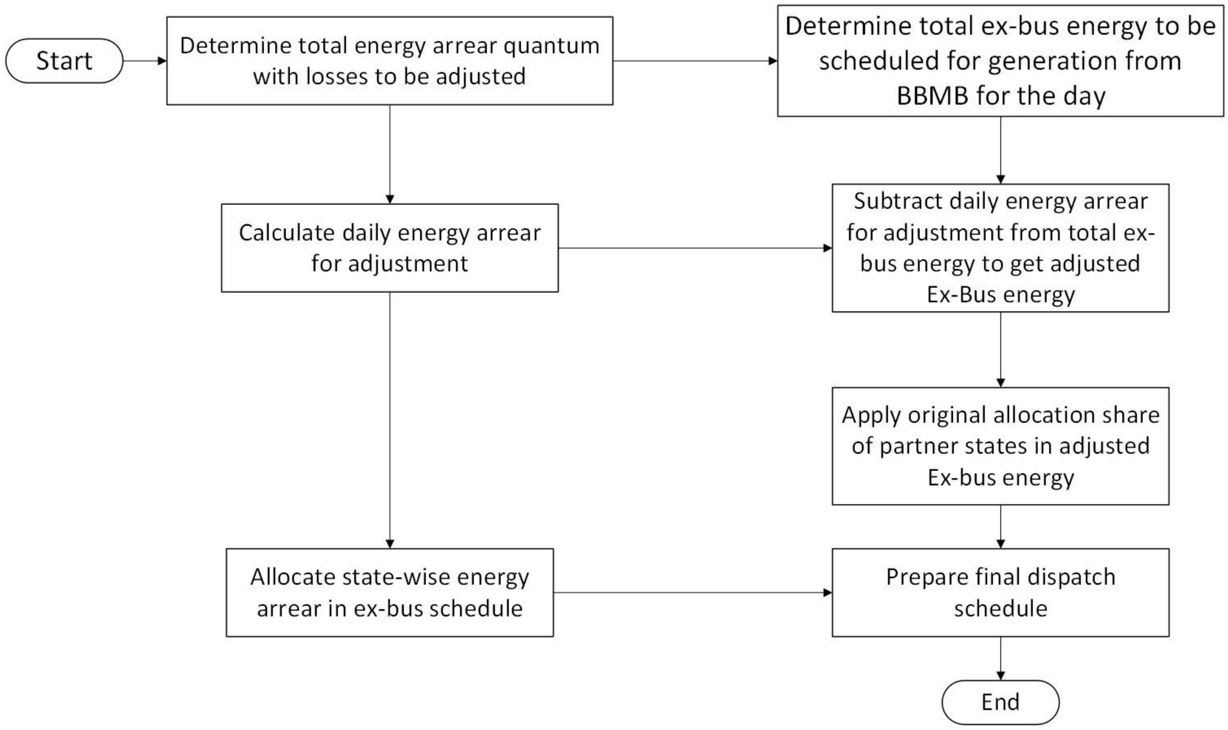
A.9 Energy accounting of Auxiliary consumption at Grid Substations of BBMB (agenda by BBMB)

<u>TCC Deliberation</u>

A.9.1 Representative of BBMB apprised that In compliance to CERC direction, BBMB has come under ABT mechanism w.e.f. 01.06.2016. Energy accounting of Auxiliary & Housing colony consumption at Grid Substations of BBMB prior to implementation of ABT in BBMB was being done as per the decision taken in 120th Commercial Sub-Committee of erstwhile NREB held on 22.11.2005 as described here: To account for this energy, due credit for the energy consumed at various substations was given to the respective states where substation is located, in their metered drawl by NRLDC/NRPC in the Regional Energy Accounts. This energy was treated as common pool consumption of Bhakra complex and was subtracted from the Ex-Bus energy sent out/scheduled from Bhakra Complex power houses before working out energy shares of partner states of BBMB in the Regional Energy Accounts (REAs) issued by NRPC secretariat.

A.9.2 Further, he apprised that in the meeting held at NRPC on 29.08.2016 to discuss modalities regarding scheduling, metering & energy accounting of BBMB under ABT, it was decided to discontinue earlier accounting procedure for auxiliary consumption (prior to 01.06.2016). It was further agreed that auxiliary energy consumption charges of BBMB grid substations would be borne by BBMB as per Tariff Regulations. Accordingly, DISCOMs, where BBMB S/s are located, started raising energy bills for S/s APC and S/s Colony consumption which has resulted in accumulation of huge energy arrears. This has resulted in accumulation of energy arrears to Punjab, Haryana, UT Chandigarh & Delhi.

A.9.3 Further, he apprised that in the 153rd Power Sub-committee (PSC) meeting of BBMB held on 11.07.2025, BBMB proposed to restore the earlier energy accounting procedure at BBMB grid substations prevalent before 01.06.2016 for adjustment of Auxiliary consumption in respect of energy arrears as well as current energy consumption by giving credit for the energy consumed at various substations to the respective constituents in their daily Scheduled allocation (by allocating additional energy in schedule allocation) by NRLDC/NRPC subject to consent from the partner states of BBMB. This energy will be subtracted from the Ex-Bus energy scheduled from Bhakra Complex power houses before working out the energy shares of partner States of BBMB. The BBMB partner states, gave their consent for the above energy accounting procedure for the adjustment of energy arrears of Auxiliary consumption at the BBMB grid substations, accumulated w.e.f. 01.06.2016 up to 30.04.2025. As regards the adjustment of Auxiliary energy consumption for the period 30.04.2025 onwards, all partner states except Haryana agreed. It was in decided in the 153rd PSC meeting that Haryana (UHBVNL) will take up the matter with their management for further decision and the same will be conveyed to BBMB accordingly, within fifteen days. The revised mechanism of adjustment of Auxiliary energy consumption is illustrated in the following flow chart:



A.9.4 The quantum of energy arears (in kWHr) of partner states accumulated w.e.f. 01.06.2016 to 30.04.2025 at respective Substations is as tabulated below:

S No.	Partner State/Utility	Energy Arrear Quantum without losses (in kWHr)
1.	Punjab	1,34,57,545
2.	Haryana	3,60,96,234
3.	UT of Chandigarh	9,52,082
	Total	5,05,05,861

A.9.5 BBMB proposed that all pending energy arrears worked out up to 30.04.2025 may be adjusted in daily Scheduled allocation of respective constituent state over the period of one year. Auxiliary energy consumption at BBMB Grid S/s of Delhi will be taken up with Delhi separately by BBMB; and

BBMB further apprised that decision of Haryana for adjustment of energy consumption for period 01.05.2025 onwards is awaited.

A.9.6 ED, NRLDC enquired whether the energy arrear up to 30.04.2025 have been agreed by the partner states. It was also advised that BBMB route the proposal through NRPC secretariat. He further informed that mechanism of adjustment of Auxiliary energy may be executed through the special provisions been made in WBES for BBMB. BBMB replied that all partners states have agreed on the quantum of 50.50 MUs without losses and 52.5 MUs with losses and the quantum will not be changed throughout the year.

A.9.7 Members agreed to the proposal of revised mechanism of adjustment of Auxiliary energy consumption at BBMB Grid S/s in Punjab, Haryana, and UT of Chandigarh for clearing energy arrears of approx. 50 LU worked out upto 30.04.2025.

A.9.8 Members opined that for if BBMB works out any similar mechanism of adjustment for the period 01.05.2025 onwards, it may do so with approval from its partner states in BBMB board meeting or its PSC and convey its decision to NRPC secretariat for implementation.

NRPC Deliberation

A.9.9 NRPC forum noted the deliberation held in TCC meeting and the Forum was in consonance of the same.

A.9.10 On enquiry of members, BBMB informed that the adjustment will be done on a monthly basis if consent comes from Haryana.

A.9.11 Member (GO&D), CEA emphasized that Haryana should not make further delay its consent; otherwise, again, arrears would accumulate. He opined that if Haryana does not submit its decision for similar mechanism proposed by BBMB for the adjustment period 01.05.2025 onwards within a month, the consent of Haryana should be deemed granted.

A.9.12 ***Decision of the Forum:***

I. *Revised mechanism of adjustment of Auxiliary energy consumption at BBMB Grid S/s in Punjab, Haryana, and UT of Chandigarh, as described above, for clearing energy arrears of approx. 50 LU worked out up to 30.04.2025 was approved. BBMB may work out energy arrears, including applicable losses and convey its decision to the NRPC secretariat for implementation.*

II. If Haryana does not submit its decision for the similar mechanism proposed by BBMB for the adjustment period 01.05.2025 onwards within a month, the consent of Haryana may be deemed granted.

A.10 Transmission Scheme for Rajasthan REZ Ph-IV (Part-6: 6GW) (Bikaner Complex) (agenda by CTUIL)

<u>Transmission Scheme</u>

A.10.1 CTU representative apprised that a Transmission scheme has been evolved for the evacuation of 6GW RE power from Bikaner complex (Bikaner V PS) in Rajasthan to various load centres of the Northern Region.

A.10.2 Earlier, an HVDC system was planned from Bikaner-V PS to Begunia (Odisha in ER) to meet the demand of Green Hydrogen (GH) in Paradeep and Gopalpur areas. However, due to non-receipt of adequate applications from Green Hydrogen developers in Odisha as well as upcoming thermal generations in ER, power transfer requirement from RE pockets of Rajasthan to Odisha in ER is presently not envisaged in 2028-29 timeframe.

A.10.3 CTU informed that in the CEA meeting held on 19.12.24 under the Chairmanship of Chairperson, CEA to discuss the planning of transmission system for RE potential zones in Rajasthan, it was stated that that power from RE generators can now be evacuated only through HVDC System as power has to be brought outside Rajasthan for consumption in other States and the distance of RE potential zones in Rajasthan to the border of neighbouring states is more than 600-700 km. In the meeting, Chairperson, CEA, stated that some RE capacity which could be evacuated through the AC system needs to be explored as the EHVAC system could be completed in 2-3 years, whereas HVDC system would take 5-6 years.

A.10.4 Considering all the above aspects, an EHVAC system has evolved from Bikaner-V PS to various load centres in NR. The broad feature of the scheme is as under:

a. For evacuation of 6GW RE power from Bikaner V PS on EHVAC system, which will take a lesser implementation time than HVDC system

b. Resolve the issue of critical loading of 765kV Bikaner-Moga D/c line as well as the issue of higher angular separation (>20 degree) under N-1/N-1-1 contingency

c. Resolve the issue of critical loading of 765kV Aligarh-G. Noida line

d. Provide supply to Mohali region to resolve the power deficit situation in Punjab based on the request of PSTCL. This will also improve ATC/TTC limits of Punjab.

e. Feed the RE power to new load centres of Punjab, Delhi and UP to cater the future load demand

f. Feed the RE power to Greater Noida complex as suggested by UPPTCL

A.10.5 The scheme comprises EHVAC system with establishment of Bikaner-V PS along with LILO of one double ckt of 400kV Bikaner II PS- Khetri (Twin HTLS) 2xD/c line at Bikaner-V PS. For dispersal of power establishment of Pallu S/s & Panipat S/s,765 kV Bikaner-V PS – Pallu-Panipat 2xD/c line, 400 kV Pallu – Hanumangarh (RVPN) D/c line & LILO of both ckts of 765kV Bikaner – Moga D/c line at Pallu S/s is proposed. Further, for onward evacuation of power in Punjab, the establishment of 400kV Mohali S/s along with Lilo of one circuit of 400kV Patiala-Panchkula D/c line at Mohali & 400 kV Panipat S/s – Mohali D/c line is proposed. Further, 400 kV Panipat S/s – Mandola D/c line is proposed to meet the demand of Delhi. For onwards evacuation of power in Uttar Pradesh, establishment of 765kV Bulandshahr S/s, 765kV Lucknow-II S/s & Asana S/s along with 765kV Bulandshahr – Lucknow-II – Asana D/c line & LILO of 765kV Aligarh – Gr. Noida line at Bulandshahr S/s, 765kV Bulandshahr - Noida sec-148, 400 kV Lucknow-II – Gonda D/c line, LILO of both ckts of 400kV Varanasi – Biharsharif D/c line at Asana S/s & LILO of both ckts of 400kV Balia – Patna D/c line is proposed. As part of the scheme, STATCOM is also proposed at Bikaner-V PS and space for SynCon/STATCOMs shall be kept a part of the future scope on various intermediate substations.

A.10.6 Studies were carried out in 2029-30, time frame in various scenarios (solar maximized, evening peak and night off-peak scenarios). Study files were circulated on 29.07.25. To deliberate on above proposal, joint study meeting was held on 18.08.25 with all stakeholders. Grid-India vide their mail 11.08.25 provided their observations on studies as well as on the transmission scheme. Major observations of Grid-India is as under:

S.No.	Grid India observation	CTU reply/ measures to be taken
1	Severe low voltage issue in NR Grid in Solar maximized scenarios	Separate network studies to be carried out by CTU in consultation with CEA and Grid India

2	High fault level on Various substation in Rajasthan	
3	Higher angular separation in 400kV Kishenpur -Moga D/c line in N-1 contingency	Feasibility of upgradation of 400kV Kishenpur Moga at 765kv level is being carried out in future planning studies with envisaged hydro generation in J&K and solar injection at Moga.
4	Planning of dynamic compensation as part of scheme.	Incorporated as part of present and future scope
5	High loading on 400kV Agra (PG)-Agra (UPPTCL) line	Based on loading data, reconductoring proposal for 400kV Agra (PG)-Agra (UPPTCL) line will be taken up in CMETS-NR meeting.
6	N-1 violation issues pertaining to Intra State lines/ICTs (STU network) in NR (Details enclosed in agenda)	STUs may take remedial measures for identified STU lines/ICTs which are under N-1 violation.
7	Overloading of some of the 400/220kV ICTs and 220kV lines (breaching thermal limit in N-1 scenarios) • N-1 noncompliance issues at Kankroli, Bhinmal and Chittorgarh S/s • Stability issue on opening of 400kV Jodhpur (Surpura) – Kankroli Line	High loading & stability issue is observed due to nearby PSP generators for which system is yet to be planned by RVPN. Loadings will be reviewed for Chittorgarh ICTs (Banswara) which is under approval by RVPN
8	Overloading of 400kV Bikaner-Sikar D/c line in planning files	proposal will be examined with all possible alternatives and will be deliberated in discussion with CEA, Grid-India and RVPN.
9	N-1 non-compliance of Ramgarh 765/400kV ICTs, 400kV Bhiwani (PG) – Bhiwani line (On opening of Bhiwani-Moga line) and high loading of 400/220kV Saharanpur ICT	ICT augmentation at Ramgarh S/s is taken up in ensuing CMETS-NR meeting whereas ICT augmentation at Saharanpur S/s shall be taken up after reviewing the real time loading data and approval of Leh RE park scheme (5GW). Regarding 400kV Bhiwani (PG) – Bhiwani line, CTU will examine the loading and take up the suitable measures

A.10.7 The comprehensive scheme was agreed in 40th CMETS-NR meeting held on 12.09.25 and 47th CMETS-ER meeting held on 30.09.25.

A.10.8 Tentative timeframe of scheme: 24 months from SPV transfer with an estimated cost: Rs 27,000 Cr.

TCC Deliberation

A.10.9 NRLDC had following observations on the said Transmission scheme:

a. Severely high fault levels at some of the buses such as BIKANER-3 (91kA), Khuskhera (70kA), Bhiwadi(70kA), Bikaner-IV (72kA), Rampura Tonk (71kA).

b. Severe low voltages foreseen which require planning at STU levels so that power factor for drawl from ISTS remains in range of +/-0.95.

c. RRVPNL may take care and implement its planned transmission network in matching timeframe including for 13GW RE as agreed earlier.

d. Upgradation of Kishenpur-Moga corridor may be expeditiously planned along with augmentation requirement of 765/400kV Moga ICTs (bus-split operation).

A.10.10 NRLDC stated that CTU informed during the CMETS-NR meeting that all the issues highlighted by GRID-INDIA would be addressed progressively and that appropriate remedial measures would be implemented so these solutions remain in matching timeframe of transmission scheme.

A.10.11 CTU stated that studies for reactive compensation and high loading of ISTS lines as well as higher angular separation (Kishenpur-Moga) are undergoing. Studies for high short circuit levels will be carried out in next 1-2 months after receipt of data.

A.10.12 CTU stated that applications have already been received for RE Bikaner-V totaling 6 GW, with a scheduled completion in 2027–28. The proposal has been submitted for technical approval and will subsequently be forwarded for ERPC approval.

A.10.13 MS, ERPC stated that a comprehensive scheme may be submitted by CTU, as the present scheme has implications for the Eastern region also.

A.10.14 CTU requested to grant technical approval for the NR region so that the same can be taken up in NCT for approval. For ER portion, it will be discussed separately in the ERPC forum.

A.10.15 MS, ERPC stated that this scheme has been presented for the first time and there was not sufficient time for detailed deliberation, as it was only recently discussed in the OCC meeting of ERPC. Therefore, additional time is required to assess the entire scheme.

A.10.16 CTU stated that the scheme had already been discussed with Eastern Region constituents during the CMETS-ER meeting; however, it can be discussed again with ERPC any required modifications can be discussed before submission to the NCT. Furthermore, any delay in approving the transmission system will further constrain RE generation, which is already an issue in the current scenario.

A.10.17 TCC Forum asked CTU to review the scheme by taking into account the observations of GRID-INDIA and MS, ERPC and to submit a comprehensive proposal at the earliest possible timeframe.

OPGW Requirement

A.10.18 Regrading, OPGW requirement, representative of CTUIL explained that in the proposed transmission scheme, LILO of the following transmission lines is proposed on the upcoming ISTS substations namely: Bikaner-V, Pallu, Mohali, Bulandshahr, Asana S/s.

a. LILO of one D/c of 400 kV 2 X D/c Bikaner-II – Khetri at 765/400 kV Bikaner-V S/s
b. LILO of both ckt of 765 kV D/c Bikaner- Moga at 765/400 kV Pallu S/s
c. LILO of one circuit of 400 kV Patiala – Panchkula at 400/220kV Mohali S/s
d. LILO of 765kV Aligarh – Gr. Noida line at 765 kV Bulandshahar S/s
e. LILO of both ckts of 400kV Balia – Patna D/c line at 765/400 kV Asana S/s
f. LILO of both ckts of 400kV Varanasi – Biharsharif D/c line at 765/400 kV Asana S/s

A.10.19 CTUIL informed that as per the database available with CTU and inputs from UNMS, OPGW is available on the following lines:

a. 400 kV 2 X D/c Bikaner-II – Khetri
b. 765 kV D/c Bikaner- Moga
c. 400 kV Patiala – Panchkula
d. 765kV Aligarh – Gr. Noida
e. 400kV Balia – Patna D/c line

A.10.20 However, OPGW is not available on the Varanasi - Biharshariff line. A comprehensive scheme for the installation of OPGW for all the ISTS lines where OPGW is not available is already under the finalization by CTU. In principle, approval of the same was accorded in the 55th TCC & 80th NRPC held on 17-18.07.2025. OPGW on 400kV Varanasi – Biharsharif D/c line is already considered under the Comprehensive scheme for installation of OPGW. Therefore, a separate scheme for this OPGW requirement is not proposed. CTU informed that this shall become part of the “Comprehensive scheme for installation of OPGW on existing ISTS lines”.

A.10.21 Forum noted the information for the OPGW requirement.

<u>NRPC Deliberation</u>

A.10.22 Member (GO&D), CEA emphasized that the timely execution of the transmission system is of prime importance. It was suggested that, since the scheme involves both the NR and ER, it should be referred to Member (Power System), CEA, and a meeting should be convened with all stakeholders—including CEA and GRID-INDIA—so that the technical aspects can be appropriately addressed.

A.10.23 He also stated that, the reasons discussed in the TCC meeting, the same may also deliberation with Member (PS), CEA is necessary so that the entire planning exercise can be carried out holistically.

A.10.24 Member (GO&D),CEA advised CTU to schedule a meeting within the next two weeks to discuss the scheme, including discussions with NR and ER constituents if required. The proposal should be taken up in advanced mission mode and not be held until the next RPC meetings. It should be submitted for final approval of the NCT within one month.

A.10.25 ***Decision of the Forum:***

I. *Forum advised that a separate meeting under Member (Power System), CEA may be convened within next two weeks by CTU along with concerned stakeholders and the outcome of the meeting shall be discussed at NRPC/ERPC forum before taking it to the NCT meeting.*

II. *CTU and STU may do necessary studies & take up corrective measures in matching timeframe of the proposed scheme to address the observation raised by GRID-INDIA.*

A.11 Submission of protection performance indices of 220 kV and above system, along with reason and corrective action taken for indices less than unity to NRPC Secretariat monthly basis (Agenda by NRPC Secretariat)

<u>TCC Deliberation</u>

A.11.1 EE(O), NRPC apprised that as per clause 15 (6) of IEGC 2023;

- *Users shall submit the following protection performance indices of previous month to their respective RPC and RLDC on monthly basis for 220 kV and above (132 kV and above in NER) system, which shall be reviewed by the RPC:*

  a) *The **Dependability Index** defined as* $D = Nc/Nc{+}Nf$

  b) *The **Security Index** defined as* $S = Nc/Nc{+}Nu$

  c) *The **Reliability Index** defined as* $R = Nc/\ Nc{+}Ni$

  where,

  Nc is the number of correct operations at internal power system faults,

  Nf is the number of failures to operate at internal power system faults,

  Nu is the number of unwanted operations,

  Ni is the number of incorrect operations and is the sum of Nf and Nu

- *Each user shall also submit the reasons for performance indices less than unity of individual element wise protection system to the respective RPC and action plan for corrective measures. The action plan will be followed up regularly in the respective RPC.*

A.11.2 Further, he added that in earlier PSC meeting, it was decided that each utility shall submit the performance **indices of previous month by 7th day of next month.**

A.11.3 Accordingly, the status of the indices reported for the month of June, July, August & September 2025 is attached as **Annexure-A.I**.

A.11.4 It was observed that several utilities have not been complying and have not shared the protection performance indices. Forum acknowledged the same.

A.11.5 NTPC representative ensured that protection performance indices will be shared as per the timeline.

A.11.6 MS, NRPC emphasized that the calculation of protection performance indices must be carried out by the utilities as per IEGC. She mentioned that discussing events causing indices to fall below unity has been found helpful. Therefore, she requested all utilities to share the protection performance indices on a monthly basis for the 220 kV and above system.

A.11.7 MS, NRPC added that each utility may nominate a nodal officer for reporting protection performance indices and provide other protection-related inputs to ensure compliance with the Protection Code of IEGC 2023, as already requested by the NRPC Secretariat vide letter dated 25.09.2025.

A.11.8 AEE (P), NRPC highlighted that utilities should adhere to the timeline of sharing performance indices so that the same may be discussed in the monthly held protection sub-committee meeting.

A.11.9 Further, reporting of performance indices from RE plants was discussed and it was highlighted that agenda has been discussed in RE Sub-Committee meeting to raise awareness on the matter.

A.11.10 MS, NRPC stated that a letter may be sent to the concerned RE plants requesting them to share the Protection Performance Indices within the stipulated time.

<u>NRPC Deliberation</u>

A.11.11 NRPC forum noted the deliberation held in TCC meeting and Forum was in consonance of the same.

A.11.12 Member GO&D, CEA emphasized that protection plays a crucial role in grid operations. Therefore, all utilities must ensure necessary compliance as per IEGC, 2023.

A.11.13 ***Decision of the Forum:***

I. *Utilities were asked to submit the Protection performance indices timely by 7th day of the month, element-wise, along with corrective action taken for indices less than unity.*

II. *A letter may be sent to the concerned RE plants for sharing the Protection Performance Indices within the stipulated time.*

A.12 Annual protection audit plan for FY 2026-27 (Agenda by NRPC Secretariat)

TCC Deliberation

A.12.1 EE(O), NRPC apprised that as per clause 15 of IEGC 2023;

I. *Annual audit plan for the next financial year shall be submitted by the users to their respective RPC by 31st October. The users shall adhere to the annual audit plan and report compliance of the same to their respective RPC.*

In view of the above, all utilities need to submit the annual protection audit plan for FY-2026-27 latest by 31st October 2025.

A.12.2 MS, NRPC highlighted that, as per IEGC 2023, utilities are required to conduct an annual internal protection audit and prepare the corresponding plan accordingly.

A.12.3 Based on reporting from utilities, the status of the Annual Protection Audit plan for FY 2026-27 is enclosed as **Annexure-A.II.**

A.12.4 Accordingly, utilities are requested to submit their annual audit plans at the earliest. Further, all utilities should adhere to the finalized protection audit plan and ensure the timely completion of the audit.

A.12.5 Forum asked utilities to share the substation-wise internal protection audit plan, having list of all of their substations for FY 2026-27 latest by 31st October 2025.

NRPC Deliberation

A.12.6 NRPC forum noted the deliberation held in TCC meeting and Forum was in consonance of the same.

A.12.7 ***Decision of the Forum:***

Utilities were asked to submit the substation-wise internal protection audit plan having list of all of their substations for FY 2026-27 latest by 31st October 2025.

A.13 Third-party protection audit plan (Agenda by NRPC Secretariat)

TCC Deliberation

A.13.1 EE(O), NRPC apprised that as per clause 15 of IEGC 2023:

All users shall also conduct third party protection audit of each sub-station at 220 kV and above (132 kV and above in NER) once in five years or earlier as advised by the respective RPC.

A.13.2 In view of the above, third-party audit plans submitted by utilities and audit status have been compiled (enclosed as **Annexure-A.III**).

A.13.3 It was also informed that, as decided in the 58th PSC meeting, two different states may conduct mutual third-party audits.

A.13.4 Further, based on the received inputs in PSC meetings, a third-party protection auditor has been planned as below-

Organization where audit is to be done	Organizations finalized for performing audit								
	DTL	RVPN	HVPN	UPPTCL	PSTCL	HPPTCL	PTCUL	POWERGRID	External Vendor
DTL	-	-	-	-	✓	-	-	-	-
RVPN	-	-	✓	-	-	-	-	-	-
HVPN	-	✓	-	-	-	-	-	-	-
UPPTCL	-	-	-	-	-	-	-	-	ERDA
PSTCL	✓	-	-	-	-	-	-	-	-
HPPTCL	-	-	-	-	-	-	-	✓	-
PTCUL	-	-	-	-	-	-	-	-	CBIP
UT of J&K	-	-	-	-	-	-	-	✓	-
UT of Ladakh	-	-	-	-	-	-	-	✓	-
UT of Chandigarh									
POWERGRID	-	-	-	-	✓	✓	-	-	✓

A.13.5 PSTCL representative informed that PSTCL is unable to conduct third-party protection audits for DTL and POWERGRID due to a shortage of protection manpower. However, he proposed that DTL could conduct third-party protection audits of PSTCL substations on a payment basis.

A.13.6 DTL representative conveyed that the matter has just come to their notice and needs to be discussed with the protection team; they will provide an update accordingly.

A.13.7 MS, NRPC emphasized that utilities should plan third-party protection audits so that each substation is audited by an external party once every five years. Based on the audit reports, utilities should address the observations and report the corrective actions taken to the NRPC Secretariat.

A.13.8 SE (O), NRPC requested that utilities include the date of the previous third-party protection audit when submitting the substation-wise plan for the next audit.

<u>NRPC Deliberation</u>

A.13.9 NRPC forum noted the deliberation held in the TCC meeting and the Forum was in consonance of the same.

A.13.10 ***Decision of the Forum:***

Utilities were asked to submit the third-party protection audit plan along with date of the previous third-party protection audit. Subsequently, the audit reports along with compliance status may be submitted to the NRPC Secretariat within one month of completion of the audit.

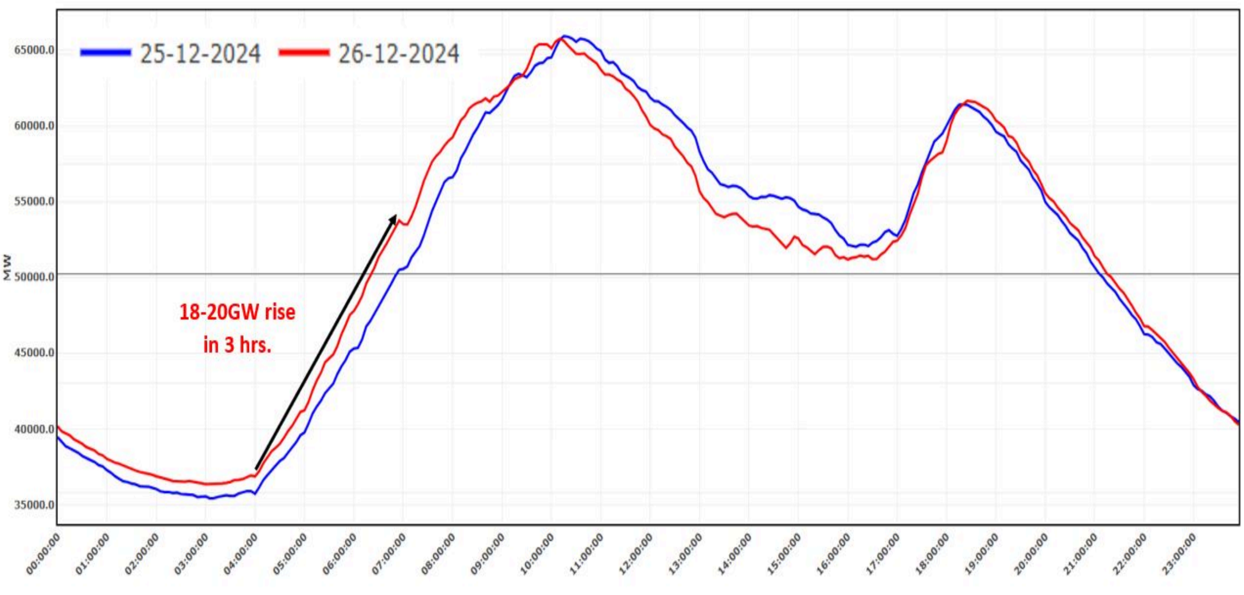
A.14 Winter Preparedness 2025-26 (Agenda by NRLDC)

<u>TCC Deliberation</u>

A.14.1 NRLDC representative stated that winter in Northern region usually begins from mid of October till February end, and the challenges faced during these months are well known to all the utilities. During winter, the demand of NR states except Rajasthan and hilly states is on the lower side. With decreasing temperatures and festivals, onset of winter also brings some severe challenges to NR grid operators. High ramp rate in demand during morning peak and evening peak is being observed which is likely to get further steeper.

i) Load-generation balance (Action by SLDCs/ NRLDC)

A.14.2 Typical regional demand pattern of NR for a winter day is shown below:



A.14.3 Measures to be taken by utilities to manage load generation balance during winter months as discussed during previous many meetings are mentioned below:

a. Forecast of demand ramp has also become important especially with increasing penetration of solar generation, and so SLDCs are advised to forecast load ramping so that commensurate ramping of generation can also be planned.

b. Minimize generation to technical minimum as per IEGC guidelines /CERC directions during low demand.

c. Co-ordination of ramping of generation during morning & evening peak ramping.

d. Optimum utilization of Hydro resources for meeting peak hour demand.

ii) High voltages in grid (Action by all utilities)

A.14.4 NRLDC stated that another big challenge with decrease in demand, is the high voltages observed in the grid. With NR load reducing significantly, the lines become lightly loaded and are generating MVAR most of the time leading to high voltages in grid. Moreover, with heating loads across most of the NR states the power factor also is improved minimizing any reactive power requirement from the grid.

To overcome this challenge following measures are reiterated for TCC/NRPC members:

a. Ensuring to switch off capacitors & switch on reactors.

b. Ensuring healthiness of all commissioned reactors in the system

c. Monitoring of reactive power through SCADA displays.

d. Reactive power support (absorption) by generating stations as per the capability curve.

e. Synchronous condenser operation of hydro units (Tehri HEP, Tehri PSP Chamera-2, Pong, RSD) during night hours for dynamic voltage support.

f. ICT Tap Optimization at 400kV & above is carried out by NRLDC. Same exercise needs to be carried out by SLDCs at 220kV & below levels.

A.14.5 NRLDC highlighted that even after taking all necessary measures for voltage control as available with NRLDC including opening of 50-60 EHVAC lines to control high voltages, high voltage issues are observed in NR grid.

Accordingly, TCC forum advised that any planned commissioning of bus reactors may be expedited before winter 2025.

iii) Plan for winter preparedness (Action by SLDCs)

A.14.6 NRLDC mentioned that following actions are being taken at their end for controlling high voltages in the grid. To avoid frequent opening of lines, following instructions are given to avoid over voltages in the system.

a. The bus reactors are switched in.
b. The manually switchable capacitor banks are taken out.
c. The switchable line/tertiary reactor are taken in.
d. Optimized the filter banks at HVDC terminal.
e. All the generating units on bar are advised to absorb reactive power within the capability curve.
f. Reduced power flow on HVDC terminals so that loading on parallel EHV network goes up resulting in drop in voltage.

A.14.7 After exhausting all the above stated resources, in the last resort, lightly loaded lines were opened and priority was given to the lines which have switchable line reactor, so that their line reactors(L/R) can be converted to bus reactors(B/R) to contain the overvoltage.

A.14.8 CGM (SO), NRLDC stated that MVAR Support from State sectors as per the capability curve of units will facilitate in maintaining grid voltages. Philosophy has also been discussed in PSC meetings.

A.14.9 ED, NRLDC highlighted that monitoring of MVAR support at SLDC with display should be there so that further follow up with plants not providing VAR support can be taken up.

A.14.10 MS, NRPC advised all SLDCs and STUs to provide support as per the capability curve.

A.14.11 High Voltage observed in DTL in Winters owing to low demand in night hours, Cable network in transmission and distribution network further injects high MVAR to the grid to the tune 1000-1200 MVAR.

A.14.12 CGM (SO), NRLDC, enquired about DTL's future plans for voltage management. DTL responded that they plan to install bus reactors at Peeragarhi and Harsh Vihar substations.

A.14.13 DTL informed that they have been facing difficulties in receiving bids for reactors, similar to the challenges experienced in transformer procurement, with tenders being repeatedly extended. If bids are received, the procurement process will be initiated.

DTL reported that received only one bid for bus reactor installation at a 400 kV substation and no bids have been received for 220 kV substations. DTL plans to revise the tender conditions to ensure successful bid submission in the future.

A.14.14 CGM (SO), NRLDC, also mentioned that Delhi's demand drops to around 2,500 MW during night hours, which is about one-third of the day's peak demand. Due to the extensive network of cables in transmission and distribution, voltages become very high. To control overvoltage, NRLDC operators have to open a large number of transmission lines, yet high voltages persist. DTL should actively pursue the installation of reactors. The pending bus-reactors in Delhi have been highlighted by NRLDC over the past 4–5 years.

A.14.15 He also mentioned that opening a large number of transmission lines weakens the network. Transmission utilities, including DTL, should take immediate steps to install voltage-controlling devices in their control areas. Utilities are observed to incur high reactive power charges during the winter months, and the installation of shunt reactors would help reduce these charges.

A.14.16 MS, NRPC also requested DTL to take the necessary corrective measures regarding the NITs, as the issue of reactor installation has been pending for an extended period.

A.14.17 Director (SO), GRID-INDIA, stated that additional studies should be conducted in light of the changing network and future projections, so that necessary actions can be planned and implemented at the planning stage itself.

A.14.18 DTL informed that new sub-stations are being planned along with the bus-reactors.

A.14.19 MS, NRPC, also advised SLDCs to coordinate with generators in their control areas during state OCC meetings and instruct them to provide MVAR support according to the capability curve of running units, based on system requirements.

A.14.20 **TCC forum advised to take following measures:**

I. *SLDCs to carry out tap change exercise at 220kV and below voltage level. NRLDC will also be studying the voltage profile of 400/220kV substations in NR in winters.*

II. *SLDCs to coordinate with generators in their control areas during state OCC meetings and instruct them to provide MVAR support according to the capability curve of running units, based on system requirements.*

III. *DTL to take the necessary corrective measures regarding the NITs, as the issue of reactor installation has been pending for an extended period. Additional studies should be conducted in light of the changing network and future projections*

iv) EHV line trip during fog/Smog (Action by transmission line owners)

A.14.21 NRLDC mentioned that that one more challenge during winter months is tripping of EHV lines due to fog. With low temperature across Northern region and sometimes with high humidity in the air, fog starts to appear across Northern region. This problem is generally most severe from 15Dec- 15Feb period. During this time additional care need to be taken by system operator as many multiple element tripping events have been reported in the past especially in Punjab and Eastern UP. Following lines tripped on two or more occasions during Dec-Jan months of last 2 winter seasons between 21:00hrs-11:00hrs

Name of line	Owner	2023-24	2024-25
220 KV RAPS_A(NP)-Sakatpura(RS) (RS) Ckt-2	RRVPNL	12	7
400 KV Agra-Unnao (UP) Ckt-1	UPPTCL	8	2
220 KV RAPS_B(NP)-Sakatpura(RS) (RS) Ckt-1	RRVPNL	10	4
220 KV Ratangarh(RS)-Sikar(PG) (PG) Ckt-1	POWERGRID	5	2
220 KV Debari(RS)-RAPS_A(NP) (RS) Ckt-1	RRVPNL	6	9
220 KV Agra(PG)-Bharatpur(RS) (PG) Ckt-1	POWERGRID,RRVPNL	2	8
220 KV RAPS_A(NP)-Sakatpura(RS) (RS) Ckt-1	RRVPNL	9	14
400 KV Noida Sec 148-Noida Sec 123 (UP) Ckt-1	UPPTCL	2	4
220 KV RAPS_B(NP)-Debari(RS) (PG) Ckt-1	POWERGRID	2	2
400 KV Indirapuram-Noida Sec 123 (UP) Ckt-1	WUPPTCL	2	2
220 KV Sahupuri(UP)-New Karamnasa (BS) (BSEB) Ckt-1	BSEB	2	4
220 KV Duni(RS)-Kota(PG) (RS) Ckt-1	RRVPNL	2	2
132 KV Dehar(BB)-Kangoo(HP) (HPPTCL) Ckt-1	HPPTCL	2	5
220 KV RSVPL_SL_FTHG3_PG-Fatehgarh_III(PG) Ckt-1	POWERGRID	2	4
220 KV Agra(PG)-Kirawali(UP) (PG) Ckt-1	POWERGRID,UPPTCL	2	2
220 KV Fatehgarh_II(PG)-ASEJOL_HB FTGH2	ASEJOL	2	2

(ASEJOL) Ckt-1			
132 KV Khatima(UK)-Pilibhit(UP) (PTCUL) Ckt-1	PTCUL	2	4

A.14.22 RRVPNL informed that disc insulators have been replaced with polymer insulators in the fault-prone area in 220 KV RAPS-Sakatpura line.

A.14.23 NPCIL representative raised the issue of frequent tripping of 220 RAPS-Debari line, as the line is also part of islanding scheme. In reply, RRVPNL representative informed that with commissioning of ICT at Chittorgarh and restriction of load up to 90 MW, tripping is expected to be minimized.

A.14.24 It is being seen that there is higher number of tripping in lines passing through UP and Rajasthan as compared to Punjab and Haryana. These tripping were also discussed in past OCC and protection subcommittee meetings, wherein actions being taken at utility end were also discussed.

TCC forum asked all concerned transmission licensees to ensure:

I. *Priority wise cleaning & replacement is carried out. Priority to be given to the lines that have historical record of tripping during foggy weather.*

II. *Progress on cleaning replacement of porcelain insulator with polymer insulator to be monitored and latest status may be furnished to NRPC/NRLDC. NRLDC will also try and prioritize shutdowns for crucial lines having past instances of tripping during foggy weather.*

v) Ensuring protection settings as approved by NRPC (Action by all transmission & generating stations)

A.14.25 During winter months, it has been observed that there is frequent tripping of ICTs on overflux and lines on overvoltage especially in Punjab and Haryana areas. On number of occasions, it is seen that utilities are correcting their protection settings after tripping events. It is important all the protection settings are as approved by NRPC.

<u>**NRPC Deliberation**</u>

A.14.26 Director(SO), GRID-INDIA emphasized on the following issues to be taken care of by the utilities in view of the upcoming Winter season:

i) If insulators have not been planned to be replaced in the fog tripping prone area, then washing of insulators must be taken up on priority in November and early December. Even re-washing may be required.
ii) Also, utilities which have given contract for the above work for the upcoming winter season should also follow up the same on priority.
iii) Further, high ramping requirement in morning hours is observed due to heating load and therefore more commitment of thermal units on bar would be required. In case of requirement of frequency control, the same can be done through hydro generation considering its high ramping abilities.
iv) Also, due to fog conditions solar generation may not come up to the desired levels during morning hours and mismatch in generation availability may lead to constituents resorting to load shedding. It was advised to keep some extra thermal generation on bar to mitigate these challenges.

A.14.27 ***Decision of the Forum:***

Forum noted the deliberation held in TCC meeting and Forum was in consonance of the same. Constituents agreed to take necessary measures for Winter preparedness as deliberated in the meeting for safe and reliable grid operation in the upcoming Winter season.

A.15 Critical Operation of Rajasthan Grid during upcoming winter season (Agenda by NRLDC)

A.15.1 Issues related to grid operation in Rajasthan state control area have been highlighted from NRLDC side in last several OCC/TCC/NRPC meetings. It is to be noted that such issues get aggravated during winter months when agricultural demand in state is on the higher side. Several issues were encountered in Rajasthan control area during last winter season. The major issues in Rajasthan transmission network include:

i) Augmentation in transformation capacity of 11 number of the intra-state stations to meet the increased drawl and RE absorption requirements. List is mentioned subsequently.

ii) Upgradation of terminal equipment at 07 no. intrastate substations could be carried out so as to make them commensurate with the line capacity. This will ensure optimal utilization of the intra-state transmission system.

iii) Augmentation of intrastate transmission network for relieving the constraints (power flow and voltage) and improving reliability. Necessary strengthening to relieve 220 kV Bassi (PG)-Sikar (RRVPN), 220 kV Kankroli (PG)-Kankroli(RRVPN), Kankroli (PG)-Amberi (RRVPN), Sikar (PG)-Dhod(RRVPN), Bhiwadi (PG)-Khuskhera (RRVPN) etc. may be planned and implemented on priority.

iv) Augmentation of shunt compensation capacity near load centres like Bikaner, Jodhpur, Kankani, Merta, Hindaun, Alwar etc. to improve the voltage profile as well as reduce transmission losses.

ICTs MW drawl, MVAr drawl, Power factor and S/s voltage for Solar hours (10:00-14:00hrs) for Rajasthan Control area (01-08 Dec 2024)					
400/220 Sub-Station ICTs	ICTs Capacity (MVA)	MW Drawl	MVAr Drawl	Power factor	Voltage(kV)
Bikaner (RVPN)	2*315	100-300	150-300	0.40-0.65	375-390
Jodhpur (RRVPN)	2*315	400-500	200-300	0.85-0.90	375-385
Kankani (RRVPN)	(315+500)	500-700	200-300	0.87-0.90	370-385
Merta (RRVPN)	2*315	400-500	200-250	0.85-0.89	380-395
Bhinmal (PG)	2*315	500-600	200-300	0.87-0.90	360-370

v) Enforcement of adequate dynamic reactive support from RE plants connected to STU system as mandated in CEA technical standards. Further, other compliances of CEA technical standards with respect to fault ride through, harmonics, flicker, etc. for the existing and upcoming RE capacity in the intrastate network may be ensured for reliable operation of the integrated grid. The compliance verification process being followed by CTUIL and Grid-India for the interconnection of ISTS RE plants may be considered for adoption by STU/SLDC.

A.15.2 Majority of 400/220kV ICTs in Rajasthan state (both interstate as well as intrastate are N-1 non-compliant). For intrastate/interstate substations in Rajasthan where SPS has not yet been planned or implemented, necessary action may be initiated. The list of N-1 non-compliant substations without SPS provision is given below:

Constrained location	SPS Status as available with NRLDC
3*315=945 MVA ICT at Bhiwadi(PG)	Not planned
2*315+500=1130 MVA ICT at Bassi(PG)	Not planned
315+500=815 MVA ICT at Neemrana(PG)	Not planned
2*500=1000 MVA ICT at Jaipur South(PG)	Not planned
2*315+500=1130 MVA ICT at Sikar(PG)	Not planned
3*315=945 MVA ICT at Kankroli(PG)	Not planned
2*315=630 MVA ICT at Kotputli(PG)	Not planned
2*315=630 MVA ICT at Deedwana (RVPN)	Not planned
3*250+315=1065 MVA ICT at Heerapura (RVPN)	Not planned

TCC Deliberation

A.15.3 NRLDC stated that with demand in Rajasthan expected to increase from November onwards, it is reiterated that commissioning of SPS at the identified N-1 non-compliant substations be expedited to ensure reliable and secure system operation.

A.15.4 RRVPNL representative informed that the ICT at Bikaner, Rajasthan, is expected to be commissioned by December 2025, while the ICT at Merta is anticipated by the start of November. Erection and commissioning activities at Jodhpur are currently in progress.

A.15.5 RRVPNL informed that DISCOMs have planned the installation of capacitor banks; however, they may not be operational this winter. The installation of 880 MVAR of capacitor banks by RRVPNL is expected by December 2025.

A.15.6 PGCIL informed that bay construction work is in progress at various locations, and ICTs are expected to be commissioned next year. Additionally, SPS can be installed at PGCIL substations within a one-month timeline for feeders emanating from PGCIL.

A.15.7 MS, NRPC, mentioned that PSDF funding should not be relied for the installation of STATCOMs and capacitor banks. Given the urgent need for voltage management, own resources should be utilized, and RDSS funding may also be explored.

A.15.8 CGM (SO), NRLDC, stated that voltages at Hindaun have been dropping as low as 320 kV for several years. Operation of Dholpur units improves the voltage by approximately 18–20 kV. It was also reiterated that Rajasthan has been drawing 3,000–4,000 MVAR from the grid, and reactive power charges are payable. The critical grid operation issues in Rajasthan have been flagged at the highest level, with letters issued in addition to discussions at OCC and NRPC forums.

A.15.9 CE, RRVPNL stated that the 400 kV Kumher station is planned within the next two years, which is expected to improve voltages in the area. While operation of Dholpur units improves voltage, they are primarily run when power is unavailable in the market, and their operation has commercial implications.

A.15.10 MS,NRPC advised RRVPNL, to expedite the installation of capacitor banks, and Operate Dholpur gas units to avoid critically low voltages. Non-essential load may be shifted to non-solar hours.

NRPC Deliberation

A.15.11 Director (SO), GRID-INDIA, emphasized that voltages are dropping to very low levels, even below 0.90 pu. The forum needs to decide on immediate actions to be taken if voltages fall below this threshold. RRVPNL must implement prompt measures, such as load management, in case voltages drop below 0.90 pu, especially if other measures, like running gas units, are not available.

A.15.12 CGM (SO), NRLDC, stated that voltages at Hindaun are dropping below 320 kV, and operation of Dholpur units improves the voltage by approximately 20 kV. Therefore, Dholpur gas units should be operated during the Rabi crop season.

A.15.13 CE, RRVPNL stated that the operation of Dholpur gas units is under the control of Urja Vikas Nigam, which holds the PPA with Utpadan Nigam, and decisions are taken by them. Rajasthan SLDC has repeatedly highlighted the issue due to very low voltages during the high agricultural season and has advocated for bringing Dholpur units online. However, the units are operated occasionally by Urja Vikas Nigam, Rajasthan, primarily when power is unavailable in the market. These are the technical issues affecting the area.

A.15.14 Member (GO&D), CEA, stated that Rajasthan is drawing high MVAR from the ISTS, and persistent low voltages are not being adequately controlled. There is a limit to the extent to which Rajasthan can rely on the grid.

A.15.15 CE, RRVPNL stated that there are two ways to address the low voltage scenario:

a. Although the Government of Rajasthan mandates supplying agricultural power for two blocks during morning solar hours, DISCOMs have decided that in areas experiencing low voltage, supply will be provided for four blocks instead of two.

b. Generators also need to be operated, and RRVPNL will escalate the matter to higher management to ensure Dholpur units are brought online, thereby raising the issue with the DISCOMs.

A.15.16 Member (GO&D), CEA opined that if the low voltage scenario persists, it could lead to line trippings, affecting a large number of consumers. RRVPNL will need to take measures to prevent such situations.

A.15.17 CE, RRVPNL informed that Rajasthan SLDC is taking stringent measures, such as load management, whenever low voltages are observed in the system. Load shedding is implemented to maintain the voltage profile within safe limits. It was also noted that RRVPNL has recommended the installation of capacitor banks to the Rajasthan DISCOMs to address low voltages and high MVAR drawl, particularly due to reactive power consumption from agricultural motors. The DISCOM management agreed, and programs have been formulated. However, commissioning during the current winter season will not be possible, as tendering and other preparatory activities must be completed prior to procurement and installation of capacitor bank.

A.15.18 Member (GO&D), CEA informed that PSDF funding is currently being utilized for critical works such as SOCs, NOCs, etc., which must be implemented across all states. Therefore, the capacitor installation program will be funded from the states' own resources. Capacitor banks will not receive PSDF funding, as sufficient funds are not available. RRVPNL management should be informed that the installation of capacitor banks must be undertaken using their own resources.

A.15.19 Forum advised that the installation of reactive power devices should be funded from own resources and not delayed awaiting PSDF funds. RRVPNL representatives should communicate this to RRVPNL management. Reference was made to the Jodhpur region proposal in 2023, where PSDF funding was not approved and no further action was taken by the state for capacitor bank installation. Such inaction is undesirable given the current system conditions.

A.15.20 Member (GO&D), CEA advised that, given the current circumstances, other measures recommended by NRLDC should be implemented to maintain the voltage profile. Load management should also be carried out in accordance with grid conditions.

A.15.21 CGM (SO), NRLDC, stated that Rajasthan draws 3,000–4,000 MVAR from the ISTS. In a separate meeting held in Jaipur in October 2024 with Rajasthan state utilities, this issue was highlighted, and it was advised at that time to fund the installation of capacitor banks using own resources, as PSDF fund approval for this work was not forthcoming.

A.15.22 RRVPNL also informed the forum that solar generators drawing VARs from the grid were instructed to inject VARs to help maintain the voltage profile. Q-schedules are now being issued to RE generators through the SLDC.

A.15.23 Member (GO&D), CEA also highlighted the issue of compliance with grid connectivity standards by intra-state generators and reiterated that it is the responsibility of STUs and SLDCs to ensure that generators connecting to the intra-state system meet the required standards.

A.15.24 RRVPNL stated that compliance is being ensured for new generators connecting to the grid, but older generators installed before the regulations came into force are not fully compliant.

A.15.25 It was advised that older generators must also comply with the regulations in view of overall system requirements.

A.15.26 Member (GO&D), CEA emphasized that the Rajasthan power system has been facing persistent issues for several years, and immediate actions are required to address these ongoing challenges.

A.15.27 ***Decision of the Forum:***

I. *Forum advised RRVPNL to take corrective actions from load side if Voltages go below 0.90 pu for ensuring safe and reliable grid operation.*

II. *RRVPNL was also advised to take up with their higher management for running of Dholpur units this winter season to improve the Voltage profile.*

III. *RRVPNL to expedite the commissioning of ICTs where N-1 non-compliance is observed.*

IV. *Prioritise installation of capacitor banks in areas where low voltages and low power factor are observed.*

V. *Installation of SPS at locations where N-1 issues were observed and take up in the upcoming OCC and PSC meetings.*

VI. *Rajasthan SLDC/STU to ensure compliance of grid connectivity standards of the intra-state generators which get connectivity to the grid of the state network.*

A.16 Power supply position of Jammu & Kashmir and related issues (Agenda by NRLDC)

<u>TCC Deliberation</u>

A.16.1 It was highlighted that Jammu & Kashmir (J&K) grid being weakly connected from the rest of the grid and due to its isolated location suffers from several issues which are generally not seen in other parts of the country. Moreover, as J&K U/T generation portfolio is mostly hydro generation which is available only during summer and monsoon months and has limited availability during winter months, J&K U/T suffers from number of grid operation related challenges that are prominent in the months from Nov-Feb. It was also submitted that NRLDC has also raised these issues in number of TCC/NRPC meetings previously.

A.16.2 A separate physical meeting was convened on 06.02.2025 between officers from all these utilities and NRPC sect. in Jammu which was also graced by the presence of MD, JKPTCL.

A.16.3 NRLDC representative highlighted the following aspects of J&K power system

i. Power supply position in J&K:

NRLDC representative stated that:

a. During winter months, J&K imports power from the interstate network.
b. From the total imported power, power procurement by J&K from the market is approximately. 40-50% during lean season (Overdependency)
c. There is no increase in internal generation in J&K U/T for the last 4-5 years, therefore, the increased demand had to be met by importing higher power from the interstate network.

JKPDCL informed that

d. Dependency on the market has reduced to 17%.
e. Banking arrangements with UP and Punjab have been made.
f. 1020 MW under banking arrangements as intimated by JKPDCL.

ii. Upcoming ISTS network in J&K U/T

A.16.4 Following are upcoming 400kV substations in J&K area:

1. 400/132kV Kishtwar (approved in 2nd NRPCTP held on 01.09.2020)
2. 400/220kV Siot (approved in 3rd NRPCTP held on 19.2.2021)

JKTPCL representative informed that tendering for intrastate network is in progress.

TCC forum agreed that JKPTCL may take up for timely implementation of intrastate transmission system at these substations in matching timeframe so that J&K can draw power from 400/132kV Kishtwar and 400/220kV Siot S/s in future.

A.16.5 In addition to the above, presently, there is a severe N-1 non-compliance issue at 400/220kV Amargarh ICTs during the winter months. JKPTCL, in coordination with Indigrid, may expedite commissioning of an additional 3rd ICT at 400/220kV Amargarh, which was approved in the 16th NR-CMETS held on 28.02.2023 to resolve the N-1 non-compliance-related issue.

Indigrid informed that the 3rd ICT would be commissioned by January 2026

iii. Low voltage issues in Kashmir valley area during winter months

A.16.6 Kashmir valley is connected to rest of the grid through 400kV Samba and Kishenpur substations. Connectivity to the valley is mainly through following paths:

a. 400kV Kishenpur-New Wanpoh/Baglihar-Wagoora-Amargarh ckts
b. 220kV Kishenpur-Ramban-Mirbazar-Pampore ckts

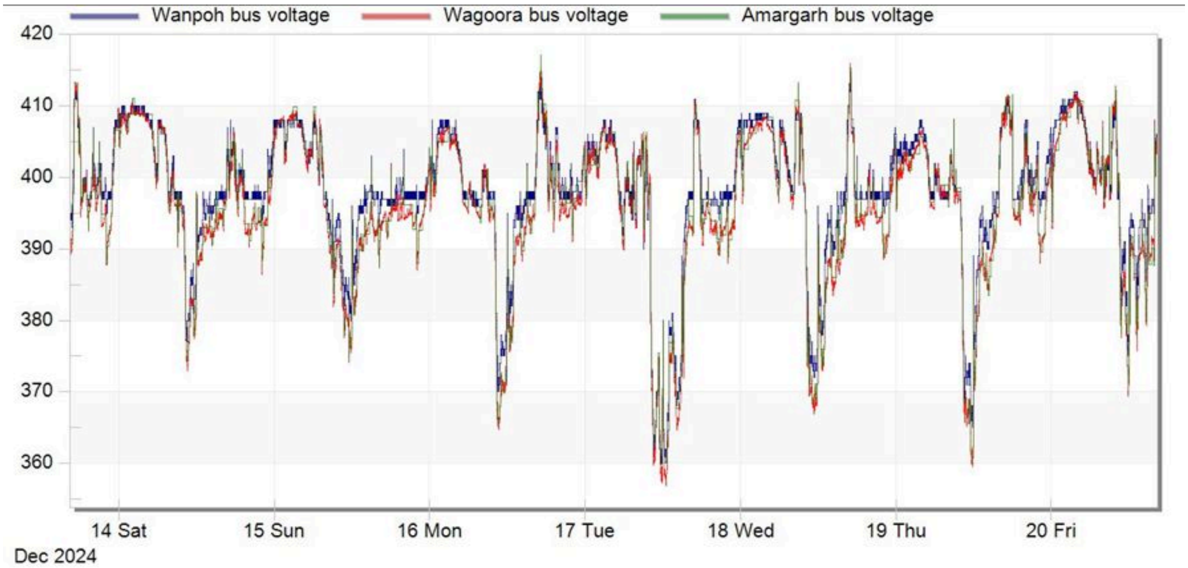
A.16.7 Further, power is being imported by J&K from 400kV Moga-Kishenpur D/C lines and 400kV Jalandhar-Samba D/C lines.

A.16.8 It is being noticed that heavy power is being drawn by 400kV lines from Moga to Kishenpur during the winter months, whereas the power flow on 400kV Jalandhar-Samba is not that high.

A.16.9 It has been discussed and suggested on numerous occasions earlier to J&K to plan & expedite commissioning of reactive power devices especially capacitors at lower voltage level to improve the voltage profile in valley area and also avoid large sums payable as reactive energy charges.

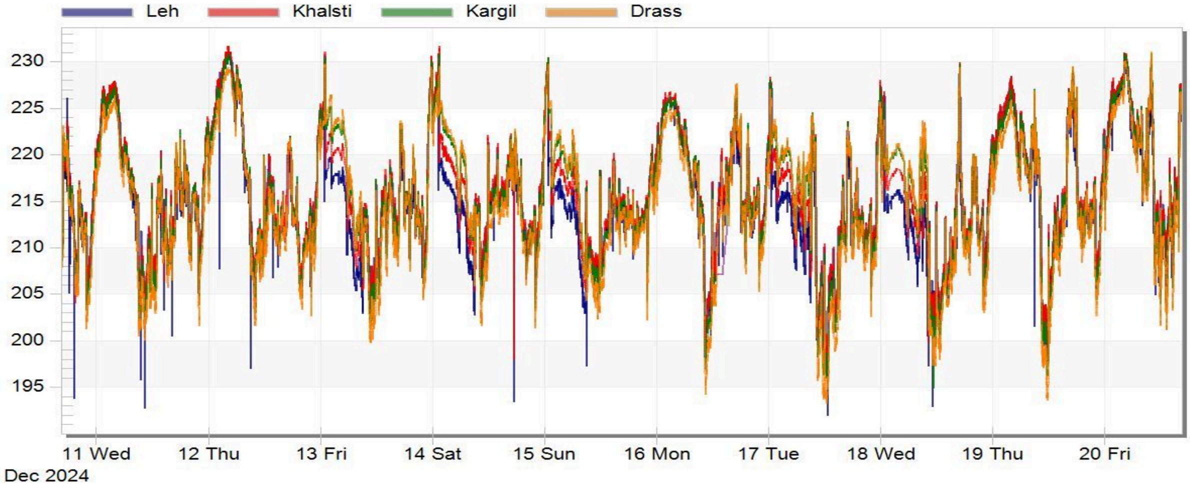
A.16.10 Low voltage related issues of J&K and Ladakh (UT) has been regularly shared by NRLDC with CEA and CTUIL in Grid-India's quarterly operational feedback report as well. The issue has been continuously raised in NRPC as well as OCC meetings still the issues of low voltage persist in J&K especially Kashmir valley.

A.16.11 400kV voltages are reaching 370kV at Amargarh, Wagoora and Wanpoh substations. Even the SVC at New Wanpoh is being fully utilized and no margin is available for dynamic support. Plots of 400kV bus voltages of Amargarh, Wagoora and Wanpoh substations for Dec 2024 are shown below:

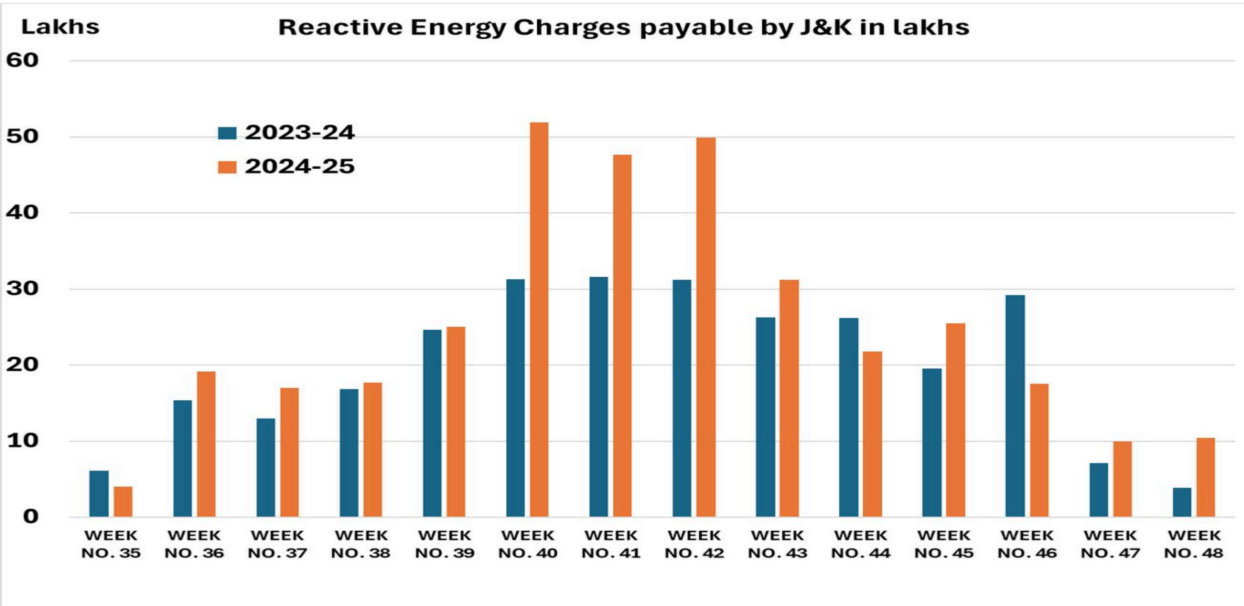


A.16.12 Pattern of MW and MVAR drawl by 400/220kV ICTs at ISTS substations such as Amargarh, Wagoora and New Wanpoh suggest, there is an urgent requirement for reactive compensation in the intrastate network. From the plots, it is clear that the reactive drawl is at least half of the MW drawl of 400/220kV ICTs. This increases % loading of transmission elements and also leads to low voltages in the grid. The power factor at 400/220kV ISTS substations is in range of 0.8-0.9.

A.16.13 Further, low voltages are also being observed in Ladakh area also during winter months:



A.16.14 In addition to the low voltage issued in the grid and at the consumer end, J&K also has to pay huge sums of money as reactive energy charges. Following is the amount (In Lakhs Rs) of reactive energy charges payable by J&K state in 2024-25 and 2023-24 during week no.35- week no. 48 (Dec-Feb period):



A.16.15 Considering that the state is already paying a huge amount of money as reactive energy charges during every winter season, the commissioning of capacitors at transmission & distribution level may be expedited to improve voltage profile as well as avoid reactive energy charges.

A.16.16 It may be noted that as around 700-800MVAr is being drawn by 400/220kV ICTs from Amargarh, Wagoora and New Wanpoh and 300MVAr support is being provided by New Wanpoh SVC, there seems to be requirement of nearly 1000MVAr reactive power compensation (capacitive) in Kashmir valley at transmission and distribution level in next 1-2 years. If a proposal is prepared for a futuristic scenario, further additional capacity as per requirement may be planned.

In view of the urgent requirement of capacitor banks, TCC forum suggested that funding be done through its own resources in view of urgent requirements and not wait for PSDF funds.

A.16.17 CTUIL representative mentioned that STATCOMs of 75 MVAR have been planned with 5 GW Pang Scheme at Leh, Khalsti and Kargil.

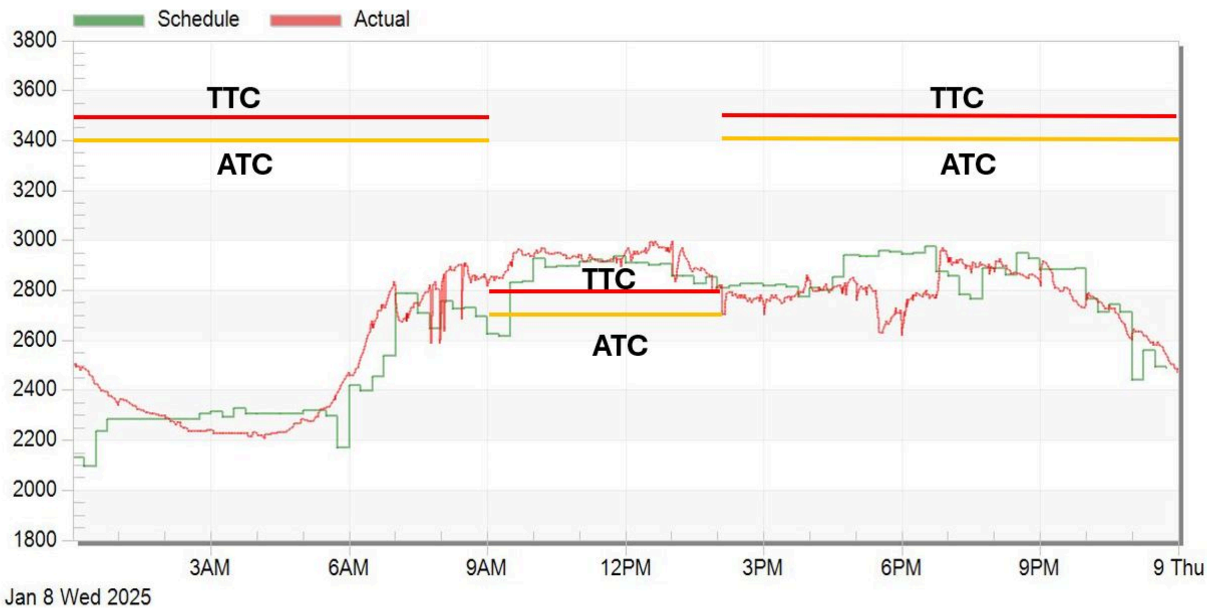
A.16.18 Director (SO), GRID-INDIA stated that for the improvement of the Voltage profile of the Ladakh area network, augmentation is to be done as presently the area is being fed from a Single long radial line. The installation of Capacitor banks would improve the Voltage profile to some extent. STATCOMs would provide diurnal support, and the upcoming Transmission system associated with RE generation evacuation at Pang would also have an overall improvement on the Voltage profile.

MS,NRPC advised JKPTCL to take up with CEA and CTU for further planning of transmission system.

iv. Transfer Capability Assessment of J&K control area

A.16.19 J&K SLDC is sharing (transfer capability limit) ATC/TTC basecase on regular basis as per CERC approved procedure. However, due to low voltages during the daytime, the ATC/TTC figures for day time were recently reviewed and revised figures were communicated to J&K SLDC. Due to low voltages in Kashmir valley area, the transfer capability limits (ATC/TTC) are 2700/2800MW during 09-14hrs and 3400/3500MW for other than 09-14hrs duration.

A.16.20 Schedule and Actual violations were observed in real-time during 2025. One such sample is shown below:



A.16.21 It may be noted that as of now schedule of state control area is not being restricted to ATC, and sometimes it is crossing the assessed ATC/TTC limits. However, in future, as is the case with Punjab which is separate bid area, schedule of J&K state may be restricted up to their ATC/TTC limits upon formation of separate bid area. Accordingly, expeditious actions are required from J&K side to improve the low voltages in Kashmir valley.

JKPTCL representative assured the forum that actions are being taken for ATC/TTC enhancement of J&K.

v. Removal of T-point connection of 220kV Wagoora-Ziankote line

A.16.22 In a meeting organized by CEA on 04.10.2023 to deliberate the issue of Charging of 220 kV Wagoora- Zainakote Transmission line after re-conductoring, J&K was asked to remove the tapping of 220kV Wagoora-Ziankote line and NRPC/OCC was asked to follow up the same at RPC level. Extract of MoM of the meeting are quoted below:

"JKPTCL was requested to complete the 2nd D/c line between Wagoora- Zainakote with LILO at Budgam, at the earliest and subsequently remove the tapping of existing circuit at Budgam at the earliest."

"NRPC to be apprised about the issue, so that the same could be deliberated in NRPC/OCC forum so as to ensure that the tapping is removed at the earliest."

CEA safety standards, 2023, clause 46(4) mentions that:

Quote

(4) There shall not be tapping of another transmission line from the main line for 66 kV and above class of lines:

Provided that during natural calamities, tapping may be allowed to ensure emergency power supply to affected areas till normalcy is restored.

Unquote

A.16.23 CGM(SO) NRLDC stated that it was important to have redundancy in the system as even for the planned outage of only available Single bus, notice is to be given and the whole area remains dark during the planned shutdown of the bus.

JKPTCL representative informed that Tapping arrangement on 220 KV Wagoora-Zianakote at Budgam would be removed by March 2026 as ROW issue has now been resolved.

vi. Single bus scheme at old 220kV substations in J&K

A.16.24 As discussed in earlier meetings convened between NRLDC, NRPC and &K such as on 28.07.2020 & 06.02.2025, most of the 220 kV voltage level stations of PDD-J&K have only one Main and transfer bus scheme instead of double main transfer (DMT) bus arrangement and therefore bus shutdown requires shutdown of entire station which affects reliability of power supply.

JKPTCL representative informed the forum that they are exploring the possibility of bus sectionalization at certain substations, and the details will be communicated once finalized.

vii. Telemetry Issues

A.16.25 Reliability and accuracy of SCADA data and its associated communication system is essential for monitoring and coordinating operations of a large electricity grid. It helps in visualization and management of the critical grid element failure/grid incident in real time and minimizes the possibility of any untoward incidences/disturbances.

A.16.26 Real-Time data availability from Jammu and Kashmir is very poor. There is zero visibility of data in J&K stations at J&K and NRLDC. With poor monitoring of data, it is very difficult to monitor grid in efficient manner.

A.16.27 The matter has been discussed in various TCC and TeST Meetings but there is no improvement of the same.

A.16.28 During the meeting held on 06.02.2025, JKPTCL representative informed that recently on 09.01.2025, MOP has sanctioned some amount to J&K.

A.16.29 POWERGRID representative informed that after receipt of payment from J&K, 500kM OPGW laying that is pending, would be taken up. 76 RTUs in J&K are also to be replaced. POWERGRID has written letter on 15.01.2025 to J&K, citing immediate payments be done, so that all works are started. It was also mentioned that RTU commissioning work as well as OPGW laying need to be carried out in synch with each other so that both works are completed by July 2026.

A.16.30 J&K may make balance payments to POWERGRID and POWERGRID may ensure that works for OPGW as well as RTU commissioning is carried out simultaneously so that telemetry is available at J&K SLDC and NRLDC by July 2026.

A.16.31 The agenda was also listed for discussion in 27th TEST meeting held on 21.04.2025, but could not be discussed in detail due to non-availability of representative from J&K side.

JKPTCL representative informed that alternate communication like GPRS is being explored. In 2-3 months, good visibility would be there.

viii. Workforce adequacy in J&K SLDC control room

A.16.32 MoP vide communication dated 30.10.2024 had circulated Workforce Adequacy Guidelines for Load Dispatch Centres and Guidelines for deputation of Workspace from SLDCs to Grid-India for fixed terms.

1. Workforce Adequacy Guidelines for Load Dispatch Centers will serve as a Bench-Mark for enhancing the Load Despatch Centres to ensure that LDCs are equipped with sufficient skilled manpower resources.
2. Guidelines for Load Dispatch Centers and Guidelines for deputation of Workspace from SLDCs to Grid focus on fostering collaboration and knowledge sharing among various SLDCs

A.16.33 J&K SLDC falls under medium SLDC category.

A.16.34 IEGC 2023 has also mandated all utilities including LDCs to perform new tasks. It has come out of discussion that with the present manpower in LDCs, it is challenging to perform all the tasks mentioned in the IEGC 2023 within the timelines provided.

CERC has issued final order dated 05.10.2025 regarding 9/SM/2024 which also emphasis ensuring adequate workforce in SLDCs.

A.16.35 It may be noted that several reminders dated 09.04.2025, 16.04.2025, 22.04.2025 & 09.05.2025 have been sent from NRLDC side to all states in this regard.

A.16.36 Based on the guidelines issued by MoP, it is suggested that J&K SLDC ensures sufficient manpower in their control centers so that all tasks are completed in time bound manner.

A.16.37 In the meeting held on 06.02.2025, all members discussed that unavailability of skilled officers at J&K SLDC is major cause of concern.

A.16.38 Director (SO), GRID-INDIA also stated that letter regarding workforce adequacy has been sent from Power Secretary side to all the Chief Secretaries of all states including J&K. UP has good number of workforce and other states/UTs can take cue from them for improving their workforce.

JKPTCL representative confirmed that recruitment was likely in upcoming months.

ix. Bus coupler issue at Baglihar HEP

A.16.39 During the meeting held on 06.02.2025, Baglihar HEP representative had informed that bus couplers for both Stage-I and Stage-II are under prolonged outage. For bus coupler of Stage-I, there is some issue with earth switch, for which LOA has been placed to M/S GE and work is expected to be completed by Nov 2025. For bus coupler of Stage-II, there is flashover, and same is under outage and OEM visit from Hyosung has been planned to attend the same as flashover was observed when it was again tried to be closed.

A.16.40 JKPDCL informed that Bus coupler of Stage 1 is to be restored by April 2026 while Bus Coupler of Stage 2 to be ready by 2027.

A.16.41 NRLDC representative again advised to couple the buses at Baglihar HEP as in case of a Contingency outage of generating units can occur.

A.16.42 CGM(SO) NRLDC highlighted that lack of peaking support from Baglihar HEP has been taken up for the past years from NRLDC and also in the special meeting at Jammu on 06.02.2025. The units were found to be running in flat mode and no consistent ramping support was visible from Baglihar HEPs. In the meeting at

Jammu referred above Baglihar HEP stated that ramping/peaking provision is not available in their machines. NHPC representatives in the meeting emphasized that there is no such limitation on hydro units. It was advised that it would be prudent to conserve water during the day time and provide peaking support in Morning and Evening hours.

A.16.43 Director (SO), GRID-INDIA stated that Baglihar hydro stations have to be treated as peaking station and the same was envisaged during its construction. However peaking support was not visible.

MD JKPDCL stated that with lesser reliance on Power exchange for meeting J&K demand in view of the banking arrangements being made instructions have been given to Baglihar and even smaller projects like Lower Jhelum to provide peaking support.

x. Non submission of Disturbance recorder (DR), Event logger(EL) and tripping reports of Tripping events

A.16.44 It is to be noted that as per the IEGC provision under clause 37.2 (c), tripping report along with DR/EL has to be furnished within 24 hrs of the occurrence of the event and detail report of the event is to be submitted within a week of event. However, no DR/EL & tripping report of any have been received from J&K control area for any of the grid event till date. Field data is very much important for complete analysis of the grid events.

A.16.45 NRLDC/NRPC can suggest measures only if DR/EL data is shared with NRLDC and NRPC. DR/EL and protection related issues are discussed in protection subcommittee meetings and J&K would benefit by sharing DR/EL data with NRLDC/NRPC.

A.16.46 It was requested that DR/EL of all the trippings shall be uploaded on Web Based Tripping Monitoring System “https://postda.nrldc.in/Account/Login.aspx” within 24 hours of the events as per IEGC clause 37.2(c) and clause 15.3 of CEA grid standard.

JKPTCL representative confirmed that Nodal officer from JKPTCL would be nominated for grid event and protection-related issues.

NRPC Deliberations:

A.16.47 CGM(SO), NRLDC stated that in J&K grid operation majorly following issues are observed:

a. Reactive power management -In winter season high MVAR is drawn from the grid and paying as high as 50 lakhs per week on account of reactive energy accounts. If Capacitor banks are installed then this charge can be minimized.

b. Telemetry issue - The intra-state network is not visible. The state grid is monitored as per the available data from ISTS connected portion.

c. Transmission augmentation is also required in the intra-state network.

A.16.48 Director (SO), GRID-INDIA reiterated that as there are long radial lines up to Ladakh, Voltage falls and gets aggravated in Winter months as winters are quite severe and voltages remains low. So, investment is required at a faster pace to address these persistent issues.

A.16.49 JKPTCL representative enquired about PSDF funds as they are in process of formulating DPR under PSDF fund. It was enquired what components can be projected as they had envisaged capacitor installation through PSDF funding.

A.16.50 Chairman NRPC asked to prepare DPR without focussing on source of funding which can be seen at a later stage. He opined that at many times it has been observed that DPR has not been initiated on various occasions.

A.16.51 Member (GO&D),CEA stated that one of the projects at Jammu was still not closed despite of repeated requests. This creates difficulty in approval of more projects, so it is of utmost importance to adhere to the timeline of the project and also close the project.

A.16.52 ***Decision of the Forum:***

The forum endorsed the recommendations of the TCC and advised that Jammu & Kashmir and Ladakh UTs go for their own resources to install capacitor banks and not wait for PSDF fund. Further, JKPTCL to take necessary actions as discussed in the TCC meeting.

A.17 Expediting transmission system related to evacuation of RE power in Western Rajasthan (Agenda by NRLDC)

A.17.1 In line with Govt. of India targets for renewable energy integration, majority of the RE power at ISTS level is being commissioned in Western Rajasthan area. A total of 22.89 GW of ISTS connected RE generation in Rajasthan has been commissioned and being scheduled by NRLDC as on 08.10.2025. The agenda related to need for matching commissioning of transmission system in line with the rapid pace of integration of RE generation has also been deliberated. However, there continues to be delay in commissioning of planned RE evacuation transmission system and restriction has to be imposed on the RE generation that can be safely evacuated due to non-availability of associated transmission system (ATS).

A.17.2 It may be noted that the original SCOD of phase-II-Part G and Part G1 was Nov-23 and phase-II-Part E was Sept-24, but Tr. System of phase-II Part G and Part E is not yet commissioned/partially commissioned and delayed by ~24 months and 15 months respectively, same is summarized in below table:

Transmission System	Implementing Agency	SCOD	Revised Anticipated COD
Phase-II-Part E (*765kV Bhadla2- Sikar2 – 2nd D/C*)	SPV: POWERGRID Bhadla Sikar Transmission Limited (PBSTL)	Sep-24	Dec-25
Phase-II-Part G* (*765/400kV Narela GIS – 3*1500 MVA, 765kV Khetri-Narela D/C, LILO of 765kV Meerut-Bhiwani @ Narela*)	SPV Name: POWERGRID Narela Transmission Ltd.	Nov-23	Nov-25
Phase-II-Part G1 (*Removal of LILO of 400kV Bawana-Mandola D/C @ M'bgh, 400kV Gopalpur S/S, 400kV M'bgh- Narela D/C and 400kV M'bgh-G'pur-Narela D/C*)	POWERGRID	Nov-23	Nov-25

** LILO of 765kV Meerut-Bhiwani @ Narela charged on 01.10.25*

A.17.3 Due to the significant delay in commissioning of the planned transmission system, considerable quantum of RE power in Rajasthan REZ is getting bottlenecked. Details of present RE capacity commissioned in Rajasthan REZ, quantum of GNA & T-GNA and restriction in NOC for T-GNA due to non-availability of transmission system is summarized below;

i) As on 08.10.25, total 22897 MW (~22.90 GW) of ISTS connected large RE generation in Rajasthan have been commissioned and being scheduled. Out of 22897 MW, 14590 MW has effective GNA (ATS commissioned) and 8307 MW has Non-effective GNA (ATS pending). ~36% of ISTS connected RE capacity is having non-effective GNA (Commissioning of Associated Transmission system is still pending) and is being evacuated under T-GNA using NRLDC NOC.

ii) NOC restrictions under deemed T-GNA of ISGS RE have been implemented from 09:30 hrs onwards, with staggered curtailments applied in steps every 15 minutes between 09:30 hrs and 10:30 hrs. A flat restriction was applied from 10:30 hrs to 14:30 hrs, after which the restriction was gradually lifted in a staggered manner between 14:30 hrs and 15:45 hrs at 15-minute intervals. Full requested NOC quantum for T-GNA was available before 09:30 hrs and after 15:45 hrs.

A.17.4 The limiting constraints being identified for RE evacuation from Western Rajasthan are mentioned below:

a) De-rated 400kV Bhadla (RS)-Bikaner (RS) D/C (RRVPNL) ACSR Quad line (Quad conductor line (thermal limit 1704 MVA) derated to 750 MW by RRVPNL due to hotspots and frequent failures.

b) Risk of angular instability under N-1 contingency of 765kV Bhadla-II-Ajmer D/C line and 765 kV Bhadla – II – Sikar – II D/C

c) Voltage oscillations in case of High RE penetration in the Rajasthan RE complex

d) Low voltage and high reactive power drawl issues in the Rajasthan STU network

A.17.5 It is pertinent to mention that ~2.8 GW of Phase-III generation have been commissioned but not a single transmission element of Phase-III is commissioned yet. Timely commissioning of Phase-III transmission system is equally important to relive the constraint and facilitating evacuation of upcoming RE generation in Rajasthan REZ.

TCC Deliberation:

A.17.6 POWERGRID has updated in the meeting that;

a. 765 KV Bhadla2-Sikar II to be commissioned by Dec 2025(Phase-II)

b. 765 KV Khetri-Narela to be commissioned by Dec 2025(Phase-II)

c. 400 KV Narela to Maharanibagh to be connected by 25 Nov 2025.

A.17.7 CTU proposed a LILO of one circuit of the 765 kV Bhadla-Bikaner line to evacuate 250 MW of generation at Ramgarh and an additional 250 MW at Bhadla-3.

A.17.8 CGM (SO), NRLDC, stated that the study files for the proposed charging of 765 KV Ramgarh-Bhadla III have not yet been received from CTU. Inputs will be provided once than the details of the plan and study files are shared.

A.17.9 CGM (SO), NRLDC, mentioned that the associated transmission system (ATS) for Phase-II has not yet been completed, and 2,800 MW of the Phase-III system has also been commissioned without ATS. RE evacuation is being facilitated under T-GNA as per the available transmission system margins, with 8,442 MW currently supported. However, during peak solar hours, 4,647 MW out of this 8,442 MW is being restricted due to the non-availability of ATS.

A.17.10 Director (SO), GRID-INDIA, emphasized that no new network has been commissioned for the evacuation of RE generation, and the RE evacuation challenges remain unresolved.

NRPC Deliberation

A.17.11 NRPC forum noted the deliberation held in TCC meeting and Forum was in consonance of the same.

A.17.12 ***Decision of the Forum:***

Forum stressed on the timely commissioning of associated transmission system related to evacuation of RE power to avoid bottlenecking of RE generation.

A.18 Demand forecasting and resource adequacy related: CERC order dated 05.10.2025 (Agenda by NRLDC)

A.18.1 With reference to the Clause 31(2) of Central Electricity Regulatory Commission-IEGC Regulations, 2023 and the Operating Procedure of NRLDC prepared in accordance with the same, each SLDC has to furnish the demand estimation for day ahead, week ahead, month ahead (with time block wise granularity) and demand estimation for year ahead (with hour granularity). The sub-clause 31(2) (h) of IEGC-2023 states the following timeline for the submission of demand estimate data to RLDC.

Type of Demand Estimation	Timeline
Daily	10:00 hours of previous day
Weekly	First working day of previous week
Monthly	Fifth day of previous month
Yearly	30th September of previous year

A.18.2 Status of Day Ahead Forecasting, week ahead, month-ahead and year-ahead submission status for Oct-2025 as per Clause 31(4) (a) & (b) of IEGC-2023 is shown below:

State/Entity	Day Ahead (As on Sep-25)	Week Ahead	Month Ahead	Year-Ahead(2026-27)
Punjab	As per Format	As per Format	As per Format	Not received
Haryana	Irregular	Only demand & irregular	Not received	Not received
Delhi	Demand and Resource not as per format	As per Format	As per Format	As per Format
Rajasthan	As per Format but irregular	As per Format	As per Format	Not received
Uttar Pradesh	As per Format	As per Format	As per Format	As per Format
Uttarakhand	As per Format	As per Format	As per Format	Not received
Himachal Pradesh	As per Format	As per Format	As per Format	Not received
J&K and Ladakh (UT)	As per Format	Not received	Not received	Only Demand
Chandigarh (UT)	As per Format	Not received	Not received	Not received

<u>TCC Deliberation</u>

A.18.3 MS, NRPC expressed concern on the non-submission of data by states and asked the concerned states to submit the data as per IEGC mandated timelines in future.

All SLDCs agreed to take actions at their end for the timely submission of demand forecasting and resource adequacy data on a day-ahead, week-ahead, month ahead and year-ahead basis.

A.18.4 A sample of the state day-ahead forecast, prepared at NRLDC based on data provided by the state, was discussed. The forecast highlighted periods of surplus generation and periods of shortfall during the day. Such forecasts can be used to sell surplus power, back down internal generation, and arrange power during shortfall, thereby avoiding over drawl and load shedding.

A.18.5 NRLDC stated that a portal has been prepared for the submission of data by states. The user credentials have been provided to all states of the Northern region. NRLDC also mentioned that they have also carried out month-ahead resource adequacy analysis on a regional basis for Nov 2025 as per data available at NRLDC through PRAS software.

A.18.6 NRLDC had also organized training program for NR SLDCs on 29.07.2025 regarding Demand Forecast, RA Planning & Reserve Assessment for SLDCs of Northern Region. Subsequently, a meeting was also convened on 11.08.2025 by CERC in Lucknow, in which chairpersons of SERC, Head of STUs, DISCOMs and SLDCs were also invited.

A.18.7 It was also discussed that NRLDC is regularly sending emails based on day day-ahead resource adequacy exercise being carried out at NRLDC end. In case of a major shortfall seen for a state based on the demand forecast and generation adequacy data submitted by the state, NRLDC communicates the actions required from the state side in real-time also.

A.18.8 Key points from Hon’ble CERC order dated 05.10.2025 regarding 9/SM/2024 were deliberated as follows:

i. Adequacy of Workforce in SLDCs

ii. Training and Certification of SLDC staff

iii. Alignment of the State Grid Code with the Indian Electricity Grid Code

iv. Backing down of intra-state thermal generating units

v. Enablement of AGC in intra-state generating stations

vi. Maintaining adequate Reserves

vii. Two Shift Operation of thermal generating stations

viii. Cybersecurity preparedness

ix. Implementation of the SAMAST (Scheduling, Accounting, Metering, and Settlement of Transactions) Scheme

x. If a unit goes under USD:

- Schedules are adjusted based on available units.
- Beneficiaries may lose entitlement if no unit remains on-bar.

xi. DC Declaration Rules:

- Generators must not declare lower DC during peak hours than off-peak hours
- If violated lower DC will be considered for fixed charge billing

A.18.9 CGM(SO), NRLDC stated that earlier beneficiaries used to take power in only peak hours and not requisitioning during off peak hours, now as per latest CERC order the beneficiaries have to give requisition on day ahead basis otherwise unit would go under shut down. However, the beneficiaries would have to bear the fixed cost even though unit is under shutdown due to non-availability of technical minimum schedule.

A.18.10 MS, NRPC, emphasized that maintaining reserves is crucial, and each state should plan accordingly in line with the CERC order.

NRPC Deliberation

A.18.11 ED, NRLDC, advised the constituents to comply with the orders issued by the Hon'ble CERC. One of the CERC observations highlighted the development of AGC in intra-state generating stations. NRLDC further stated that nearly 80 GW of generation in ISGS is already integrated with AGC, aiding frequency control. Simulations indicate that SRAS/AGC support has resulted in approximately a 20% improvement in frequency response. Implementation of AGC for generators is beneficial for both the grid and the generators.

A.18.12 PPGCL Bara, a state-sector plant, has been integrated under AGC. Similarly, other intra-state generators requiring assistance or discussions on AGC implementation may approach NRLDC/GRID-INDIA for consultations, either online or offline.

A.18.13 PPGCL Bara shared their experience with AGC implementation. It was noted that 90% of Bara's generation is supplied to UP, while 10% is merchant capacity. The plant installed the required hardware locally, while intra-state generators need to establish signal communication with the CTU network. AGC was implemented in September this year with cooperation from NLDC, PGCIL, NRLDC, and UP SLDC, resulting in a profit of ₹6–7 lakhs per week. As AGC is part of Ancillary Services, the associated CAPEX must be borne by the intra-state generators themselves.

A.18.14 Director (SO), GRID-INDIA, urged hydro stations to participate in AGC due to their greater operational flexibility. He advised that machines should be immediately integrated into AGC as soon as they come online, even if for a short duration, such as during the winter months.

A.18.15 It was also stated that CERC has permitted wiring to inter-state, as AGC is currently not functional at the SLDC level. Additionally, no impact on intra-state or inter-state DSM is observed, provided proper accounting is maintained.

A.18.16 The following points regarding the implementation of AGC for state control area plants were also discussed:

a. Even if the SLDC is not currently utilizing AGC, they will still benefit from understanding its functioning, including any advantages and potential pitfalls. Similarly, generators will gain insights. Over the next two years, if generators are connected to the SLDC, the knowledge and experience gained now will facilitate smoother integration.

b. If certain plants are permitted to continue participating in the inter-state market, they may do so.

A.18.17 ***Decision of the Forum:***

Forum advised all constituents to adhere to the CERC Order dated 05th October,2025.

A.19 Strengthening Emergency Restoration Systems in the Northern Region: Current Status and Emerging Importance (Agenda by NRLDC)

<u>TCC Deliberation</u>

A.19.1 Regulation 22 of the CEA (Grid Standards) Regulations, 2010 provides as follows:

"Emergency Restoration System: Each transmission licensee shall have an arrangement for restoration of transmission lines of 400 kV and above and strategic 220 kV lines through the use of Emergency Restoration System in order to minimize the outage time of the transmission lines in case of tower failures."

A.19.2 NRLDC highlighted that tower collapses have been reported at various locations this year due to adverse weather conditions. Under such adverse situations, the availability of an effective mechanism for emergent restoration of transmission lines in the shortest possible time is of utmost importance. Immediate and temporary restoration of transmission networks is possible by deploying the "Emergency Restoration Systems (ERS)."

A.19.3 Grid Standards notified by the Central Electricity Authority(CEA) stipulate that every Transmission Licensee shall have an arrangement for restoration of transmission lines of at least 220kV and above through the use of ERS. However, presently the States do not possess sufficient ERS infrastructure. Consequently, POWERGRID becomes the last resort whose ERS infrastructure is also limited.

A.19.4 NRLDC representative stated that several lines were under outage for more than 12 days, which is the timeline as per CERC Standards of Performance for restoration of transmission lines on ERS.

A.19.5 NRLDC intimated that presently 08 no. EHV lines have been restored on ERS towers, further depleting the already limited ERS availability. Currently, 03 no. EHV lines remain out of service due to tower collapses.

A.19.6 Forum asked Transmission licensees to submit detail records of available ERS towers, the number of ERS towers already utilized, and the duration of their utilization to NRPC/NRLDC.

A.19.7 JKPTCL requested approval for re-routing of 220 KV Kishenpur-Mir Bazar transmission line in view of its vulnerability due to landslides.

A.19.8 MS, NRPC advised to approach CEA for the proposed re-routing of 220 KV Kishenpur-Mir Bazar line.

NRPC Deliberation

A.19.9 Forum was of view that excessive consumption of ERS towers could deplete the available stock, leaving insufficient towers to meet contingency requirements.

Therefore, adequate reserves should be maintained within the respective control area.

A.19.10 In response to JKPTCL's request regarding the re-routing of the 220 kV Kishenpur–Mir Bazar line, the forum advised JKPTCL to approach CEA to assess the proposal.

A.19.11 NRPC forum noted the deliberation held in TCC meeting

A.19.12 ***Decision of the Forum:***

Forum noted the deliberation held in TCC meeting and Forum was in consonance of the same.

A.20 Blackout in the Spanish Peninsular Electrical System on 28th April 2025 and Suggested Measures for Indian Power System (Agenda by NRLDC)

TCC Deliberation

A.20.1 NRLDC apprised the forum that, a meeting was held under the chairmanship of the Secretary (Power), MoP on 27.08.2025 to discuss the Spanish Peninsular blackout event.

A.20.2 NRLDC made a detailed presentation (attached at **Annexure-A.IV**) on the subject highlighting the following:

i. On April 28, 2025, at 12:33:30 hrs, the Spanish and Portuguese electricity systems experienced a total voltage collapse, triggering disconnection from the continental

European electricity grid.

ii. Prevalent Grid conditions were low load, high RE penetration (82% in Spain and 91% in Portugal), voltage fluctuations, high voltage, low frequency oscillations in voltage.

iii. Sudden voltage increase in the grid led to generation disconnections, which in turn further increased the voltages and ultimately blackout within a period of 20 seconds.

iv. Insufficient dynamic reactive power and voltage control, poor damping of oscillations, and cascade tripping due to over voltages were identified as root causes for the blackout.

v. Restoration was initiated by black start of hydro and gas stations as well as support from neighbouring countries. Total time for restoration was around 19 hours.

vi. Recommendations include reinforcement of VRE compliance verification, capabilities for voltage control, interconnections, grid flexibility, storage and black start capabilities (through grid forming technology)

A.20.3 NRLDC stated that a presentation on the Spanish Peninsular blackout event was also delivered by NRLDC in the recent FOLD meeting.

A.20.4 NRLDC presented the recommendations of the Spanish committee on Iberian GRID Disturbance:

i. Reinforcement of the process of supervision and verification of compliance against specified regulations

ii. Technical measures to reinforce the capabilities for voltage control and protection against oscillations in the system.

- Approval and implementation of the new voltage control support services from both conventional and RE plants.
- Incorporate penalties for non-compliance of RE Plants against proposed voltage control requirements.
- Additional tools for voltage control and management of oscillations, viz. Planning of dynamic reactive power compensation devices such as Synchronous Condensers, FACTS devices (including power oscillation dampers), etc.

iii. Promote the interconnections with the European system.

iv. Enable the entry of new technologies (grid forming) to facilitate autonomous start-up (black start).

v. Enhance robustness and flexibility of the electric power system via boosting energy storage, promoting flexibility and capacity market regulations etc.

vi. Repowering renewable energy projects - replacement of old renewable energy equipment with modern equipment to incorporate the latest control, management and system robustness requirements.

A.20.5 TCC forum discussed the following course of action for the India Power System:

a. Strict compliance verification & penalties for non-compliance.
b. Deployment of Synchronous Condensers and STATCOMs at critical locations.
c. Ensure flexible resources for high RE penetration scenarios.
d. Accelerate grid modernization: energy storage, grid-forming inverters, enhanced monitoring.
e. Periodic simulation & tuning of grid controllers for voltage & oscillation management.
f. Enable the entry of new technologies (grid forming) to facilitate autonomous start-up (black start).

NRPC Deliberation

A.20.6 ED, NRLDC stated that any delay in strengthening standards could result in the exemption of large capacities of RE generation, bulk loads, etc. Therefore, standards and regulations must be incorporated in a timely manner. STUs should collect data for upcoming RE plants and subsequently analyze it to ensure compliance with existing standards.

A.20.7 Member (GO&D), CEA, enquired whether SLDCs have complete visibility of the system. SLDC Rajasthan responded that they do not have full visibility of RE plants. It was advised that SLDCs need to address this gap and ensure they can monitor generation, which would enable more accurate scheduling of generation and load. SLDCs should plan to monitor all RE plants connected within their state control area, especially if they are currently not reflected in SLDC data.

A.20.8 He further stated that the tripping event in the Spanish and Portuguese power system serves as a key learning experience. SLDCs should ensure full visibility of RE plants at their control centers, particularly as rooftop solar installations are increasing significantly. There is a risk that SLDCs may remain unaware of the actual RE capacity in operation. Therefore, whenever connectivity is granted to new RE plants, it must be ensured that telemetry and communication systems remain fully operational at all times, and are not limited to demonstration only at the time of connectivity approval.

A.20.9 With the widespread implementation of rooftop solar across India, SLDCs should coordinate with DISCOMs and seek their support in obtaining relevant data.

RRVPNL informed that, as of now, data for rooftop solar and the KUSUM scheme is not reaching the SLDC and must be compiled at the DISCOM level.

A.20.10 Member (GO&D), CEA, stated that while the data may reside on DISCOM servers, it must be communicated to the SLDC. Without this, SLDCs will not be able to accurately determine the generation available in their system at any given time, leading to potential errors in generation and load forecasting. While communication channels are maintained at the ISTS level by GRID-INDIA and CTU, SLDCs must take similar measures to ensure the continuous availability of communication channels and telemetry data.

A.20.11 RRVPNL agreed that system visualization is essential for effective monitoring and maintenance of the power system.

A.20.12 CGM (SO), NRLDC, stated that Rajasthan has its own REMC. However, states such as UP, with 2,500 MW of RE, and Punjab, with 865 MW of RE, may confirm whether generation data is available at their respective control centers.

A.20.13 PSTCL responded that only partial data is available, as generation data from older stations is not accessible. Member (GO&D) stated that data and communication from older stations should also be available, since regulations have been in place from the beginning and would assist states in planning load and generation. SLDCs need to coordinate with DISCOMs to achieve complete visibility of RE in the system.

A.20.14 Director (SO), GRID-INDIA, emphasized the need for dynamic reactive power reserves in the system, as highlighted in the Iberian Peninsula grid event report. This is particularly important because RE generators were operating in fixed power factor mode. Additionally, compliance verification is crucial to ensure the safe and reliable operation of the grid.

A.20.15 ***Decision of the Forum:***

Forum advised all STUs and SLDCs:

I. *To ensure data availability of RE generation of both the Grid connected RE plants as well as rooftop solar for getting the actual status of power system in their respective Control area.*

- ***II.*** *Ensure strict compliance verification of new Plants before connectivity to the Grid as per the extant CEA standards for Connectivity to grid and other applicable Regulations and also monitor the performance post connectivity.*
- ***III.*** *Plan for dynamic reserves on immediate basis for safe and reliable grid operation.*
- ***IV.*** *To take necessary action on the measures suggested in the recommendations of the Spanish committee on Iberian GRID Disturbance.*

A.21 Grid Event – 17th June 2024: 16.5 GW Load Loss in NR Following HVDC Champa–Kurukshetra Tripping – Learnings and Way Forward (Agenda by NRLDC)

A.21.1 On 17th June 2024, a grid event occurred at 13:53 hours in the Northern Region, leading to a substantial load reduction of approximately 16.5 GW. This event started with the tripping of both bi-poles of the +/-800 kV HVDC Champa (WR) – Kurukshetra (NR) link, which was transferring 4500 MW of power from the Western Region (WR) to the Northern Region (NR). The tripping of this HVDC link triggered a series of events. There was a sudden voltage drop across the stations in the Northern region which resulted in a significant load drop of around 16.5 GW in the Northern region. There was simultaneous reduction of around 2800 MW of RE-based generation in the Rajasthan RE complex. There was also trippings of conventional generating units leading to a generation loss of 3909 MW at the all India level. The significantly higher load loss resulted in the rise in frequency of the Indian power system from 50.03 Hz to 50.68 Hz. The load drop resulted in a rise in the voltages of stations in the Northern region. This high voltage resulted in the tripping of 18 nos. of EHVAC lines in the Northern Region on over-voltage protection. The power system was normalised after the revival of all the poles of HVDC Champa-Kurukshetra by 15:51 Hrs

A.21.2 Some major observations of the event are summarized below:

1. **Cause of Voltage dip and high Reactive Power Drawl by loads: -** There was significant voltage drops across Northern Region and Reactive power absorption increased, exacerbating voltage issues.

