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

SPCSPC.admin1

दिनांक: 06.06.2024

सेवा में : संरक्षण उप-समिति के सदस्य (सूची के अनुसार) ।
To: Members of Protection Sub-Committee (As per mail list)

विषय: संरक्षण उप-समिति की 50 वीं बैठक की कार्यवृत्त |
Subject: Minutes for 50th Protection Sub-Committee Meeting.

संरक्षण उप-समिति की **50 वीं बैठक, दिनांक 29.04.2024 को 10:00 बजे** से **होटल क्राउन प्लाजा, ग्रेटर नोएडा** में नोएडा पावर कंपनी लिमिटेड (**NPCL**) द्वारा आयोजित की गयी थी | उक्त बैठक की कार्यवृत्त संलग्न है । यह उत्तर क्षेत्रीय विद्युत् समिति की वेबसाइट (http://164.100.60.165/) पर भी उपलब्ध है |

The **50th meeting** of Protection Sub-Committee was held on **29.04.2024** at **10:00 Hrs** at **Hotel Crowne Plaza, Greater Noida** by Noida Power Company Limited (**NPCL**). The minutes of the meeting is attached herewith. The same is also available on NRPC website (http://164.100.60.165/).

Signed by Reeturaj Pandey
Date: 06-06-2024 17:17:02

(ऋतुराज पाण्डेय)
(Reeturaj Pandey)
कार्यपालक अभियंता (संरक्षण)

50th Protection Sub-Committee Meeting (29th April, 2024)-MoM

Contents

Minutes of
50th Meeting of Protection Sub-Committee (PSC) of
Northern Regional Power Committee

Date and time of meeting : ***29.04.2024 10.00 Hrs.***

Venue : ***Hotel Crowne Plaza, Greater Noida (Hosted by NPCL)***

Sr. Vice President, NPCL welcomed all the participants and thanked NRPC for giving opportunity to host the meeting.

Member Secretary, NRPC welcomed the participants. He thanked Noida Power Company Limited for hoisting the meeting. He highlighted the grid related incidents happened in past months and requested all stakeholders to do post fault analysis for arriving on conclusion of event and learn from mistakes. He stressed upon compliance of IEGC 2023 regulation.

List of participants is attached as **Annexure-P**.

A.1. Confirmation of minutes of 49th meeting of Protection Sub-Committee

A.1.1 AEE (P), NRPC apprised that the 49th PSC meeting was held on 25.01.2024. Minutes of the meeting were issued vide letter dtd. 08.03.2024. No comment has been received till the date.

Decision taken by Forum:

Forum approved the minutes of 49th PSC meeting as issued.

A.2. Furnishing of substation details for implementation of Centralized Database for Protection Settings in Northern Region (agenda by NRPC Sectt.)

A.2.1 AEE (P), NRPC apprised that in 48th TCC & 70th NRPC Meeting (held on 17-18 Nov 2023), NRPC Committee has approved for development of a portal through PSDF for Centralized database containing details of relay settings for grid elements connected to 220 kV and above. The scope was already approved in the above meeting.

A.2.2 Further, a meeting was held on 08.01.2024 with POWERGRID to deliberate on tendering, wherein POWERGRID desired number of sub-stations and elements for which

relay details shall be modelled in Centralized Database for preparation of estimate of work for implementation of the portal.

A.2.3 In view of above, it was requested vide letter dtd. 23.01.2024 (**Annexure-I**) to NRLDC/NLDC and SLDCs of Northern region to furnish the details of all elements connected at 220 kV and above, in respective control area latest by 30.01.2024.

A.2.4 He added that a reminder mail dtd. 06.02.2024 was also sent for the same.

A.2.5 Further, in 216th OCC meeting held on 14.02.2024, SLDCs were requested to furnish the details of all elements connected at 220 kV and above of Transco, Generators, IPPs, TBCB projects and Private utilities in respective control area latest by 28.02.2024 and NRLDC was requested to follow up with concerned CPSUs for sub-mission of details latest by 28.02.2024.

A.2.6 Received data was presented to forum.

A.2.7 EE (P) expressed that even after discussion at various forum, data has not been received from lot of utilities. He highlighted that UPPTCL has not sent data for remaining two zones out of six. NTPC has sent data only for Dadri. SJVN has not sent any data.

A.2.8 MS, NRPC directed utilities to provide the tentative no. of relays in order to finalize total database.

A.2.9 It was deliberated that tentative number may be taken for estimation of total relay count.

A.2.10 UPSLDC representative conveyed that the no. of relays for remaining 2 zones may be considered based on average no. of relays of received details. In view of above 1400 relays were considered for remaining 2 zones of UPPTCL.

A.2.11 JKPTCL representative told to send the relays data later.

A.2.12 There was no representative from SJVN in the meeting.

A.2.13 EE (P), NRPC stated that it has been learnt that PSDF Fund has been blocked till March 2025. Therefore, this project is getting delayed.

A.2.14 MS, NRPC advised that concerned utilities may send pending data of substation and relays within a week else a tentative value shall be considered by NRPC Secretariat.

A.2.15 CGM, NRLDC conveyed that NRLDC may provide the required data for RE Substations.

A.2.16 Compiled status is attached as **Annexure-II**.

Decision taken by Forum:

i. Utilities were requested to send pending data for no. of relays and substations within a week.

ii. It was decided to consider tentative/ average data if details are not submitted by utilities within a week.

iii. It was decided that NRLDC may provide the required data for RE Substations.