2. **Analysis of behaviour of Load during the event:** Voltage reduction caused stalling of induction motors: total 16.5 GW load Reduced in NR. Stalling of motors at comparatively higher voltages (~0.85 - 0.9 p.u. voltage).
3. **Impact on Conventional and Renewable Energy Generation:** Approximately 2800 MW of RE generation was reduced with around 1500 MW recovering within 4 minutes. 16 Conventional Generating Units tripped.
4. **Reactive Power Support from Generating Units in NR**: Heavy reactive power drawl by loads were observed. Many RE plants had opposite response.
5. **High Voltage Scenario:** Total 18 (no.) of transmission lines (765kV and 400kV) tripped on OV, causing a partial blackout at the 765/400kV Aligarh (PG) S/s.
6. **Frequency Response by Generating Units:** More than 50% capacity of the inter-state generators and more than 85% capacity of the intrastate generators exhibited inadequate governor response during the event.
7. **Reactive Power Management:** The event highlighted the need for effective reactive power management. Heavy reactive power drawl was observed, leading to further voltage reductions.
8. **Information sharing and Co-ordination:** Timely report submissions and communication are essential.

A.21.3 Based on the above observations, following actions were recommended for avoiding the recurrence of such grid event:

1. **Reactive Power Management (Dynamic/Static) by STU and DISCOMs:** In order to maintain voltage stability, reactive power support is desired from all grid connected utilities without leaning over each other so as to ensure minimum reactive exchange at different voltage levels.
2. **Planning for dynamic reactive power sources near load centers based on load composition:** Adequate static/dynamic reactive devices may be planned at the distribution level near loads so that there is minimum drawl from reactive sources at the transmission (STU) level. The dynamic reactive power sources may be commissioned near load centre stations based on the composition and quantum of individual load type.

3. **Enhance reliability of HVDC Link:** POWERGRID to review protection schemes to avoid frequent outages, review transmission line design including cross arms, jumpers, etc. and to design filter switching logic which support system voltage.

4. **Implementation of Overvoltage protection setting:** Followings are recommended for implementing overvoltage Stage-I protection settings:

    a. Pick up voltage & time delay setting of Antitheft lines to be kept low with sufficient time gap from other lines at S/s.

    b. Parallel lines grading to be done such that one line should trip early by setting at low voltage and other line should trip last by keeping setting at high voltage.

    c. Highly loaded lines should be given last priority in tripping.

    d. Net MVAr relief (based on line charging MVAr & MVAr compensation in line) based on the simulation to be considered for arriving at the priority of line tripping. Lines providing high net MVAr relief to be tripped early.

    e. Grading to be done in such a manner that one major incoming and outgoing line shall remain connected after tripping of lines at any node.

    f. Protection setting of remote end station of a line need to be coordinated so as to avoid tripping of line from other end.

    g. Drop-off to pick-up ratio of Relays implemented for overvoltage protection shall be more than 99.5%.

5. **Frequency Response by Generating Units as per IEGC 2023:** It is recommended that the performance of generating units where inadequate primary response was observed to be discussed at RPC level.

6. **Compliance of CEA Standards by Renewable Generating Plants:** RE generators must comply the CEA Standards. It is recommended that:

    a. Protection settings of inverters/WTG shall be coordinated in such a way that it accounts for the voltage rise/drop between inverter/WTG terminal

& Point of interconnection (POI). Overvoltage /undervoltage trip settings should be configured accordingly.

b. The reactive power controller settings (droop, deadband, power factor, operating modes) in inverters/WTGs should be configurable and shall be set in consultation with the respective load dispatch centre.

c. The protection settings of elements in collector system viz. transformers, cables etc. shall such that it allows RE plants to ensure the compliance of CEA standards at POI.

d. RE plants to ensure that the event records shall be shared with SLDC/RLDC within the stipulated time for event analysis. All such data shall be retained in a retrievable format in a suitable archival system.

7. **Retain of Conventional generators near load centers for providing grid support during such events:** The presence of thermal generators near the load centres may significantly improve the voltage profile and can provide dynamic reactive power support in case of contingencies improving the stability.

8. **Compliance of Standards by Load Serving Machines:** The stalling of motors at high voltage (0.85-0.9 pu) to be investigated and the motors serving load need to be compliant with IS/IEC.

9. **Amendments in Existing Regulations:** For ensuring reliable operation, provisions related to different emerging types of loads (Electrolysers etc.) may be added in the existing CEA standards.

<u>TCC Deliberation</u>

A.21.4 CGM (SO), NRLDC, stated that this was a significant event, with frequency rising to 50.68 Hz due to a large quantum of load loss. Voltages in the affected areas also surged, making system management very challenging. Adherence to all the actions recommended by NRLDC can help prevent such events in the future.

A.21.5 Director (SO), GRID-INDIA made the following observations:

a. The HVDC Champa-Kurukshetra tripping event, along with the Spanish grid event, highlights the need for greater emphasis on planning and simulation studies. Comprehensive and detailed studies must be conducted to address such issues.

b. The modeling of loads and generators has become critically important.

c. Dynamic reactive support in the system is urgently required, as its availability could have mitigated the impacts of both the Champa-Kurukshetra tripping event and the Spanish grid event.

d. Similar challenges are being encountered globally, and we need to take a proactive lead in addressing them. All utilities, including SLDCs and STUs, must undertake comprehensive studies. Whenever a new generator is being connected, a bulk load is being added, or any new facility is commissioned, detailed analyses are required. STUs and SLDCs should collect data from utilities seeking connectivity and ensure thorough verification, including performance assessment during grid events, to prevent such adverse repercussions.

e. Utilities, SLDCs, and STUs need to take immediate steps to implement dynamic reactive power compensation, particularly in the Northern Region, where there is a high concentration of load in the NCR area.

<u>NRPC Deliberation</u>

A.21.6 Member (GO&D), CEA stated that it was a very important analysis done by GRID-INDIA and NRPC in which POWERGRID was also associated. Key findings obtained in the analysis of the tripping event of 17th June 2024:

i) The motors currently installed in the agricultural sector, as well as those used in domestic air conditioners, require significant improvement. Distribution utilities can play a more proactive role, as these loads are connected at the distribution level. Supervision by DISCOMs is essential to monitor the quality of motors being installed in both agricultural and domestic settings. If higher-quality motors had been installed, such event might have been avoided.

ii) The presence of conventional generators near load centers is also critically important. The concept of locating the transmission system in one area and generators elsewhere is no longer viable. Conventional generators, along with dynamic reactive compensation devices, are required close to load centers. While dynamic compensation was previously considered only at ISTS-level grid substations, in the current scenario, it is also necessary to implement dynamic reactive compensation near the load centers.

iii) The substantial MVAR drawl from the states has reached alarming levels. This event was a near miss and could have potentially resulted in a significant grid disturbance.

iv) Protection and communication audits are crucial, as highlighted in earlier agenda discussions. System upgrades alter power flows, making it essential to review protection settings and ensure reliable communication from both the load and generator sides. Consequently, the role of the SLDC becomes critically important.

v) Currently, SLDCs are not equipped to conduct such studies but will need to perform regular system analyses to address future requirements and support system improvements. SLDCs will play a key role in assisting RLDCs with these studies. Developing an expert and professional workforce at SLDCs is therefore becoming increasingly critical, particularly as the share of renewable energy continues to grow.

vi) The purpose of presenting these analysis reports at the TCC and NRPC forums is to emphasize that this is a challenge the entire power system is likely to face. To prevent such situations from escalating into disturbances, corrective measures must be implemented immediately. The system is already showing signs of vulnerability, and all stakeholders are urged to take actions based on the presented analysis and to educate their counterparts at the state level, as the impact affects everyone connected to the power system.

A.21.7 Director (SO), GRID-INDIA also emphasized that as observed in the Spanish grid event, dynamic reactive power compensation in STU networks is essential. STUs with concentrated loads, such as Delhi, Haryana, and Punjab, should also plan for dynamic reactive power compensation.

A.21.8 ***Decision of the Forum:***

The forum requested all the constituents to go through the Tripping Analysis Report of tripping pertaining to HVDC Champa-Kurukshetra on 17.06.2024 *and also take necessary measures as recommended in the report for safe and reliable grid operation (Event analysis report enclosed as Annexure-A.V)*

A.22 Non-Payment of Pool Deficit Recovery Charges (Agenda by NRLDC)

A.22.1 NRLDC representative mentioned that Hon'ble CERC has approved "Detailed Procedure for recovery of charges in case of deficit in the Deviation and Ancillary Service Pool Account" (effective from 15.10.2024) for recovering the deficit in the pool for the period prior to 16.09.24 (Legacy dues) and from 16.09.24 onwards till 31.03.2026.

A.22.2 In line with the approved procedure, NLDC had published statement namely "Net Deviation & Ancillary Services Pool Account Deficit Recovery Statement for period prior 16.09.2024 (Legacy Dues)" dated 11.11.2024, specifying the All-India deficit of Deviation and Ancillary Services Pool Accounts and per instalment amount to be paid by the drawee DICs.

A.22.3 NLDC vide letter dated 03.03.2025, revised pool deficit recovery statement due to revised assessment of the respective regional deviation and ancillary pool account.

A.22.4 Further in line with the approved procedure, NLDC had published first statement (Bill-01) namely "Net Deviation & Ancillary Services Pool Account, Pool Deficit Recovery Statement dated 13.01.2025 for the duration of 16.09.2024 to 22.12.2024.

A.22.5 Payment from all constitutes received except UP and J&K. Outstanding details are as below:

Entities	Pool Deficit Recovery Charge (in Cr)		Pool Deficit Recovery Charges (in Cr) (Legacy Dues prior to 16.09.2024)	Total (in Cr)
	(NLDC statement dated 13/01/2025)	(NLDC statement dated 17/09/2025)		
Uttar Pradesh	17.84	13.96	221.54	**253.34**
Jammu & Kashmir	2.92	1.96	45.37	**50.25**
Total	**20.76**	**15.92**	**266.91**	**303.59**

TCC Deliberation

A.22.6 UPSLDC apprised that UPERC has given a decision that Legacy dues are to be billed to DICs and cannot be paid from the UP-state DSM account. In this regard, a order issued on 15.10.2025 by UPERC.

A.22.7 UPSLDC was asked to break-up of pending payment details of DICs namely; NPCL, UPPCL, Northern Railway and Allahabad Railways. Further, contact details of DIC's was also requested.

A.22.8 NRLDC representative stated that the payment is ultimately to be paid by the DISCOMs. UPSLDC was asked to coordinate accordingly. UPSLDC and UPSTU will coordinate for the same with RLDC and NRPC.

A.22.9 ED, NRLDC emphasized that payments to the statutory pool account should be treated as a high priority.

A.22.10 MS, NRPC urged UP and J&K to clear their pending dues of pool deficit recovery at the earliest, noting that delays in such payments impact the timely disbursement of receivables to other constituents.

A.22.11 TCC Forum requested UP and J&K to clear their pending dues at the earliest.

A.22.12 MD, JKPDCL informed that out of the total dues of ₹130 crores, ₹30 crores have been paid, and the remaining ₹100 crores will be settled within the current financial year.

NRPC Deliberation

A.22.13 NRPC forum noted the deliberation held in TCC meeting.

Decision of the Forum:

I. *Forum advised to UP SLDC/STU will coordinate with RLDC/NRPC in view of the UPERC order.*

II. *A separate meeting with UP SLDC, STU and DISCOM with NRLDC and NRPC would be called for facilitating the legacy dues payment.*

A.23 Non-Payment of Deviation & Reactive Energy Charges by J&K (Agenda by NRLDC)

TCC Deliberation

A.23.1 NRLDC representative apprised the forum that NRLDC is operating and maintaining the “Northern Region Pool Account” for deviation charges, Reactive Energy Charges and Congestion Charges in accordance with provisions under various CERC Regulations. As per Regulations, the payment to the statutory pool account has high priority and the concerned utilities are required to pay the indicated amounts within 10 days of the issue of the weekly energy account by the NRPC secretariat.

A.23.2 In this regard, the payment of deviation charges and Reactive energy charges of J&K is long pending. After continuous follow-up, JKPDCL has made a payment of ₹30 Cr towards deviation charges on 15.09.2025.

Net outstanding charges of J&K as on 23.10.2025:

Sr. No.	Entity/Description	J&K
		(Amount in Cr)
1	DSM Charges	50.79
2	Pool Deficit Charges (Legacy Dues)	45.37
3	Pool Deficit Charges (NLDC statement dtd 13.01.25)	2.92
4	Pool Deficit Charges (NLDC statement dtd 17.09.25)	1.96
	Total Charges	**101.04**

A.23.3 Further following petition has been filed with Hon’ble CERC:

a. Petition filed by NLDC on 02/05/2025 for non-payment of legacy dues by DIC.

b. Petition filed by NRLDC on 24/03/2025 for non-payment of legacy dues and DSM charges

A.23.4 TCC Forum requested J&K to clear their pending dues at the earliest.

A.23.5 MD, JKPDCL stated that all outstanding dues would be settled within the current financial year.

NRPC Deliberation

A.23.6 NRPC forum noted the deliberation held in TCC meeting.

A.23.7 ***Decision of the Forum:***

Forum requested J&K to clear their pending dues at the earliest.

A.24 Installation of standby meters/other end meters on various feeders in NR (Agenda by NRLDC)

<u>TCC Deliberation</u>

A.24.1 NRLDC representative apprised that a separate online meeting was convened by NRLDC on 09th April 2025, during which representatives from CTU/POWERGRID informed that there was a shortage of meters. It was indicated that new meters were expected to be supplied by May 2025, with installation planned by June 2025.

A.24.2 As per NRLDC, current status of meters installation is as below:

Category	Total Meters Proposed	Meters Pending	Key Reason
BBMB Standby Meters	38	7	Lack of redundancy affects data validation
Other States' Standby Meters	50	50	No installation yet; impacts validation in meter data discrepancies

A.24.3 Subsequently, in the 52nd Commercial Sub-Committee meeting held on 27th August 2025, CTU informed that installation of the remaining 7 meters is pending due to non-receipt of consent from the entities/substations. For 50 additional meters, installation will take another 4 months due to a meter shortage.

A.24.4 Regarding the installation of 50 standby meters for other states, PGCIL informed that the supply is expected in December 2025.

A.24.5 With regard to status of meter replacement, current status updated by NRLDC was as below:

Meter Description	Total Meters to be Replace	Meters Pending for Replacement	Key Reason
Vincom Meters	31	21	Replacement delayed
Elster Meters	115	36	Vendor support withdrawn, Persistent data conversion issues

A.24.6 MS, NRPC stated that installation should be expedited wherever consent has been provided.

A.24.7 Director (SO), GRID-INDIA suggested PGCIL to contact the respective state nodal officials, considering the commercial aspects, rather than relying solely on site personnel. States and other utilities were also requested to provide the details of their Nodal Officers to facilitate the smooth installation of meters.

A.24.8 Kishanganga (NHPC) was advised not to insist on replacing healthy meters merely to maintain uniformity of make, and to expedite the installation of meters.

A.24.9 TCC forum was of view that consent issues to be mutually sorted out among POWERGRID and utilities.

A.24.10 CTU informed that advance payments for both the replacement and installation of new meters will be processed through the portal. An internal SOP is being prepared, and constituents will be required to obtain prior approval for advance payments in accordance with the SOP.

NRPC Deliberation

NRPC forum noted the deliberation held in TCC meeting and Forum was in consonance of the same.

A.25 Current status on replacement of Vincom and Elster meters (Agenda by NRLDC)

A.25.1 The agenda was discussed in conjunction with Agenda Item A.24.

A.26 Requirement for Additional VOIP SIP Numbers (Agenda by NRLDC)

Background

A.26.1 The existing SIP numbers at NRLDC have been fully utilized, making it impossible to configure any new substations or plants. POWERGRID had been requested to coordinate with M/s Orange for the allocation of additional SIP extension numbers to ensure seamless VOIP communication.

A.26.2 During 27th TeST meeting, the representative from POWERGRID informed that the RRVPN Orange Exchange will be utilized, which was also confirmed by the RRVPN representative.

A.26.3 During 28th TeST meeting, Representative from NRLDC informed about the configuration issue in integrating the SIP number via the SLDC Rajasthan Orange server then POWERGRID representative informed the forum that a visit of M/s orange personnel to NRLDC will be scheduled shortly to explore through RRVPN or NLDC Orange Exchange and resolve configuration issues. But the visit still pending.

A.26.4 POWERGRID further informed that tender for new VOIP scheme has been floated after taking approval from NCT.

TCC Deliberation

A.26.5 PGCIL reported that issues were being encountered in the RRVPN Orange Exchange, preventing the successful allocation of additional SIP extension numbers. However, a spare old license is available at Panipat, SLDC Haryana, and recent testing has been successfully completed. This license will be utilized to ensure seamless VoIP communication.

A.26.6 Forum noted the same.

A.26.7 **NRPC Deliberation**

NRPC forum noted the deliberation held in TCC meeting and Forum was in consonance of the same.

A.27 Guidelines for diversion of RPC approved spare Transformers/Reactors to constituents/state transmission utilities (Additional Agenda by NRPC Secretariat)

TCC Deliberation

A.27.1 EE(C), NRPC apprised that in line with the discussion held in 55th TCC and 80th NRPC meeting regarding diversion of RPC-approved spare transformers/ reactors, POWERGRID was asked to submit draft guidelines for diverting RPC-approved spare transformers and reactors to regional constituents. Guidelines should cover scope, cost implications, penalty provisions, responsibilities of borrowers, timeline for return, and other general aspects related to diversion.

A.27.2 In compliance to the above, POWERGRID submitted draft guidelines for diversion of RPC approved Spare Transformers to the constituents/state transmission utilities. Draft guidelines submitted by POWERGRID was deliberated in the 234th and 235th OCC meeting of NRPC and 52nd Commercial Sub-Committee (CSC) meeting of NRPC.

A.27.3 The draft guidelines was further revised by the NRPC Secretariat to incorporate the aspects discussed in CSC and subsequently discussed in the 236th OCC meeting of NRPC. The OCC forum, in general, agreed to the draft guidelines, with the observation that conditions related to utilization of Bank Guarantees should be included.

A.27.4 EE(C), NRPC presented to the forum, draft guidelines for diverting RPC-approved spare transformers and reactors to regional constituents. Salient Points of the above-mentioned guidelines are as follows:

a. **Purpose and Scope:**

Regional spares are meant for ISTS substations. Diversion to an STU substation is allowed only in exceptional cases, based on criticality of the requirement and subject to expeditious replenishment by the Borrower. Diversions for commissioning new assets or inter-regional diversions under these guidelines are not permitted.

b. **Ownership and Record Keeping:**

All diversions are strictly on a replenishment basis—no sale or transfer of ownership. POWERGRID will maintain a centralized inventory of all regional spares with complete technical details and location records.

c. **Borrower Responsibilities:**

- Verify equipment condition jointly with POWERGRID before signing the MoU.
- Bear all costs for transportation (both ways), insurance, erection, testing, commissioning, statutory charges, and any incidental expenses or losses to POWERGRID.
- Ensure site readiness and equipment compatibility prior to diversion.
- Return or replenish the equipment in healthy condition within the approved timeline and bear repair/replacement costs for any damage.

d. **Testing After Return:**

After returning of equipment, all pre-commissioning tests may be jointly performed at POWERGRID station to ascertain healthiness. In case of any deviation, POWERGRID may take up the repair of equipment and cost of the repair may be borne by the Borrower.

e. **Approval and MoU Process:**

RPC Secretariat will place the diversion proposal before the RPC forum for decision. After approval, POWERGRID and the Borrower must sign a MoU within 45 days, detailing responsibilities, financial implications, BG requirements, timelines, and penalties.

f. **Handover Timelines:**

The Borrower must take physical handover of the equipment within 45 days of MoU signing. Failure to take handover within 90 days of RPC approval will be treated as automatic revocation, except for a one-time extension of up to 30 days granted by POWERGRID.

g. **Cost Implication:**

Diversion of Regional Cold Spares may be carried out on a cost-neutral basis, ensuring that POWERGRID neither incurs financial loss nor earns additional revenue on account of such diversion. The diversion should not result in any change in the Yearly Transmission Charges recoverable by POWEGRID as per the approved tariff against the diverted asset all financial adjustments, if any, may be settled within the regional pooling mechanism as approved by the RPC forum.

h. **Penalty for Delay in Return:**

If the Borrower fails to return or replenish the equipment within the agreed period (maximum 24 months), a penalty of 15% of the approved YTC of the diverted asset will be imposed on a pro-rata basis for the delayed duration. The penalty will be credited to the Regional Component of ISTS charges.

A.27.5 DTL was of the view that, considering the prevailing delivery period of transformers (approx. 36 months), the maximum diversion period of twenty-four (24) months specified in the draft guidelines is inadequate.

A.27.6 MS, NRPC clarified that diversion of cold regional spare to STU is envisaged to cater to the its demand in case of failure of their equipment and consequent system constraints and not for commissioning of new asset. Keeping this in view, the maximum diversion period has been determined based on an average repair time of 18 months, as informed by POWERGRID, and an additional 6 months for transportation and commissioning, de- commissioning, etc. Any request for extension of the diversion period beyond twenty-four (24) months may require prior approval of the concerned RPC forum, supported by justification.

A.27.7 MS, NRPC stated that this agenda would also be placed before the NPC for obtaining views from all RPCs.

A.27.8 Director (SO), Grid-India, mentioned that the guidelines appear to be in order and suggested that the matter be taken up in the NPC forum to ensure uniformity at the pan-India level.

NRPC Deliberation

A.27.9 NRPC forum noted the deliberation held in the TCC meeting and the Forum was in consonance with the same.

A.27.10 Member (GO&D), CEA stated that requests from borrowers seeking diversion of regional spares may also be evaluated by the Operation Coordination Committee (OCC) of the respective RPC considering urgency of some cases, as OCC meetings are held more frequently.

A.27.11 Member (GO&D), CEA opined these guidelines will be applicable for future cases. However, for current transformer diversion cases—particularly those in which the utility has not returned the diverted equipment for over two years—may be referred to the Commercial Sub-Committee for deliberation.

A.27.12 ***Decision of the Forum:***

I. *Forum approved the guidelines for diverting RPC-approved cold spares (transformers and reactors) to regional constituents and asked RPC secretariat to implement the same. (Copy of the guidelines enclosed as Annexure-A.VI)*

II. *Guidelines may next be taken up in the NPC forum for ensuring uniformity at the pan-India level.*

A.28 Implementation of Travelling Wave Fault Locator (TWFL) on critical transmission

lines in the Northern Region (Additional Agenda by NRPC Secretariat)

A.28.1 EE(O), NRPC apprised forum that in the 55th TCC and 80th NRPC meeting, a proposal received from PGCIL for Implementation of Travelling Wave Fault Locator (TWFL) in hilly terrains, Critical Renewable, & NCR transmission lines in Northern

Region was discussed. After detail deliberation, the NRPC forum decided to formulate a sub-group, comprising members from CEA, CTU, NRPC, NRLDC, Powergrid, Indigrid, ATIL, Sterlite, Sekura, RVPNL, PTCUL, HPPTCL and JKPCTL with the following Terms of Reference.

i) Formulate criteria to identify critical transmission lines that warrant the installation of TWFL, based on operational importance and reliability considerations.

ii) Evaluate the restoration benefits of TWFL—specifically in terms of fault location and faster restoration—by comparing scenarios with and without TWFL, using data provided by Powergrid for lines where TWFL is already implemented.

A.28.2 Accordingly, based on nominations received from concerned utilities, the Sub-group was formed under Chairmanship of SE(O&P) NRPC. Sub-group held two meetings on 28.08.2025 and 17.10.2025 respectively (MoM of the meetings are attached at **Annexure-A.VII**). Further, a physical visit at POWERGRID Meerut S/s was conducted by a team comprising of members from CEA, NRLDC, CTU and NRPC Secretariat on 19.09.2025 to understand the functioning of the TWFL system and to evaluate the benefits of its installation on transmission lines.

A.28.3 After deliberation in the meetings, sub-group members agreed that;

a. Travelling Wave-Based Fault Locator (TWFL) has emerged as a highly advanced and precise fault location technology. This is useful for **quickly identifying the fault location with accuracy (±500 m error), which directly contributes to reduced outage durations, improved system availability, and enhanced reliability of the transmission network**.

b. TWFL implementation may be taken up in phased manner. Following criteria may be used to identify critical transmission lines for installation of TWFL in the first phase:

i. 220kV, 400kV and 765 kV lines having length more than 200 Km.

ii. 220kV, 400kV and 765 kV lines used for evacuating nuclear and RE Power having length more than150 Km.

iii. 220kV and above lines in hilly terrain.

iv. Inter-regional 220kV and above lines having length more than 150 Km.

c. Based on the above criteria committee reviewed the lines proposed by PGCIL in the 55th TCC and 80th NRPC meetings for TWFL implementation. Out of the 25 nos. lines, 20 nos. lines as mentioned at **Annexure-A.VIII** may be considered for TWFL implementation.

d. A policy may be formulated by CTU for implementation of TWFL in intra-state lines.

A.28.4 CTU mentioned that policy for Implementation of Travelling Wave Fault Locator (TWFL) for ISTS and intra state lines may be formulated by CEA in consultation with CTU, Grid-India and all other NR stakeholders.

A.28.5 Director (SO), Grid-India, suggested that the sub-group's recommendations be discussed at the NPC level for uniform policy decisions at the pan-India level.

NRPC Deliberation

A.28.6 Member (GO&D), CEA enquired about the cost of the TWFL devices and suppliers in Indian Market.

A.28.7 SE(O), NRPC replied that the cost of supply, installation, testing and commissioning of TWFL, as intimated by PGCIL is approximately 25 lakh per end for a two-line module, 50 lakh per end for a four-line module, and ₹100 lakh per end for an eight-line module.

A.28.8 Regarding the manufacturers of TWFL devices, SE(O), NRPC intimated that same was discussed in sub-group's meeting and PGCIL has informed that GE and Qualitrol manufactured TWFL devices are available in the Indian market. Additionally, TWFL devices manufactured by SEL and Kehui are also available globally.

A.28.9 ***Decision of the Forum:***

Forum was of view that sub-group's recommendations be discussed at the NPC level for uniform policy decisions at the pan-India level.

A.29 Table Agenda 1: Procurement of power from the Subansiri Lower Hydroelectric Project (2,000 MW), with Punjab's allocated share being 64 MW (Agenda by NHPC)

NRPC Deliberation

A.29.1 GM (Commercial), NHPC presented the matter to the forum. Details are enclosed as **Annexure-A.IX**.

A.29.2 Members noted that issues concerning the PPA lie beyond the scope of this forum. They advised that NHPC/Punjab pursue the matter with CERC/the Ministry of Power, as appropriate.

Agenda for NRPC Meeting

B.1 Outstanding Contribution for FY 2025-26 (Agenda by NRPC Secretariat)

B.1.1 EE, NRPC informed that during the 78th NRPC meetings (held on 17 March 2025), the forum approved the membership contribution for the year 2025-26 to be Rs. 14 lakh per member. Members were requested to complete the above contribution towards NRPC fund by 30.06.2025, failing which 1% simple interest rate per month would be levied on late payment from 1st July, 2025 onwards.

B.1.2 Following this, a demand Letter for contribution towards NRPC fund for the year 2025-26 was sent by 10.04.2025 to all the constituent members. The letter also specified that for any payment beyond 30th June, 1% simple interest per month shall be levied. It was informed that payment has not been received from some constituent members as of June 30, 2025.

B.1.3 Accordingly, the total outstanding contribution as apprised in the meeting as on date is mentioned below:

S. No.	Name of Constituent	Period (FY)	Outstanding Amount	Penalty	Total
1.	UT of Chandigarh	2025-26	14,00,000	14,000	14,14,000
2.	Talwandi Sabo Power Ltd.	2025-26	0	28,000	28,000
3.	UT of Ladakh	2025-26	0	28,000	28,000
4.	NVVN	2025-26	0	28,000	28,000
	Total		14,00,000	98,000	14,98,000

**Last date of payment for UT of Chandigarh was 30.09.2025 as decided in 80th NRPC meeting.*

B.1.4 EE, NRPC apprised that Ministry of Power (MoP) vide Resolution dated 3rd December 2021 has re-constituted five RPCs. Clause - 3 of above gazette resolution dtd. 03.12.2021 states provide as follows:

***"**From each of the Union Territories in the region, a representative nominated by the administration of the Union Territory concerned out of the entities engaged in generation/ transmission/ distribution of electricity in the Union Territory."*

B.1.5 It is informed that for the FY 2024-25, the Electricity Wing of the Engineering Department, Chandigarh Administration was the nominated member of NRPC by the Administration of UT of Chandigarh. However, recently Electricity Wing of the Engineering Department has been reconstituted and the distribution company has been privatized, a revision in the nomination was requested from UT of Chandigarh.

B.1.6 UT of Chandigarh vide memo no. G1/2025/2128175 dated 16.06.2025, has nominated State Transmission Utility (STU)" within the Union Territory of Chandigarh as member of NRPC for FY 2025-26. Subsequently, a demand letter has been issued to the STU of Chandigarh for their contribution towards NRPC fund for the year 2025-26.

B.1.7 NVVN vide letter no. NVVN/Comml./NRPC/2025-26/01 dated 09.05.2025, requested for exemption from NRPC membership amount under SNA category. In this regard, EE, NRPC apprised that Rule 29 of the NRPC Conduct of Business Rules provides as under:

"All the Members and rotational members except the following shall contribute equally on annual basis, which shall be decided every year in NRPC meeting based on review of actual expenditure of the previous year and estimated expenditure in current/next year:

- *NLDC/NRLDC/SLDC*
- *Member (Go&D), CEA*
- *MS, NRPC*
- *Exempted by MoP "*

B.1.8 Accordingly, Ministry of Power (MoP) is empowered to grant exemption from the membership amount. Therefore, in the 80th NRPC meeting, NVVN was advised to approach MoP for obtaining the necessary exemption, if desired.

B.1.9 EE, NRPC informed that for FY 2024-25, interest amount was pending from two organisations. Details of which are:

S. No.	Name of Constituent	Period (FY)	Penalty (Rs)	Total Outstanding amount (Rs)
1	UT of Chandigarh	2024-25	12,000	12,000

2	Talwandi Sabo Power Ltd.	2024-25	24,000	24,000
			Total	Rs 36,000

B.1.10 As per the decision taken during the 78th NRPC meeting held in Kochi, the interest amount was to be waived only if the contribution for FY 2025–26 was paid by 30.06.2025. Since, Talwandi Sabo Power Ltd and UT of Chandigarh did not pay the contribution amount for FY 2025-26 within the stipulated time, interest for FY 2024-25 is still applicable on them.

B.1.11 Thus, total Outstanding contribution to NRPC Fund for FY 2025-26 and FY 2024-25 as apprised in the meeting is as follows:

S. No.	Name of Constituent	Period (FY)	Outstanding Amount (Rs)	Penalty (Rs)	Total (Rs)
1.	UT of Chandigarh	2025-26	14,00,000	14,000	14,26,000
		2024-25	0	12,000	
2.	Talwandi Sabo Power Ltd.	2025-26	0	28,000	52,000
		2024-25	0	24,000	
3.	UT of Ladakh	2025-26	0	28,000	28,000
4.	NVVN	2025-26	0	28,000	28,000
	Total		14,00,000	1,34,000	15,34,000

B.1.12 MS, NRPC requested above organizations to pay the contribution amount and the interest amount at the earliest to avoid further levying of penalty charges.

B.1.13 Forum noted that, as discussed in the 80th NRPC meeting held on 18 July 2025, NVVN had been advised to approach the MoP to obtain the required exemption. Subsequently, NVVN has paid the contribution amount of ₹14,00,000/-. Therefore, the penalty for FY 2025–26 may be waived.

B.1.14 In the meeting, the UT of Ladakh agreed to pay the penalty amount, which has been paid by them on 13th November 2025.

B.1.15 Therefore, total outstanding contribution as on 13th November**,** 2025 is as follows :

(all figures in Rs.)

S. No.	Name of Constituent	Contribution amount (FY 2025-26)	Penalty (FY 2025-26)	Penalty (FY 2024-25)	Total Outstanding amount
1	UT of Chandigarh	14,00,000	28,000	12,000	14,40,000
2	Talwandi Sabo Power	0	28,000	24,000	52,000

	Ltd.				
	Total				14,92,000

B.1.16 ***Decision of the Forum:***

Forum directed the concerned to pay the outstanding contribution along with penalty as applicable. The penalty amount for NVVN for FY 2025-26 was waived off.

B.2 SOP for Operation of NRPC Fund (Agenda by NRPC Secretariat)

B.2.1 EE, NRPC apprised that as per the Standard Operating Procedure (SOP) for Operation of the NRPC Fund, communicated vide letter No. 1/1/2-23-Bud(CEA)/1308 dated 01.05.2023, financial powers have been delegated to the Member Secretary, RPC, for approval of recurring expenditures up to ₹10 lakh per case.

B.2.2 The monthly electricity bill for the NRPC premises (comprising the NRPC and NRLDC office complex) often exceeds the aforementioned financial ceiling. As per the arrangement approved by the Secretary, CEA, vide letter dated 17.05.2023, the electricity charges for the common premises are shared between NRLDC and NRPC based on actual consumption. This arrangement replaces the earlier 80:20 sharing ratio (NRLDC:NRPC).

B.2.3 Although NRPC's share of electricity consumption remains within the ₹10 lakh limit, the total monthly bill — covering both NRPC and NRLDC portions — frequently exceeds this ceiling. As per the approved arrangement, NRPC initially makes full payment to the electricity utility, with NRLDC reimbursing its share subsequently.

B.2.4 Since electricity charges constitute a critical and recurring expenditure, NRPC Secretariat has taken up the proposal of enhancement of the financial powers of MS, NRPC with Secretary, CEA. This revision would ensure smooth processing of essential utility payments and help avoid audit observations relating to expenditure exceeding the presently delegated financial limits.

B.2.5 ***Decision of the Forum:***

Forum asked MS, NRPC, to take up the matter with the Secretary, CEA. It was also suggested that, until the limit for recurring expenditure is raised beyond ₹10 lakh per case, utility payments may be processed by the NRPC Secretariat.

B.3 Status of Expenditure incurred during Quarter-2 of FY 2025- 26 from NRPC Fund (Agenda by NRPC Secretariat)

B.3.1 EE, NRPC apprised that as per the Standard Operating Procedure (SOP) for budgeting and expenditure of RPCs in pursuance to the MoP letter dated 23.02.2006, NRPC had finalized its annual Internal Budget for FY 2025-26 and got it approved by Forum in 78th NRPC meeting held on 17.03.2025. In line with the budget finalized, status of actual expenditure incurred (INR 4,74,15,315) during Quarter-1 of FY 2025-26 was apprised in 80th NRPC meeting held on 18.07.2025.

B.3.2 In line with the budget finalized, Status of actual expenditure incurred during Quarter-2 of FY 2025-26 (All figures in Rs.) is as follows:

Account Head	Budget Estimate for FY 2025-26	Remarks/ Booking of Expenditure during Q1 and Q2 /FY 2025-26	Total Expenditure during Q1/ FY 2025-26	Total Expenditure during Q2/ FY 2025-26	Total Expenditure FY 2025-26
Salaries*	1,85,00,000	Salary bills	50,39,825	43,63,972	94,03,797
Rewards*	1,10,000	Bonus for Group-C Employees	0	0	0
Allowances*	1,42,50,000	HRA, DA etc	43,11,514	34,67,662	77,79,176
Leave Travel Concession*	5,30,000	LTC	8,995	0	8,995
Medical Treatment	10,00,000	Cost of Medical Treatments	44,674	67,790	1,12,464
Training Expenses	5,00,000	Training Expenses of NRPC Officials	0	0	0
	63,72,000	Protection Expert Group Training	0	0	0
Domestic Travel Expenses	15,00,000	Domestic tour expense	2,39,643	26,635	2,66,278
Office		Office			

Account Head	Budget Estimate for FY 2025-26	Remarks/ Booking of Expenditure during Q1 and Q2 /FY 2025-26	Total Expenditure during Q1/ FY 2025-26	Total Expenditure during Q2/ FY 2025-26	Total Expenditure FY 2025-26
Expenses	2,00,00,000	expenditure- Recurring expenses of salary of contractual staff, AMC and other bills.	17,41,741	30,43,893	47,85,634
	30,00,000	NPC Meeting	0	0	0
Rent, Rates and Taxes	2,00,000	Rent rate and Taxes- One time expense of property tax.	1,90,552	0	1,90,552
Digital Equipment	5,00,000	Digital equipment (cartridges, Hard Disks, pen drive etc.)	1,67,183	1,32,342	2,99,525
Repair and Maintenance	1,50,00,000	ARMO, Civil & Electrical works in NRPC Complex through CPWD, AMC of IT Maintenance.	67,27,059	21,08,568	88,35,627
Other Revenue Expenditure	5,00,000	Hospitality and other similar bills (Mobile, Newspaper Bills etc)	36,674	1,66,318	2,02,992
Information, Computer, Telecommunications (ICT) equipment	38,00,000	Cyber Security and Hybrid VC projects and other related	0	4,67,999	4,67,999

Account Head	Budget Estimate for FY 2025-26	Remarks/ Booking of Expenditure during Q1 and Q2 /FY 2025-26	Total Expenditure during Q1/ FY 2025-26	Total Expenditure during Q2/ FY 2025-26	Total Expenditure FY 2025-26
		works.			
Furniture & Fixtures	5,00,000		0	2,48,398	2,48,398
NRPC Reimbursement FY 2024-25		Salary and allowances expenses	2,89,07,455	0	2,89,07,455
Total	8,62,62,000		4,74,15,315	1,40,93,577	6,15,08,892

**As per Budget allocated by CEA/MoP for the FY 2025-26*

B.3.3 The expenditure for the current quarter has been classified and booked under the revised Budget Heads in alignment with the Gazette Notification S.O. 5895(E) dated 16th December, 2022, issued by the Department of Expenditure, Ministry of Finance. This ensures uniformity with the standardized financial classification framework prescribed by the Government of India.

B.3.4 MS, NRPC informed that an officer of the NRPC Secretariat has been assigned additional responsibilities as the Independent Financial Advisor (IFA) for MS, NRPC. The role of the IFA is to advise MS, NRPC on all financial matters and ensure that decisions are in accordance with the provisions of the GFR and CVC guidelines.

B.3.5 ***Decision of the Forum:***

Forum noted the information.

B.4 Development of Unified Accounting Software (UAS) for RPCs and NPC (Agenda by NRPC Secretariat)

B.4.1 EE(C), NRPC apprised the forum of the agenda, and that financial and administrative approval is sought by NRPC secretariat for:

a. Hiring of Agency for IT Projects for *Design and Development of the Unified Accounting Software (UAS)* with one-year warranty and six years of Extended Technical Services (ETS) and floating of the bid on the Government e-

Marketplace (GeM) as per the finalized Technical Specifications, and other tender documents.

b. Award of Work to the bidder found technically and financially suitable, as recommended by the duly constituted Bid Evaluation Committee, in accordance with the tender terms and conditions.

c. Release of Payments to the successful bidder as per the approved *Payment-cum-Implementation Schedule* and the provisions of the tender and contract documents.

d. Approval of additional cost estimate of approx. 4.96 crores towards items not covered under the PSDF grant, namely Web Application firewalls (2nos.), L-2 Access Switches (3 nos.), Network Attached Storage (1 no.), and Extended Technical Services for 5th and 6th Year.

B.4.2 Forum noted that the Ministry of Power has sanctioned a PSDF grant of ₹31.298 crore (including GST) for the "Development of Unified Accounting Software for RPCs and NPC," covering software development, warranty, and four years of ETS. It was also noted that tender documents have been prepared with a Bill of Quantities (BoQ) that includes some essential items which could not be proposed earlier to PSDF for funding, as these provisions emerged during detailed planning and expert consultations, primarily to strengthen cybersecurity and support long-term software operations. The revised BoQ now includes Web Application Firewalls (2 units), L-2 Access Switches (3 units), Network Attached Storage (1 unit), and Extended Technical Services (ETS) for the 5th and 6th year—items currently not covered under the sanctioned grant.

B.4.3 Chairman, NRPC opined that NRPC Secretariat, as the nodal RPC, may proceed with the bidding process based on the revised BoQ and the updated project cost estimate of about ₹36.08 crores, however, it should approach the PSDF Nodal agency to include the additional items in the Revised BoQ with revised cost estimates. He further opined that SOP for Operation of NRPC Fund is applicable to expenditure incurred from RPC fund. Since the instant case being a project financed through the PSDF grant, PSDF grant sanctioned by Ministry of Power may be deemed as financial approval for this project, but only to the extent of the sanctioned grant ceiling.

B.4.4 ***Decision of the Forum:***

I. *Forum accorded administrative approval to NRPC Secretariat, being the nodal RPC for implementation of UAS project, to proceed with the bidding process based on the revised BoQ and the updated project cost estimate of about ₹36.08 crores.*

II. *Forum advised NRPC Secretariat to approach the PSDF Secretariat to increase the sanction grant to include additional items as per revised BoQ and revised cost estimates as the project is of interest to larger number of utilities.*

B.5 Overhaul and AMC of Existing Energy Accounting Software of NRPC for year 2025-27 (Agenda by NRPC Secretariat)

B.5.1 EE(C), NRPC apprised that the existing energy accounting software currently being used at NRPC Secretariat was developed over a decade ago and needs an overhaul to operate reliably and remain compliant with evolving regulatory requirements for next 2 to 2.5 years till transition to the Unified Accounting Software (UAS). In view of above, a proposal for Overhaul and Two (2) Years of AMC of existing Energy Accounting Software of NRPC for year 2025-27 was approved at an estimated cost of ₹39,70,037 in 79th NRPC meeting held on 30.05.2025 with following scope:

a. Deployment of Two (2) full-time Resident Engineers during the first year and one full-time Resident Engineer during the second year of AMC, responsible for executing both overhaul and regular maintenance activities.

b. Procurement and deployment of a dedicated Development and Testing server having minimum 12-core CPU, 32 GB ECC RAM, and sufficient storage, with licensed Windows Server and SQL Server Standard Edition, to replicate the production environment and facilitate safe, parallel testing.

B.5.2 He further apprised that during the tendering process, technical specifications for the proposed Development and Testing Server were reviewed where it was observed that certain tech specs of server were inadvertently defined at a lower tier—closer to workstation-grade configurations rather than enterprise-grade server requirements necessary for reliable testing and parallel validation. Accordingly, the server specifications were revised, with the updated cost estimate assessed at ₹7.09 lakh.

B.5.3 Further, with the AMC for the decade-old software nearing expiry and the system being indispensable for timely and accurate regional energy accounts, continuing operations without maintenance support posed a risk to the commercial settlement process of the Northern Region. Accordingly, a bid for Overhaul and 2 years of AMC of Existing Energy Accounting Software of NRPC, incorporating the revised technical specifications of the UAT server and an updated cost estimate of ₹42,59,079 was floated on GeM. GeM bid is awarded to M/s Sharajman Technologies Private Limited on 15th October 2025 at ₹45,58,338/-.

B.5.4 ***Decision of the Forum:***

I. *Forum approved the revised cost estimate of ₹42,59,079 for the Overhaul and AMC of the Existing Energy Accounting Software for the period 2025–27.*

II. *Forum noted that the bid is* awarded to M/s Sharajman Technologies Private Limited on 15th October 2025 at ₹45,58,338/- and approved the same.

B.6 Deployment of one NHPC official on loan basis in NRPC Secretariat (Agenda by NRPC Secretariat)

B.6.1 MS, NRPC apprised that currently, the NRPC Secretariat is experiencing a significant shortage of manpower at the levels of Assistant Executive Engineer/Assistant Engineer.

B.6.2 This shortage significantly impacts the Secretariat's capacity to efficiently executive its assigned functions as mandated by the MoP resolution and the central electricity regulatory commission in a timely manner. The table below illustrates the sanctioned versus posted strength:

Officer Level	Sanctioned Strength	Posted Strength
Assistant Executive Engineer/ Assistant Engineer	8	5

B.6.3 The issue of manpower shortage has been highlighted in various TCC/NRPC meetings over the past years. In these meeting, it has been discussed that constituents may deploy their officials on rotational basis to NRPC Secretariat for timely discharge functions entrusted with NRPC Secretariat.

B.6.4 In this regard, MS, NRPC informed forum that NHPC has deputed one official Sh. Amit Kumar, Engineer (E&C) on loan basis to NRPC Secretariat for a period of one year w.e.f. 30.06.2025.

B.6.5 ***Decision of the Forum:***

Forum noted the information and expressed gratitude to NHPC for deployment of its one no. of official on loan basis to NRPC Secretariat.

B.7 Development of new website of NRPC through NICSI (Agenda by NRPC Secretariat)

B.7.1 EE, NRPC apprised forum that in the 76th NRPC meeting held on 25.10.2024, approval was granted by NRPC Forum for the development of a new website with a one-year warranty and a five-year Annual Maintenance Contract (AMC) at an estimated cost of **₹37,91,695/-.** This amount includes development, AMC, and hosting costs, exclusive of NICSI service charges.

B.7.2 Subsequently, during discussions with NICSI, it was informed that the entire payment for the project, including AMC, would need to be made in the first year. Accordingly, it was decided to limit the project scope to the development of the website with a one-year warranty only. The five-year AMC will be procured separately through the GeM portal thereafter.

B.7.3 Following this, NICSI awarded the contract for the website development with a one-year warranty to M/s Ornate Techno Services Pvt. Ltd. NICSI issued Proforma Invoice No. PWDDL250041 dated 05.06.2025 for **₹11,69,998/-.** In compliance with relevant GFR rules, an advance payment of ₹4,67,999/- (40% of the total value, including TDS and GST TDS) has been made to NICSI. NICSI subsequently issued Work Order No. W2500060 dated 04.08.2025 to M/s Ornate Techno Services Pvt. Ltd., and the vendor has commenced work on the website development.

B.7.4 Moreover, AMC would be taken up separately after the completion of development of new website.

B.7.5 ***Decision of the Forum:***

Forum noted the information.

B.8 Award of contracts for various services through GeM portal in NRPC Sectt. (Agenda by NRPC Secretariat)

B.8.1 EE, NRPC apprised that NRPC Sectt. have awarded contracts for various services in FY 2025-26 which are tabulated as under:

S.no.	Name of Service	GeM Contract no. / date	Service Provider	Total Contract Value	Duration

				Including All Duties and Taxes (INR)	
1	Manpower Outsourcing Services - Fixed Remuneration	GEMC-511687723128839 Dated 18.06.2025	M/s World Dream Solutions	Rs. 29,97,510/-	01.08.2025 to 31.07.2026
2	Manpower Outsourcing Services - Minimum wage	GEMC-511687734167904 Dated 30.06.2025	M/s Sew Howck Security Services	Rs. 63,53,457/-	11.08.2025 to 10.08.2026
3	Annual Maintenance Service - Desktops, Laptops and Peripherals	GEMC-511687789324937 Dated 22.08.2025	M/s Biro Infotech	Rs. 6,76,500/-	25.08.2025 to 24.08.2027
4	Laundry Service	GEMC-511687774865221 Dated 30.06.2025	M/s Kanojiya and Sons Washing and Drycleaning	Rs. 1,93,814/-	16.08.2025 to 15.08.2027
5	Annual Maintenance Service-Air Conditioner	GEMC-511687733106746 Dated 01.05.2025	M/s A S ENTERPRISES	Rs. 41,600/-	05.05.2025 to 04.05.2027
6	## Catering service (Event Based)	GEMC-511687740091455 Dated 26.06.2025	M/s Ravinder Canteen Contractor	Rs. 45,400/-	01.07.2025 to 30.06.2026
7	Annual Maintenance Services for Water Purification and Conditioning System	GEMC-511687747616766 Dated 01.07.2025	M/s KGN Water Tech India	Rs. 42,900/-	21.07.2025 to 20.07.2028
8	Financial Audit Services	GEMC-511687789444105 Dated 21.08.2025	M/s Agarwal U R S & CO	Rs. 20,700/-	01.09.2025 to 30.09.2025
9	Hiring of Agency for IT Projects for	GEMC-511687730537606	M/s Sharajman Technologies	Rs. 45,58,338/-	22.10.2025 to 21.10.20

	overhaul and AMC of Existing Energy Accounting Software of NRPC for year 2025-27	Dated 15.10.2025	Private Limited		27
10	Procurement of 31 nos. of GAMS Software Licenses for SLDCs and CEA	GEMC-511687705269836 Dated 23.10.2025	M/s SKYQ TECH PRIVATE LIMITED	Rs. 5,34,75000/- Source of Fund: PSDF	01.11.2025 to 31.10.2030

B.8.2 ##Catering service (Event Based)- It is to apprise that this catering contract GEMC-511687740091455 dated 26.06.2025 was envisaged as a rate contract with a validity of a period of one year. However, the contract value came out to be Rs. 45,400/-. The contract value has been exhausted; therefore, this contract has been cancelled and a new bid for catering contract shall be floated.

B.8.3 MS, NRPC apprised that GAMS software will empower States to conduct their own resource adequacy assessments as mandated by the resource Adequacy Guidelines, thus promoting capacity building and uniform, data-driven planning and this project would benefits 28 States and 2 UTs and is being implemented by a central agency (CEA).

B.8.4 NRPC Secretariat is under process for awarding following contracts:

S.No.	Name of Service	Approved in NRPC meeting	Status	Bid Estimated Value	Duration
1	AMC of Integrated Security and Surveillance (CCTV) System	Estimate is less than 25 Lakhs	Under Bidding process: bids sent to Technical Evaluation Committee (TEC)	Rs. 2,14,000/-	3 years
2	AMC of EPBAX system	Estimate is less than 25 Lakhs	Bid under preparation	Rs. 1,04,000/-	3 years

B.8.5 Further, NRPC Secretariat celebrated Independence Day 2025 on 15.08.2025 at its premises and organized Hindi Pakhwada 2025 from 14.09.2025 to 28.09.2025. A total expenditure of Rs. 1,30,906/- was incurred for the arrangements related to the celebrations of Independence Day 2025 and Hindi Pakhwada 2025.

B.8.6 MS, NRPC further informed that a common Canteen-cum-Cafeteria facility as per MOU between NRPC and NRLDC has been established and has been operational since the last quarter. The facility serves staff members, officers, official visitors, guests, and service providers of NRPC, NRLDC, NLDC, and other offices functioning within the premises.

B.8.7 ***Decision of the Forum:***

Forum noted the information.

B.9 Replacement of damaged Submersible Pump in NRPC Colony under the existing work of "Replacement of Fire Alarm System and Renovation & upgradation of existing Fire Fighting System at NRPC, New Delhi" by CPWD (Agenda by NRPC Secretariat)

B.9.1 EE, NRPC apprised forum that NRPC colony maintains a Submersible pump for contingency situations. During the last fortnight of August 2025, there was disruptions in the water supply from Delhi Jal Board. During this period, it was intended to use the Submersible pump, however, upon use, it was found to be damaged and unusable. Consequently, water tankers were arranged twice during this period to meet the water requirements of the NRPC Colony residents.

B.9.2 An ongoing CPWD work titled "Replacement of Fire Alarm System & Renovation and Upgradation of Existing Fire-Fighting System at NRPC, New Delhi" is currently underway, with a sanctioned cost of ₹52,71,420.

B.9.3 CPWD provided an estimate of ₹1,12,735 for the replacement of the old and damaged submersible pump. Accordingly, CPWD was requested to undertake the replacement of the submersible pump at NRPC Colony as part of the ongoing fire safety works. The work of replacement of old & damaged Submersible pump in NRPC colony has been completed.

B.9.4 ***Decision of the Forum:***

Forum noted the information.

B.10 Table Agenda 2: Hosting of next physical TCC & NRPC meeting (Agenda by NRPC Secretariat)

B.10.1 MS, NRPC proposed that next physical TCC & NRPC meeting may be hosted by THDCIL. THDCIL to finalize date & venue of the meeting in consultation with NRPC Secretariat.

B.10.2 ***Decision of the Forum:***

Forum asked THDCIL to finalize venue to host the next Physical TCC and NRPC meeting and intimate NRPC Secretariat accordingly.

Meeting ended with a vote of thanks to the chair and special thanks to JKPTCL & UT of Ladakh for hosting the meeting in splendid way.

******

NRPC Members for FY 2025-26				
S. No.	**NRPC Member**	**Category**	**Nominated/ Notified/Delegated Member**	**E-mail**
1	Member (GO&D), CEA	Member (Grid Operation & Distribution), Central Electricity Authority (CEA)	Member (GO&D), CEA	member.god@cea.nic.in
2	NLDC	National Load Despatch Centre	Director (System Operation)	rk.porwal@grid-india.in
3	NRLDC	Northern Regional Load Despatch Centre	Executive Director	mkagarwal@grid-india.in
4	CTUIL	Central Transmission Utility	Chief Operating Officer	drozekar@powergrid.in
5	PGCIL	Central Government owned Transmission Company	Director (Operations)	naveensrivastava@powergrid.in
6	NTPC	Central Generating Company	Director (Finance)	jaikumar@ntpc.co.in
7	BBMB		Chairman	cman@bbmb.nic.in
8	THDC		CGM (EM-Design)	rrsemwal@thdc.co.in
9	SJVN		CMD	sectt.cmd@sjvn.nic.in
10	NHPC		Director (Technical)	sadhikari@nhpc.nic.in
11	NPCIL		Director (Finance)	df@npcil.co.in
12	Delhi SLDC	State Load Despatch Centre	General Manager	gmsldc@delhisldc.org
13	Haryana SLDC		Chief Engineer (SO&C)	cesocomml@hvpn.org.in
14	Rajasthan SLDC		Chief Engineer (LD)	ce.ld@rvpn.co.in
15	Uttar Pradesh SLDC		Director	directorsldc@upsldc.org
16	Uttarakhand SLDC		Chief Engineer	anupam_singh@ptcul.org
17	Punjab SLDC		Chief Engineer	ce-sldc@punjabsldc.org
18	Himachal Pradesh SLDC		Managing Director	mdhpsldc@gmail.com
19	DTL	State Transmission Utility	CMD	cmd@dtl.gov.in
20	HVPNL		Managing Director	md@hvpn.org.in
21	RRVPNL		CMD	cmd.rvpn@rvpn.co.in
22	UPPTCL		Managing Director	md@upptcl.org
23	PTCUL		Managing Director	md@ptcul.org
24	PSTCL		CMD	cmd@pstcl.org
25	HPPTCL		Managing Director	md.tcl@hpmail.in
26	IPGCL	State Generating Company	Managing Director	md.ipgpp@nic.in
27	HPGCL		Managing Director	md@hpgcl.org.in
28	RRVUNL		CMD	cmd@rrvun.com
29	UPRVUNL		Director (Technical)	director.technical@uprvunl.org
30	UJVNL		Managing Director	mdujvnl@ujvnl.com
31	HPPCL		Managing Director	md@hppcl.in
32	PSPCL	State Generating Company & State owned Distribution Company	CMD	cmd-pspcl@pspcl.in
33	DHBVN	State owned Distribution Company (alphabetical rotational basis/nominated by state govt.)	Managing Director	md@dhbvn.org.in
34	Ajmer Vidyut Vitran Nigam Ltd.		Managing Director	MD.AVVNL@RAJASTHAN.GOV.IN
35	Purvanchal Vidyut Vitaran Nigam Ltd.		Managing Director	nomination awaited(md@puvvnl.in)
36	UPCL		Managing Director	md@upcl.org
37	HPSEB		Managing Director	md@hpseb.in
38	Prayagraj Power Generation Co. Ltd.	IPP having more than 1000 MW installed capacity	Head (Commercial & Regulatory)	sanjay.bhargava@tatapower.com
39	Aravali Power Company Pvt. Ltd		CEO	brahmajig@ntpc.co.in
40	Apraava Energy Private Limited		CEO	niraj.gupta@apraava.com
41	Talwandi Sabo Power Ltd.		Head Regulatory & Policy Advocacy	arun.kumar@vedanta.co.in
42	Nabha Power Limited		CEO	sk.narang@larsentoubro.com
43	MEIL Anpara Energy Ltd		COO & WTD, Executive Director	anandkumar.singh@meilanparapower.com arun.tholia@meilanparapower.com
44	Rosa Power Supply Company Ltd		Station Director	Hirday.tomar@relianceada.com
45	Lalitpur Power Generation Company Ltd		Managing Director	vksbankoti@bajajenergy.com
46	MEJA Urja Nigam Ltd.		CEO	hopmeja@ntpc.co.in
47	Adani Power Rajasthan Limited		Head, Thermal, O&M	Kanti.Biswas@adani.com
48	JSW Energy Ltd. (KWHEP)		Head Regulatory & Power Sales	jyotiprakash.panda@jsw.in
49	Transition Cleantech Services Private Limited	IPP having less than 1000 MW installed capacity (alphabetical rotational basis)		nomination awaited(pkanaujia@evrenenergy.com)
50	UT of J&K	From each of the Union Territories in the region, a representative nominated by the administration of the Union Territory concerned out of the entities engaged in generation/ transmission/ distribution of electricity in the Union Territory.	Chief Engineer, JKSPDCL/JKPDD	cejkpcl2@gmail.com/sojpdd@gmail.com
51	UT of Ladakh		Chief Engineer, LPDD	cepdladakh@gmail.com
52	UT of Chandigarh		Executive Engineer, EWEDC	seelo-chd@nic.in
53	NVVN	Nodal Agency appointed by the Government of India for coordinating cross-border power transactions	NVVN and PTC are two nodal agencies in Northern Region. Since PTC is already a member in this year for trader category, it is listed at serial no. 56.	ceonvvn@ntpc.co.in
54	TPDDL	Private Distribution Company in region (alphabetical rotational basis)	Head-Operations	nomination awaited(ceo.office@tatapower-ddl.cpm)
55	Gurgaon Palwal Transmission Limited	Private transmission licensee (nominated by central govt.)	AVP-O&M	lokendra.ranawat@indigrid.com
56	PTC	Electricity Trader (nominated by central govt.)	CEO	cmd@ptcindia.com
57	ReNew Power Private Limited	RE Generating Company having more than 1000 MW installed capacity	CEO	sumant@renew.com
58	NTPC Green Energy Limited		CEO	rajivgupta@ntpc.co.in
59	Azure Power India Pvt. Limited		CEO	sunil.gupta@azurepower.com
60	Avaada Energy Private Limited		CEO	kishor.nair@avaada.com
61	Adani Green Energy Limited		COO	chaitanya.sahoo@adani.com

List of addressee (via mail)

TCC Members for FY 2025-26

S. No.	TCC Member	Category	Nominated/ Notified/Delegated Member	E-mail
1	Managing Director, JKPTCL	Chairperson, TCC		mdjkptcl1@gmail.com
2	Member (GO&D), CEA	Member (Grid Operation & Distribution), Central Electricity Authority (CEA)		cegm-cea@gov.in
3	NLDC	National Load Despatch Centre		susha@grid-india.in
4	NRLDC	Northern Regional Load Despatch Centre	Executive Director	mkagarwal@grid-india.in
5	CTUIL	Central Transmission Utility	Chief Operating Officer	drozekar@powergrid.in
6	PGCIL	Central Government owned Transmission Company	ED, NR-I	aloksharma99@powergrid.in
7	NTPC		Regional ED, NR	rednr@ntpc.co.in
8	BBMB		Member (Power)	mp@bbmb.nic.in
9	THDC		GM (EMD)	neerajverma@thdc.co.in
10	SJVN	Central Generating Company	Director (Projects)	de.sectt@sjvn.nic.in
11	NHPC		ED (O&M)	hod-om-co@nhpc.nic.in
12	NPCIL		Outstanding Scientist & ED (commercial)	nrchoudhary@npcil.co.in
13	Delhi SLDC			nomination awaited
14	Haryana SLDC		Chief Engineer/SO & Comml.	cesocomml@hvpn.org.in
15	Rajasthan SLDC		Superintending Engineer (SOLD) RVPN	SE.SOLD@RVPN.CO.IN
16	Uttar Pradesh SLDC	State Load Despatch Centre	Chief Engineer (PSO)/Chief Engineer (C&S)	cepso@upsldc.org
17	Uttarakhand SLDC			nomination awaited
18	Punjab SLDC		Chief Engineer	ce-sldc@pstcl.org
19	Himachal Pradesh SLDC			nomination awaited
20	DTL		Director (Operation)	dir.opr@dtl.gov.in
21	HVPNL		Director (Projects)	directorprojects@hvpn.org.in
22	RRVPNL		Chief Engineer (PP&D)	ce.ppm@rvpn.co.in
23	UPPTCL	State Transmission Utility	Director (Planning & Commercial)	director_comm@upptcl.org
24	PTCUL		Chief Engineer	ce_oandmk@ptcul.org
25	PSTCL		Director / Technical	dir-tech@pstcl.org
26	HPPTCL		GM (C&D)	gmcd.tcl@hpmail.in
27	IPGCL		Director(Tech.)	corporate.ppcl@gmail.com
28	HPGCL		Director/Technical	dirtech@hpgcl.org.in
29	RRVUNL	State Generating Company	Dy. Chief Engineer	dyce.elect.katpp@rrvun.com
30	UPRVUNL		Director (Technical)	director.technical@uprvunl.org
31	UJVNL		General Manager	kkjaiswal99@gmail.com
32	HPPCL		Director (Electrical) General	dir_elect@hppcl.in gm_elect@hppcl.in
33	PSPCL	State Generating Company & State owned Distribution Company		nomination awaited
34	DHBVN			directoroperations@dhbvn.org.in
35	Ajmer Vidyut Vitran Nigam Ltd.		Director (Tech.), AVVNL, Ajmer	DT.AVVNL@RAJASTHAN.GOV.IN
36	Purvanchal Vidyut Vitaran Nigam Ltd.	State owned Distribution Company (alphabetical rotational basis/nominated by state govt.)		nomination awaited
37	UPCL		Director (P)	dpupcl29@gmail.com
38	HPSEB			nomination awaited
39	Prayagraj Power Generation Co. Ltd.		Head – Commercial & Regulatory	Sanjay.bhargava@tatapower.com
40	Aravali Power Company Pvt. Ltd		CEO	brahmajig@ntpc.co.in
41	Apraava Energy Private Limited			nomination awaited
42	Talwandi Sabo Power Ltd.		Dy. Head O&M	ravinder.thakur@vedanta.co.in
43	Nabha Power Limited			nomination awaited
44	MEIL Anpara Energy Ltd	IPP having more than 1000 MW installed capacity	COO & WTD, Executive Director	anandkumar.singh@meilanparapower.com arun.tholia@meilanparapower.com
45	Rosa Power Supply Company Ltd		VP-Technical Services	Niranjan.Jena@relianceada.com
46	Lalitpur Power Generation Company Ltd		GM Electrical	aupadhyay.ltp@lpgcl.com
47	MEJA Urja Nigam Ltd.		GM (O&M)	piyushkumar@ntpc.co.in
48	Adani Power Rajasthan Limited		AVP	Manoj.taunk@adani.com
49	JSW Energy Ltd. (KWHEP)		Head of Plant	kaushik.maulik@jsw.in
50	Transition Cleantech Services Private Limited	IPP having less than 1000 MW installed capacity (alphabetical rotational basis)		nomination awaited
51	UT of J&K	From each of the Union Territories in the region, a representative		nomination awaited
52	UT of Ladakh	nominated by the administration of the Union Territory concerned		nomination awaited
53	UT of Chandigarh	out of the entities engaged in generation/ transmission/ distribution of electricity in the Union Territory		seelo-chd@nic.in
54	NVVN	Nodal Agency appointed by the Government of India for coordinating cross-border power transactions		VIKASKUMAR04@NTPC.CO.IN
55	TPDDL	Private Distribution Company in region (alphabetical rotational basis)		nomination awaited
56	Gurgaon Palwal Transmission Limited	Private transmission licensee (nominated by central govt.)		lokendra.ranawat@indigrid.com
57	PTC	Electricity Trader (nominated by central govt.)		bikramsingh@ptcindia.com
58	ReNew Power Private Limited			nomination awaited
59	NTPC Green Energy Limited			nomination awaited
60	Azure Power India Pvt. Limited	RE Generating Company having more than 1000 MW installed capacity		nomination awaited
61	Avaada Energy Private Limited			nomination awaited
62	Adani Green Energy Limited			nomination awaited

Special Invitees:

1. Smt. Rishika Saran, Member Secretary, NPC, Sewa Bhawan, R. K. Puram, New Delhi-66 [Email-rishika@nic.in]
2. Shri Deepak Kumar, Member Secretary, WRPC, Plot No- F-3, MIDC Area, Marol, Opp. SEEPZ, Central Road, Andheri (East), Mumbai-40093. [email: ms-wrpc@nic.in]
3. Shri Asit Singh, Member Secretary, SRPC, No.29, Race Course Cross Road, Bengaluru-560009. [Email: mssrpc-ka@nic.in]
4. Shri N.S. Mondal, Member Secretary, ERPC,14,Golf Club Road, ERPC Building, Tollygunje,Kolkata-700033.[Email: mserpc-power@nic.in]
5. Shri K B Jagtap, Member Secretary, NERPC, NERPC Complex, Dong Parmaw, Lapalang, Shillong-793006. [Email: ms-nerpc@gov.in]
6. Shri Brieflee Lyngkhoi, Chief Engineer, GM Division, CEA, Sewa Bhawan, R.K. Puram, New Delhi-66 [Email: cegm-cea@gov.in]

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ANNEXURE-P

Attendance 56th TCC Meeting of NRPC on 30.10.2025

S. No.	Organization	Name	Designation	Email
1	JPDCL	G.P. Singh Arora	IAS, Chairperson, TCC and Managing Director, JPDCL	gpsarora2002@gmail.com
2	Ladakh PDD	Rudra Goud. P.T.	IAS, Secretary PDD and NRE, UT Ladakh	pt.rudraogoud75@py.gov.in
3	Grid-India	Rajiv Porwal	Director (SO)	rk.porwal@grid-india.in
4	JKPCL	Rahul Yadav	Managing Director JKPCL	mdjkpcl@gmail.com
5	NRPC	Rishika Sharan	Member Secretary	rishika@nic.in
6	ERPC	N S Mondal	Member Secretary	nsmondal@nic.in
7	NERPC	K B Jagtap	Member Secretary	kb.jagtap@gov.in
8	WRPC	Deepak Kumar	Member Secretary	deepak.cea@gmail.com
9	NRLDC	Manoj K. Agrawal	Executive Director	mkagarwal@grid-india.in
10		Somara Lakra	Chief GM	somara.lakra@grid-india.in
11		Bikash Kumar Jha	DGM	bikaskjha@grid-india.in
12	NRPC	Anzum Parwej	SE (C & S)	anjum.parwej@nic.in
13		D.K. Meena	SE (O & P)	dharmendra.cea@gov.in
14		Praveen Jangra	EE	praveen.cea@gov.in
15		Vipul Kumar	EE	vipul.cea@gov.in
16		Omkishor	EE	omkishor.sahu@gov.in
17		Ravi Kant	EE	ravikant.cea@gov.in
18		Lokesh Agrawal	AEE	lokesh.cea@gov.in
19		Omprakash Rajput	AEE	omprakashrajput.cea@gov.in
20		Priyanka Patel	Nodal Officer	priyanka.nrpc@gov.in
21	CTU	Vikas Bagadia	Dy COO	vbagadia@powergrid.in
22		V C Sekhar	Sr. GM	chandu@powergrid.in
23		Sandeep Kumawat	DGM	sandeepk@powergrid.in
24		Tej Prakash Verma	DGM	tejprakash@powergrid.in
25	POWERGRID CC	Manju Gupta	Executive Director	manju@powergrid.in
26	POWERGRID GA&C	Sunil Kumar	CGM-I/C	sunilkumar@powergrid.in
27		Mohan Kishor N	DGM	mohan.kishor@powergrid.in
28	POWERGRID, NR1	Kuleshwar Sahu	CGM	kuleshwar@powergrid.in
29	POWERGRID, NR2	Shafat Ahmed Wani	CGM	ahmed.shafat@powergrid.in
30		Rakesh Kumar Gupta	DGM	rakeshgupta@powergrid.in
31	NTPC	A S Pandey	GM, Commercial	aspandey@ntpc.co.in
32	NHPC	I P Ranjan	ED (O&M)	ipranjan@nhpc.nic.in
33		Onkar Yadav	GM(Comml)	onkaryadav@nhpc.nic.in
34		Dharmendra Kumar	DGM (E)	dharmendrakumar@nhpc.nic.in
35	THDC	R R Semwal	CGM	rrsemwal@thdc.co.in
36		S S PANWAR	AGM	ssinghpanwar@thdc.co.in
37	PTC India Limited	Manoj Kumar Jhawar	CMD	manoj.jhawar@ptcindia.com
38		H L Choudhary	EVP	hlchoudhary@ptcindia.com
39	JSW	Kaushik Maulik	Vice President	kaushik.maulik@jsw.in
40	APCPL	Dilip Kaibortta	CEO	dilipkaiborta@ntpc.co.in
41		Amit Hooda	Sr. Manager (EEMG-Comml)	amit.hooda01@apcpl.co.in
42	GPTL	Lokendra Singh Ranawat	Head Regulatory, IndiGrid	lokendra.ranawat@indigrid.com
43	NGEL	Sunit Kumar	HoD Commercial	sunitkumar@ntpc.co.in
44	HPPTCL	Rajiv Sood	Managing Director	md.tcl@hpmail.in
45		Er. Rohit Sharda	GM (Projects)	gmprojects.tcl@hpmail.in
46	HPSEBL	Er. Madan Gopal Sharma	Director(O)	madangopal_hpsebl@yahoo.com
47		Er. Mandeep Singh	CE (Sys Op)	cesysophpsebl@gmail.com
48	HPSLDC	B.L. Thakur	Managing Director	mdhpsldc@gmail.com
49		Rohit Kumar	Assistant Engineer	choudhary.rohit2012@gmail.com
50	UPPTCL	Er. S. K. Das	Dir(Planning & Comm.)	director.comm@upptcl.org
51		Er. Satyendra Kumar	SE(TP&PSS)	setppss@upptcl.org
52		Pankaj Saxena	SE STU	smart.saxena@gmail.com
53	UPSLDC	Ram Baran	Chief Engineer	cepso@upsldc.org
54		Mohsin Khan	Executive Engineer	mohsin.khan@upsldc.org
55		Sanjay Jaiswal	Executive Engineer	sanjay.jaiswal@upsldc.org
56	Rajasthan SLDC	Kamal Patidar	SE (SO&LD)	se.sold@rvpn.co.in
57	RVPNL	Sona Shishodia	CE(PPD)	ce.ppm@rvpn.co.in
58	RRVUNL	Purshottam Dhariwal	Addl. CE	dhariwal2011@gmail.com
59	SJVN	Aman Katoch	General Manager	amankatoch72@gmail.com
60	Haryana SLDC	Rajeev Kumar Tayal	Chief Engineer	cesoc@hvpn.org.in
61		Naveen Kumar Verma	Director Technical	directortechnical@hvpn.org.in
62		Baljeet Singh Malik	xen sldc op	sesldcop@hvpn.org.in
63		Hem Joshi	Assistant Executive Engineer	hjoshi12418@gmail.com
64	HPGCL	Amit Dilbagi	Director Technical	dirtech2@hpgcl.org.in
65		Atul Khanna	SE/Technical (HQ)	atul.khanna.hpgcl@gmail.com
66	Delhi SLDC	Ashok Kumar	Dy General Manager	kumarashok.dtl@gmail.com
67	DTL-STU	Birendra Prasad	Director (Operations)	dir.opr@dtl.gov.in
68	PSTCL	Sanjeev kumar Sood	Director/Technical	sood108@gmail.com
69	PSPCL	Paranapal Singh Johl	Dy. CE	se-pr@pspcl.in
70		Sandeep kumar	Addl. SE	pc-pspcl1@pspcl.in
71	PSLDC	Vivek Kumar	Dy.CE/SLDC(Op)	vivek_khanna@mail.com
72	PTCUL	G.S. Budiyal	Director (Operations)	director.op@ptcul.org
73		Avinash Awasthi	Superintending Engineer	se_engy_ss@ptcul.org
74	Uttarakhand SLDC	Er. Illa Chandra	Chief Engineer	ce_candp@ptcul.org
75		Amit Kumar Singh	SE(SLDC)	se_sldc@ptcul.org
76	NPCIL	Mridul Shukla	Sr. Manager (Comml.)	mridulshukla@npcil.co.in
77		Jyoti Thakur	SO/G	jyotiaryan14@gmail.com
78	BBMB	H S Manocha	Chief Engineer SO	ceso@bbmb.nic.in
79		Ajay K Sharma	Spl Secretary	spsecy@bbmb.nic.in
80		Ruchi Sharma	Director PR	dirpr@bbmb.nic.in
81	ADANI POWER LTD	Mayursinh Gohil	DGM	mayurgohil01@gmail.com
82	AGEL	Narendra Kumar Ojha	Lead - BD	narenderan.ojha@adani.com
83	ROSA POWER SUPPLY CO. LTD	Hirday Singh Tomar	Executive Director	hirday.tomar@reliance-groupindia.com
84	MEIL ANPARA ENERGY	Arun Tholia	Executive Director	arun.tholia@meilanparapower.com
85	PPGCL, Bara	Sanjay Bhargava	Chief - O&M Services	sanjay.bhargava@tatapower.com
86	NVVN	Prasanta Kanjilal	DGM-BD	pkanjilal@ntpc.co.in
87		Randeep Singh	AGM-Comm/SO	randeepsingh@ntpc.co.in
88	UJVNL	K K Jaiswal	General Manager	kkjaiswal99@gmail.com
89	UPCL	Anil Kumar	Managing Director	md@upcl.org
90		Ajay Agarwal	Director Project	exe_ptcl@yahoo.co.in
91	JKPTCL(K)	Aaquib Sultana Deva	CE	cejkptclkmr@gmail.com
92	JKPCL	Vikas Anand	CE	cejkpcl2@gmail.com
93	Ladakh PDD	Tsewang Paljor	CE	cepdladakh@gmail.com
94		Tundup Spalzang	SE	sepddladakh@gmail.com
95	JPDCL	Rohit Bhagotra	XEN	bhagotrarohit@gmail.com
96	JKPTCL	A.K. Chhibber	SE	akchhibber@gmail.com
97		Vishal Chowhan	XEN	chowhan.pdd@gmail.com
98		Ehtisham Andrabi	XEN	eandrabi@gmail.com
99		Ajaz Ahmad Sheikh	SE	sheikhajaz520@gmail.com
100		Ravi Kant Kalsotra	SE	ravikantkalsotra@gmail.com
101	Leh PDD	Rinchen Wangmo	XEN	xenstdleh@gmail.com

ANNEXURE-Q

Attendance 81st NRPC Meeting of NRPC on 31.10.2025

S. No.	Organization	Name	Designation	Email
1	Govt. of J&K	Shailendra Kumar	IAS, Chairperson, NRPC and Financial Commissioner (Additional Chief Secretary), to Government of J&K, Power Development Department, UT of J&K	power.department@jk.gov.in
2	JPDCL	G.P. Singh Arora	IAS, Chairperson, TCC and Managing Director, JPDCL	gpsarora2002@gmail.com
3	Ladakh PDD	Rudra Goud. P.T.	IAS, Secretary PDD and NRE, UT Ladakh	pt.rudraogoud75@py.gov.in
4	CEA	Hemant Jain	Member (GO&D)	member.god@cea.nic.in
5	Grid-India	Rajiv Porwal	Director (SO)	rk.porwal@grid-india.in
6	JKPCL	Rahul Yadav	Managing Director JKPCL	mdjkpcl@gmail.com
7	NRPC	Rishika Sharan	Member Secretary	rishika@nic.in
8	ERPC	N S Mondal	Member Secretary	nsmondal@nic.in
9	NERPC	K B Jagtap	Member Secretary	kb.jagtap@gov.in
10	WRPC	Deepak Kumar	Member Secretary	deepak.cea@gmail.in
11	NRLDC	Manoj K. Agrawal	Executive Director	mkagarwal@grid-india.in
12		Somara Lakra	Chief GM	somara.lakra@grid-india.in
13		Bikash Kumar Jha	DGM	bikaskjha@grid-india.in
14	NRPC	Anzum Parwej	SE (C & S)	anjum.parwej@nic.in
15		D.K. Meena	SE (O & P)	dharmendra.cea@gov.in
16		Praveen Jangra	EE	praveen.cea@gov.in
17		Vipul Kumar	EE	vipul.cea@gov.in
18		Omkishor	EE	omkishor.sahu@gov.in
19		Ravi Kant	EE	ravikant.cea@gov.in
20		Lokesh Agrawal	AEE	lokesh.cea@gov.in
21		Omprakash Rajput	AEE	omprakashrajput.cea@gov.in
22		Priyanka Patel	Nodal Officer	priyanka.nrpc@gov.in
23	CTU	Vikas Bagadia	Dy COO	vbagadia@powergrid.in
24		V C Sekhar	Sr. GM	chandu@powergrid.in
25		Sandeep Kumawat	DGM	sandeepk@powergrid.in
26		Tej Prakash Verma	DGM	tejprakash@powergrid.in
27	POWERGRID CC	Manju Gupta	Executive Director	manju@powergrid.in
28	POWERGRID GA&C	Sunil Kumar	CGM-I/C	sunilkumar@powergrid.in
29		Mohan Kishor N	DGM	mohan.kishor@powergrid.in
30	POWERGRID, NR1	Kuleshwar Sahu	CGM	kuleshwar@powergrid.in
31	POWERGRID, NR2	Shafat Ahmed Wani	CGM	ahmed.shafat@powergrid.in
32		Rakesh Kumar Gupta	DGM	rakeshgupta@powergrid.in
33	NTPC	A S Pandey	GM, Commercial	aspandey@ntpc.co.in
34	NHPC	I P Ranjan	ED (O&M)	ipranjan@nhpc.nic.in
35		Onkar Yadav	GM(Comml)	onkaryadav@nhpc.nic.in
36		Dharmendra Kumar	DGM (E)	dharmendrakumar@nhpc.nic.in
37	THDC	R R Semwal	CGM	rrsemwal@thdc.co.in
38		S S PANWAR	AGM	ssinghpanwar@thdc.co.in
39	PTC India Limited	Manoj Kumar Jhawar	CMD	manoj.jhawar@ptcindia.com
40		H L Choudhary	EVP	hlchoudhary@ptcindia.com
41	JSW	Kaushik Maulik	Vice President	kaushik.maulik@jsw.in
42	APCPL	Dilip Kaibortta	CEO	dilipkaiborta@ntpc.co.in
43		Amit Hooda	Sr. Manager (EEMG-Comml)	amit.hooda01@apcpl.co.in
44	GPTL	Lokendra Singh Ranawat	Head Regulatory, IndiGrid	lokendra.ranawat@indigrid.com
45	NGEL	Sunit Kumar	HoD Commercial	sunitkumar@ntpc.co.in
46	HPPTCL	Rajiv Sood	Managing Director	md.tcl@hpmail.in
47		Er. Rohit Sharda	GM (Projects)	gmprojects.tcl@hpmail.in
48	HPSEBL	Er. Modan Gopal Sharma	Director(O)	madangopal_hpsebl@yahoo.com
49		Er. Mandeep Singh	CE (Sys Op)	cesysophpsebl@gmail.com
50	HPSLDC	B.L. Thakur	Managing Director	mdhpsldc@gmail.com
51		Rohit Kumar	Assistant Engineer	choudhary.rohit2012@gmail.com
52	UPPTCL	Er. S. K. Das	Dir(Planning & Comm.)	director.comm@upptcl.org
53		Er. Satyendra Kumar	SE(TP&PSS)	setppss@upptcl.org
54		Pankaj Saxena	SE STU	smart.saxena@gmail.com
55	UPSLDC	Ram Baran	Chief Engineer	cepso@upsldc.org
56		Mohsin Khan	Executive Engineer	mohsin.khan@upsldc.org
57		Sanjay Jaiswal	Executive Engineer	sanjay.jaiswal@upsldc.org
58	Rajasthan SLDC	Kamal Patidar	SE (SO&LD)	se.sold@rvpn.co.in
59	RVPNL	Sona Shishodia	CE(PPD)	ce.ppm@rvpn.co.in
60	RRVUNL	Purshottam Dhariwal	Addl. CE	dhariwal2011@gmail.com
61	SJVN	Aman Katoch	General Manager	amankatoch72@gmail.com
62	Haryana SLDC	Rajeev Kumar Tayal	Chief Engineer	cesoc@hvpn.org.in
63		Naveen Kumar Verma	Director Technical	directortechnical@hvpn.org.in
64		Baljeet Singh Malik	xen sldc op	sesldcop@hvpn.org.in
65		Hem Joshi	Assistant Executive Engineer	hjoshi12418@gmail.com
66	HPGCL	Amit Dilbagi	Director Technical	dirtech2@hpgcl.org.in
67		Atul Khanna	SE/Technical (HQ)	atul.khanna.hpgcl@gmail.com
68	Delhi SLDC	Ashok Kumar	Dy General Manager	kumarashok.dtl@gmail.com
69	DTL-STU	Birendra Prasad	Director (Operations)	dir.opr@dtl.gov.in
70	PSTCL	Sanjeev kumar Sood	Director/Technical	sood108@gmail.com
71	PSPCL	Paranapal Singh Johl	Dy. CE	se-pr@pspcl.in
72		Sandeep kumar	Addl. SE	pc-pspcl1@pspcl.in
73	PSLDC	Vivek Kumar	Dy.CE/SLDC(Op)	vivek_khanna@mail.com
74	PTCUL	G.S. Budiyal	Director (Operations)	director.op@ptcul.org
75		Avinash Awasthi	Superintending Engineer	se_engy_ss@ptcul.org
76	Uttarakhand SLDC	Er. Illa Chandra	Chief Engineer	ce_candp@ptcul.org
77		Amit Kumar Singh	SE(SLDC)	se_sldc@ptcul.org
78	NPCIL	Mridul Shukla	Sr. Manager (Comml.)	mridulshukla@npcil.co.in
79		Jyoti Thakur	SO/G	jyotiaryan14@gmail.com
80	BBMB	H S Manocha	Chief Engineer SO	ceso@bbmb.nic.in
81		Ajay K Sharma	Spl Secretary	spsecy@bbmb.nic.in
82		Ruchi Sharma	Director PR	dirpr@bbmb.nic.in
83	ADANI POWER LTD	Mayursinh Gohil	DGM	mayurgohil01@gmail.com
84	AGEL	Narendra Kumar Ojha	Lead - BD	narenderan.ojha@adani.com
85	ROSA POWER SUPPLY CO. LTD (Reliance Power)	Hirday Singh Tomar	Executive Director	hirday.tomar@reliance-groupindia.com
86	MEIL ANPARA ENERGY	Arun Tholia	Executive Director	arun.tholia@meilanparapower.com
87	PPGCL, Bara	Sanjay Bhargava	Chief - O&M Services	sanjay.bhargava@tatapower.com
88	NVVN	Prasanta Kanjilal	DGM-BD	pkanjilal@ntpc.co.in
89		Randeep Singh	AGM-Comm/SO	randeepsingh@ntpc.co.in
90	UJVNL	K K Jaiswal	General Manager	kkjaiswal99@gmail.com
91	UPCL	Anil Kumar	Managing Director	md@upcl.org
92		Ajay Agarwal	Director Project	exe_ptcl@yahoo.co.in
93	JKPTCL(K)	Aaquib Sultana Deva	CE	cejkptclkmr@gmail.com
94	JKPCL	Vikas Anand	CE	cejkpcl2@gmail.com
95	Ladakh PDD	Tsewang Paljor	CE	cepdladakh@gmail.com
96		Tundup Spalzang	SE	sepddladakh@gmail.com
97	JPDCL	Rohit Bhagotra	XEN	bhagotrarohit@gmail.com
98	JKPTCL	A.K. Chhibber	SE	akchhibber@gmail.com
99		Vishal Chowhan	XEN	chowhan.pdd@gmail.com
100		Ehtisham Andrabi	XEN	eandrabi@gmail.com
101		Ajaz Ahmad Sheikh	SE	sheikhajaz520@gmail.com
102		Ravi Kant Kalsotra	SE	ravikantkalsotra@gmail.com
103	Leh PDD	Rinchen Wangmo	XEN	xenstdleh@gmail.com

Annexure-A.I

Status of perfomance indices reporting of June, July, August & September 2025

S. No.	Utility		Received Status (Yes/No)	Vide mail dated	Received Status (Yes/No)	Vide mail dated	Received Status (Yes/No)	Vide mail dated	Received Status (Yes/No)	Vide mail dated	Remarks
			Month -June, 2025		Month -July, 2025		Month -August, 2025		Month -September, 2025		
1	PGCIL	Central Government owned Transmission Company	Y	06.07.2025	Y	07.08.2025	Y	06.09.2025	Y	07.10.2025	NR-1
			Y	07.07.2025	Y	12.08.2025	Y	23.09.2025	Y	14.10.2025	NR-2
			Y	08.07.2025	Y	08.08.2025	Y	09.09.2025	Y	08.10.2025	NR-3
2	NTPC		Y	09.07.2025			Y	03.09.2025			Anta
							Y	27.09.2025			Auriya
			Y	03.07.2025	Y	12.08.2025	Y	08.09.2025			Dadri
			Y	10.07.2025			Y	28.10.2025	Y	28.10.2025	Koldam
							Y	29.09.2025			Rihand
			Y	11.07.2025			Y	04.09.2025			Singrauli
			Y	13.07.2025	Y	01.08.2025	Y	01.09.2025			Unchahar
			Y	04.07.2025	Y	05.08.2025	Y	08.09.2025			Tanda
3	BBMB	Central Generating Company	Y	21.07.2025	Y	21.08.2025	Y	25.09.2025	Y	10.10.2025	-
4	THDC		Y	07.07.2025	Y	02.08.2025	Y	05.09.2025	Y	04.10.2025	Tehri
					Y	06.08.2025	Y	05.09.2025	Y	06.10.2025	Tehri PSP
			Y	07.07.2025	Y	13.08.2025	Y	03.09.2025	Y	06.10.2025	Koteshwar
5	SJVN		Y	05.07.2025	Y	06.08.2025	Y	06.09.2025	Y	06.10.2025	RHPS
			Y	05.07.2025	Y	06.08.2025	Y	04.09.2025	Y	06.10.2025	NJHPS
6	NHPC		Y	01.07.2025	Y	01.08.2025	Y	03.09.2025	Y	06.10.2025	-
7	NPCIL				Y	07.08.2025	Y	05.09.2025	Y	15.10.2025	RAPS-A
			Y	07.07.2025	Y	05.08.2025	Y	05.09.2025	Y	06.10.2025	RAPS-B
			Y	04.07.2025	Y	05.08.2025	Y	04.09.2025	Y	04.10.2025	RAPS-C(5&6)
			Y	02.09.2025	Y	02.08.2025	Y	02.09.2025			RAP -D (7 & 8)
							Y	04.09.2025	Y	03.10.2025	NAPS-1&2
8	DTL		Y	11.11.2025	Y	11.11.2025	Y	07.09.2025	Y	07.10.2025	
9	HVPNL		Y	07.07.2025	Y	05.08.2025	Y	05.09.2025	Y	06.10.2025	-
10	RRVPNL		Y	04.07.2025	Y	07.08.2025	Y	06.09.2025	Y	07.10.2025	-
11	UPPTCL		Y	02.07.2025	Y	02.08.2025	Y	02.09.2025	Y	04.10.2025	Meerut Circle
			Y	03.07.2025	Y	04.08.2025	Y	02.09.2025	Y	06.10.2025	Agra Circle
			Y	02.07.2025	Y	01.08.2025	Y	02.09.2025	Y	04.10.2025	Jhansi Circle
		State Transmission Utility	Y	03.07.2025	Y	04.08.2025	Y	02.09.2025	Y	06.10.2025	Prayagraj Circle
			Y	03.07.2025	Y	04.08.2025	Y	02.09.2025	Y	06.10.2025	Gorakhpur Circle
			Y	03.07.2025	Y	04.08.2025	Y	02.09.2025	Y	06.10.2025	Lucknow Circle
12	PTCUL		Y	05.07.2025	Y	05.08.2025	Y	10.09.2025	Y	08.10.2025	Kumaon
13	PSTCL		Y	18.08.2025	Y	25.08.2025	Y	29.09.2025	Y	08.10.2025	
14	HPPTCL		Y	05.07.2025	Y	05.08.2025	Y	06.09.2025	Y	06.10.2025	-
15	JKPTCL	UT	Y	01.07.2025	Y	05.08.2025	Y	06.09.2025	Y (except Barn, Samba, Ghatti, Hiranagar)	06.10.2025	Jammu
		UT	Y	01.07.2025	Y	05.08.2025	Y	06.09.2025	Y (except ziankote)	06.10.2025	Kashmir
16	Chandigarh Power Distribution Ltd	RPSG Group			Y	07.08.2025	Y	07.09.2025			
17	IPGCL		Y	04.07.2025	Y	06.08.2025	Y	06.09.2025	Y	06.10.2025	PPS-I
			Y	04.07.2025	Y	06.08.2025	Y	06.09.2025	Y	06.10.2025	PPS-III, Bawana
18	HPGCL		Y	12.07.2025	Y	06.08.2025			Y	08.10.2025	PTPS, Panipat
			Y	12.07.2025	Y	06.08.2025	Y	25.09.2025	Y	08.10.2025	DCRTPP, Yamunanagar
			Y	12.07.2025	Y	06.08.2025	Y	02.09.2025	Y	08.10.2025	RGTPP (Khedar)
19	RRVUNL		Y	07.07.2025	Y	01.08.2025	Y	01.09.2025	Y	07.10.2025	KTPS
			Y	07.07.2025	Y	07.08.2025	Y	04.09.2025	Y	07.10.2025	kATPP, Jhalawar
			Y	07.07.2025	Y	07.08.2025	Y	04.09.2025	Y	07.10.2025	CSCTPP Chhabra
			Y	07.07.2025	Y	05.08.2025	Y	01.09.2025	Y	03.10.2025	RGTPP, Ramgarh
			Y	07.07.2025	Y	07.08.2025	Y	01.09.2025	Y	03.10.2025	Ctpp,Chhabra
			Y	01.07.2025	Y	01.08.2025	Y	01.09.2025	Y	01.10.2025	DCCPP, Dholpur
			Y	07.07.2025	Y	07.08.2025	Y	04.09.2025	Y	07.10.2025	STPS Suratgarh
			Y	07.07.2025	Y	07.08.2025	Y	04.09.2025	Y	07.10.2025	SSCTPS Suratgarh
18	UPRVUNL		Y	23.08.2025	Y	07.08.2025	Y	04.09.2025	Y	06.10.2025	Parichha B (220 kV)
			Y	01.07.2025	Y	01.08.2025	Y	01.09.2025	Y	01.10.2025	Parichha C (400 kV)
		State Generating Company	Y	02.07.2025	Y	01.08.2025	Y	01.09.2025	Y	04.10.2025	DTPS Anpara
			Y	23.08.2025	Y	07.08.2025	Y	08.09.2025	Y	06.10.2025	Obra A & B
			Y	23.08.2025	Y	07.08.2025	Y	08.09.2025	Y	06.10.2025	Obra C
							Y	08.09.2025	Y	27.10.2025	Harduaganj 220 kV
					Y	25.08.2025	Y	08.09.2025	Y	10.10.2025	Harduaganj 400 kV
			Y	23.08.2025	Y	07.08.2025	Y	08.09.2025	Y	06.10.2025	Ghatampur 765 kV
			Y	23.08.2025	Y	07.08.2025	Y	08.09.2025	Y	08.10.2025	Anpara-A&B
			Y	23.08.2025	Y	07.08.2025	Y	08.09.2025	Y	06.10.2025	Panki TPS
			Y	23.08.2025	Y	07.08.2025	Y	08.09.2025	Y	06.10.2025	Jawaharpur
19	UJVNL		Y	02.07.2025			Y	04.09.2025	Y	04.10.2025	Dharasu
			Y	02.07.2025			Y	04.09.2025	Y	04.10.2025	Tiloth
							Y	03.09.2025	Y	06.10.2025	Khodri
							Y	03.09.2025	Y	06.10.2025	Chibro
							Y	03.09.2025	Y	06.10.2025	Vyasi
20	HPPCL		Y	05.07.2025	Y	21.08.2025	Y	04.09.2025	Y	08.10.2025	Kashang HEP
			Y	05.07.2025	Y	21.08.2025	Y	04.09.2025	Y	08.10.2025	Sawara Kuddu
			Y	05.07.2025	Y	21.08.2025	Y	04.09.2025	Y	08.10.2025	Sainj
21	PSPCL	State Generating Company & State owned Distribution Company	Y	03.07.2025	Y	05.08.2025	Y	04.09.2025	Y	01.10.2025	RSD
			Y	11.07.2025	Y	21.08.2025	Y	11.09.2025	Y	09.10.2025	GGSTPS, Rupnagar
			Y	01.07.2025	Y	01.08.2025	Y	01.09.2025	Y	01.10.2025	GVK Power Goindwal Shahib Ltd.
					Y	06.08.2025	Y	05.09.2025	Y	06.10.2025	GHSTPS, Lehra Mohabbat
22	HPSEBL	Distribution company having Transmission	Y	05.07.2025	Y	04.08.2025	Y	06.09.2025	Y	08.10.2025	Hamirpur Circle
			Y	05.07.2025	Y	07.08.2025	Y	05.09.2025	Y	04.10.2025	Shimla Circle
23	Prayagraj Power Generation Co. Ltd.		Y	01.07.2025	Y	01.08.2025	Y	01.09.2025	Y	03.10.2025	

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			Month -June, 2025		Month -July, 2025		Month -August, 2025		Month -September, 2025		
24	Aravali Power Company Pvt. Ltd		Y	28.10.2025	Y	28.10.2025	Y	28.10.2025	Y	28.10.2025	
25	Apraava Energy Private Limited		Y	21.07.2025	Y	06.08.2025	Y	29.09.2025	Y	28.10.2025	
26	Talwandi Sabo Power Ltd.		Y	02.07.2025	Y	06.08.2025	Y	04.09.2025	Y	08.10.2025	
27	Nabha Power Limited		Y	01.07.2025	Y	01.08.2025	Y	02.09.2025	Y	01.10.2025	
28	MEIL Anpara Energy Ltd (Anpara-C)		Y	17.09.2025	Y	17.09.2025	Y	17.09.2025	Y	07.10.2025	
29	Rosa Power Supply Company Ltd		Y	04.07.2025	Y	04.08.2025	Y	03.09.2025	Y	03.10.2025	
30	Lalitpur Power Generation Company Ltd		Y	02.07.2025	Y	06.08.2025	Y	01.09.2025	Y	03.10.2025	
31	MEJA Urja Nigam Ltd.						Y	02.09.2025			
32	Adani Power Rajasthan Limited		Y	05.07.2025	Y	05.08.2025	Y	06.09.2025	Y	08.10.2025	Kawai
33	JSW Energy Ltd. (KWHEP)		Y	03.07.2025	Y	04.08.2025	Y	01.09.2025	Y	03.10.2025	
	ISTS Transmission Utilities										
34	INDIGRID								Y	07.10.2025	
35	ADHPL		Y	07.07.2025	Y	06.08.2025	Y	06.09.2025	Y	01.10.2025	220 kV Prini
36	Adani Transmission Limited	AESL	Y	11.07.2025	Y	06.08.2025	Y	08.09.2025	Y	10.10.2025	
37	Bikaner Khetri Transmission Limited		Y	11.07.2025	Y	06.08.2025	Y	08.09.2025	Y	10.10.2025	
38	Fatehgarh Bhadla Transmission Limited		Y	11.07.2025	Y	06.08.2025	Y	08.09.2025	Y	10.10.2025	
	State Utilities										
	Uttar Pradesh										
39	Vishnuprayag Hydro Electric Plant (J.P.)				Y	01.08.2025	Y	01.09.2025	Y	01.10.2025	
40	Alaknanda Hydro Electric Plant (GVK)		Y	08.07.2025	Y	05.08.2025	Y	01.09.2025	Y	03.10.2025	
41	Khara Power House (Khara)		Y	04.07.2025	Y	04.08.2025	Y	04.09.2025	Y	04.10.2025	
42	WUPPTCL		Y	02.07.2025	Y	02.08.2025	Y	03.09.2025	Y	04.10.2025	
43	SEUPPTCL				Y	07.08.2025			Y	06.10.2025	
44	GTL	**AESL**	Y	11.07.2025	Y	06.08.2025	Y	08.09.2025	Y	09.10.2025	
45	OCBTL	**AESL**	Y	11.07.2025	Y	06.08.2025	Y	08.09.2025	Y	09.10.2025	
	Rajasthan										
46	Barsingsar Plant	**NLC**					Y	06.09.2025			
47	Rajwest Plant	**JSW**					Y	06.09.2025			
48	ATSCL	**AESL**	Y	11.07.2025	Y	06.08.2025	Y	08.09.2025	Y	10.10.2025	
49	HPTSL	**AESL**	Y	11.07.2025	Y	06.08.2025	Y	08.09.2025	Y	10.10.2025	
50	STSL	**AESL**	Y	11.07.2025	Y	06.08.2025	Y	08.09.2025	Y	10.10.2025	
51	MTSCL	**AESL**	Y	11.07.2025	Y	06.08.2025	Y	08.09.2025	Y	10.10.2025	
	RE Utilities										
52	ABC Renewable Pvt. Ltd		Y	07.07.2025	Y	07.08.2025	Y	05.09.2025	Y	08.10.2025	
53	ACME Heeragarh powertech Pvt. Ltd										
54	ACME Chittorgarh Solar Energy Pvt Ltd										
55	AHEJOL-Hybrid-1 Madhopura	ADANI GREEN	Y	07.07.2025	Y	06.08.2025	Y	03.09.2025	Y	04.10.2025	
56	AHEJ3L - Hybrid-2B 300MW	ADANI GREEN	Y	07.07.2025	Y	06.08.2025	Y	03.09.2025	Y	04.10.2025	
57	AHEJFL(AEML_250)	ADANI GREEN	Y	07.07.2025	Y	06.08.2025	Y	03.09.2025	Y	04.10.2025	
58	AHEJ4L(AEML-350)	ADANI GREEN	Y	07.07.2025	Y	06.08.2025	Y	03.09.2025	Y	04.10.2025	
59	ASEJ2PL(Hapasar 300MW) SPC11PL	ADANI GREEN	Y	07.07.2025	Y	06.08.2025	Y	03.09.2025	Y	04.10.2025	
60	Adani Renewable Energy (RJ) Limited Rawra 200	ADANI GREEN	Y	07.07.2025	Y	06.08.2025	Y	03.09.2025	Y	04.10.2025	
61	Adani Solar Energy Four Limited SECI 50	ADANI GREEN	Y	07.07.2025	Y	06.08.2025	Y	03.09.2025	Y	04.10.2025	
62	Adani Solar Energy Jodhpur Two Limited Merchant 50	ADANI GREEN	Y	07.07.2025	Y	06.08.2025	Y	03.09.2025	Y	04.10.2025	
63	ASEJ05PL (RJ200)	ADANI GREEN	Y	07.07.2025	Y	06.08.2025	Y	03.09.2025	Y	04.10.2025	
64	ASERJ2PL - Phalodi 150 MW	ADANI GREEN	Y	07.07.2025	Y	06.08.2025	Y	03.09.2025	Y	04.10.2025	
65	ASERJ01PL-Pokhran 300 MW (SB energy six)	ADANI GREEN	Y	07.07.2025	Y	06.08.2025	Y	03.09.2025	Y	04.10.2025	
66	AGE25L(Badi Sid)	ADANI GREEN	Y	07.07.2025	Y	06.08.2025	Y	03.09.2025	Y	04.10.2025	
67	Bhadla park - South block	ADANI GREEN	Y	07.07.2025	Y	06.08.2025	Y	03.09.2025	Y	04.10.2025	
68	AGE24L (Bhimsar)	ADANI GREEN			Y	06.08.2025	Y	03.09.2025	Y	04.10.2025	
69	AHEJ2L - Hybrid-2A 300MW	ADANI GREEN			Y	06.08.2025	Y	03.09.2025	Y	04.10.2025	

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			Month -June, 2025		Month -July, 2025		Month -August, 2025		Month -September, 2025		
70	ASERJ2PL - Devikot 180 MW	ADANI GREEN			Y	06.08.2025	Y	03.09.2025	Y	04.10.2025	
71	ASEJOPL-Hybrid 450 MW	ADANI GREEN	Y	07.07.2025	Y	06.08.2025	Y	03.09.2025	Y	04.10.2025	
72	Altra Xergi Pvt. Ltd.		Y	07.07.2025	Y	04.08.2025	Y	03.09.2025	Y	30.10.2025	
73	AMP Energy Green Four Pvt. Ltd.		Y	05.07.2025	Y	07.08.2025			Y	07.10.2025	
74	AMP Energy Green Five Pvt. Ltd.		Y	05.07.2025	Y	07.08.2025			Y	07.10.2025	
75	AMP Energy Green Six Pvt. Ltd.		Y	05.07.2025	Y	07.08.2025			Y	07.10.2025	
76	Amplus Ages Private Limited	GENTARI	Y	07.07.2025	Y	07.08.2025	Y	23.09.2025	Y	08.10.2025	
77	Avaada RJHN_240MW	Avaada	Y	04.07.2025	Y	04.08.2025	Y	05.09.2025	Y	07.10.2025	
78	Avaada sunce energy Pvt limited		Y	04.07.2025	Y	04.08.2025	Y	05.09.2025	Y	07.10.2025	
79	Avaada Sunrays Pvt. Ltd.		Y	04.07.2025	Y	04.08.2025	Y	05.09.2025	Y	07.10.2025	
80	Avaada Sustainable RJ Pvt. Ltd.		Y	04.07.2025	Y	04.08.2025	Y	05.09.2025	Y	07.10.2025	
81	Ayana Renewable Power Three Private Limited		Y	08.07.2025							
82	Ayaana Renewable Power One Pvt. Ltd.		Y	08.07.2025							
83	Azure Power Forty One Pvt limited										
84	Azure Power Forty Three Pvt. Ltd._RSS										
85	Azure Maple Pvt. Ltd.										
86	AZURE POWER INDIA Pvt. Ltd., Bhadla										
87	Azure Power Thirty Four Pvt. Ltd.										
88	SB Energy Six Private Limited, Bhadla										
89	Clean Solar Power (Jodhpur) Pvt. Ltd.	Hero Future Energies	Y	01.09.2025	Y	01.09.2025	Y	01.09.2025	Y	03.10.2025	
90	Eden Renewable Cite Private Limited										
91	Grian Energy private limited	GENTARI	Y	07.07.2025	Y	07.08.2025	Y	23.09.2025	Y	08.10.2025	
92	Mahindra Renewable Private Limited										
93	Mega Surya Urja Pvt. Ltd. (MSUPL)										
94	AURAIYA Solar										
95	DADRI SOLAR										
96	SINGRAULI SOLAR										
97	Anta Solar										
98	Unchahar Solar										
99	NTPC Devikot Solar plant-1	NGEL	Y	08.08.2025	Y	08.08.2025	Y	17.09.2025	Y	09.10.2025	
100	NTPC Devikot Solar plant-2		Y	08.08.2025	Y	08.08.2025	Y	17.09.2025	Y	09.10.2025	
101	SKB NTPC -1 (250MW)	NGEL	Y	08.08.2025	Y	08.08.2025	Y	17.09.2025	Y	09.10.2025	
102	SKB NTPC-2 (300MW)		Y	08.08.2025	Y	08.08.2025	Y	17.09.2025	Y	09.10.2025	
103	NTPC Nokhra_300MW		Y	08.08.2025	Y	08.08.2025	Y	17.09.2025	Y	09.10.2025	
104	NTPC Fatehgarh 296MW		Y	08.08.2025	Y	08.08.2025	Y	17.09.2025	Y	09.10.2025	
105	One Volt energy Pvt. Ltd.	GENTARI	Y	07.07.2025	Y	07.08.2025	Y	23.09.2025	Y	08.10.2025	
106	ReNew Solar Urja Private Limited	IndiGrid			Y				Y	08.10.2025	
107	ReNew Solar Energy (Jharkhand Three) Private Limited		Y	04.07.2025	Y	08.08.2025	Y	05.09.2025	Y	03.10.2025	
108	Renew Sun Bright Pvt. Ltd. (RSBPL)		Y	04.07.2025	Y	08.08.2025	Y	05.09.2025	Y	03.10.2025	
109	Renew Surya Partap Pvt. Ltd.		Y	04.07.2025	Y	08.08.2025	Y	05.09.2025	Y	03.10.2025	
110	Renew Surya Ravi Pvt. Ltd.		Y	04.07.2025	Y	08.08.2025	Y	05.09.2025	Y	03.10.2025	
111	Renew Surya Roshni Pvt. Ltd.	ReNew	Y	04.07.2025	Y	08.08.2025	Y	05.09.2025	Y	03.10.2025	
112	Renew Surya Vihan Pvt. Ltd.		Y	04.07.2025	Y	08.08.2025	Y	05.09.2025	Y	03.10.2025	
113	Renew Surya Ayaan Pvt. Ltd.		Y	04.07.2025	Y	20.08.2025	Y	05.09.2025	Y	03.10.2025	
114	Renew Solar Photovoltaic Pvt Ltd		Y	04.07.2025	Y	20.08.2025	Y	05.09.2025	Y	03.10.2025	

Status of perfomance indices reporting of June, July, August & September 2025

S. No.	Utility		Received Status (Yes/No)	Vide mail dated	Received Status (Yes/No)	Vide mail dated	Received Status (Yes/No)	Vide mail dated	Received Status (Yes/No)	Vide mail dated	Remarks
			Month -June, 2025		Month -July, 2025		Month -August, 2025		Month -September, 2025		
115	RENEW SOLAR POWER Pvt. Ltd. Bikaner				Y	08.08.2025	Y	05.09.2025	Y	03.10.2025	
116	Neemba Renew Surya Vihan Pvt. Ltd.		–	–	–	–	Y	05.09.2025	Y	03.10.2025	
117	Renew Surya jyoti Pvt. Ltd.		–	–	–	–	Y	05.09.2025	Y	03.10.2025	
118	Renew Hans Urja Pvt Ltd.		–	–	–	–	Y	05.09.2025	Y	03.10.2025	
119	Rising Sun Energy-K Pvt. Ltd.										
120	Serentica Renewables India 4 Private Limited										
121	Solzen Urja Private Limited	Sekura	Y	07.07.2025	Y	05.08.2025	Y	05.09.2025	Y	06.10.2025	
122	Tata Power Green Energy Ltd. (TPGEL)		Y	04.07.2025	Y	06.08.2025	Y	03.09.2025	Y	09.10.2025	
123	Tata Power Renewable Energy Ltd. (TPREL)		Y	04.07.2025	Y	06.08.2025	Y	03.09.2025	Y	09.10.2025	
124	Banderwala Solar Plant TP Surya Ltd.	TATA POWER	Y	04.07.2025	Y	06.08.2025	Y	03.09.2025	Y	09.10.2025	
125	Thar Surya Pvt. Ltd.										
126	TRANSITION ENERGY SERVICES PRIVATE LIMITED										
127	Transition Green Energy Private Limited										
128	Transition Sustainable Energy Services Private Limited										

Annexure-A.II

Status of Internal Protection Audit Plan for FY 2026 -27								
S. No.	**NRPC Member**	**Category**	**Status**	**Schedule submitted as per utility**	**Present Status Comlpleted (yes/no)**	**Report Submission Date by audit party**	**Discussion held in PSC meeting number**	**Compliance status**
1	PGCIL	Central Government owned Transmission Company	Received (NR-2) (24 Substations)					
2	NTPC	Central Generating Company						
3	BBMB		Received					
4	THDC							
5	SJVN							
6	NHPC		Received (13 stations)					
7	NPCIL							
8	Delhi SLDC	SLDC						
9	Haryana SLDC							
10	Rajasthan SLDC							
11	Uttar Pradesh SLDC							
12	Uttarakhand SLDC							
13	Punjab SLDC							
14	Himachal Pradesh SLDC							
15	DTL	State Transmission Utility	Received (47 Substations)					
16	HVPNL		Received (91 Substations)					
17	RRVPNL							
18	UPPTCL		Meerut Zone	10/1/2027 -15/3/2027				
			Agra Zone	10/1/2027 -30/3/2027				
			Lucknow Zone	1/1/2027-10/3/2027				
			Jhansi Zone	5/1/2027 -30/3/2027				
			Prayagraj Zone	1/1/2027- 10/3/2027				
			Gorakhpur Zone	10/1/2027-30/3/2027				
19	PTCUL							
20	PSTCL							
21	HPPTCL		Received (12 Substations)					
22	IPGCL	State Generating Company	CCGT Bawana (PPS-III), PPS-I- Received	10/20/2026 - 10/30/2026 and 11/10/2026 - 11/15/2026				
23	HPGCL							
24	RRVUNL							
25	UPRVUNL		Anpara B	October 2026				
			Obra A & B	October 2026				
			Panki	October 2026				
			Anpara D	May 2026				
			Harduaganj	May 2026				
			Harduaganj D	May 2026				
			Harduaganj E	May 2026				
			Parichha	August 2026				
			Parichha Ext	August 2026				
			Obra C	October 2026				
			Jawaharpur	October 2026				
26	UJVNL		Dharashu	December, 2026				
			Tiloth	December, 2026				
27	HPPCL							
28	PSPCL	State Generating Company & State owned Distribution Company						
29	HPSEBL	Distribution company having Transmission connectivity ownership						
30	Prayagraj Power Generation Co. Ltd.	IPP having more than 1000 MW installed capacity	Received	Sep-26				
31	Aravali Power Company Pvt. Ltd		Received	Mar-27				
32	Apraava Energy Private Limited							
33	Talwandi Sabo Power Ltd.							
34	Nabha Power Limited							
35	MEIL Anpara Energy Ltd		Received	Aug-26				
36	Rosa Power Supply Company Ltd		Received	Jan-27				
37	Lalitpur Power Generation Company Ltd		Received	Sep-26				
38	MEJA Urja Nigam Ltd.							
39	Adani Power Rajasthan Limited							
40	JSW Energy Ltd. (KWHEP)							
41	UT of J&K	UT of Northern Region	Received (Kashmir Region-8 Substation)	15/4/2026-25/11/2026				
42	UT of Chandigarh							
	ISTS Transmission Utilities							
43	INDIGRID							
44	ADHPL							
45	Adani Transmission Limited		Received	Oct-26				
46	Bikaner Khetri Transmission Limited		Received	Oct-26				
47	Fatehgarh Bhadla Transmission Limited		Received	Sep-26				
48	Powergrid Sikar Transmission Limited							

Status of Internal Protection Audit Plan for FY 2026 -27								
S. No.	**NRPC Member**	**Category**	**Status**	**Schedule submitted as per utililty**	**Present Status Comlpleted (yes/no)**	**Report Submission Date by audit party**	**Discussion held in PSC meeting number**	**Compliance status**
49	Powergrid Aligarh Sikar Transmission Limited							
50	Powergrid Ajmer Phagi Transmission Limited							

Status of Internal Protection Audit Plan for FY 2026 -27								
S. No.	**NRPC Member**	**Category**	**Status**	**Schedule submitted as per utililty**	**Present Status Comlpleted (yes/no)**	**Report Submission Date by audit party**	**Discussion held in PSC meeting number**	**Compliance status**
51	Powergrid Bikaner Transmission System Limited							
52	Powergrid Khetri Transmission System Limited							
53	Powergrid Ramgarh Transmission Limited							
54	Powergrid Fatehgarh Transmission Limited							
55	Powergrid Bhadla Transmission Limited							
56	Powergrid Meerut Simbhavli Transmission Limited							
57	Powergrid Kala Amb Transmission Limited							
	State Utilities							
	Uttar Pradesh							
58	Vishnuprayag Hydro Electric Plant (J.P.)		Received	March, 2027				
59	Alaknanda Hydro Electric Plant (GVK)		Received	Nov-26				
60	Ghatampur TPS		Received	Feb-27				
61	Khara Power House (Khara)		Received	Dec-26				
62	WUPPTCL		Received	Oct-26				
63	SEUPPTCL		Received	Dec-26				
64	ATSCL	AESL	Received	Sep-26				
65	GTL (765 kV Hapur extension bays)	AESL	Received	Nov-26				
66	GTL (765 kV Agra and Gr. Noida extension bays)	AESL	Received	Nov-26				
67	HPTSL	AESL	Received	Aug-26				
68	MTSCL	AESL	Received	Aug-26				
69	OBTL	AESL	Received	Dec-26				
70	STSL	AESL						
	Rajasthan							
71	Barsingsar Plant	NLC						
72	Rajwest Plant	JSW						
	RE Utilities							
73	ABC Renewable Pvt. Ltd							
74	ACME Heeragarh powertech Pvt. Ltd							
75	ACME Pholidi							
76	ACME Deagarh							
77	ACME Raisar							
78	ACME Dhoulpar							
79	ACME Chittorgarh Solar Energy Pvt Ltd							
80	Adani Hybrid Energy Jaisalmer One Ltd.	AGEL	Received	7/16/2026				
81	Adani Hybrid Energy Jaisalmer Two Ltd.	AGEL	Received	7/25/2026				
82	Adani Hybrid Energy Jaisalmer Three Ltd.	AGEL	Received	8/8/2026				
83	Adani Hybrid Energy Jaisalmer Four Ltd. (AEML 1 -350)	AGEL	Received	8/15/2026				
84	Adani Hybrid Energy Jaisalmer Four Ltd. (AEML 2 -250)	AGEL	Received	9/11/2026				
85	Adani Renewable Energy (RJ) limited Rawara	AGEL	Received	9/26/2026				
86	Adani Solar Enegry Four Private Limited	AGEL	Received	9/26/2026				
87	Adani Solar Energy Jaisalmer Two Private Limited Project Two	AGEL	Received	10/17/2026				
88	SB Energy Six Private Limited, Bhadla	AGEL	Received	10/28/2026				
89	Adani Solar Enegry Jodhpur Two Limited, Rawara	AGEL	Received	9/26/2026				
90	Adani Solar Energy Jaisalmer One Ltd. (Hybrid450)	AGEL	Received	10/3/2026				
91	Adani Solar Energy RJ Two Pvt. Ltd. (Devikot)	AGEL	Received	11/7/2026				
92	Adani Solar Energy RJ Two Pvt. Ltd. (Phalodi)	AGEL	Received	11/14/2026				
93	Adani Green Energy 24 Limited (Bhimsar)	AGEL	Received	11/26/2026				
94	Adani Green Twenty-Five Limited (Badisid)	AGEL	Received	12/4/2026				
95	Bhadla park - South block	AGEL	Received	12/16/2026				
96	AEML-250 WIND (Hybrid-2A)	AGEL	Received	9/16/2026				
97	AEML-260 WIND (Hybrid-2B)	AGEL	Received	9/20/2026				
98	Hybrid450-WIND (SBE Hybrid 450)	AGEL	Received	10/7/2026				
99	Altra Xergi Pvt. Ltd.							
100	AMP Energy Green Four Pvt. Ltd.							

Status of Internal Protection Audit Plan for FY 2026 -27								
S. No.	NRPC Member	Category	Status	Schedule submitted as per utililty	Present Status Comlpleted (yes/no)	Report Submission Date by audit party	Discussion held in PSC meeting number	Compliance status
101	AMP Energy Green Five Pvt. Ltd.							
102	AMP Energy Green Six Pvt. Ltd.							
103	Amplus Ages Private Limited							
104	Avaada RJHN 240MW							
105	Avaada sunce energy Pvt limited							
106	Avaada Sunrays Pvt. Ltd.							
107	Avaada Sustainable RJ Pvt. Ltd.							
108	Ayana Renewable Power Three Private Limited							
109	Ayaana Renewable Power One Pvt. Ltd.							
110	Azure Power Forty One Pvt limited							
111	Azure Power Forty Three Pvt. Ltd. RSS							
112	Azure Maple Pvt. Ltd.							
113	AZURE POWER INDIA Pvt. Ltd., Bhadla							
114	Azure Power Thirty Four Pvt. Ltd.							
115	Clean Solar Power (Jodhpur) Pvt. Ltd.							
116	Eden Renewable Cite Private Limited							
117	Grian Energy private limited							
118	Mahindra Renewable Private Limited							
119	Mega Surya Urja Pvt. Ltd. (MSUPL)							
120	AURAIYA Solar							
121	DADRI SOLAR							
122	SINGRAULI SOLAR							
123	Anta Solar							
124	Unchahar Solar							
125	NTPC Devikot Solar plant 240MW							
126	NTPC Kolayat 400kV							
127	Nedan Solar NTPC							
128	NTPC Nokhra 300MW							
129	One Volt energy Pvt. Ltd.							
130	ReNew Solar Energy (Jharkhand Three) Private Limited							
131	RENEW SOLAR POWER Pvt. Ltd. Bikaner							
132	ReNew Solar Urja Private Limited							
133	Renew Sun Bright Pvt. Ltd. (RSBPL)							
134	Renew Surya Partap Pvt. Ltd.							
135	Renew Surya Ravi Pvt. Ltd.							
136	Renew Surya Roshni Pvt. Ltd.							
137	Renew Surya Vihan Pvt. Ltd.							
138	Renew Surya Ayaan Pvt. Ltd.							
139	Renew Solar Photovoltaic Pvt Ltd							
140	Renew Hans Urja Pvt Ltd							
141	Renew Surya Jyoti Pvt Ltd							
142	Rising Sun Energy-K Pvt. Ltd.							
143	Serentica Renewables India 4 Private Limited							
144	Solzen Urja Private Limited							
145	Tata Power Green Energy Ltd. (TPGEL) (225MW)							
146	Tata Power Renewable Energy Ltd. (TPREL) (300MW)							
147	Thar Surya Pvt. Ltd.							
148	TP Surya Ltd., Noorsar (110MW)							
149	Banderwala Solar Plant TP Surya Ltd. (300MW)							
150	TRANSITION ENERGY SERVICES PRIVATE LIMITED							
151	Transition Green Energy Private Limited							
152	Transition Sustainable Energy Services Private Limited							

Annexure-A.III

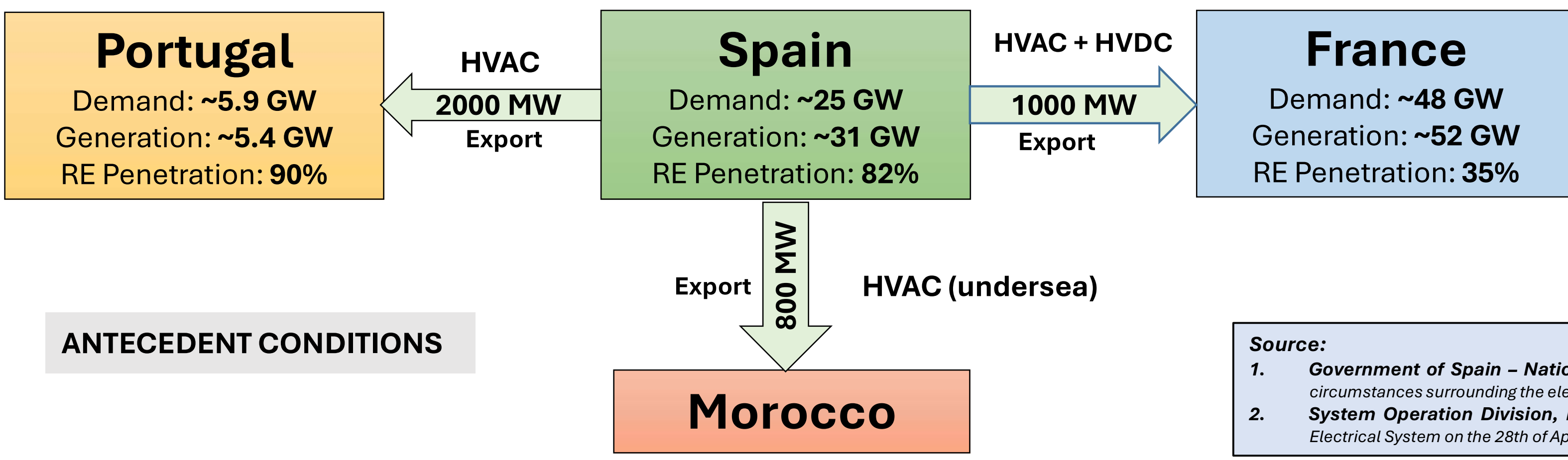
Status of 3rd Party Protection Audit Plan and audited substation							
S. No.	**Name of Utility**	**Total no of Substation/Generating Station**	**Audit Plan received**	**Status**	**Schedule submitted as per utililty**	**Present Status Comlpleted**	**No. of Audited Substation/Generating Station**
	NRPC Member						
1	PGCIL	96	35	Received (7 S/s of NR-1, 24 S/s of NR-2, 4 S/s of Nr-3)			0
2	NTPC	8	8	Received (Singrauli, Rihand, Unchahar, Dadri, Dadri Gas, Auraiya Gas, Faridabad Gas, Anta Gas Power Station)	By Oct 2028		0
				Received (Tanda)	By 17.07.2025		
3	BBMB	24	24	Received	From Feb. 2027		0
4	THDC	4	2	Received	March 2026-Tehri, F.Y. 2025-26- Koteshwar		0
5	SJVN	2	2	Received	Nov-Dec 2025 for RHPS, Nov 24- March 25 for NJHPS		
6	NHPC	12	12	Received	FY-2025-26	Completed (Dulhasti)	5
						Completed (Salal)	
						Completed (Bairasul)	
						Completed (Chamera-I)	
						Completed (Parbati-III)	
7	NPCIL	5	4	Completed (220kV) (NAPS)	Jan'25	Completed	4
				RAP -A (1 & 2)		Completed	
				RAPS-C (6&5)	-	Completed	
				RAP-B (3& 4)		Completed	
8	DTL	47	47	Received	September, 2025 to November, 2026		0
9	HVPNL	90	5	Received	June-Oct 2025		1
10	RRVPNL	143	40	Received	Mar-26		0
11	UPPTCL	194	194	Received	2025;	Under tendering	0
12	PTCUL	14	14	Received	By Dec 2025	Completed	10
13	PSTCL	111	0				0
14	HPPTCL	12	12	Received	FY 25-26		0
15	IPGCL	2	2	Received (PPS-III)	FY 25-26		0
16	HPGCL	3	3	PTPS, Panipat	Nov-25		1
				DCRTPP, Yamunanagar	Aug-25	Completed	
				RGTPP (Khedar)	Oct'25		
17	RRVUNL	8	8	CTPP, Chhabra	2029	CTPP-Completed	3
				CSCTPP, Chhabra	2027-28		
				STPS, suratgarh	Sep-27		
				SSCTPP, suratgarh	2028-29	SSCTPS-completed	
				KTPS, Kota	2025-2026	KSTPS -Completed	
				KaTPP, Jhalawar	2027		
				RGTPP, Ramgarh	Jun-26		
				DCCPP, Dholpur	Jun-26		
18	UPRVUNL	11	11	Obra-B	2026-27		0
				Obra-C	Feb-26		
				Anpara D	2025	Under tendering	
				Anpara B	2025	Under tendering	
				Harduagani	2025	Under tendering	
				Harduagani D	2025	Under tendering	
				Harduagani E	2025	Under tendering	
				Parichha	2025	Under tendering	
				Parichha Ext	2025	Under tendering	
				Jawaharpur	2025	Under tendering	
				Panki	2025		
19	UJVNL	5	3	Dharasu		Completed in Nov, 2024	3
				Tiloth			
				Vyasi			
				Chibro		Completed	
				Khodri		Completed	
20	HPPCL	3	2	Swara Kuddu	2026		0
				Sainj			
				Kashang HEP	FY 2025-26		
21	PSPCL	4	4	Reeceived (GHTP)	Dec. 2025		0
				Received (GATP)	May 2025		
				GGSSTP	2026		
				RSD/ Sahapur Kandi	Mar'26		
22	HPSEBL	10	6	Kunihar	Conducted	19.10.2024	6
				Upper Nangal	Conducted	13.02.2025	
				Kango	Conducted	Report not submitted	
				Mattansidh	Conducted	Report not submitted	
				Nehrain	Conducted	Report not submitted	
				Baddi	Conducted	04.03.2025	
23	Prayagraj Power Generation Co. Ltd.	1	1	Received	Dec-24	Januray 2025	1
24	Aravali Power Company Pvt. Ltd	1	1	Received	Sep-26		0
25	Apraava Energy Private Limited	1	1	Received	By May, 2025	Completed	1
26	Talwandi Sabo Power Ltd.	1	0				0
27	Nabha Power Limited	1	1	Received	By December, 2025		0
28	MEIL Anpara Energy Ltd	1	1	Received	* May 2025		0
29	Rosa Power Supply Company Ltd	1	1	Conducted	By 30.09.2024	08.08.2024	1
30	Lalitpur Power Generation Company Ltd	1	1	Conducted	26.03.2024		1
31	MEJA Urja Nigam Ltd.	1	1	Conducted		Completed in Oct, 2024	1
32	Adani Power Rajasthan Limited	1	1	Conducted	November, 2024	Kawai	1
33	JSW Energy Ltd. (KWHEP)	1	1	Received	December 2024 to March 2025	Completed	1
34	UT of J&K (JKPTCL)	17	0				0
35	UT of Chandigarh (CDPL)	1	0				
	ISTS Transmission Utilities						
36	INDIGRID	5	2	Received (PTCL)	FY 25-26		0
				Received (NRSS 29)	FY 24-25		
37	ADHPL	1	1	Received	* September 2026		0
38	Adani Transmission Limited			Received (400kV Mohindergarh SS)	October, 2025		

39	Bikaner Khetri Transmission Limited	7	7	Received (765 kV Bikaner and Khetri extension bays)	September, 2025		0
40	Fatehgarh Bhadla Transmission Limited			Received (400 kV Fatehgarh SS)	September, 2025		
	State Utilities						
	Uttar Pradesh						
41	Vishnuprayag Hydro Electric Plant (J.P.)	1	1	Received	December, 2028		0
42	Alaknanda Hydro Electric Plant (GVK)	1	1	Received	Mar-25		0
43	Ghatampur TPS	1	1	Received	FY 27-28		0
44	Khara Power House (Khara)	1	1	Received	Dec-25		0
45	WUPPTCL	7	7	Conducted		Completed	7
46	SEUPPTCL	3	3	Completed		Completed	3
47	ATSCL	1	1	Received (400/220KV Alwar SS)	September, 2025		0
48	GTL	1	1	Received (765 kV Hapur extension bays)	September, 2025		0
49	GTL	2	2	Received (765 kV Agra and Gr. Noida extension bays)	September, 2025		0
50	HPTSL	1	1	Received (220kV Ranpur SS)	August, 2025		0
51	MTSCL	1	1	Received (400/220/132KV Deedwana SS)	August, 2025		0
52	OCBTL	1	1	Received (400/220/132KV Badaun SS)	January, 2025	Completed	1
53	STSL	1	0				0
	Rajasthan						
54	Barsingsar Plant	1	0				0
55	Rajwest Plant	1	0				0
	RE Utilities						
56	ABC Renewable Pvt. Ltd	1	0				0
57	ACME Heeragarh powertech Pvt. Ltd	1	0				0
58	ACME Pholidi	1	0				0
59	ACME Deagarh	1	0				0
60	ACME Raisar	1	0				0
61	ACME Dhoulpar	1	0				0
62	ACME Chittorgarh Solar Energy Pvt Ltd	1	0				0
63	Adani Hybrid Energy Jaisalmer One Ltd.	1		5 years have not completed since commissiong			0
64	Adani Hybrid Energy Jaisalmer Two Ltd.	1		5 years have not completed since commissiong			0
65	Adani Hybrid Energy Jaisalmer Three Ltd.	1		5 years have not completed since commissiong			0
66	Adani Hybrid Energy Jaisalmer Four Ltd. (AEML 1 -350)	1		5 years have not completed since commissiong			0
67	Adani Hybrid Energy Jaisalmer Four Ltd. (AEML 2 -250)	1		5 years have not completed since commissiong			0
68	Adani Renewable Energy (RJ) limited Rawara	1	1	Received	1/15/2026		0
69	Adani Solar Enegry Four Private Limited	1		5 years have not completed since commissiong			0
70	Adani Solar Energy Jaisalmer Two Private Limited Project Two	1		5 years have not completed since commissiong			0
71	SB Energy Six Private Limited, Bhadla	1		5 years have not completed since commissiong			0
72	Adani Solar Enegry Jodhpur Two Limited, Rawara	1		5 years have not completed since commissiong			0
73	Adani Solar Energy Jaisalmer One Ltd. (Hybrid450)	1		5 years have not completed since commissiong			0
74	Adani Solar Energy RJ Two Pvt. Ltd. (Devikot)	1		5 years have not completed since commissiong			0
75	Adani Solar Energy RJ Two Pvt. Ltd. (Phalodi)	1		5 years have not completed since commissiong			0
76	Adani Green Energy 24 Limited (Bhimsar)	1		5 years have not completed since commissiong			0
77	Adani Green Twenty-Five Limited (Badisid)	1		5 years have not completed since commissiong			0
78	Bhadla park - South block	1	1	Received	1/28/2026		
79	AEML-250 WIND (Hybrid-2A)	1		5 years have not completed since commissiong			
80	AEML-260 WIND (Hybrid-2B)	1		5 years have not completed since commissiong			
81	Hybrid450-WIND (SBE Hybrid 450)	1		5 years have not completed since commissiong			
82	Altra Xergi Pvt. Ltd.	1	1	Conducted		Completed	1
83	AMP Energy Green Four Pvt. Ltd.	3	3	Received		Completed for common substation	3
84	AMP Energy Green Five Pvt. Ltd.			Received	Nov-27		
85	AMP Energy Green Six Pvt. Ltd.			Received	Nov-27		
86	Amplus Ages Private Limited	1	0				0
87	Avaada RJHN_240MW	1	1	Received	Aug-26		0
88	Avaada sunce energy Pvt limited	1	1	Received	Aug-26		0
89	Avaada Sunrays Pvt. Ltd.	1	1	Received	Aug-27		0
90	Avaada Sustainable RJ Pvt. Ltd.	1	1	Received	Aug-26		0
91	Ayana Renewable Power Three Private Limited	1	1	Conducted		24.05.2025	1
92	Ayaana Renewable Power One Pvt. Ltd.	1	1	Conducted			1
93	Azure Power Forty One Pvt limited	1	0				0
94	Azure Power Forty Three Pvt. Ltd. RSS	1	0				0
95	Azure Maple Pvt. Ltd.	1	0				0
96	AZURE POWER INDIA Pvt. Ltd., Bhadla	1	0				0
97	Azure Power Thirty Four Pvt. Ltd.	1	0				0
98	Clean Solar Power (Jodhpur) Pvt. Ltd.	1	0				0
99	Eden Renewable Cite Private Limited	1	0				0
100	Grian Energy private limited	1	0				0
101	Mahindra Renewable Private Limited	1	0				0
102	Mega Surya Urja Pvt. Ltd. (MSUPL)	1	0				0
103	AURAIYA Solar	1	0				0
104	DADRI SOLAR	1	0				0
105	SINGRAULI SOLAR	1	0				0
106	Anta Solar	1	0				0
107	Unchahar Solar	1	0				0
108	NTPC Devikot Solar plant 240MW	1	1	Received	Aug-26		0
109	NTPC Kolayat 400kV	1	1	Received	May-26		0
110	Nedan Solar NTPC	1	1	Received	Jul-26		0
111	NTPC Nokhra 300MW	1	1	Received	Jun-26		0
112	One Volt energy Pvt. Ltd.	1	0				0
113	ReNew Solar Energy (Jharkhand Three) Private Limited	1	0				0
114	RENEW SOLAR POWER Pvt. Ltd. Bhadla	1	0				0
115	ReNew Solar Urja Private Limited	1	0				0
116	Renew Sun Bright Pvt. Ltd. (RSBPL)	1	0				0
117	Renew Surya Partap Pvt. Ltd.	1	0				0

118	Renew Surya Ravi Pvt. Ltd.	1	0				0
119	Renew Surya Roshni Pvt. Ltd.	1	0				0
120	Renew Surya Vihan Pvt. Ltd.	1	0				0
121	Renew Surya Ayaan Pvt. Ltd.	1	0				0
122	Renew Solar Photovoltaic Pvt Ltd	1	0				0
123	RENEW SOLAR POWER Pvt. Ltd. Bikaner	1	0				0
124	Rising Sun Energy-K Pvt. Ltd.	1	0				0
125	Serentica Renewables India 4 Private Limited	1	0				0
126	Solzen Urja Private Limited	1	1	Received	Oct-26		0
127	Tata Power Green Energy Ltd. (TPGEL) (225MW)	1	1	Received	31-03-2027		0
128	Tata Power Renewable Energy Ltd. (TPREL) (300MW)	1	1	Received	31-03-2027		0
129	Thar Surya Pvt. Ltd.	1	0				0
130	TP Surya Ltd., Noorsar (110MW)	1	1	Received	31-03-2027		0
131	Banderwala Solar Plant TP Surya Ltd. (300MW)	1	1	Received	31-03-2027		0
132	TRANSITION ENERGY SERVICES PRIVATE LIMITED	1	0				0
133	Transition Green Energy Private Limited	1	0				0
134	Transition Sustainable Energy Services Private Limited	1	0				0
		949	500				57

1. Summary of Iberian Disturbance on 28 April 2025

- **Event Date:** April 28, 2025
- **Event Time –** 12:33:30 hrs (Local time)
- **Affected Power Systems:**
  - Spain (Complete Blackout)
  - Portugal (Complete Blackout)
  - France (small disruptions near the Spanish border)
- **Total Population Affected:** ~ 60 million (Spain + Portugal)
- **Time taken for complete restoration:** ~19 Hrs



ANTECEDENT CONDITIONS

Source:
1. ***Government of Spain – National Security Council:*** *"Committee for the analysis of the circumstances surrounding the electricity crisis of 28 April 2025"*
2. ***System Operation Division, Red Eléctrica (REE):*** *"Blackout in the Spanish Peninsular Electrical System on the 28th of April 2025"*

2. Analysis of the Sequence of Events

Chain Reaction Overvoltage: High voltages triggered generation trips → further rise in voltage → more tripping

Phase 0
(Before 12:00)
Voltage Fluctuations

- Many voltage-supporting **units were offline**
- RE plants operating in **constant power factor mode**
- **Inadequate reactive** margin/support from conventional plants

Phase 1
(12:00–12:30)
System Oscillations

- **Voltage oscillations**
- **Damping measures** taken by System Operator as per protocol:
  - Connection of additional lines
  - Switching of reactors
  - Reduction in export

Phase 2
(12:32–12:33:18)
Generation losses due to overvoltage

- Voltages began **rising sharply across the network**
- Overvoltage caused **tripping of several power plants,** including wind and solar - both at the **transmission and distribution level**

Phase 3
(12:33:18–12:33:30)
Voltage Collapse

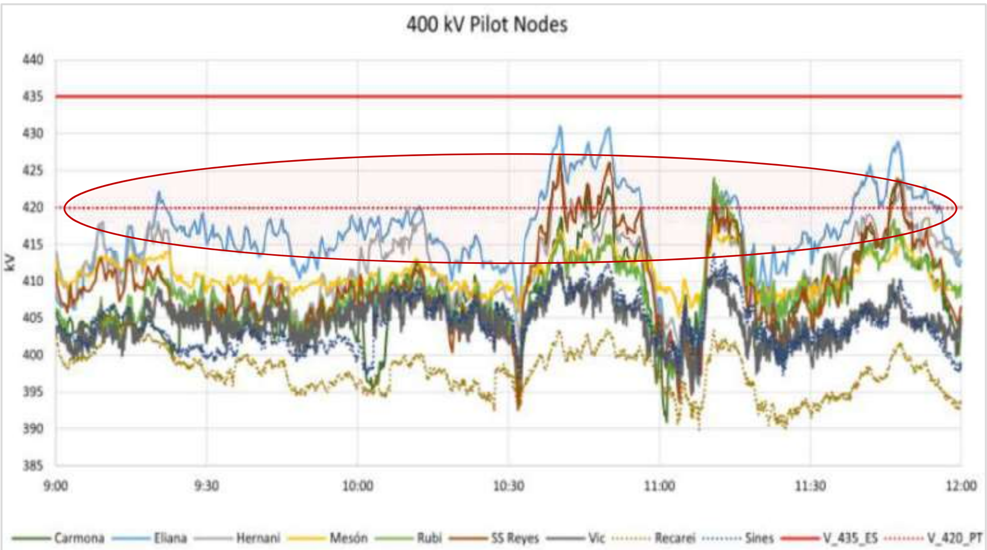
- **Within seconds, voltage collapse** observed across large parts of the system
- **12:33:20,473:** Morocco separated from Spain
- **12:33:23,960:** Separation of the Iberian Peninsula from France

Despite high RE penetration, adequate inertia was available as per the threshold

No evidence of cyber-attack found in the event analysis

3. Brief of Iberian Disturbance on 28 April 2025 (1/2)

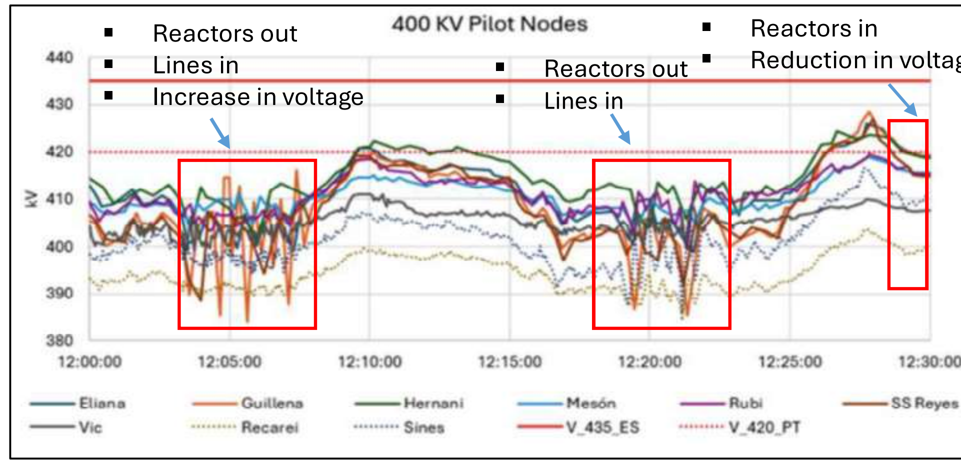
Phase 0: Voltage Fluctuations (Before 12:00 hrs)



Evolution of the Voltage profile from 9:00 to 12:00 CEST in the main 400 kV in Spain and Portugal.

- ❖ Many conventional power plants were offline due to planned and forced outages:
  - Gas – 7400 MW
  - Nuclear – 3000 MW
  - **Total outage – 12800 MW**
- ❖ High renewable energy penetration - **82%**
- ❖ Fluctuations in voltages observed from early morning hours

Phase 1: System Oscillations (12:00–12:30 hrs)



- ❖ Voltage oscillations of the tune of 32 kV peak to peak were detected in the Spanish system
- ❖ Actions taken by System Operator as per the **standard operating procedure:**
  - Connected more transmission lines
  - Reactor switching operations
  - HVDC switched to fixed power mode
  - Reduced electricity exports to stabilize the grid
- ❖ Despite efforts, large voltage swings observed at key substations

3. Brief of Iberian Disturbance on 28 April 2025 (2/2)

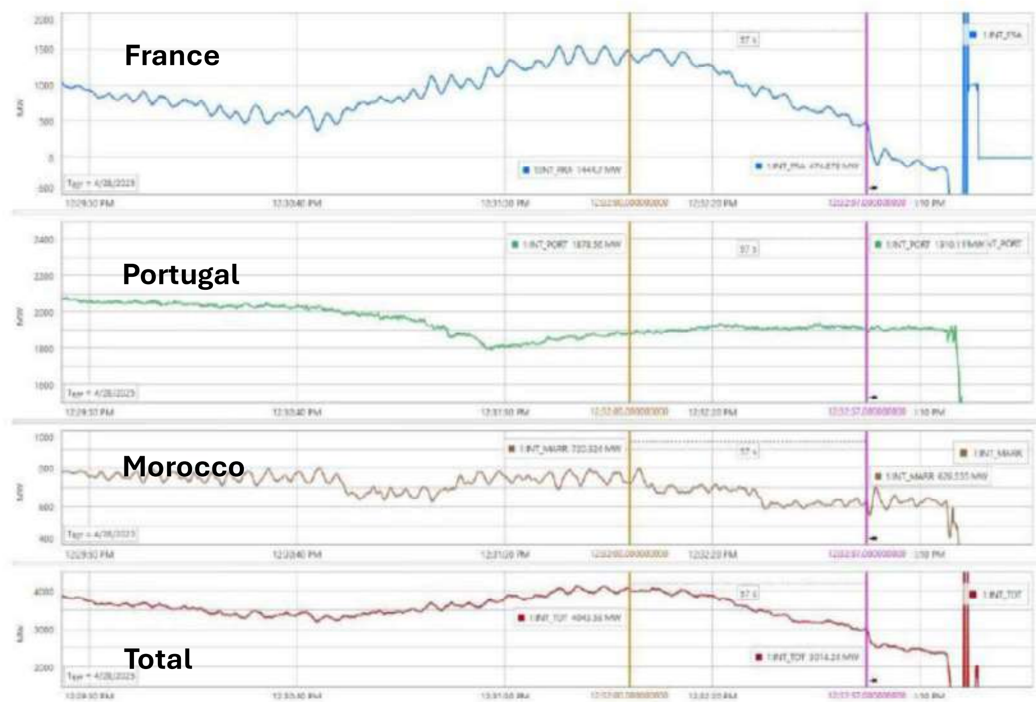
Phase 2: Generation losses due to overvoltage (12:32:00–12:33:18 hrs)

- ❖ Overvoltage caused tripping of several power plants, including wind and solar - both at the transmission and distribution level
- ❖ Within seconds, a large quantum of generation was lost

Phase 3: Voltage Collapse (12:33:18–12:33:30 hrs)

- ❖ Voltage collapse observed across large parts of the system
- ❖ Sharp decline in frequency leading to disconnection of more generators
- ❖ Interconnections with France and Morocco automatically cut off by protection systems to prevent the blackout from spreading:

Interconnector Flows



- ❖ By 07:00 hrs the next day (29th April 2025), 99.95% of demand was restored
- ❖ Hydro and Gas Plants were critical for the restoration of the supply
- ❖ All the technical work was completed by 14:36 hrs of 29th April 2025

4. Recommendations of the Committee on Iberian Disturbance

1. Reinforcement of the process of supervision and **verification of compliance** against specified regulations

2. Technical measures to reinforce the **capabilities for voltage control** and **protection against oscillations** in the system.
   - Approval and implementation of the new voltage control support services from both **conventional and RE plants**.
   - Incorporate **penalties for non-compliance of RE Plants against proposed** voltage control requirements.
   - Additional tools for voltage control and management of oscillations, viz. Planning of dynamic reactive power compensation devices such as **Synchronous Condensers, FACTS devices** (including power oscillation dampers), etc.

3. Promote the **interconnections** with the European system.

4. Enable the entry of new technologies **(grid forming)** to facilitate **autonomous start-up (black start).**

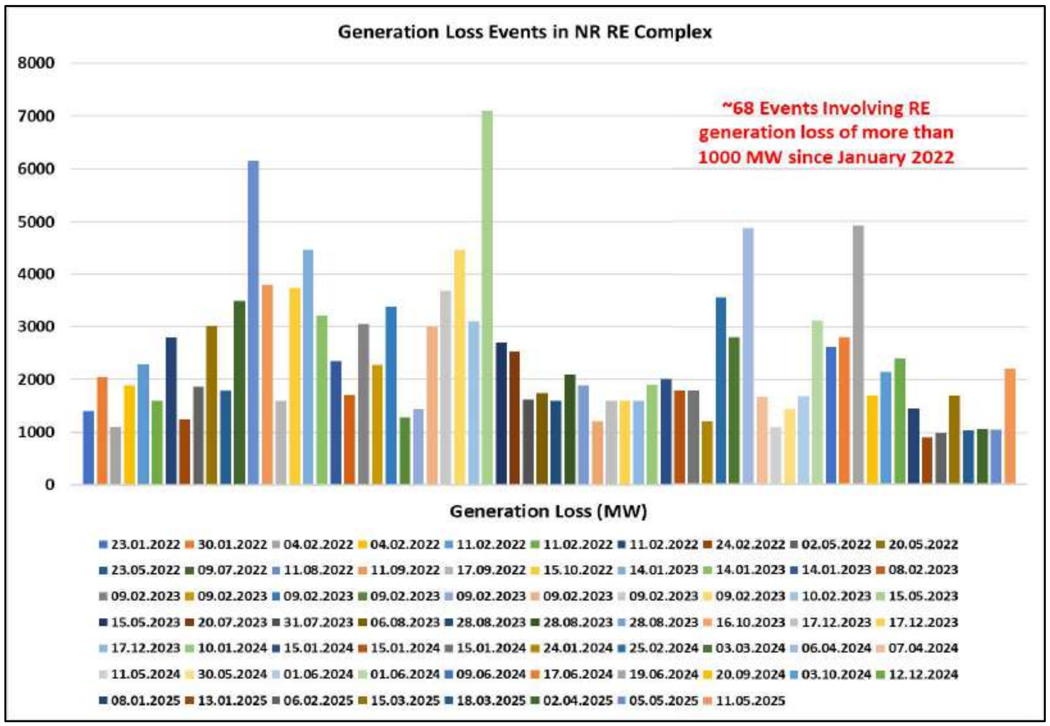
5. Enhance robustness and flexibility of the electric power system via **boosting energy storage, promoting flexibility and capacity market regulations** etc.

6. **Repowering of renewable energy projects** - replacement of old renewable energy equipment with modern equipment to incorporate the latest control, management and system robustness requirements.

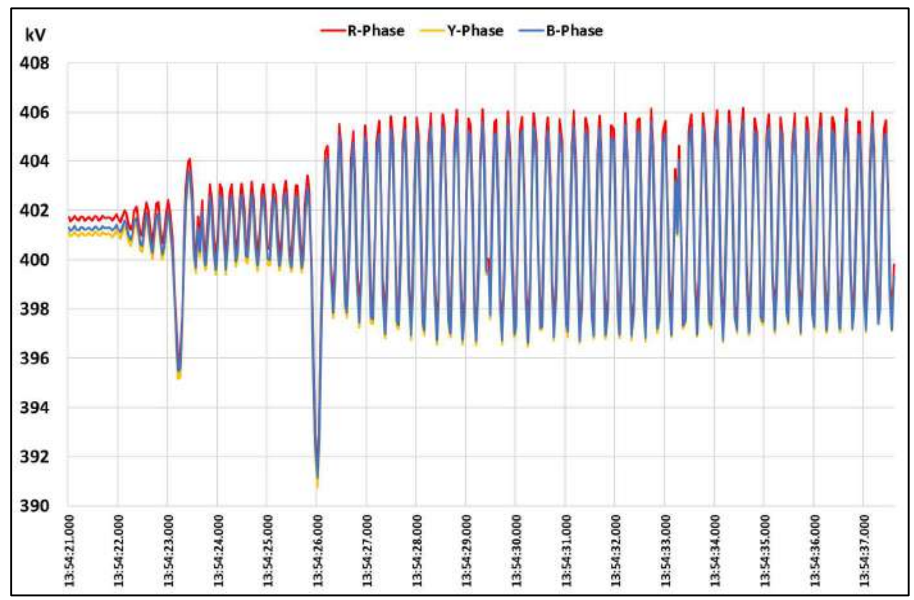
5. Major Grid Events in RE Complexes in India (1/2)

1. **~68 events involving RE generation** loss of above **1000 MW** between Jan’22 to Jun’25

2. **Reasons for the above events:**
   - Non-compliance of the RE plants to specified CEA Standards
   - Low system strength in remote RE pockets
   - Tuning of controllers of RE plants and FACTS devices (STATCOMs etc.)

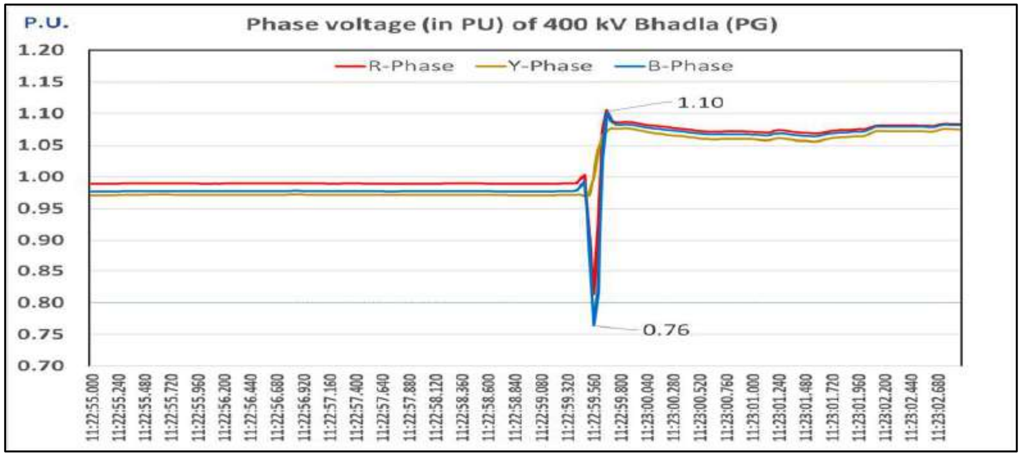


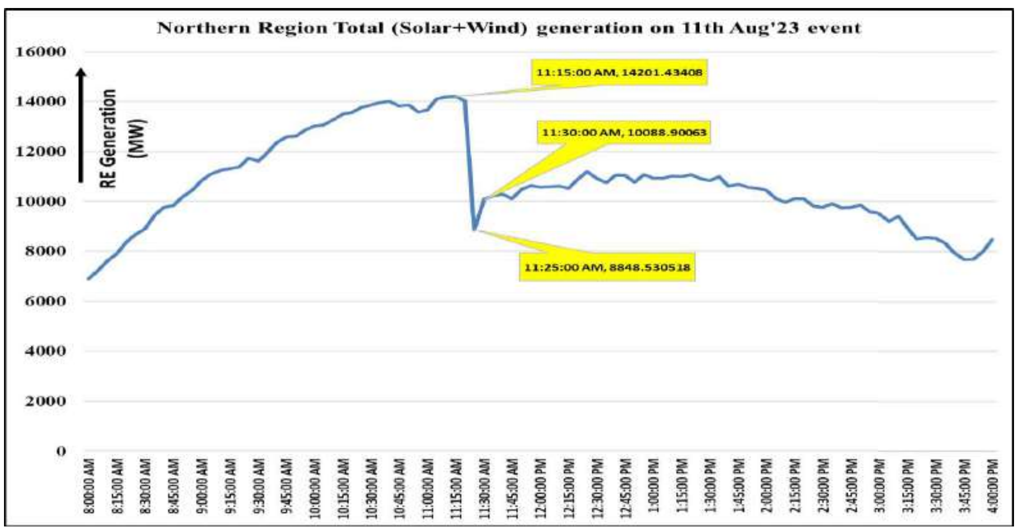
Intermittent Low Frequency Oscillations during solar hours



5. Major Grid Events in the RE Complexes in India (2/2)

~6000 MW Generation Loss in Rajasthan RE Complex on 11th Aug 2022





Event Description

Generation loss: **6157 MW** (Solar : 5807MW, Wind : 350 MW)

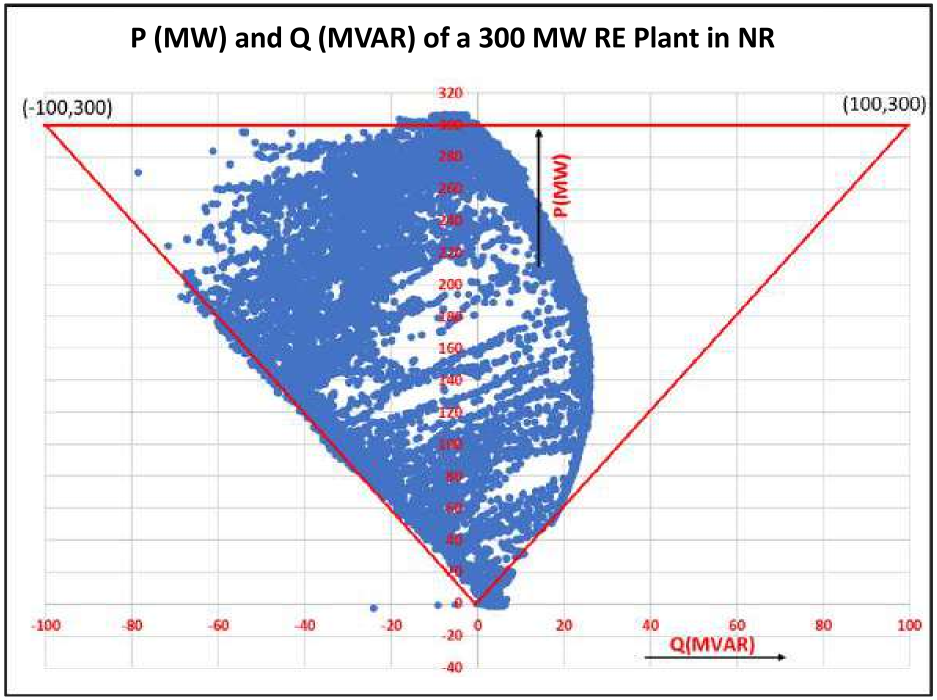
Frequency drop: **0.7 Hz** (50.16 Hz to 49.46)

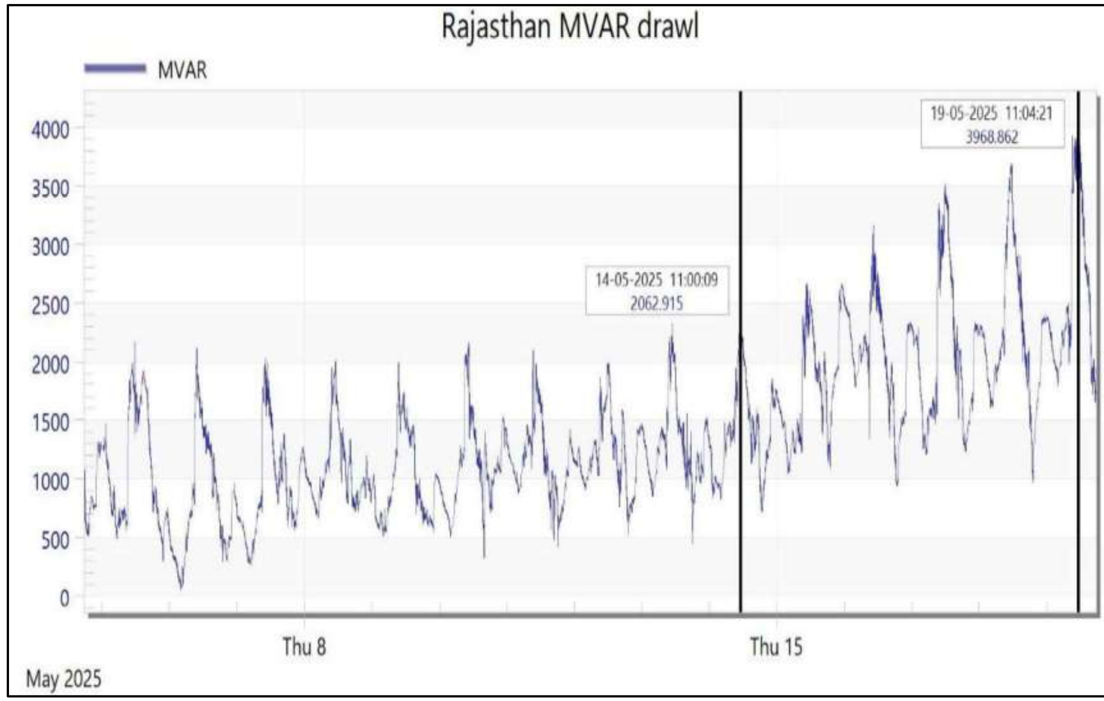
Chronology:

- R-B phase fault on 220 kV Bhadla (PG) - Clean Solar Power (Jodhpur) Pvt. Ltd. Line
- Voltage dip at 400 kV Bhadla (PG) - **0.77 pu**
- Most inverters **failed to recover MW output** within 1s **after fault clearance**
- Due to a reduction in generation, the **EHV network got offloaded**, causing a further rise in voltage
- Sustained overvoltage led to significant generation loss (HVRT) and tripping of multiple EHV lines on over voltage
- Triggering of under frequency load shedding (~750 MW)

6. Voltage Stability and Reactive Power Support

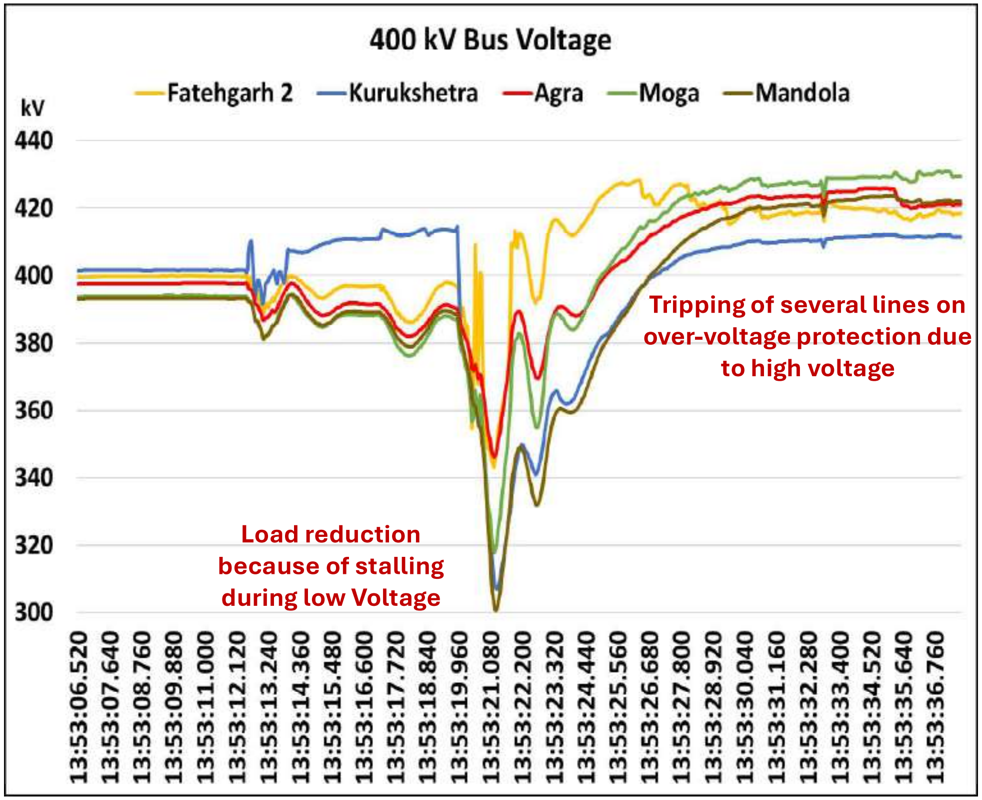
Reactive Power Reserve Shortfall due to non-compliance





Intra-state system drawing high MVAr from the grid, leading to poor power factor and persistent low-voltage issues at 400/220 kV stations

7. 17 June 2024 Northern Region Load Loss Event



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

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

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

3. High voltage scenario due to off loading of transmission network.

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

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

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

6. **Planning for dynamic reactive power sources near load centers**

8. Initiatives taken in Indian Power System

1. A comprehensive set of **regulations and standards** governing interconnection and operations of the renewable plants
2. **Proposed amendments** to standards /procedures are under various stages of preparation by CEA
3. Established procedures for **compliance verification**. Joint compliance verification by system planner & operator
4. Regular **monitoring and reporting** of non-compliance by RLDCs to developers, RPCs, CEA, CERC, MOP and MNRE
5. Robust **inter-regional transmission network**
6. **Perspective transmission planning** on a rolling basis to ensure timely availability of transmission
7. **Transmission resource adequacy plans** for states under development by CEA
8. NRPC committee report on installation of **Synchronous Condensers** published in Dec 2024
9. MOP Guidelines for **Resource Adequacy Planning Framework** for India, 2023.
10. Initiatives with IMD, ISRO, National Centre for Medium Range Weather Forecast (NCMRWF), IIT Bombay are already being taken up to improve the **forecast accuracy**.

Checklist for First Time Energization and Integration of RE plants: https://webcdn.grid-india.in/files/grdw/2025/08/Checklist%20for%20FTE&I%20and%20Trial%20Run%20of%20PSPs_Aug%2025_534.pdf

9. Suggested Measures for Indian Power System

Compliance

- Enforcement of compliance to specified standards at both ISTS and **In-STS level**
- Periodic testing and tuning of controllers of all grid elements by respective asset owners

Grid Planning

- Static and dynamic reactive power planning – SynCONs, STATCOMs etc.
- Timely commissioning of the associated transmission system for RE evacuation
- Augmentation of intra-state transmission system
- Generation Flexibility and Adequacy - Timely commissioning of Energy Storage Systems

Resiliency

- Distributed RE capacity addition across the country from resiliency perspective
- Ensuring Black Start Capability / Fast System Restoration – Grid Forming, VSC HVDCs etc.

Frequency Stability

- Participation by RE plants and BESS in Primary, Secondary and Fast Freq. Control
- Measures for addressing gradual decline in inertia – SynCONs at suitable locations

Standards and Regulations

- Regular review and strengthening of standards, regulations and guidelines
- Inclusion of standards for new actors – Electrolyzers, Data Centers, Energy Storage etc.

ग्रिड-इंडिया
GRID-INDIA
ग्रिड कंट्रोलर ऑफ इंडिया लिमिटेड
भारत सरकार का उद्यम
GRID CONTROLLER OF INDIA LIMITED
(A Government of India Enterprise)
[formerly Power System Operation Corporation Limited (POSOCO)]
उत्तर क्षेत्रीय भार प्रेषण केन्द्र / Northern Regional Load Despatch Centre

कार्यालय : 18-ए, शहीद जीत सिंह सनसनवाल मार्ग, कटवारिया सराय, नई दिल्ली-110016
Office : 18-A, Shaheed Jeet Singh Sansanwal Marg, Katwaria Sarai, New Delhi-110016
CIN : U40105DL2009GOI188682, Website : www.nrldc.in, E-mail : nrldc@grid-india.in, Tel.: 011 26519406, 26523869, Fax: 011 26852747

Report on load loss event in Northern Region at 13:53hrs on 17th June 2024

1. **Date & Time of event:** 13:53 hrs on 17.06.2024

2. **Location/Control Area:** Haryana, Punjab, UP, Delhi, J&K, HP, Chandigarh, Uttarakhand & Rajasthan

3. **Plant/Substation Name:** 800 kV Kurukshetra HVDC (PG), 765/400kV Aligarh(PG), 765/400kV Rampur (PRSTL), 400kV Mahendergarh(APL), 400kV Karcham HEP(JSW), 765/220kV Lalitpur TPS(UP), 400kV Rajwest TPS(RS), 220kV Sainj HEP(HP), Bhakra (Left & Right) HEP (BBMB), Panipat TPS (HR) and RSD HEP (PS) and RE stations in RE complex at Rajasthan.

4. **GD/GI Category:** GD-2

5. **Antecedent Condition (as per SCADA data):**
   - NR Load : 89410 MW
   - Frequency : 50.05 Hz
   - Weather condition : Heat wave
   - IR exchange : 15488 MW
   - Antecedent voltage scenario in grid :

Substation Name	Voltage recorded at 13:52:00 hrs (as per SCADA data)
765/400kV Jhatikara(PG)	749kV & 385kV
765/400kV Aligarh(PG)	755kV & 394kV
400kV Dwarka(PG)	384kV
400kV Ludhiana(PG)	393kV
400kV Dhanashu(PS)	394kV
400kV Kaithal(PG)	388kV
400kV Koldam HEP (NTPC)	393kV
400kV Kadarpur(GTPC)	385kV
400kV Ballabhgarh(PG)	384kV
400kV Karcham HEP (JSW)	401kV
400kV Panipat(HR)	393kV
400kV Mahinderagrh(APL)	402kV

   - Antecedent reactive power demand of states :

Name of the State	Reactive Power Demand
Punjab	245 MVAr
Haryana	1921 MVAr
Rajasthan	2876 MVAr
Delhi	7.2 MVAr
UP	1500 MVAr
Uttarakhand	216 MVAr
Chandigarh	13 MVAr
HP	390 MVAr
J&K	297 MVAr

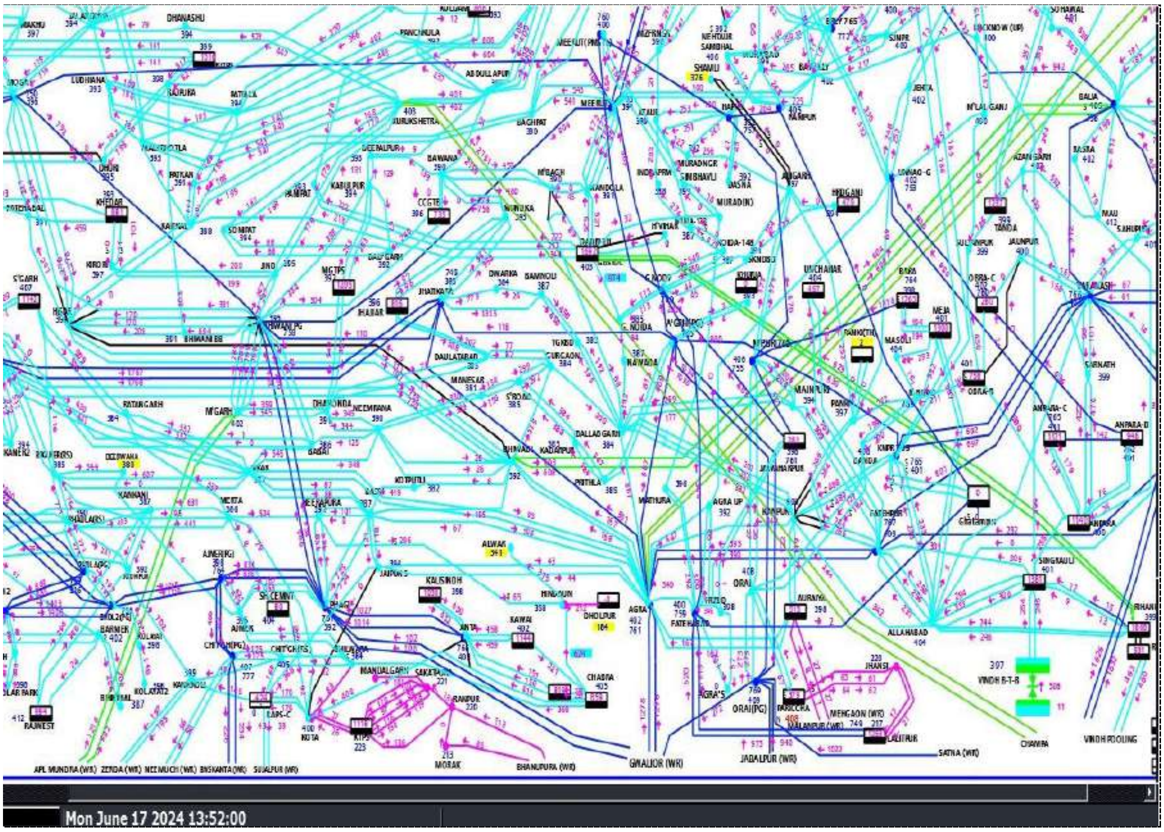


Fig: SCADA display of Northern Regional Grid Network diagram at 13:52:00 hrs

6. **Generation loss/Load loss (as per SCADA):**
   - Reduction in Northern Region demand of approx. 16500 MW.
   - Reduction in NR total RE generation of approx. 2870 MW.
   - Loss in NR thermal & hydro generation of approx. 2370 MW.

   Total reduction in NR generation was approx. 5240 MW.

7. **Duration of interruption:** ~00:39 (hh:mm) (Restoration time: 14:32hrs)

8. **Tripped elements:**

   Transmission lines:

S. No	Name of Elements	Outage Time	Revival Time	Reason of tripping
1	800 KV HVDC Kurukshetra(PG) Pole-2	13:53:17 hrs	17-Jun-2024 15:46 hrs	Blocked on DC line fault
2	800 KV HVDC Kurukshetra(PG) Pole-4		17-Jun-2024 15:51 hrs	
3	800 KV HVDC Kurukshetra(PG) Pole-1	13:53:19 hrs	17-Jun-2024 14:45 hrs	Blocked during fault in DMR-2. NBGS overcurrent protection operated at Champa end
4	800 KV HVDC Kurukshetra(PG) Pole-3		17-Jun-2024 15:01 hrs	
5	765 KV Orai-Aligarh (PG) Ckt-1	13:53:35 hrs	17-Jun-2024 14:34 hrs	On overvoltage stage-1 protection operation
6	765 KV Orai-Aligarh (PG) Ckt-2	13:53:39 hrs	17-Jun-2024 14:40 hrs	
7	765 KV Jhatikara-Aligarh (PG) Ckt-1	13:53:41 hrs	17-Jun-2024 14:37 hrs	
8	765 KV Aligarh(PG)-SIKAR_2 (PASTL) Ckt-1	13:53:32 hrs	17-Jun-2024 21:46 hrs	
9	765 KV Aligarh(PG)-SIKAR_2 (PASTL) Ckt-2	13:53:34 hrs	17-Jun-2024 21:57 hrs	
10	765 KV Agra-Aligarh (PG) Ckt-1	13:53:35 hrs	17-Jun-2024 14:32 hrs	
11	765 KV Kanpur_GIS-Aligarh (PG) Ckt-1	13:53:35 hrs	17-Jun-2024 14:46 hrs	
12	765 KV Hapur(UP)-Rampur_PRSTL (UP) (GTL) Ckt-1	13:53:32 hrs	17-Jun-2024 15:53 hrs	
13	765 KV Rampur_PRSTL - Ghatampur TPS (UP) Ckt-1	13:53:32 hrs	17-Jun-2024 16:40 hrs	
14	765 KV Koteshwar-Meerut (PG) Ckt-1	13:53:36 hrs	17-Jun-2024 14:38 hrs	
15	765 KV Koteshwar-Meerut (PG) Ckt-2	13:53:38 hrs	17-Jun-2024 16:24 hrs	
16	400 KV Koteswar(TH)-Koteshwar(PG) (PG) Ckt-1	13:53:39 hrs	17-Jun-2024 15:36 hrs	
17	400 KV Mahindergarh(APL)-Dhanoda(HV) (ATIL) Ckt-1	13:53:35 hrs	17-Jun-2024 16:13 hrs	
18	400 KV Mahindergarh(APL)-Dhanoda(HV) (ATIL) Ckt-2	13:53:35 hrs	17-Jun-2024 17:37 hrs	
19	400 KV Mahindergarh(APL)-Bhiwani(PG) (PG) Ckt-3	13:53:35 hrs	17-Jun-2024 15:38 hrs	
20	400 KV Kishenpur-Moga (PG) Ckt-1	13:53:35 hrs	17-Jun-2024 14:23 hrs	

21	400 KV Kishenpur-Moga (PG) Ckt-2	13:53:36 hrs	17-Jun-2024 14:23 hrs	
22	132 KV Mahendra Nagar(PG)-Tanakpur(NH) (PG) Ckt-1	13:53 hrs	17-Jun-2024 15:30	Over loading

Generating units:

S. No	Name of Elements	Outage Time	Revival Time	Reason of tripping
1	250 MW Karcham Wangtoo HPS - UNIT 2	13:53:27 hrs	17-Jun-2024 14:25 hrs	SPS case-2 operated (voltage less than 395kV)
2	250 MW Karcham Wangtoo HPS - UNIT 4	13:53:27 hrs	17-Jun-2024 14:27 hrs	
3	250 MW Panipat TPS - UNIT 8	13:53:23 hrs	17-Jun-2024 18:23 hrs	backup impedance protection
4	135 MW Rajwest (IPP) LTPS - UNIT 1	13:53 hrs	17-Jun-2024 15:27 hrs	Turbine problem
5	660 MW Lalitpur TPS - UNIT 2	13:53 hrs	17-Jun-2024 17:23 hrs	high boiler pressure
6	126 MW Bhakra HPS (Left) - UNIT 5	13:53 hrs	17-Jun-2024 16:40 hrs	field(excitation) failure
7	157 MW Bhakra HPS (Right) - UNIT 6	13:53 hrs	17-Jun-2024 14:13 hrs	overcurrent protection
8	157 MW Bhakra HPS (Right) - UNIT 8	13:53 hrs	17-Jun-2024 14:27 hrs	
9	157 MW Bhakra HPS (Right) - UNIT 9	13:53 hrs	17-Jun-2024 14:28 hrs	
10	150 MW RSDPH - UNIT 4	13:53 hrs	17-Jun-2024 19:20 hrs	overcurrent protection
11	50 MW Sainj HEP - UNIT 1	13:53 hrs	17-Jun-2024 14:07 hrs	over frequency
12	50 MW Sainj HEP - UNIT 2	13:53 hrs	17-Jun-2024 14:23 hrs	

9. Brief description of event:

i) During antecedent condition, 800kV HVDC Champa-Kurukshetra Bipole-1&2 was carrying total ~4500MW from WR to NR.

ii) At 13:53:17 hrs, 800kV HVDC Kurukshetra Pole-2&4 blocked on DC line fault. Fault distance recorded was ~616.85km from Champa end (tower location no. 1805).

iii) Further at 13:53:19 hrs, 800kV HVDC Kurukshetra Pole-1&3 also blocked on NBGS (Neutral Breaker Grounding Switch) overcurrent protection operation at Champa end during fault in DMR-2. Hence, all four poles of 800kV HVDC Kurukshetra blocked.

iv) As reported by POWERGRID, localized storm leading to abnormal swing of jumper caused flashover with tower body at location no. 1805 led to transient nature of fault in live negative pole conductor and DMR conductor.

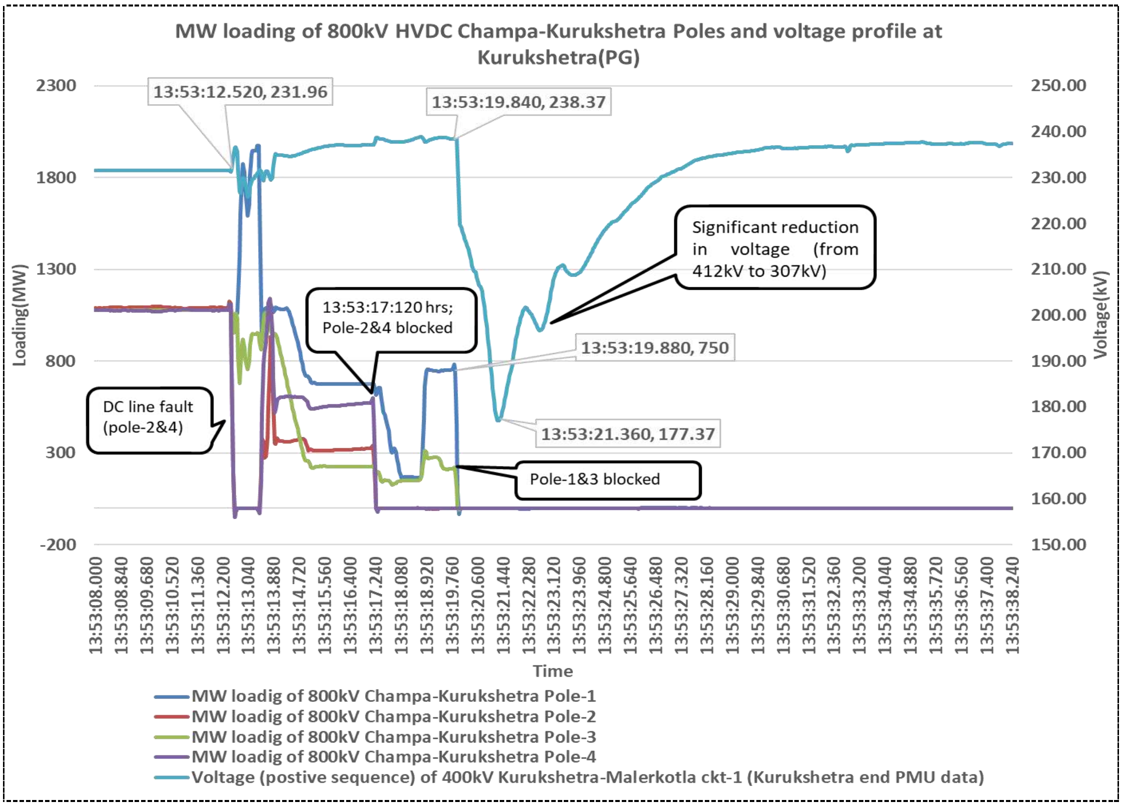


Fig: MW loading of 800kV HVDC Champa-Kurukshetra Poles and voltage profile at Kurukshetra(PG)

v) At the same instant when Pole-1&3 of 800kV Kurukshetra blocked, sudden reduction in voltage of all 3-phase of AC system at almost all the 400kV & 765kV stations in Northern Region occurred. As per PMU data, voltage at 400kV Kurukshetra dropped from 412kV to 307kV.

vi) As per SCADA data, bus voltage recorded at 13:53:30 hrs at different substations in Northern Region are:

Substation Name	**Voltage recorded at 13:53:30 hrs (as per SCADA data)**
765/400kV Jhatikara(PG)	611kV & 360kV

400kV Dwarka(PG)	361kV
400kV Ludhiana(PG)	365kV
400kV Dhanashu(PS)	357kV
400kV Kaithal(PG)	319kV
400kV Koldam HEP (NTPC)	326kV
400kV Kadarpur(GTPC)	316kV
400kV Ballabhgarh(PG)	377kV
400kV Karcham HEP (JSW)	382kV
400kV Panipat(HR)	333kV

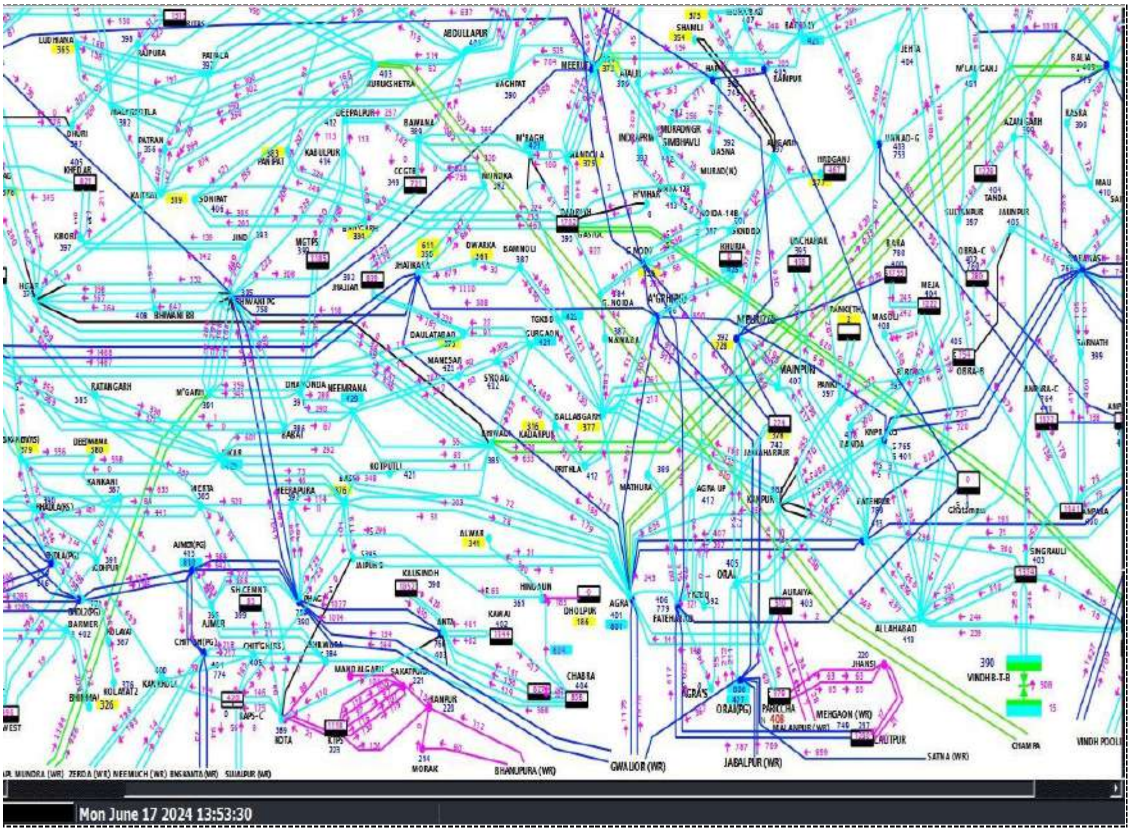


Fig: SCADA display of Northern Regional Grid Network diagram at 13:53:30 hrs (showing low voltage in grid)

vii) On this voltage dip, significant increase in MVAr drawl leading to further reduction in voltage followed by reduction in active power at different load centers are also observed.

Voltage, Active & Reactive power profile of few of the Delhi load centers i.e., Tuglakabad, Nawada & Mandola based on PMU data of 400kV side are shown in below figures:

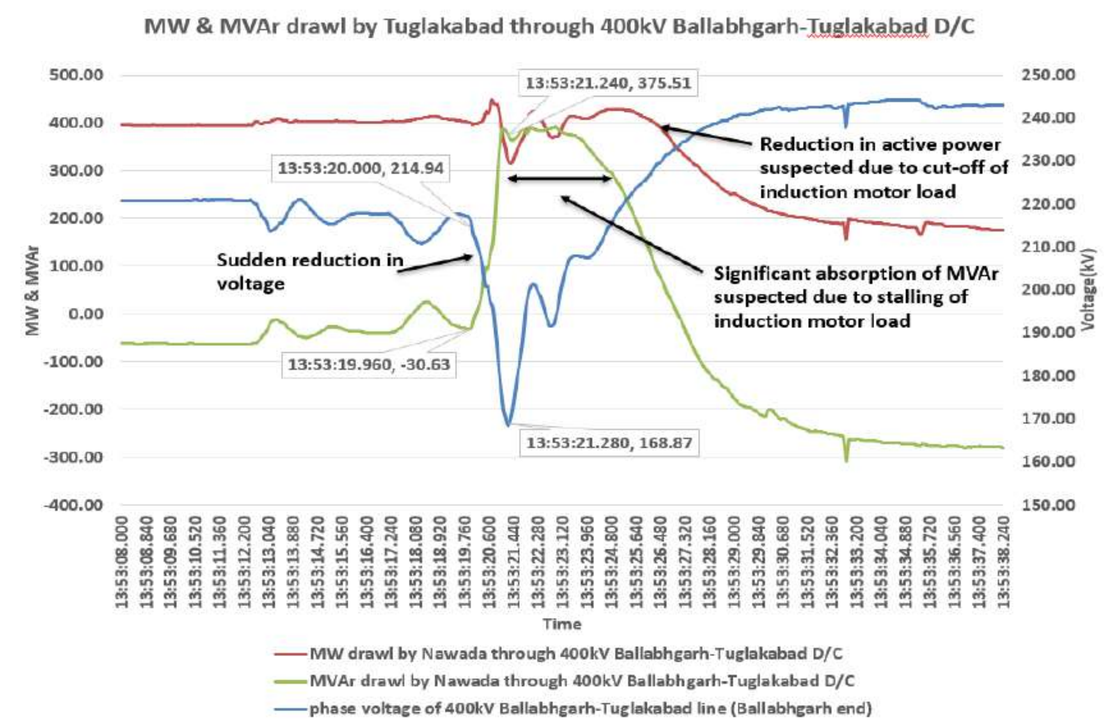


Fig: MW & MVAr drawl by Tuglakabad through 400kV Ballabhgarh-Tuglakabad D/C

From above figure it is observed that, reactive power absorption at Tuglakabad through Ballabhgarh line increased from -30MVAr (injection) to ~375MVAr and voltage reduced from ~370kV to ~290kV followed by reduction in active power which recovered gradually.

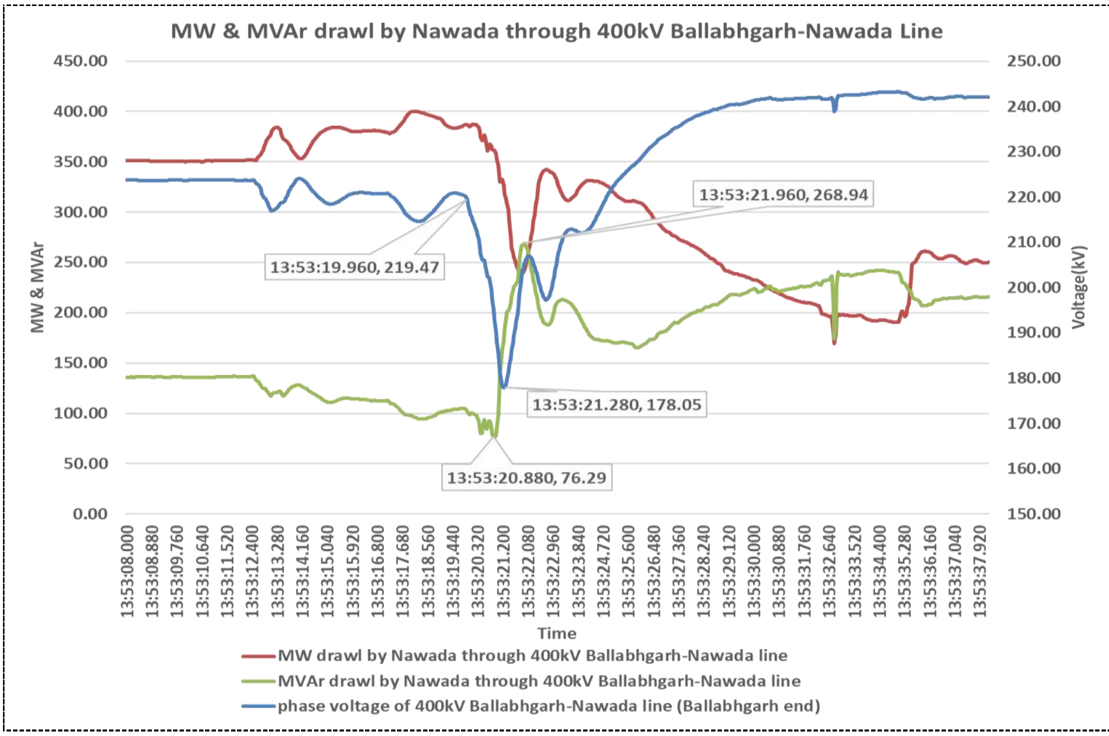


Fig: MW & MVAr drawl by Nawada through 400kV Ballabhgarh-Nawada Line

From above figure it is observed that, reactive power absorption at

Nawada through Ballabhgarh line increased from ~76MVAr to ~269MVAr and voltage reduced from ~380kV to ~308kV followed by reduction in active power which recovered gradually.

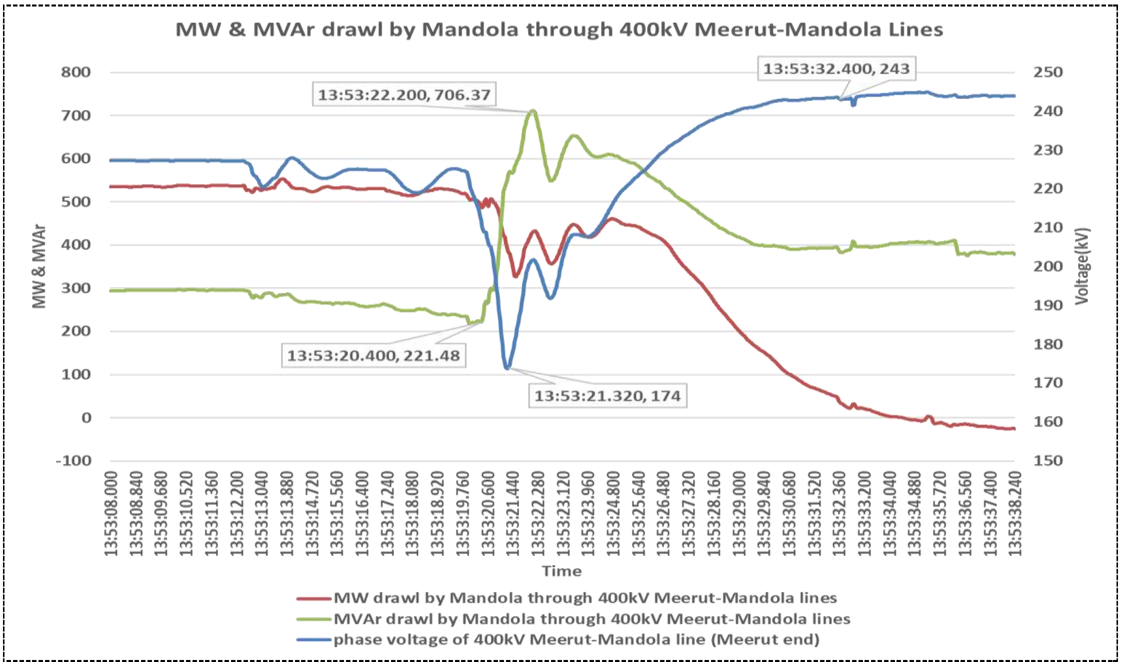


Fig: MW & MVAr drawl by Mandola through 400kV Meerut-Mandola Lines

From above figure it is observed that, reactive power absorption at Mandola through Meerut lines increased from ~221MVAr to ~706MVAr and voltage reduced from ~387kV to ~301kV followed by reduction in active power which recovered gradually.

From above PMU data of load centre in Delhi control area it is suspected that sudden reduction in voltage after outage of 800kV Champa-Kurukshetra link, led to stalling of induction motor load (high MVAr absorption resulting into further reduction in voltage) which further cut-off and active power reduced.

viii) Northern Region demand reduced by ~16500 MW during the event. State wise reduction in demand during the event is mentioned in below table:

STATE/UT	Pre-Event Demand (MW)	LOAD Drop (MW)	Percentage Load drop (%)	Load recovery
PUNJAB	15320	3780	25%	3357MW recovered by 14:18hrs
HARYANA	13148	4095	31%	4040MW recovered by 14:32hrs
UTTAR PRADESH	28939	2823	10%	1220MW recovered by 14:04hrs

STATE/UT	Pre-Event Demand (MW)	LOAD Drop (MW)	Percentage Load drop (%)	Load recovery
RAJASTHAN	17636	2858	16%	2858MW recovered by 14:08hrs
DELHI	7513	2152	29%	2152MW recovered by 14:35hrs
UTTRAKHAND	2237	350	16%	320MW recovered by 14:20hrs
HIMACHAL PRADESH	1743	240	14%	240MW recovered by 13:58 hrs
CHANDIGARH	400	220	55%	170MW recovered by 14:05 hrs
J&K and Ladakh	2523	376	15%	376MW recovered by 14:12hrs
NORTHERN REGION	**89410**	**16518**	**18%**	**11070MW recovered by 14:12hrs**

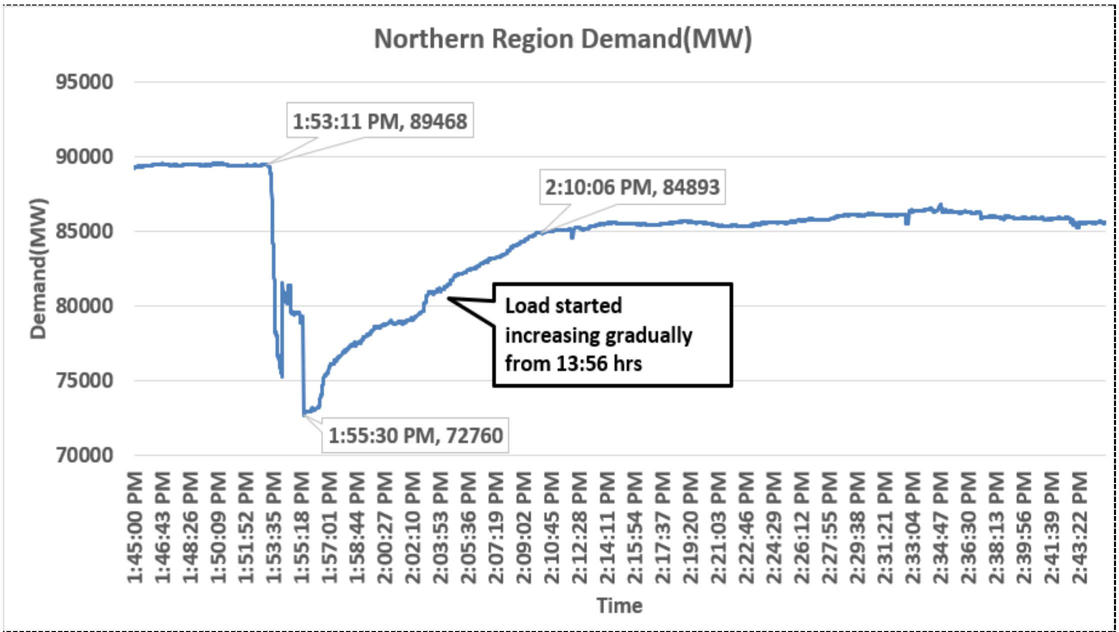


Fig: Northern Region Demand during the event (as per SCADA data)

ix) During this voltage drop, significant reduction in NR RE generation also observed. ~2800 MW RE generation reduced out of which ~1500MW RE generation recovered within 04 minutes. As per PMU data, voltage dropped to 0.81pu at Bikaner(PG), 0.83pu at Bhadla(PG), 0.85pu at Bhadla2(PG), 0.86pu at Fatehgarh2(PG) and 0.88pu at ADANI Solar park and voltage recovered within 01sec. Compliance status of RE station (LVRT compliance) based on PMU data of RE plant end is attached in Annexure.

x) Tripping of some of the ISGS and state control generating units also reported during the event.

Few of the generating unit tripped during low voltage scenario and few tripped during over frequency scenario. Details of tripping of generating units along with protection operation / relay flags during the event is mentioned in below table:

Sr. No.	**Generating unit**	**Region**	**Gen Loss (MW)**	**Reason of Tripping / Relay flags**
1	Lalitpur TPS - UNIT 2 (660 MW)	NR	631	Tripped on high boiler pressure
2	Karcham Wangtoo HPS - UNIT 2 & 4 (250 MW)	NR	560	On SPS operation (case 2: voltage less than 395kV); Voltage dropped to 382kV at Karcham HEP
3	Rajwest (IPP) LTPS - UNIT 1 (135 MW)	NR	133	Turbine problem (exact detail yet to be received)
4	Sainj HEP - UNIT 1 & 2 (50 MW each)	NR	99	Tripped on over frequency (protection setting yet to be received)
5	Bhakra HPS (Left) - UNIT 5 (126 MW)	NR	586	Tripped on field(excitation) failure
6	Bhakra HPS (Right) - UNIT 6, 8 & 9 (157 MW each)	NR		Tripped on overcurrent protection operation
7	Panipat TPS - UNIT 8 (250 MW)	NR	230	Tripped on backup impedance protection.
8	RSDPH - UNIT 4 (150 MW)	NR	135	O/C protection operation (51GA). Pole slip relay(78). Auxiliary overflux relay (88x).
9	Mahan Energen Ltd. TPS Unit 1 & 2 (660 MW each)	WR	1117	Tripped on Over Frequency
10	OTPC Palatana Unit 1 & 2 (363.3 MW each)	NER	418	Tripped on Over Frequency
Total			**3909**	

Total reduction in all India generation was approx. 6775MW.

xi) Due to significant reduction in Northern Region demand, grid frequency increased significantly. As per PMU data, grid frequency increased from 50.03Hz to 50.68Hz. Frequency reduced back to ~50.0Hz by 13:59 hrs.

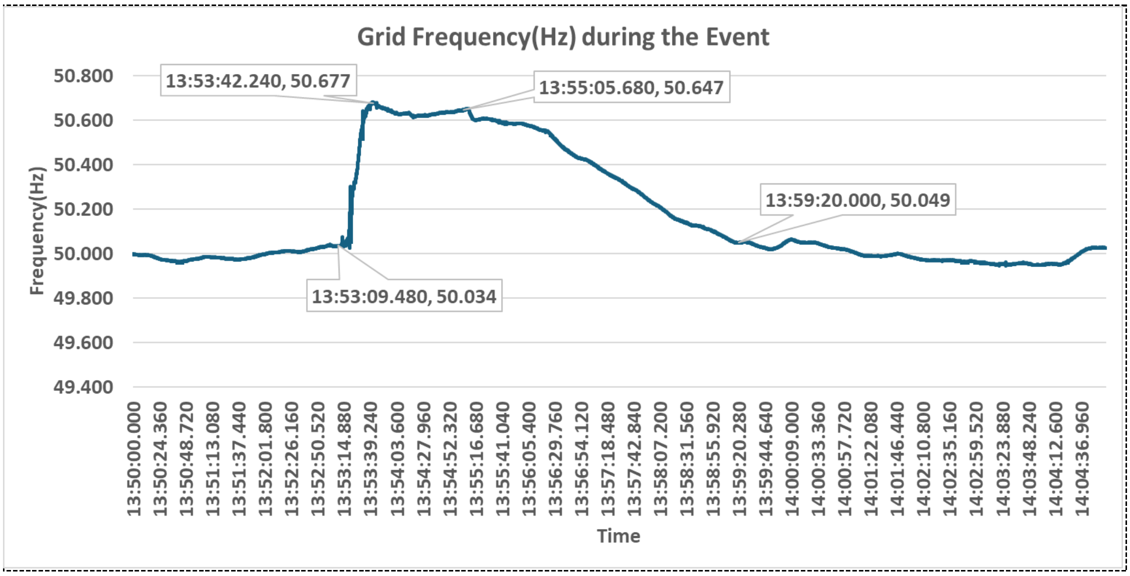


Fig: Grid Frequency during the event

xii) High voltage scenario also observed just after recovery of very low voltage, due to offloading of transmission lines on reduction of load (suspected due to stalling of induction motor load). On this high voltage, multiple 765kV and 400kV lines tripped on operation of overvoltage stage-1 protection. List of the 765kV & 400kV lines tripped on overvoltage along with relay flags recorded is mentioned in below table:

S. No	Transmission line	Trip time	Protection operated (As per DR)	O/V Protection Settings
1	765 KV Aligarh(PG)-SIKAR_2 (PASTL) Ckt-1	13:53:32 hrs	OV stage-1 at Aligarh(PG) end (V=~1.07pu)	1.05 pu, 5 sec
2	765 KV Aligarh(PG)-SIKAR_2 (PASTL) Ckt-2	13:53:34 hrs	OV stage-1 at Aligarh(PG) end (V=~1.07pu)	1.05 pu, 6 sec
3	765 KV Orai-Aligarh (PG) Ckt-1	13:53:35 hrs	OV stage-1 at Aligarh(PG) end (V=~1.07pu)	1.07 pu, 5 sec
4	765 KV Kanpur_GIS-Aligarh (PG) Ckt	13:53:35 hrs	OV stage-1 at Aligarh(PG) end (V=~1.08pu)	1.06 pu, 6 sec
5	765 KV Agra-Aligarh (PG) Ckt	13:53:35 hrs	OV stage-1 at Agra(PG) end (V=~1.084pu)	1.08 pu, 5 sec
6	765 KV Koteshwar-Meerut (PG) Ckt-1	13:53:36 hrs	OV stage-1 at Koteshwar (PG) end (V=~1.09pu)	1.08 pu, 7 sec
7	765 KV Koteshwar-Meerut (PG) Ckt-2	13:53:38 hrs	OV stage-1 at Koteshwar (PG) end (V=~1.09pu)	1.08 pu, 9 sec

8	765 KV Orai-Aligarh (PG) Ckt-2	13:53:39 hrs	OV stage-1 at Aligarh(PG) end (V=~1.07pu)	1.07 pu, 7 sec
9	765 KV Jhatikara-Aligarh (PG) Ckt	13:53:41 hrs	OV stage-1 at Aligarh(PG) end (V=~1.072pu)	1.08 pu, 6 sec

Out of eight (08) 765kV lines at Aligarh(PG), seven (07) lines tripped on overvoltage. Only 765kV Aligarh-Gr. Noida line remained charged. Additionally, the following lines tripped during the event on overvoltage stage-1 protection operation:

- 765kV Rampur(PRSTL)-Ghatampur ckt
- 765kV Rampur(PRSTL)-Hapur ckt
- 400kV Kishenpur-Moga D/C
- 400kV Mahindergarh-Bhiwani ckt-2&3
- 400kV Mahindergarh-Dhanonda ckt-1
- 400kV Koteshwar(PG)-Koteshwar(THDC) ckt -1

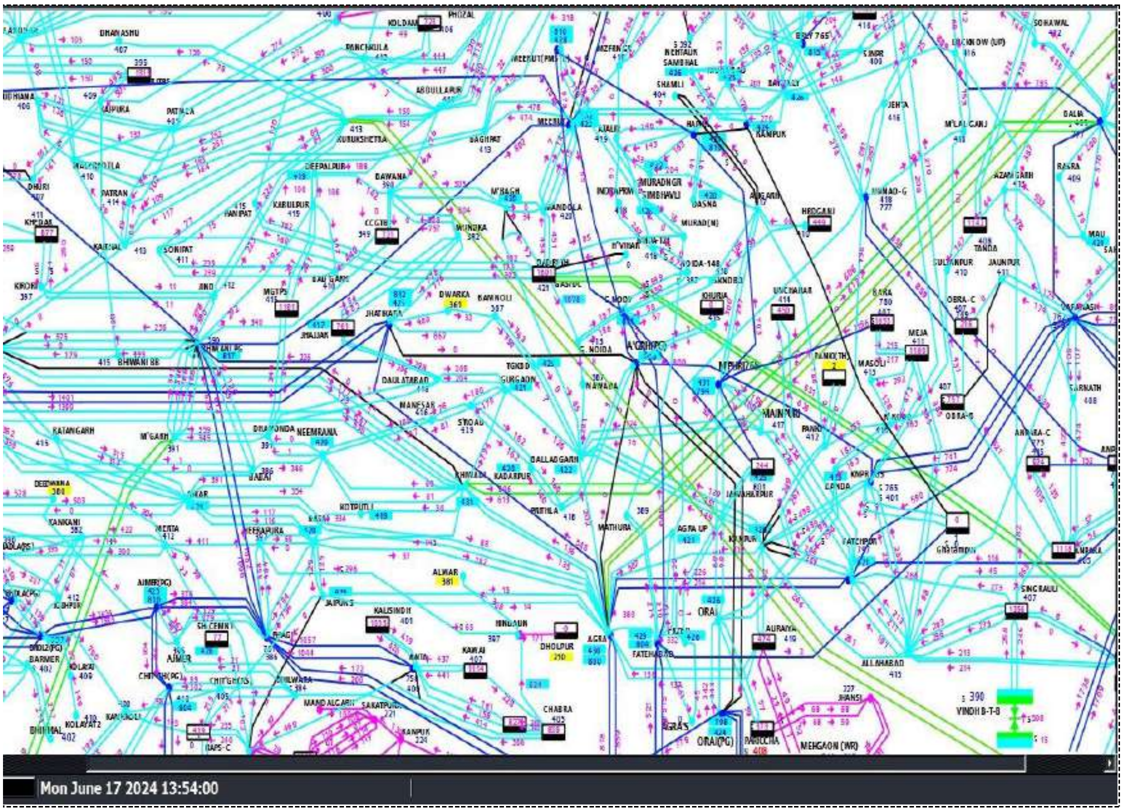


Fig: SCADA display of Northern Regional Grid Network diagram at 13:54:00 hrs (showing high voltage in grid)

xiii) Primary frequency response of inter-state and intra-state generators from SCADA data are as follows:

For inter-state generators, unit-wise governor response analysis has been carried out to observe the response provided by various units and compared with the ideal governor response using 4-second SCADA data. More than 50% of the analysed capacity showed Average or Below Average or Poor or Very Poor response for the event.

Table: Summary of governor response analysis of inter-state generators

S.No.	Particular	Capacity (MW)
1	Aggregate Capacity analysed	48348
2	Capacity with Excellent Response (Response >= 100% of mandated response)	16321
3	Capacity with Good Response (85% <= Response < 100% of mandated response)	5543
4	Capacity with Average Response (75% <= Response < 85% of mandated response)	2749
5	Capacity with Below Average Response (50% <= Response < 75% of mandated response)	5747
6	Capacity with Poor Response (30%<=Response <50% of mandated response)	7100
7	Capacity with Very Poor Response (Response <30% of mandated response)	10888

For the intra-state generators, plant-wise response analysis has been carried out to observe the response provided by various generating plants and compared with the ideal response using 10 second SCADA data. More than 85% of the analyzed capacity exhibited Below Average or Poor or Very Poor Response.

Table: Summary of governor response analysis of intra-state generators

S.No.	Particular	Capacity (MW)
1	Aggregate Capacity analysed	78281
2	Capacity with Excellent Response (Response >= 100% of mandated response)	9563
3	Capacity with Good Response (85% <= Response < 100% of mandated response)	172
4	Capacity with Average Response (75% <= Response < 85% of mandated response)	0
5	Capacity with Below Average Response (50% <= Response < 75% of mandated response)	5600
6	Capacity with Poor Response (30%<=Response <50% of mandated response)	12036
7	Capacity with Very Poor Response (Response <30% of mandated response)	50910

xiv) Reactive power response behavior of some of the generating stations analysed from SCADA data are as follows:

a) Dadri TPS(NTPC):

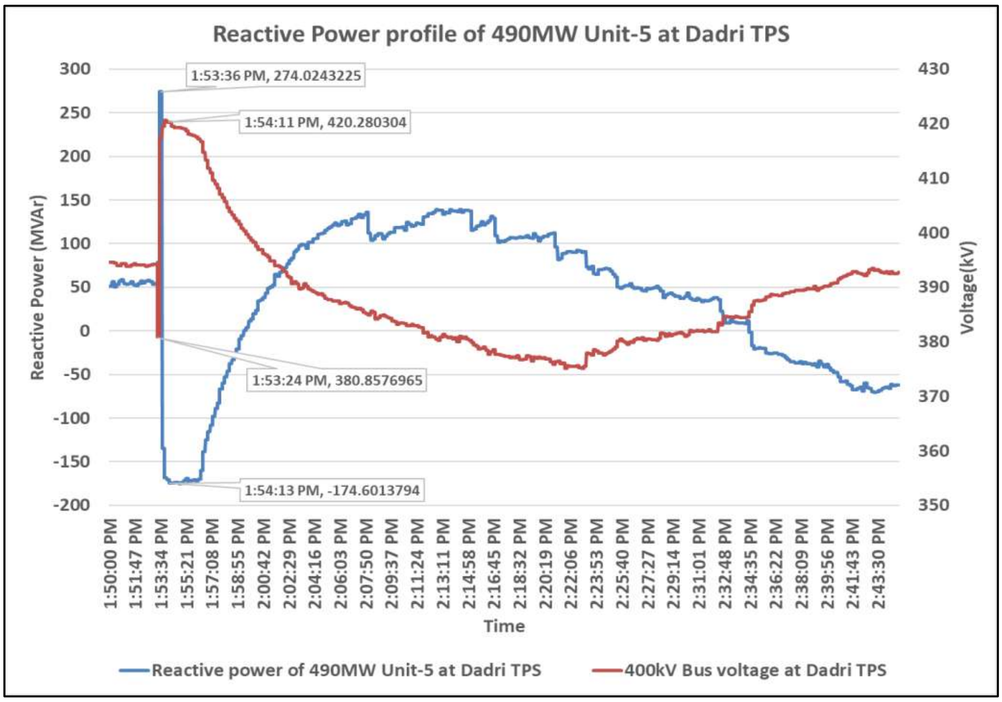


Fig: Reactive power behavior of Dadri TPS Unit-5 during the event (as per SCADA data)

b) Jhajjar TPS(APCPL):

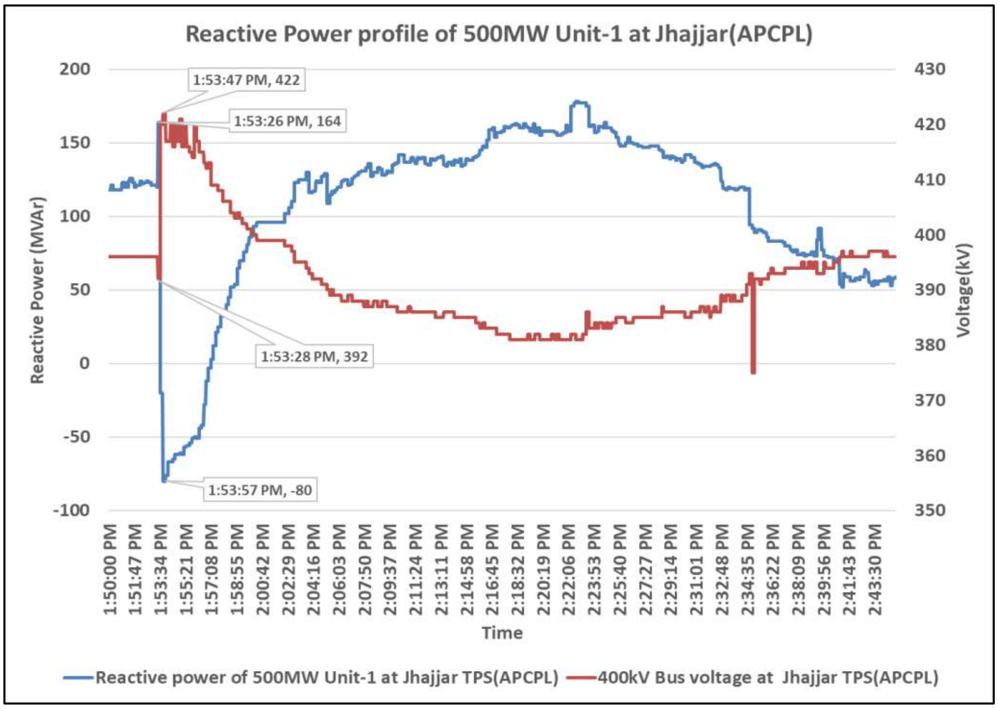


Fig: Reactive power behavior of Jhajjar TPS(APCPL) Unit-1 during the event (as per SCADA data)

c) Khedar TPS(RGTPS):

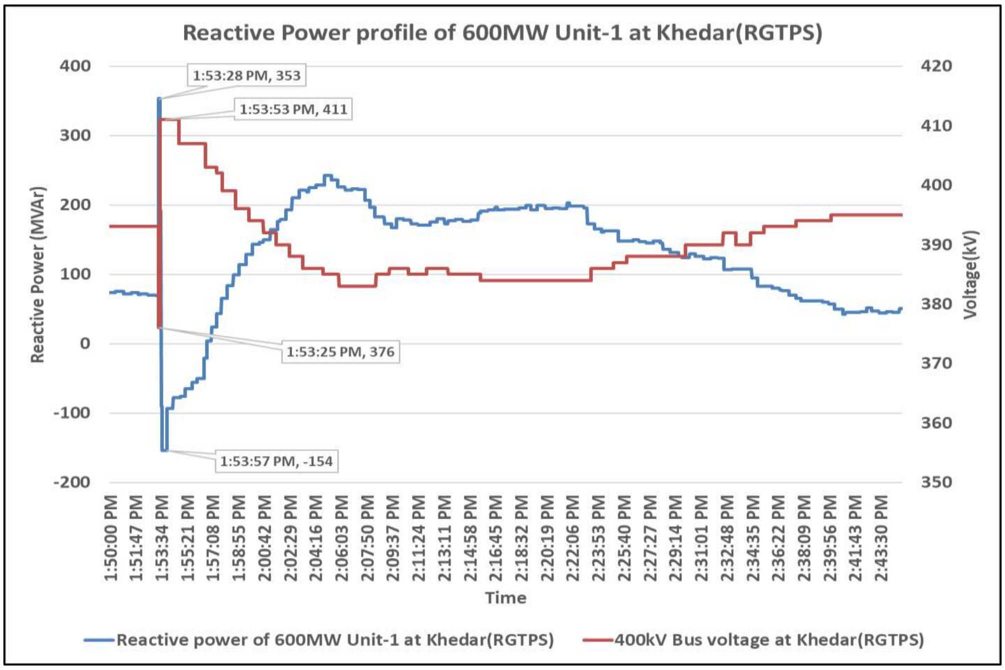


Fig: Reactive power behavior of Khedar TPS(RGTPS) Unit-1 during the event (as per SCADA data)

From above figures, it is observed that Dadri TPS, Jhajjar TPS (APCPL) and Khedar TPS(RGTPS) provided reactive power support during sudden reduction of voltage and subsequent overvoltage condition.

xv) Loads were also getting restored gradually. As 765/400kV Aligarh was under partial blackout condition and multiple 765kV and 400kV lines were also in tripped condition, increase in load resulted in low voltage in grid by 14:05hrs.

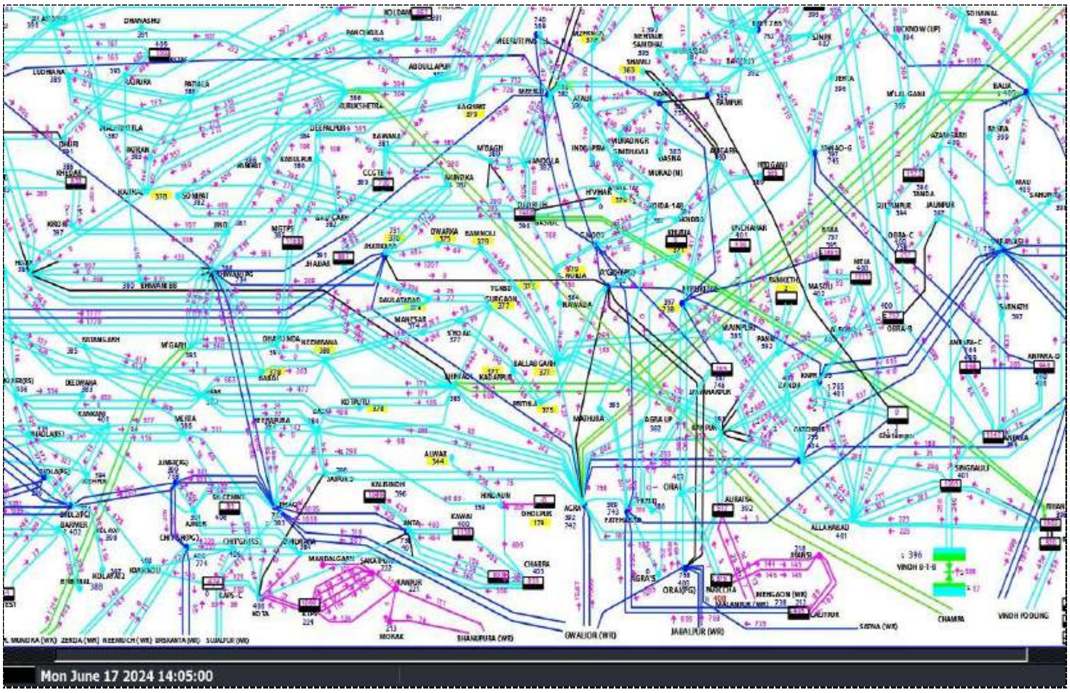


Fig: SCADA display of Northern Regional Grid Network diagram at 14:05:00 hrs (showing low voltage in grid)

10.Restoration and action taken

i) During high frequency scenario between 13:53 hrs to 13:59 hrs, generating stations were instructed to reduce the generation.

ii) Many 765kV & 400kV lines were also in tripped condition. By 14:05 hrs, again there was low voltage scenario in the grid due to gradual recovery of load.

iii) In view of very low voltage scenario in the grid, ISGS and state controlled generating stations (Hydro, Thermal and Gas generations) were instructed to maximize the generation.

iv) To avoid further low voltage in the grid, SLDCs were advised to not increase further load. Code issued from NRLDC to open the radial feeders on physical regulations. Following feeders were opened on physical regulation:

   a) 220kV Meerut-Gajraula ckt
   b) 220kV Allahabad(PG)- Jhusi (UP) D/C
   c) 220kV Baghpat(PG)- Baghpat (UP) D/C
   d) 220kV Amritsar-Naraingarh (PS) D/C
   e) 220kV Patiala-Nabha (PS) D/C
   f) 220 kV Bhinmal (PG) –Sayla (RS) D/C
   g) 220 kV Bassi(PG) - Bagru (RS) ckt
   h) 220kV BTPS-Okhla (DTL) D/C

v) Most of the reactors were already in open condition, however code issued to open few of the reactors which were in service to improve the voltage profile. Following reactors were opened:

   a) 240 MVAR Bus Reactor No 1 & 2 at 765KV Agra(PG)
   b) 125 MVAR Bus Reactor No 2 at 400 KV Mandola(PG)
   c) 125 MVAR Bus Reactor No 1 at 400KV Agra Fatehbad(UP)
   d) 125 MVAR Bus Reactor No 1 at 400 KV Maharanibagh(PG)
   e) 125 MVAR Bus Reactor No 1 at 400 KV Sahupuri(UP)

vi) SLDCs and transmission licensees were contacted immediately for reporting of tripping details.

vii) Due to gradual increase in load and non-availability of 765kV Orai-Aligarh D/C, loading of 765kV Agra-Gwalior D/C and 765kV Varanasi-Vindhyachal D/C started increasing, it increased to total ~4000MW & ~3800MW (as per SCADA) respectively by around 14:30hrs.

viii) 765kV Orai-Aligarh line-1&2 were charged at 14:34 hrs & 14:40 hrs and loading of 765kV Agra-Gwalior D/C and 765kV Varanasi-Vindhyachal D/C reduced and came within safe limit.

ix) 765kV lines emanating from Aligarh and other 765 & 400 kV lines were charged one by one and the voltage profile improved gradually.

x) After restoration of transmission lines and improvement in grid voltage, loads were gradually restored. System load was restored to normal levels by 15.00 hrs.

11. Observations:

i) **Cause of Voltage dip and high Reactive Power Drawl by loads:** There was significant voltage drop across stations of Northern Region and reactive power absorption increased, exacerbating voltage issues.

ii) **Analysis of behaviour of Load during the event:** Voltage reduction caused stalling of induction motors: total 16.5 GW load Reduced in NR (Stalling of motors at comparatively higher voltages (~0.85 - 0.9 p.u. voltage)).

iii) **Impact on Conventional and Renewable Energy Generation:** Approximately 2800 MW of RE generation was reduced with around 1500 MW recovering within 4 minutes. 16 Conventional Generating Units tripped.

iv) **Reactive Power Support from Generating Units in NR:** Though reactive power support was observed from some of the conventional generating units, many RE plants had opposite response.

v) **High Voltage Scenario:** Total 18 (no.) of transmission lines (765kV and 400kV) tripped on Over-voltage, causing a partial blackout at the 765/400kV Aligarh (PG) S/s.

vi) **Frequency Response by Generating Units:** More than 50% capacity of the inter-state generators and more than 85% capacity of the intrastate generators exhibited inadequate governor response during the event.

vii) **Reactive Power Management:** The event highlighted the need for effective reactive power management. Heavy reactive power drawl by load was observed, leading to further voltage reductions.

viii) **Information sharing and Co-ordination:** Timely report submissions and communication are essential.

12. Recommendations:

i) **Reactive Power Management (Dynamic/Static) by STU and DISCOMs:** In order to maintain voltage stability, reactive power support is desired from all grid connected utilities without leaning over each other so as to ensure minimum reactive exchange at different voltage levels.

ii) **Planning for dynamic reactive power sources near load centers based on load composition:** Adequate static/dynamic reactive devices may be planned at the distribution level near loads so that there is minimum drawl from reactive sources at the transmission (STU) level. The dynamic reactive power sources may be commissioned near load centre stations based on the composition and quantum of individual load type.

iii) **Enhance reliability of HVDC Link:** POWERGRID may review protection schemes to avoid frequent outages, review transmission line design including cross arms, jumpers, etc. and design filter switching logic which support system voltage.

iv) **Implementation of Overvoltage protection setting:** Followings are recommended for implementing overvoltage Stage-I protection settings:
a. Pick up voltage & time delay setting of Antitheft lines to be kept low with sufficient time gap from other lines at S/s.
b. Parallel lines grading to be done such that one line should trip early by setting at low voltage and other line should trip last by keeping setting at high voltage.
c. Highly loaded lines should be given last priority in tripping.
d. Net MVAr relief (based on line charging MVAr & MVAr compensation in line) based on the simulation to be considered for arriving at the priority of line tripping. Lines providing high net MVAr relief to be tripped early.
e. Grading to be done in such a manner that one major incoming and outgoing line shall remain connected after tripping of lines at any node.
f. Protection setting of remote end station of a line need to be coordinated so as to avoid tripping of line from other end.
g. Drop-off to pick-up ratio of Relays implemented for overvoltage protection shall be more than 99.5%.

v) **Frequency Response by Generating Units as per IEGC 2023:** Performance of generating units where inadequate primary response was observed may be discussed at RPC level.

vi) **Compliance of CEA Standards by Renewable Generating Plants:** RE generators must comply the CEA Standards. It is recommended that:
a. Protection settings of inverters/WTG shall be coordinated in such a way that it accounts for the voltage rise/drop between inverter/WTG terminal & Point of interconnection (POI). Overvoltage /undervoltage trip settings should be configured accordingly.

b. The reactive power controller settings (droop, deadband, power factor, operating modes) in inverters/WTGs should be configurable and shall be set in consultation with the respective load dispatch centre.

c. The protection settings of elements in collector system viz. transformers, cables etc. shall be such that it allows RE plants to ensure the compliance of CEA standards at POI.

d. RE plants need to ensure that the event records shall be shared with SLDC/RLDC within the stipulated time for event analysis. All such data shall be retained in a retrievable format in a suitable archival system.

vii) **Retain of Conventional generators near load centres for providing grid support during such events**: The presence of thermal generators near the load centres may significantly improve the voltage profile and can provide dynamic reactive power support in case of contingencies improving the stability.

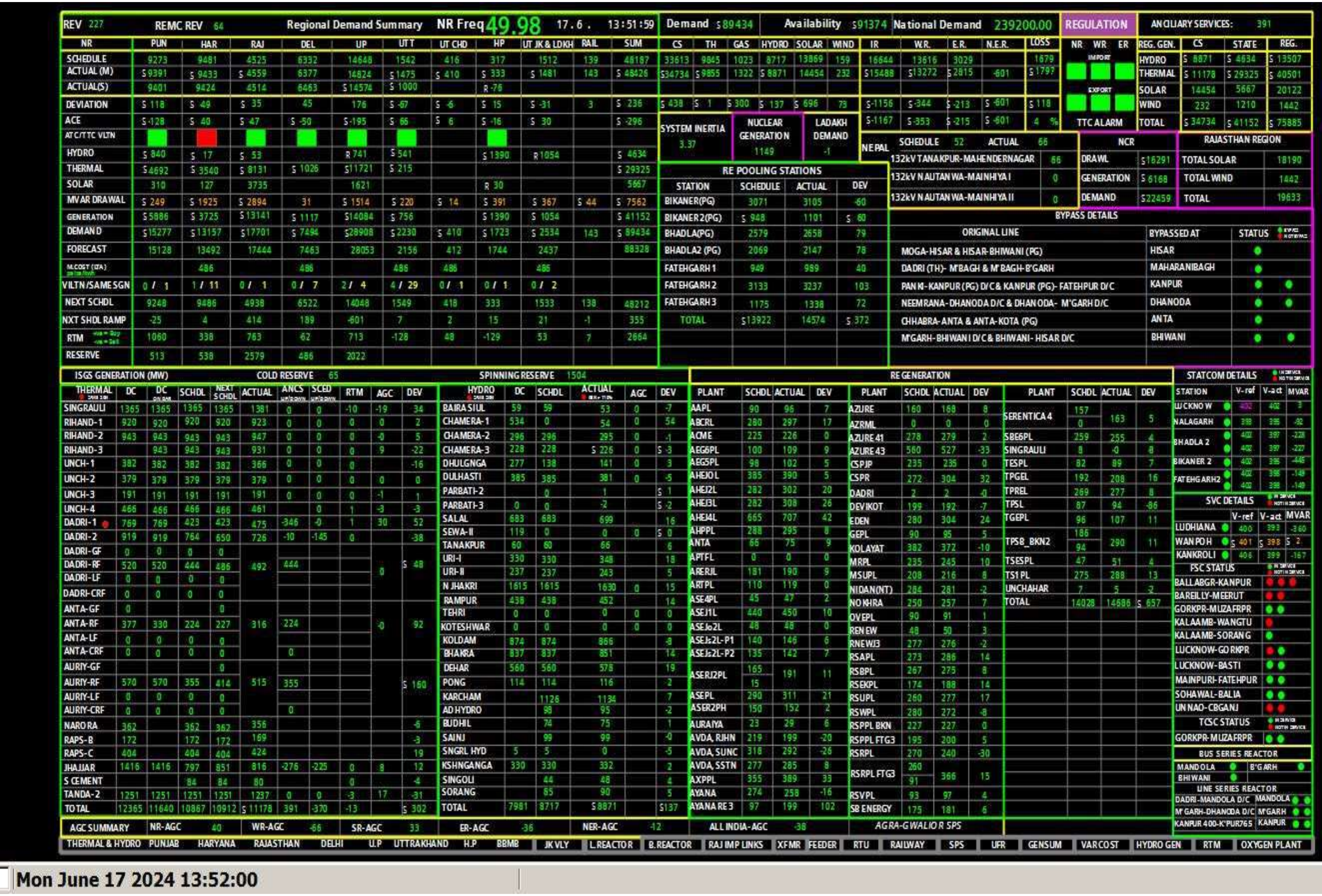
viii) **Compliance of Standards by Load Serving Machines:** The stalling of motors at high voltage (0.85-0.9 pu) may be investigated and the motors serving load need to be compliant with IS/IEC.

ix) **Amendments in Existing Regulations:** For ensuring reliable operation, provisions related to different emerging types of loads (Electrolysers etc.) may be added in the existing CEA standards.

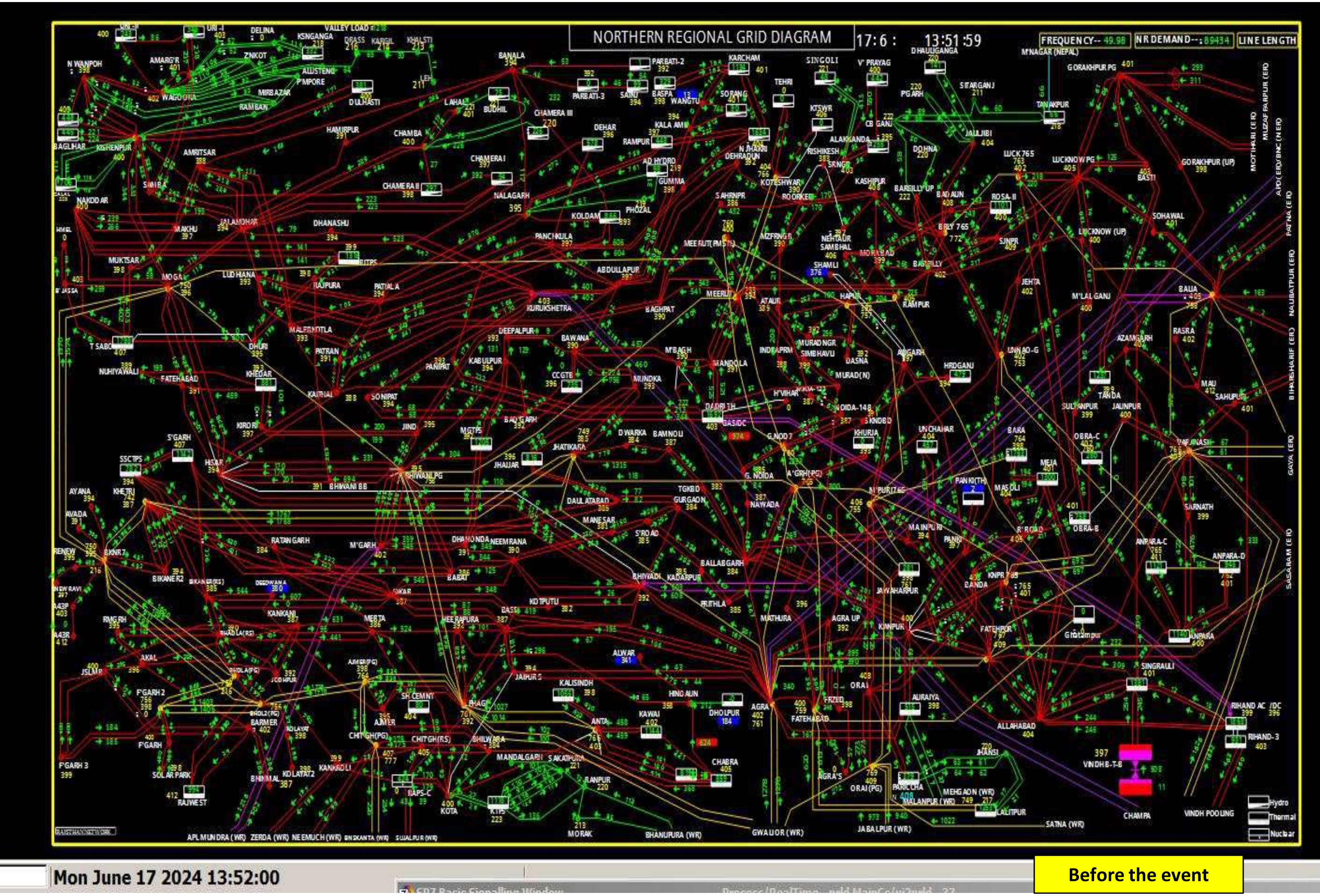
***SCADA & PMU plots, DR/EL files and SOE is attached as Annexure**

Annexure

Regional Summary before the event

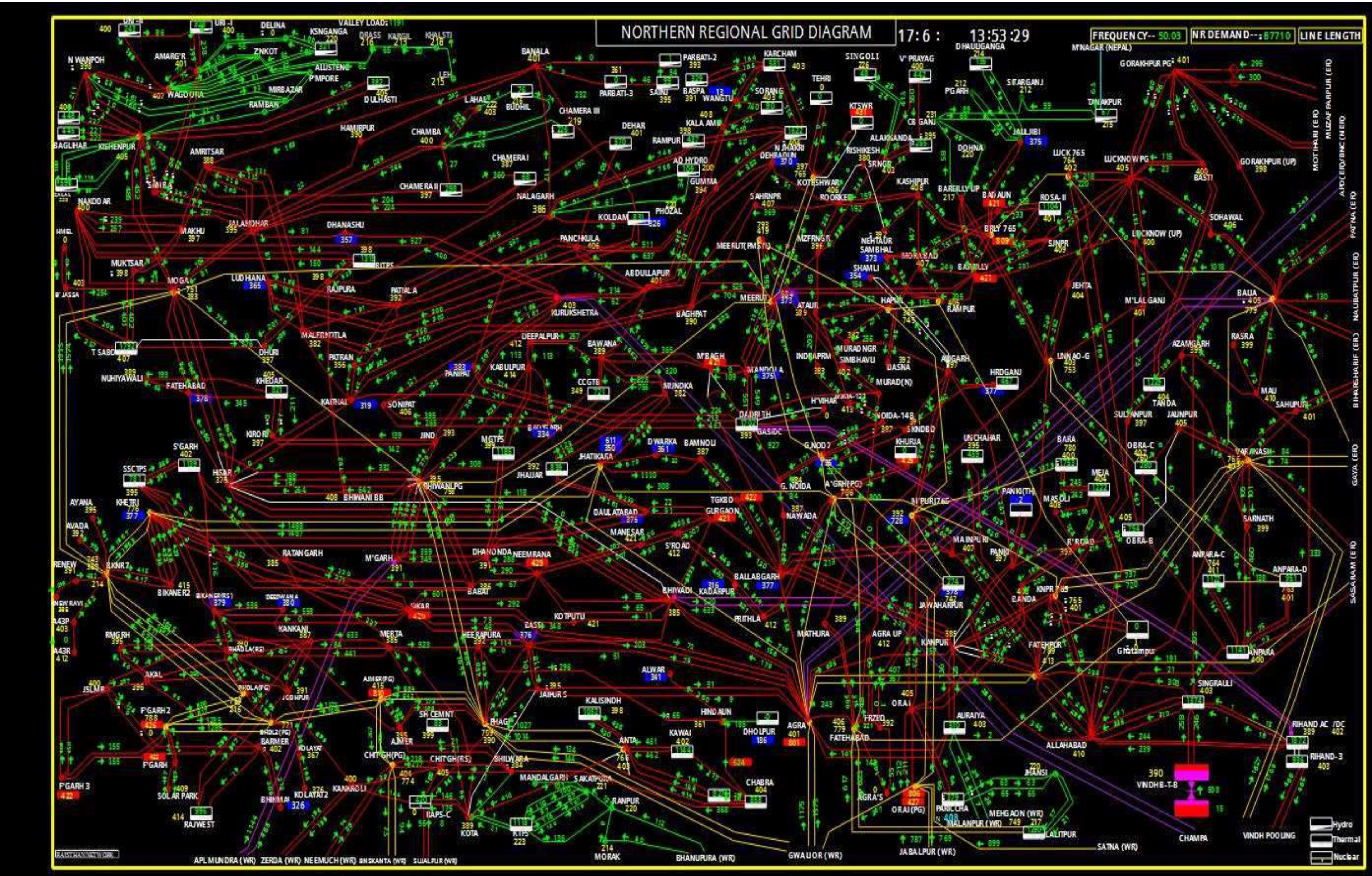


NR Network Diagram @13:52:00hrs



Before the event

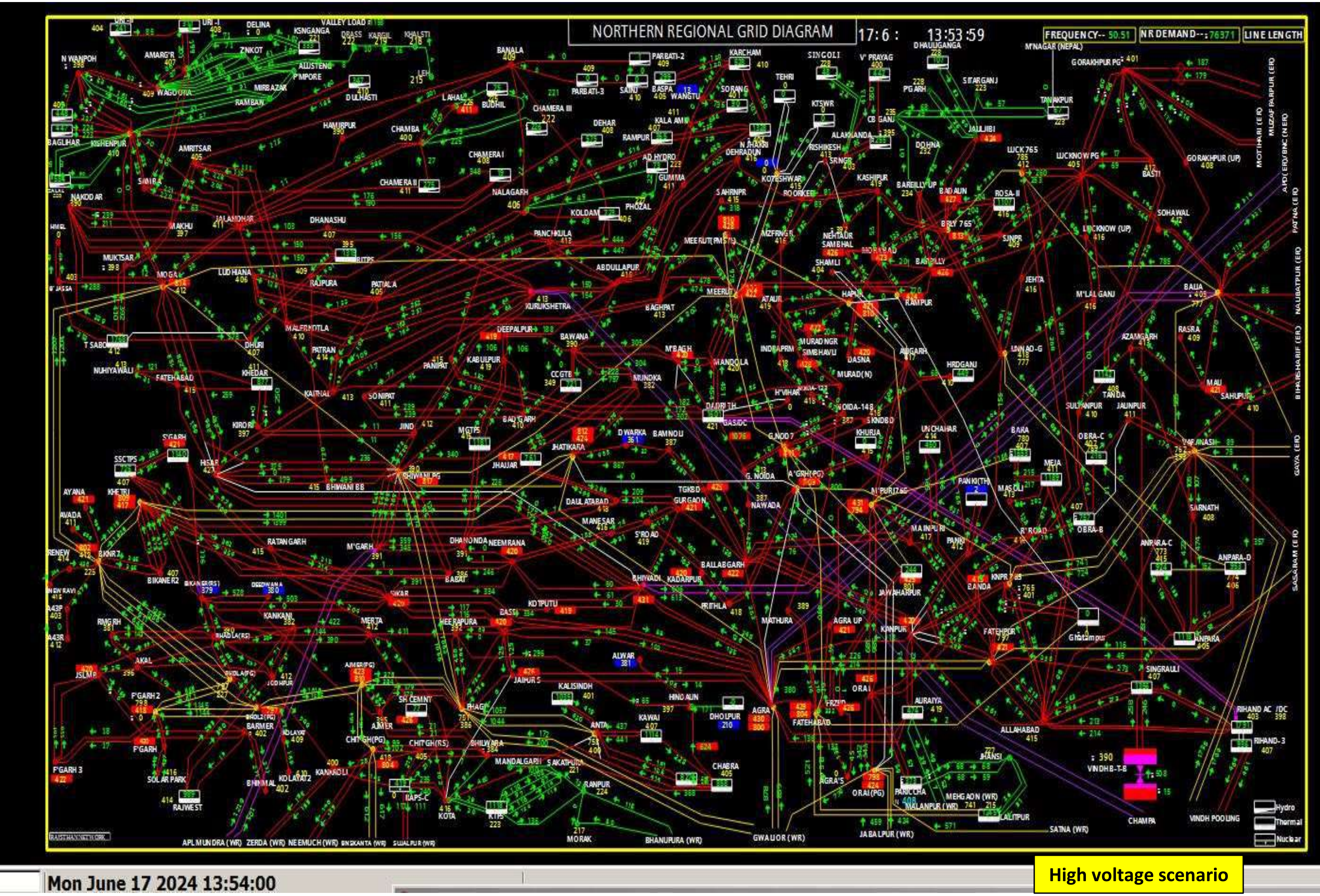
NR Network Diagram @13:53:30hrs



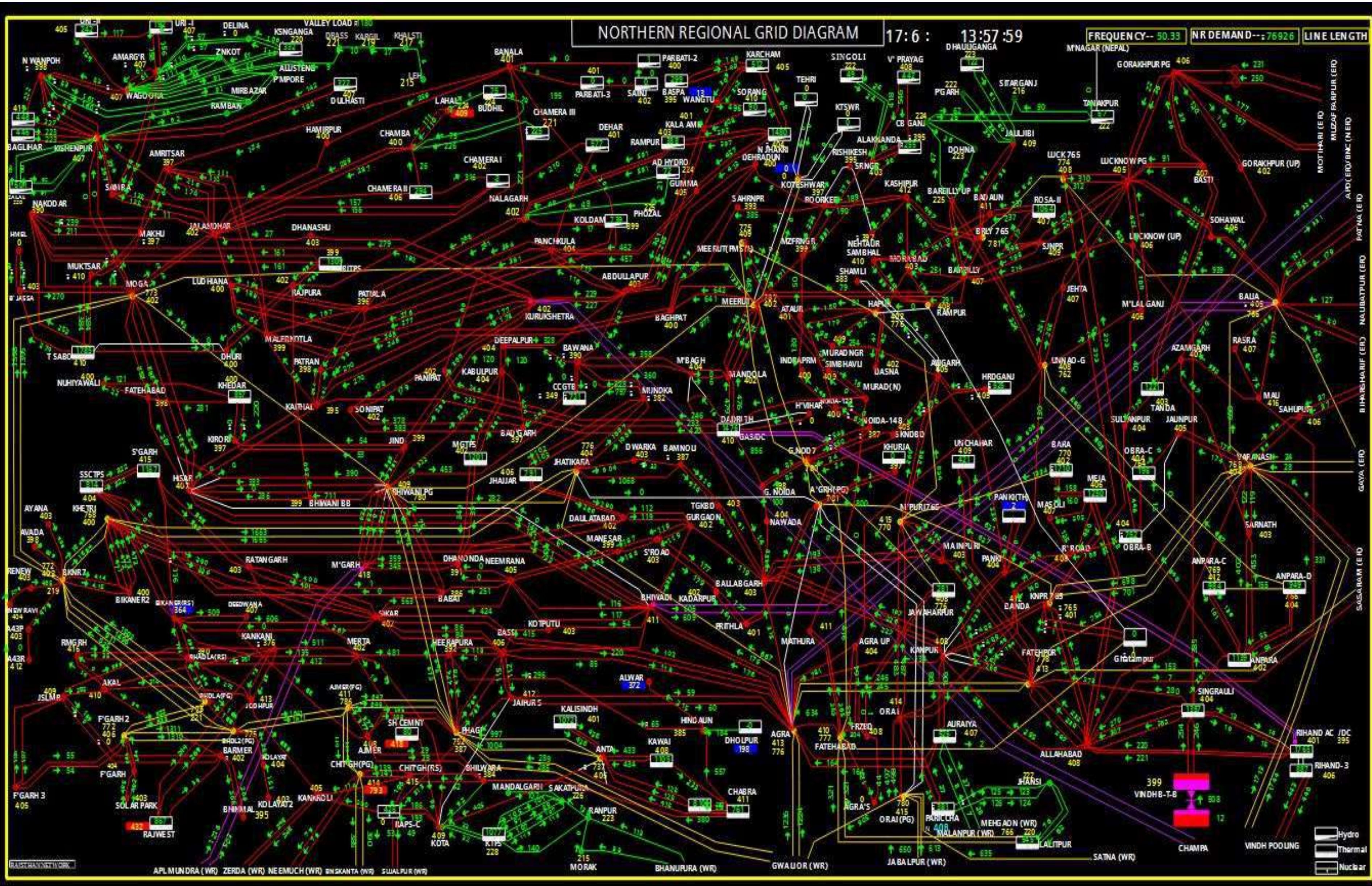
Mon June 17 2024 13:53:30

Low voltage scenario

NR Network Diagram @13:54:00hrs



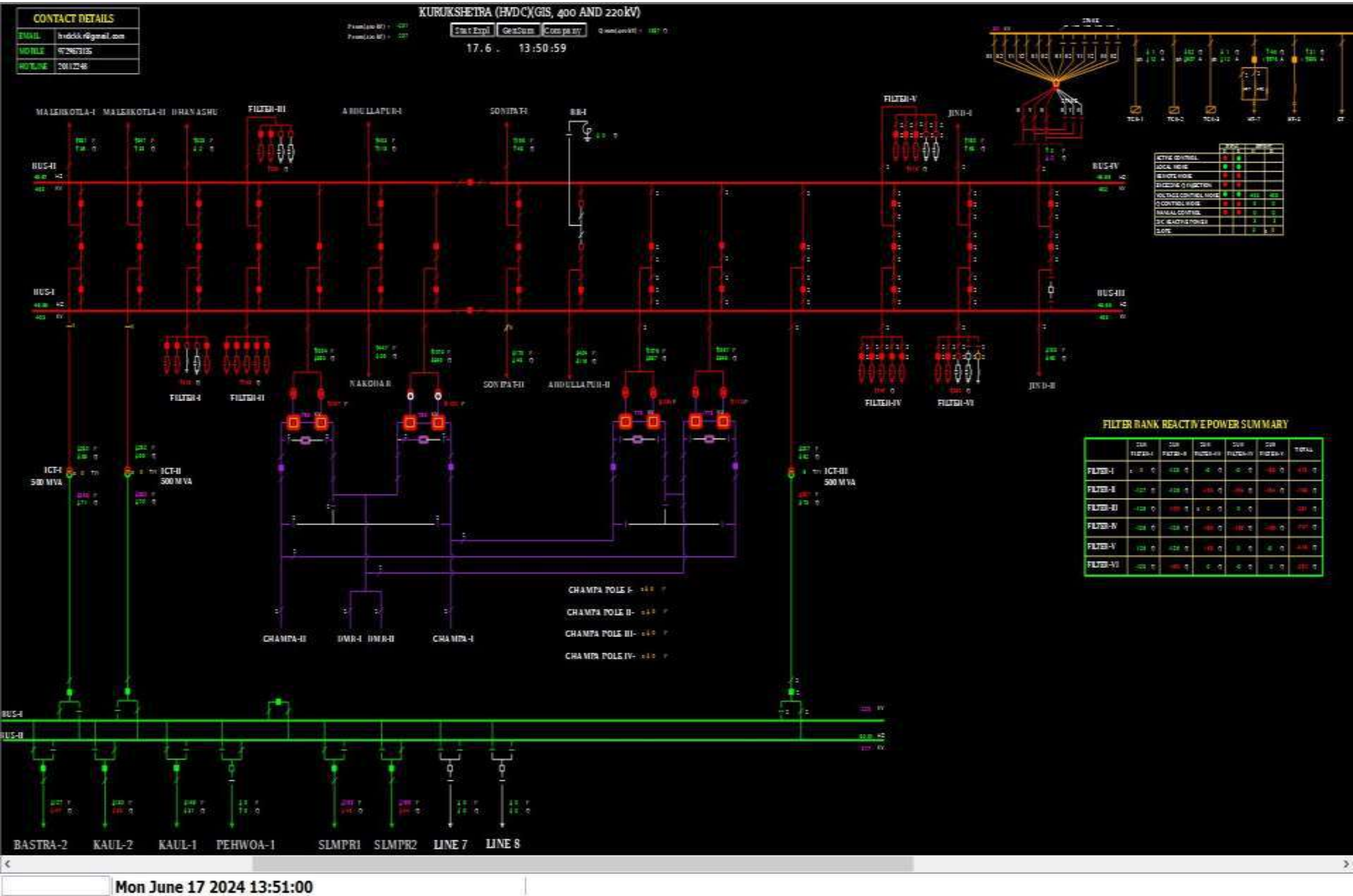
NR Network Diagram @13:58:00hrs



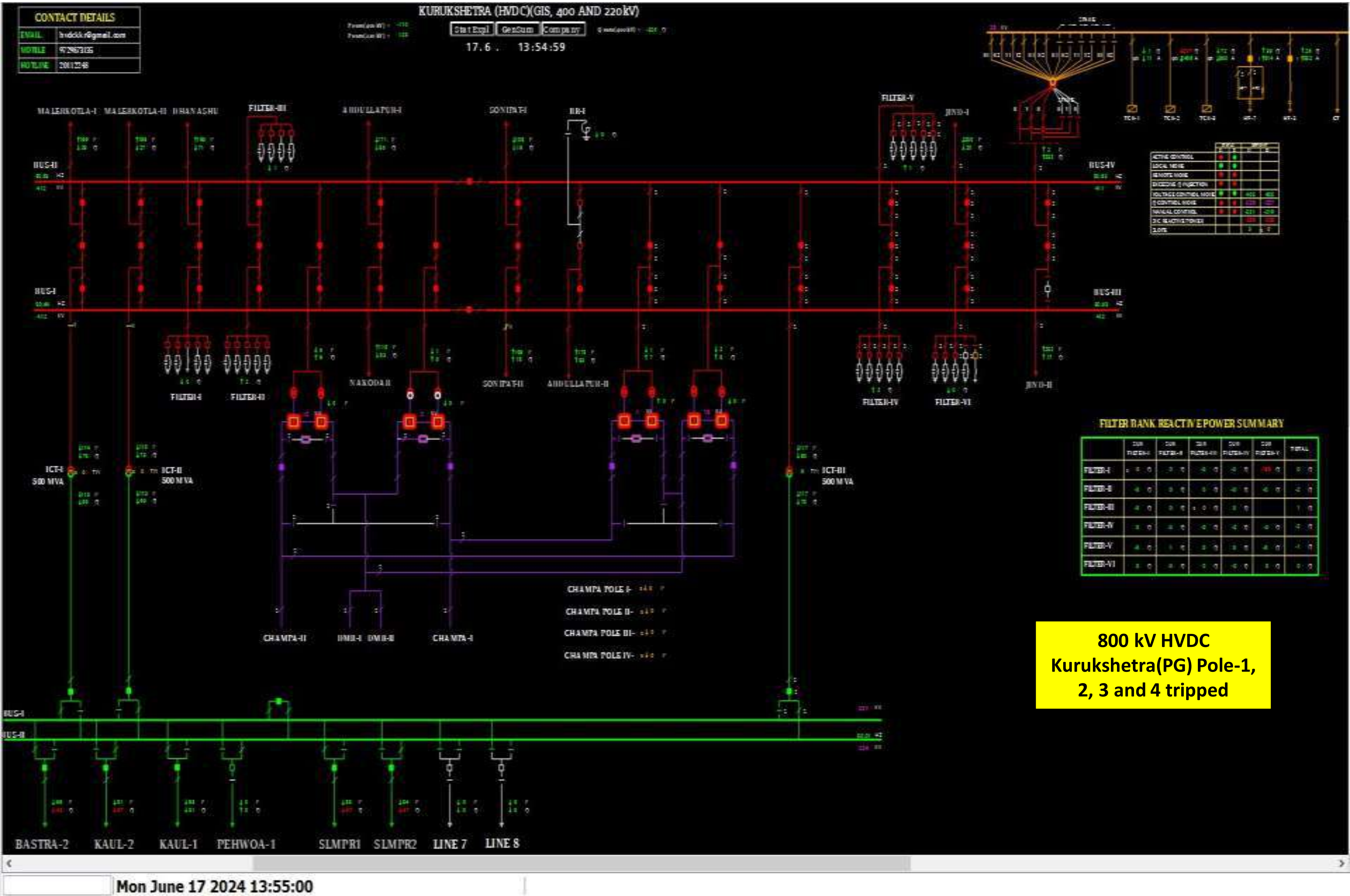
Mon June 17 2024 13:58:00

Voltage normalised

SLD of HVDC Kurukshetra(PG) before the event

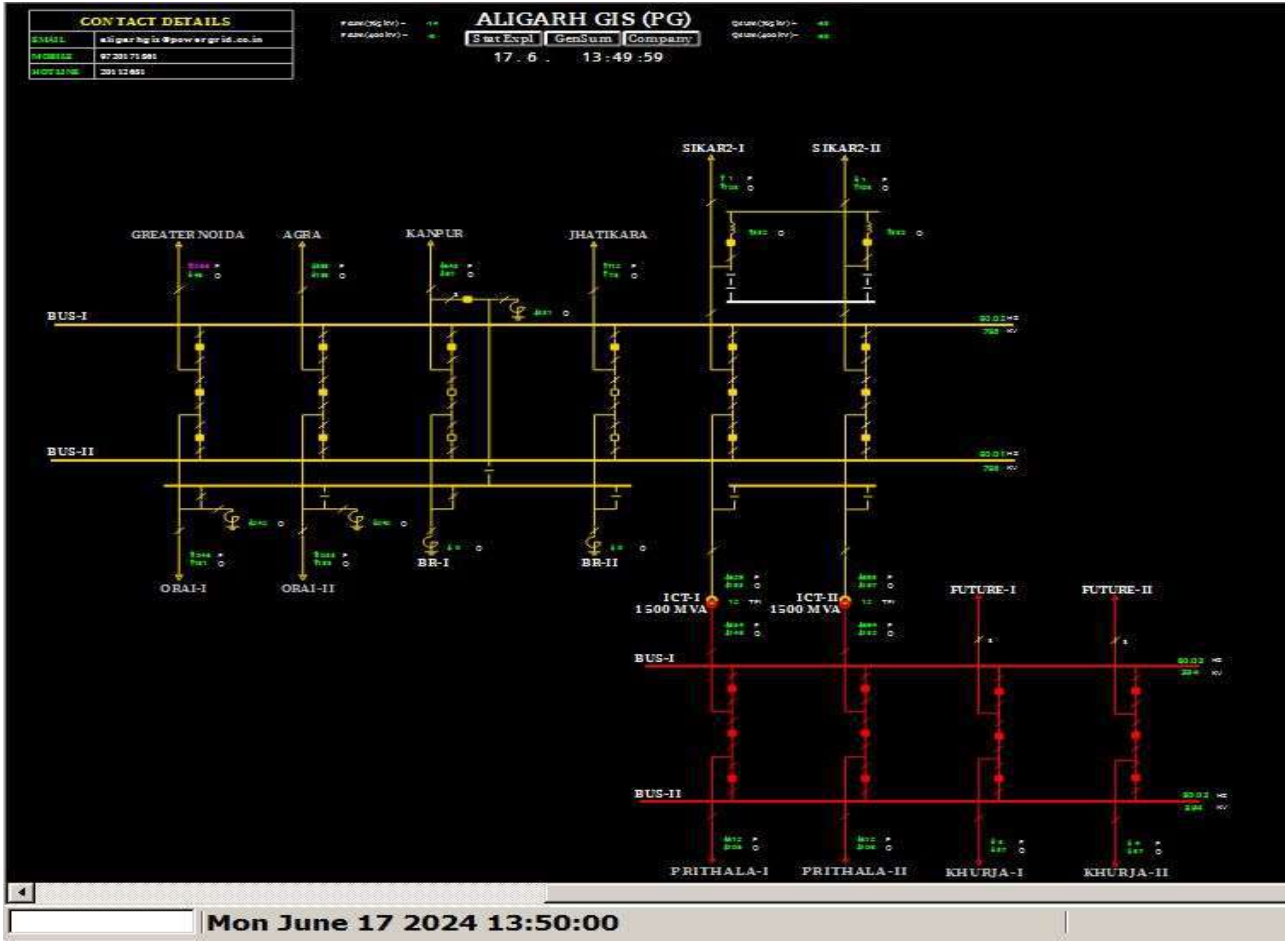


SLD of HVDC Kurukshetra(PG) after the event



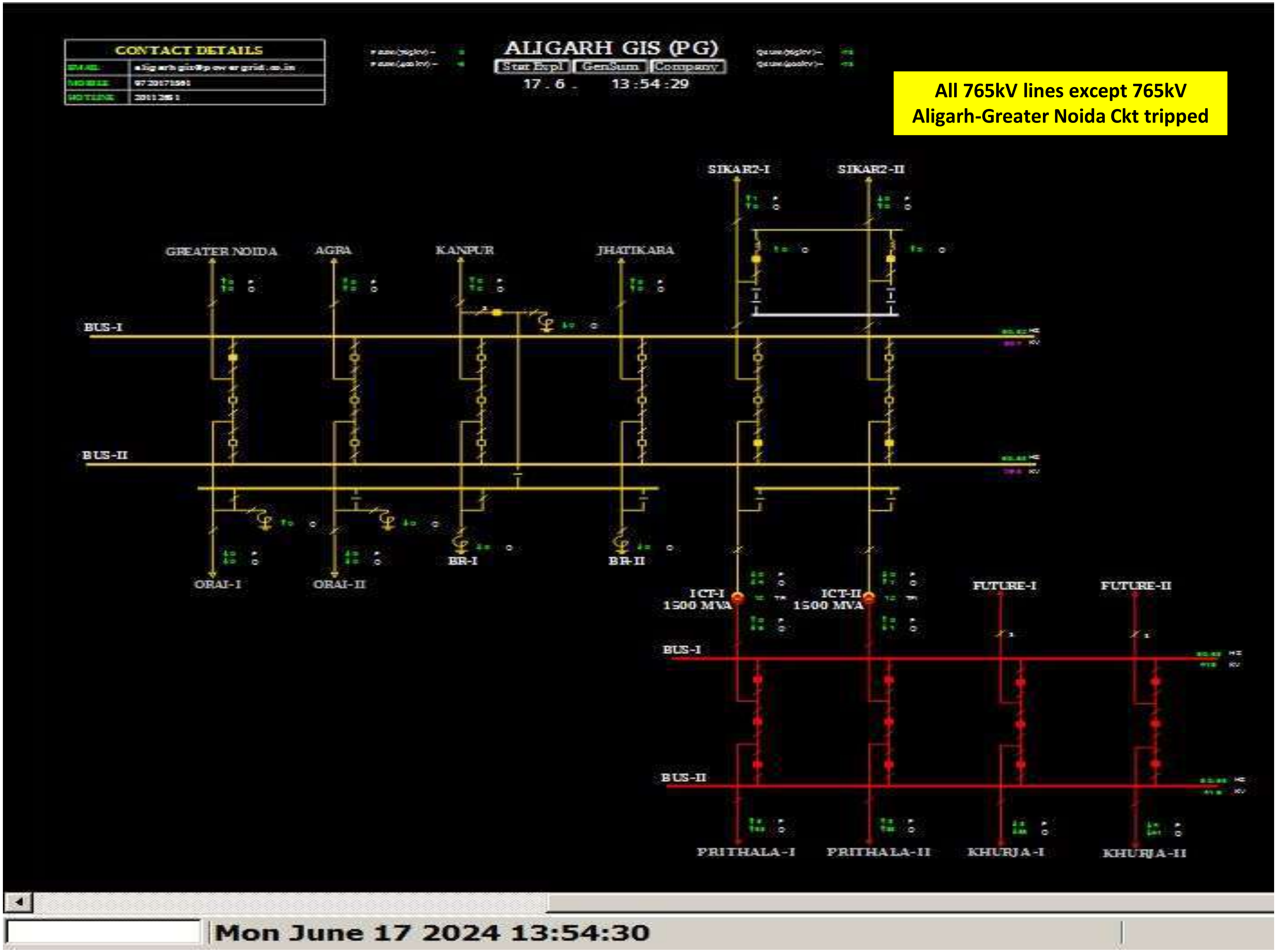
800 kV HVDC Kurukshetra(PG) Pole-1, 2, 3 and 4 tripped

SLD of 765/400kV Aligarh(PG) before the event

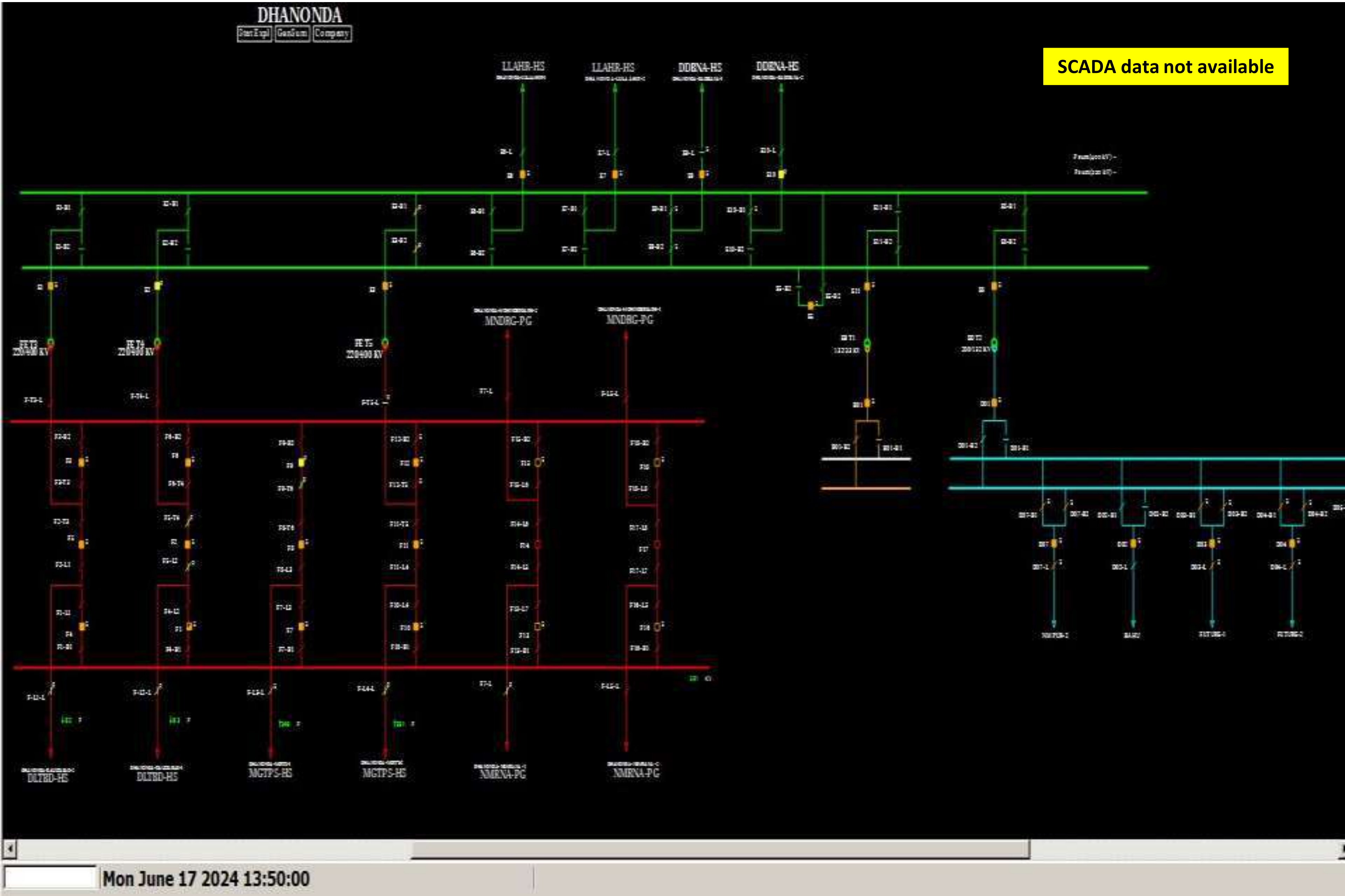


SLD of 765/400kV Aligarh(PG) after the event

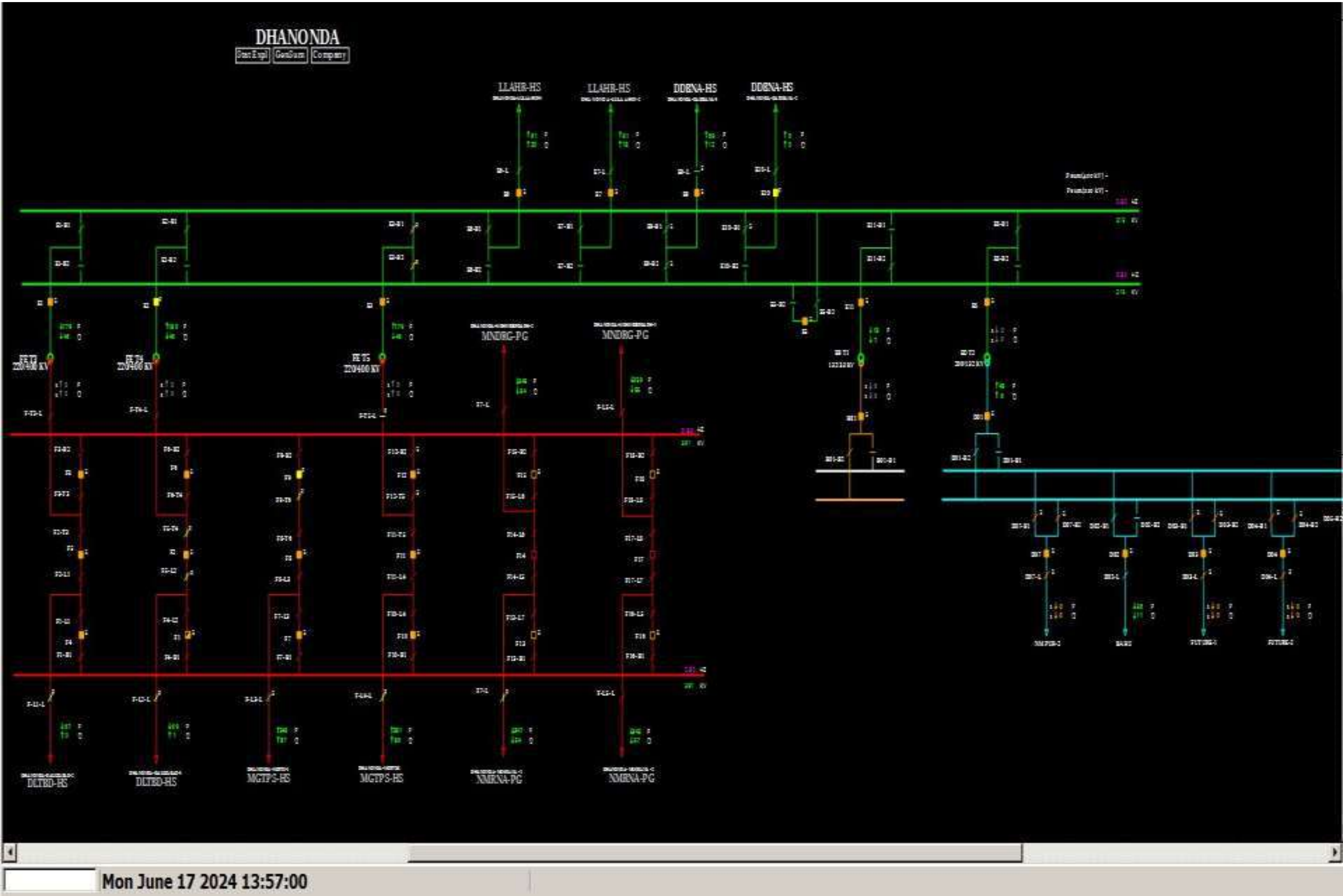
All 765kV lines except 765kV Aligarh-Greater Noida Ckt tripped



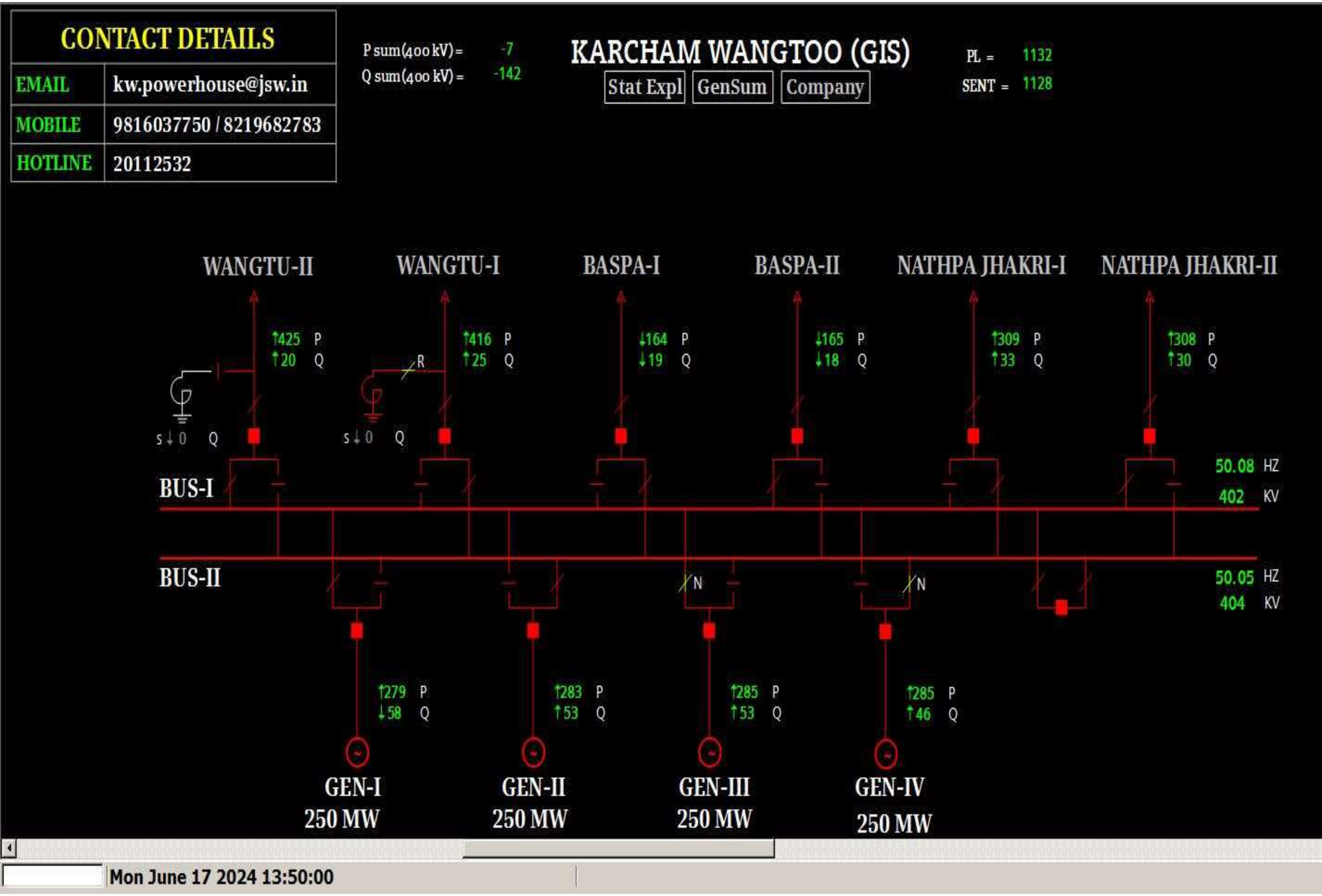
SLD of 400/220/132kV Dhanoda(HS) before the event



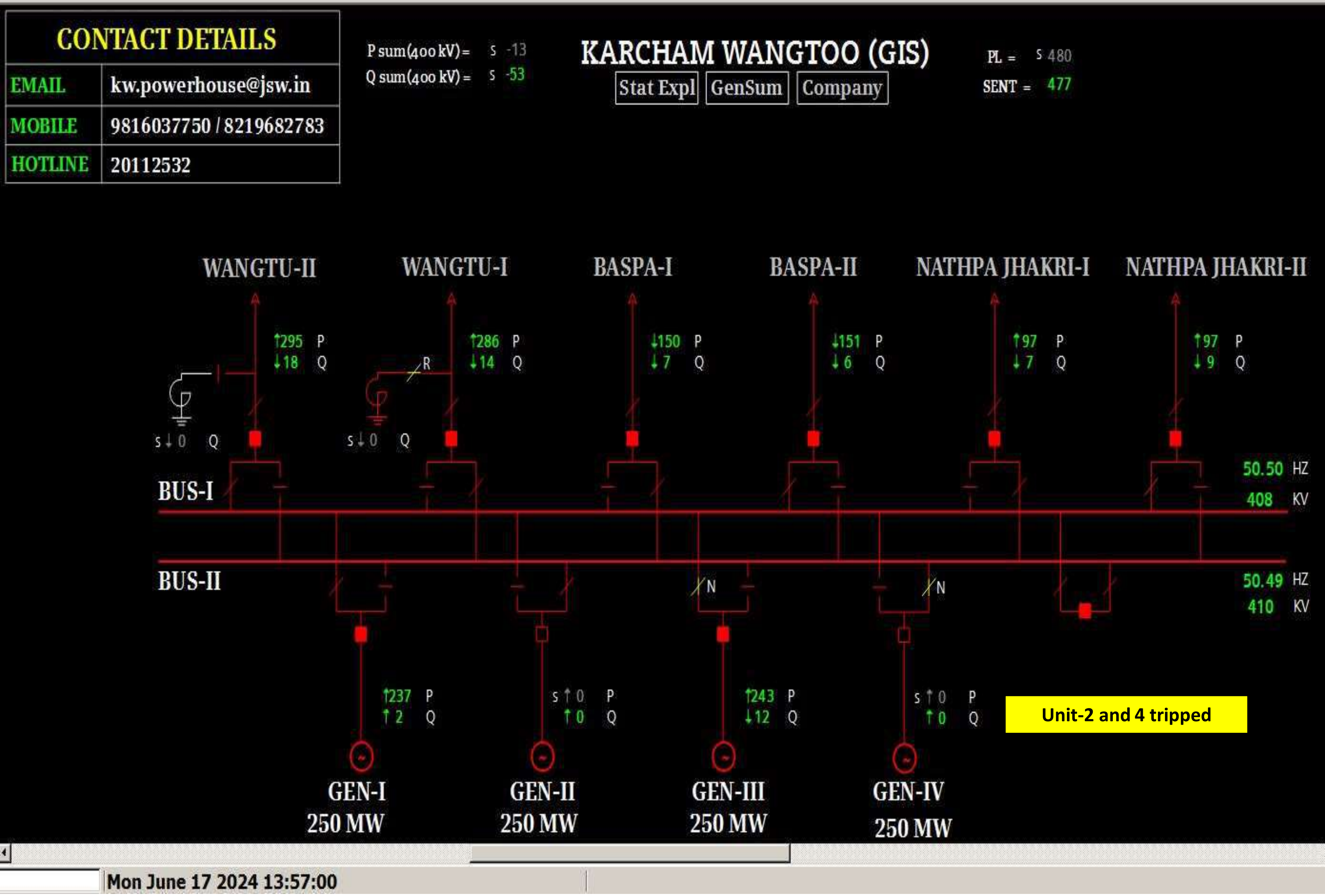
SLD of 400/220/132kV Dhanoda(HS) after the event



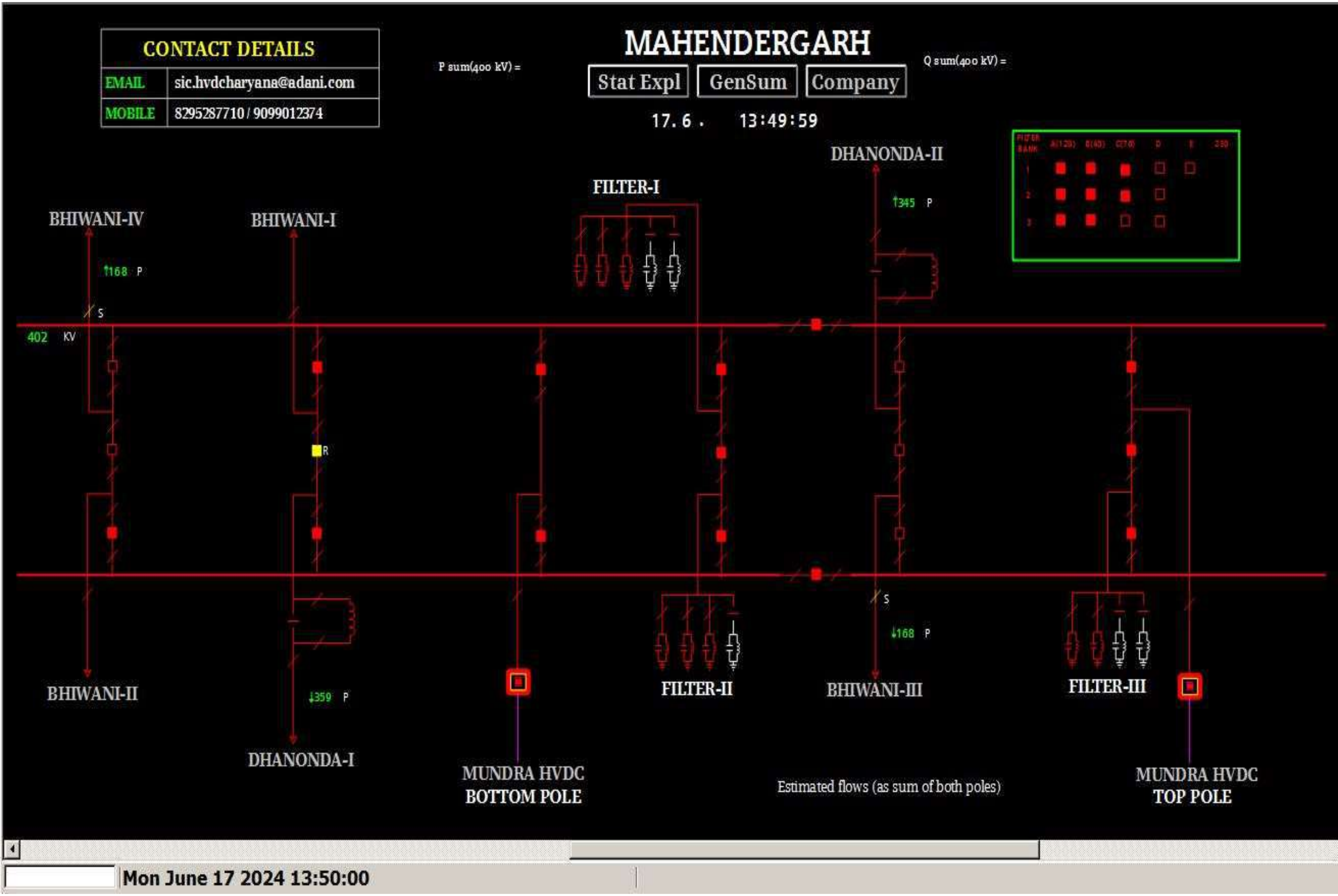
SLD of 400kV Karcham Wangtoo(JSW) before the event



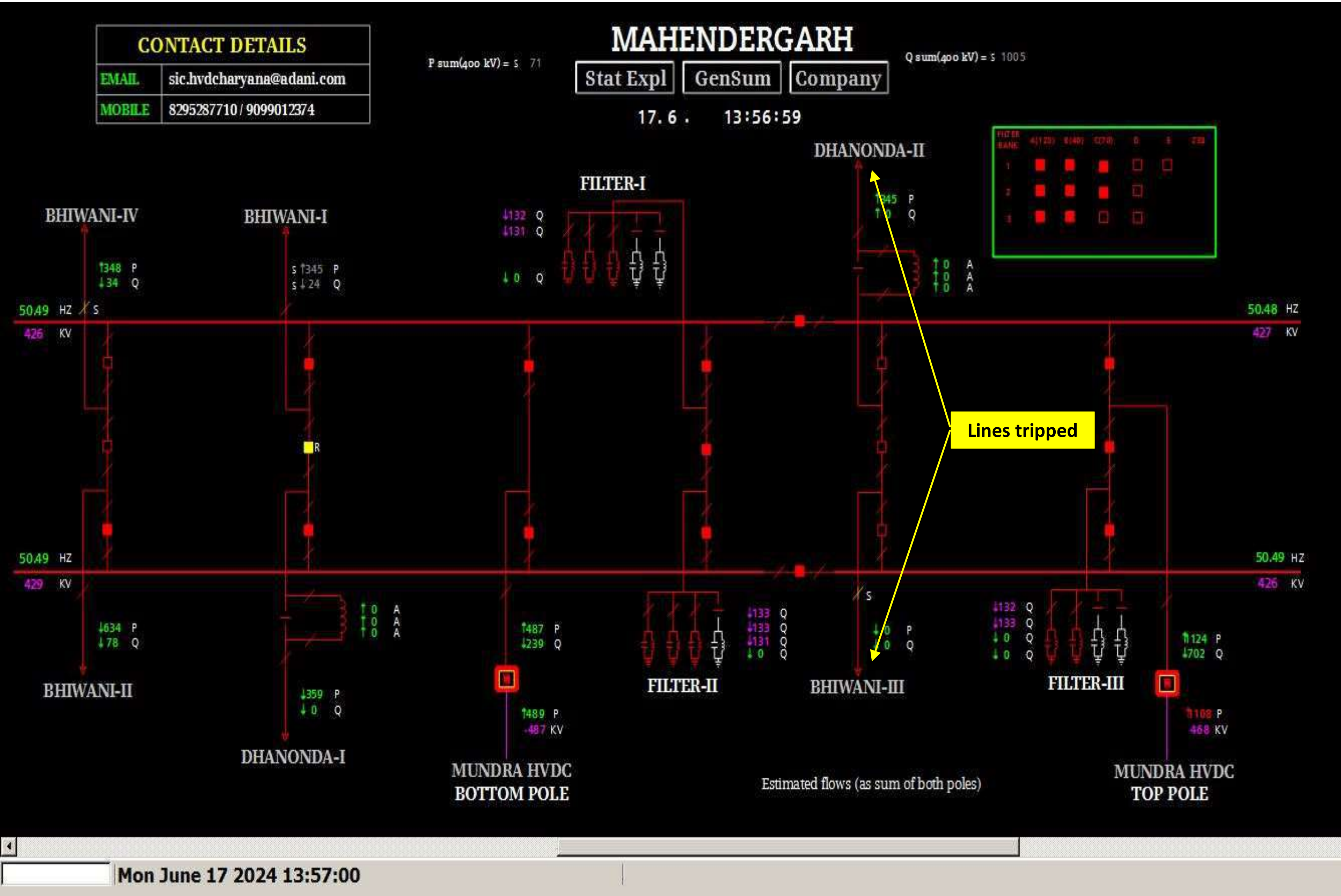
SLD of 400kV Karcham Wangtoo(JSW) after the event



SLD of 400kV Mahendergarh(APL) before the event



SLD of 400kV Mahendergarh(APL) after the event



RE generation Summary before the event

RE GENERATION SUMMARY

17.6. 13:52:59 Company

RE GEN	Ins CAPACITY	Av. CAPACITY	FORECAST	SCHDL	NEXT SCHL	ACTUAL MW	ACTUAL MVAR	DEV	NOC
ACME	250	250	235	225	222	229	26	3	250
APTFL	130	1	23	0	0	0	S 0	0	130
AREPJL	200	200	185	181	174	189	11	9	200
ASE4PL	50	50	46	45	45	47	-11	2	50
ASEJ2L	50	50	46	48	47	48	11	-0	50
ASER2PH	150	150	141	150	148	152	0	2	150
AZURE	200	200	172	160	155	167	S -5	6	200
AZURE MAPPLE	300	1	71	0	0	0	S 0	0	300
AZURE 41	300	300	278	278	277	272	S 36	-6	300
CSPJP	250	250	235	235	233	235	35	-0	250
CSPR	300	300	284	272	272	304	21	32	300
MRPL	250	250	231	235	233	244	-45	9	250
RENEW	50	50	47	48	47	50	S 0	3	50
SB ENERGY	200	200	186	175	167	181	16	6	200
SBE6PL	300	300	258	259	255	258	S -9	-1	300
TPREL	300	300	278	269	264	276	13	7	300
BHADLA (PG)	3280	2852	2575	2579	2540	2653	S 100	74	3280

RE GEN	Ins CAPACITY	Av. CAPACITY	FORECAST	SCHDL	NEXT SCHL	ACTUAL MW	ACTUAL MVAR	DEV	NOC
AVADA, RJHN	240	240	220	219	216	195	45	-24	240
AVADA, SUNC	350	350	319	318	314	280	60	-37	350
AVADA SSTN	300	300	277	277	274	285	65	8	300
ASEJs 2L-P1	150	150	139	140	140	134	15	-6	150
ASEJs 2L-P2	150	150	137	135	135	142	0	7	150
AYANA	300	300	283	274	272	250	37	-24	300
ARP3PL	300	194	179	97	97	200	34	102	194
AZURE 43	600	600	566	560	540	532	20	-28	600
RSRPL	300	300	278	270	264	255	-2	-15	300
RSPPL BKN	250	250	231	227	224	230	2	4	250
TPGBL	225	225	206	192	189	202	1	9	225
TPSL	110	110	95	87	86	95	-1	-86	110
TS1PL	300	300	284	275	270	289	31	14	300
BIKANER (PG)	3575	3469	3215	3071	3019	3089	351	-75	3469

RE GEN	Ins CAPACITY	Av. CAPACITY	FORECAST	SCHDL	NEXT SCHL	ACTUAL MW	ACTUAL MVAR	DEV	NOC
AHEJ1L	390 (360+100)	390	330	385	385	393		8	390
AHEJ2L	300 (300+75)	300	269	282	282	302	24	20	300
AHEJ3L	300 (300+75)	300	288	282	282	308	49	26	300
ASEJ1L	450 (421+105)	450	432	440	430	453	-0	13	450
ASERJ2PL	180	165	151	165	165	191	-8	11	180
DEVIKOT	240	240	199	199	194	191	50	-8	240
EDEN	300	300	280	280	280	309	31	25	300
RNEWJ3	300	300	277	277	277	276	50	-2	300
RSBPL	300	300	277	267	266	275	48	8	300
RSUPL	300	300	276	260	258	276	50	16	300
RSWPL	300	300	272	280	277	271	50	-8	300
FTGH2 (PG)	3360	3345	2902	3132	3096	3240	S 344	107	3360

RE GEN	Ins CAPACITY	Av. CAPACITY	FORECAST	SCHDL	NEXT SCHL	ACTUAL MW	ACTUAL MVAR	DEV	NOC
ABCRL	300	300	286	280	280	297	1	17	300
AEGSPL	100	100	93	100	100	108	-5	8	100
AEGSPL	100			98	98	102	6	5	100
AHPPL	300	300	287	288	286	295	0	7	300
ASEPL	320	320	301	290	287	311	-0	21	320
KOLAYAT	400	400	369	382	378	364	4	-18	400
MSUPL	250	250	225	208	208	215	1	7	250
NOKHRA	300	250	254	250	250	257	1	7	300
RSBKPL	190	190	167	174	174	188	34	14	190
BHADLA2 (PG)	2160	S 2110	1980	2069	2060	2139	41	70	2260

RE GEN	Ins CAPACITY	Av. CAPACITY	FORECAST	SCHDL	NEXT SCHL	ACTUAL MW	ACTUAL MVAR	DEV	NOC
AHEJ4L	700 (600+510)	700	689	665	665	705	62	40	700
NIDAN(NT)	296	296	274	284	284	281	40	-2	296
PTGH1	996	996	962	949	949	986	102	37	996

RE GEN	Ins CAPACITY	Av. CAPACITY	FORECAST	SCHDL	NEXT SCHL	ACTUAL MW	ACTUAL MVAR	DEV	NOC
AXPPL	380	380	361	355	351	386	94	31	380
RSVPL	100	100	93	93	93	97	20	4	100
RSPPL - FTG3	200	200	188	195	190	200	40	5	200
RSAPL	300	300	275	273	268	286	35	13	290
RSRPL FTG3	400	265	283	260	268	365	46	14	380
FATEHGARH 3	1380	1265	1200	1175	901	1334	237	69	1350

RE GEN	Ins CAPACITY	Av. CAPACITY	FORECAST	SCHDL	NEXT SCHL	ACTUAL MW	ACTUAL MVAR	DEV
ANTA	90	90	67	66	63	78	0	11
AURAIYA	40	40	28	23	22	28	S 0	6
DADRI	5	5	3	2	2	2	0	0
SINGRAULI	15	15	5	8	7	0	3	8
UNCHAHAR	10	10	4	7	5	4	0	2

RE GEN	Ins CAPACITY	Av. CAPACITY	FORECAST	SCHDL	NEXT SCHL	ACTUAL MW	ACTUAL MVAR	DEV	NOC
AAPL	100	100	95	90	90	97	28	7	100
ARTPL	110	110	120	110	110	120	15	10	110
GEPL	100	100	92	90	90	95	28	5	100
OVEPL	100	100	90	90	90	91	27	1	100
SRI4PL	125	162	149	157	157	163	-9	6	162
TESPL	84.4	84	95	82	82	84	28	2	84
TGEPL	100	100	98	96	96	106	16	10	100
TPSB	300	200	200	186	181	293	9	14	300
TSESPL	50	50	48	47	47	51	13	4	50
BIKANER 2	1069.4	1006	989	S 948	S 943	1098	155	S 57	S 1106

	SCHDL	ACTUAL	DEV
TOTAL	14028	14651	S 623

Mon June 17 2024 13:53:00

RE generation Summary after the event

RE GENERATION SUMMARY

17.6. 13:54:29 Company

RE GEN	Ins CAPACITY	Av. CAPACITY	FORECAST	SCHDL	NEXT SCHL	ACTUAL MW	ACTUAL MVAR	DEV	NOC
ACME	250	250	235	225	222	196	28	-30	250
APTFL	130	1	23	0	0	0	S 0	0	130
ARERJL	200	200	185	181	174	169	10	-11	200
ASE4PL	50	50	46	45	45	37	-10	-7	50
ASEJ2L	50	50	46	48	47	40	11	-8	50
ASER2PH	150	150	141	150	148	133	8	-17	150
AZURE	200	200	172	160	155	166	S -5	6	200
AZURE MAPPLE	300	1	71	0	0	0	S 0	0	300
AZURE 41	300	300	278	278	277	231	S 36	46	300
CSPJP	250	250	235	235	233	189	-1	46	250
CSPR	300	300	284	272	272	295	2	23	300
MRPL	250	250	231	235	233	243	51	8	250
RENEW	50	50	47	48	47	34	S 0	-13	50
SB ENERGY	200	200	186	175	167	179	645	4	200
SBE6PL	300	300	258	259	255	258	S -9	-1	300
TPREL	300	300	278	269	264	196	7	-73	300
BHADLA (PG)	3280	2852	2575	2579	2540	2365	S 760	-214	3280

RE GEN	Ins CAPACITY	Av. CAPACITY	FORECAST	SCHDL	NEXT SCHL	ACTUAL MW	ACTUAL MVAR	DEV	NOC
AVADA, RJHN	240	240	220	219	216	211	45	-8	240
AVADA, SUNC	350	350	319	318	314	276	-12	-41	350
AVADA SSTN	300	300	277	277	274	284	27	7	300
ASEJs 2L-P1	150	150	139	140	140	128	28	-12	150
ASEJs 2L-P2	150	150	137	135	135	135	0	-0	150
AYANA	300	300	283	274	272	276	27	2	300
ARP3PL	300	194	179	97	97	191	31	94	194
AZURE 43	600	600	566	560	540	478	20	-82	600
RSRPL	300	300	278	270	264	247	1	-23	300
RSPPL BKN	250	250	231	227	224	187	-5	-40	250
TPGEL	225	225	206	192	189	85	-10	-108	225
TPSL	110	110	95	87	86	84	-7	-97	110
TS1PL	300	300	284	275	270	-0	2	-275	300
BIKANER (PG)	3575	3469	3215	3071	3019	2581	66	-683	3469

RE GEN	Ins CAPACITY	Av. CAPACITY	FORECAST	SCHDL	NEXT SCHL	ACTUAL MW	ACTUAL MVAR	DEV	NOC
AHEJ1L	390 (360+100)	390	330	385	385	344		-41	390
AHEJ2L	300 (300+75)	300	269	282	282	249	12	-33	300
AHEJ3L	300 (300+75)	300	288	282	282	275	32	-7	300
ASEJ1L	450 (421+105)	450	432	440	430	450	-0	10	450
ASERJ2PL	180	165	151	165	165	169	68	-11	180
DEVIKOT	240	240	199	199	194	43	37	-156	240
EDEN	300	300	280	280	280	304	29	24	300
RNEWJ3	300	300	277	277	277	206	32	-71	300
RSBPL	300	300	277	267	266	239	57	-28	300
RSUPL	300	300	276	260	258	254	39	-7	300
RSWPL	300	300	272	280	277	270	48	-10	300
FTGH2 (PG)	3360	3345	2902	3122	3096	2805	S 228	-319	3360

RE GEN	Ins CAPACITY	Av. CAPACITY	FORECAST	SCHDL	NEXT SCHL	ACTUAL MW	ACTUAL MVAR	DEV	NOC
ABCRL	300	300	285	280	280	284	9	4	300
AEGSPL	100	100	93	100	100	98	4	-2	100
AEGSPL	100			98	98	0	0	-97	100
AHPPL	300	300	287	288	286	291	0	4	300
ASEPL	320	320	301	290	287	312	-30	22	320
KOLAYAT	400	400	369	382	378	385	-39	3	400
MSUPL	250	250	225	208	208	222	4	14	250
NOKHRA	300	250	254	250	250	248	-15	-2	300
RSBKPL	190	190	167	174	174	189	3	16	190
BHADLA2 (PG)	2160	S 2110	1980	2069	2060	2029	-71	-40	2260

RE GEN	Ins CAPACITY	Av. CAPACITY	FORECAST	SCHDL	NEXT SCHL	ACTUAL MW	ACTUAL MVAR	DEV	NOC
AHEJ4L	700 (600+510)	700	689	665	665	642	42	-23	700
NIDAN(NT)	296	296	274	284	284	250	36	-34	296
PTGH1	996	996	962	949	949	892	80	-57	996

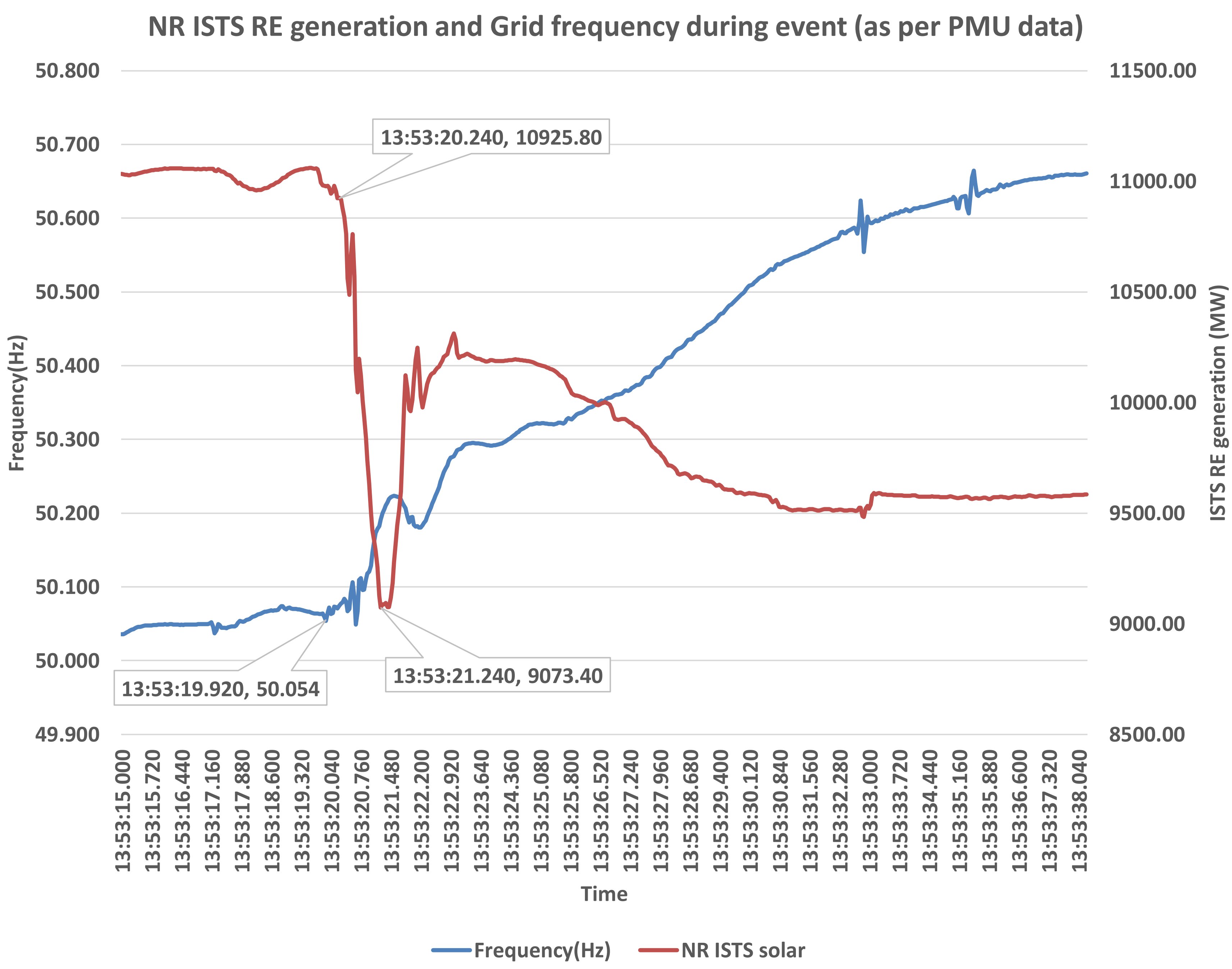
RE GEN	Ins CAPACITY	Av. CAPACITY	FORECAST	SCHDL	NEXT SCHL	ACTUAL MW	ACTUAL MVAR	DEV	NOC
AXPPL	380	380	361	355	351	254	85	-101	380
RSVPL	100	100	93	93	93	83	26	-10	100
RSPPL - FTG3	200	200	188	195	190	168	44	-26	200
RSAPL	300	300	275	273	268	267	33	-6	290
RSRPL FTG3	400	285	283	260	268	310	39	-40	380
FATEHGARH 3	1380	1265	1200	1175	901	1084	228	-185	1350

RE GEN	Ins CAPACITY	Av. CAPACITY	FORECAST	SCHDL	NEXT SCHL	ACTUAL MW	ACTUAL MVAR	DEV
ANTA	90	90	67	66	63	75	8	9
AURAIYA	40	40	28	23	22	28	S 0	6
DADRI	5	5	3	2	2	2	0	-1
SINGRAULI	15	15	5	8	7	-0	-3	-8
UNCHAHAR	10	10	4	7	5	4	-0	-3

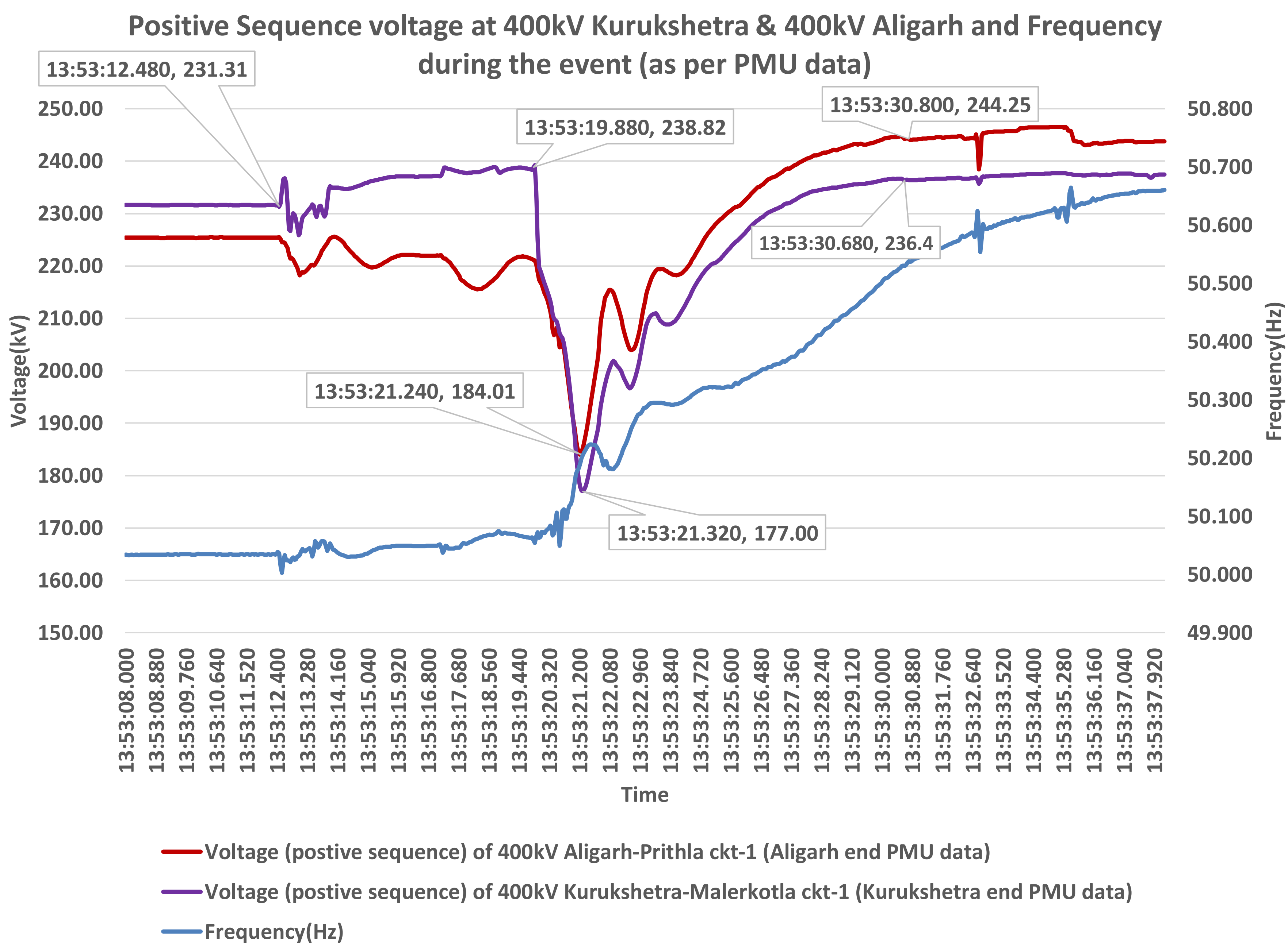
RE GEN	Ins CAPACITY	Av. CAPACITY	FORECAST	SCHDL	NEXT SCHL	ACTUAL MW	ACTUAL MVAR	DEV	NOC
AAPL	100	100	95	90	90	57	-28	-33	100
ARTPL	110	110	120	110	110	120	10	10	110
GEPL	100	100	92	90	90	49	-39	-41	100
OVEPL	100	100	90	90	90	31	-20	-59	100
SRI4PL	125	162	149	157	157	90	-47	-67	162
TESPL	84.4	84	95	82	82	84	25	2	84
TGEPL	100	100	98	96	96	106	11	10	100
TPSB	300	200	200	186	181	285	3	5	300
TSESPL	50	50	48	47	47	51	12	4	50
BIKANER 2	1069.4	1006	989	S 948	S 943	872	-74	S -170	S 1106

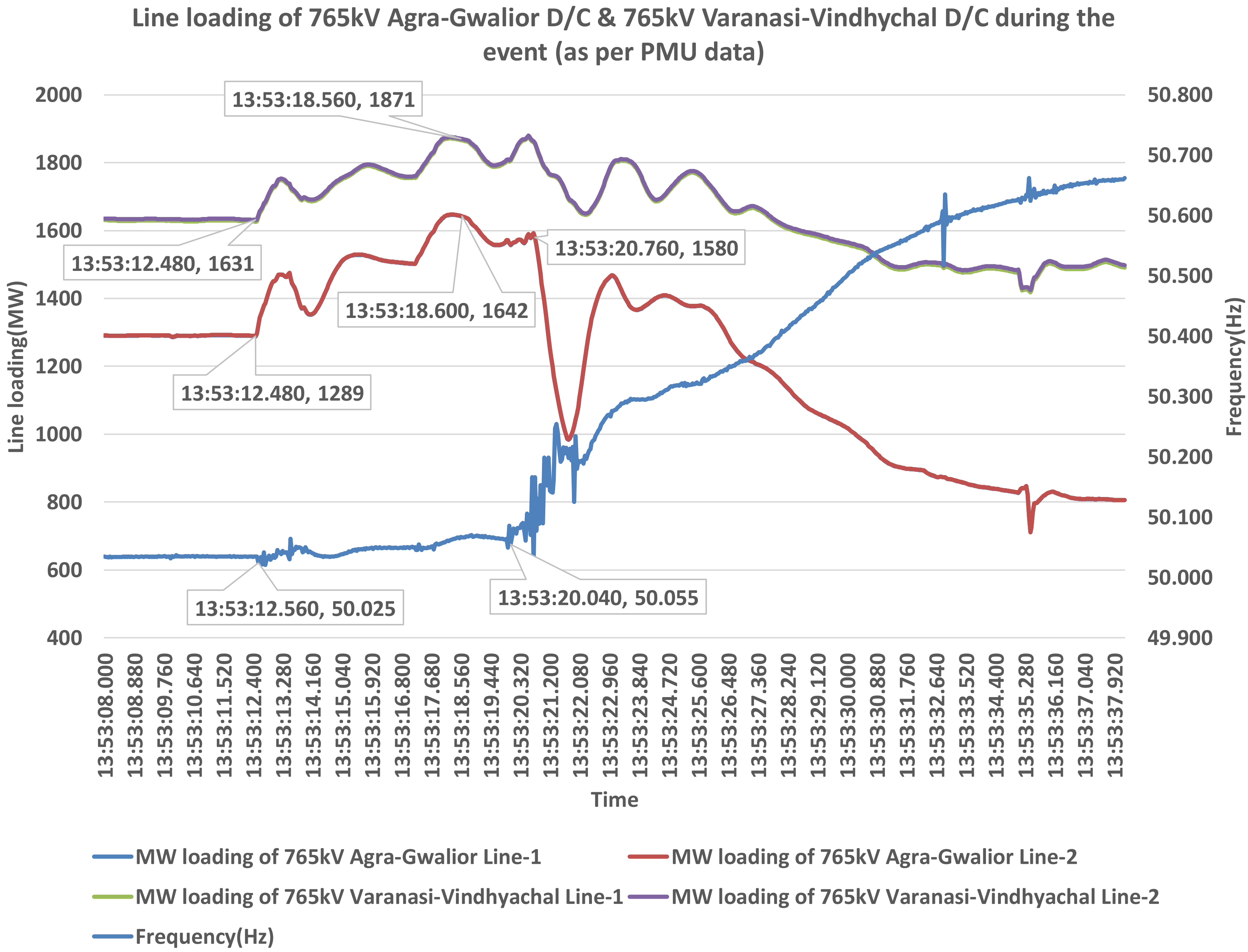
	SCHDL	ACTUAL	DEV
TOTAL	14028	12734	S -1295

Mon June 17 2024 13:54:30

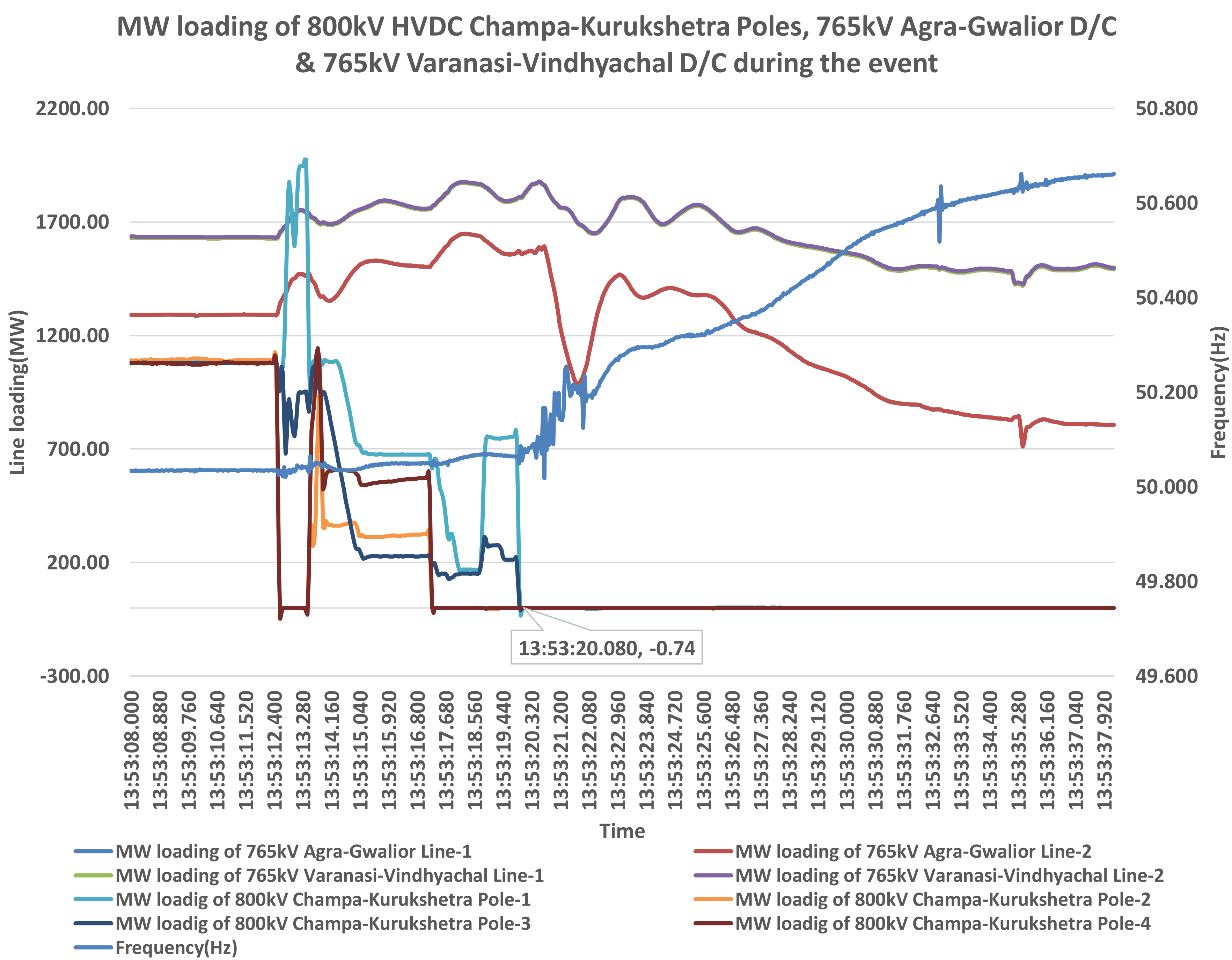


NR ISTS RE generation and Grid frequency during event (as per PMU data)
Frequency(Hz)
ISTS RE generation (MW)
Time
13:53:20.240, 10925.80
13:53:19.920, 50.054
13:53:21.240, 9073.40
50.800
50.700
50.600
50.500
50.400
50.300
50.200
50.100
50.000
49.900
11500.00
11000.00
10500.00
10000.00
9500.00
9000.00
8500.00
13:53:15.000
13:53:15.720
13:53:16.440
13:53:17.160
13:53:17.880
13:53:18.600
13:53:19.320
13:53:20.040
13:53:20.760
13:53:21.480
13:53:22.200
13:53:22.920
13:53:23.640
13:53:24.360
13:53:25.080
13:53:25.800
13:53:26.520
13:53:27.240
13:53:27.960
13:53:28.680
13:53:29.400
13:53:30.120
13:53:30.840
13:53:31.560
13:53:32.280
13:53:33.000
13:53:33.720
13:53:34.440
13:53:35.160
13:53:35.880
13:53:36.600
13:53:37.320
13:53:38.040
Frequency(Hz)
NR ISTS solar


Positive Sequence voltage at 400kV Kurukshetra & 400kV Aligarh and Frequency during the event (as per PMU data)
13:53:12.480, 231.31
13:53:19.880, 238.82
13:53:30.800, 244.25
13:53:30.680, 236.4
13:53:21.240, 184.01
13:53:21.320, 177.00
Voltage(kV)
Frequency(Hz)
Time
Voltage (postive sequence) of 400kV Aligarh-Prithla ckt-1 (Aligarh end PMU data)
Voltage (postive sequence) of 400kV Kurukshetra-Malerkotla ckt-1 (Kurukshetra end PMU data)
Frequency(Hz)



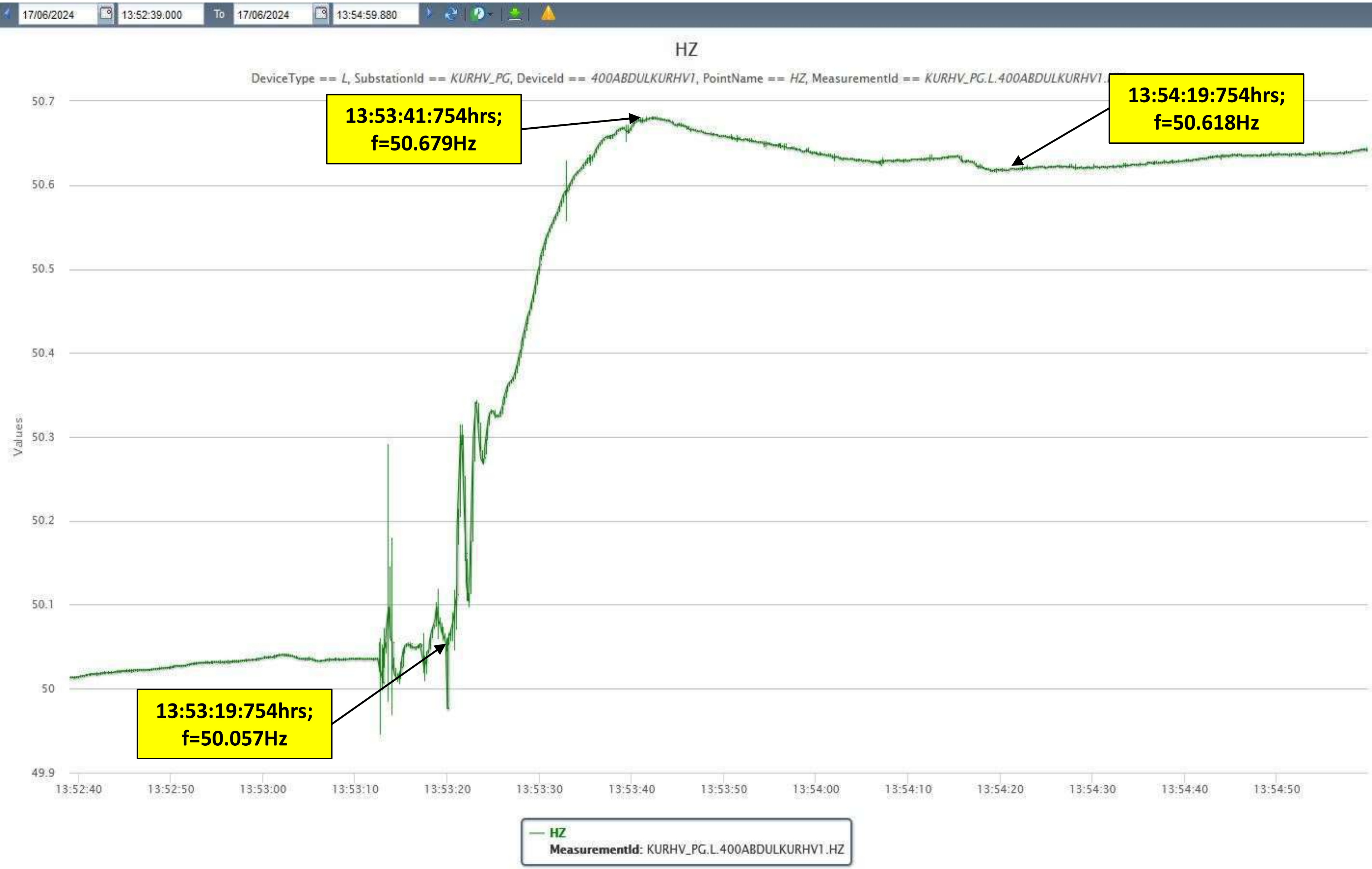
Line loading of 765kV Agra-Gwalior D/C & 765kV Varanasi-Vindhychal D/C during the event (as per PMU data)
13:53:18.560, 1871
13:53:12.480, 1631
13:53:20.760, 1580
13:53:18.600, 1642
13:53:12.480, 1289
13:53:12.560, 50.025
13:53:20.040, 50.055
Line loading(MW)
Frequency(Hz)
Time
MW loading of 765kV Agra-Gwalior Line-1
MW loading of 765kV Agra-Gwalior Line-2
MW loading of 765kV Varanasi-Vindhyachal Line-1
MW loading of 765kV Varanasi-Vindhyachal Line-2
Frequency(Hz)



MW loading of 800kV HVDC Champa-Kurukshetra Poles, 765kV Agra-Gwalior D/C & 765kV Varanasi-Vindhyachal D/C during the event
Line loading(MW)
Frequency(Hz)
2200.00
1700.00
1200.00
700.00
200.00
-300.00
50.800
50.600
50.400
50.200
50.000
49.800
49.600
13:53:20.080, -0.74
13:53:08.000
13:53:08.880
13:53:09.760
13:53:10.640
13:53:11.520
13:53:12.400
13:53:13.280
13:53:14.160
13:53:15.040
13:53:15.920
13:53:16.800
13:53:17.680
13:53:18.560
13:53:19.440
13:53:20.320
13:53:21.200
13:53:22.080
13:53:22.960
13:53:23.840
13:53:24.720
13:53:25.600
13:53:26.480
13:53:27.360
13:53:28.240
13:53:29.120
13:53:30.000
13:53:30.880
13:53:31.760
13:53:32.640
13:53:33.520
13:53:34.400
13:53:35.280
13:53:36.160
13:53:37.040
13:53:37.920
Time
MW loading of 765kV Agra-Gwalior Line-1
MW loading of 765kV Agra-Gwalior Line-2
MW loading of 765kV Varanasi-Vindhyachal Line-1
MW loading of 765kV Varanasi-Vindhyachal Line-2
MW loadig of 800kV Champa-Kurukshetra Pole-1
MW loadig of 800kV Champa-Kurukshetra Pole-2
MW loadig of 800kV Champa-Kurukshetra Pole-3
MW loadig of 800kV Champa-Kurukshetra Pole-4
Frequency(Hz)

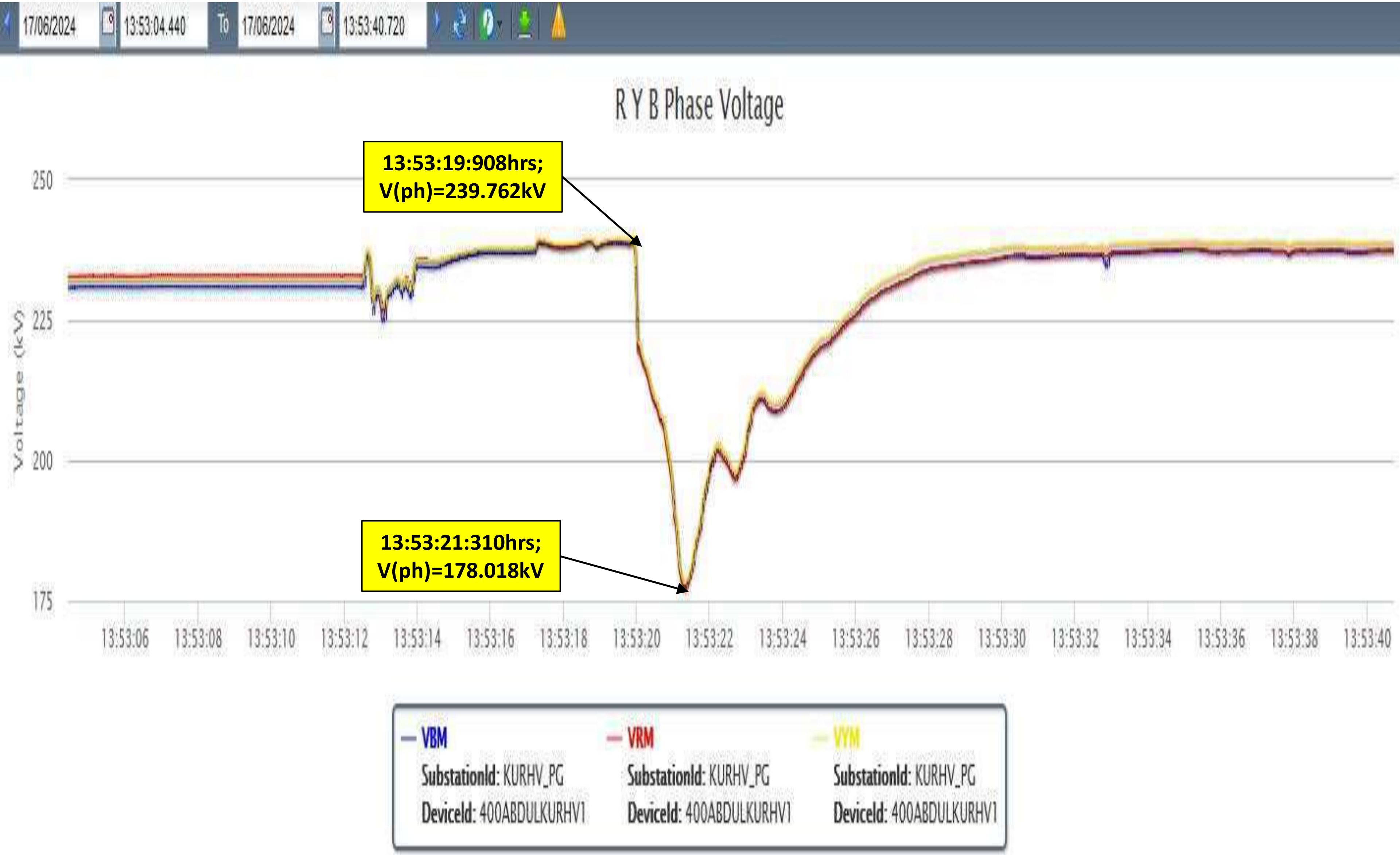
PMU Plot of frequency at HVDC Kurukshetra(PG)

13:53 hrs/17-June-24



PMU Plot of Phase voltage magnitude at HVDC Kurukshetra(PG)

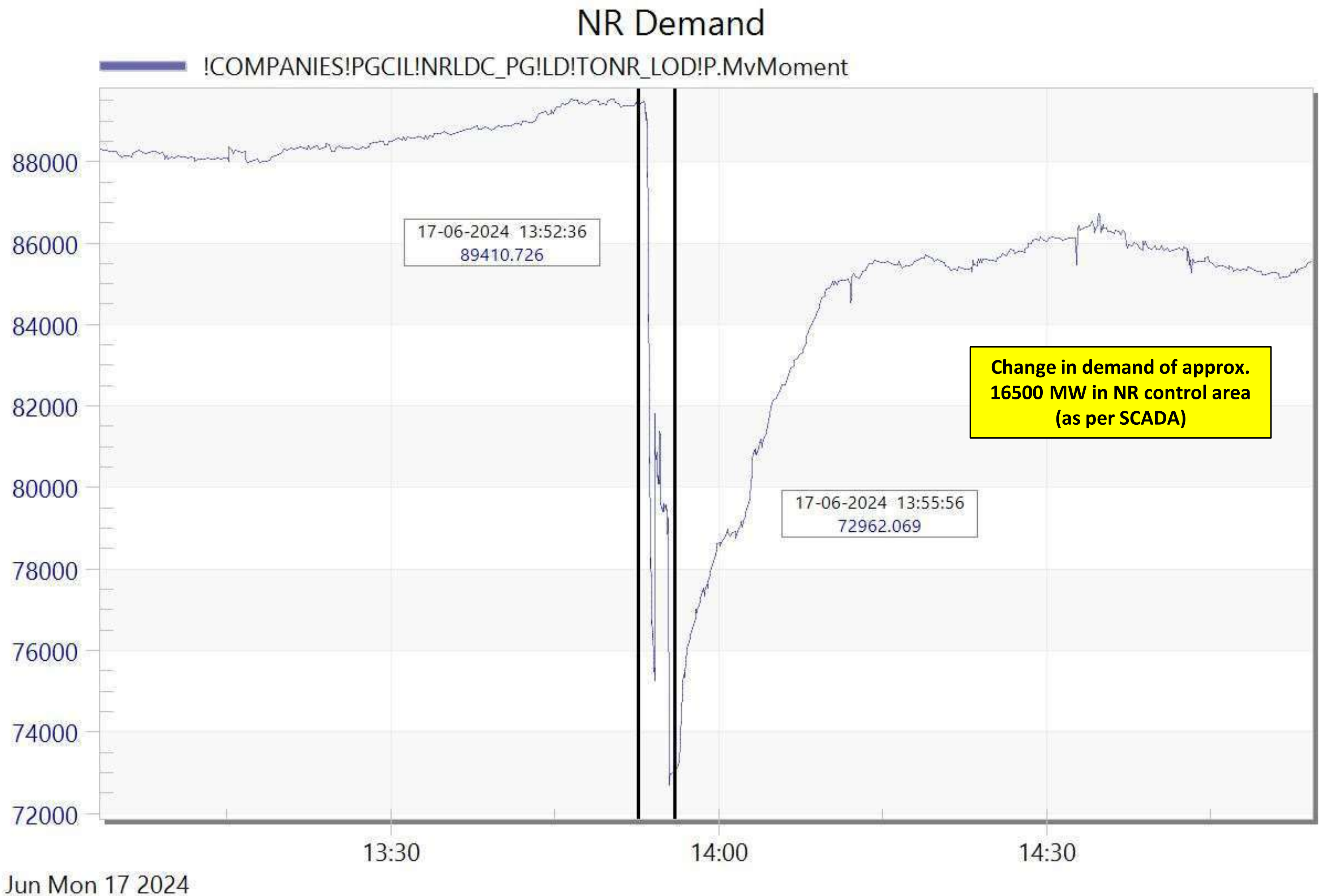
13:53 hrs/17-June-24



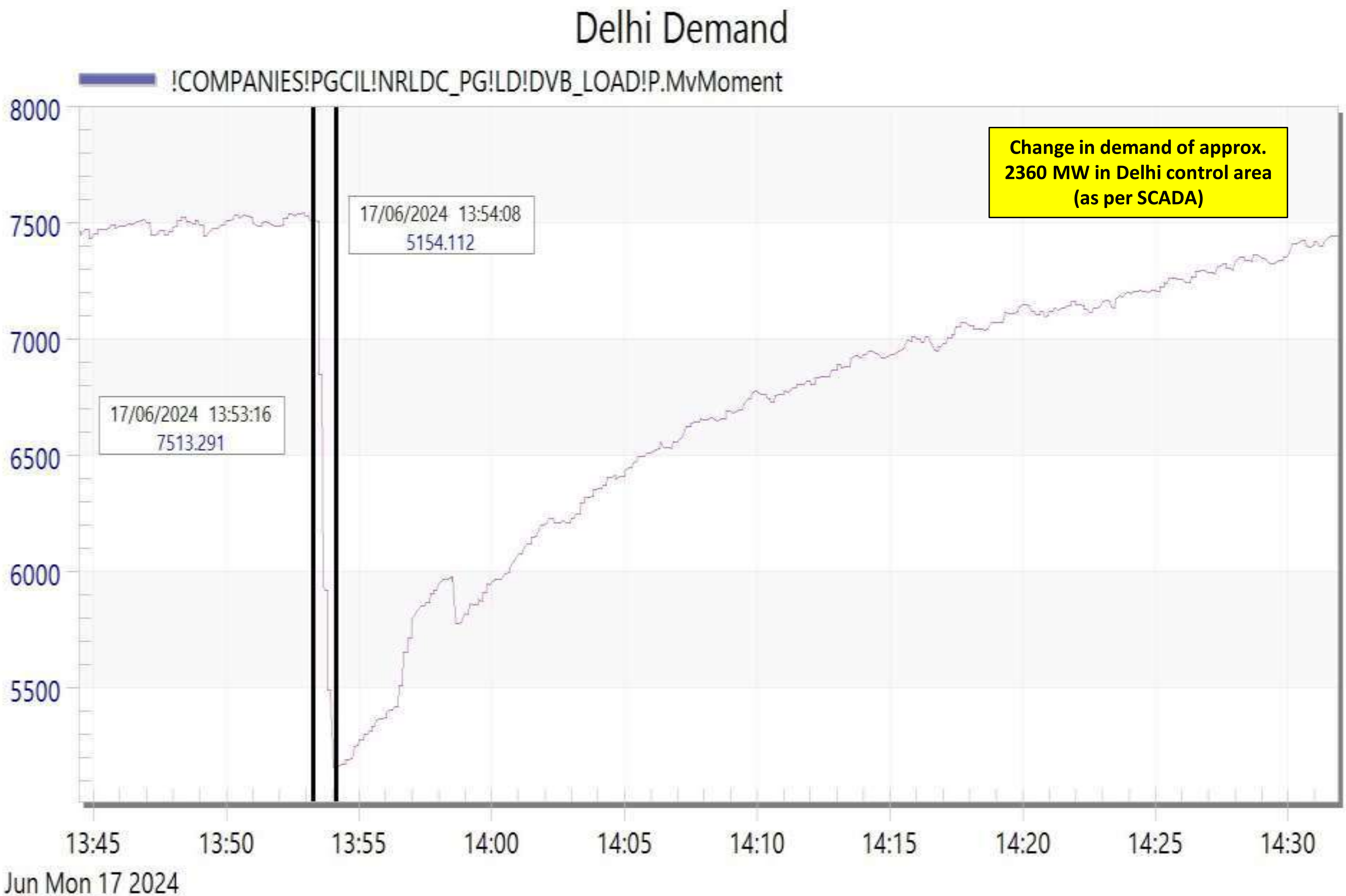
PMU Plot of Phase voltage magnitude at Aligarh(PG)

13:53 hrs/17-June-24

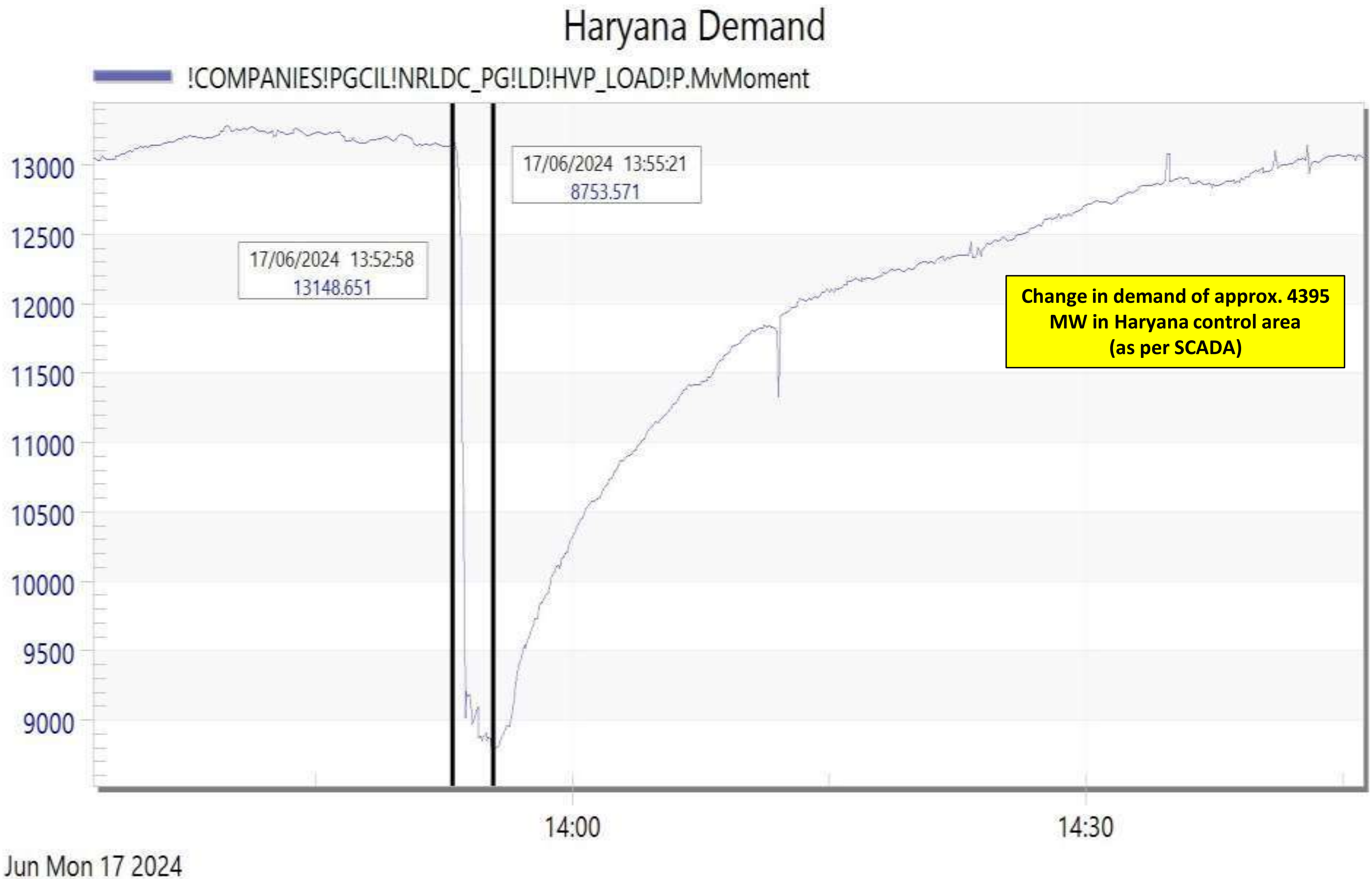
NR demand during the event



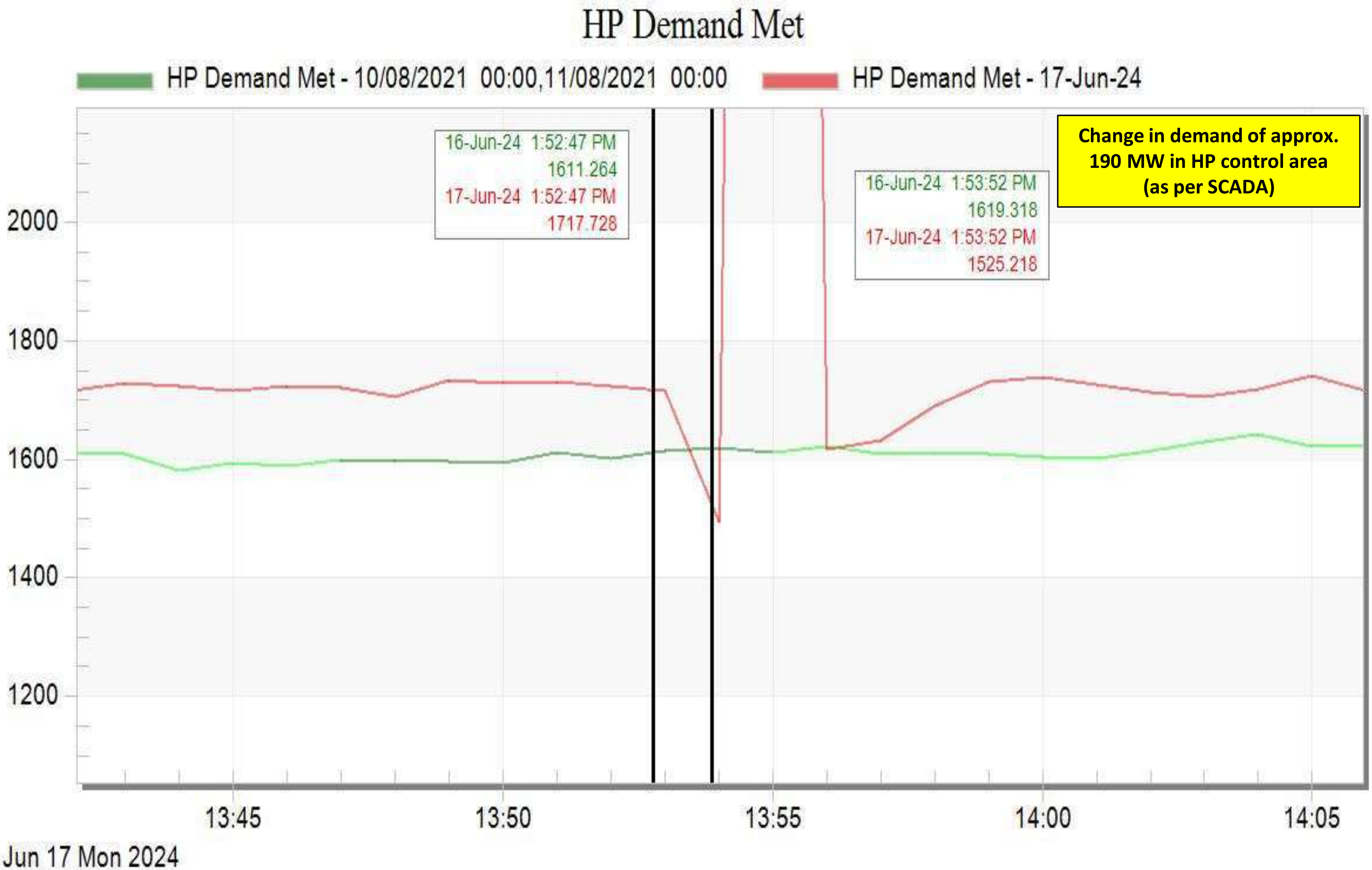
Delhi Demand during the event



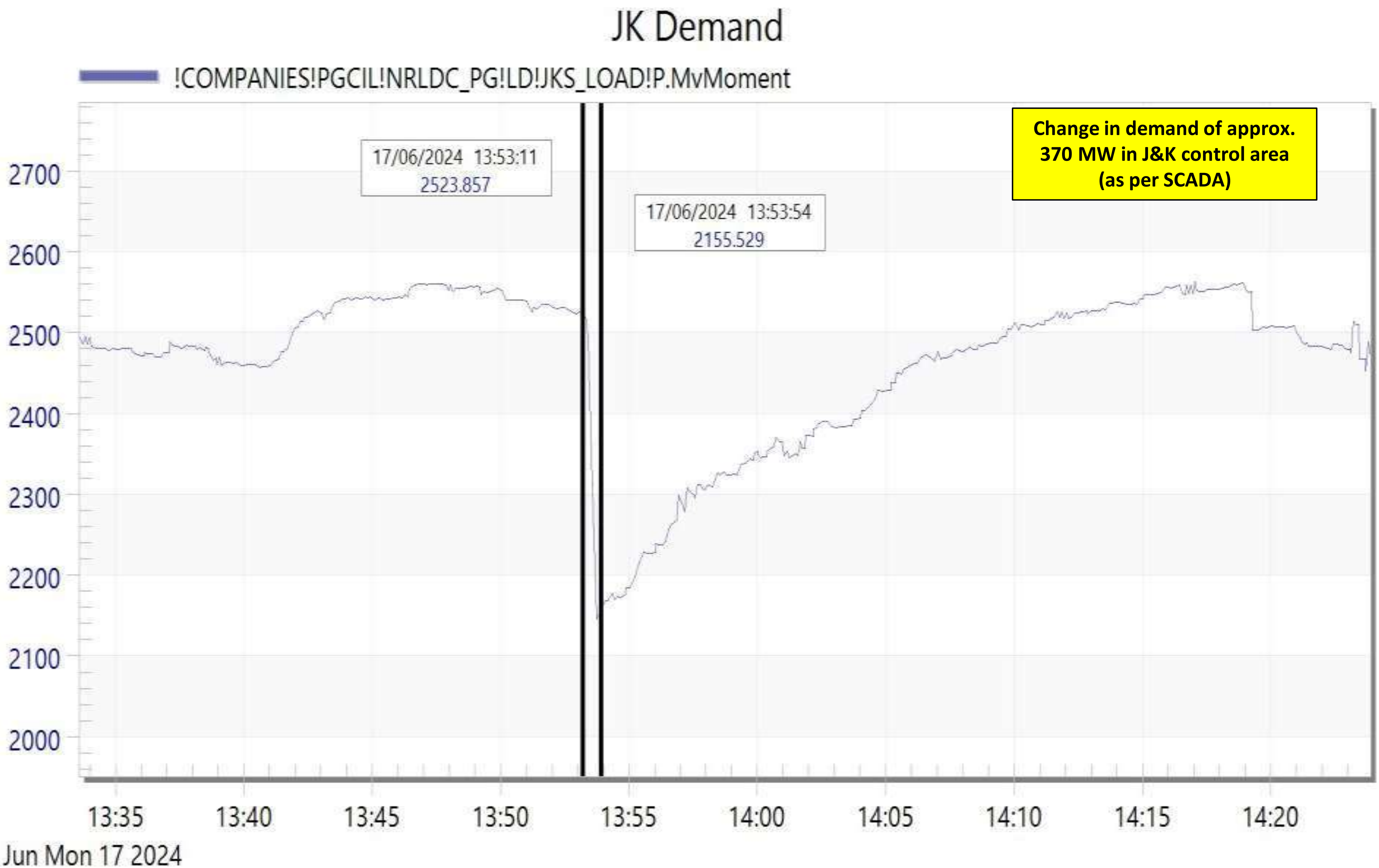
Haryana Demand during the event



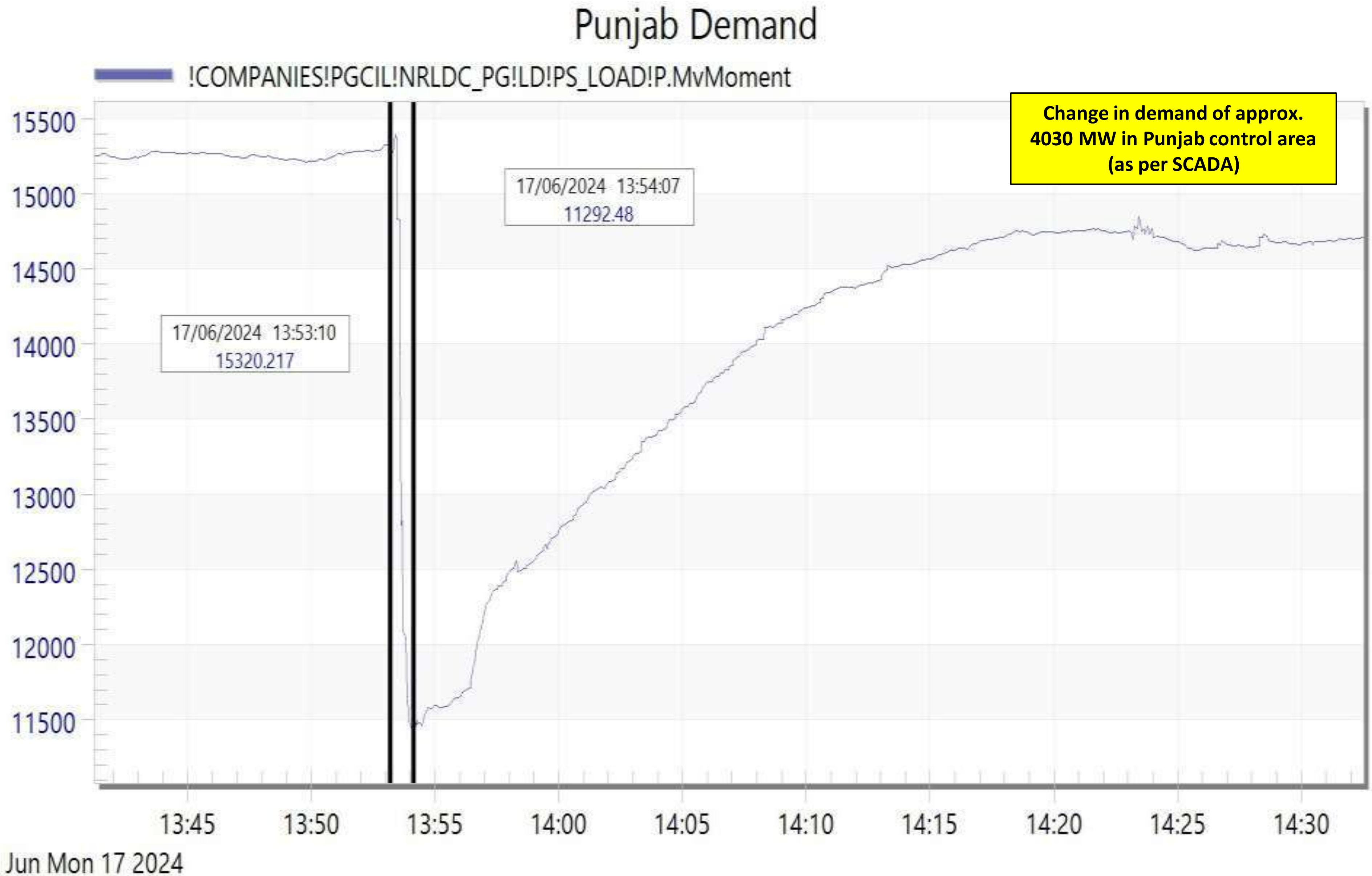
Himachal Pradesh Demand during the event



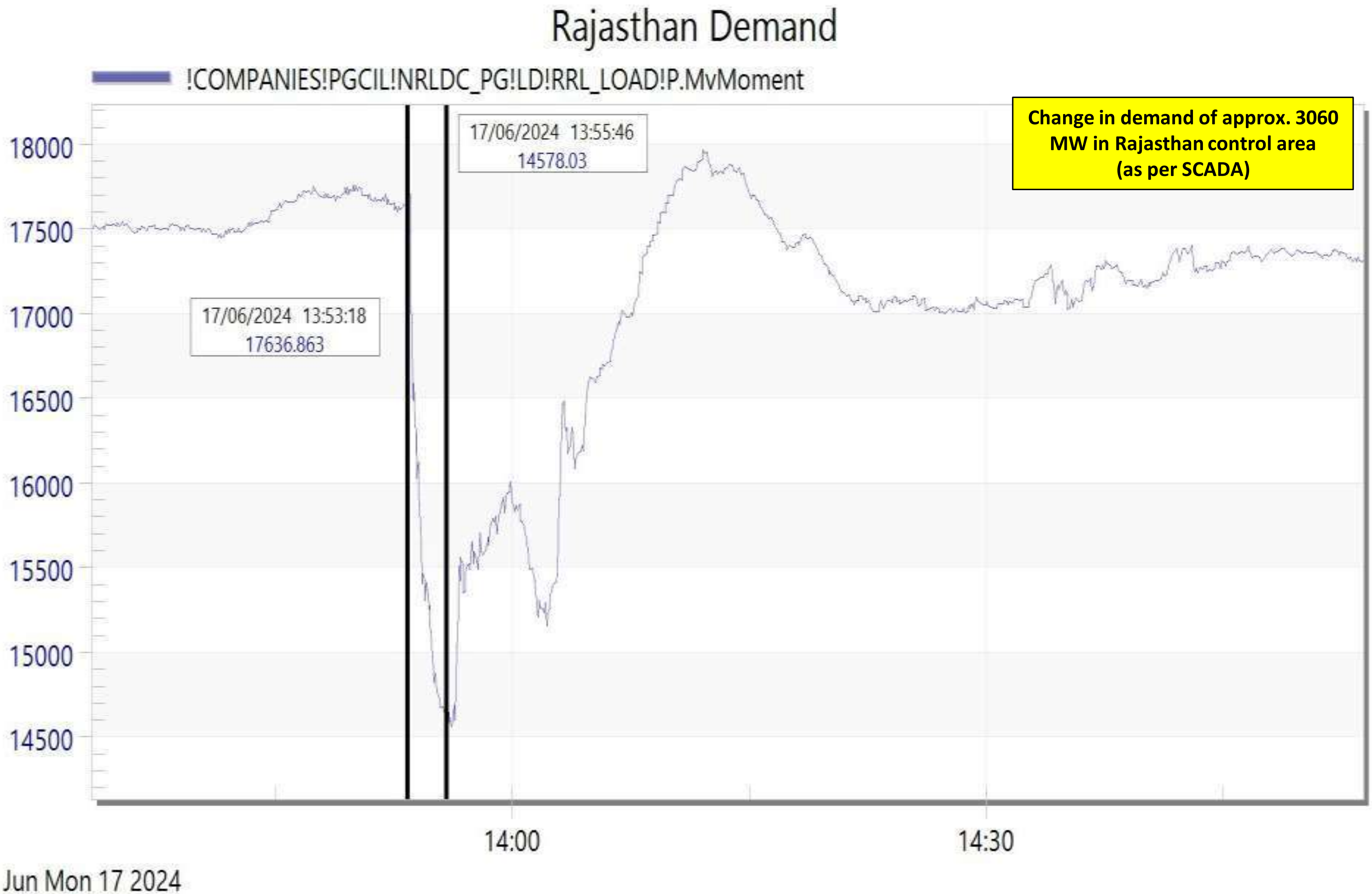
J&K Demand during the event



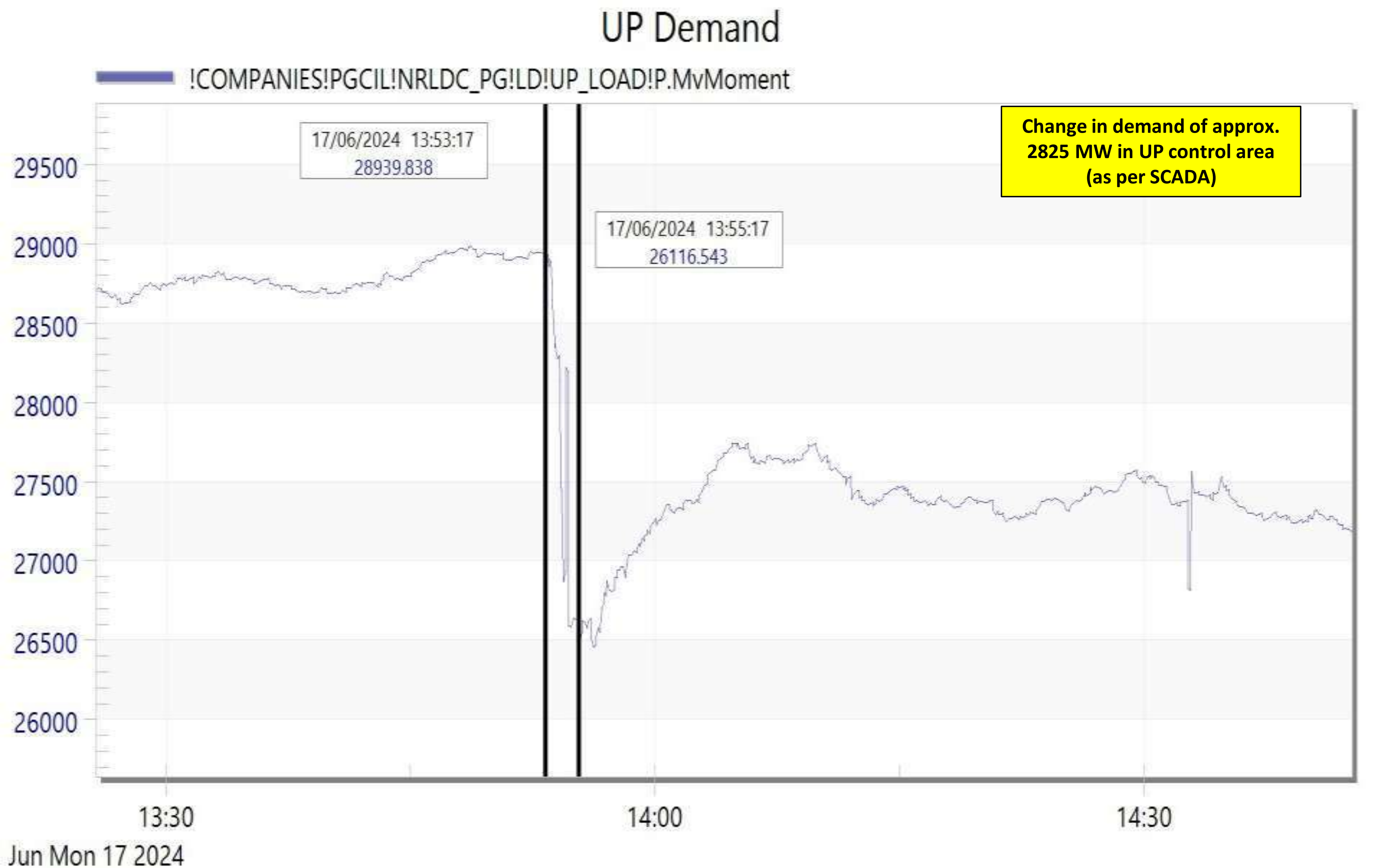
Punjab Demand during the event



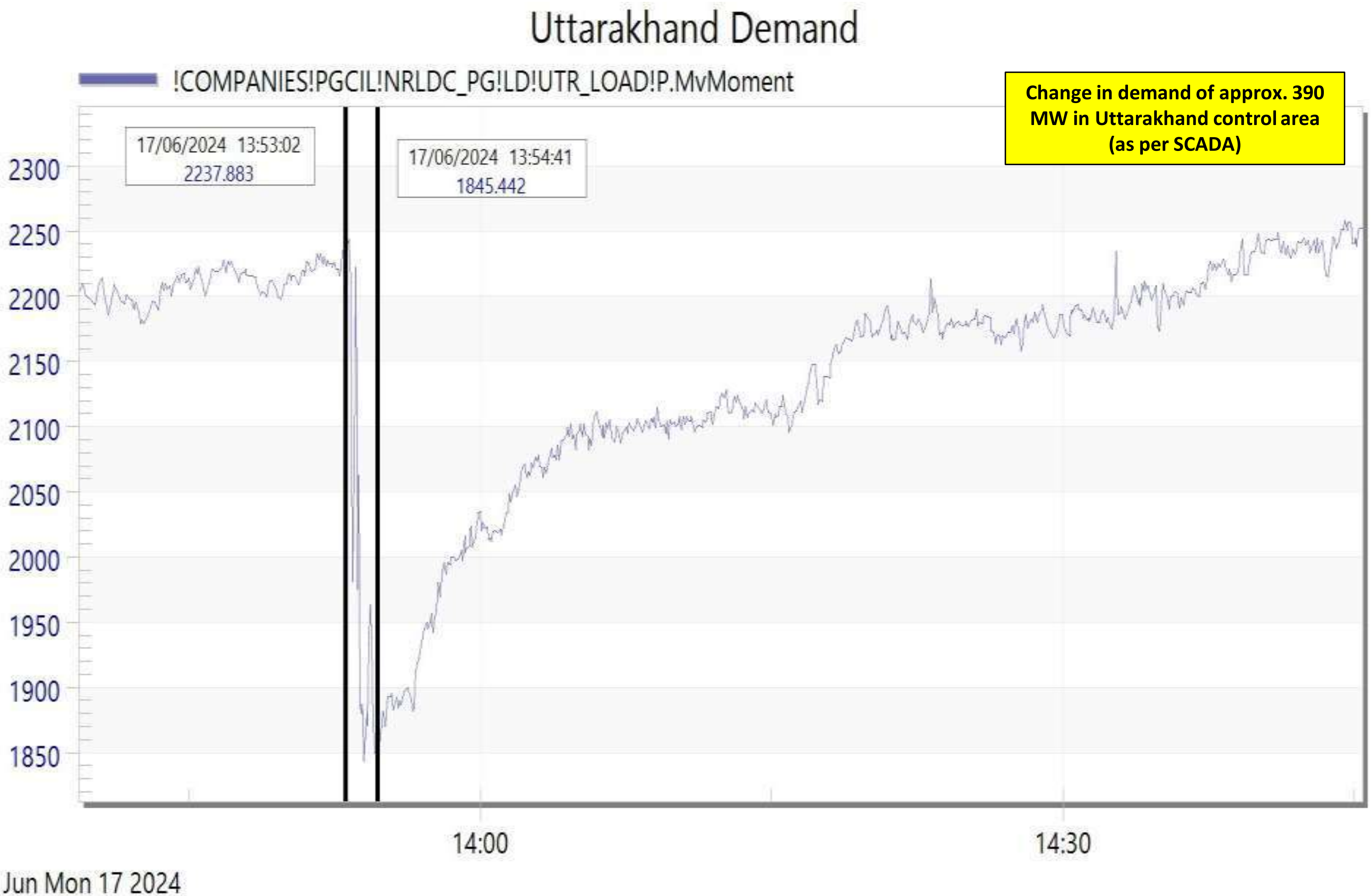
Rajasthan Demand during the event



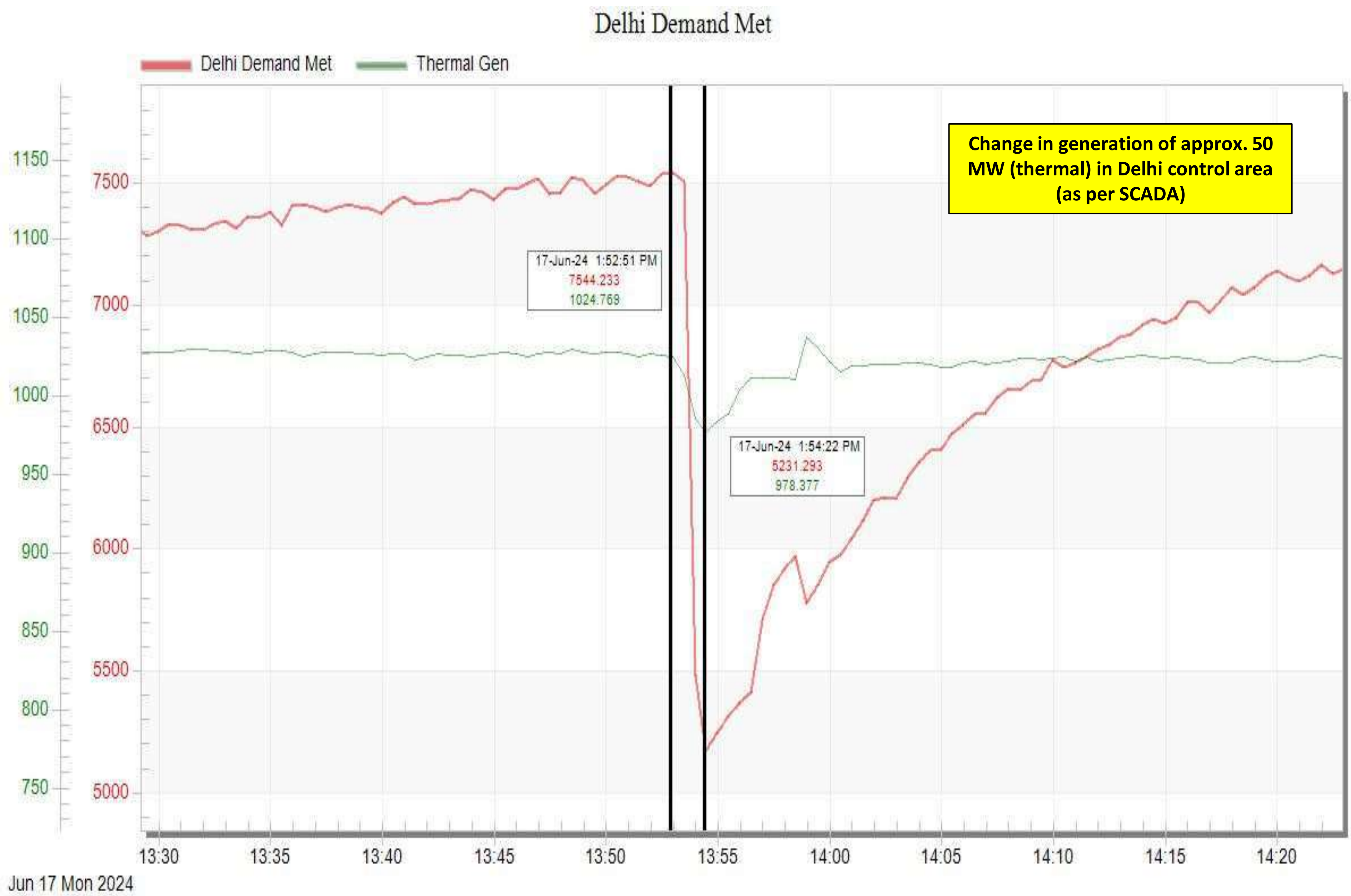
Uttar Pradesh Demand during the event



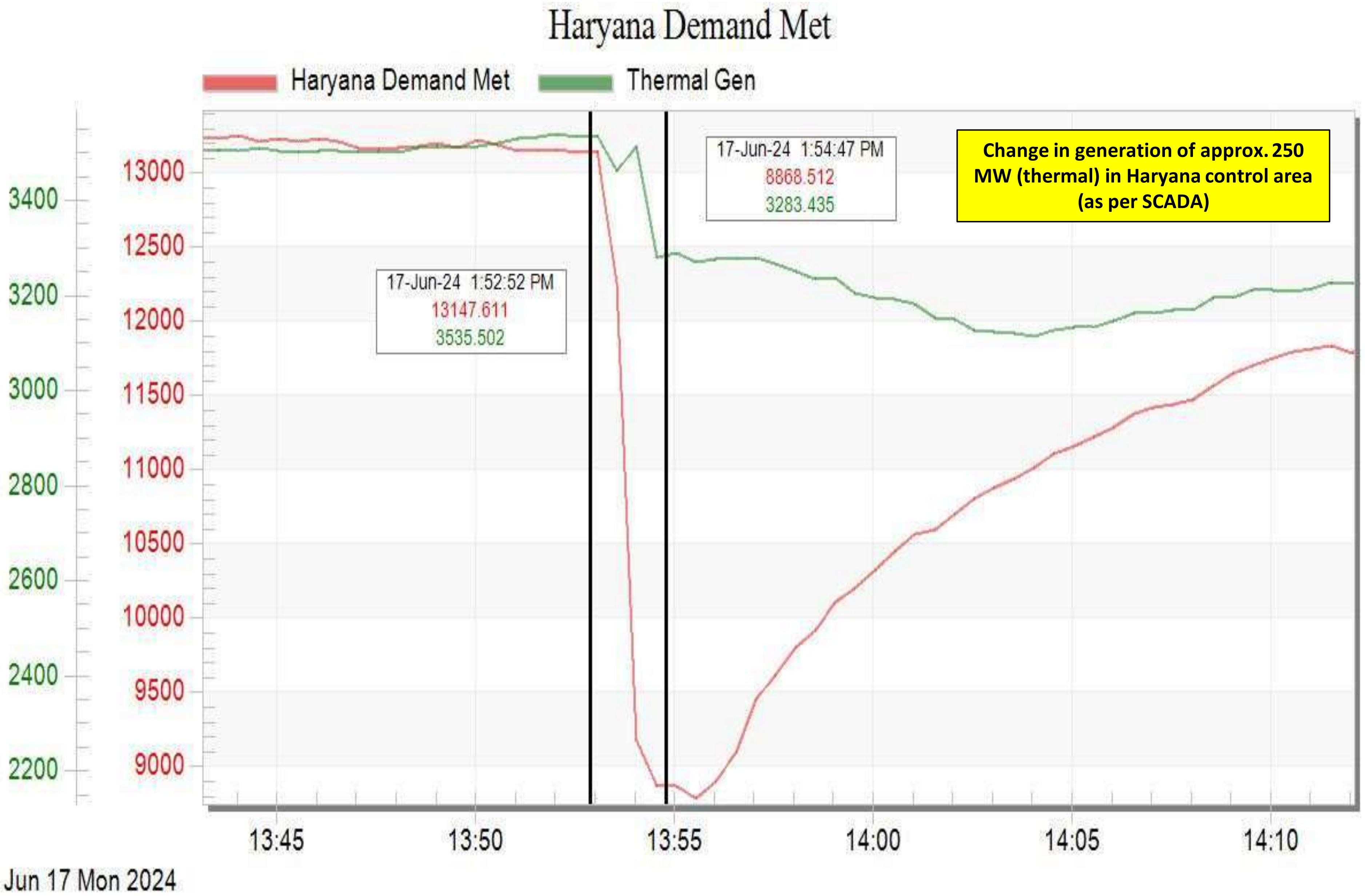
Uttarakhand Demand during the event



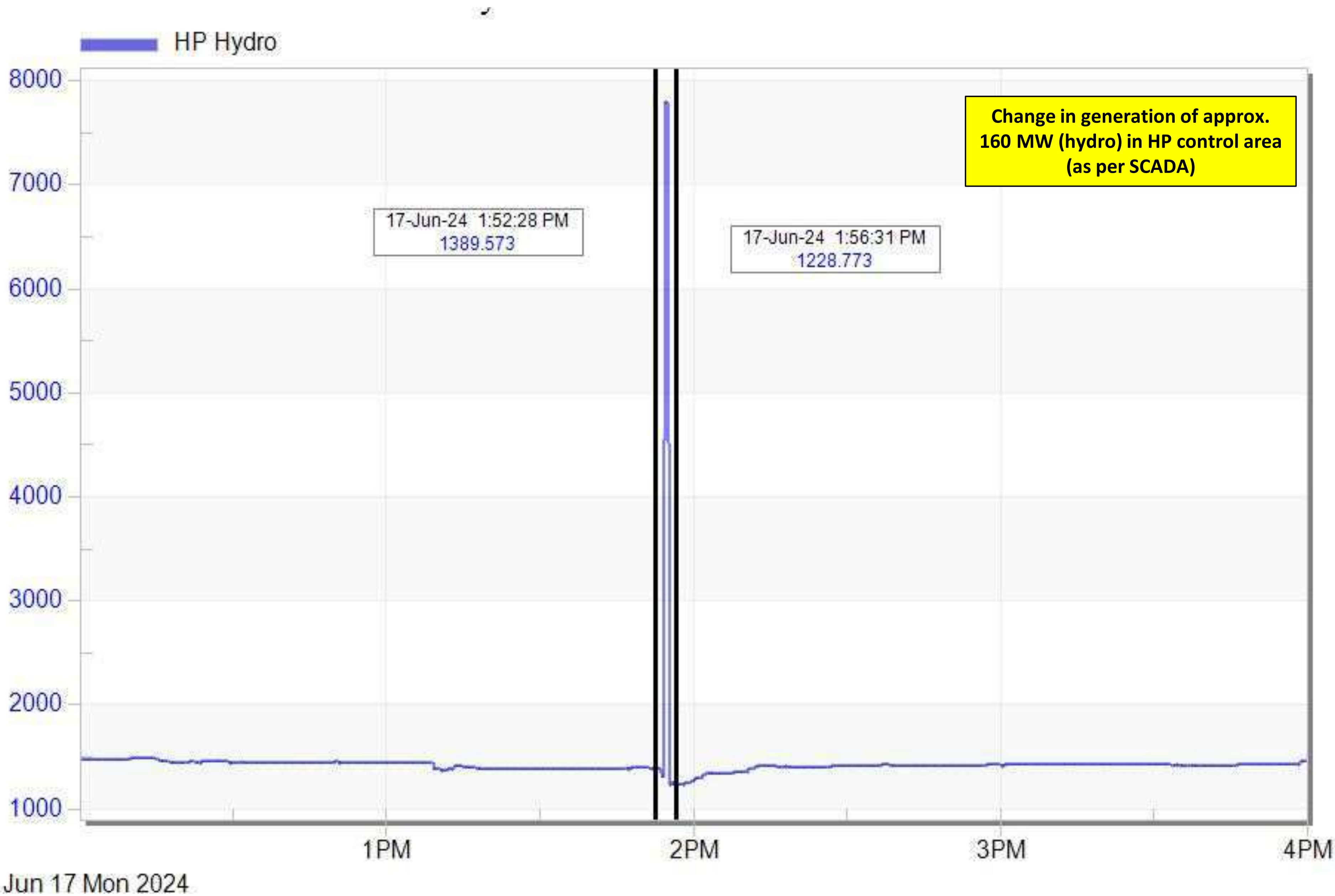
Delhi Generation during the event



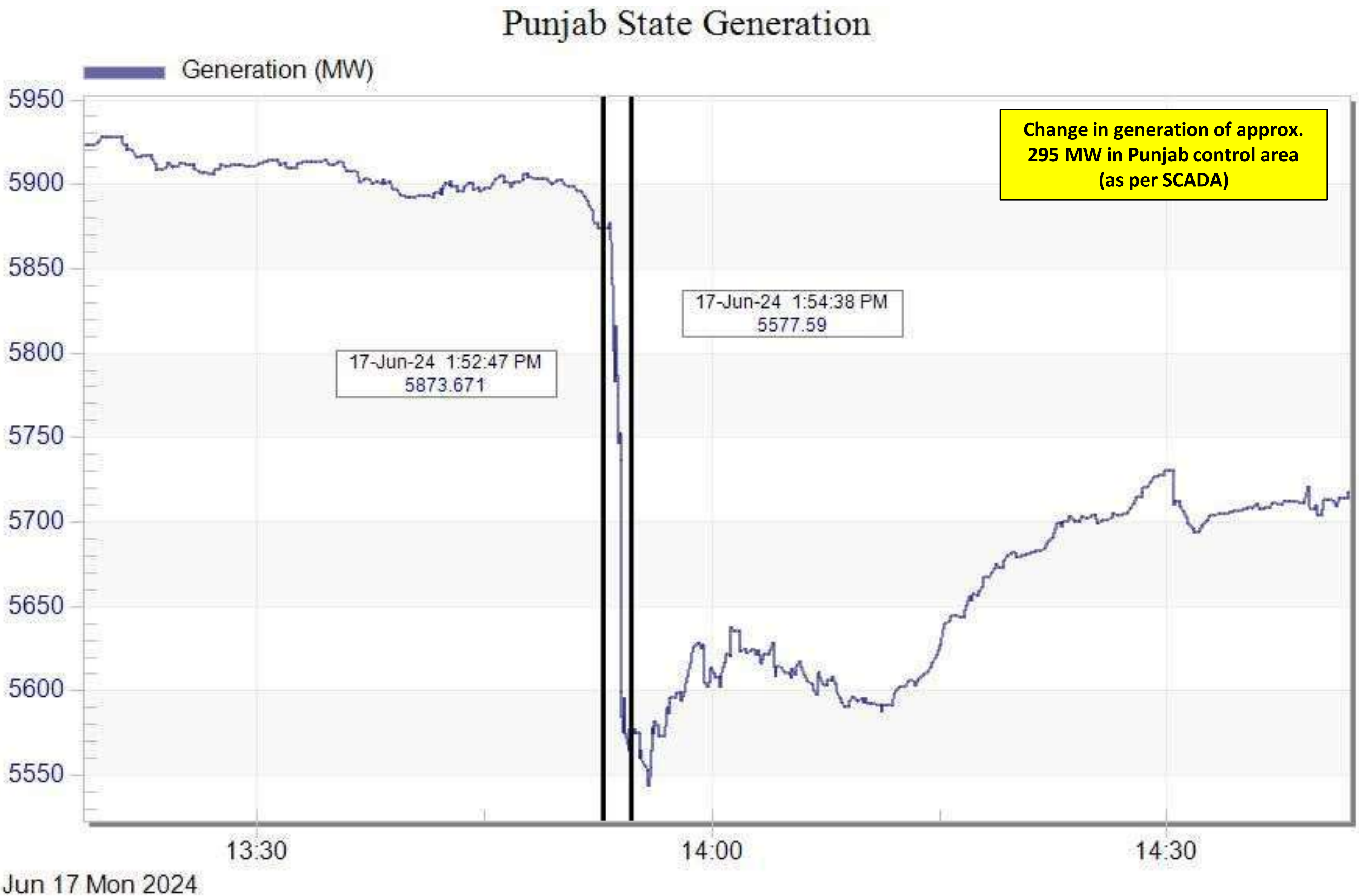
Haryana Generation during the event



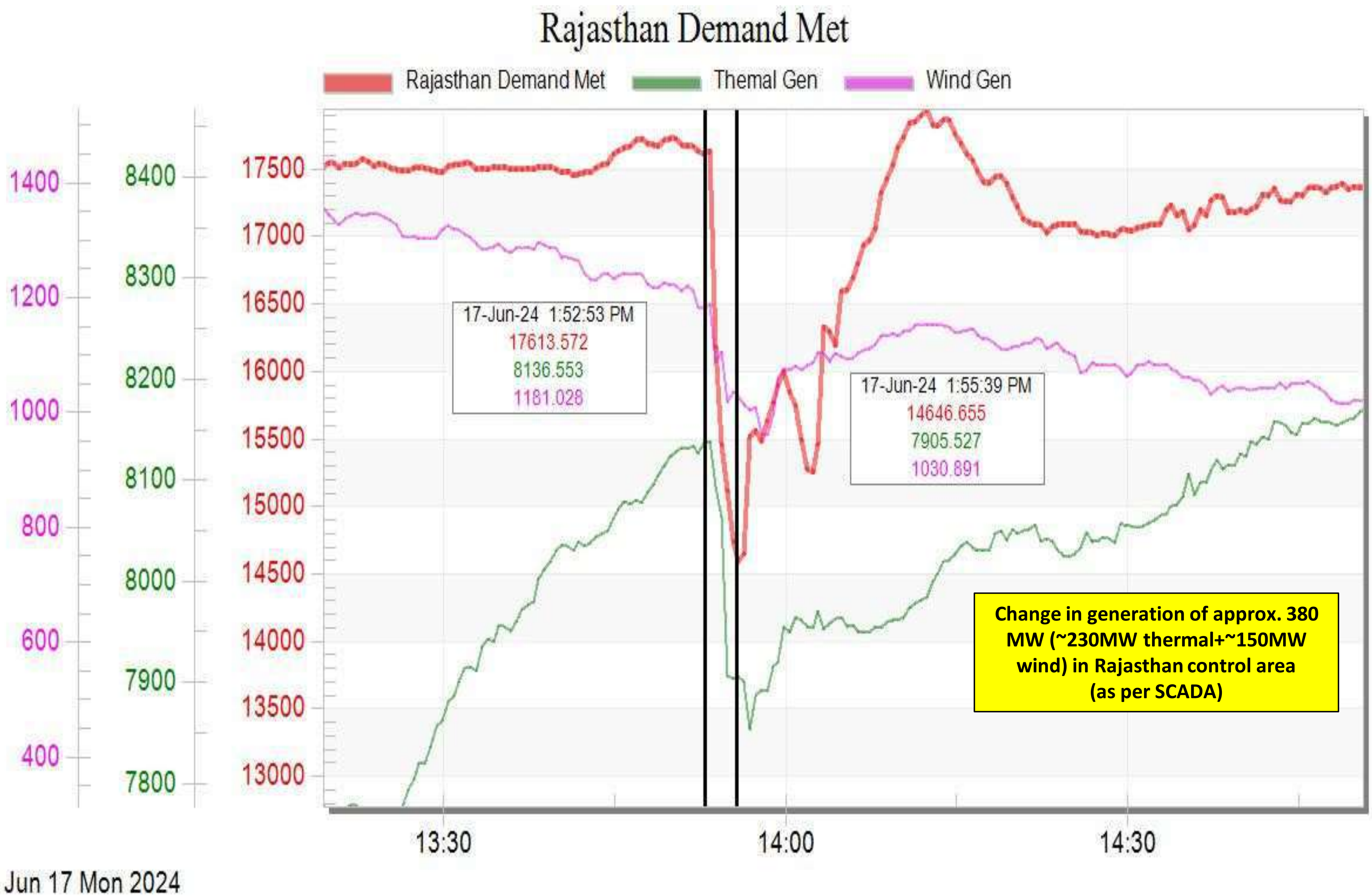
Himachal Pradesh Generation during the event



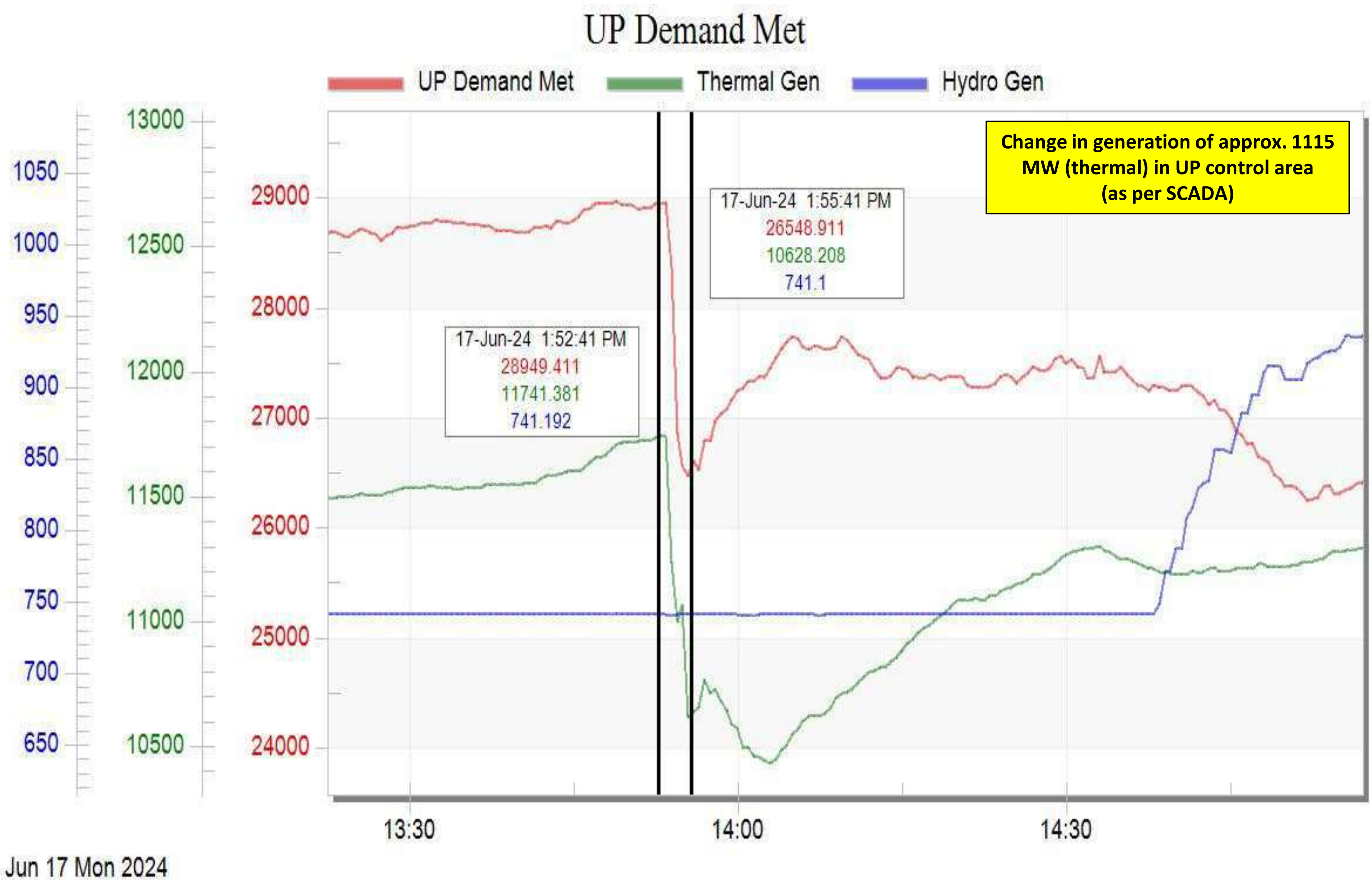
Punjab Generation during the event



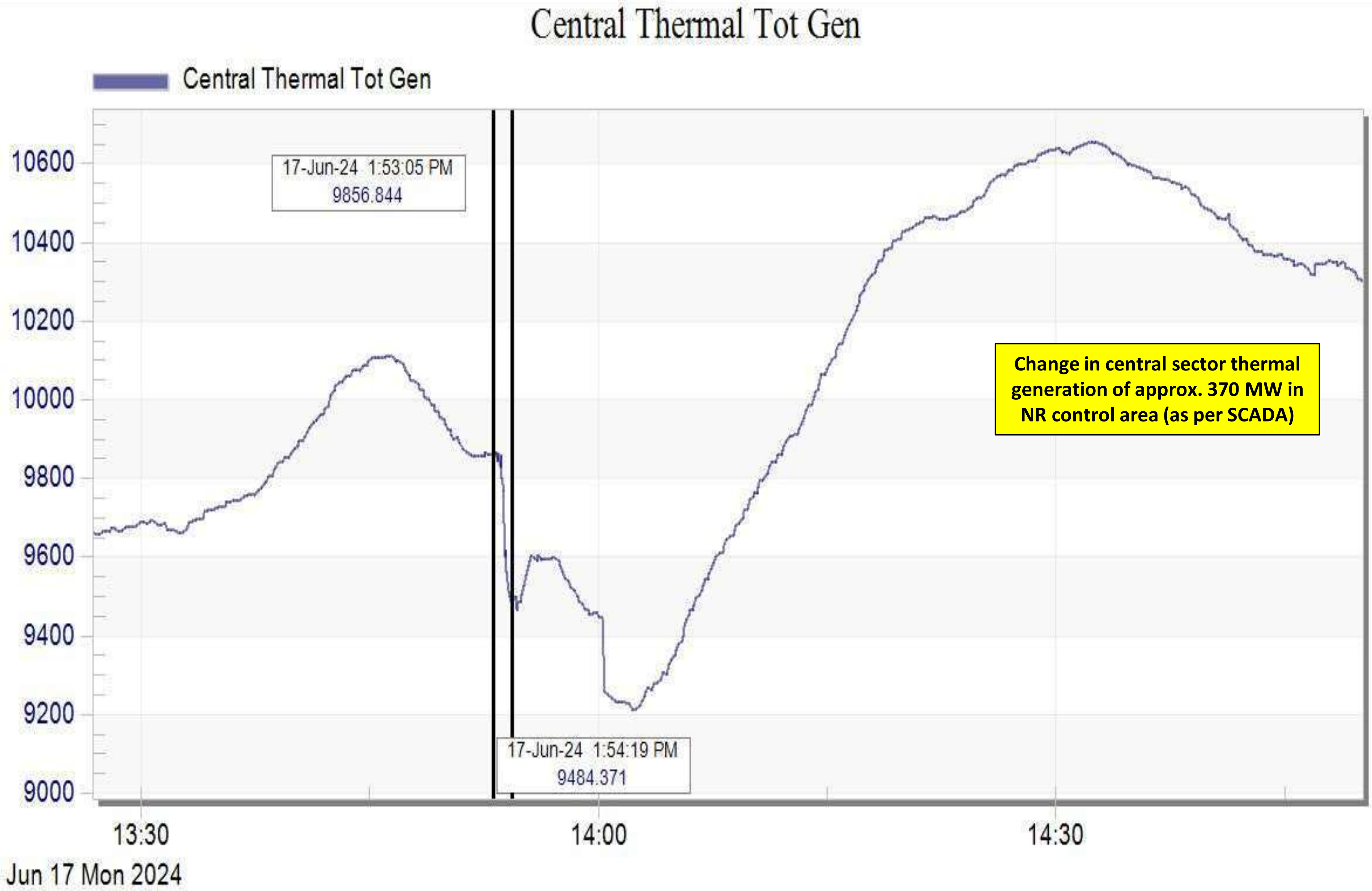
Rajasthan Generation during the event



Uttar Pradesh Generation during the event

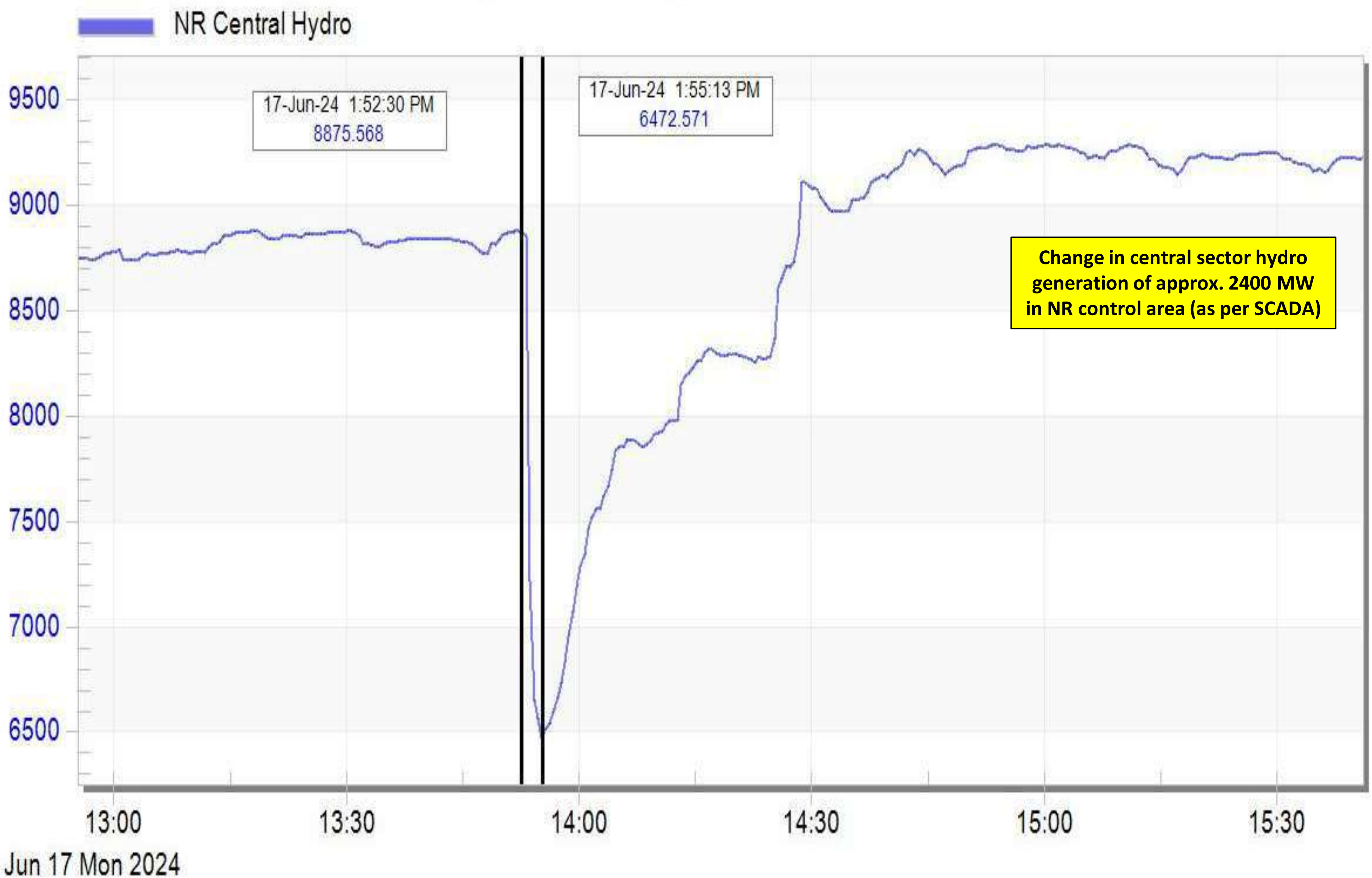


NR central sector thermal generation during the event

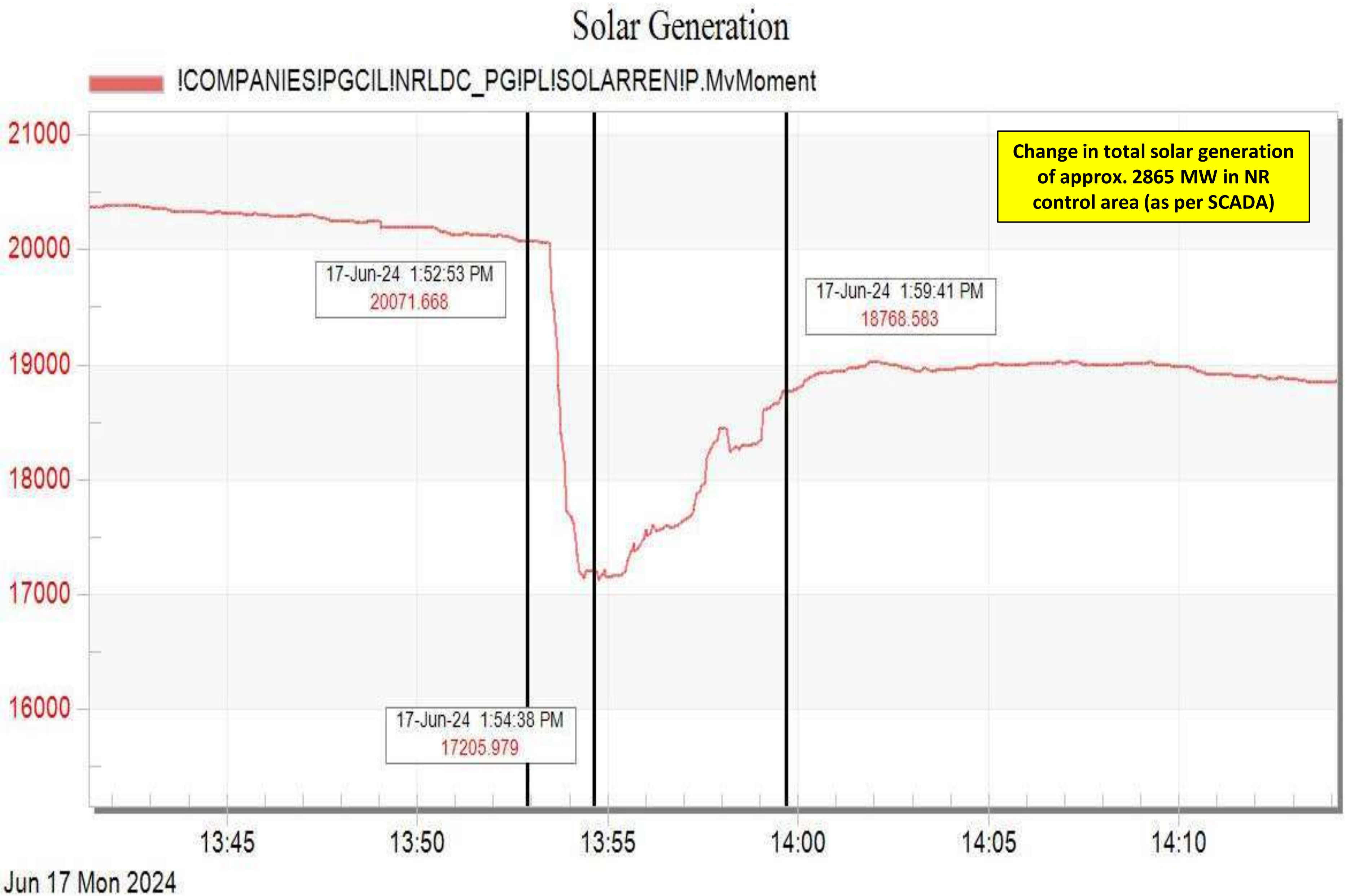


Change in central sector thermal generation of approx. 370 MW in NR control area (as per SCADA)

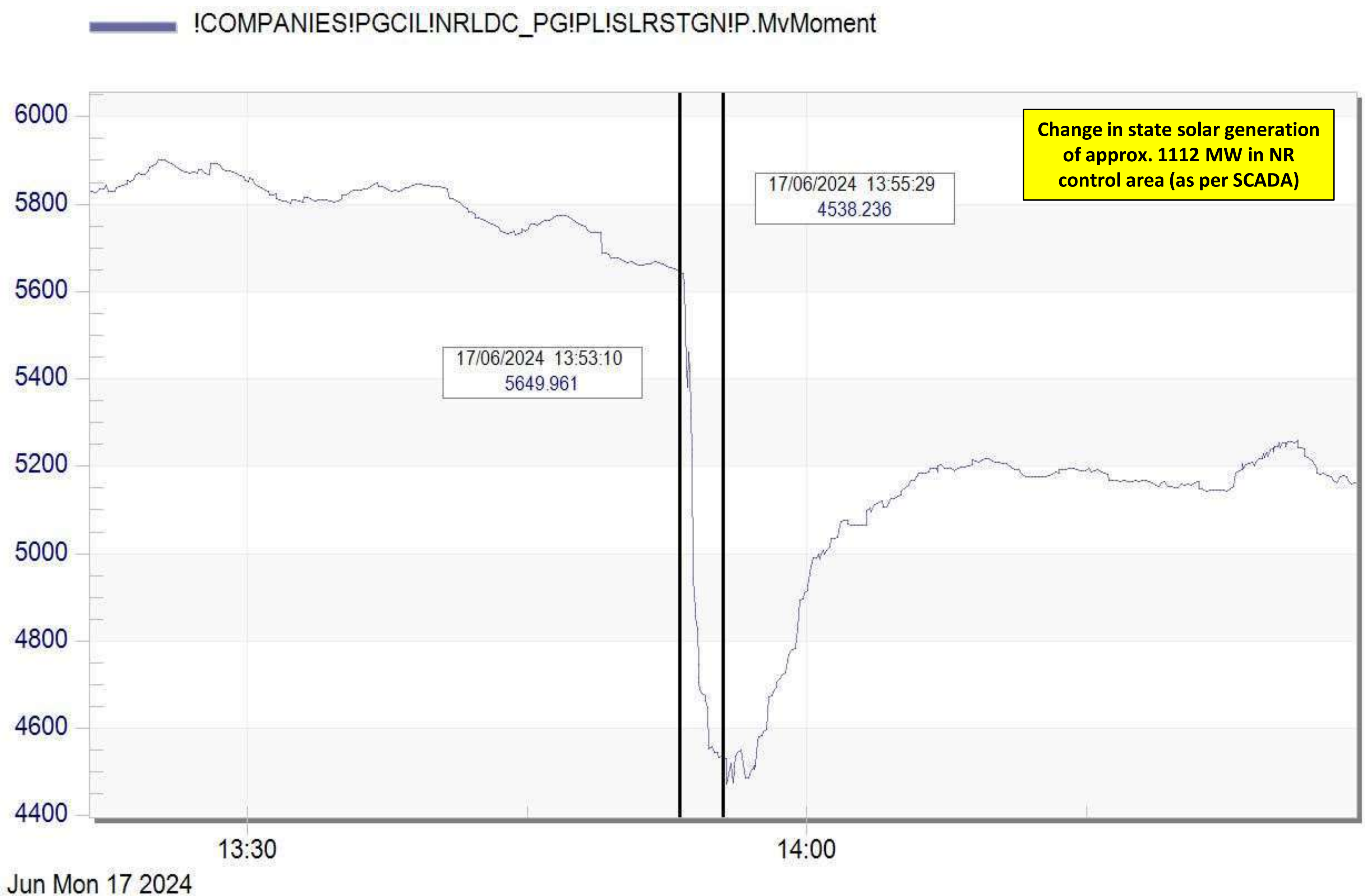
NR central sector hydro generation during the event



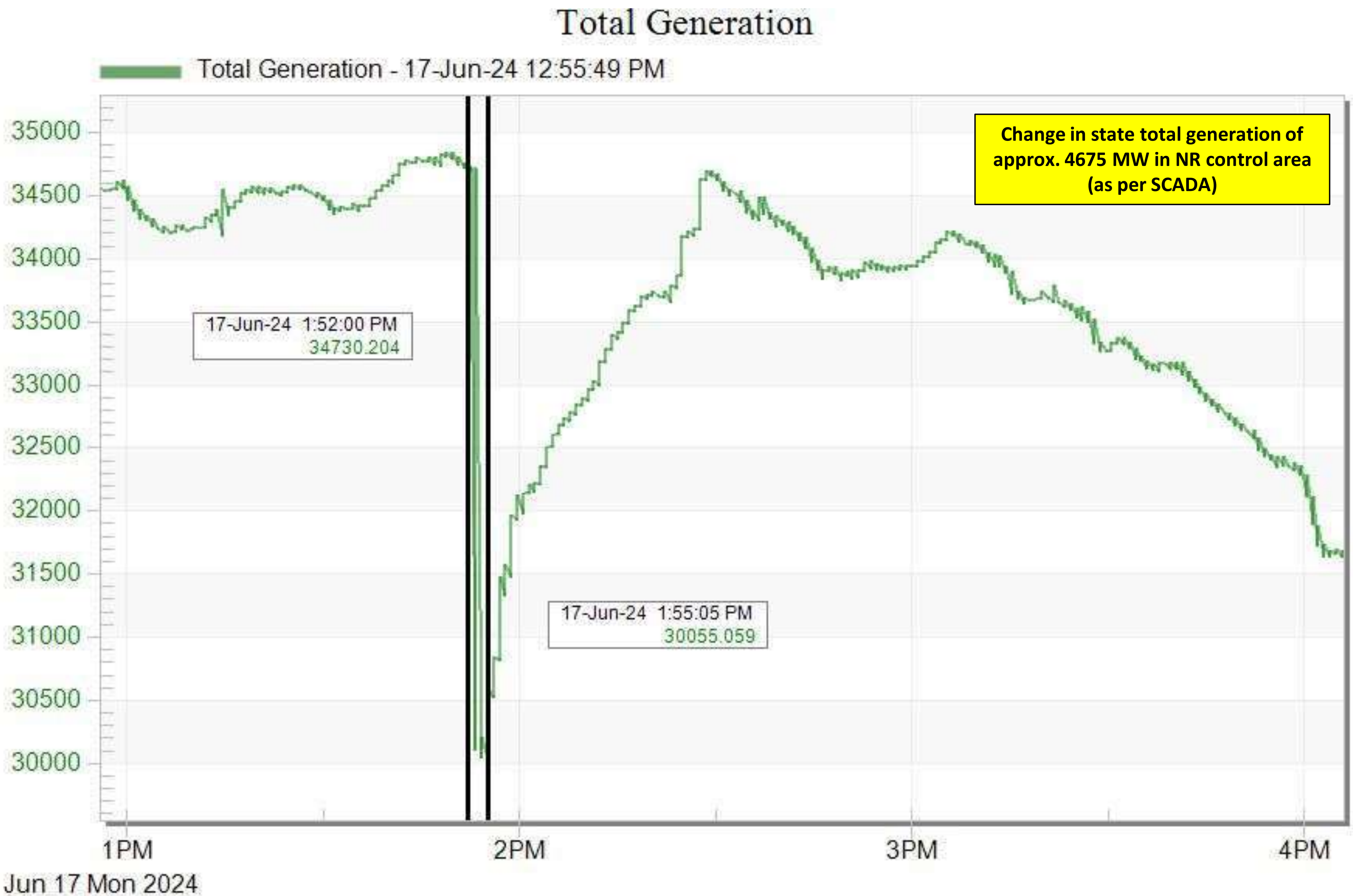
NR total Solar generation during the event



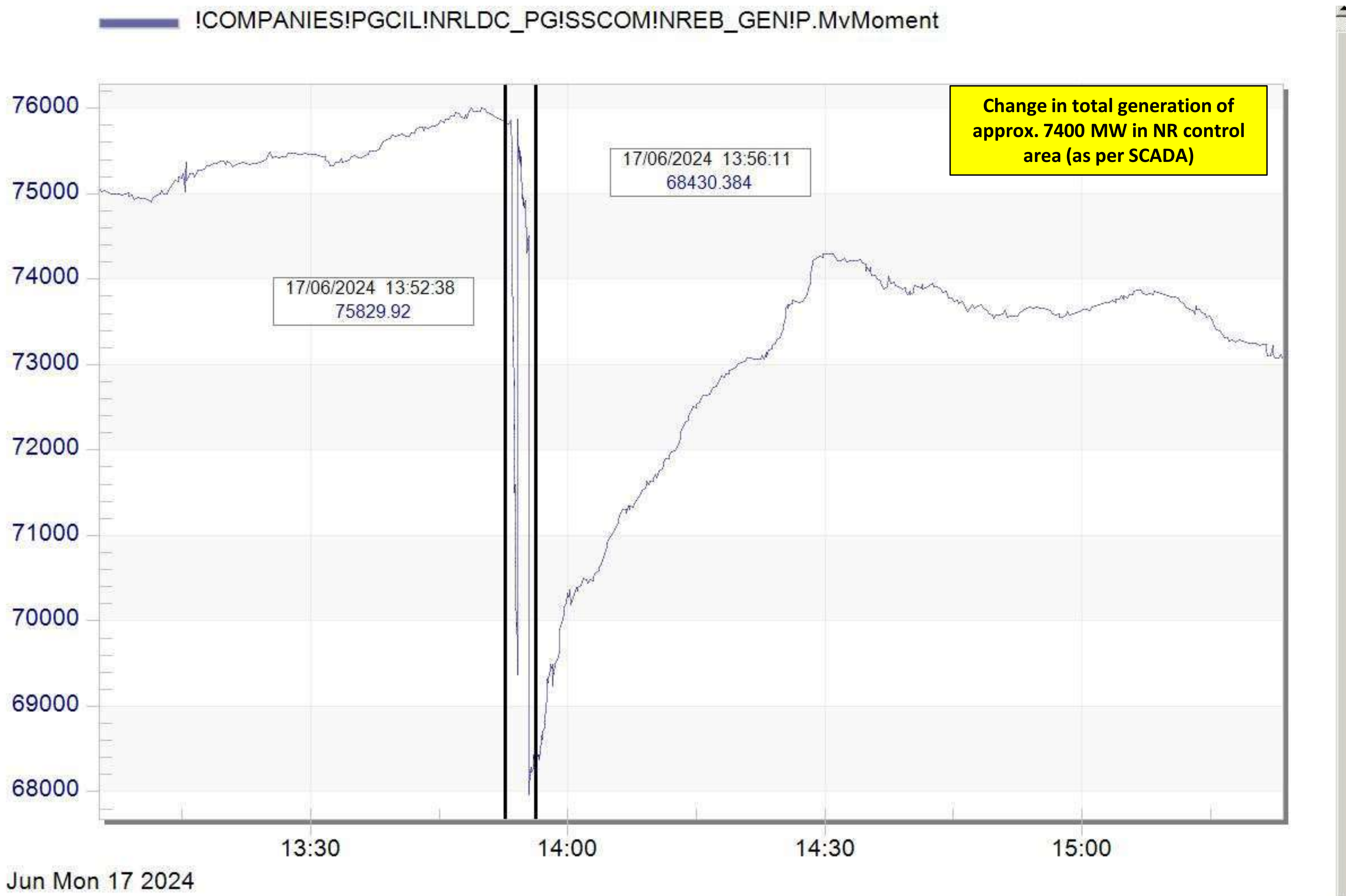
NR State Solar generation during the event



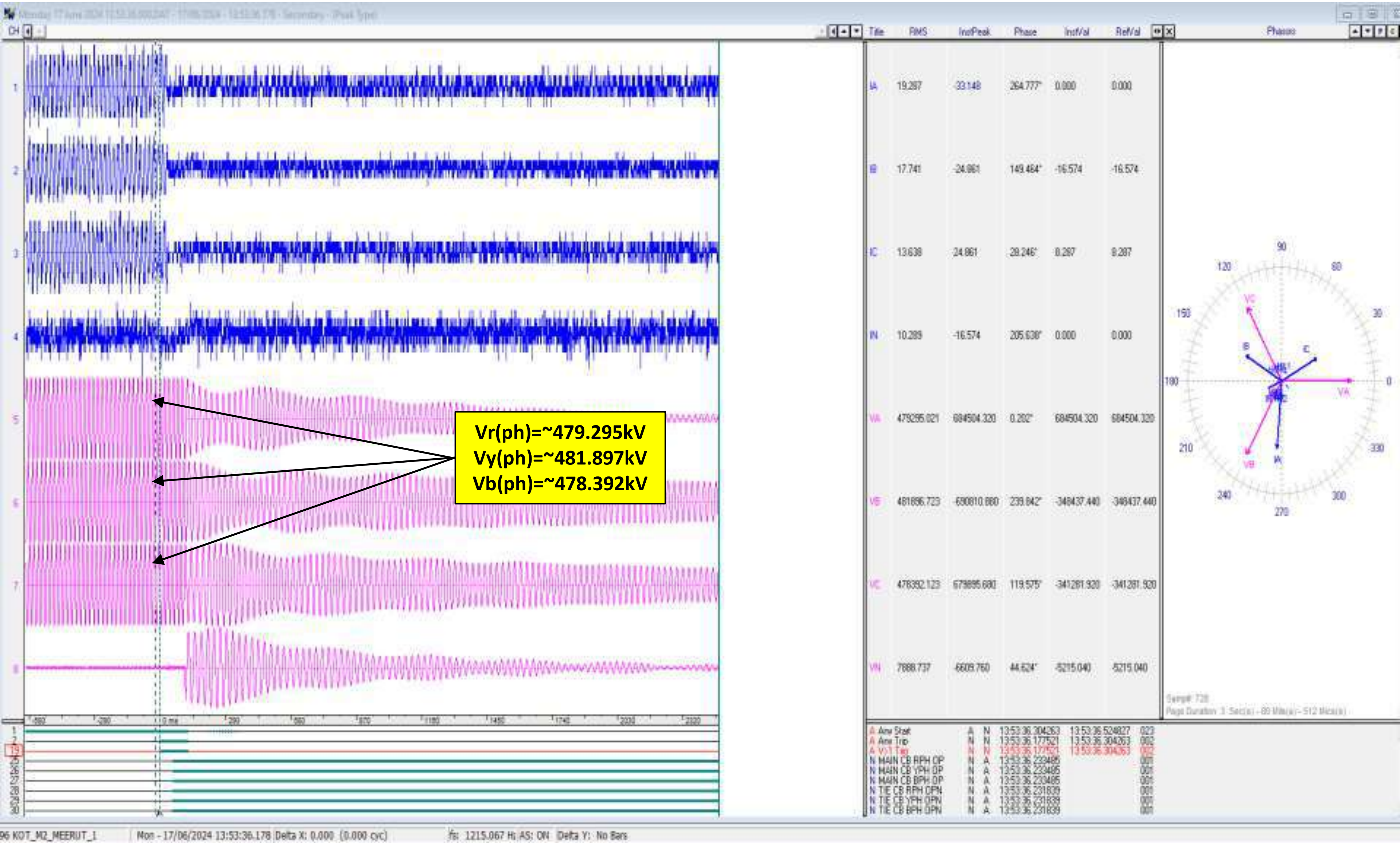
NR total state generation during the event



NR total generation during the event



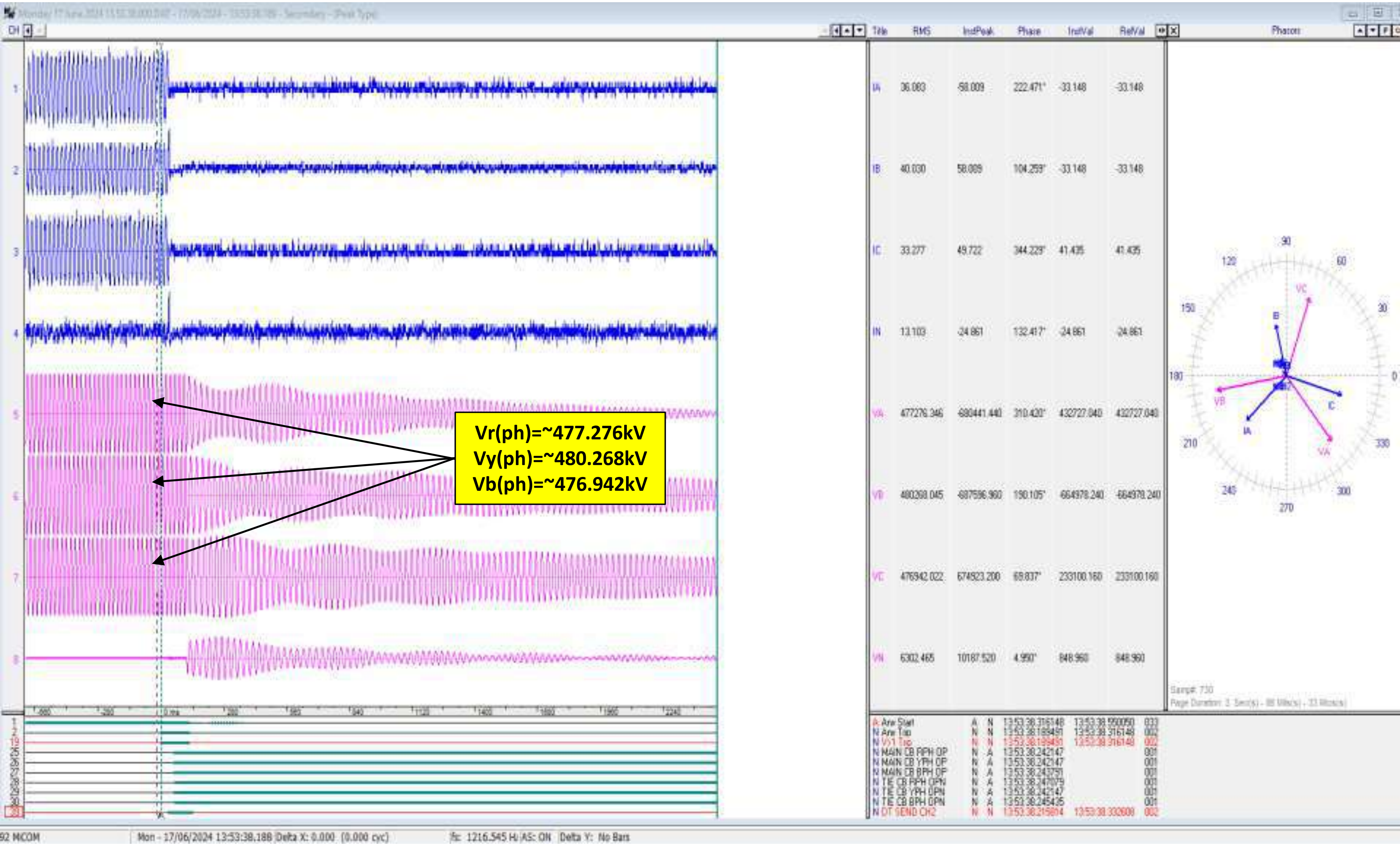
DR of 765 kV Koteshwar(end)-Meerut (PG) Ckt-1



- ✓ Over-voltage stage-1 operated
- ✓ Voltage increased upto ~1.091p.u.

System Frequency recorded : 50.64 Hz
(As per relay event logger)

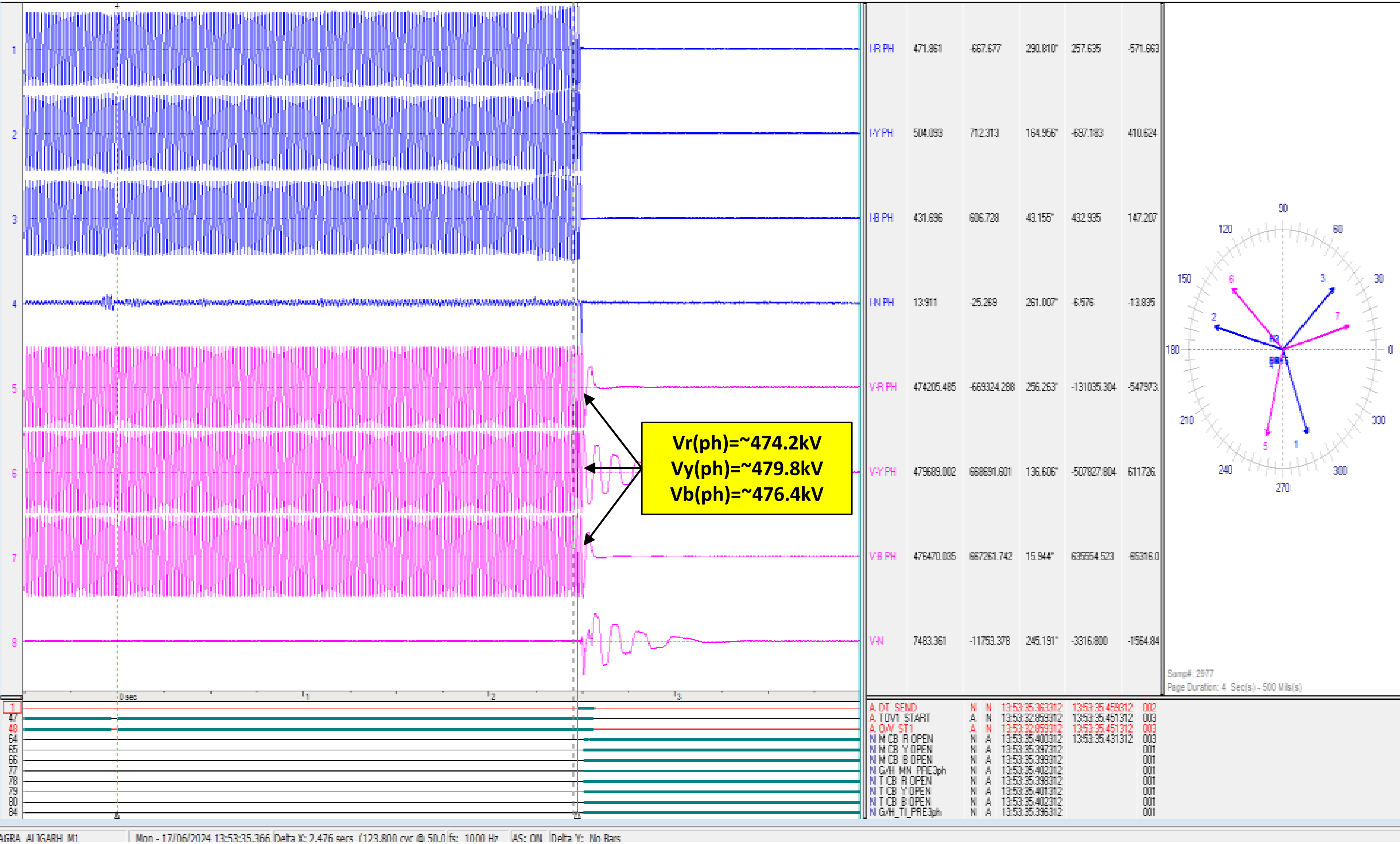
DR of 765 kV Koteshwar(end)-Meerut (PG) Ckt-2



- ✓ Over-voltage stage-1 operated
- ✓ Voltage increased upto ~1.087p.u.

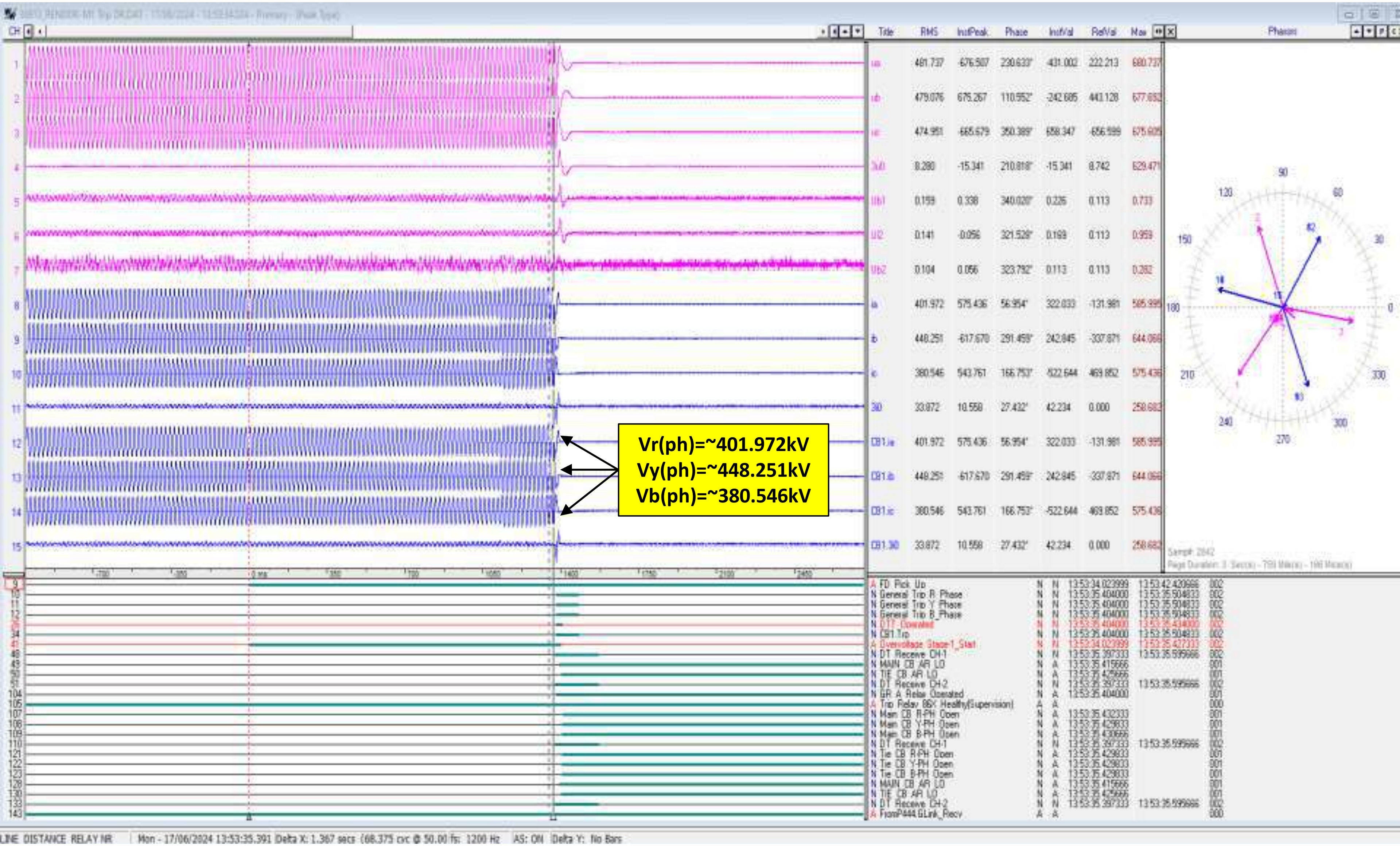
System Frequency recorded : 50.65 Hz
(As per relay event logger)

DR of 765 KV Agra(end)-Aligarh (PG) Ckt-1



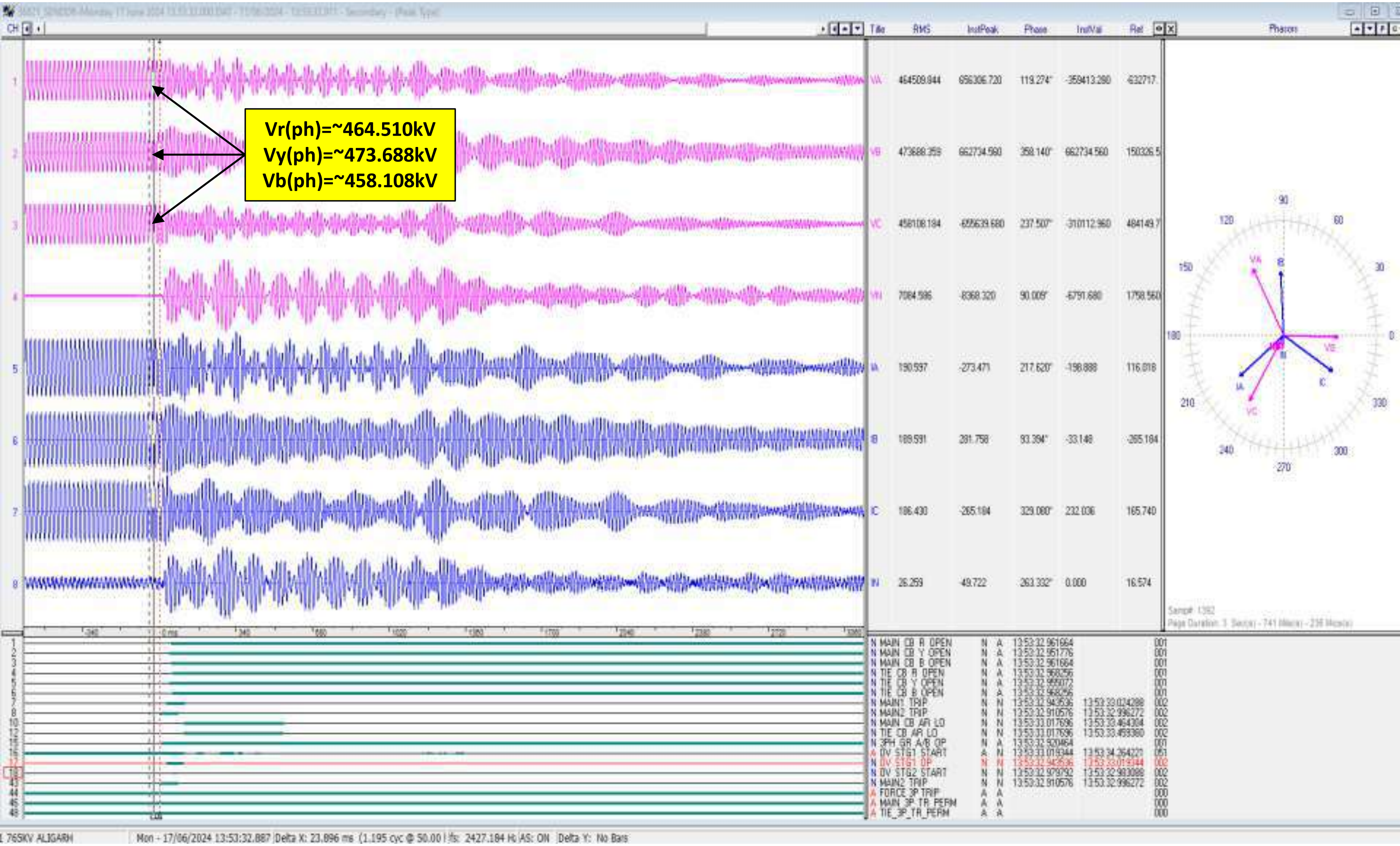
- ✓ Over-voltage stage-1 operated; DT sent
- ✓ Voltage increased upto ~1.084p.u.

DR of 765 KV Agra-Aligarh (end) (PG) Ckt-1



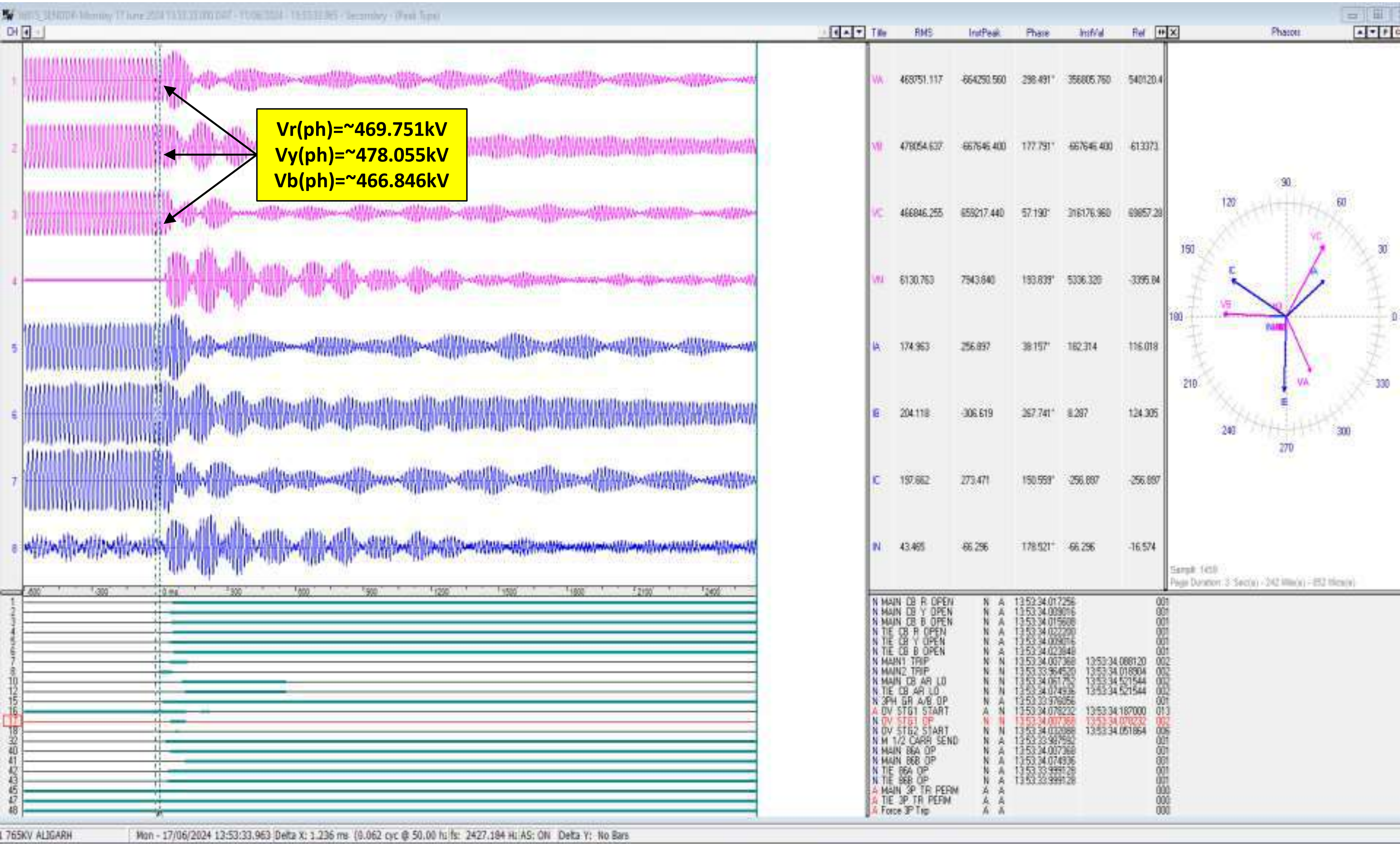
- ✓ O/V Stage-1 started; DT received; Direct Transfer Trip (DTT) operated
- ✓ Voltage increased upto ~1.015p.u.

DR of 765 KV Aligarh(PG) (end)-SIKAR_2 (PASTL) Ckt-1



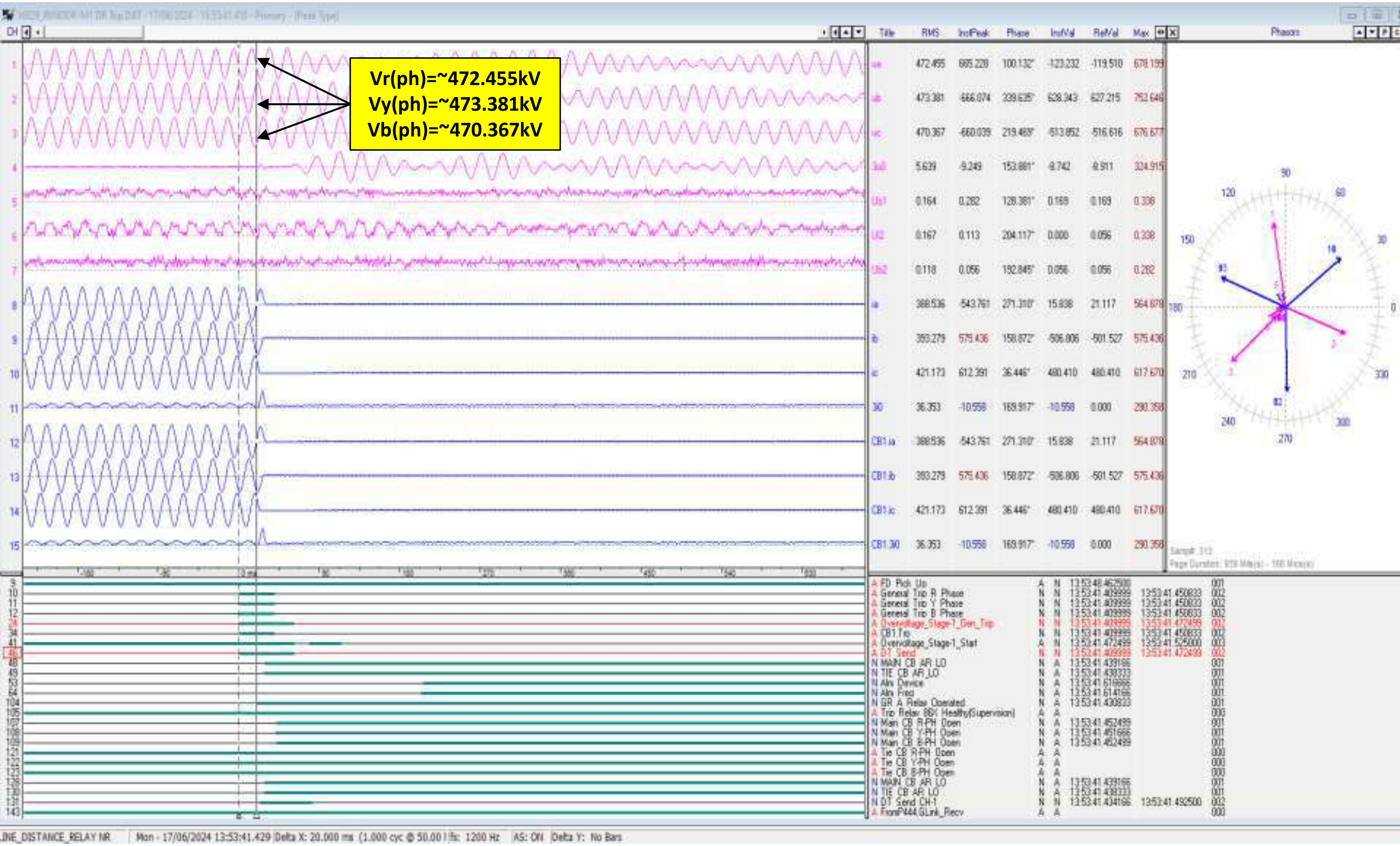
- ✓ O/V Stage-1 operated
- ✓ Voltage increased upto ~1.072p.u.

DR of 765 KV Aligarh(PG) (end)-SIKAR_2 (PASTL) Ckt-2



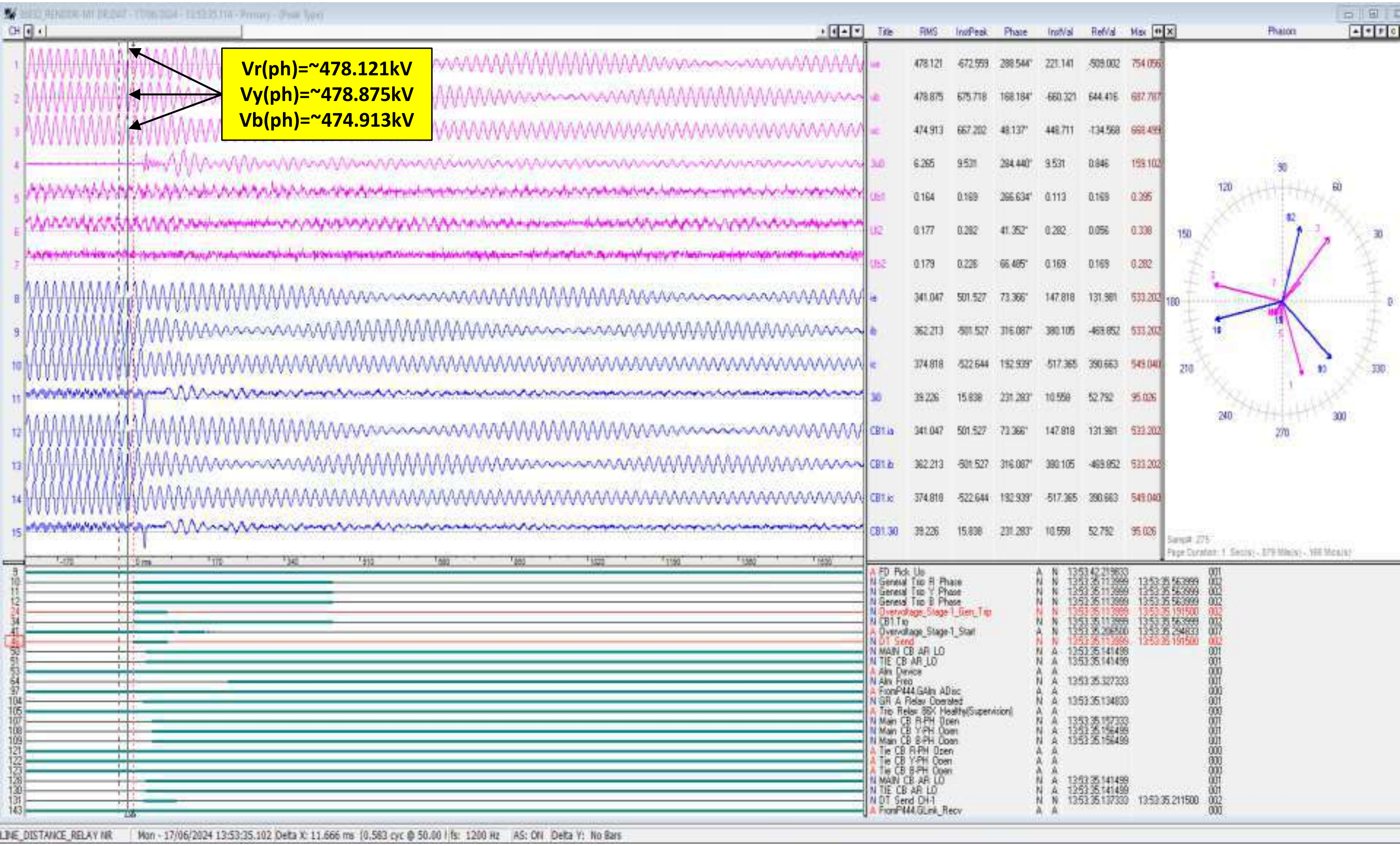
- ✓ O/V Stage-1 operated
- ✓ Voltage increased upto ~1.082p.u.

DR of 765 KV Jhatikara-Aligarh (end) (PG) Ckt-1



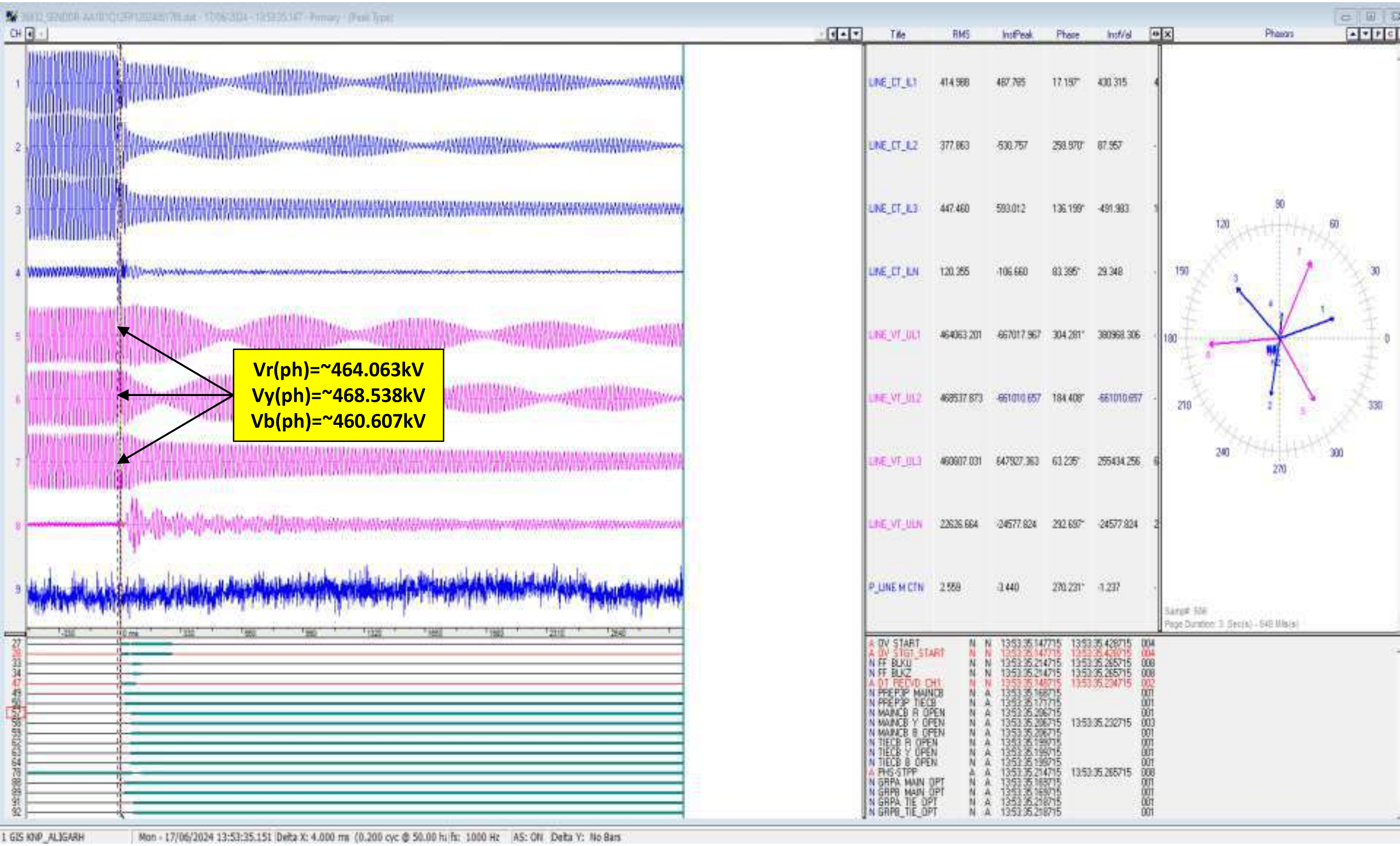
- ✓ O/V Stage-1 operated; DT sent
- ✓ Voltage increased upto ~1.072p.u.

DR of 765 KV Kanpur_GIS-Aligarh (end) (PG) Ckt-1



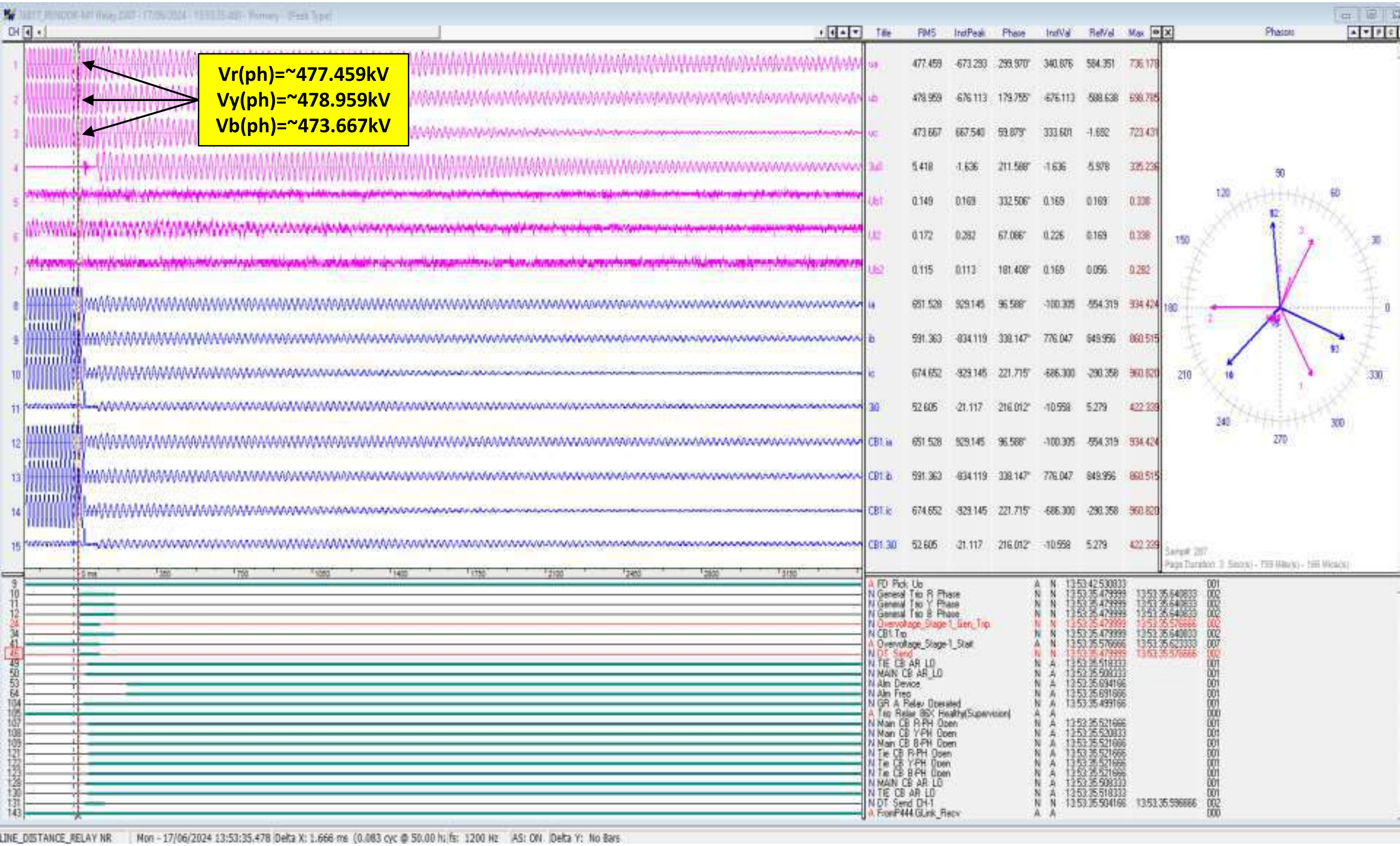
- ✓ O/V Stage-1 operated; DT sent
- ✓ Voltage increased upto ~1.084p.u.

DR of 765 KV Kanpur_GIS (end)-Aligarh (PG) Ckt-1



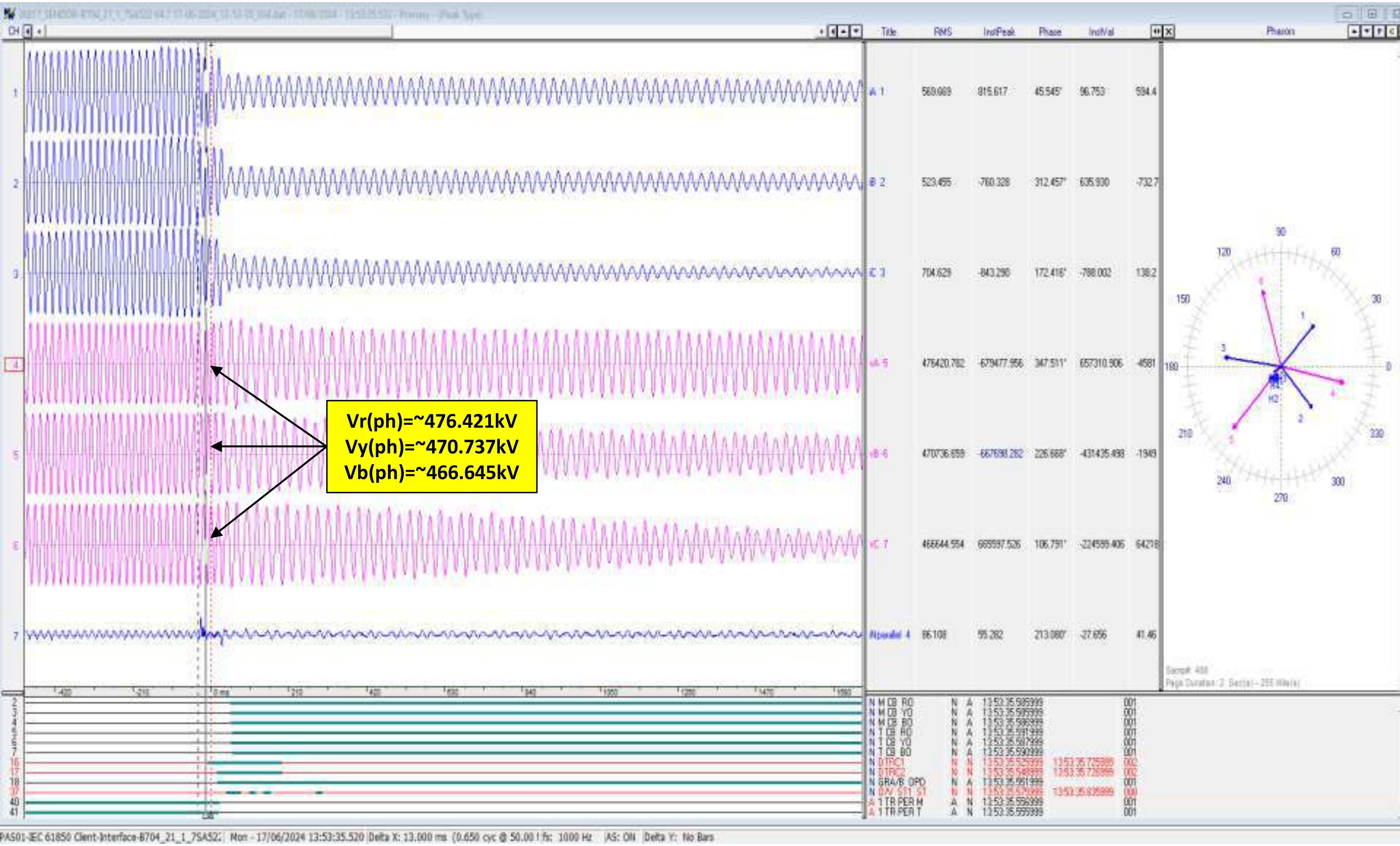
- ✓ O/V Stage-1 started; DT received
- ✓ Voltage increased upto ~1.061p.u.

DR of 765 KV Orai-Aligarh (end) (PG) Ckt-1



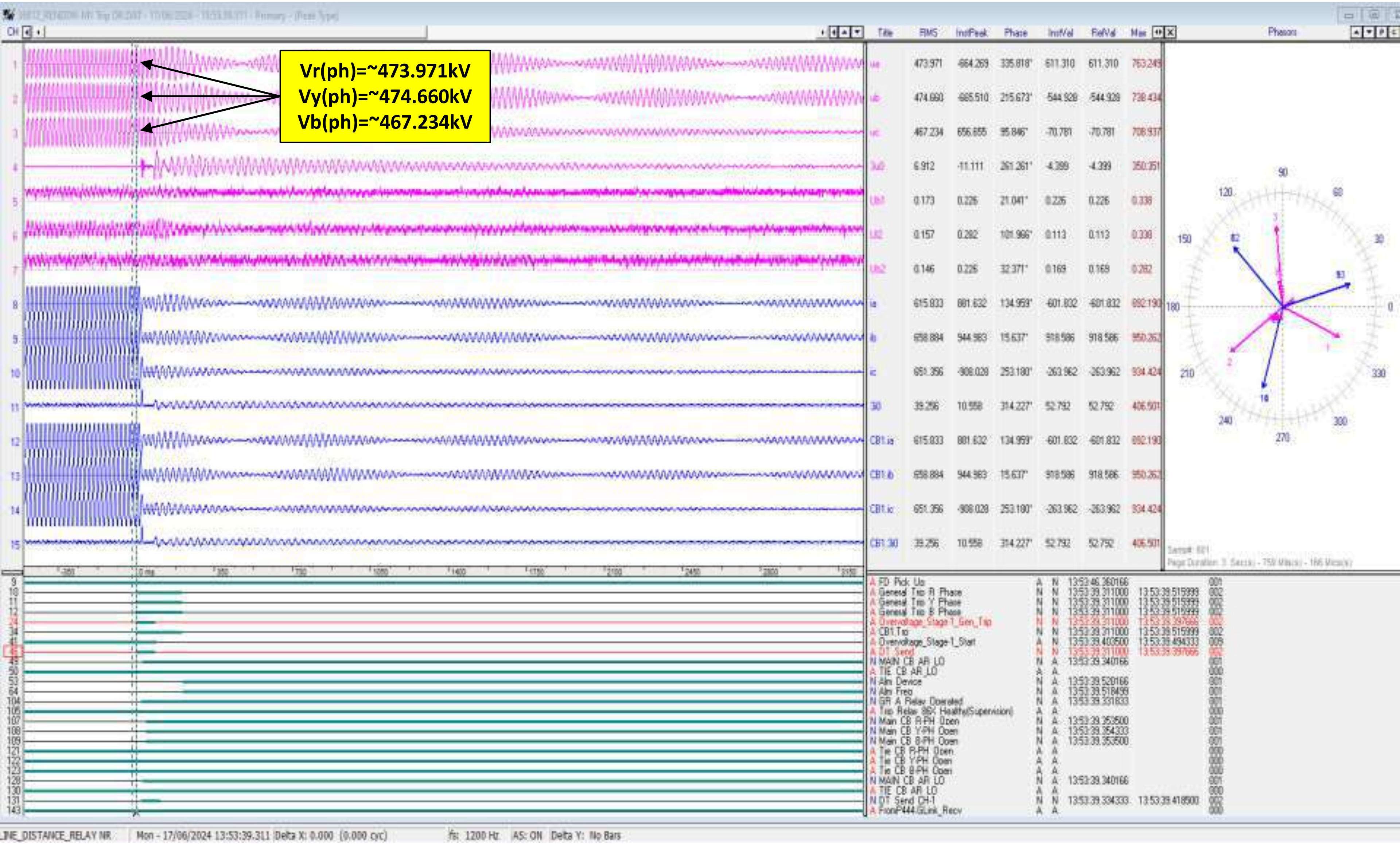
- ✓ O/V Stage-1 operated; DT sent
- ✓ Voltage increased upto ~1.084p.u.

DR of 765 KV Orai (end)-Aligarh (PG) Ckt-1



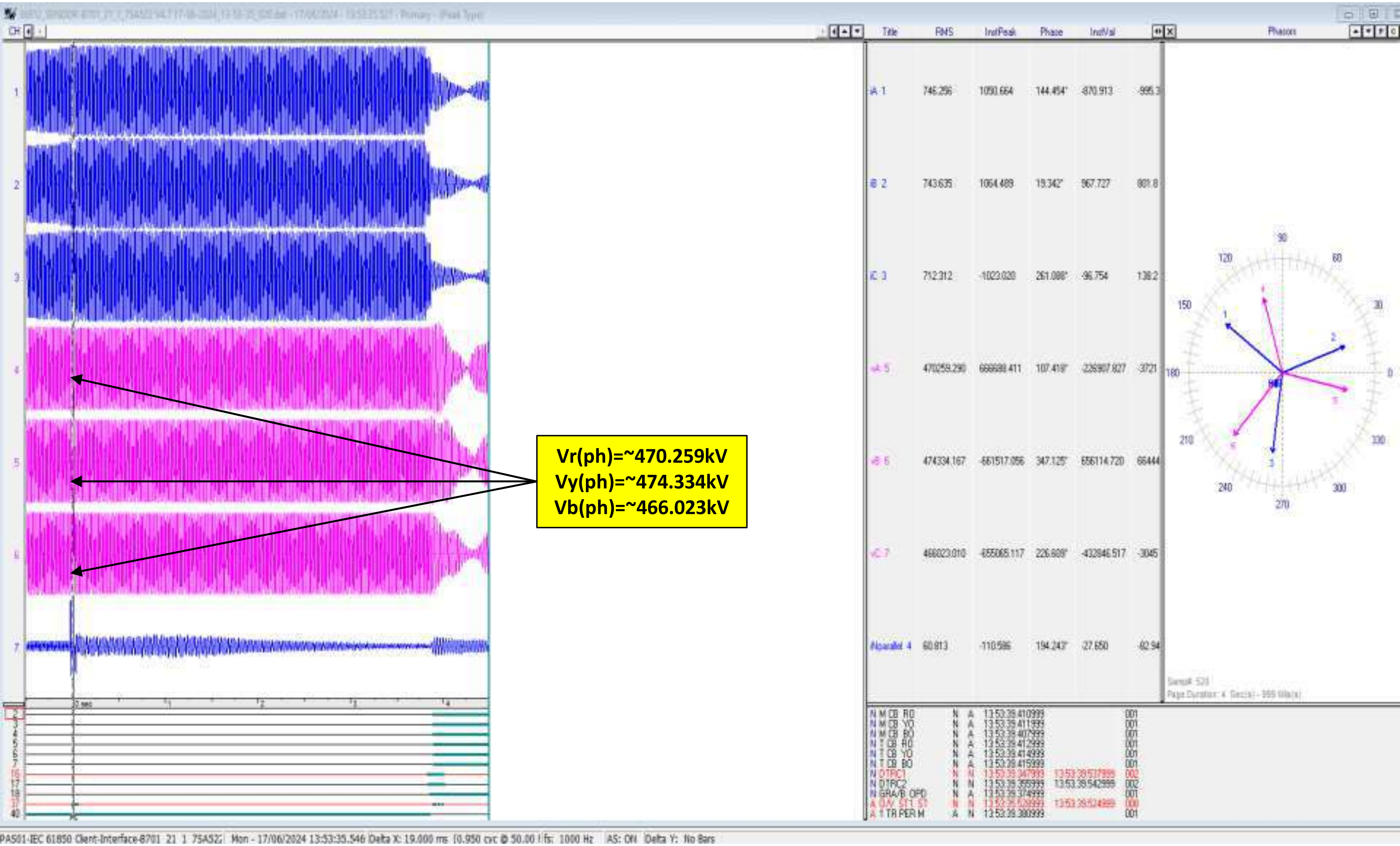
- ✓ O/V Stage-1 started; DT received
- ✓ Voltage increased upto ~1.079p.u.

DR of 765 KV Orai-Aligarh (end) (PG) Ckt-2



- ✓ O/V Stage-1 operated; DT sent
- ✓ Voltage increased upto ~1.075p.u.

DR of 765 KV Orai (end)-Aligarh (PG) Ckt-2



- ✓ O/V Stage-1 started; DT received
- ✓ Voltage increased upto ~1.074p.u.

SCADA SOE

Time	Station Name	Voltage Level	Element Name	Element Type	Element Status	Remarks
13:53:19,973	KURHV_PG	400	BKC6_2	Circuit Breaker	Open	800 kV HVDC Kurukshetra(PG) Pole-1, 2, 3 and 4 opened
13:53:19,973	KURHV_PG	400	BKC4_3	Circuit Breaker	Open	
13:53:19,973	KURHV_PG	400	BKC4_1	Circuit Breaker	Open	
13:53:19,974	KURHV_PG	400	BKC5_3	Circuit Breaker	Open	
13:53:19,974	KURHV_PG	400	BKC5_1	Circuit Breaker	Open	
13:53:19,974	KURHV_PG	400	BKC4_5	Circuit Breaker	Open	
13:53:19,974	KURHV_PG	400	BKC4_4	Circuit Breaker	Open	
13:53:19,975	KURHV_PG	400	BKC5_2	Circuit Breaker	Open	
13:53:19,976	KURHV_PG	400	BKC4_2	Circuit Breaker	Open	
13:53:20,083	KURHV_PG	400	BKC6_1	Circuit Breaker	Open	
13:53:20,975	KURHV_PG	400	BKC1_5	Circuit Breaker	Open	
13:53:20,975	KURHV_PG	400	BKC1_2	Circuit Breaker	Open	
13:53:20,975	KURHV_PG	400	BKC1_1	Circuit Breaker	Open	
13:53:20,976	KURHV_PG	400	BKC3_1	Circuit Breaker	Open	
13:53:20,976	KURHV_PG	400	BKC2_2	Circuit Breaker	Open	
13:53:20,977	KURHV_PG	400	BKC2_5	Circuit Breaker	Open	
13:53:20,977	KURHV_PG	400	BKC3_2	Circuit Breaker	Open	
13:53:20,977	KURHV_PG	400	BKC2_4	Circuit Breaker	Open	
13:53:20,977	KURHV_PG	400	BKC2_3	Circuit Breaker	Open	
13:53:20,97						

Time	Station Name	Voltage Level	Element Name	Element Type	Element Status	Remarks
13:53:21,207	BHABA_HP	220	05H03	Circuit Breaker	Open	CB at 220kV side of 40 MW Unit-3 at Bhaba(HP) opened
13:53:22,104	BHDRA_RS	220	04T1	Circuit Breaker	Open	CB at 220kV side of 200/132kV 100 MVA ICT-1 at Bhadra(RS) opened
13:53:22,251	BHAKR_BB	220	21G6	Circuit Breaker	Open	CB at 220kV side of 157 MW Unit-6 at Bhakra(BBMB) opened
13:53:22,256	BHAKR_BB	220	27G8	Circuit Breaker	Open	CB at 220kV side of 157 MW Unit-8 at Bhakra(BBMB) opened
13:53:22,285	BHAKR_BB	220	31G9	Circuit Breaker	Open	CB at 220kV side of 157 MW Unit-9 at Bhakra(BBMB) opened
13:53:22,483	BADDI_HP	220	12PINJR2	Circuit Breaker	Open	CB at Baddi(HP) end of 220 KV Baddi(HP)-Pinjore (HV) (HPPTCL) Ckt-2 opened
13:53:22,790	BHAKR_BB	220	16H05	Circuit Breaker	Open	CB at 220kV side of 126 MW Unit-6 at Bhakra(BBMB) opened

SCADA SOE

Time	Station Name	Voltage Level	Element Name	Element Type	Element Status	Remarks
13:53:23,509	PANTH_HS	220	98U8	Circuit Breaker	Open	CB at 220kV side of 250 MW Panipat TPS - UNIT 8 opened
13:53:25,100	RSDPH_PS	220	11H04	Circuit Breaker	Open	CB at 220kV side of 150MW Unit-4 at RSDPH(PS) opened
13:53:30,042	SIRSA_HS	220	01FTEBD	Circuit Breaker	Open	CB at Sirsa(HS) end of 220kV Sirsa(HS)-Fatehbad(PG) Ckt opened
13:53:30,090	BHIWN_HS	220	05BHWPG1	Circuit Breaker	Open	CB at Bhiwani(HS) end of 220kV Bhiwani(HS)-Bhiwani(PG) Ckt-1 opened
13:53:30,100	NNKPR_HS	132	01ROPAR2	Circuit Breaker	Open	CB at Nanakpur(HS) end of 132kV Nanakpur(HS)-Ropar(PS) Ckt-2 opened
13:53:32,068	RAMPG_UP	765	02NUPLT1	Circuit Breaker	Open	Tie CB at Rampur(PRSTL) end of 765kV Rampur(PRSTL)-Ghatampur(NUPPL) Ckt opened
13:53:32,068	RAMPG_UP	765	01NUPPL	Circuit Breaker	Open	Main CB at Rampur(PRSTL) end of 765kV Rampur(PRSTL)-Ghatampur(NUPPL) Ckt opened
13:53:32,340	RAMPG_UP	765	06HAPRT2	Circuit Breaker	Open	Tie CB at Rampur(PRSTL) end of 765kV Rampur(PRSTL)-Hapur(UP) Ckt opened
13:53:32,341	RAMPG_UP	765	05HAPR7	Circuit Breaker	Open	Main CB at Rampur(PRSTL) end of 765kV Rampur(PRSTL)-Hapur(UP) Ckt opened
13:53:32,954	ALIGR_PG	765	13SIKR21	Circuit Breaker	Open	Main CB at Aligarh(PG) end of 765kV Aligarh(PG)-Sikar2 Ckt-1 opened
13:53:32,961	ALIGR_PG	765	14TIE	Circuit Breaker	Open	Tie CB at Aligarh(PG) end of 765kV Aligarh(PG)-Sikar2 Ckt-1 opened
13:53:34,011	ALIGR_PG	765	16SIKR22	Circuit Breaker	Open	Main CB at Aligarh(PG) end of 765kV Aligarh(PG)-Sikar2 Ckt-2 opened
13:53:34,016	ALIGR_PG	765	17TIE	Circuit Breaker	Open	Tie CB at Aligarh(PG) end of 765kV Aligarh(PG)-Sikar2 Ckt-2 opened
13:53:35,146	ALIGR_PG	765	07KNPR71	Circuit Breaker	Open	Main CB at Aligarh(PG) end of 765kV Aligarh(PG)-Kanpur Ckt opened
13:53:35,156	DHNDA_HS	400	17MN2TIE	Circuit Breaker	Open	Tie CB at Dhanoda(HS) end of 400 KV Mahindergarh(APL)-Dhanoda(HV) (ATIL) Ckt-2 opened
13:53:35,291	DHNDA_HS	400	14MN1TIE	Circuit Breaker	Open	Tie CB at Dhanoda(HS) end of 400 KV Mahindergarh(APL)-Dhanoda(HV) (ATIL) Ckt-1 opened
13:53:35,323	NMRNA_PG	400	4DHNDA1	Circuit Breaker	Open	Main CB at Neemrana(PG) end of 400kV Neemrana(PG)-Dhanoda(HS) Ckt-1 opened

SCADA SOE

Time	Station Name	Voltage Level	Element Name	Element Type	Element Status	Remarks
13:53:35,353	KISHN_PG	400	24MOGA_1	Circuit Breaker	Open	Main CB at Kishenpur(PG) end of 400 KV Kishenpur-Moga (PG) Ckt-1 opened
13:53:35,353	KISHN_PG	400	23MO1TIE	Circuit Breaker	Open	Tie CB at Kishenpur(PG) end of 400 KV Kishenpur-Moga (PG) Ckt-1 opened
13:53:35,391	ALIGR_PG	765	04AGRA1	Circuit Breaker	Open	Main CB at Aligarh(PG) end of 765 KV Agra-Aligarh (PG) Ckt opened
13:53:35,400	AGRA__PG	765	5T2ALGRH	Circuit Breaker	Open	Tie CB at Agra(PG) end of 765 KV Agra-Aligarh (PG) Ckt opened
13:53:35,400	AGRA__PG	765	4ALIGRH1	Circuit Breaker	Open	Main CB at Agra(PG) end of 765 KV Agra-Aligarh (PG) Ckt opened
13:53:35,403	ALIGR_PG	765	05AG1OR2	Circuit Breaker	Open	Tie CB at Aligarh(PG) end of 765 KV Aligarh-Orai (PG) Ckt-2 opened
13:53:35,509	ALIGR_PG	765	03ORAI1	Circuit Breaker	Open	Main CB at Aligarh(PG) end of 765 KV Aligarh-Orai (PG) Ckt-1 opened
13:53:35,510	ALIGR_PG	765	02GN1OR1	Circuit Breaker	Open	Tie CB at Aligarh(PG) end of 765 KV Aligarh-Orai (PG) Ckt-1 opened
13:53:35,537	NMRNA_PG	400	5BBITIE	Circuit Breaker	Open	Tie CB at Neemrana(PG) end of 400kV Neemrana(PG)-Dhanoda(HS) Ckt-1 opened
13:53:35	ORAI_PG	765	05AL1T2	Circuit Breaker	Open	Tie CB at Orai(PG) end of 765 KV Aligarh-Orai (PG) Ckt-2 opened
13:53:36,155	KISHN_PG	400	21MOGA_2	Circuit Breaker	Open	Main CB at Kishenpur(PG) end of 400 KV Kishenpur-Moga (PG) Ckt-2 opened
13:53:36,159	MOGA__PG	400	20HS3KI2	Circuit Breaker	Open	Tie CB at Moga(PG) end of 400 KV Kishenpur-Moga (PG) Ckt-2 opened
13:53:36,167	KISHN_PG	400	20WNPO4T	Circuit Breaker	Open	Tie CB at Kishenpur(PG) end of 400 KV Kishenpur-Moga (PG) Ckt-2 opened
13:53:36,229	KTSWR_PG	765	11T4MRT1	Circuit Breaker	Open	Tie CB at Koteshwar(PG) end of 765kV Koteshwar-Meerut(PG) Ckt-1 opened
13:53:36,231	KTSWR_PG	765	12MEERT1	Circuit Breaker	Open	Main CB at Koteshwar(PG) end of 765kV Koteshwar-Meerut(PG) Ckt-1 opened
13:53:36	ORAI_PG	765	04ALIGR1	Circuit Breaker	Open	Main CB at Orai(PG) end of 765 KV Aligarh-Orai (PG) Ckt-1 opened
13:53:36,443	MEERT_PG	765	8T3K1TIE	Circuit Breaker	Open	Tie CB at Meerut(PG) end of 765kV Koteshwar-Meerut(PG) Ckt-1 opened
13:53:36,472	MEERT_PG	765	7KTSWR1	Circuit Breaker	Open	Main CB at Meerut(PG) end of 765kV Koteshwar-Meerut(PG) Ckt-1 opened

SCADA SOE

Time	Station Name	Voltage Level	Element Name	Element Type	Element Status	Remarks
13:53:37,316	KTSWR_PG	400	07TH1	Circuit Breaker	Open	Line CB at Koteshwar(PG) end of 400kV Koteshwar(PG)-Koteshwar(THDC) Ckt-1 opened
13:53:38,240	KTSWR_PG	765	6MEERT2	Circuit Breaker	Open	Main CB at Koteshwar(PG) end of 765kV Koteshwar-Meerut(PG) Ckt-2 opened
13:53:38,243	KTSWR_PG	765	5T2MERT2	Circuit Breaker	Open	Tie CB at Koteshwar(PG) end of 765kV Koteshwar-Meerut(PG) Ckt-2 opened
13:53:38,360	MEERT_PG	765	2T1K2TIE	Circuit Breaker	Open	Tie CB at Meerut(PG) end of 765kV Koteshwar-Meerut(PG) Ckt-2 opened
13:53:39,019	MEERT_PG	765	1KTSWR2	Circuit Breaker	Open	Main CB at Meerut(PG) end of 765kV Koteshwar-Meerut(PG) Ckt-2 opened
13:53:39,342	ALIGR_PG	765	06ORAI2	Circuit Breaker	Open	Main CB at Aligarh(PG) end of 765 KV Aligarh-Orai (PG) Ckt-2 opened
13:53:39	ORAI_PG	765	02AL2T1	Circuit Breaker	Open	Tie CB at Orai(PG) end of 765 KV Aligarh-Orai (PG) Ckt-2 opened
13:53:39,772	KTSWR_TH	400	04KTSWR1	Circuit Breaker	Open	Line CB at Koteshwar(THDC) end of 400kV Koteshwar(PG)-Koteshwar(THDC) Ckt-1 opened
13:53:40	ORAI_PG	765	01ALIGR2	Circuit Breaker	Open	Main CB at Orai(PG) end of 765 KV Aligarh-Orai (PG) Ckt-2 opened
13:53:41,438	ALIGR_PG	765	10JTIKR1	Circuit Breaker	Open	Main CB at Aligarh(PG) end of 765kV Aligarh(PG)-Jhatikara Ckt opened
13:53:42,957	RAJWT_RS	220	05U1	Circuit Breaker	Open	CB at 220kV side of 135 MW Rajwest (IPP) LTPS - UNIT 1 opened
13:54:11,366	HAPR7_UP	765	704RMPR	Circuit Breaker	Open	Main CB at Hapur(UP) end of 765kV Rampur(PRSTL)-Hapur(UP) Ckt opened

SCADA SOE

Time	Station Name	Voltage Level	Element Name	Element Type	Element Status	Remarks
13:55:21	MNDRG_PG	400	3CBHIWN3	Circuit Breaker	Open	Tie CB at Mahindergarh(APL) end of 400 KV Mahindergarh(APL)-Bhiwani(PG) (PG) Ckt-3 opened
13:55:21	MNDRG_PG	400	1ABHWNI4	Circuit Breaker	Open	Main CB at Mahindergarh(APL) end of 400 KV Mahindergarh(APL)-Bhiwani(PG) (PG) Ckt-3 opened
13:55:21	MNDRG_PG	400	3ADHNDA2	Circuit Breaker	Open	Main CB at Mahindergarh(APL) end of 400 KV Mahindergarh(APL)-Dhanoda(HV) (ATIL) Ckt-2 opened
13:55:21	MNDRG_PG	400	3BTIE	Circuit Breaker	Open	Tie CB at Mahindergarh(APL) end of 400 KV Mahindergarh(APL)-Dhanoda(HV) (ATIL) Ckt-1 opened
13:55:21	MNDRG_PG	400	1BTIE	Circuit Breaker	Open	Tie CB at Mahindergarh(APL) end of 400 KV Mahindergarh(APL)-Dhanoda(HV) (ATIL) Ckt-2 opened
13:57:58,680	DURLA_HS	220	02CHEKA1	Circuit Breaker	Open	
13:59:11,802	DURLA_HS	220	03CHEKA2	Circuit Breaker	Open	
13:59:33,066	SIRSA_HS	220	04T2	Circuit Breaker	Open	CB at 220kV side of 220/132kV ICT-2 at Sirsa(HS) opened
13:59:34,920	SIRSA_HS	220	03T1	Circuit Breaker	Open	CB at 220kV side of 220/132kV ICT-1 at Sirsa(HS) opened
13:59:42,887	SIRSA_HS	132	05T1	Circuit Breaker	Open	CB at 132kV side of 220/132kV ICT-1 at Sirsa(HS) opened
13:59:44,593	SIRSA_HS	132	06T2	Circuit Breaker	Open	CB at 132kV side of 220/132kV ICT-2 at Sirsa(HS) opened
14:00:00,000	KRCHM_PG	400	G4H04	Circuit Breaker	Open	CB at 400kV sid eof 250 MW Karcham Wangtoo HPS - UNIT 4 opened
14:00:00,000	KRCHM_PG	400	G2H02	Circuit Breaker	Open	CB at 400kV side of 250 MW Karcham Wangtoo HPS - UNIT 2 opened

Complaince Status of RE plants vis-à-vis CEA Technical Standards for Connectivity to The Grid

S.No	Connected at	Name of SPPD/Generator	Installed Capacity (MW)	Inverter/ WTG Make	Inverter/WTG Model	PMU Code	Voltage (during fault at POI (PU) (13:53:19.680)	Highest Voltage recorded at POI (PU)	Active Power (MW)			Reactive power (MVAR			HVRT/LVRT Compliance	Reactive Power Support during fault condition (partially, fully, non-complaint)
									Before at (13:53:18.600)	After One second (13:53:20.600)	Percentage Recovered immediately after fault	Before at (13:53:19.520)	At fault Instant (13:53:19.600)	Immediately after fault clearance (13:53:19.680)		
1	400 kV Bhadla I (PG)	Adani Solar Enegry Jodhpur Two Limited, Rawara	50	HUAWEI	SUN2000-185KTL-H1	RAWRA_IP	PMU DATA NOT AVAILABLE									
2		Adani Solar Enegry Four Private Limited	50	HUAWEI	SUN2000-185KTL-H2											
3		Adani Renewable Energy (RJ) limited Rawara	200	HUAWEI	SUN2000-95KTL-INH0											
4		Mahindra Renewable Private Limited (MRPL)	250	SUNGROW	SUNGROW SG3125HV-20	MRPL_IP										
5		Essel Saurya Urja Company of Rajasthan Limited (ESURL)	300	SINENG	EP3125-HA-UD	ESURL_IP										
6		Azure Power Maple Pvt. Limited (AZRMP)	300	HUAWEI	SUN2000-200KTL-H2	AZRMP_IP										
7		ACME Chittorgarh Solar Energy Pvt. Ltd (ACME)	250	TBEA	TC3750KF	ACME_IP	0.83	1.06	226.59	228.97	101%	22.29	21.69	20.21	compliant	opposite response
8		Azure Power Forty One Private Limited (AZR41)	300	HUAWEI	SUN2000-185KTL-INH0	AZR41_IP	PMU DATA NOT AVAILABLE									
9		RENEW SOLAR POWER Pvt. Ltd. Bhadla	50	HUAWEI	SUN2000-95KTL-INH1	AREPR_IP										
10		AZURE POWER INDIA Pvt. Ltd., Bhadla	200	SUNGROW/TMEIC	SG3125HV/PVH-L2500EQ											
11		TPREL (Chhayan)	300	TMEIC/SUNGROW	PVH-L2500EQ-2/SG3125HV	TPREL_IP	0.83	1.06	280.01	238.96	85%	-22.12	4.91	1.53	Non compliant	
12		SB ENERGY FOUR PRIVATE LIMTED, Bhadla	200	KEHUA	SPI3125K-B-H	SURJA_IP	0.82	1.05	478	472	99%	-4	-22	-15	compliant	opposite response
13		Clean Solar Power (Bhadla) Pvt. Ltd	300	SUNGROW	SG3125HV											
14		Azure Power Thirty Four Pvt. Ltd.	130	TMEIC	PVH-L2500EQ-2	APTFL_IP	PMU DATA NOT AVAILABLE									
15		Clean Solar Power (Jodhpur) Pvt. Ltd.	250	SUNGROW	SG250HX-IN	CSPJP_IP	0.83	1.06	230	205	89%	46	20	19	Non compliant	opposite response
16		Adani Solar Energy RJ Two Pvt. Ltd. (Phalodi)	150	-	-	ASEPH_IP	0.84	1.08	152	152	100%	-1	-8	-7	compliant	opposite response

Status of RE Plants at 765 kV Bhadla 2 (PG)

S.No	Connected at	Name of SPPD/Generator	Installed Capacity (MW)	Inverter/ WTG Make	Inverter/WTG Model	PMU Code	Voltage (during fault at POI (PU) (13:53:19.680)	Highest Voltage recorded at POI (PU)	Active Power (MW)			Reactive power (MVAR			HVRT/LVRT Compliance	Reactive Power Support during fault condition (partially, fully, non-complaint)
									Before at (13:53:18.600)	After One second (13:53:20.600)	Percentage Recovered immediately after fault	Before at (13:53:19.520)	At fault Instant (13:53:19.600)	Immediately after fault clearance (13:53:19.680)		
1	765 kV Bhadla 2 (PG)	Mega Suryaurja Private Limited (MSUPL)	250	SINENG	EP3125-HA-UD	MSUPL_IP	0.84	1.05	214.32	220.01	103%	-1	0	3	compliant	Partial response
2		ACME Heergarh Powertech Private Limited (AHPPL)	300	SUNGROW/SINENG	SG3125HV-31/EP3125-HA-UD	AHPPL_IP	0.85	1.06	292	296	101%	-2	-21	-18	compliant	opposite response
3		ABC Renewable Energy (RJ-01) Private Limited (ABCRL)	300	TBEA	TC3125KF	ABCRL_IP	0.86	1.06	299	294	98%	0	-4	-5	compliant	opposite response
4		NTPC Kolayat_1	200	KEHUA	SPI3125K-B-H	SKBSL_NT	0.86	1.06	367	366	100%	-3.1	-8.4	-4.2	compliant	opposite response
5		NTPC Kolayat_2	200			SKBS2_NT	0.86	1.06	146	147	100%	146.4	108.7	113.4	compliant	opposite response
6		Avaada Sunrays Pvt. Ltd.	320			ASEPL_IP	0.86	1.06	310	309	100%	-1	-7	-5	compliant	opposite response
7		NTPC Nokhra	250	SINENG	EP-3125-HA-UD	Nokra_NT	0.85	1.06	257.82	248.30	96%	-0.57	-3.69	-3.12	compliant	opposite response
				TBEA	TBEA TC 3125 KF											
8		Rising Sun Energy-K Pvt. Ltd.	190	-	-	RSEKPL_IP	PMU DATA NOT AVAILABLE									
9		AMP Energy Green Six Pvt. Ltd.	100	-	-	AEGPL_IP	0.86	1.06	208	96	46%	0	4	4	Non compliant	Partial response

Status of RE Plants at 765 kV Bikaner (PG)

S.No	Connected at	Name of SPPD/Generator	Installed Capacity (MW)	Inverter/ WTG Make	Inverter/WTG Model	PMU Code	Voltage (during fault at POI (PU) (13:53:19.680)	Highest Voltage recorded at POI (PU)	Active Power (MW)			Reactive power (MVAR			HVRT/LVRT Compliance	Reactive Power Support during fault condition (partially, fully, non-complaint)
									Before at (13:53:18.600)	After One second (13:53:20.600)	Percentage Recovered immediately after fault	Before at (13:53:19.520)	At fault Instant (13:53:19.600)	Immediately after fault clearance (13:53:19.680)		
1	765 kV Bikaner (PG)	Avaada RJHN_240MW	240	SINENG	EP-3125-HA-UD	AVADA_IP	0.81	1.07	770.84	778.69	101%	49.74	41.11	47.35	compliant	opposite response
2		Avaada sunce energy Pvt limited	350	SINENG	EP-3125-HA-UD											
3		Avaada Sustainable RJ Pvt. Ltd.	300	SINENG	EP-3125-HA-UD											
4		Ayana Renewable Power	300	SUNGROW	SG3125HV	AYANA_IP	PMU DATA UNAVAILABLE									
5		Azure Power	600	SUNGROW	SG3125HV	AZR43_IP	0.80	1.06	525	528	101%	25	5	3	compliant	opposite response
6		SBSR Power Cleantech Eleven Private Limited (SPCEP)	212.5	KEHUA	SPI3125K-B-H	SPCEP_IP	0.82	1.07	266	250	94%	60	23	25	compliant	opposite response
7		Thar Surya 1 Private Limited (TS1PL)	300	GAMESA	GAMESA E - 2.25MVA-SB-I	TS1PL_IP	0.82	1.07	281	18	6%	31	82	82	Non compliant	Partial response
8		Renew Surya Ravi Private Limited Bikaner (RSRPL)	300	SUNGROW	SG250HX-IN	RSRPL_IP	0.81	1.07	255	245	96%	2	-18	-18	compliant	opposite response
9		Renew Solar Power Pvt Ltd, Bikaner (250MW) (BIKNP)	250	HUAWEI	SUN2000-185KTL-H1	BIKNR_IP	0.80	1.06	475	467	98%	-2	25	19	compliant	Partial response
10		Tata Power Green Energy Ltd. (TPGEL)	225	SUNGROW	SG3125HV-32	TPGEL_IP	0.80	1.06	280	282	101%	1	-21	-20	compliant	opposite response

Status of RE Plants at 400 kV Fatehgarh (Adani)

S.No	Connected at	Name of SPPD/Generator	Installed Capacity (MW)	Inverter/ WTG Make	Inverter/WTG Model	PMU Code	Voltage (during fault at POI (PU) (13:53:19.680)	Highest Voltage recorded at POI (PU)	Active Power (MW)			Reactive power (MVAR			HVRT/LVRT Compliance	Reactive Power Support during fault condition (partially, fully, non-complaint)
									Before at (13:53:18.600)	After One second (13:53:20.600)	Percentage Recovered immediately after fault	Before at (13:53:19.520)	At fault Instant (13:53:19.600)	Immediately after fault clearance (13:53:19.680)		
1	400 kV Fatehgarh (Adani)	SINGRAULI SOLAR PV POWER STATION (SPRJ) - Nedan Solar NTPC	296	HUAWEI	SUN2000-185KTL-INH0	SPRJ_NT	0.87	1.08	271	271	100%	37	24	25	compliant	opposite response
2		Adani Solar Park PSS-1 (ASPS1)	250	HUAWEI	SUN2000-185KTL-H1	ASPS1_IP	0.83	1.03	237	233	99%	49	32	32	compliant	opposite response
3		Adani Solar Park PSS-2 (ASPS2)	350	HUAWEI	SUN2000-185KTL-H1	ASPS2_IP	0.88	1.09	343	338	98%	40	35	36	compliant	opposite response
4		Adani Wind Park PSS-3 (AWPS1)	250	Suzlon WTG/Siemens Gamesa WTG	Suzlon S120/Siemens Gamesa S2.2	AWPS1_IP	0.89	1.07	59	49	82%	-4	21	22	Non compliant	partial response
5		Adani Wind Park PSS-4 (AWPS2)	260			AWPS2_IP	0.89	1.09	58	52	89%	-6	23	24	Non compliant	partial response

Status of RE Plants at 765 kV Fatehgarh II (PG)

S.No	Connected at	Name of SPPD/Generator	Installed Capacity (MW)	Inverter/ WTG Make	Inverter/WTG Model	PMU Code	Voltage (during fault at POI (PU) (13:53:19.680)	Highest Voltage recorded at POI (PU)	Active Power (MW)			Reactive power (MVAR			HVRT/LVRT Compliance	Reactive Power Support during fault condition (partially, fully, non-complaint)
									Before at (13:53:18.600)	After One second (13:53:20.600)	Percentage Recovered immediately after fault	Before at (13:53:19.520)	At fault Instant (13:53:19.600)	Immediately after fault clearance (13:53:19.680)		
1	765 kV Fatehgarh II (PG)	Renew Sun Bright Private Limited (RSBPL)	**300**	HUAWEI	Huawei SUN2000-185KTL-INH0	RSBPL_IP	0.87	1.09	265	260	98%	43	49	46	compliant	partial response
2		Adani Hybrid Energy Jaisalmer Two Limited (AHEJ2)	**300**	SUNGROW	SG250HX-IN	AHEJ2_IP	PMU DATA UNAVAILABLE									
3		Adani Hybrid Energy Jaisalmer Two Limited (AHEJ2): Wind	**75**	Suzlon WTG	Suzlon S120											
4		Adani Hybrid Energy Jaisalmer Three Limited (AHEJ3)	**300**	Suzlon WTG	TS208KTL-HV	AHEJ3_IP	0.88	1.09	302.30	253.16	84%	48.01	28.42	28.65	Non compliant	opposite response
5		Adani Hybrid Energy Jaisalmer Three Limited (AHEJ3): Wind	**75**	TBEA	Suzlon S120											
6		Adani Hybrid Energy Jaisalmer One Limited (ADNHB)	**360**	Suzlon WTG	SUN2000-185KTL-H1	ADNHB_IP	PMU DATA UNAVAILABLE									
7		Adani Hybrid Energy Jaisalmer One Limited (ADNHB): Wind	**101**	HUAWEI	Siemens Gamesa S2.2											
8		Adani Solar Energy Jaisalmer one Limited: Solar	**209**	Siemens Gamesa WTG	SG3125HV	ASJ1S_IP (ckt I)	0.86	1.08	222	226	102%	-6	-14	-15	compliant	opposite response
9			**212.5**	SUNGROW	SPI312K-B-HUD, SPI312K-B-H2	ASJ1S_IP (ckt II)	0.86	1.09	220	224	102%	-1	-9	-10	compliant	opposite response
10		Adani Solar Energy Jaisalmer one Limited: Wind	**105**	KEHUA	Suzlon S120	ASJ1W_IP	0.86	1.09	45	46	101%	-8	0	1	compliant	partial response
11		Eden Renewable Cite Private Limited (EDEN)	**300**	SUNGROW	SG3125HV	EDEN_IP	0.86	1.09	296	311	105%	23	-9	-6	compliant	opposite response
12		ReNew Solar Energy Jharkhand Three Pvt. Ltd (RJ3PL)	**300**	HUAWEI	Huawei SUN2000-185KTL-INH0	RJ3PL_IP	0.87	1.09	273	227	83%	48	-33	-8	Non compliant	partial response
13		ReNew Solar Urja Private Limited(RSUPL)	**300**	SUNGROW/TBEA	SG250HX-IN/TS208KTL-HV	RSUPL_IP	0.87	1.10	270	122	45%	47	27	26	Non compliant	opposite response
14		ReNew Sun Waves Private Limited, Fatehgarh-II (RNEWJ)	**300**	SUNGROW	SG250HX-IN	RNEWJ_IP	0.86	1.08	262	198	76%	41	23	26	Non compliant	opposite response
15		NTPC Devikot Solar Plant	**240**	TBEA	TBEA TC2500KF	DVKOT_NT	PMU DATA UNAVAILABLE									

***Postive Mvar represent Injection into system and negative Mvar resprenst absorption**

Status of RE Plants at 765 kV Fatehgarh III (PG)

S.No	Connected at	Name of SPPD/Generator	Installed Capacity (MW)	Inverter/ WTG Make	Inverter/WTG Model	PMU Code	Voltage (during fault at POI (PU) (13:53:19.680)	Highest Voltage recorded at POI (PU)	Active Power (MW)			Reactive power (MVAR			HVRT/LVRT Compliance	Reactive Power Support during fault condition (partially, fully, non-complaint)
									Before at (13:53:18.600)	After One second (13:53:20.600)	Percentage Recovered immediately after fault	Before at (13:53:19.520)	At fault Instant (13:53:19.600)	Immediately after fault clearance (13:53:19.680)		
1	Fatehgarh III (PG)	Altra Xergi Pvt. Ltd.	**380**	-	-	AXPPL_IP	0.86	1.09	383	385	101%	97	5	8	compliant	opposite response
2		Renew Surya Vihan Pvt. Ltd.	**380**	-	-	RERSH_IP	PMU DATA UNAVAILABLE									
3		Renew Surya Partap Pvt. Ltd.	**290**	-	-	RSAPL_IP	0.86	1.09	285.51	285.51	100%	30.92	30.92	30.92	compliant	no response
4		Renew Surya Ayaan Pvt. Ltd.		-	-											
5		Renew Surya Roshni Pvt. Ltd.	**290**	-	-	RERSH_IP	0.86	1.10	364.56	345.31	95%	48.28	54.67	54.67	compliant	partial response

Status of RE Plants at 765 kV Bikaner-II (PG)

S.No	Connected at	Name of SPPD/Generator	Installed Capacity (MW)	Inverter/ WTG Make	Inverter/WTG Model	PMU Code	Voltage (during fault at POI (PU) (13:53:19.680)	Highest Voltage recorded at POI (PU)	Active Power (MW)			Reactive power (MVAR			HVRT/LVRT Compliance	Reactive Power Support during fault condition (partially, fully, non-complaint)
									Before at (13:53:18.600)	After One second (13:53:20.600)	Percentage Recovered immediately after fault	Before at (13:53:19.520)	At fault Instant (13:53:19.600)	Immediately after fault clearance (13:53:19.680)		
1	Bikaner-II (PG)	One Volt energy Pvt. Ltd.	**300**	-	-	GEPL_IP	0.80	1.07	279.48	281.21	101%	53.93	-8.73	-11.59	Compliant	opposite response
2		Amplus Ages Private Limited		-	-											
3		Grian Energy private limited		-	-											
4		Adept Renewable Technologies Pvt. Ltd.	**194**	-	-	PGPL_IP	PMU DATA UNAVAILABLE									
5		TRANSITION ENERGY SERVICES PRIVATE LIMITED		-	-											
6		Banderwala Solar Plant TP Surya Ltd.	**200**	-	-	TPSB_IP										

Annexure-A.VI

GUIDELINES
on
DIVERSION of REGIONAL COLD SPARES (TRANSFORMERS and REACTORS)

November 2025

NORTHERN REGIONAL POWER COMMITTEE

1. Background & Objective

POWERGRID procures and maintains regional spares- transformers and reactors- to ensure the continuity of power supply and grid stability in the event of a contingency, such as the sudden failure of an in-service transformer or reactor. The primary purpose of these spares is to meet contingencies/emergencies within ISTS substations of the region. Regional spares are primarily sanctioned for use in Inter-State Transmission System (ISTS) substations. However, diversion of such spares to a State Transmission Utility (STU) may be permitted only under exceptional circumstances, based on the criticality of the requirement and subject to expeditious replenishment by the Borrower.

These Guidelines sets out the framework, eligibility, processes, roles, responsibilities, and conditions under which regional spares- transformers and reactors-maintained by POWERGRID may be diverted to eligible utilities. These Guidelines seeks to balance the need to extend emergency support to constituents with the responsibility of ensuring adequate spare availability for the ISTS network.

2. Scope & Applicability

These Guidelines applies exclusively to transformers and reactors approved by the respective Regional Power Committee (RPC) as *Cold Regional Spares* for use in Inter-State Transmission System (ISTS) substations within the region. These spares are procured, owned, and maintained by POWERGRID to ensure operational continuity of the ISTS network during contingencies. Diversion of Regional Spares may be considered for the following eligible beneficiaries within the same Region:

- **ISTS Substations**.
- **State Transmission Utility (STU) Substations**

Diversion may be considered only in case of failure of existing in-use equipment and where diversion is essential for grid security and reliability. Diversion for commissioning of new assets or Inter-regional diversion of equipment to any constituent may not be permitted. All diversions may be executed strictly on a replenishment basis and may not amount to sale or transfer of ownership of the equipment.

3. Roles and Responsibilities

3.1. Lender (POWERGRID): POWERGRID may ensure that the cold regional spares- Transformers and Reactors- are maintained in operationally ready condition and available for deployment during contingencies. POWERGRID may:

- Maintain a central inventory of all Regional Spares with technical particulars and locations.
- Implement the diversion only after RPC or its sub-forum’s approval, as the case may be, and in accordance with these guidelines.
- Record every approved diversion in the central register, including date of diversion, borrower, and approved return timeline.

- Monitor adherence to approved diversion timelines and report deviations to the respective RPC Secretariat.

3.2. Borrower: The Borrower may be responsible for safe custody and operation of the diverted Regional Spare during its possession. The Borrower may:

- Submit a formal diversion request to the respective RPC Secretariat with required technical and contingency details.
- Jointly verify the equipment condition at POWERGRID substation prior to MoU signing.
- Bear all expenses associated with transportation (both ways), transit insurance, erection, testing, commissioning, and related statutory charges, as applicable, and any incidental expenditure or loss to POWERGRID.
- Ensure site readiness and compatibility of the spare equipment before diversion.
- Furnish a valid Bank Guarantee equal to the prevailing cost of the equipment, effective till 45 days after return or replenishment is completed.
- Maintain and operate the equipment in accordance with applicable technical standards and POWERGRID's guidelines.
- Return or replenish the equipment in healthy condition within the approved timeframe and bear any repair or replacement cost arising from damage or failure.
- After returning of equipment, all pre-commissioning tests may be jointly performed at POWERGRID station to ascertain healthiness. In case of any deviation, POWERGRID may take up the repair of equipment and cost of the repair may be borne by the Borrower.

3.3. RPC Secretariat: The concerned RPC Secretariat may facilitate deliberation of the diversion proposal in the RPC or its sub-forum and place the Borrower's request before the members for decision. It may record all decisions, including timelines for return or replenishment. RPC Secretariat may communicate the decision of the forum to borrower and Powergrid within one week of decision in RPC or its sub-forum meeting.

4. Procedure for Diversion

4.1. Submission of Request: The Borrower may submit a written request to the concerned RPC Secretariat, specifying:

- The nature of contingency or failure necessitating diversion, including details of affected substation and equipment.
- Technical parameters of the failed equipment and the matching requirement from the Regional Spare pool.
- A detailed action plan and proposed timeline for return or replenishment of the diverted equipment.

4.2. Evaluation and Approval: The RPC or its sub-forum may evaluate the request on merit, considering:

- The severity and genuineness of the contingency.
- Availability of the Regional Spare and its necessity for ISTS grid reliability.
- Impact on overall system stability and adequacy of remaining spares.

The decision of the RPC or its sub-forum will be final and binding on all concerned entities. Upon approval, the forum may record the diversion details and the agreed period of utilization in its proceedings.

4.3. Execution of Memorandum of Understanding (MoU)

- Following the approval of diversion by the respective RPC or its sub-forum, the Borrower and POWERGRID may execute a Memorandum of Understanding (MoU) within forty-five (45) days from the date of RPC or its sub-forum. *For the purpose of these Guidelines, date of communication by RPC secretariat of the decisions of the forum to borrower and Powergrid as defined in para 3.3 shall be treated as the date of RPC or its sub-forum approval, as the case may be.*
- The MoU may specify all terms and conditions of diversion, including equipment details, responsibilities of both parties, financial implications, Bank Guarantee (BG) requirements, maintenance and reporting obligations, timelines for return/replenishment, and applicable penalties for default.

4.4. Condition Assessment and Testing

- Before diversion, a joint inspection of the equipment may be carried out by POWERGRID and the Borrower at the designated POWERGRID substation. The physical condition and test results may be documented and signed jointly.
- Upon return, the equipment may undergo joint pre-commissioning testing at the POWERGRID station to ascertain its healthiness. Any deviation, defect, or damage observed during inspection may be rectified at the Borrower’s cost. Where repair or refurbishment is necessary, the Borrower may carry it out through the OEM or other approved agency as per POWERGRID specifications.

5. General Conditions of Diversion

5.1. Timeframe for Diversion and Return

- The Borrower should take the physical handover of the equipment from the designated POWERGRID substation within forty-five (45) days from the date of execution of the MoU.
- Failure to take the physical handover of the equipment within the ninety-days (90) days from RPC or its sub-forum approval, as applicable, may be treated as revocation the diversion approval.

- The maximum diversion period may not exceed twenty-four (24) months from the Zero Date of Diversion.
- The Borrower may ensure return or replenishment of the diverted equipment within this period as per the action plan approved by the RPC or its sub-forum, as applicable, and the provisions of the MoU.
- Any request for extension of the diversion period beyond twenty-four (24) months or delay in taking the physical handover of the equipment may require prior approval of the respective RPC or its sub-forum, as applicable, supported by written justification.
- On completion of the diversion period, the Borrower should return the equipment in healthy condition to POWERGRID to POWERGRID's technical specifications.
- *The "Zero Date of Diversion" shall be the date recorded in the joint handover certificate signed by representatives of POWERGRID and the Borrower at the time of physical transfer from the designated POWERGRID substation or storage location.*
- *The "Date of Return" shall be the date recorded in the joint handover certificate signed by representatives of POWERGRID and the Borrower, after successful healthiness checking, at the time of physical transfer at the designated POWERGRID substation or storage location.*

5.2. Early Recall

- RPC Forum may recall any diverted equipment at any time before the expiry of the approved period if required in the interest of grid security or system reliability.
- The Borrower should return the equipment immediately upon receipt of such recall notice, and the RPC Secretariat may be intimated accordingly.

5.3. Financial Provisions: Diversion of Cold Regional Spares may be carried out on a cost-neutral basis, ensuring that POWERGRID neither incurs financial loss nor earns additional revenue on account of such diversion. The diversion should not result in any change in the Yearly Transmission Charges recoverable by POWEGRID as per the approved tariff against the diverted asset and financial adjustments, if any, may be settled within the regional pool mechanism as approved by the RPC forum. The Borrower may bear all direct and incidental costs, including transportation, loading/unloading, insurance, erection, testing, and commissioning charges. The Borrower may be fully liable for any loss, damage, theft, or deterioration of the equipment during the diversion period. Insurance coverage may be obtained in the joint name of POWERGRID and the Borrower, with POWERGRID designated as the primary beneficiary.

In line with these principles, the financial treatment for diversion may be as follows:

- **ISTS Substations:** Diversion to any ISTS substation, should be without financial liability to Powergrid/DIC. Such diversion should not affect the Regional tariff or cost-sharing framework.
- **STU Substations:** For diversions to STU substations, the equivalent Yearly Transmission Charge (YTC) of the diverted asset on pro-rate basis, along with any applicable penalty, may be credited to the Regional ISTS Pool for the diverted period.

  For this purpose, POWERGRID may raise bilateral bills to the borrower to recover the equivalent YTC of the diverted asset on pro-rate basis, along with any applicable penalty. The YTC may be computed in accordance with the prevailing Tariff Regulations, Sharing Regulations, or any other rules or regulations notified by CERC or the Ministry of Power, and all provisions relating to due dates, late payment surcharge, interest, or other billing conditions may likewise be governed by the applicable rules or regulations. The amount so recovered may be adjusted in the Regional ISTS Pool through the Second Bill mechanism under sharing regulations, and the corresponding credit shall be passed on to the DICs of the Region in the same Second Bill.

5.4. Bank Guarantee (BG) requirements:

- Borrower may furnish a valid Bank Guarantee equal to the prevailing cost of the equipment, effective till 45 days after return or replenishment is completed.
- The BG may be invoked by POWERGRID to recover any financial loss or liability arising from events such as failure to return or replenish the equipment within the agreed timeframe, or failure to repair, refurbish, or replace the equipment in the event of damage, failure, or loss during transit, erection, or operation.

5.5. Penalty and Default:

- If the Borrower fails to return or replenish the diverted equipment within the agreed timeframe, which may not exceed 24 months, a penalty of 15% of the approved Yearly Transmission Charge (YTC) of the diverted asset may be levied on a pro-rata basis for the delayed duration.
- The penalty amount may be credited to the Regional Component of ISTS charges for the corresponding period. In case of continued default or non-replenishment, POWERGRID may report the matter to the RPC forum for further decision, which may include encashment of the Bank Guarantee and/or regulatory intervention.

5.6. **Record-Keeping and Monitoring:** POWERGRID may maintain a centralized and up-to-date register of all diversions, containing the following information:

- Borrower entity name and category.
- Equipment details (type, rating, make, serial number).
- Date of diversion and expected return date.
- Physical and test condition at dispatch and upon return.
- Financial treatment and applicable YTC adjustments.
- Status of replenishment or replacement.

6. **Review and Amendment:** These Guidelines may be reviewed from time to time to incorporate operational experience, regulatory updates, or changes in system requirements.

7. **Power to Relax:** RPC forum may relax any of the provisions of these guidelines on its own or on an application made before it by the affected party.

CEA-GO-17-11(11)/1/2023-NRPC I/55530/2025

भारत सरकार
Government of India
विद्युत मंत्रालय
Ministry of Power
उत्तर क्षेत्रीय विद्युत समिति
Northern Regional Power Committee

विषय: Minutes of the Second meeting of the Sub-Group for implementation of Travelling Wave Fault Locator (TWFL) on critical transmission lines in the Northern Region held on 17th October 2025 -reg.

Kindly find attached minutes of the Second meeting of the Sub-Group for implementation of Travelling Wave Fault Locator (TWFL) on critical transmission lines in the Northern Region held on 17th October 2025.

This issues with the approval of SE(O), NRPC.

Encl: As above

27.10.2025

(ओमकिशोर)
कार्यपालक अभियंता (प्रचालन)

List of addressees:

1. Sh. Sandeep Kumawat, DGM, CTU (sandeepk@powergrid.in)
2. Sh. Pankaj Jha, Chief Manager, PGCIL (pankaj.jha@powergrid.in)
3. Sh. D. K. Jain, SE (Protection Engg.) RRVPNL (se.prot.engg@rvpn.co.in)
4. Sh. Lokendra Singh Ranawat, Head Regulatory, IndiGrid (lokendra.ranawat@indigrid.com)
5. Sh. Rajender Kumar Thakur, Vice President, Sekura Energy Pvt. Ltd. (Rajender.thakur@energy-sel.com)
6. Sh. Nitesh Ranjan, Manager, Assistant Vice President, Resonia (nitesh.ranjan@resonia.com)
7. Sh. Abhishek Kukreja, Lead O&M, ATIL, (abhishek.kukreja@adani.com)
8. Ms. Shobhna Singh Kurmi, Assistant Director (PSPA-I Division), CEA (shobhnasingh@cea.nic.in)
9. Ms. Rashmi, Assistant Director-II, PSE&TD Division, CEA (rashmi.cea@gov.in)
10. Sh. Deepak kumar , Dy.Manager, NRLDC (deepak.kr@grid-india.in)
11. Chief Engineer, PTCUL, (hitendra0107@gmail.com)
12. General Manager, HPPTCL, (gmcd.tcl@hpmail.in)
13. Superintending Engineer, JKPTCL, (ravikantkalsotra01@gmail.com)

Minutes of the Second meeting of the Sub-Group for implementation of Travelling Wave Fault Locator (TWFL) on critical transmission lines in the Northern Region held on 17th October 2025

Superintending Engineer (Operation), NRPC welcomed all the participants to the meeting. List of Participants is attached at **Annexure-I**.

1. SE(O), NRPC apprised the forum that in the 1st meeting of the sub-group held 28.08.2025 it was decided that a physical visit at POWERGRID Meerut S/s may be conducted to see the functioning of TWFL (MoM of the first meeting is attached at **Annexure-II**). Accordingly, a team comprising of members from CEA, NRLDC, CTU and NRPC Secretariat visited the 765/400 kV Meerut Substation on 19.09.2025 to understand the functioning of the TWFL system and to evaluate the benefits of its installation on transmission lines. A brief report of the visit is attached at **Annexure-III**.

2. During the visit the team was apprised about the details of the fault location recorded by TWFL at Meerut Substation for some of the faults in last two months are tabulated below:

Sr. No.	Line Name	Date	Time	M-1	M-2	TWFL		Patrolling Distance
				(km)	(km)	Local End (km)	Remote End (km)	(km)
1	Koteshwar-2	12.09.25	10:50:22	117.1	116.9	128.31	47.32	128.4
2	Koteshwar-2	18.09.25	04:57:07	92.8	89.69	74.37	104.32	74.9
3	Koteshwar-1	07.09.25	03:58:56	117.2	118.8	125.38	53.31	125
4	Moga	31.07.25	01:13:21	222.2	222.7	245.64	91.5	245.6
5	Moga	16.07.25	09:29:07	0.3	0.3	0	337.14	0.3

3. SE(O), NRPC stated that from the above data it can be observed that fault location provided by TWFL is much more accurate as compared to the fault location provide by M-1 and M-2 relays.

4. PGCIL representative stated that in the 1st meeting PGCIL was asked to share operation philosophy of TWFL and the literature related to it so that the same could be studied by members of the sub-group. Accordingly, PGCIL had shared TWFL manuals and a conference paper on TWFL. Documents shared by PGCIL is attached at **Annexure-IV**.

5. PGCIL representative delivered a presentation highlighting the limitations of conventional fault location methods, along with the working principle and architecture of TWFL. (Presentation of PGCIL is attached at **Annexure-V**)

6. Regarding the manufacturers of TWFL devices, the PGCIL representative informed that GE and Qualitrol manufactured of TWFL devices are available in the Indian market. Additionally, TWFL devices manufactured by SEL and Kehui are also available globally.

7. The RVPN representative inquired whether these devices are equipped with inbuilt GPS or rely on the substation's GPS. The PGCIL representative clarified that the devices are provided with inbuilt GPS; however, the substation GPS can also be utilized if required.

8. Based on the data provided by PGCIL during the first meeting and the subsequent site visit, the sub-group members agreed that TWFL is useful for accurate fault detection and, consequently, enables faster restoration of transmission lines.

9. SE(O), NRPC enquired from PGCIL about the criteria adopted for selecting the transmission lines for TWFL implementation as proposed by PGCIL in the 55th TCC and 80th NRPC meetings.

10. PGCIL representative replied that 765 kV lines in RE pockets, critical lines in the NCR region, lines in hilly areas, lines connected to generating stations, lines with frequent faults, and long transmission lines were considered for TWFL implementation.

11. SE(O), NRPC asked view of members regarding criteria to identify critical transmission lines that warrant the installation of TWFL.

12. CTU representative stated that TWFL implementation may be taken up in phased manner. In first phase lines having long length and lines of hilly terrain may be considered. Based on the experience of first phase, other lines may be considered subsequently.

13. PGCIL representative stated that in case of long lines error in fault distance shown by DR is high and therefore more time is required for restoration. Therefore he stated that lines having long length and lines of hilly terrain may be considered. Further, lines of RE Pocket may also be considered.

14. SE(O), NRPC enquired about the threshold length that can be considered.

15. It was discussed that all 765kV lines may be considered in the first phase.

16. NRLDC representative stated that some 765 KV lines are having length less than 100Km. So these lines may not require TWFL.

17. RVPN representative stated that patrolling of transmission lines up to a distance of 200 km requires around 5 hours. Therefore, to minimize outage duration, lines longer than 200 km may be considered for TWFL implementation. In hilly terrain all lines may be considered irrespective of the length.

18. SE(O), NRPC enquired about the number of 765 kV and 400 kV transmission lines having a length of more than 200 km.

19. The NRLDC representative informed that in the Northern Region, around 40 transmission lines at 765 kV and 72 lines at 400 kV voltage level have lengths more than 200 km.

20. SE(O), NRPC stated that in the first phase 765 kV and 400 kV lines having length more than 200km may be considered.

21. It was discussed that in case of lines used for evacuating nuclear and RE Power, threshold length of 150 Km may be considered. Further, in hilly terrain all 220kV and above lines may be considered.

22. CEA representative enquired about requirement of TWFL in HVDC lines.

23. PGCIL representative replied that in HVDC, TWFL principle is already used for LFL by all the OEM. Therefore, no additional TWFLs are required to be installed for HVDC lines.

24. SE(O), NRPC enquired about the cost of TWFL devices.

25. PGCIL representative replied that the cost of supply, installation, testing and commissioning of TWFL, as per the latest Purchase Order (PO), is approximately ₹25 lakh per end for a two-line module, ₹50 lakh per end for a four-line module, and ₹100 lakh per end for an eight-line module.

26. SE(O), NRPC stated that a policy may be formulated by CTU for implementation of TWFL in intra-state lines.

27. **After detailed deliberation, Committee members agreed that;**

   A. Travelling Wave-Based Fault Locator (TWFL) has emerged as a highly advanced and precise fault location technology. This is useful for quickly identifying the fault location with accuracy (±500 m error), which directly contributes to reduced outage durations, improved system availability, and enhanced reliability of the transmission network.

   B. TWFL implementation may be taken up in phased manner. Following criteria may be used to identify critical transmission lines for installation of TWFL in the first phase:

   i. 220kV, 400kV and 765 kV lines having length more than 200Km.
   ii. 220kV, 400kV and 765 kV lines used for evacuating nuclear and RE Power having length more than150 Km.
   iii. 220kV and above lines in hilly terrain.
   iv. Inter-regional 220kV and above lines having length more than150 Km.

   C. Based on the above criteria committee reviewed the lines proposed by PGCIL in the 55th TCC and 80th NRPC meetings for TWFL implementation. Out of the 25 nos. lines, 20 nos. lines as mentioned at Annexure-VI may be considered for TWFL implementation.

D. A policy may be formulated by CTU for implementation of TWFL in intra-state lines

Meeting ended with vote of thanks to the Chair.

*****

Annexure-I

Name	Designation	Organisation
Dharmendra Meena NRPC	Superintending Engineer	NRPC
Omkishor	Executive Enginner	NRPC
Deepak Kumar	Dy. Manager	NRLDC
Pankaj Kumar Jha	Chief Manager	PGCIL
Rashmi	Assistant Director	CEA
SHOBHNA SINGH KURMI	Assistant Director	CEA
Vijay Pal RVPN	Executive Enginner	RVPN
Sandeep Kumawat	Deputy General Manager	CTU

Annexure-II

भारत सरकार
Government of India
विद्युत मंत्रालय
Ministry of Power
उत्तर क्षेत्रीय विद्युत समिति
Northern Regional Power Committee

विषय: Minutes of the first meeting of the Sub-Group for implementation of Travelling Wave Fault Locator (TWFL) on critical transmission lines in the Northern Region held on 28th August 2025 -reg.

Kindly find attached minutes of the first meeting of the Sub-Group for implementation of Travelling Wave Fault Locator (TWFL) on critical transmission lines in the Northern Region held on 28th August 2025.

This issues with the approval of SE(O), NRPC.

Encl: As above

Signed by Omkishor
Date: 03-09-2025 17:11:14

(ओमकिशोर)
कार्यपालक अभियंता (प्रचालन)

List of addressees:
1. Sh. Sandeep Kumawat, DGM, CTU (sandeepk@powergrid.in)
2. Sh. Pankaj Jha, Chief Manager, PGCIL (pankaj.jha@powergrid.in)
3. Sh. D. K. Jain, SE (Protection Engg.) RRVPNL (se.prot.engg@rvpn.co.in)
4. Sh. Lokendra Singh Ranawat, Head Regulatory, IndiGrid (lokendra.ranawat@indigrid.com)
5. Sh. Rajender Kumar Thakur, Vice President, Sekura Energy Pvt. Ltd. (Rajender.thakur@energy-sel.com)
6. Sh. Nitesh Ranjan, Manager, Assistant Vice President, Resonia (nitesh.ranjan@resonia.com)
7. Sh. Abhishek Kukreja, Lead O&M, ATIL, (abhishek.kukreja@adani.com)
8. Ms. Shobhna Singh Kurmi, Assistant Director (PSPA-I Division), CEA (shobhnasingh@cea.nic.in)
9. Ms. Rashmi, Assistant Director-II, PSE&TD Division, CEA (rashmi.cea@gov.in)
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12. General Manager, HPPTCL, (gmcd.tcl@hpmail.in)
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Minutes of the first meeting of the Sub-Group for implementation of Travelling Wave Fault Locator (TWFL) on critical transmission lines in the Northern Region held on 28th August 2025

Superintending Engineer (Operation), NRPC welcomed all the participants. List of Participants is attached at **Annexure-I**.

1. SE(O) NRPC apprised the forum that in the 55th TCC and 80th NRPC meeting, a proposal received from PGCIL for Implementation of Travelling Wave Fault Locator (TWFL) in hilly terrains, Critical Renewable, & NCR transmission lines in Northern Region was discussed. After detail deliberation, the NRPC forum decided to formulate a sub-group, comprising members from CEA, CTU, NRPC, NRLDC, Powergrid, Indigrid, ATIL, Sterlite, Sekura, RVPNL, PTCUL, HPPTCL and JKPCTL with the following Terms of Reference.

    i. Formulate criteria to identify critical transmission lines that warrant the installation of TWFL, based on operational importance and reliability considerations.
    ii. Evaluate the restoration benefits of TWFL—specifically in terms of fault location and faster restoration—by comparing scenarios with and without TWFL, using data provided by Powergrid for lines where TWFL is already implemented.

    Accordingly, based on nominations received from concerned utilities, the sub-group was formed under chairmanship of SE(O&P) NRPC. Composition of the sub-group is mentioned in Annexure-II.

2. EE(O), NRPC stated that agenda was brought by Powergrid NR-1 in 55th TCC & 80th NRPC meeting, wherein Powergrid proposed for implementation of TWFL in 06 nos. 765 kV Lines, 08 nos. 400 kV lines & 02 nos. 220 kV lines based on criticality and various parameters like line terrain, power flow capacity, generator connectivity, tripping frequencies etc.,under Additional Capitalization for tariff block 2024-29.

3. Representative from Powergrid presented the comparison of the distance shown by distance relays during fault, distance observed on TWFL and the actual fault location detected by the patrolling team on the lines on which TWFL has already been installed. (Attached at Annexure-II)

4. Representative from Powergrid mentioned that in case of line of long length or in case of transmission line in hilly terrains TWFL is very beneficial as the fault location as per TWFL is matching with that of the location of fault detected during patrolling giving an accuracy within limit of one tower span or 0.5 km distance.

5. Representative from Powergrid submitted that since the terrain of the transmission lines is hilly, distance of fault location obtained from TWFL will ease the efforts during patrolling and early fault rectification will help during mismatch of fault location in Main -1 and Main-2 relays at S/S.

6. POWERGRID representative explained the reasoning behind difference in values obtained from Distance relays and TWFL. He said that the distance relays are impedance based relays and hence depends on parameters like R0, X0, R1, X1, mutual compensation in case of double circuit line. Also, distance relays are affected by in feed /out-feed to fault (depending on the number of lines in

service). However, TWFL is independent of these parameters and only depends upon the current and voltage waves generated due to fault, which transmits from the fault location towards both the ends of the line. The time it takes to reach the end of the line and reflects, multiplied with the speed of light give the distance of fault location from both the ends.

7. SE(O) NRPC asked about the time which it usually takes to detect and rectify fault in absence of TWFL. To this, POWERGRID representative replied that fault detection and rectification usually gets delayed in case of fault during evening hours on lines located in difficult terrains and usually the patrolling starts from early morning of next day hence causing delay. However, with TWFL time is saved in fault identification.

8. SE(O), NRPC asked POWERGRID to submit data regarding the time saved in respect of faults occurred on lines where the TWFL was installed. He also asked POWERGRID to provide the details of cost of installation of TWFL.

9. EE(P), NRPC asked POWERGRID whether the existing relays were replaced after installation of TWFL. To this, POWERGRID representative replied that existing relays will remain as such and TWFL shall be used only for identifying fault location.

10. NRLDC representative suggested that a physical visit at POWERGRID Meerut S/S may be conducted to see the functioning of TWFL. He also asked that operation philosophy of TWFL and the literature related to this may be shared by POWERGRID with all the members so that the same could be studied before visit.

11. SE(O), NRPC requested Powergrid to share the required data, operation philosophy & the literature of TWFL and arrange the visit before 2nd meeting of the committee.

Meeting ended with vote of thanks to the Chair.

*****

Annexure-I

Name	Designation	Organisation
Dharmendra Meena NRPC	Superintending Engineer	NRPC
Omkishor	Executive Enginner	NRPC
Reeturaj Pandey	Executive Enginner	NRPC
Rajat Dixit	Asst. Executive Enginner	NRPC
D K JAIN	Superintending Engineer	RVPN
Sunil Aharwal/NRLDC	General Manager	NRLDC
Gaurav Singh	Chief Manager	NRLDC
Deepak Kumar	Dy. Manager	NRLDC
Akash Tomar	Dy. Manager	NRLDC
Pankaj Kumar Jha	Chief Manager	PGCIL
Rashmi	Assistant Director	CEA
SHOBHNA SINGH KURMI	Assistant Director	CEA
D K JAIN	Superintending Engineer	RVPN
Vijay Pal RVPN	Executive Enginner	RVPN
Sandeep Kumawat	Deputy General Manager	CTU

Annexure II

Case Number	REGION	NAME OF ELEMENT	TRIPPING DATE (sample 01-12-2022)	TIME HRS (sample 00:00)	REASON (Type of fault)	Total Line length	Relay Details	Relay Details	Location as per TWFL (H)		Location as per Patrolling (J)		Error(in km) B	% error (B)	Make of TWFL
						in km	M-1 Distance	MAIN-2	From Station A	From Station B	From Station A	From Station B	(H-J)		
1	NER	400 KV New Mariani-Misa-2(404L)	24.07.2024	11:57		221.7	126.7	128.7	138.57	82.24	139	82	-0.24	-0.3	GE
2	NERTS	400kV Misa-Silchar #1	29-05-2024	02:34		178.36	127	108.1	130.92	47.44	131.384	46.97	-0.47	-1.0	GE
3	NERTS	400kV Misa-Silchar #2	01-05-2024	20:00		178.36	--	102.9	133.16	45.2	133.954	44.4	-0.8	-1.8	GE
4	NERTS	400kV Misa-Silchar #1	26-06-2024	15:11		178.36	151.1	102.2	113.04	65.32	111.32	67.034	1.714	2.6	GE
5	NERTS	400kV Silchar-Misa #2	23-07-2024	13:08		178.36	28.91	29.9	--	26.1	151.834	26.52	0.42	1.6	GE
6	ER-1	765KV GAYA-VARANASI-2	21-05-2024	05:07	TRIPPED DUE TO R-N FAULT.	273.18	109.4	108.2	116.09	157.09	115.71	157.47	0.38	0.2	GE
7	ER-1	765KV NEW RANCHI-DHARAMJAIGARH-	11-05-2024	18:12	TRIPPED DUE TO R-N FAULT.	302	2.9	NA	1.24	299.76	1.3	300.7	0.94	0.3	GE
8	ER-1	400KV RANCHI - SIPAT 2	07-05-2024	18:23	TRIPPED DUE TO Y-N FAULT	404.5	23.16	NA	23.9	380.6	24.5	380	-0.6	-0.2	GE
10	SR-I	765kV NIZAMABAD-WARDHA-1	21.10.2024	13:45	R-N fault	291.1	118	120	125.7	165.4	126	165	-0.4	-0.2	Qualitrol
11	SR-I	765KV KURNOOL- NPS-2	18.08.2024	15:30	B-N fault	302.2	200	201	199.11	103.09	198.9	103.3	0.21	0.2	GE
12	SR-I	JEYPORE- GAJUWAKA-2	27.08.2024	13:37	Y-N fault	225	13	10	2.43	222.07	2.5	222.5	0.43	0.2	GE
13	SR-I	RAICHUR- KURNOOL-2	18.09.2024	03:37	Y-N fault	118.4	21.51	21.5	97.26	21.14	97.484	20.916	-0.224	-1.1	GE
14	SR-I	RAICHUR-KURNOOL-2	29.09.2024	19:11	R-N fault	118.4	45.16	45.2	70.3	48.1	71.48	46.92	-1.18	-2.5	GE
15	ODISHA	5KV SUNADARGARH-DHARMAJAYGARI	20-08-2024	04:48	R-N fault	151.5	22.1	22.9	23.4	128.1	24	127.5	-0.6	-0.5	GE
16	ODISHA	765KV ANGUL-SUNDARGARH-II	05-09-2024	12:04	B-N fault	272	220.2	212.8	208.6	63.4	210	65	1.6	2.5	GE
17	ODISHA	400KV JEYPORE-GAZUWAKA-I	06-09-2024	17:45	B-N fault	225	43.43	41.1	55.24	170.1	53.67	171.33	1.23	0.7	GE
22	NR3	765KV VARANASI-BALIA	27-08-2024	16:44:00	B-N fault	167.676	125.10	125.3	141.9	24.72	142.57	25.106	0.386	1.5	GE
24	NR3	765KV AGRA-FATEHPUR-II	14-11-2024	04:38:00	B-N fault	334.308	89.00	88.7	84.72	249.92	84.95	249.358	-0.562	-0.2	GE
25	NR3	765KV AGRA-FATEHPUR-II	14-11-2024	04:42:00	B-N fault	334.308	89.50	89	85.15	249.53	84.95	249.358	-0.172	-0.1	GE
26	NR3	765KV AGRA-FATEHPUR-II	14-11-2024	04:53:00	B-N fault	334.308	77.70	77.4	82.46	252.21	84.95	249.358	-2.852	-1.1	GE
27	NR3	765KV AGRA-FATEHPUR-I	20-11-2024	05:49:00	Y-N fault	333.582	293.30	294.5	302.96	31.2	302.282	31.3	0.1	0.3	GE
29	ER-1	400KV BIHARSHARIF-BALIA-1	28-09-2024	16:08	Y-N fault	241.79	119.30	120.9	122.98	118.81	123.49	118.3	-0.51	-0.4	GE
31	NR-1	765kV PHAGI(RRVPNL)-GWALIOR-1	02-07-2025 02:22	03-07-2025 02:07	R-N fault. Gwalior_gis_ais:5.73kA/119.30km /78.53deg. IN:6.10kA & VF:344.83 kV.Line tripped on persistent	306.21	181.2	119.3	185.65	120.49	189.24	120.92	0.43	0.4	GE
32	NR-1	765kV BHIWANI-MOGA	02-05-2025 03:40	02-05-2025 09:18	B-N fault. Moga765_ais_gis:3.14kA/194.418 km/88.331deg. Tripped on fault in reclaim time.	273	33.31	239.69	Distance not fetched	238.86	33.7	239.3	0.44	0.2	GE
33	NR-1	765kV KOTESHWAR-MEERUT-2	15-03-2025 03:05	15-03-2025 03:05	Y-N fault. Koteshwar765:3.58kA/37.52km/8 2.73deg. Double-End distance(Koteshwar765):40.03km.	175.63	37.84	134.1	38.49	137.14	38.498	137.14	0	0.0	GE
34	NR-1	765kV KOTESHWAR-MEERUT-1	21-02-2025 04:38	21-02-2025 04:38	B-N fault. Koteshwar765:3.26kA/74.44km/8 6.31deg. Double-End distance(Koteshwar765):73.88km.	179.27	74.44	100.47	73.86	104.83	77.42	101.85	-2.98	-2.9	GE
35	NR-1	765kV CHITTORGARH-AJMER-1	13-01-2025 05:23	15-01-2025 07:20	R-N fault. Chittorgarh:6.15kA/38.03km/87.6 2deg. Autoreclose attempt taken but line tripped on Persistent	211.79	36.86	161.1	37.35	174.04	37.758	172.934	-1.106	-0.6	GE
36	NR-1	765kV KOTESHWAR-MEERUT-1	01-01-2025 20:54	02-01-2025 16:07	Y-N fault. Koteshwar765:4.39kA/44.5km/84. 9deg. Tripped on Reclaim.	179.27	44.5	132.712	48.61	130.53	49.165	130.008	-0.522	-0.4	GE

REPORT ON VISIT OF COMMITTEE MEMBERS AT POWERGRID, MEERUT SUBSTATION FOR TWFL

A committee consisting of members from NRPC, CEA, CTU, Grid India and POWERGRID visited the 765/400 kV Meerut Substation on 19.09.2025 to understand the functioning of the TWFL system and to evaluate the benefits of its installation on transmission lines. During the visit, the committee visited the kiosks where TWFL systems were installed and held detailed discussions on their functionalities, wiring arrangements, communication architecture, and fault location details. A comparative analysis was carried out between fault location data recorded by TWFL and those obtained from the distance relays for the same fault events. A brief technical presentation on these aspects was delivered by the representatives of Meerut Substation.

The committee noted that TWFLs have been installed on several 765 kV transmission lines emanating from Meerut Substation, namely Meerut–Koteshwar Line-1 and Line-2, Meerut–Bhiwani Line, and Meerut–Moga Line.

At the Meerut Substation, all the installed TWFLs are of GE (Reason) make and operate on a decentralized architecture. In this configuration, each transmission line is equipped with a dedicated acquisition unit responsible for capturing high-frequency voltage and current signals. These acquisition units communicate with a central processing unit that can interface with up to four such line-based units. The decentralized system offers flexibility, redundancy, and scalability for multi-line substations.

Electrical connection/wiring diagram of GE make TWFL installed is shown in Figure 1 below.

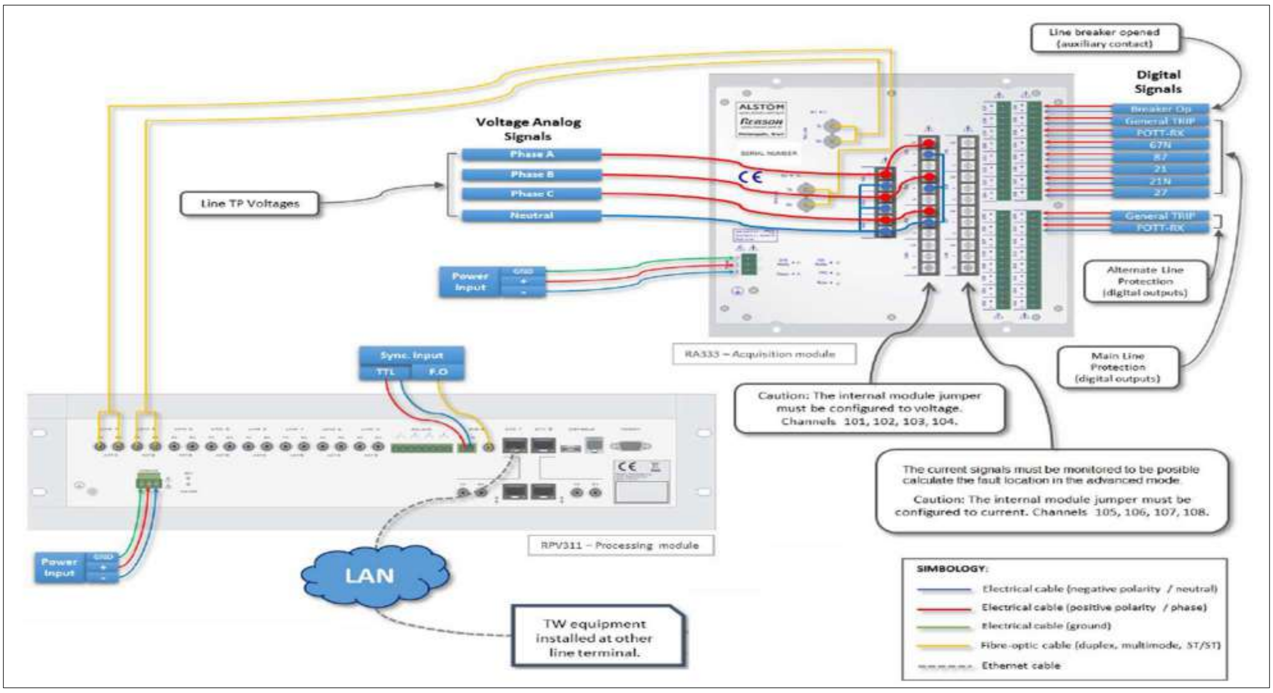


Figure 1: Electrical Connection of GE make TWFL

The decentralized architecture of the GE make TWFL installed at Meerut Substation is shown in Figure 2 below

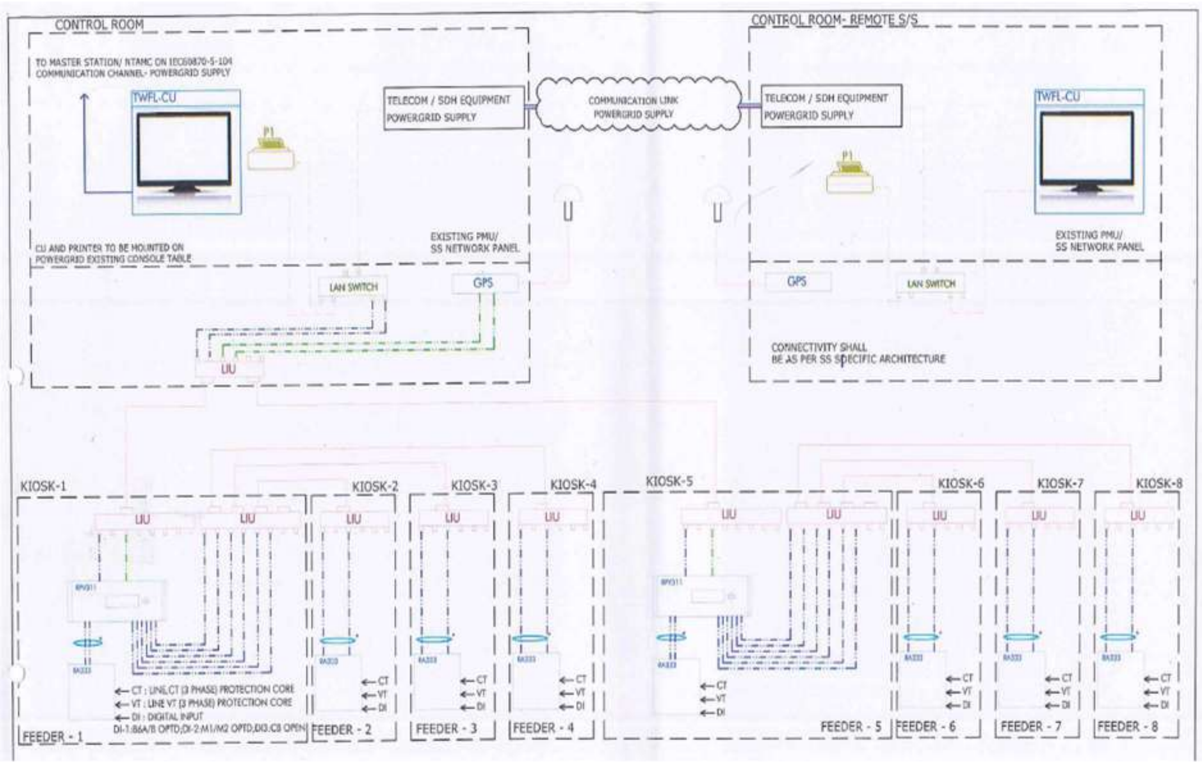


Figure 2: Decentralized Architecture of GE make TWFL

The field experience at Meerut Substation demonstrates that TWFL-based systems can identify and localize faults far more accurately than conventional impedance-based approaches. Their independence from system parameters, high resolution in fault distance estimation, and integration with digital substation communication networks make them an essential tool for modern transmission system operation and asset management. The successful implementation and operation of TWFLs at 765 kV Meerut have provided valuable insights and practical validation for wider adoption of this technology across the Indian transmission grid.

The details of the fault location recorded by TWFL at Meerut Substation for some of the faults in last two months are tabulated below:

Sr. No.	Line Name	Date	Time	M-1	M-2	TWFL		Patrolling Distance
				(km)	(km)	Local End (km)	Remote End (km)	(km)
1	Koteshwar-2	12.09.25	10:50:22	117.1	116.9	128.31	47.32	128.4
2	Koteshwar-2	18.09.25	04:57:07	92.8	89.69	74.37	104.32	74.9
3	Koteshwar-1	07.09.25	03:58:56	117.2	118.8	125.38	53.31	125
4	Moga	31.07.25	01:13:21	222.2	222.7	245.64	91.5	245.6
5	Moga	16.07.25	09:29:07	0.3	0.3	0	337.14	0.3

GE
Grid Automation

TW COMMISSIONING MANUAL
Travelling wave fault location in transmission lines

Revision 2 – alberto.becker@ge.com
Revision 1 – alberto.becker@ge.com

Summary

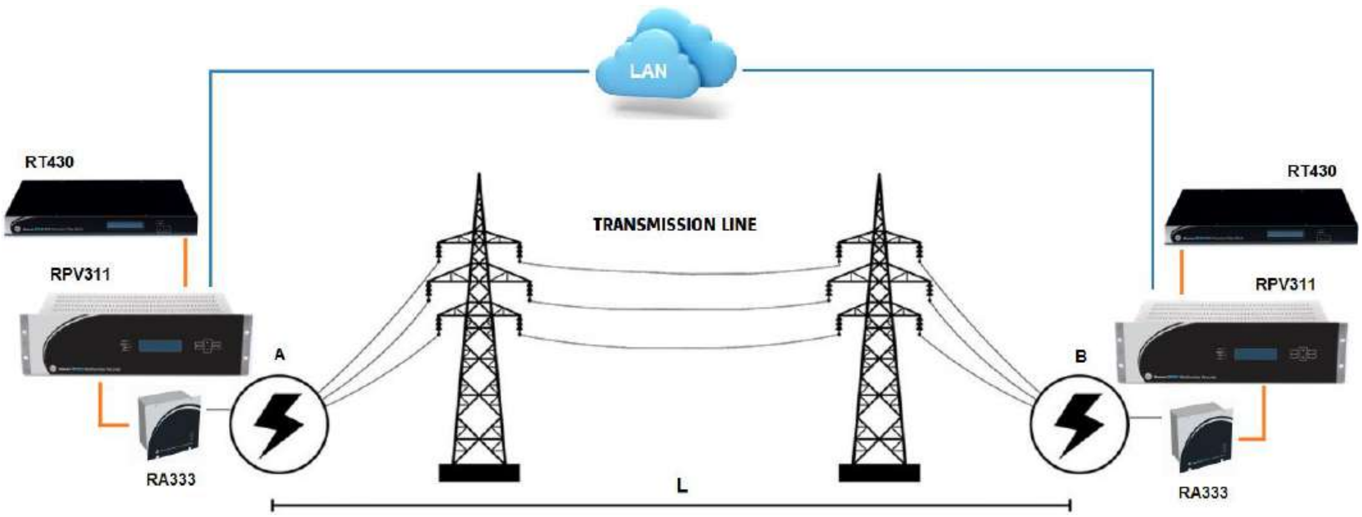
Objective

This document aims to guide the professionals involved in the commissioning TW Reason systems for the correct setup procedure and tests necessary to locate faults in overhead or mixed transmission lines (with an overhead section and one underground). The correct functioning of the monitoring system is subject to the use of configuration and commissioning techniques described herein.

Application

Fault location in mixed transmission lines through TW Reason system comprising the use of the following equipments:

- Processing module of the digital fault recorder, Reason RPV311
- Remote acquisition module for traveling wave, Reason RA333
- GPS Grandmaster clock, Reason RT430 (or other compatible sync source)
- RPV Manager Software, Reason version 07A00



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1. INITIAL CONSIDERATIONS

Before starting the commissioning of the TW system, it should be borne in mind that the fault for traveling waves of Reason tracking system works in conjunction with an DFR, so it is essential that the DFR is properly commissioned and this includes the parameter setting circuits monitored and the realization of acquisition test of all digital and analog signals monitored by DFR. These signals form the basis for triggering the limits associated with the system. The DFR commissioning should be performed using the document referred to as "Test Report - Commissioning" and must precede the commissioning of the TW system. To be able to perform commissioning, the customer will need to provide some details of the construction characteristics of the transmission lines needed to determine the system configuration parameters, as will be described herein. The procedures will be described only refer to the commissioning of the TW system, both in exclusively overhead lines as in mixed lines.

2. INSTALLATION

2.1. Checking the internal jumpers of the RA333 module

When using more than one module RA333 in the same processing unit, RPV311, you must configure the QTW board RA333 module, a combination of jumpers to define a unique ID for each module. As RPV311 can work with up to four RA333 modules connected in their links, these modules should be identified each IDs different from each other. It is not necessary that the modules are connected in any sequence in RPV311 links. The important thing is that each has a different ID from the others. The figure below shows all ID combinations possible to be configured in the RA333. Note that the ID-0 is the only combination that does not require jumper in any position of JP2, JP3 and JP4.

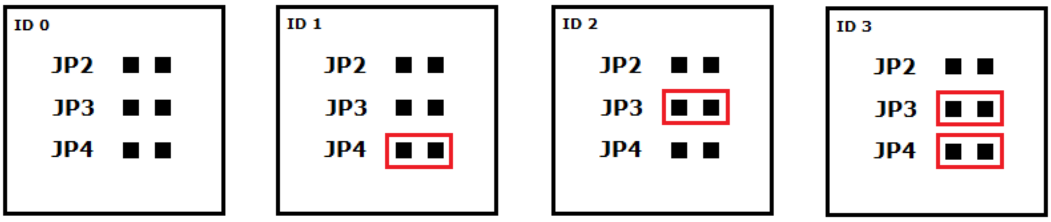


Figure 1 – Combinations of the ID jumpers on the board QTE

The QTW board is one that makes the communication link TW RA333 module with links from RPV311. To extract the QTW card is to open the back cover of the RA333 module, preferably before installing the panel. Only after checking and setting the ID's, you should do the installation on the panel. In the picture below presents the location of the JP2 pins, JP3 and JP4, where the jumpers must be connected.

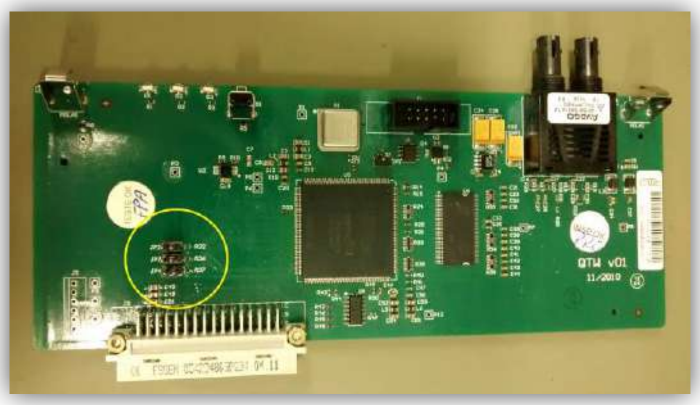


Figure 2 –Link TW QTE board (extracted from the RA333)

2.2. Electrical connections

Once installed on the panel makes the electrical connection of current signals, voltage and digital from the monitored line.The module RA333 makes recording of traveling waves through high frequency voltage acquisition channels, in the MHz range, channels 301, 302 and 303. Therefore, it is necessary to make a parallel connection between the low frequency channels (50 / 60Hz), numbers 101, 102 and 103, for the DFR with high frequency channels (MHz), numbers 301, 302 and 303, for the TW. Briefly, it needs to be monitored three voltage/current of the line and digital signals 52 (operated) GENERAL TRIP, POTT-RX, 67N, 87, 21, 21N and 27N, regarding main protection line. If possible it is indicated that the equivalent signals of the secondary protection, are also wired to the equipment and monitored. To be able to locate the faults nimbly through the localization software, it is recommended that the two devices are connected to a network for remote access. Below is the schematic example of the installation.

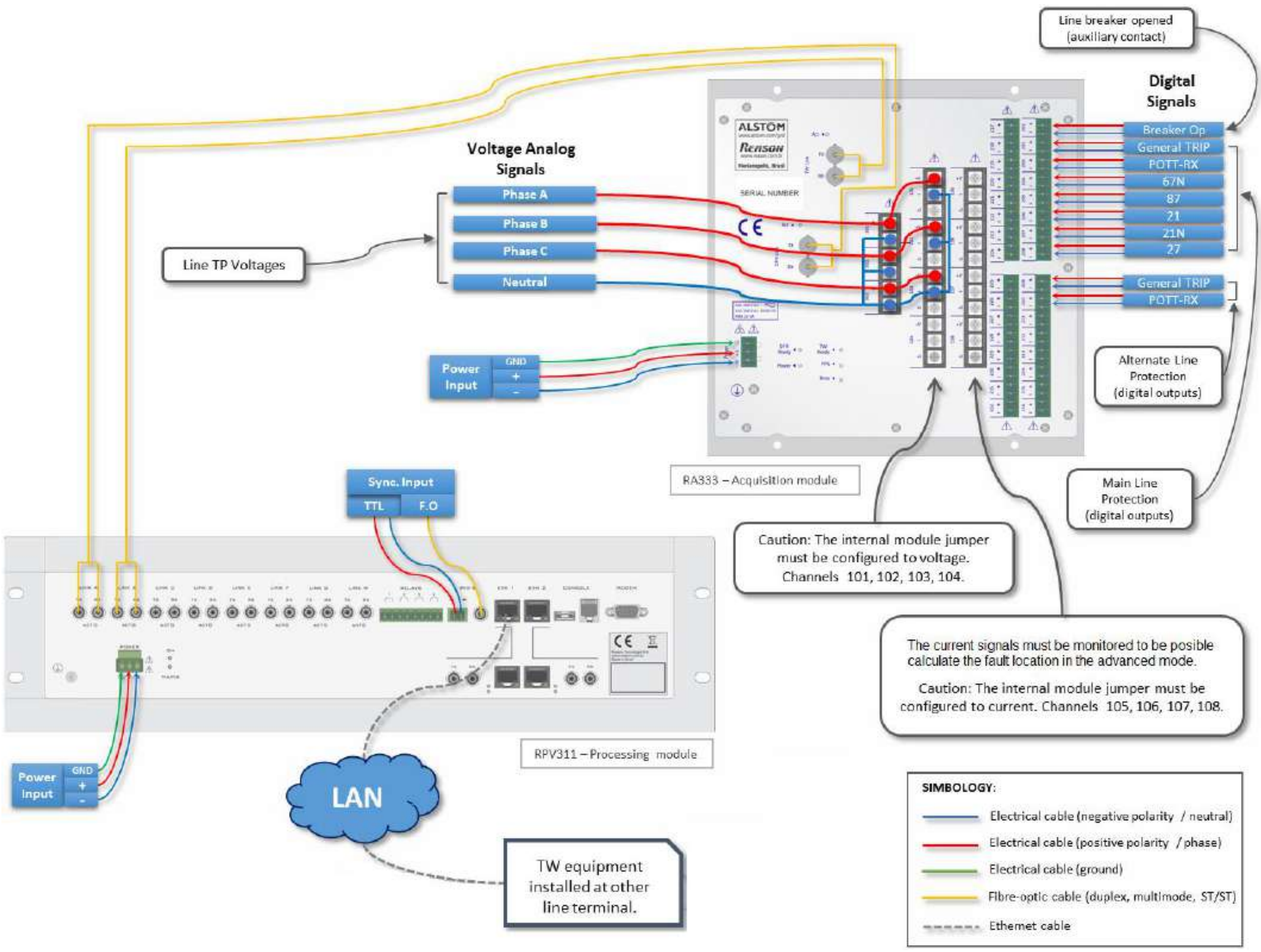


Figure 3 – Electrical schematic wiring

2.3. Installation and acquisition validation tests

After completion of physical installation must be done tests that prove the correct functioning of the DFR on both ends of the line, as indicated in the “Test Report – Commissioning” used in the DFR commissioning. After validating the operation of the DFR the TW acquisition system should be specifically tested to ensure that the RA333 module is installed properly and acquiring the signals properly.

For this, It is suggested the following:

a) Open the RA333 modules and verify that the jumper that sets the ID number of each module is consistent with the number of modules installed in each RPV, and the position of the voltage / current analog channels jumpers. Physically check the installation of TW module to ensure that there is wiring in parallel with the TW channels with the voltage channels of the monitored transmission line.

b) First the current/voltage channels (50 / 60Hz) must be tested, applying three-phase signal through test case on equipment channels from the source panel of these signals and check by monitoring web interface the correct acquisition of these signals.

c) After validating the acquisition of analog signals should be tested all digital points used in the system trigger, closing the digital contacts from terminal blocks of the signal source panels.

d) Before testing the TW acquisition system the TW terminal must be set up and activate the recording register. Create and activate an undervoltage threshold of 0.9 PU. Apply nominal value in line voltage inputs to be monitored. Ensure that the equipment is synchronized with IRIG-B000 signal and PPS LED is blinking in the RA333 module. In DFR web interface the synchronism status should be "Locked" and, in addition, all the RA modules connected in DFR links must be active.

e) After ensuring that the system is properly synchronized and with all links active, the TW system should be tested. To test the acquisition, provoke the appearance of a small traveling wave through the electrical opening of at least one of the voltage channels (eg, by opening the test block) and check the trigger of the RA333 module through the Busy LED lighting. When LED turns off (after 2 minutes) access the equipment and check the existence of traveling wave record. Open the registry and visualize the traveling wave generated by the opening of voltage circuit during the test.

3. TW CONFIGURATIONS

The TW system configuration consists in creating specific limits so that equipment located in both line terminals simultaneously trigger when a fault occurs because during the fault, travelling waves are generated spontaneously. Any type of electrical interruption, even the opening of a line circuit breaker can generate traveling waves, so it is important that the equipment is set to trigger only when needed. Therefore, for each equipment operation condition, are created specific limits to be activated according to the equipment operation mode.

3.1. Thresholds trigger configurations for the travelling wave system

The configuration of the trigger limits of the equipment must be made in web interface configuration of equipment installed at each end. They should be set up analog and digital limits and subsequently activated in the "traveling wave recorder" option.

The trigger limits used in equipment while operating in operation mode are different from those configured during the step of calibration field testing, because the trigger condition is different in both cases. All limits are created together and are available in the configuration, but only the limits related to equipment operating mode at the time must be activated. The limits are set by equipment configuration web interface, in the option "Thresholds".

Therefore, we use the following threshold settings for each situation:

a) Thresholds for trigger in test mode

- Phase overcurrent (greater than 10% of the load current)
    - Example: If the line current with load is 800A must be set the threshold value in 80A. For practical reasons, it was suggested the setting of an overcurrent limit greater than 10% of the line current before opening the line. Therefore to determine the trigger limit should be monitored what the current of the line in operation condition is and then calculate the current limit equivalent to 10% of the line load value.

b) Thresholds for trigger in the operation mode

Digital thresholds:

- 52 (open circuit breaker, ABC phase) - with normal logic

  Example: Create a limit for each open breaker contact with normal logic so that the recording is triggered when the circuit breaker contacts are closed. The objective is to trigger the recording at the time when the line is de-energized.

- TRIP GENERAL POTT-RX
- 67N, 87, 27, 21, 21N
- If possible also TRIP contacts and 52 (circuit breaker) equivalent alternating protection.

Analog thresholds:

- Phase undervoltage (less than 0.9PU)
- Phase overvoltage (greater than 1.1PU)
- Neutral overvoltage (greater than 0.2PU)
- Overcurrent (greater than 10% of the phases nominal value)

  Example: If the line current with load is 800A must be set the threshold value in 80A.

- Negative sequence overcurrent (greater than 10% of the nominal value of phases)

  Example: If the line current with load is 800A must be set the threshold value in 80A.

3.2. TW Configuration in the equipment web interface

Accessing to equipment configuration web interface, through the option "traveling wave recorder" you can add and create TW terminals in each equipment. This option is set the terminal name of the equipment in question and a list of all limits that have been created is displayed. Only the limits related to TW should be activated in this option. These are the limits that when violated will trigger the traveling wave recording. Must be attentive to activate and deactivate the limits required for each device operating condition. This will depend on the operating condition to which you want the equipment to work.

3.3. Necessary parameters for TW Fault Locator Software

The RPV Manager software tools, will pool the CONTRADE files records of traveling waves, at the two ends of the line, on the same computer and based on the time stamp of the front wave of each record, it will calculate the fault location. For this it is necessary to have network connection with the two devices.

The fault location with accuracy requires to be determined some necessary variables to correct parameterization of location software. These variables are parameters that can be used directly in the RPV Manager software configuration, in the case of L1 and L2 as well as calculated based on the characteristics of the conductors in the case of K1 and K2, where:

- L1 - overhead section length
- L2 - the underground section length
- K1 - reduction factor in overhead section
- K2 - reduction factor in underground section

Following this document the methods to be used for determining those factors will be presented.

3.3.1. Parameter determination of an overhead line

a) Determination of L parameter – overhead line

The L value is the overhead project length, however it is known that this differs from the actual length of the line conductors, it does not consider the line catenaries and not the internal substation cables (TP until TW acquisition modules). When it has two or more events it is possible to minimize the errors associated with the L calculation by using the linear regression method. This method will be described following this document.

b) Determination of K parameter – overhead line

The value of K is the total factor of wave velocity reduction in line in relation to the speed of light, in general this value varies from 0.985 to 0.995. A value in this range can be adjusted experimentally until mathematical methods can be used for its determination. When there is a single event in the line is already possible to determine a first estimated value using the equation below. The calculation of K with only an event should not be considered definitive, since the values of the variables Ta, Tb, L and X generally have intrinsic measurement errors.

$$k = \frac{2x - L}{c\left(\tau_a - \tau_b\right)}$$

Where:

- X - Real location of the fault
- L - Line Length
- C - Speed of light
- Ta, Tb - Wave front Time in Terminals A and B

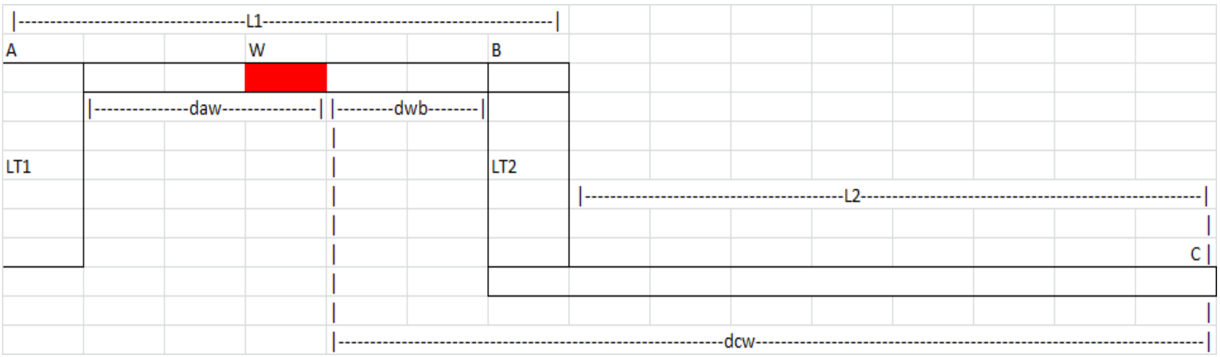
When there are two or more events it is possible to minimize the errors associated with K calculated by using the linear regression method. This method will be described following this document.

3.3.2. Parameter determination of a mixed line

a) Mathematical modeling to locate faults in mixed lines

To calculate the location of faults in mixed lines, we must first determine if the failure occurred in the overhead or underground section of the line. Depending on the segment where ocurred the fault you must use a specific set of equations. To know which section was the fault, first calculate the Daw value for the overhead line section. If the result is lower than or equal to the overhead line section (L1) means that the fault occurred in the overhead section. In this case the fault location is Daw value already calculated. When the calculated value of Daw is greater than the length of the overhead section means that the fault is located in the underground section, L2, therefore it must use the set of equations of the underground section to find the fault.

Fault in the overhead line section (AB):



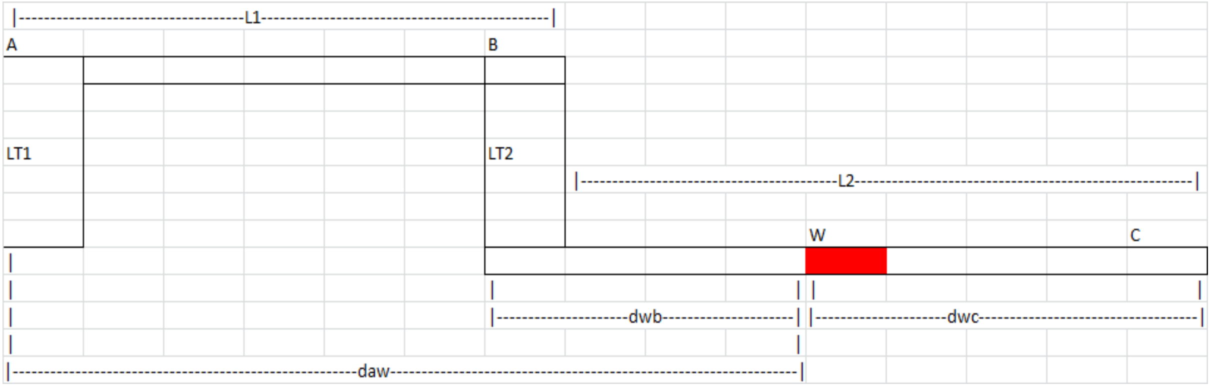
Where:

$$D_{wb} = L_1 - D_{aw}$$

$$D_{aw} = \frac{L_2 + \alpha L_1 + \alpha K_1 C \Delta T}{2\alpha}$$

$$D_{wc} = L_2 + L_1 - D_{aw}$$

Fault in the overhead line section (AB):



Where:

$$\boxed{D_{wb} = L_2 - D_{wc}}$$

$$\boxed{D_{aw} = L_2 + L_1 - D_{wc}}$$

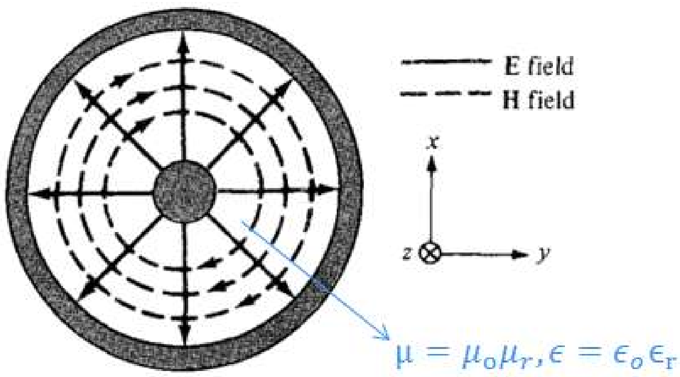
$$\boxed{D_{wc} = \frac{L_2 + \alpha L_1 - \alpha K_1 C \Delta T}{2}}$$

- W: The fault point
- Daw = Distance from terminal A to fault
- Dwb = Distance from terminal B to fault
- Dcw = Distance from terminal C to fault
- C = Light Speed (~ 300.000 km/s)
- L1 = Length of overhead line
- L2 = Length of underground line
- K1 = Velocity Coefficient for overhead Line
- K2 = Velocity coefficient for underground line
- Ta = Time to TW arrive on ending point A
- Tb = Time to TW arrive on ending point B
- Tc = Time to TW arrive on ending point C

Now it is known what are the variables involved in the fault location equations for each faulting condition to determine the parameters of the line.

b) Determination of K parameter – mixed lines

The parameter K is a variable that determines the speed reduction factor of the wave conductor according to the characteristics of each line section. It is considered that the vacuum propagation velocity of electromagnetic waves equals the speed of light. However, the velocity of propagation of a traveling wave in the coaxial cable depends on the permeability and permittivity constants that determine the dielectric insulation characteristics of each type of cable.



$$V_{wave} = \frac{1}{\sqrt{\mu_o \epsilon_o}} = \frac{C}{\sqrt{\mu_r \epsilon_r}}$$

Where:

- μo – Magnetic permeability constant vacuum $4\pi \text{ x } 10^{-7}$ H/m
- μr – Relative permeability of each material
- Єo – Dielectric permittivity of vacuum ≅ $8.854 \text{ x } 10^{-12}$ F/m
- Єr – Permittivity relative of each material

In a mixed line there are different K-factors for each line section, for the isolation of these conductors has different characteristics. Thus we have:

- K1 - reduction factor in overhead section
- K2 - reduction factor in underground section

Thus, the K value representing the mixed line is calculated by the ratio of K2 and K1:

$$K = \frac{K2}{K1}$$

Therefore to determine the K parameter is first necessary to calculate the values of K1 and K2, as will be described below.

- **K1 factor calculation – overhead section**

In the case of K1 factor relating to overhead line, without insulating material, it is considered that the dielectric material insulating the cable is only the air. In this case the constant of permeability and permittivity is very close to 1.

$$\mu_{r_{air}} \cong 1 \qquad \epsilon_{r_{air}} \cong 1$$

$$\boxed{V_{wave_{overhead}} = \frac{C}{\sqrt{\mu_{r_{air}}\epsilon_{r_{air}}}} \cong C}$$

In overhead lines, the speed of wave is very close the speed of light, between 98% and 99.5%, it means that the factor K1 is in the range from 0.985 until 0.995. For calculating with precision is a very complex task, because it depends on unknown constants of permeability and permittivity of the dielectric of overhead line cable. As in this case the dielectric is air, these constants may vary with humidity, atmospheric pressure and distance between the the conductors of the transmission line in question. Therefore, during the commissioning of a line, we fix the K1 value at 0.99 and it therefore infers an initial error in the location of faults.

- **K2 factor calculation – underground section**

For the underground line section it is necessary to calculate the K2 factor. This factor can be calculated easily because the underground line cable has a great difference regarding to the cables used in overhead lines, that is the dielectric insulation material. In these cables the insulation is not only the air but a previously known material and designed for the application wich the cable is used, therefore known by the manufacturer and reported in the datasheet cable. Knowing the material used in cable insulation can be obtained its constant permeability and permittivity, so you could determine the value of the wave velocity reduction factor for each type of cable. A common material used in the insulation of these cables is XLPE, but you must find what material is in fact used in the isolation of the underground cable in question. In the example below, it is calculated the value of K2 to an insulated cable with XLPE and with their constant permeability and permittivity, where the result is K2 = 0.66.

$$\mu_{r_{xlpe}} \cong 1 \qquad \epsilon_{r_{xlpe}} \cong 2.3$$

$$\boxed{V_{wave_{underground}} = \frac{C}{\sqrt{\mu_{r_{xlpe}}\epsilon_{r_{xlpe}}}} \cong 0.66C}$$

c) Determination of L parameter – mixed line

The length of the line section is known by the owner to be part of the transmission line project, however knowing the length of the line does not mean knowing the length of its cables. The length of the cables can vary depending on the catenary of the overhead line and also the internal substation cables that carry the signal from the TP to the input panel on which is installed the RA333 acquisition module. This difference is found in the overhead line section and is a source of error in the fault locations. In the underground line section, it is known the exact cable length because the length of the underground line is exactly the length of the cable itself, so in this case we do not have a source of error for the system. So L is the sum of L1 and L2 as shown below:

$$L = L_1 + L_2$$

Where:

- L – Line real length
- L1 – Overhead section length
- L2 – Underground section length

The value of L1 is the line project length; however it is known that this differs from the real length of the line cables because it does not consider the catenaries and substation internal cables. But the L2 value is not need to be calculated because the length of the cable project in the underground section will be exactly the length of the underground section of the line. When there are two or more events it is possible to minimize the errors associated with L1 through the calculation using the linear regression method. This method will be described following this document.

4. CALIBRATION PROCESS

The TW system calibration process involves applying the mathematical method of linear regression to find the optimum value of each setting parameter of the location system considering a series of events occurring in the line transmission. Thus, it is reduced the location errors associated with imprecision in the theoretical determination of the parameters.

The obtaining of samples required for calibration can be done at the commissioning stage or even after the line is in operation.

4.1. Linear regression method

When there are two or more events with known line fault location you can use the linear regression method to get the results of K1 and L closer to reality.

Using the linear equation is possible to determine the linear projection of y depending on the sets of x and y samples from each event occurred on the line. As more samples are considered more accurate will be the y linear projection. Below is an example of linear projection chart.

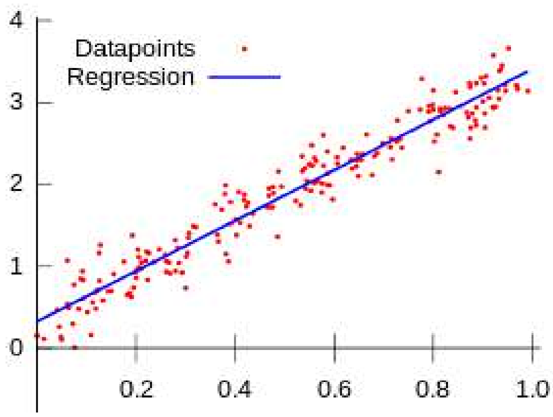


Figure 4 – Example of linear regression graph

For calculating A and B use the following equations:

$$A = \frac{\overline{\sum x} \,.\, \overline{\sum y} - \overline{\sum x.y}}{\overline{\sum x} \,.\, \overline{\sum x} - \overline{\sum x.x}}$$

$$B = \overline{\sum y} - A.\overline{\sum x}$$

Based on the calculated values of A and B it is possible to calculate the linear projection of y using the linear equation:

$$y = A.x + B$$

4.2. Linear regression equations for overhead lines

- ***Determination of L1 – overhead line***

When there are two or more events, it is possible to calculate the linear projection of L1, using the following equation:

$$L1 = 2B$$

- ***Determination of K1 – overhead line***

When there are two or more events, it is possible to calculate the linear projection of k1, using the following equation:

$$k = \frac{2A}{c}$$

4.3. Linear regression equations for mixed lines

- ***Determination of L1 – mixed line***

When there are two or more events, it is possible to calculate the linear projection of L1, using the following equation:

$$\boxed{L_1 = \frac{2.B.K_2 - K_1.L_2}{K_2}}$$

The value of L2 need not be calculated because the project cable length of the underground section will be exactly the length of the underground line.

- ***Determination of K1 – mixed line***

If possible to do the circuit breaker switching tests at the line in the commissioning stage, also will be possible to calculate the initial K1 value using the equation below for when there is only a single event:

$$\boxed{K_1 = \frac{2.K_2\,.Daw - K_2.L_1}{L_2 + K_2.C.\Delta T}}$$

Where:

- K2 – Wave propagation factor in underground cable
- Daw – Distance from the fault (Terminal A ref.)
- L1 – Overhead line length L2
- L2 – Underground line length
- ΔT – Time difference between the wavefront recorded at the line terminals A and B

When there are more than one event is possible to use linear regression to calculate K1 using the following equation:

$$\boxed{K_1 = \frac{2.A}{C}}$$

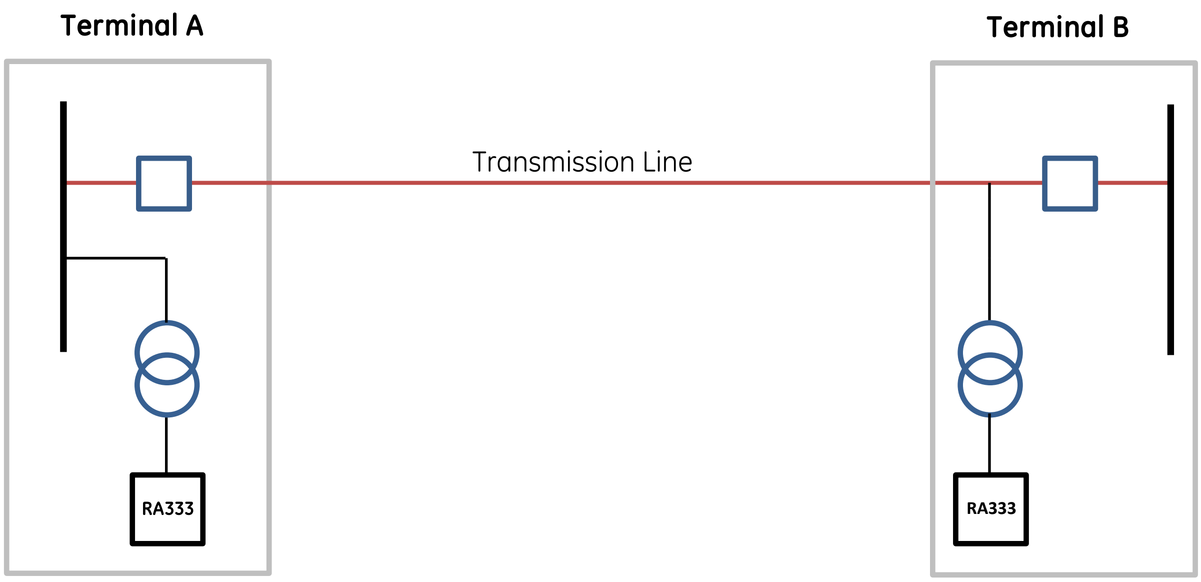
4.4. Obtaining linear regression samples

4.4.1 Through real faults – line in operation

When the line transmission is already in operation it is possible to calibrate the system using samples related to the real faults that occurred in the line. In this case for each real fault occurred it is necessary to know the location calculated by software and the real location confirmed by field team. Based on the two records it is possible to calculate the error location for each event and then calculate the linear projection of the K and L. It is recommended that the linear regression will be calculated from the third event and should continue until there is stabilization of K1 and L an acceptable error range.

4.4.2 Through circuit-breaker switching – line in test

During commissioning it is also possible to obtain the events necessary to be able to make the linear projection of K1 and L, for that will be possible it is necessary cause the appearance of traveling waves in known points on the transmission line. Usually just switching the circuit-breaker is enough to generate these waves, so it is suggested to do at least three switches in line-breakers during commissioning period for obtain at least three events required for calculating a first linear projection. However, this type of test depends on the operating line availability at the time of commissioning, it is necessary that the line is loaded; otherwise there will be no traveling waves.



Before performing any type of TW test in the transmission line is necessary to configure the equipment trigger thresholds for operation in "test mode". This configuration is described in item 3.1.a of this document.

To obtain the samples, we suggest the following sequence of circuit-breaker switching tests from the line terminal A:

Step 1: Opening the line breakers

Wait two minutes before continuing...

Step 2: Closing the line breakers

Wait two minutes before continuing...

Step 3: Opening the line breakers

Wait two minutes before continuing...

Step 4: Closing the line breakers

Wait two minutes before continuing...

Step 5: Opening the line breakers

Wait two minutes before continuing...

Step 6: Closing the line breakers

By performing this sequence of tests you have three events that will allow to calibrate the system by first linear projections of K1 and L. This will significantly improve the precision of fault location. You can also improve the result as new events are recorded by the equipment and new samples are added to the linear regression. This activity can be continued after the line is in operation.

After the tests were completed the equipment thresholds configuration should be re-established for the line transmission operation "operation mode", as described in item 3.1.b of this document.

5. FAULT LOCATION WITH THE RPV MANAGER SOFTWARE

5.1. Configuration

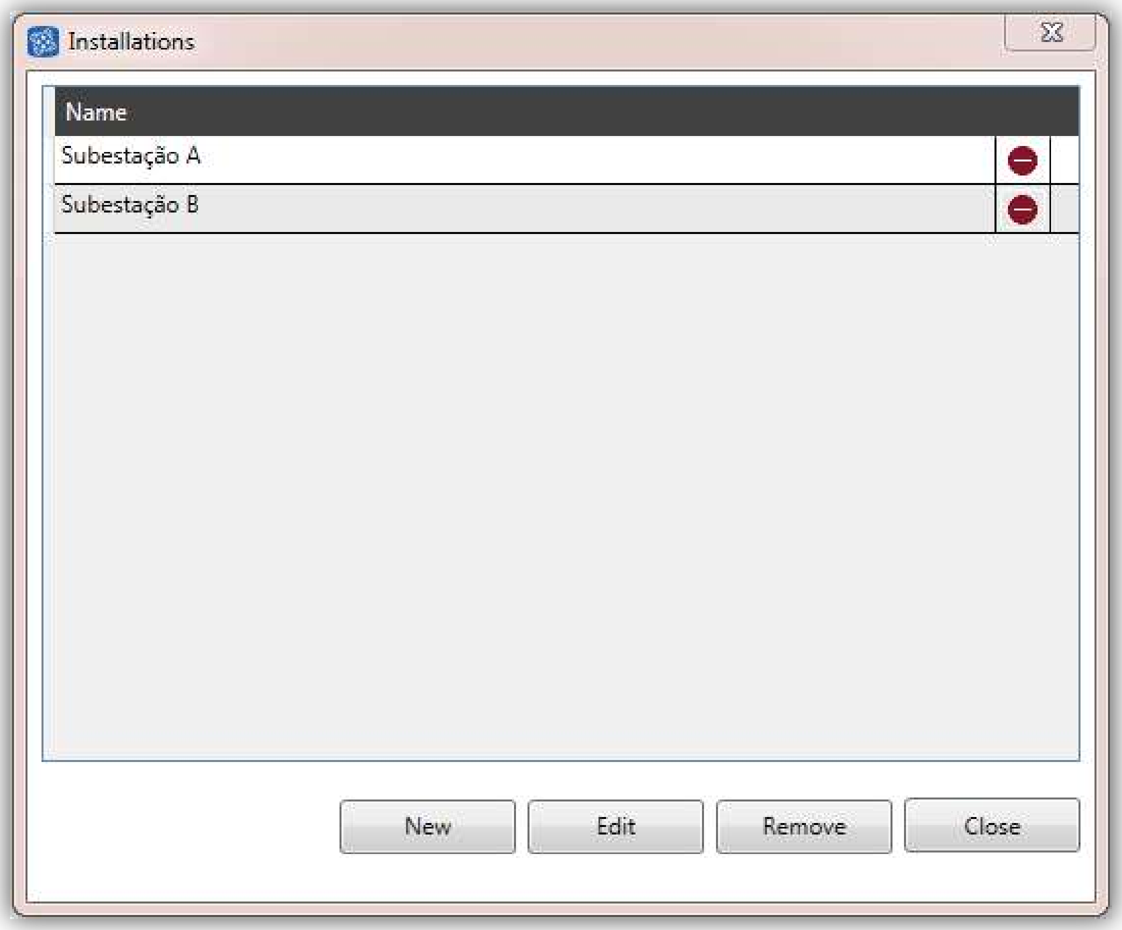
The RPV Manager is software developed specifically to work with the line of Reason's DFR, RPV311 model. The software integrates scanning tools and records management, log message display, goose configuration and fault location by traveling waves. The software is able to manage information collected from multiple devices distributed throughout the customer network. Communication is all done by TCP / IP protocol, so the computer where you installed the software needs to have connectivity to the monitored equipment. The connection to the equipment allows the software to scan all records of equipment, focusing on the local computer client. The software also uses the traveling wave records downloaded from the equipment for locating faults by the traveling wave method.

As the software manages information of various equipment installed in various places, it has a configuration method that makes the registration of lines in a structured way, you must first configure the data from substations, after the equipment and finally the monitored transmission lines.

In the screenshot below is observed the three steps of the process of setting up transmission line in the software, which will be described below.

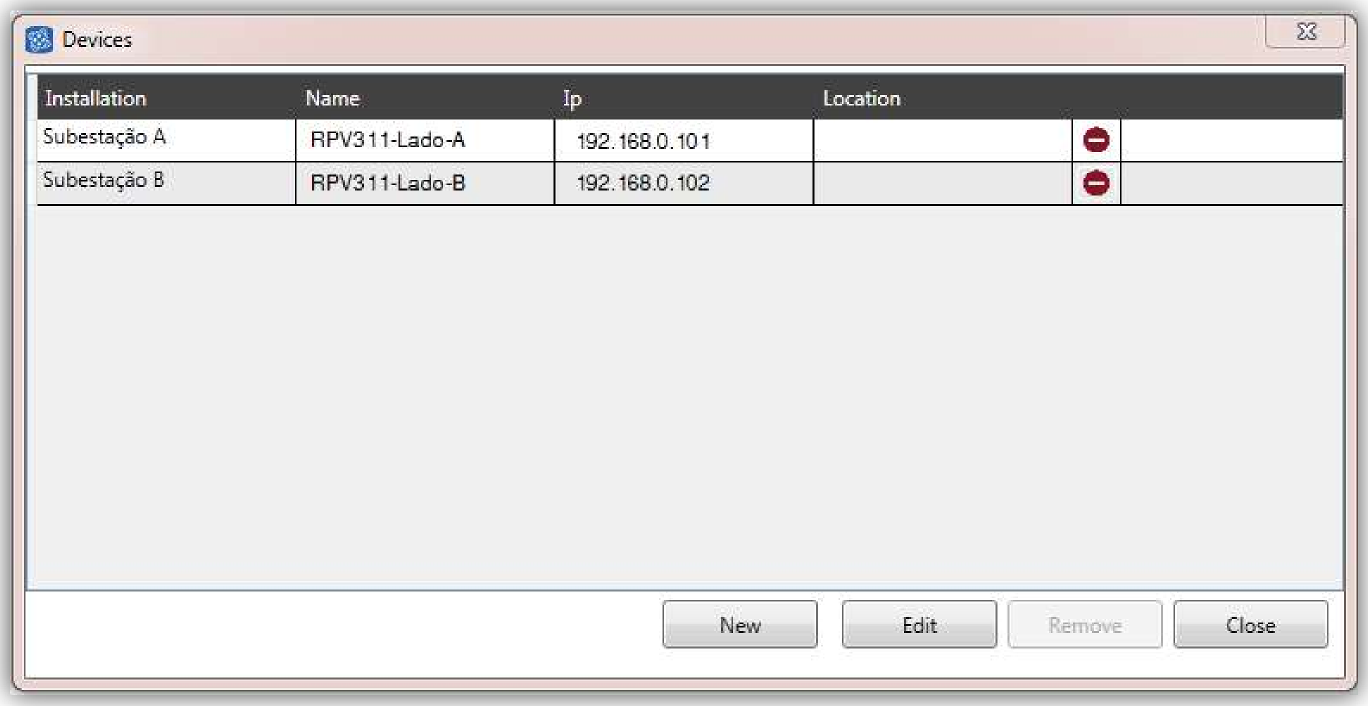
- ***1º step – Installations***

It should be registered, the name of the substations on each side of the line.



- ***2º step – Devices***

For each substation created in the previous step should be created and associated an equipment. It is possible that a substation there are multiple equipment installed, as several lines can be derived from it. For each equipment is necessary to inform the IP address because the software establishes communication with the equipment at the time of setting to get information related to identification of the equipment, such as name and location.



- ***3º step – Transmission Line***

Once created the substations and configurations of equipment installed in it, we have to associate the equipment according to the lines that they monitor. Reason TW system requires a set of equipment installed at each end. Thus when creating a transmission line is necessary to inform the substations that are on each side of the line and which equipment monitors this line. After that you must enter the number of sections, 1 for airline and 2 for mixed line.

Then must be informed of the line parameters, as follows:

- **Length (Km)** – Enter the line length in the overhead section (A = L1) and in the underground section (B = L2).
- **K** – Emnter the line K factor in the overhead section (A = K1) and in the underground section (B = K2).
- **Treshold** – Used as a reference to determine at what point of the traveling wave will be taking time. By default it should be at 0.5 and is used in the basic location method.
- **Terminal A** - Enter the name that was given to the line terminal A . This name should be identical to that set in the "Travelling Wave Recorder" in the device configuration web interface.

- **Current Circuit A** – Enter the name that was given to the line current circuit. This name should be identical to the name configured in the "Current Circuits" on the configuration web interface equipment.
- **Terminal B** - Enter the name that was given to the line terminal B. This name should be identical to that set in the "Travelling Wave Recorder" in the equipment configuration web interface.
- **Current Circuit B** – Enter the name that was given to the line current circuit. This name should be identical to the name configured in the "Current Circuits" on the configuration web interface equipment.
- **Line Name** – Enter the name that will be given to the line. This is the name that will be displayed to identify the line in the Fault Locator Tool in the RPV Manager interface.

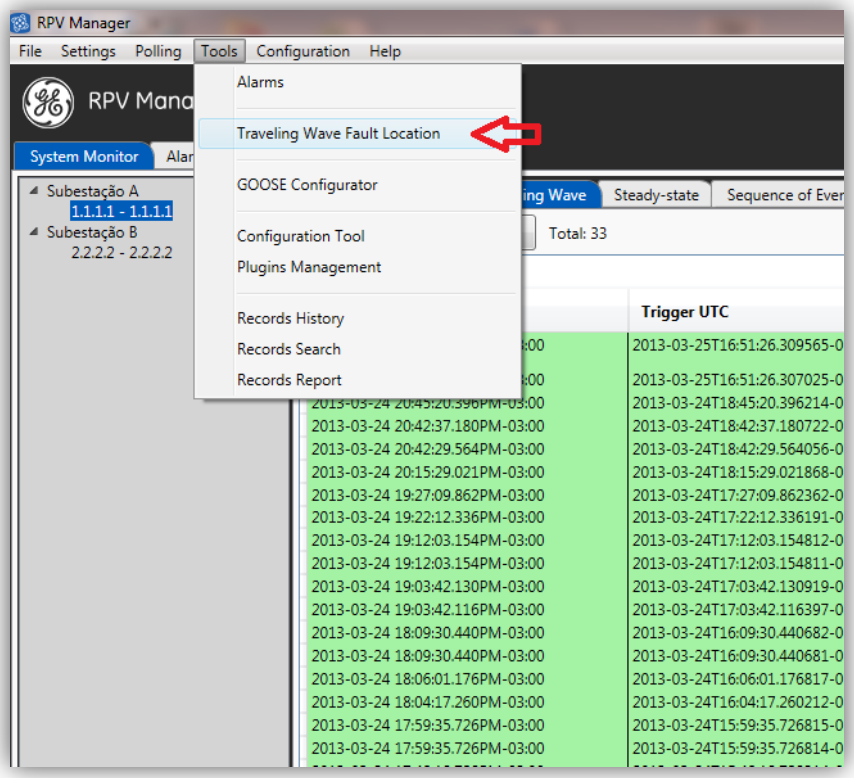
5.2. Fault location tool

The software uses the traveling wave records automatically downloaded from the equipment to make the location of faults by the traveling wave method. There are two fault location methods, advanced and basic, that depend on the type of records available for apply the location method.

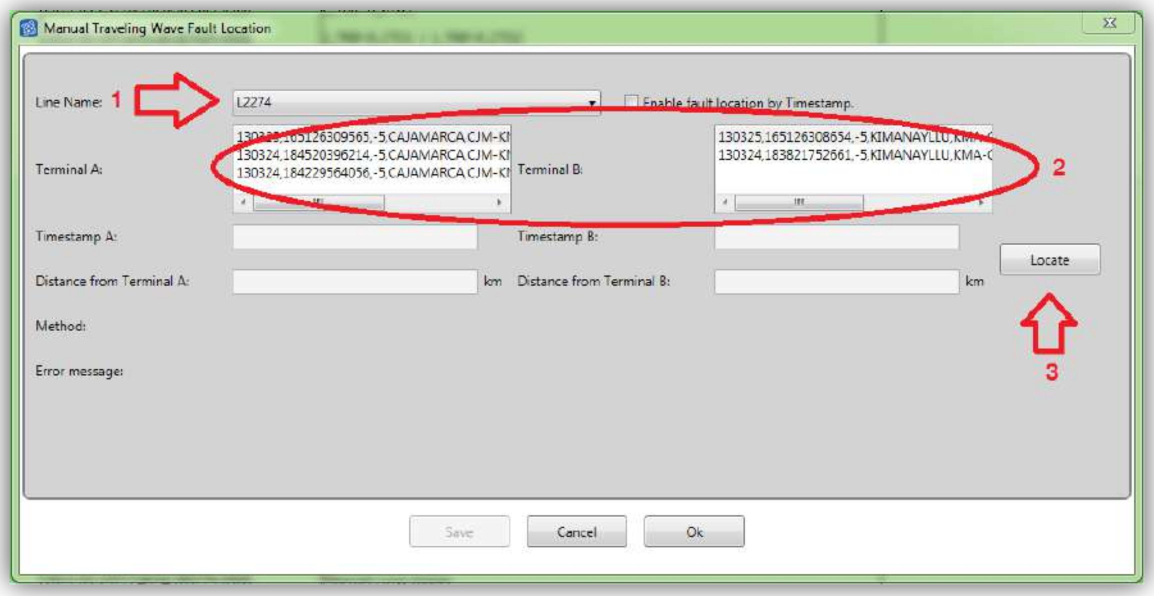
Basic Mode: Locates faults using only the traveling wave records. In this method, the time stamp on each considered traveling wave is the point where the signal level exceeds the threshold setting, usually set at 0.5 PU. This method is not very reliable when it has been traveling wave records from faults of high impedance faults, since these records have a very high noise level, which can cause the software to determine misrepresented the front wave time stamp.

Advanced Mode: In this mode is used, a signal processing algorithm that filters out high frequency signals which are not part of the traveling wave and allows the software to make a determination of the time stamp of reliably wavefront in any type fault. However it is needed the fault waveform records, with the line current signals at both terminals. Moreover, in the line setting process it is necessary to inform the current path name for each terminal.

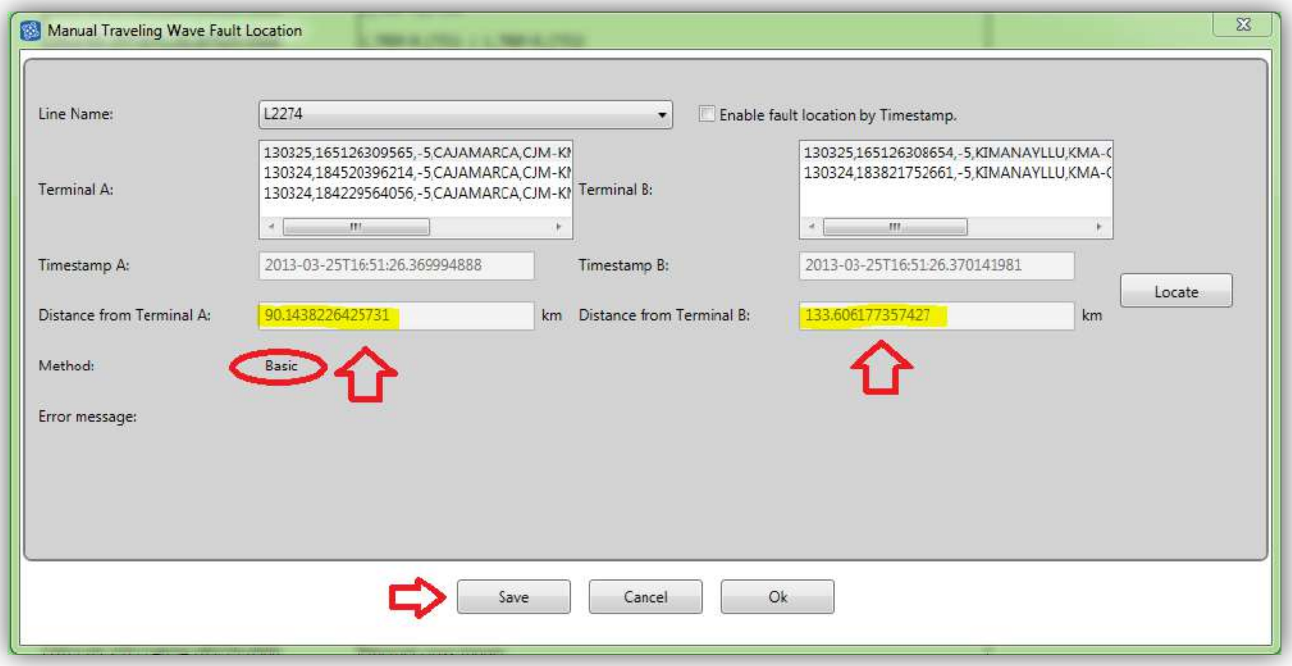
The fault location is done using the locator tool called "Travelling Wave Fault Locator", found in the menu below:



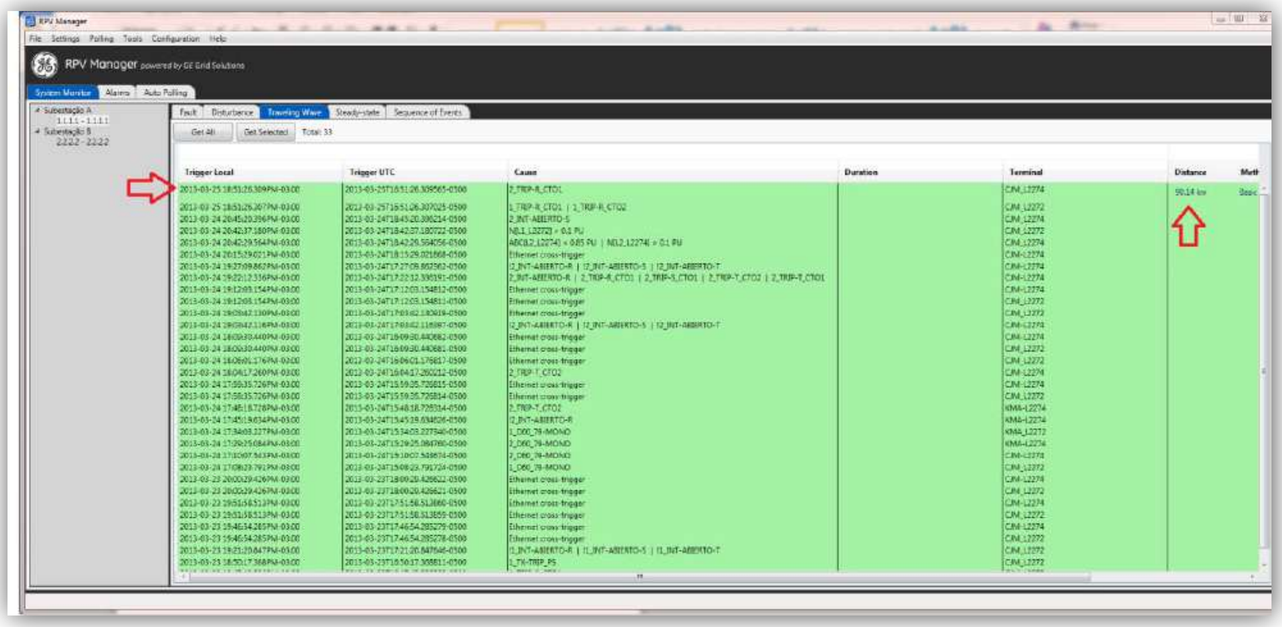
The localization tool will open the window below. You should select the line and then should be selected the tw fault records, in terminals A and B. After selecting the records the "Locate" button must be pressed.



After clicking the "Locate" the fault is located and is informed the distance in kilometers from the line terminals A and B.



After located the fault, you can save the result so that it is visible in the software interface, for that you must click the "Save" button.



GE
Grid Solutions

How to remove and import COMTRADE records in the Reason DR Manager software

VERSION CONTROL

Version	Author(s)	Department	Reason for change	Date
01	Ana Lúcia de Oliveira Tavares	R&D	Initial	05/19/2020
02	Leandro de Marchi Pintos / Ana Lúcia de Oliveira Tavares	GA&S / R&D	Review	05/21/2020

Reason Product Line
Grid Solutions

Content

1. INTRODUCTION

This application note presents how to remove and import Traveling Wave records in the Reason DR Manager 9.1.4 to fix messages in the logs as for example "*All fault locations related to Comtrade ID 4080should belong to the same Power Transmission Line*".

This error message appears to the records whose faults were located with the software version 09A00. In this old version, the software located faults with the wrong pair of TW records when more one line was configured per RPV311. This occurred because the software did not use the terminal identification to relate records. The version 9.1.4 fixed this issue ("*DR Manager locates faults in unrelated lines when a device monitors more than one line*").

Thus, when removing the records and importing them again in version 9.1.4, it will be possible to locate the fault again and thereby avoid this type messages in log files.

The fault location results are stored in Database. The "Remove" option will remove records from Database and from hard disk. Therefore, **it is necessary to make backup of ZIC files related to COMTRADEs saved in C:\RPV\records\XXX,YYY\tw to allow importing them after.**

The "Import" option is only necessary if the old records no longer exist in RPV311 and the user would like to keep the records in database. If the records are still in the RPV311, they will be downloaded in the next polling sequence.

2. REMOVAL OF RECORDS

The instructions to remove TW records are described below:

1. Open Reason DR Manager;
2. Make backup of data from "File -> Backup Data". This is recommended for precautions;
3. Change polling to "Manual" on "Polling" Tab and disable the option "Start Auto Polling on Initiation" in Configuration -> Polling. **The software will ask to be restarted, then click Yes**;
4. Make backup of records (.zic files). This is essential if it was necessary import this records later;
5. In Tools -> Records Search, select a correspondent device and setting filters.

The following are the instructions for case "LSN-3081_TWFL-DR Manager – Bina" from backup "DRManager-Backup-20200508T181718.pg" sent to us on May 9th, 2020.

2.1. Removing records of DFR1_BINA

The following messages were extracted from the log file:

2020-05-19 10:42:14.1015 ERROR All fault locations related to Comtrade ID 7021should belong to the same Power Transmission Line
2020-05-19 10:42:14.1133 ERROR All fault locations related to Comtrade ID 7022should belong to the same Power Transmission Line
2020-05-19 10:42:14.1133 ERROR All fault locations related to Comtrade ID 7024should belong to the same Power Transmission Line
2020-05-19 10:42:14.1133 WARN All fault locations related to Comtrade ID 6798 should have the same Fault Location Algorithm
2020-05-19 10:42:14.1133 ERROR All fault locations related to Comtrade ID 4090should belong to the same Power Transmission Line
2020-05-19 10:42:14.1133 ERROR All fault locations related to Comtrade ID 4079should belong to the same Power Transmission Line
2020-05-19 10:42:14.1133 ERROR All fault locations related to Comtrade ID 4082should belong to the same Power Transmission Line
2020-05-19 10:42:14.1133 ERROR All fault locations related to Comtrade ID 4080should belong to the same Power Transmission Line
2020-05-19 10:42:14.1133 ERROR All fault locations related to Comtrade ID 4059should belong to the same Power Transmission Line
2020-05-19 10:42:14.1133 WARN All fault locations related to Comtrade ID 4017should have the same Fault Location Algorithm

The R&D team identified the record names on database through the Comtrade ID in the log messages. For example, the "ID 4017" refers to:

"190716,130146846949,+5h30,BINA_765KV,DFR1_BINA,POWERGRID,000000080000,tw,BINA_SATNA1"

The following records must be removed:

1. 190716,130146846949,+5h30,BINA_765KV,DFR1_BINA,POWERGRID,000000080000,tw,BINA_SATNA1
2. 190724,003810506951,+5h30,BINA_765KV,DFR1_BINA,POWERGRID,000000080000,tw,BINA_SATNA1
3. 190724,131945646950,+5h30,BINA_765KV,DFR1_BINA,POWERGRID,000000080000,tw,BINA_SATNA1
4. 190724,131945646950,+5h30,BINA_765KV,DFR1_BINA,POWERGRID,000000080000,tw,BINA_SEONI
5. 190724,131945646952,+5h30,BINA_765KV,DFR1_BINA,POWERGRID,000000080000,tw,BINA_SATNA2
6. 190724,155112126947,+5h30,BINA_765KV,DFR1_BINA,POWERGRID,000000080000,tw,BINA_SATNA1
7. 191212,211755597497,+5h30,BINA_765KV,DFR1_BINA,POWERGRID,000000080000,tw,BINA_SATNA1
8. 191228,005304050858,+5h30,BINA_765KV,DFR1_BINA,POWERGRID,000000080000,tw,BINA_SATNA2
9. 191228,005304050858,+5h30,BINA_765KV,DFR1_BINA,POWERGRID,000000080000,tw,BINA_SEONI
10. 191228,005304050859,+5h30,BINA_765KV,DFR1_BINA,POWERGRID,000000080000,tw,BINA_SATNA1

To do so, go to “Records Search” option in the “Tools” menu and:

1. Select “DFR1_BINA” device, set “Start Date and “End Date”, and select “Traveling Wave recorder” on Type field (as shown in Figure 1);
2. Select the correspondent records;
3. Click “Delete” button.

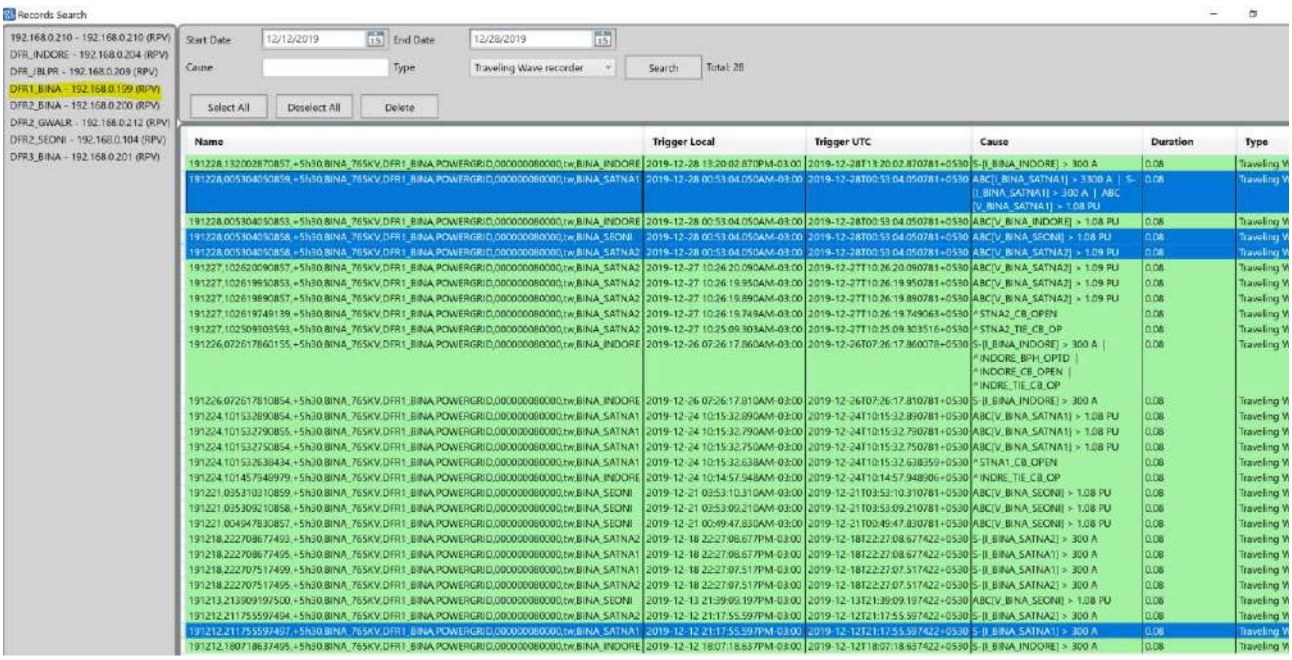


Figure 1 - Records Search window.

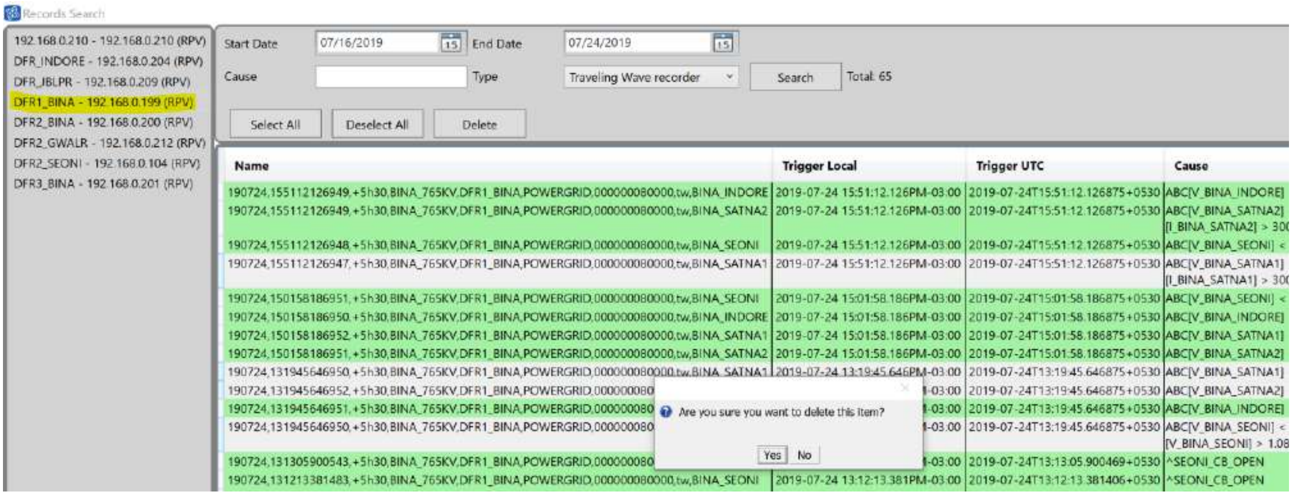


Figure 2 - Remove Records confirmation screen.

2.2. Removing records of DFR2_BINA

The following messages were extracted from the log file:

2020-05-19 10:50:30.1825 ERROR All fault locations related to Comtrade ID 6573should belong to the same Power Transmission Line

2020-05-19 10:50:30.1825 ERROR All fault locations related to Comtrade ID 6572should belong to the same Power Transmission Line

2020-05-19 10:50:30.1825 WARN All fault locations related to Comtrade ID 4290 should have the same Fault Location Algorithm

The following records must be removed through the Records Search option:

1. "190716,130146855859,+5h30,BINA_765KV,DFR2_BINA,POWERGRID,000000080000,tw,BINA_GWALR1"
2. "191128,175454075932,+5h30,BINA_765KV,DFR2_BINA,POWERGRID,000000080000,tw,BINA_GWALR1"
3. "191128,175454075937,+5h30,BINA_765KV,DFR2_BINA,POWERGRID,000000080000,tw,BINA_GWALR2"

2.3. Removing records of SATNA

The following messages were extracted from the log file:

2020-05-19 10:55:27.9258 ERROR All fault locations related to Comtrade ID 3946should belong to the same Power Transmission Line

2020-05-19 10:55:27.9258 ERROR All fault locations related to Comtrade ID 3947should belong to the same Power Transmission Line

2020-05-19 10:55:27.9258 ERROR All fault locations related to Comtrade ID 3944should belong to the same Power Transmission Line

2020-05-19 10:55:27.9296 ERROR All fault locations related to Comtrade ID 3945should belong to the same Power Transmission Line

The following records must be removed through the Records Search option:

1. "190716,130146843823,+5h30,SATNA_765KV,DFR1_SATNA,POWERGRID,000000080000,tw,SATNA_BINA2"
2. "190716,130146843822,+5h30,SATNA_765KV,DFR1_SATNA,POWERGRID,000000080000,tw,SATNA_SASAN2"
3. "190716,130146843825,+5h30,SATNA_765KV,DFR1_SATNA,POWERGRID,000000080000,tw,SATNA_BINA1"
4. "190716,130146843824,+5h30,SATNA_765KV,DFR1_SATNA,POWERGRID,000000080000,tw,SATNA_SASAN1"

3. IMPORTING RECORDS

The instructions to import COMTRADE records are described below:

1. Access “Import COMTRADE Records” from File menu:

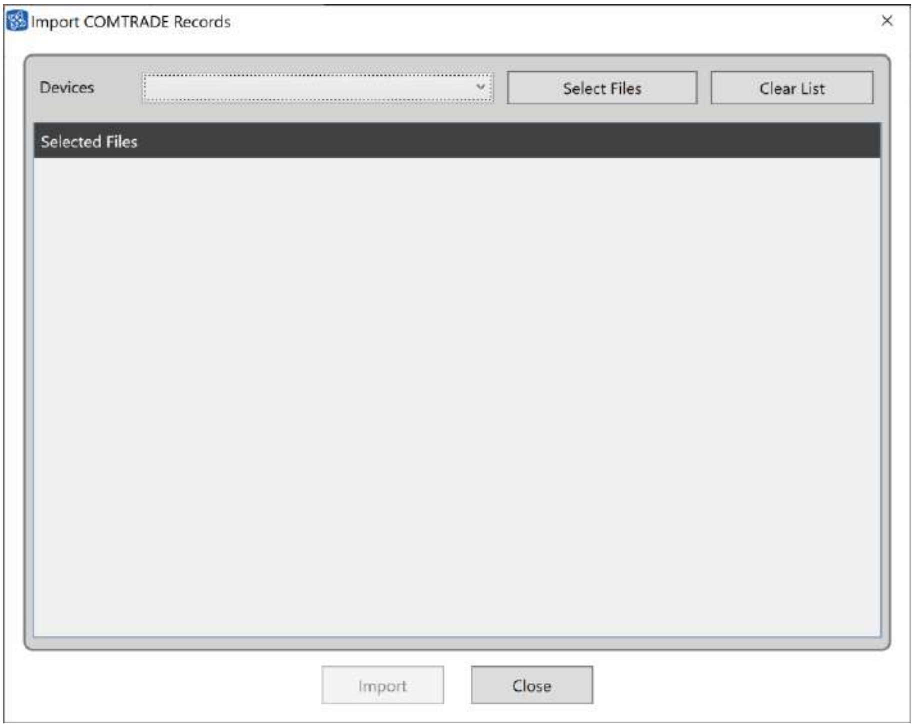


Figure 3 - Import COMTRADE Records

2. Select the Device;
3. Select TW files from hard disk:
    - The files will be saved in “C:\RPV\records\XXX,YYY\tw”
4. Click Import button.

4. REFRESH ALL DEVICES

After import all TW records, select "Refresh All Devices" from File menu to locate faults.

Finally, change polling to "Auto" on "Polling" menu and enable again the option "Start Auto Polling on Initiation" on Polling Configuration. **The software needs to be restarted.**

GE T&D India Limited

(Formerly Alstom T&D India Limited)

Grid Automation-Pallavaram Chennai

Typical Architecture for Kiosk S.S

PROJECT: POWERGRID- Travelling Wave Fault Locator (TWFL) Project.

CUSTOMER : POWER GRID CORPORATION OF INDIA LTD

PGCIL NOA REF: CC-CS/740-CC/ MISC-3335/3/G8

SALES ORDER NO.:3269046299

ENGG. REF. NO.: KXQ5

ENGINEER : SY

पावरग्रिड
(हस्ताक्षर)
Sr. Engr.
(पदनाम)
13/04/18
(तिथि)

श्रेणियां
I. ...निर्माण/हेतु अनुमोदित/जारी।
II. ...निर्माण/हेतु अनुमोदित/जारी। बशर्ते की गई टिप्पणियां एवं आशोधनों को सम्मिलित किया जाए। ... प्रस्तुत करें।
... अनुमोदनार्थ टिप्पणियां सम्मिलित कर पुनः अनुमोदनार्थ
III. प्रस्तुत करें।
IV. सूचनार्थ एवं रिकार्ड हेतु।
V. अनुमोदित नहीं।
पावरग्रिड कॉर्पोरेशन ऑफ इंडिया लि.
ऐसेट मैनेजमेंट, गुड़गाँव, हरियाणा

Abend

अरिन्दम सेनशर्मा
ARINDAM SENSARMA
अपर महाप्रबन्धक (एसेट प्रबन्धन)
Addl. General Manager (Asset Management)
पावरग्रिड, के.का. / POWERGRID, CC

LIST OF DOCUMENTS SUBMITTED

S.NO.	DESCRIPTION	DRAWING NO.	ISSUE
1	Typical Architecture for Kiosk S.S	CPD KXQ5SA1	C-07.04.2018

श्रेणियां
I. फैब्रिकेशन/निर्माण/हेतु अनुमोदित/जारी।
II. फैब्रिकेशन/निर्माण/हेतु अनुमोदित/जारी। बशर्ते दी गई टिप्पणियों एवं आशोधनों को सम्मिलित किया जाए। कृपया आशोधित दस्तावेज अनुमोदनार्थ प्रस्तुत करें।
III. टिप्पणियाँ सम्मिलित कर पुनः अनुमोदनार्थ प्रस्तुत करें।
IV. सूचनार्थ एवं रिकार्ड हेतु।
V. अनुमोदित नहीं।

(हस्ताक्षर)
Sr. Engr.
(पदनाम)
13/04/18
(तिथि)

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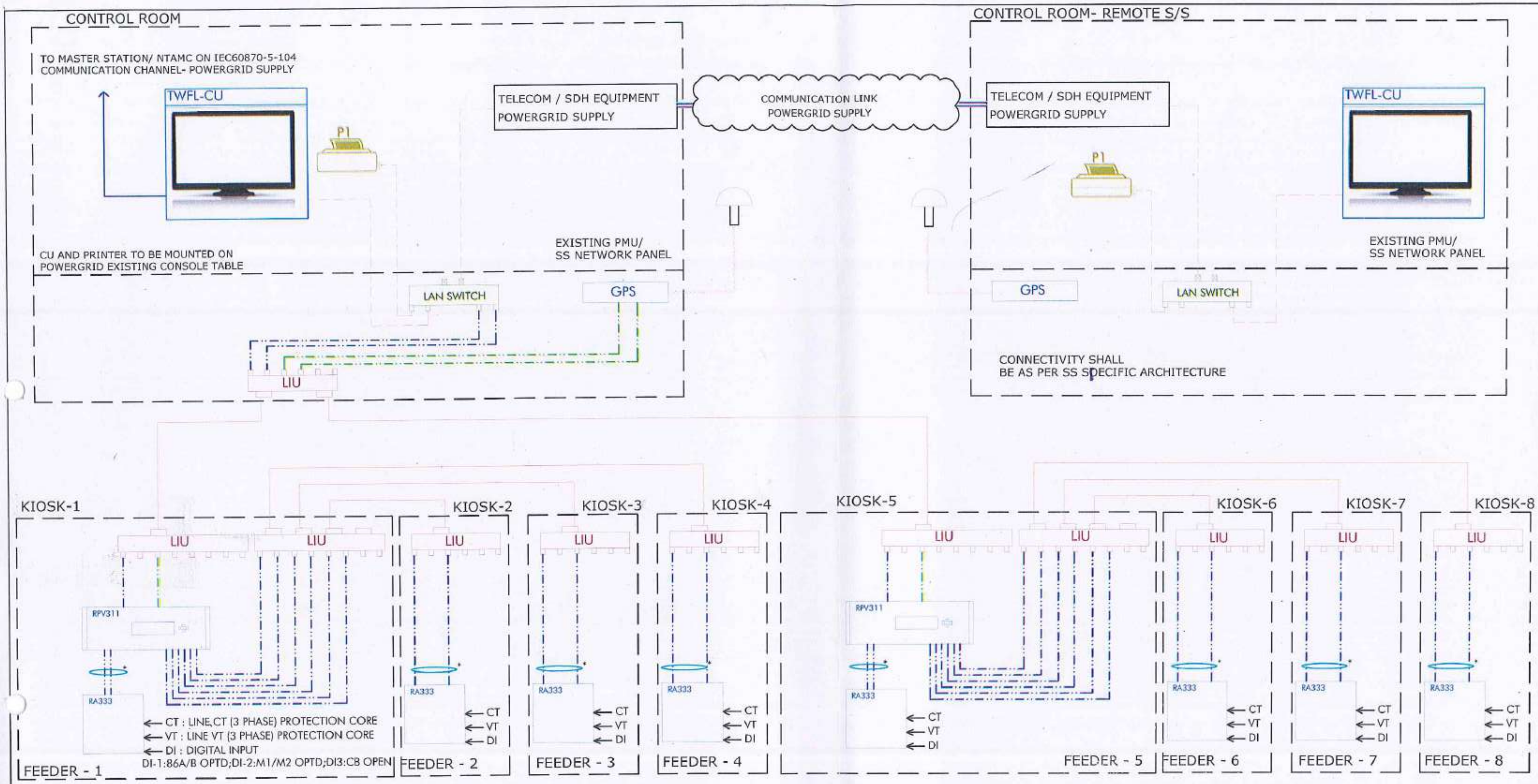
ऐसेट मैनेजमेंट, गुड़गाँव, हरियाणा

ASen

अरिन्दम सेनशर्मा
ARINDAM SENSARMA
अपर महाप्रबन्धक (एसेट प्रबन्धन)
Addl. General Manager (Asset Management)
पावरग्रिड, के.का. / POWERGRID, CC



NOTE : RPV311,RA333 WILL BE MOUNTED IN EXISTING PMUPANEL AS PER SPACE AVAILABILITY.

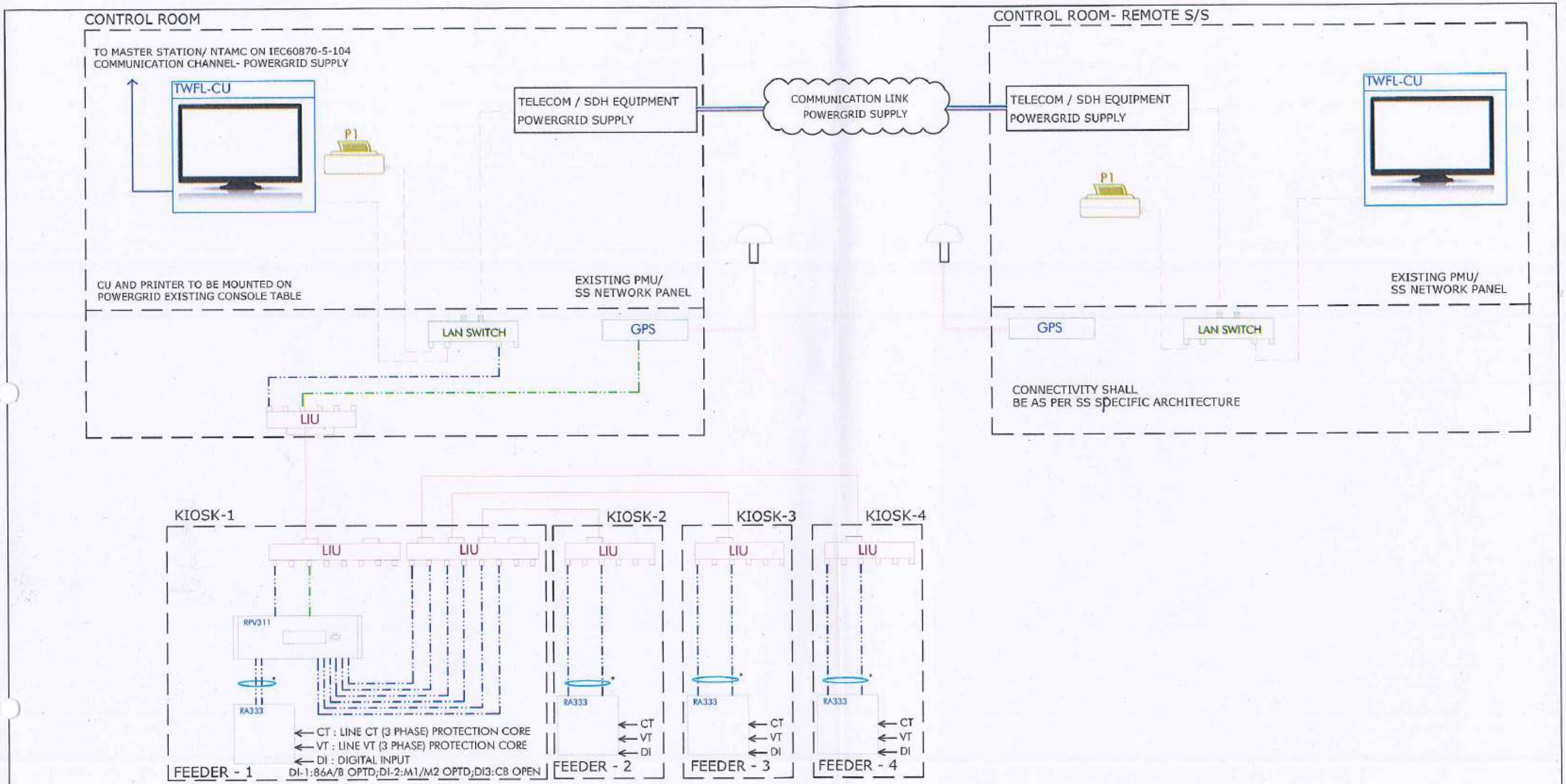
NOTE * : RA333(BAY UNIT) OCCUPIES TWO PHYSICAL LINKS OF RPV311(ACQUISITION UNIT)
ONE FOR DATA TRANSMISSION OF ANALOG CHANNELS (DFR)
OTHER FOR DATA TRANSMISSION OF TW CHANNELS (TW)

LEGEND:-

FIBER OPTIC CABLE (ARMOURED)	:100 MBPS, MULTI MODE
ETHERNET PATCH CHORD - COPPER(CAT6)	:100 MBPS, MULTI MODE
ETHERNET PATCH CHORD - FIBER OPTIC(ST-ST):100 MBPS, MULTI MODE	
COAXIAL CABLE (GPS LINK)	
ETHERNET PATCH CHORD FOR GPS - FIBER OPTIC(ST-ST):100 MBPS, MULTI MODE	

ARINDAM SENSARMA

FOR GE REF: ENGG.REF.NO.: KXQ5	CUSTOMER: POWERGRID CORP. OF INDIA LTD	GE T&D India Ltd. (Formerly Alstom T&D India Ltd) Grid Automation-Pallavaram	SCHEMATIC DRAWING	PREPARED BY: SY / REVISION: C
SCHEME TYPE:	PROJECT: TWFL PACKAGE		FILE:	CHECKED BY: GSS / DATE: 07.04.2018
	P.O.NO.: - Dated -		TITLE: TYPICAL ARCHITECTURE FOR KIOSK S/S	APPROVED BY: SSS / SCALE: --
SALES ORDER: 3269046299			QTY OF FDRS: 8 FDRS ALLOCATED IN 8 KIOSKS	DRG. NO.: CPD KXQ5SA1 SHT 01 OF 02



NOTE : RPV311,RA333 WILL BE MOUNTED IN EXISTING PMU PANEL AS PER SPACE AVAILABILITY.

NOTE * : RA333(BAY UNIT) OCCUPIES TWO PHYSICAL LINKS OF RPV311(ACQUISITION UNIT)
ONE FOR DATA TRANSMISSION OF ANALOG CHANNELS (DFR)
OTHER FOR DATA TRANSMISSION OF TW CHANNELS (TW)

पावरग्रिड कॉर्पोरेशन ऑफ इंडिया लि.
ऐसेट मैनेजमेंट, गुड़गाँव, हरियाणा

LEGEND:-

FIBER OPTIC CABLE (ARMOURED)	:100 MBPS, MULTI MODE
ETHERNET PATCH CHORD - COPPER(CAT6)	:100 MBPS, MULTI MODE
ETHERNET PATCH CHORD - FIBER OPTIC(ST-ST)	:100 MBPS, MULTI MODE
COAXIAL CABLE (GPS LINK)	
ETHERNET PATCH CHORD FOR GPS - FIBER OPTIC(ST-ST)	:100 MBPS, MULTI MODE

FOR GE REF:	ENGG.REF.NO.: KXQ5	CUSTOMER: POWERGRID CORP. OF INDIA LTD	GE T&D India Ltd. (Formerly Alstom T&D India Ltd.) Grid Automation-Pallavaram, India	SCHEMATIC DRAWING	PREPARED BY: SY	REVISION: C
SCHEME TYPE:		PROJECT: TWFL PACKAGE		FILE:	CHECKED BY: GSS	DATE: 07.04.2018
		P.O.NO.: . Dated .		TITLE: TYPICAL ARCHITECTURE FOR KIOSK S/S	APPROVED BY: SSS	SCALE: --
SALES ORDER: 3269046299				QTY OF FDRS: 4 FDRS ALLOCATED IN 4 KIOSKS	DRG. NO.: CPD KXQ5SA1	SHT 02 OF 02

अरिन्दम सेनशर्मा
ARINDAM SENSARMA
अपर महाप्रबंधक (ऐसेट प्रबंधन)
Addl. General Manager (Asset Management)
पावरग्रिड, POWERGRID

Experience in application of Traveling Wave Fault Detection

Leandro de Marchi Pintos – GE Grid Solutions, Brazil
Carlos Pimentel – GE Grid Solutions, Brazil
Gilmar Krefta – K Consulting, Brazil

1 Introduction

The need to detect and locate faults in transmission lines quickly and accurately has grown significantly in power systems globally, especially in recent decades. Changes in the market model have caused transmission companies to change the way they manage and operate their assets since they are paid not by the transmitted power but by the availability of the line they operate [1]. Thus, protection and fault location systems based on new techniques that are faster and more accurate than the traditional ones, essentially based on phasors, have attracted the interest of several utilities to overcome accuracy limitations of traditional phasor-based approaches. Furthermore, the increasingly significant penetration of renewable generation in the system, whose responses to transients are different from conventional generation systems, have demanded protection systems with faster actuation times than conventional protection relays in order to prevent systemic collapses in large scale [2].

In this context, the use of traveling waves in fault detection both for fault location and protection functions has been studied for application in power transmission systems on a larger scale [3]. The use of fault location systems based on traveling waves, instead of phasors, has been studied for decades, and the first publications date from the 1930s [4]. Since then, several articles and theses have been published, where different types of traveling wave fault locators were classified according to their method of application, and protection systems using this technique were presented.

With the evolution of equipment for protection and control, mainly in the 80s, the first equipment that used the concepts of traveling waves for selectivity and protection began to appear on the market in static relays where the actuation times became less than 5 ms, reaching 2 ms, something by that time impossible using conventional techniques. Furthermore, in the same decade the first traveling wave fault locators appeared, where accuracies in fault locations of hundreds of meters were achieved without significant influence of the length of the transmission lines or electrical parameters, such as reactive compensation [3].

From this study could be seen that is even more remarkable the interest of power system engineers in the application of systems that guarantee more accurate fault location, compared to conventional techniques [1], as well as in protection systems with faster operating times than conventional systems, normally aiming to minimize transient stability problems in the protected electrical system [5].

2 Traveling Wave in Power Systems

The traveling wave phenomena (*TW – Traveling Waves*) on power transmission lines arise from a number of causes, of which the most common are faults, switching operations and lightnings, and the propagation speed of current and voltage waves in overhead power lines is in general close to the speed of light [6]. These traveling waves are typically composed of a wavefront usually with a short rising time and a long falling time [1].

The use of traveling wave detection techniques, mainly for fault location, has been cited in the literature since 1931 [4] and became popular in the following decade after Bewley proposed a graphic method to determine the reflection time instants of the traveling waves, known as Bewley-Lattice diagram [7]. That method allowed a relatively simple analysis of the traveling wave behavior in time and space mainly for fault location where the time is represented vertically and distance horizontally. Figure 1 shows a typical Bewley diagram for a transmission line with the reflections and refractions caused by the traveling waves when a fault is present on a power system.

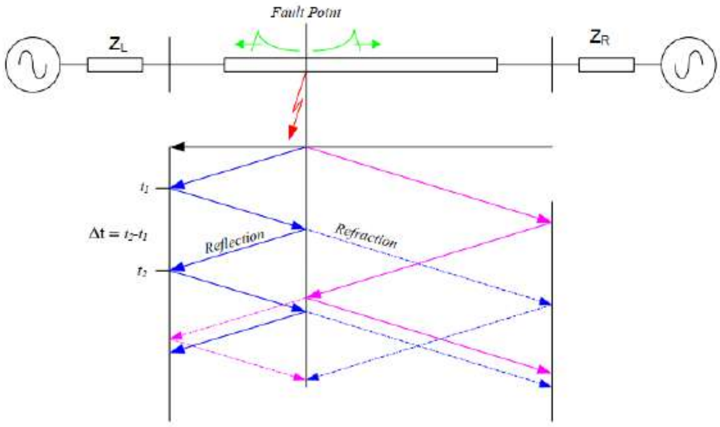


Figure 1 – Bewley-Lattice diagram [6].

Later, in 1951, Lewis classified the traveling wave detection equipment based on its mode of operation as A, B, C and D [8]. Currently, in addition to the methods defined by Lewis, the E method is also used [6].

The fault detection and location methods basically differ in two points: the first is if they have measurement in only one of the substations of the monitored line or in both substations, and the second is if they are passive detectors that are based on the generated traveling waves by the event or have pulse generators for signal injection. Thus, type A is a passive single ended terminal detector, type B is an active single ended detector, type C is an active double ended, and type D is a passive double ended detector [4]. Finally, there is the E method which consists of a single ended detector that is based on the signals generated when a line is re-energized and is used essentially for permanent fault detection [6].

Although studies date back to the 30s, 40s and 50s, applications in protections systems based on traveling waves started only in the late 1970s [9], and since the 2000s there have been several studies to develop and improve the traveling wave detection criteria for protection functions such as distance, directional, differential and for HVDC lines [10]. It is noted in this context that, even though the technique had already been available in protection relays since the late 1970s, there are a very low adoption of this technology in transmission lines in the electrical system that uses traveling wave for protection purposes, and mostly conventional protection relays are applied for this purpose. Traveling wave applications in power systems are mostly related to fault location.

Practical applications of traveling wave fault location, on the other hand, gained strength mainly after the development of synchronized clock technology via GPS (*Global Positioning System*) became available for civil use, as it allowed the TW system to have a unique time base used by the equipment that is generally installed at both ends of the transmission line, that is, far from each other. For double ended fault location methods it is necessary to use the GPS system so that the Traveling Wave records at both ends of the line are synchronized [11].

A more recent study presented in [4] compared different types of traveling wave fault locations applicable in power systems, including GPS based location. Recent studies over the last decade comparing single and double ended impedance fault location methods with traveling wave methods show that errors for a nearly 200 km line can be on the order of kilometers for impedance-based methods and hundreds of meters for methods based on traveling waves [12].

To guide engineers and technicians in the selection of how to perform fault location, the IEEE published the *C37.114 IEEE Guide for Determining Fault Location on AC Transmission and Distribution Lines* [6] where several ways to perform the fault location are compared, in which are also listed the advantages and ways of implementation in transmission lines. Finally, the ways to perform the fault location by measuring current or voltage are compared, where it is concluded that, although the initial analysis indicated that the current should be preferred, in practice both ways are applied in fault location and showing good results.

Field experience shows that the accuracy in both methods is similar, making the decision up to manufacturers on how the traveling wave signal is measured in their equipment. To illustrate this relationship, as well as to illustrate the typical behavior of TW signals captured in voltage or current is like, Figures 2 and 3 show an example of a traveling wave signal used for fault location, where Figure 2 shows the signal measured by the secondary voltage of a 500 kV CVT and Figure 3 shows the secondary current measured by the line CT for the same fault.

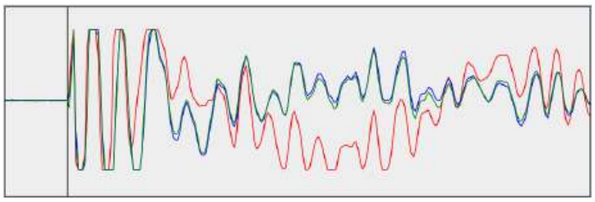


Figure 2 – TW Voltage signal measured during a fault in a 500kV system.

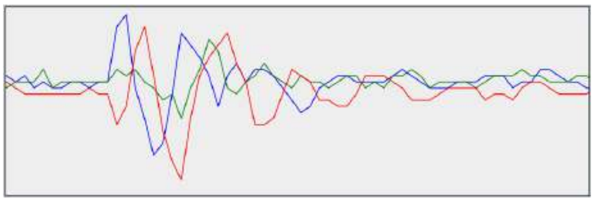


Figure 3 – TW Current signal measured during a fault in a 500kV system.

3 Considerations in the use of Traveling Wave for Power Systems application

Given the intrinsic characteristics of fault location by traveling waves, the assertiveness of its application is established when it provides better fault location accuracy in relation to conventional impedance methods. For short alternating current lines (up to 80 km), for long lines (greater than 240 km), as well as for applications in mixed lines and HVDC lines, the results obtained over time show that its applicability is positive in terms of accurate fault location.

Added to this benefit is the fact that the observed accuracy has little or no relationship with the length of the line, power flow, series compensation or usage of reactors in the busbar or the transmission line. It is noted, on the other hand, that the complexity of determining the fault location when there are elements of compensation, medium or high impedance faults, as well as faults related to lightnings, is greater compared to low impedance faults or faults in uncompensated lines.

In order to locate a fault with the traveling wave method, it is necessary that the system accurately captures the desired signals. Single ended locators must be able to distinguish the wavefronts and reflections from the signals of interest, as well as Double ended locators must distinguish wavefronts when a fault occurs. Traveling wave signals have different characteristics depending on the type and impedance of the fault and are captured differently in HVAC and HVDC systems.

The behavior of traveling wave signals, in general, summarizes the result of the location system: a fault location system is perceived as accurate when, in front of different fault scenarios, it remains accurate in the location within the expected range by the technology, of a few hundred meters, even in situations where the wavefront is low or barely perceptible against the captured noise. High impedance faults, faults with slow wavefront rise, faults caused by lightning or transmission lines in circuits with radial characteristics are examples of situations in which locators can suffer a negative influence on fault location.

However, it is noted that even the fault location accuracy, once the wavefront is accurately determined, is not significantly impacted by factors such as fault impedance or line compensation, the difficulty in determining the wavefront is greater in these situations when compared with the location of low impedance faults. Thus, the accuracy in fault location, whether performed manually or by automatic algorithms, is generally negatively impacted mainly by the impedance of the fault if the operator has not been properly trained or the algorithm used by the fault locator software does not have the necessary robustness for field applications.

To illustrate these differences, the following figures show several TW records captured by traveling wave fault locator recorders for lines with voltages above 220 kV and whose signals are measured by secondary voltage of inductive voltage transformers (IVT) and capacitive voltage transformers (CVT).

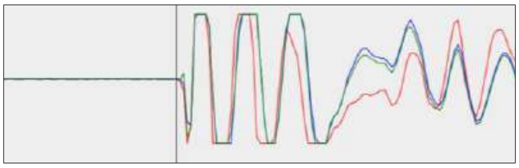


Figure 4 – Example of TW signal measured by a CVT for low impedance fault.

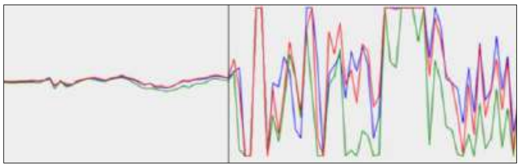


Figure 5 – Example of TW signal measured by a CVT for low impedance fault in a compensated line.

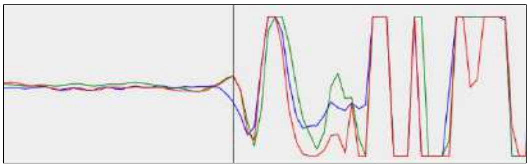


Figure 6 – Example of TW signal measured by a IVT for low impedance fault.

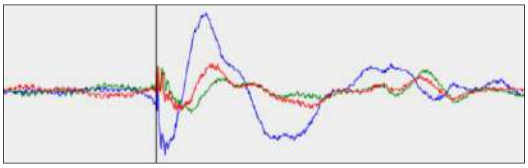


Figure 7 – Example of TW signal measured by a CVT for medium impedance fault.

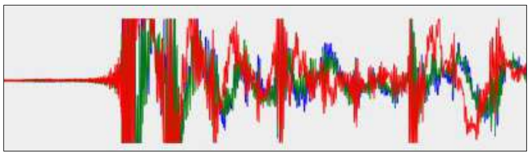


Figure 8 – Example of TW signal measured by a CVT for a lightning strike in a line with reactors.

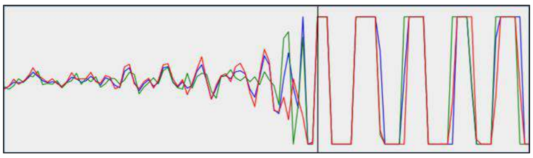


Figure 9 – Wavefront detail of Figure 8.

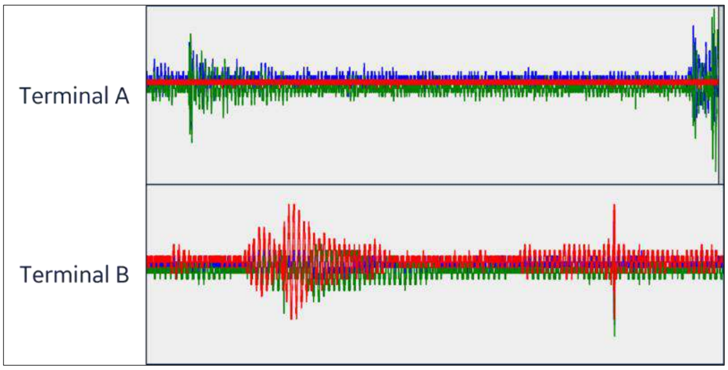


Figure 10 – Traveling wave signals in both terminals of a radial transmission line during a fault, measured by an IVT.

For faults with high or very high impedance, as in cases involving faults with trees, the level of the signal to be captured from the wavefront, in general, is superimposed by noise related to the fault, but the noise is not interesting to the fault locator. In these situations, the locator must be able to distinguish the signals of interest from the measured noises. Figure 11 shows a typical example of a high impedance fault with the details of the correct point to be used by the fault locator and the time reference range of the record in the different time scales used.

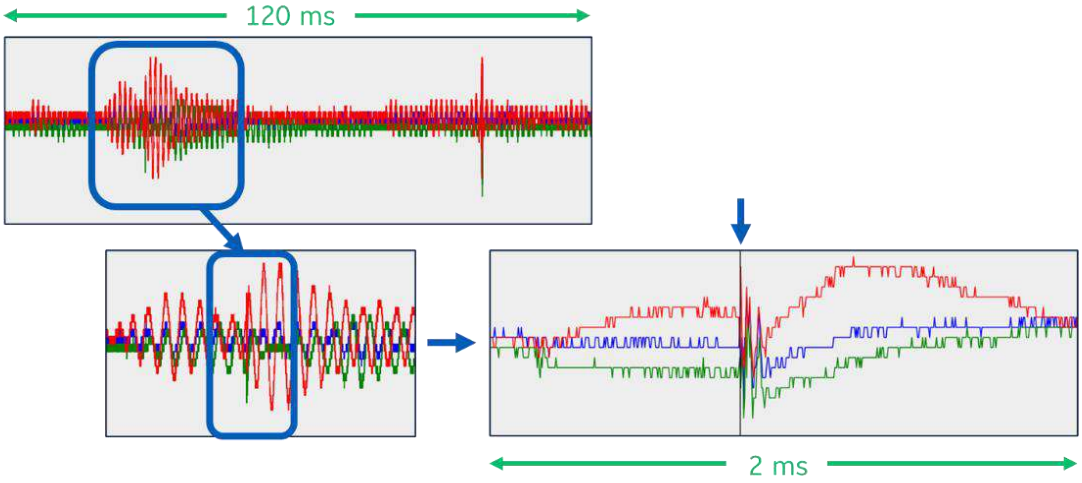


Figure 11 – Example of the determination of wavefront for a high impedance fault.

Mainly in cases of high impedance faults, the traveling wave record shows that, although the wavefront behavior is visually perceptible, the same cannot be said to the automatic fault location algorithms since the magnitude, the duration and the behavior of the traveling waves is not easily modeled in these situations. While it is possible to evaluate only the traveling wave record in these cases, in general these situations require additional tools from the operator or algorithm in order to determine a time zone smaller than the record as a whole, a tool that works as a guide to perform a more in-depth filtering in a smaller time interval.

One possibility in this case is the use of the records triggered by a Fault Recorder synchronized in the same time base as the fault locator, where the oscillography record is used as an additional tool to evaluate the time instant when the fault occurs, then the traveling wave record is used with the same time base. Figure 12 shows, as example, the use of this technique to define the time range – three-phase voltage signals at the top, three-phase current signals at the middle and traveling wave signals at the bottom.

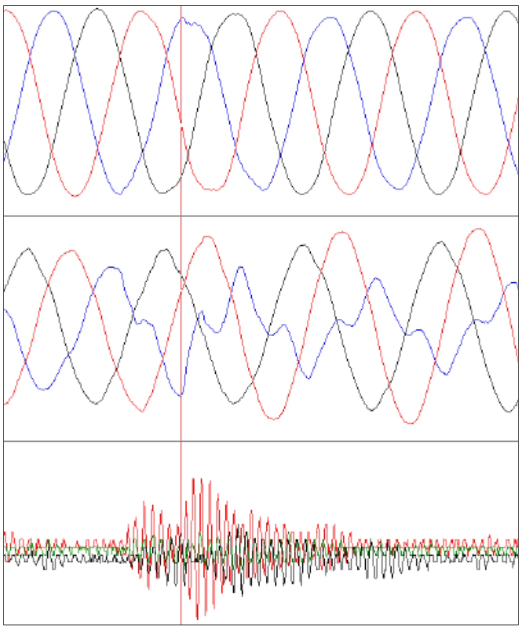


Figure 12 – Fault and Traveling Wave records combination to wavefront peak determination.

4 Traveling Wave Fault Location examples with confirmed location

Currently, there are several applications of global scope using traveling waves and the vast majority are related to fault location. Despite having a clear improvement in the accuracy of fault location with the traveling wave technique, it is generally perceived that its use globally is more widespread or is more consolidated in electrical systems and countries that have a significant number of long transmission lines, mainly due to the fact that the relative error on short lines can, in general, result in absolute errors with values acceptable to local utilities.

Numerous applications have been established around the world with the traveling wave fault location tool and some are brought here for this article in order to show its applicability for different voltage levels and types of faults.

Table 1 shows some results from locations in different regions with low and high impedance faults, different operating voltage levels and line lengths, as well as compensated lines up to 765 kV. Additionally, the estimated fault locations by the traveling wave fault locator, the actual fault location determined by line inspection and the calculated error in relation to the line length are shown too.

Table 1 – Examples of results of Traveling Wave Fault locations compared to real fault location according to maintenance personnel team.

System Voltage	Date (mm/aa)	L (km)	Confirmed Location (km)	Calculated Location (km)	Error (km)	Relative error based on line length (%)
765 kV	04/20	231.40	32.436	32.390	0.046	0.020
765 kV	06/20	231.40	40.365	40.240	0.125	0.054
765 kV	07/20	240.00	239.100	239.010	0.090	0.038
765 kV	07/20	240.00	239.100	239.140	0.040	0.017
765 kV	08/19	361.00	0.000	0.000	0.000	0.000
765 kV	07/19	342.00	270.000	270.068	0.068	0.020
765 kV	08/20	240.00	238.700	238.760	0.060	0.025
765 kV	04/21	334.46	0.300	0.300	0.000	0.000
500 kV	05/08	248.28	206.000	206.220	0.220	0.089
500 kV	04/08	248.28	206.000	206.150	0.150	0.060
400 kV	04/21	216.00	47.750	47.180	0.570	0.264
400 kV	05/17	262.41	1.902	1.920	0.018	0.000
230 kV	20/09	325.73	122.430	122.560	0.130	0.040
230 kV	27/09	325.73	325.680	325.690	0.010	0.003
230 kV	10/09	325.73	99.510	99.550	0.040	0.012
230 kV	22/09	325.73	194.620	194.650	0.030	0.009
230 kV	09/09	325.73	156.960	156.990	0.030	0.009
230 kV	09/18	64.72	48.000	46.260	1.740	2.689
230 kV	06/21	140.59	40.000	39.920	0.080	0.057
220 kV	08/15	16.40	14.960	14.959	0.001	0.000
220 kV	08/15	16.40	13.098	13.160	0.062	0.378

Fault location results are based on 765 kV and 400 kV transmission lines in India, 220 kV from Spain, 230 kV in Mexico and 230 kV and 500 kV in Brazil, using some of the results from lines in Brazil that are shown in [3]. Most of the events are single-phase-to-ground faults, where about 3 to 4 cycles later there is a single-pole breaker opening operation. One second later, an Automatic Reclose attempt is made by sending the circuit breaker closing command for the faulted phase. In cases of temporary faults, a single breaker opening is sufficient to eliminate the disturbance. For cases of persistent faults, the line is opened again after an Automatic Reclose attempt. For faults where the Automatic Reclose attempt was not successful, the protection system performs the three-phase opening of the transmission line circuit breakers.

The TW fault location is performed with the records of the first TW event, which is the Trip event. The use of the Trip event records ensures greater reliability in the fault location compared to the reclose or three-phase opening records, as the wavefront peaks are better defined, and it eases the positioning of the timestamp reference for fault location calculation.

Regarding the results shown in the table, it can be seen that the system has an accuracy with relative errors below 0.5% for the majority of cases. It is noteworthy that this precision is achieved with the refinement of the parameters involved in the location of faults by traveling waves, notably the line length (L) and the wave propagation speed, in general related to the attenuation factor k that indicates the percentage of the speed of light at which the wave travels on the line.

To provide the accuracy shown in the fault location examples, notably applicable to the Double-ended method with synchronized measurements, it is necessary to carry out a previous calibration of the transmission line parameters. These factors are usually refined during commissioning or through regression methods after the first events. These events make possible to calculate the wave propagation coefficient on the transmission line (k factor) and the real line length of the line. Given the unavailability of the traveling wave parameters commissioning, the fault location system must use real fault data to ensure greater accuracy. If the system is not calibrated and standard parameters are used, the fault location error is generally within 1 km for every 100 km of line length. The confirmation of the location of faults is carried out through the field maintenance team that travels along the lines and certifies the result of fault locations.

The fault in Table 1 where there is an error greater than 1% in relation to the size of the line, refers to a high impedance event where the wavefronts do not have a discontinuity as clear as a low impedance fault, thus being more difficult to determine the time instant of the wavefront accurately. Despite the error from the actual fault location, the calculated location provides comparatively a better estimate of the region where the fault may have occurred compared to impedance-based location.

Figure 13 and Figure 14 show the Waveform and the Traveling Wave records for both transmission line ends for the second fault shown in Table 1, a typical fault for the 765kV line. This event occurred in June 2020 and it was a low impedance fault on phase A. The single-pole circuit breaker of phase A received the opening command and, around 3,3 cycles after the fault, the phase A is deenergized. The uppermost part of the graph show the three-phase currents, the middle of graph shows the three-phase voltages and in the bottom part are the high frequency TW signals.

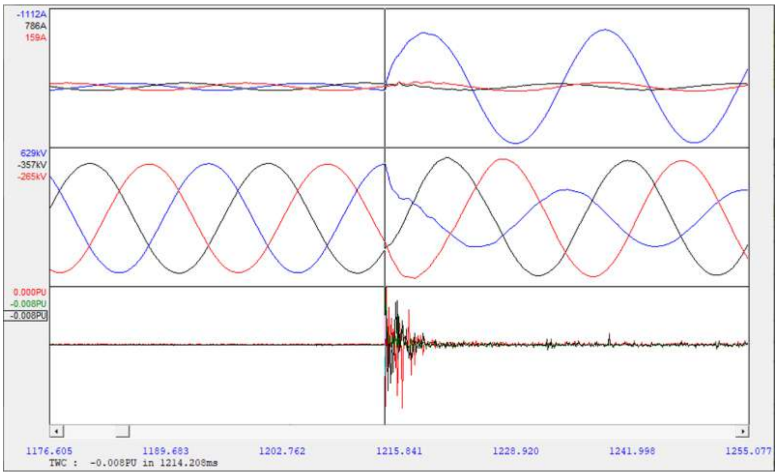


Figure 13 – Waveform record and TW record for terminal A.

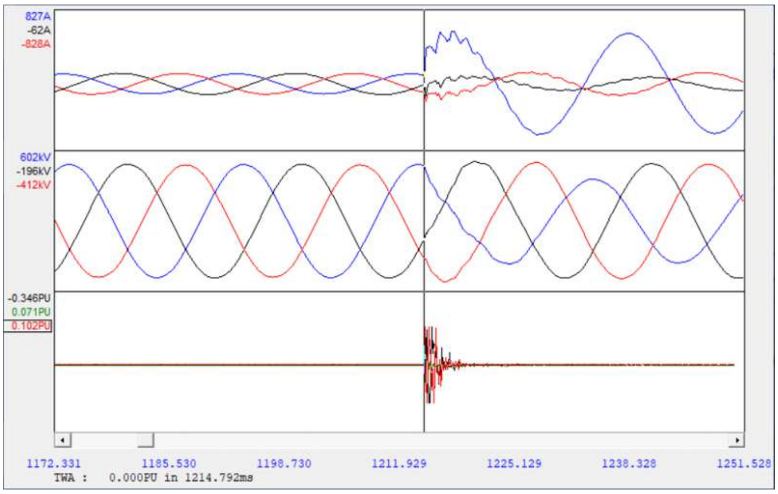


Figure 14 – Waveform record and TW record for terminal B.

It is possible to notice for the fault that, due to its low impedance characteristic, the current waveform quickly goes high, and the voltage waveform suffers an abrupt drop. The intensity of the TW wavefront for low impedance faults (bottom of the figures) is clear enough to identify the timestamps to be used to locate faults.

Another aspect to be analyzed is the way in which the accuracy of fault location methods by TW is compared. For example, the absolute fault error is based on the absolute difference between the actual location and the software-calculated location. When the line length is taken into account for the error calculation, the percentage error in relation to the actual fault location is drastically reduced [6].

It is always important to have confirmation of the actual fault location by field personnel to feed back the system and ensure better accuracy of the TW fault location method for future events. The more data with confirmed real location, the more the method becomes adherent to the real model of the line and, thus, offers better accuracy in the locations. It should be noted that an accuracy of ±150 meters with respect to the actual fault location is generally considered good enough to accurately alert field personnel to repair.

Another point is the certainty of how the field personnel confirmed the actual location of the fault. When the short circuit is close to the substation or is in easily accessible areas, for example, the location confirmed by the maintenance team occurs faster and more accurately (up to meters), but when it comes to more remote parts or in places with difficult access, this confirmed location is sometimes estimated and has errors of up to hundreds of meters. However, this error becomes tolerable once the distance between towers on average is sufficiently accurate for the line inspection team, and this distance is usually greater than 400 m.

In other cases, when there is no real confirmation of the fault location provided by the line maintenance team, the fault location compared to the traveling wave system, as a way of consolidating the result, is usually given by single or double ended impedance methods. However, attention should be paid to these cases because the actual location of the fault confirmed in this way inherently has the imprecision of the impedance methods [13], [14], and this should not be a method to calibrate the locator by traveling waves. The fault impedance, fault distance to the measurement terminals and the type of modeling implemented in the equipment can negatively affect the result provided by the impedance location method, therefore, negatively affecting the performance of the TW fault location system when the actual fault location is provided by impedance methods.

Fault location using TW methodology is based both on software and user experience when the fault location software have manual location mode. Each fault event has a unique characteristic in the behavior of TW wavefronts. A solid short-circuit, for example, will result in a much more defined TW wavefront than a high impedance fault. It is in this aspect that the user experience comes in to identify cases where greater attention is required to define the best timestamp points within the TW record, as well as cases in which the field team should consider a bigger inspection range. The analyst's ability, in these more complex cases, is a vital part of determining the most appropriate timestamps for location and consequently ensuring better accuracy.

There are tools that perform traveling wave fault location automatically based on fault records of the fundamental frequency (50/60 Hz) and high frequency components (traveling wave records), once they are available. These tools save the user time by performing automatic location based on a pair of TW records and a pair of Waveform records at each end of the transmission line. For more complex cases where location does not occur automatically due to the fault characteristic, an analyst must be assigned for analysis. On the other hand, it is recommended in systems that have manual tools that the analyst performs a critical analysis of the automatic location, thus ensuring that the inspection team is directed to the correct location of the failure and is already aware of the possibility of the inspection range being greater or smaller, depending on the analyst's difficulty in locating it.

5 Conclusion

The article, in addition to presenting a brief review and history of fault detection by traveling waves, showed considerations, experience and practical examples accumulated in the last 13 years of the use of this technique in fault location, having applications in several transmission companies in Brazil and several countries in the world, mainly in Latin America, Europe and Asia. With this history of application in different parts of the world, quite diverse, it is possible to have a relevant history of the behavior of traveling waves in different types of faults, in different electrical systems and at different voltage levels.

Some practical examples of traveling waves records in different types of faults were shown, where it is explored how the protection engineer can obtain important information through these records to determine the precise location of a fault and, depending on the situation, the expected assertiveness for the location including in situations with fault location performed automatically by location algorithms. In these examples it was possible to observe the variability of the behavior of the traveling wave signals, which is a relevant topic to be considered and analyzed when applying technologies in the field, especially when applying automatic algorithms to detect these signals.

Practical examples of the technology in operation show that, for different types of faults, high or low impedance, line lengths of hundreds of kilometers, with or without reactive compensation, etc., the accuracy of the locations can range from hundreds to tens of meters – this being the result often obtained by the traveling wave fault location system. This is verified even in situations of automatic location, which is limited to factors that are normally under the control of the utilities, such as the correct selection of the signal to trigger the locators, correct calibration of the equipment, as well as the analyst's capacity in more complex cases to understand the traveling wave signals through the records to determine the most appropriate timestamp for the fault location.

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Discussion on TWFL

Limitations of Conventional Methods of Fault Location

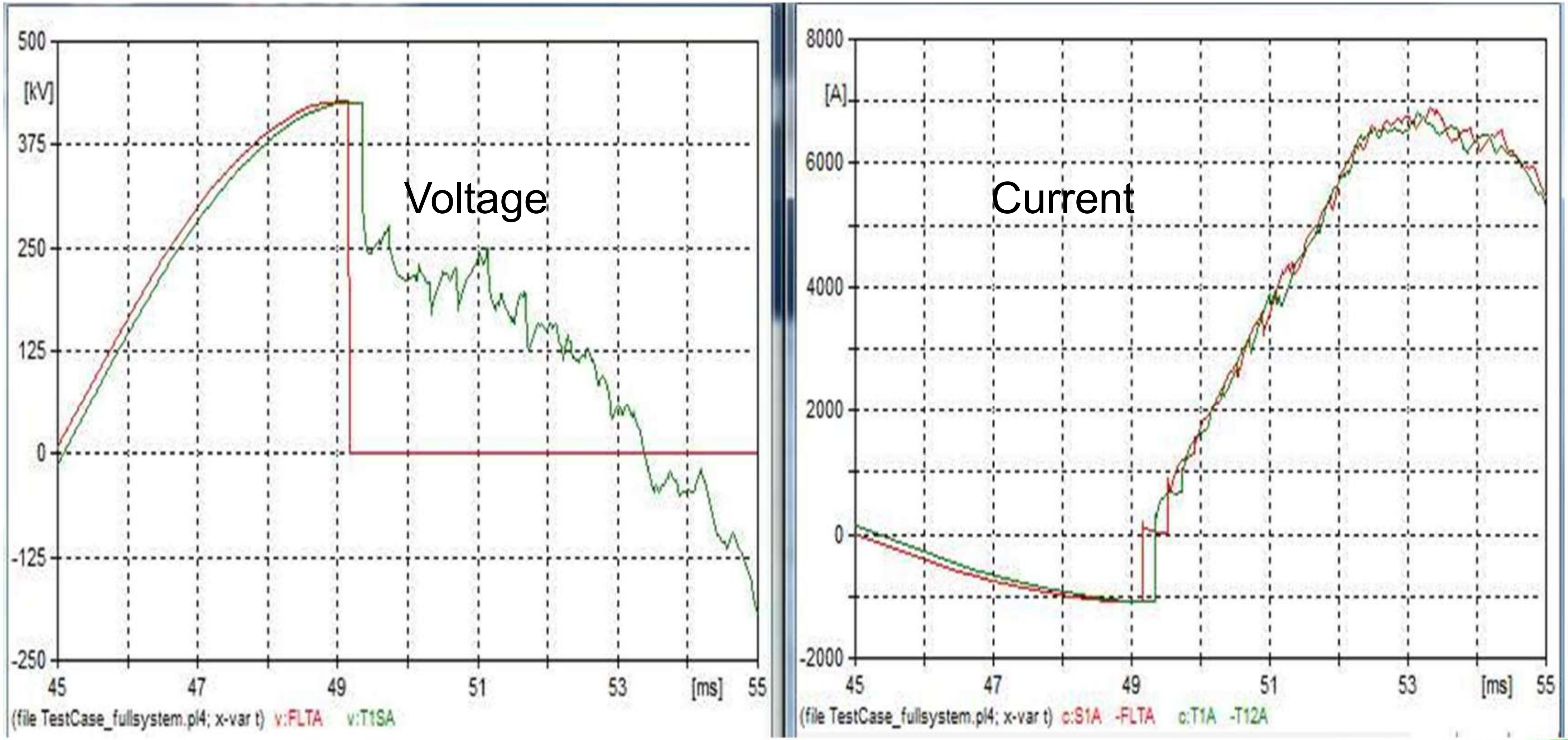
पावरग्रिड POWERGRID

- **Affected by Line Parameters**
- **Effect of In-Feed/ Out-Feed and Mutual Compensation of Parallel Lines.**
- Accuracy of fault location in the range of kilometers.
- Long outage durations and restoration time.
- Accuracy affected by Series compensation and network complexity
- Significant effect of Fault Resistance on the accuracy of this method

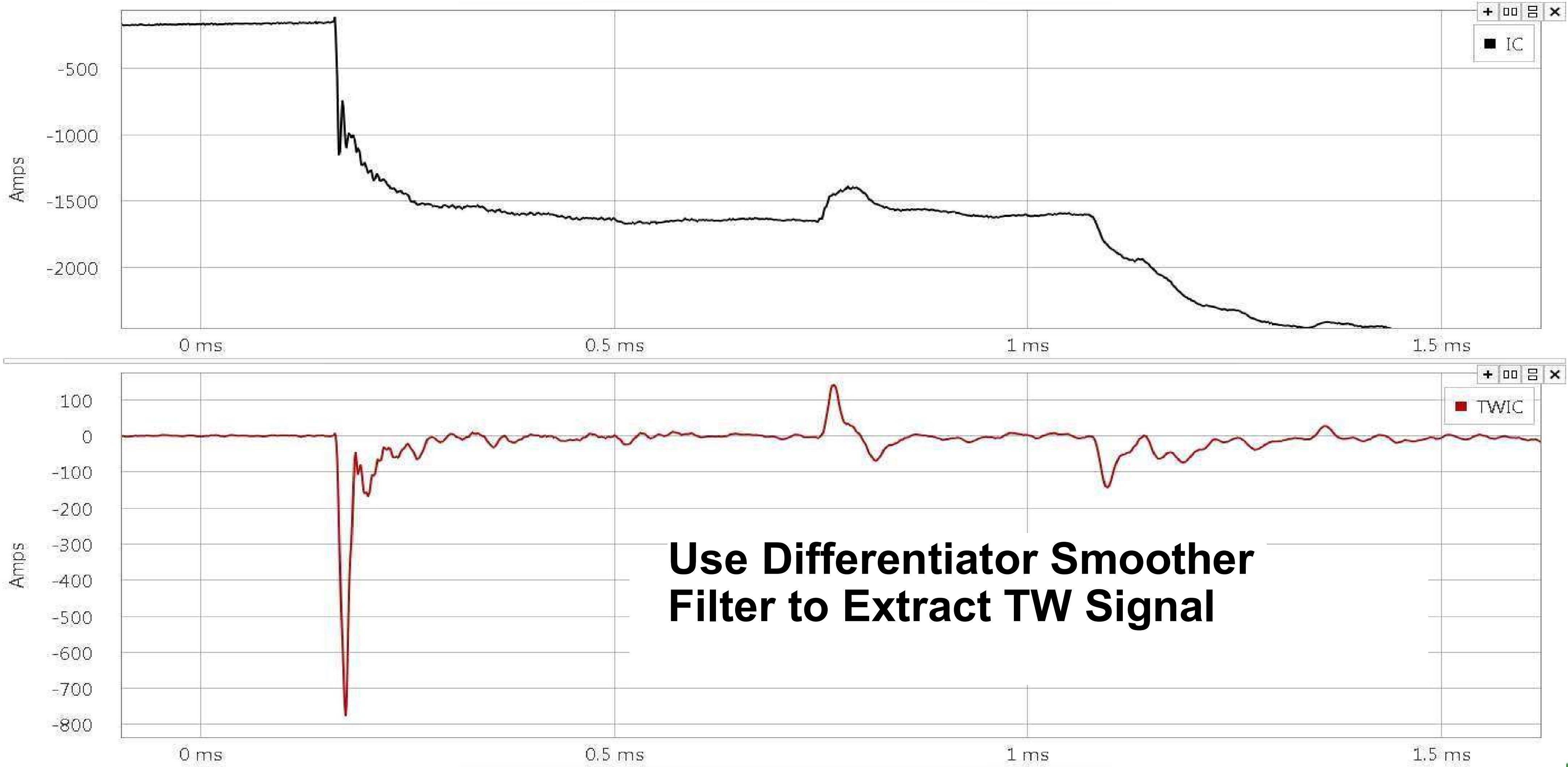
TWFL Working Principle

- Fault inception generates high-frequency electromagnetic travelling waves
- Waves propagate in both directions along the line at nearly the speed of light
- Arrival times of waves captured at line terminals using GPS time synchronization
- Central processor correlates time tags and compute fault distance using line length and wave velocity
- Automated, real-time, and highly accurate fault location

TWFL Working Principle

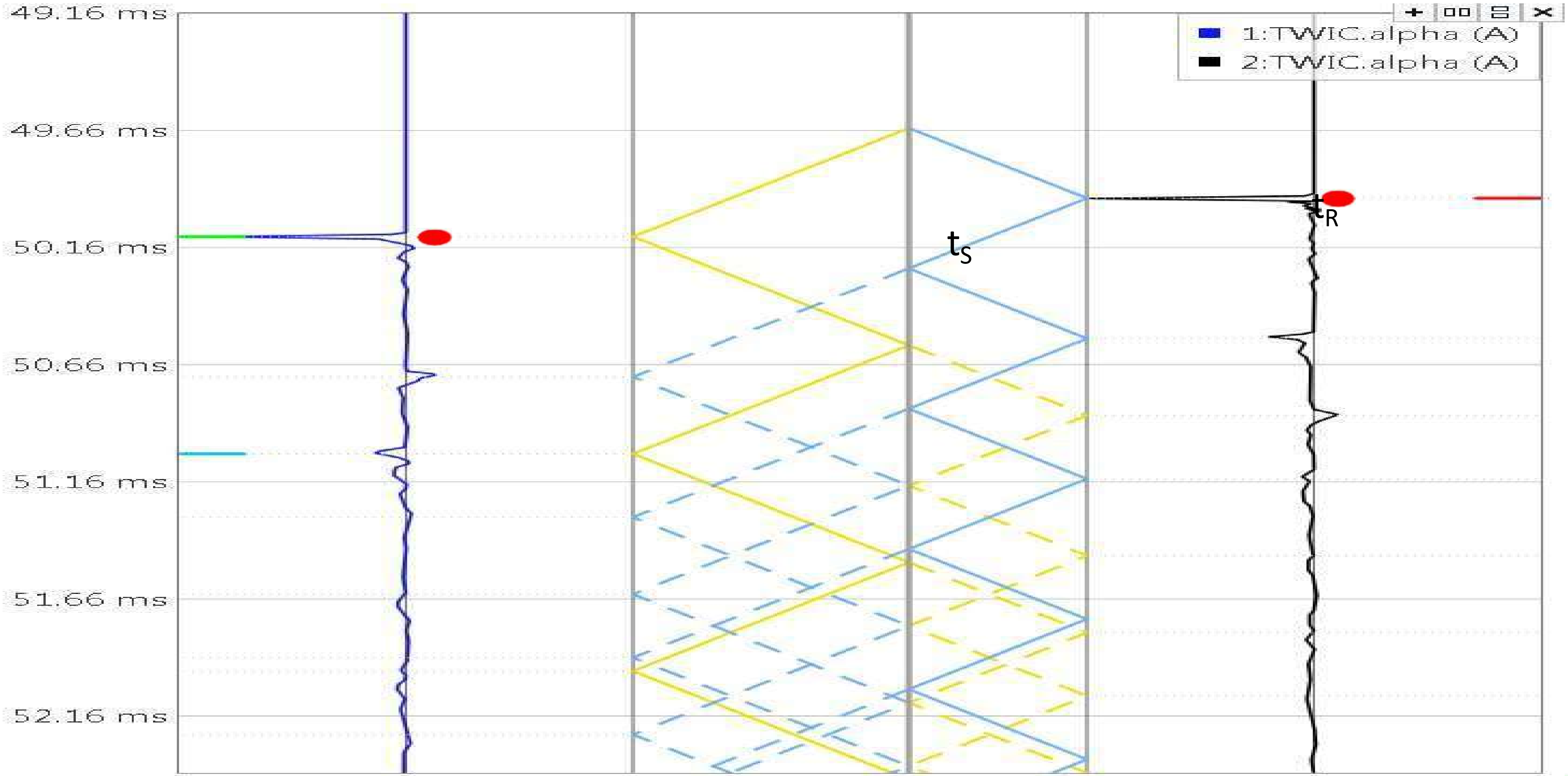


TWFL Working Principle

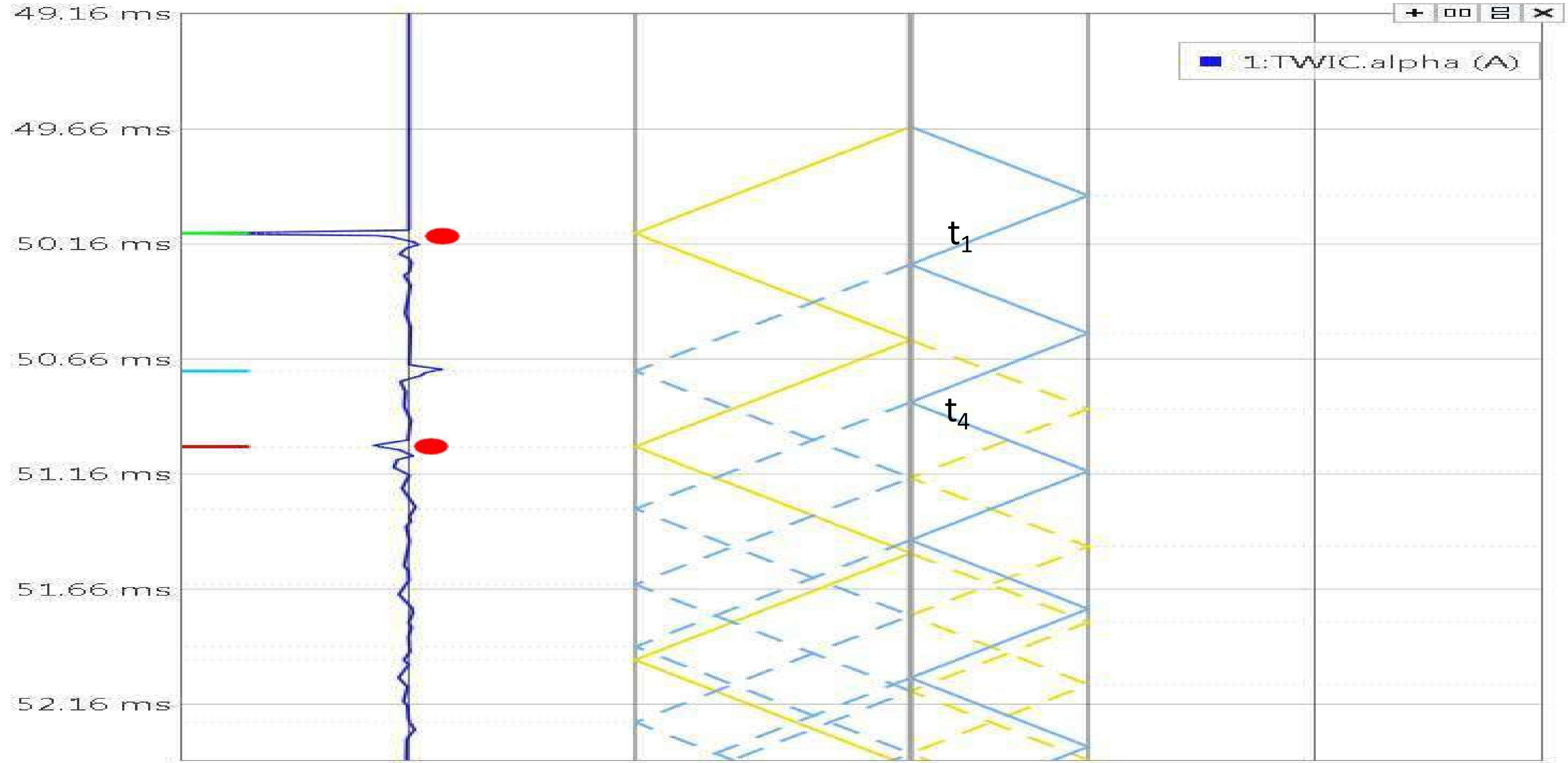


Use Differentiator Smoother Filter to Extract TW Signal

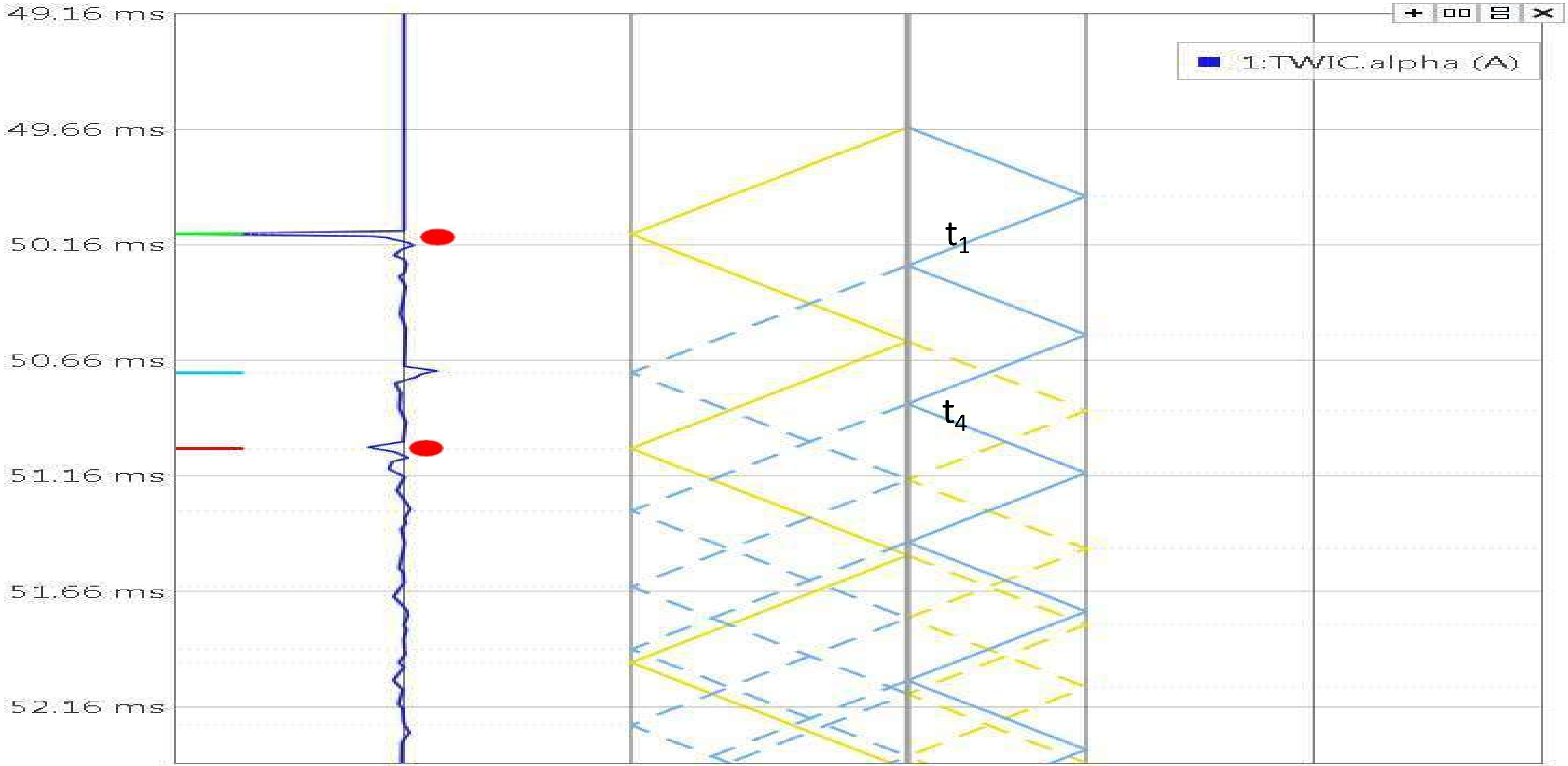
TW Fault Location (TWFL) Principle Double-Ended



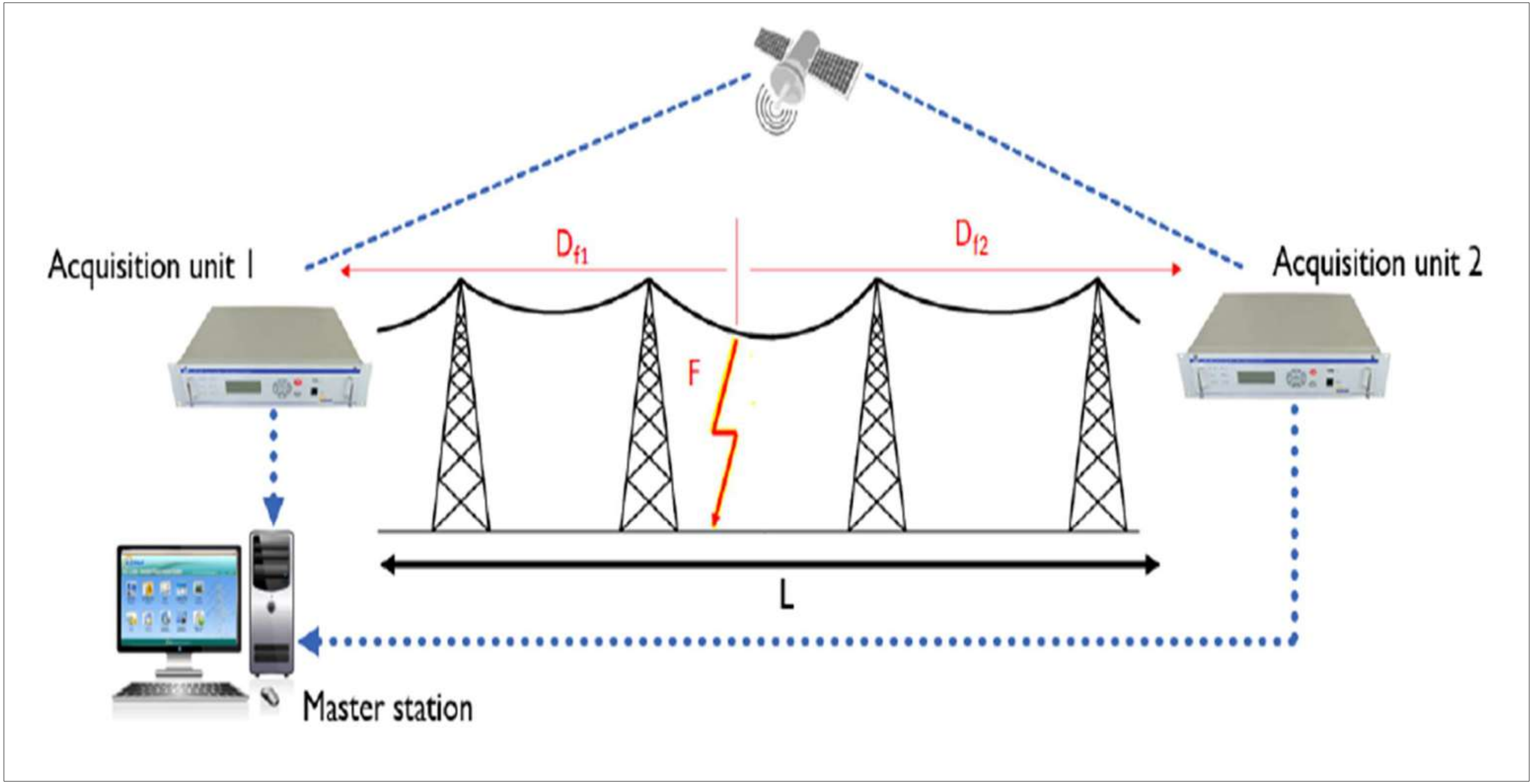
TW Fault Location (TWFL) Principle Single-Ended



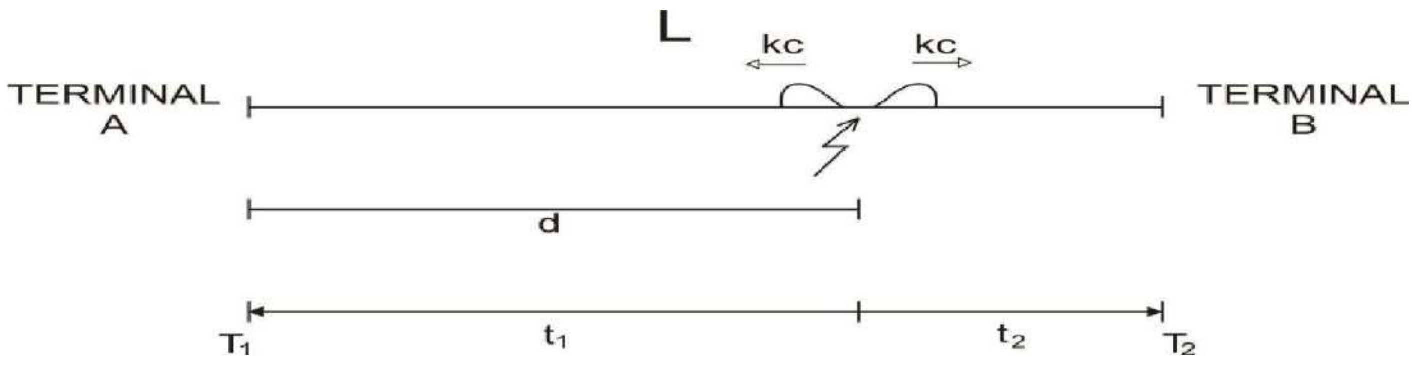
TW Fault Location (TWFL) Principle Single-Ended



TWFL Working Principle



TWFL Working Principle



$kct_1 =$ d

$kct_2 =$ L- d

where k is reduction factor

c is velocity of light

t_1 is time taken to travel from fault

t_2 is time taken to travel from fault d is distance of fault from end A

L is total length of transmission line

TWFL Working Principle

$kct_1 + kct_2 = \mathrm{L}$

$t_1 - t_2 = \mathrm{T_1\text{-}T_2}$

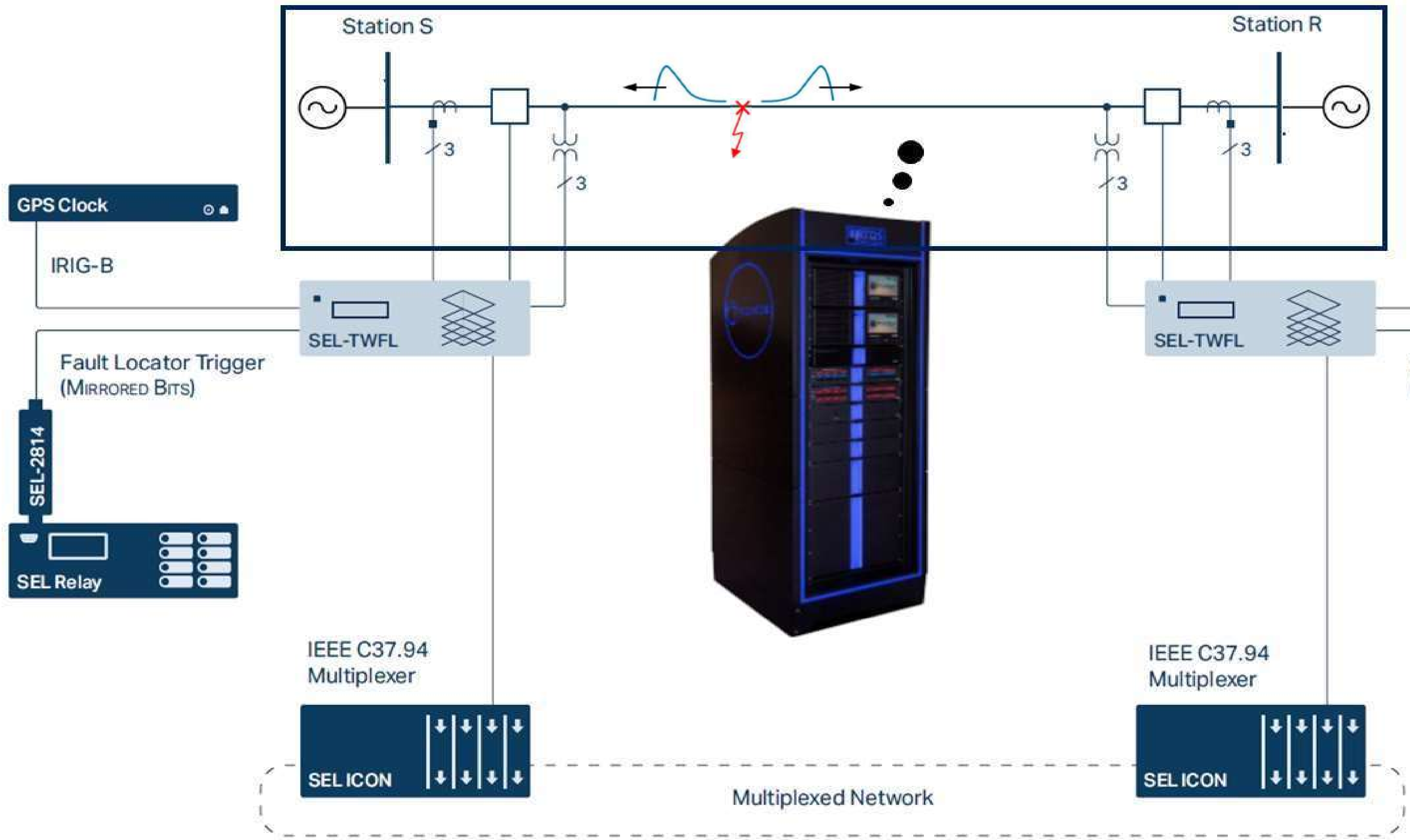
(T1 and T2 are time stamping of travelling wave at End A and End B respectively)

$t_2 = \{t_1 - (\mathrm{T_1\text{-}T_2})\}$

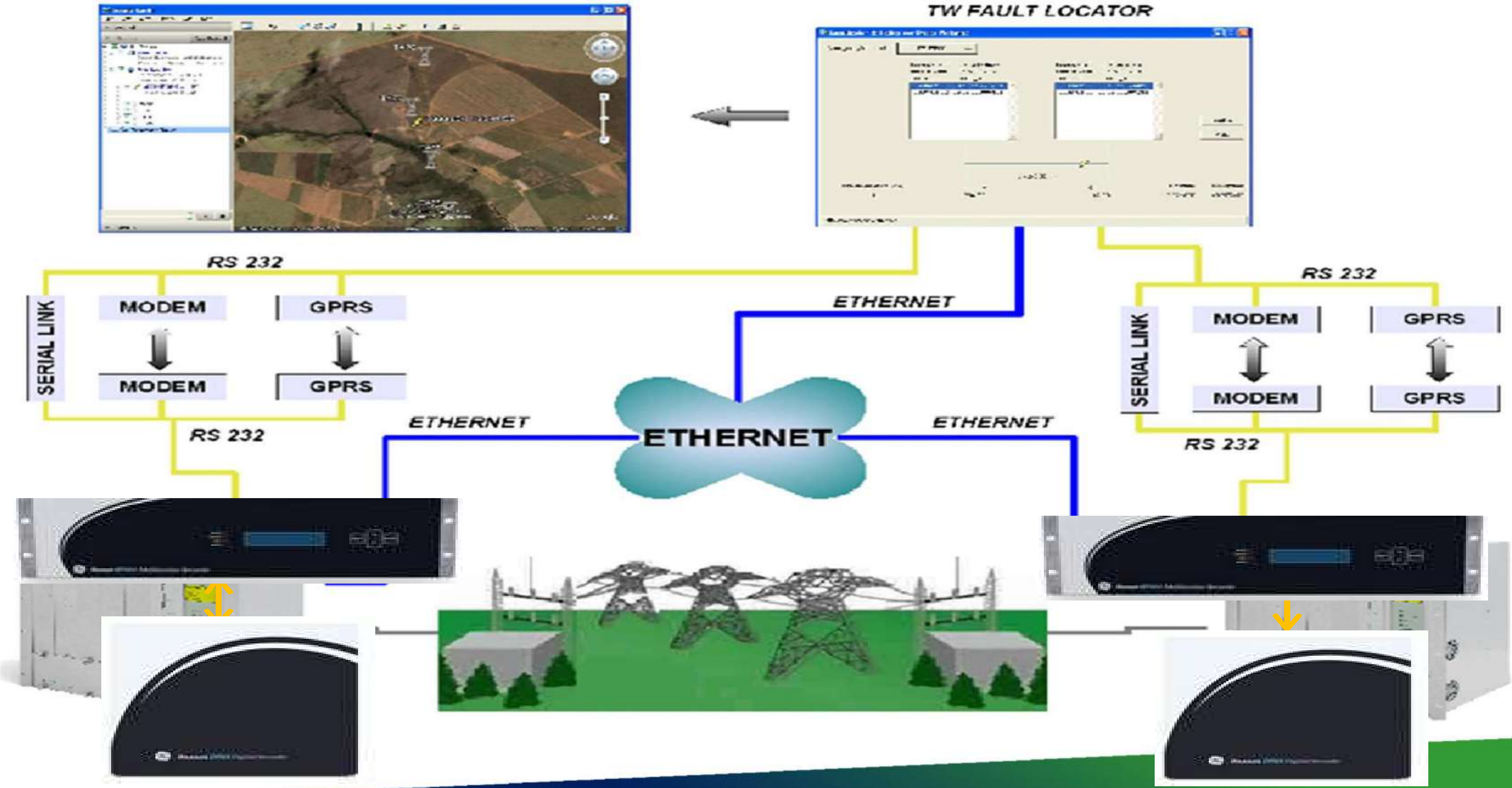
$kct_1 + kc\{t_1 - (\mathrm{T_1 - T_2})\} = \mathrm{L}$

$$\boxed{d = \frac{\mathrm{L + kC}(T1 - T2)}{2}}$$

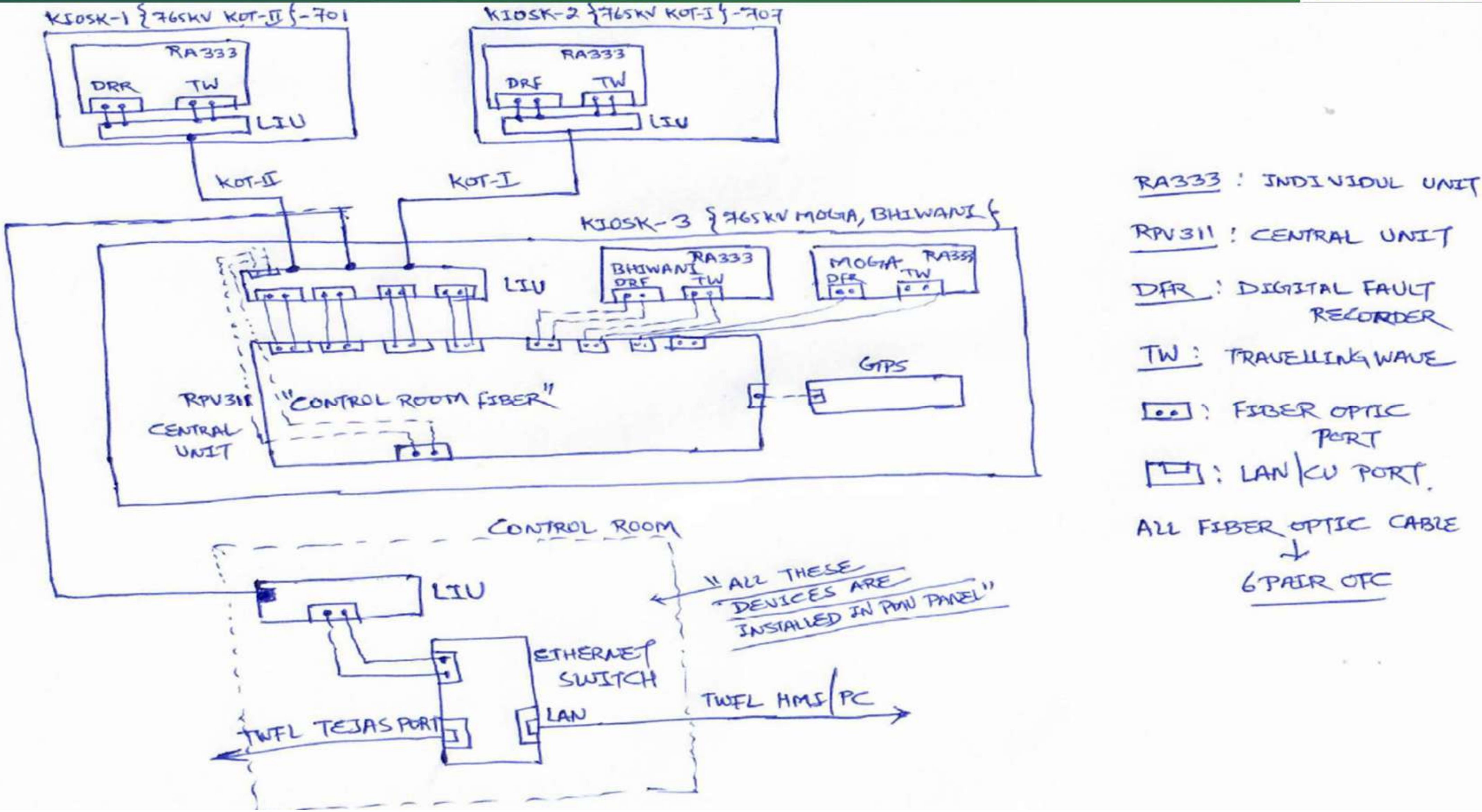
Architecture of SEL TWFL



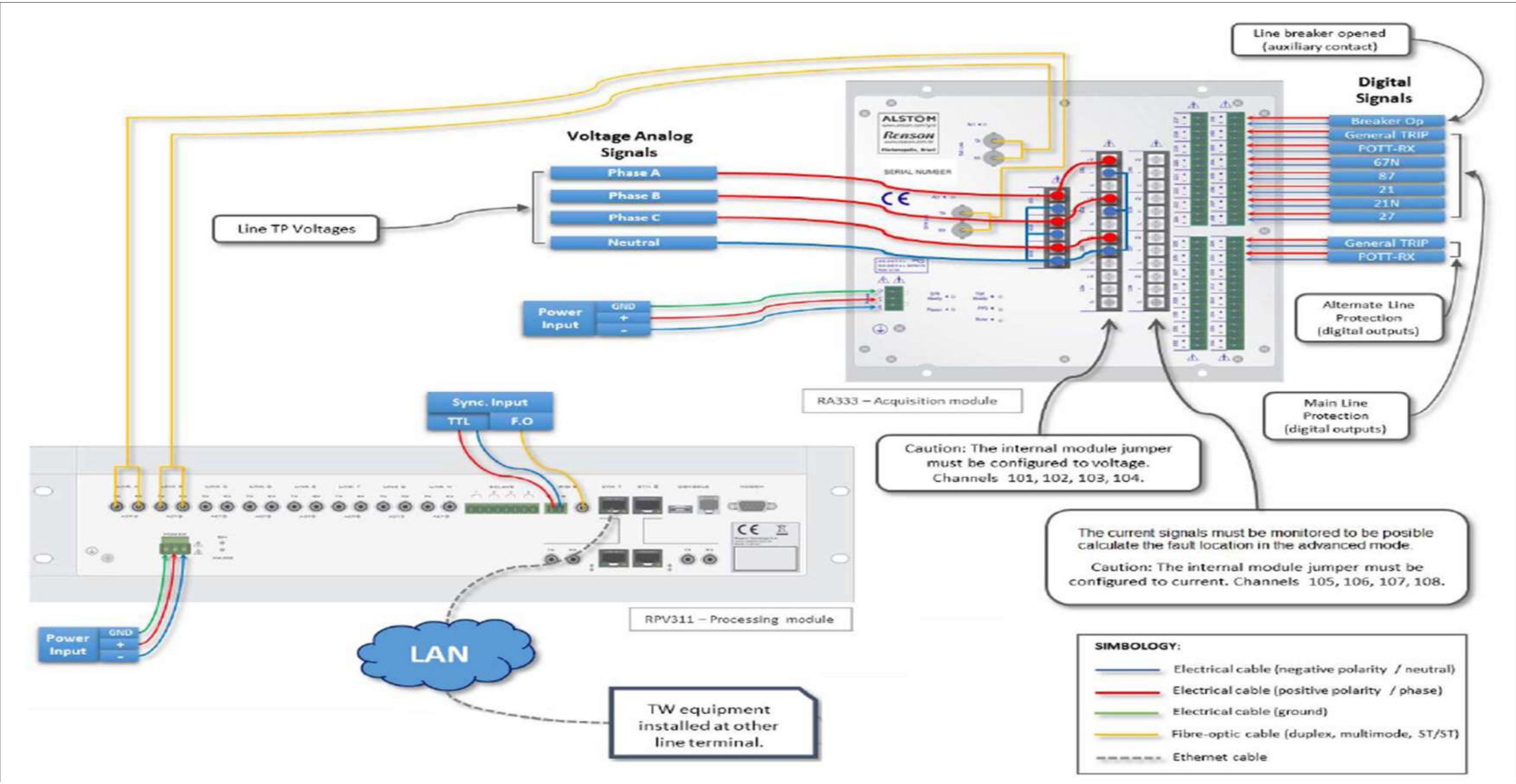
Architecture of GE TWFL



Architecture of GE TWFL



Architecture of GE TWFL



Annexure-VI

765kV Transmission Line			
S.No.	**Line Name**	**Length in km**	**Reason**
1	765kV Ajmer-Bhadla2 Line-1	272	765kV, RE
2	765kV Ajmer-Bhadla2 Line-2	272	765kV, RE
3	765kV Moga-Bikaner-1	351	765kV, RE
4	765kV Moga-Bikaner-2	351	765kV, RE
5	765kV Bhadla-2-Fatehgarh-2 Line-1	183	765kV, RE
6	765kV Bhadla-2-Fatehgarh-2 Line-2	183	765kV, RE
7	765kV Bhadla-2-Fatehgarh-2 Line-3	204	765kV, RE
8	765kV Bhadla-2-Fatehgarh-2 Line-4	204	765kV, RE
9	765kV Bhadla-1-Fatehgarh-2 Line-1	180	765kV, RE
10	765kV Bhadla-1-Fatehgarh-2 Line-2	180	765kV, RE
11	765kV Banaskantha-Chittorgarh-1	311	765kV, RE
12	765kV Banaskantha-Chittorgarh-2	311	765kV, RE

400kV Transmission Line			
S.No.	**Line Name**	**Length in km**	**Reason**
1	400kV Dehradun-Baghpat	164.0	Hilly
2	400kV Dehradun-Roorkeee	65.0	Hilly
3	400kV Jaipur(S)-RAPP D	228.182	More than 200kM
4	400kV Kankroli - RAPP ©	198.64	Nuclear
5	400kV Kota - Merta	257.9	More than 200kM
6	400kV Roorkee-Kashipur-1	150.892	Hilly
7	400kV Roorkee-Kashipur-2	150.892	Hilly

220kV Transmission Line			
S.No.	**Line Name**	**Length in km**	**Reason**
1	220kV RAPP(B)-Debari	204	Nuclear

765kV Transmission Line			
S.No.	Line Name	Length in km	Reason
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5	765kV Bhadla-2-Fatehgarh-2 Line-1	183	765kV, RE
6	765kV Bhadla-2-Fatehgarh-2 Line-2	183	765kV, RE
7	765kV Bhadla-2-Fatehgarh-2 Line-3	204	765kV, RE
8	765kV Bhadla-2-Fatehgarh-2 Line-4	204	765kV, RE
9	765kV Bhadla-1-Fatehgarh-2 Line-1	180	765kV, RE
10	765kV Bhadla-1-Fatehgarh-2 Line-2	180	765kV, RE
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220kV Transmission Line			
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एन एच पी सी लिमिटेड
(भारत सरकार का एक नवरत्न उद्यम)
NHPC Limited
(A Government of India Navratna Enterprise)

वाणिज्यिक विभाग
Commercial Department
एनएचपीसी ऑफिस कॉम्प्लेक्स, सैक्टर-33,
फ़रीदाबाद (हरियाणा)-121003
NHPC Office Complex, sector-33,
Faridabad (Haryana)-121003
फोन/Phone: 0129-2259923
ईमेल/Email: hod-commercial-co@nhpc.nic.in,
वेबसाइट/Website: www.nhpcindia.com

एनएच/वाणि/एनआरपीसी/2025/ 1511 **28.10.2025**

सदस्य सचिव
उत्तर क्षेत्रीय विद्युत समिति,
18-A, शहीदजीत सिंह मार्ग,
कटवारिया सराए, नई दिल्ली-110016.
E-mail: ms-nrpc@nic.in

विषय : उत्तरी क्षेत्रीय विद्युत समिति (एनआरपीसी) की 81वीं बैठक और तकनीकी समन्वयन समिति (टीसीसी) की 56वीं बैठक की सूचना –से सम्बंधित अतिरिक्त एजेंडा।
संदर्भ: एनआरपीसी पत्र दिनांकित 16 सितम्बर, 2025.

महोदय,

कृपया उपरोक्त विषय पर संदर्भ ग्रहण करें। इस संदर्भ में सूचित करना है कि उत्तरी क्षेत्रीय विद्युत समिति (एनआरपीसी) की 81वीं बैठक और तकनीकी समन्वयन समिति (टीसीसी) की 56वीं बैठक की **अतिरिक्त** कार्यसूची **(Additional Agenda)** अनुलग्नक-I के अनुसार है।

कृपया इस कार्यसूची को उत्तरी क्षेत्रीय विद्युत समिति की 81वीं बैठक और तकनीकी समन्वयन समिति (टीसीसी) की 56वीं बैठक में शामिल करने के लिए अनुरोध किया जाता है|

धन्यवाद,

संलग्न :अनुलग्न- I.

भवदीय,

28/10/25

(ओंकार यादव)
महाप्रबंधक (वाणिज्यिक)

SUB: Additional Agenda related to Procurement of power from Subansiri Lower HEP, Capacity - 2000 MW by Punjab Allocated capacity 64 MW- Reg.

Background:

a) Ministry of Power, GoI vide allocation orders dt 14.07.2009 allocated power of 64 MW from Subansiri Lower HEP based on consent received from Punjab and we have signed PPA on 17th May 2011 with PSPCL for power offtake of Subansiri Lower HEP to PSPCL.

b) The aforesaid PPA does not include any clause regarding validity of PPA subject to approval of Hon'ble PSERC and hence signed PPA is enforceable on both parties NHPC & PSPCL. .

c) As per clause 6.1 of PPA dt 17.05.211, the tariff to be charged & its associated terms and conditions for the energy to be supplied from NHPC Stations shall be as per Tariff Notifications/Order/Directions issued / to be issued by CERC from time to time under Electricity Act, 2003 or any other Act / Regulations may be substituted by Govt. of India in place of these provisions.

d) Notwithstanding the above, PSPCL approached the Punjab State Electricity Regulatory Commission (PSERC) through vide petition no. 51 of 2025, for obtaining approval for procurement of power from the aforesaid Subansiri Lower HEP (2000 MW).

e) **Now, PSERC vide its order dated 16.10.2025 stated that in view of the excessive cost overruns resulting in ever higher tariff projected** and the consequent pass-through burden which will accrue on the consumers of the State, the Commission is firm in its view that the 64 MW **Power purchase arrangement from Subansiri Lower HEP subject project is not an economical or viable proposition, particularly so, when much cheaper power from RE sources is available in the market even at peak load hours. As such, it would not be in the interest of the consumers of the State to unnecessarily bear the brunt of such high-power tariffs, arising out of cost and time overruns, if procurement from Subansiri Lower HEP subject project at the indicated ever increasing and yet uncertain rate is approved. Accordingly, the Commission decides to disallow the same.**

f) As per clause 2.18 of PSERC Order dated 16.10.2025 that the CEA has published its Report on the Resource Adequacy Plan for Punjab. **Around 400 MW of additional hydro generation is required to be commissioned / tied-up by Financial Year 2029-30 by the State of**

Punjab for meeting its demand and ensuring compliance of RPO targets. It is worth mentioning that in the aforementioned study, CEA has already considered the 64 MW power allocated to PSPCL from Subansiri Lower HEP under "Planned Contract". **In case PSPCL is unable to offtake the said power from Subansiri Lower HEP, there shall be more gap to fulfill hydro power to state of Punjab.**

g) As per clause 2.23 of PSERC Order dated 16.10.2025 that the generation profile of Subansiri HE Project will be ideally suitable for the demand profile of the State during paddy season. The station is likely to operate at its full capacity in the months of June, July, August and September, i.e., in the peak demand period of the State. Moreover, considerable support in peak morning / evening hours of winter months will also be available, when PSPCL faces a deficit and short-term power prices are very high (up to Rs. 10/- per unit, as seen in recent times). The Subansiri Lower HEP provides peaking power and thus helps in curtailing dependence on power exchanges/achieve economy, when power rates are the highest.

h) Now the mechanical spinning of Unit #1 of Subansiri Lower Project has been successfully carried out on 24.10.2025, after receiving clearance from the National Dam Safety Authority (NDSA). It is expected that the Commercial Operation (CoD) of the generating units shall start from first week of November 2025 and 1000 MW capacity shall be commissioned by March 2026 onwards. Balance capacity shall be commissioned in FY-2026-27.

SUBMISSION OF NHPC:

The allocation of Power to Punjab has been done by Ministry of Power, GoI based on the consent received from PSPCL on behalf of Punjab, which would have been provided by PSPCL based on complete due diligence including their future power requirement planning for the state. Thus, disallowance of procurement of power by Hon'ble PSERC from Subansiri Lower HEP based on only high tariff is not correct due to flowing reason:

1. DUE DILIGENCE BY PSPCL AND MINISTRY OF POWER:

a) **Government-level consent:** The allocation of 64 MW of power from the Subansiri Lower HEP was made by the Ministry of Power, based on consent from PSPCL.

b) **Due diligence:** This consent was presumably given after PSPCL completed its due diligence, including an assessment of Punjab's future power requirements.

2. No clause in PPA regarding approval of PSERC: Further PPA signed with beneficiaries are legally enforceable on parties and no clause in the ibid agreement allows to exit by either party on the ground of disallowance by the Hon'ble SERC.

3. PSERC's flawed reasoning: The Punjab State Electricity Regulatory Commission (PSERC) is being portrayed as incorrect for disallowing procurement based solely on a high initial tariff for the following reasons:

i) Minimal effect on overall costs: This point directly addresses concerns about high initial tariffs by demonstrating that the 64 MW allocation from the Subansiri project will have a negligible effect on Punjab's overall Average Power Purchase Cost (APPC).

ii) Insignificant increase: The forecasted increase of "less than half a paisa per unit" for FY 2025-26 shows that PSPCL can absorb this cost without heavily impacting consumers or its financial standing.

iii) Comparison with existing NHPC rates

(a) **Average NHPC rate:** This provides context by showing that NHPC already supplies power to Punjab at a low average rate of ₹3.01 per kWh from its other power stations.

(b) **Marginal increase:** Even with the inclusion of the Subansiri power, the overall average rate from all NHPC stations only rises to ₹3.32 per kWh. The 31 paise per kWh increase is presented as marginal, further reinforcing the argument in paragraph (h) about the limited impact on costs.

4. LONG-TERM FINANCIAL BENEFITS

i) **Lower initial O&M costs:** Expenses for operation and maintenance are projected to be lower during the first five years compared to Central Electricity Regulatory Commission (CERC) specifications.

ii) Decreasing tariff over time: CERC regulations allow for higher depreciation during the first 15 years. This policy enables the generator to repay loans more quickly, and consequently, the power tariff will decrease substantially from the 16th year onward.

iii) **"Prudent" long-term procurement:** This long-term tariff reduction is presented as a compelling reason for the DISCOM (PSPCL) to enter into a long-term procurement agreement, emphasizing the project's increasing affordability over time.

iv) Reasonable levelized tariff: Despite facing cost and time overruns during construction, the levelized tariff—the average cost over the plant's lifetime—is expected to be less than ₹6.51/kWh. This further highlights the project's long-term economic viability.

5. LONG-TERM AND SECONDARY BENEFITS

i) **Reduced effective tariff:** NHPC has experienced additional revenue from secondary energy generation, which could help lower the Subansiri project's effective tariff.

ii) Long-term tariff reduction: Due to CERC regulations, higher depreciation is allowed in the project's first 15 years. The hydro tariff is expected to decrease substantially from the 16th year onward, providing a long-term benefit.

6. INHERENT BENEFIT OF HYDRO POWER:

Hydro Power plant provides peaking support along with other capabilities such as fast ramping capability, black start capability, ancillary and reactive power support, which is the need of the hour keeping in view of large-scale integration of variable renewable energy sources. It is not prudent to compare the tariff rate of Hydro Power with other power sources.

NRPC constituents may kindly deliberate on the above issues and direct PSPCL to re-approach Hon'ble PSERC/ APTEL after considering above benefits of hydro power.