A.3. Proposal for line differential protection between 33KV OG feeder at UPPTCL Transmission substation and 33KV incomer feeder at NPCL 33KV S/s (agenda by Noida Power Company Limited)

A.3.1 AEE (P), NRPC apprised that NPCL vide letter dated 22.04.2024 (**Annexure-III**) has intimated issues in relay setting co-ordination with following sub-stations of UPPTCL:

i. 220/132/33 kV Sector-123
ii. 220/33 kV Sector-148
iii. 220/33 kV RC Green
iv. 132/33 kV Surajpur

A.3.2 NPCL given the detailed presentation regarding the issue of relay setting of 33 kV OG feeders at UPPTCL Transmission substations (220/132/33Kv Sector-123, 220/33Kv Sec-148, 220/33Kv RC Green & 132/33Kv Surajpur) as 33kv supply for NPCL is emanating from these substations.

A.3.3 During the presentation, NPCL informed that as per the tripping data during the period Jan'24 to Mar'24, around 80% cases, 33 kV import feeders tripped at UPPTCL's Substations along with trippings of NPCL's downstream 33 kV and / or 11 kV feeders.

A.3.4 MS, NRPC stressed that large no. of tripping is matter of concern which are to be stopped by acquiring best protection practices.

A.3.5 NPCL representative explained that reason of Upstream feeder tripping with downstream feeder is due to improper relay setting co-ordination in time delay of High set of DMT I>> & DMT Ie>> which is set at 0.08sec at 33KV OG feeder at UPPTCL's Substations. Technically, total time taken by a 33 kV Switchboard to operate and isolate the fault is at least 90 milli sec. (Relay Operating Time i.e. 30 ms plus Circuit Breaker Operation Time i.e. 45-50 ms plus 86T relay operating time i.e. 10 ms cumulatively).

A.3.6 Hence, to improve power reliability by minimizing tripping of 33KV feeder from

UPPTCL substation, NPCL requested for relay setting amendment with time delay of 0.1s in High set of DMT I>> & DMT Ie>> from existing 0.08 sec.

A.3.7 Also, to improve protection system & power reliability, NPCL proposed to implement "Zone-specific protection 'Line differential protection'.

A.3.8 During the meeting, UPPTCL representatives agreed for amendment of relay setting from existing 0.08 second to suitable higher values to restrict unwanted tripping of upstream breaker.

A.3.9 UPPTCL representative mentioned that before implementation of differential protection, techno economical analysis is to be done. He added that UPPTCL will discuss with NPCL to resolve the matter.

A.3.10 It was suggested that UPPTCL and NPCL may resolve the protection related matters through a joint meeting.

Decision taken by Forum:

Forum suggested UPPTCL and NPCL to discuss the issue and resolve the matter.

A.4. Submission of protection performance indices to NRPC Secretariat on monthly basis (agenda by NRPC Secretariat)

A.4.1 AEE (P), 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.4.2 He added that in last PSC meetings, it was decided that each utility shall submit the performance indices of previous month by 7th day of next month.

A.4.3 MS, NRPC highlighted that NRPC Secretariat will have to submit the status of reported data before the honourable CERC. Therefore, it was requested to submit the data timely. NLDC representative added that non-compliance for the same is to be intimated to CERC by July, 2024.

A.4.4 MS, NRPC commented to take this agenda to OCC forum in order to attend regular follow-up. CGM, NRLDC was also of same view.

A.4.5 EE (P), NRPC also stressed upon the same and advised utilities to have dedicated manpower for submission of data to NRPC Secretariat timely, if required. He mentioned that NPC division, CEA has also been tracking the status of non-compliance of directions of RPC forums.

A.4.6 Further, the summary of events, reported prior to this meeting which caused indices less than unity were discussed. The concerned utilities were supposed to submit the reason for the same and corrective action taken to resolve the issue. Accordingly concerned utilities were asked about reason and remedial action taken for unwanted operation and failure of operation.

A.4.7 NRLDC representative recommended that 3rd party protection audit maybe done at Bareilly and Unnao substation as there have been many trippings reported continuously. Forum agreed for the same.

A.4.8 There was no representative from the Sultanpur, Prayagraj Zone, UPPTCL in the meeting. The related event for less than unity in the month of Feb, 2024 could not be discussed.

A.4.9 Based on the detailed discussion and submission of information, the summary of the same is attached as **Annexure-IV.**

A.4.10 The current status of the indices reported for the months from Jan-2024 to March-2024 is attached as **Annexure-V.**

A.4.11 MS, NRPC conveyed that all concerned utilities may send their reasons within a week via email alongwith corrective action taken for indices less than unity.

Decision taken by Forum:

Utilities were requested to submit the performance indices of previous month by 7th day of next month element wise along with the reason regularly for indices less than unity and required corrective action.

A.5. Protection philosophy for Power Transformer and Reactor of Northern Region (agenda by NRPC Secretariat)

A.5.1 AEE (P), NRPC apprised that 71st NRPC meeting finalized the protection philosophy for Northern Region in line with the decision of 49th Protection Sub-Committee meeting.

A.5.2 In addition to that, draft protection philosophy for power transformer and reactor has been added and attached as **Annexure-VI.** Further, the detailed discussion on the same was done which is as below-

i. The differential protection was discussed and POWERGRID representative commented on the setting of Id min that 0.2 pu may be considered default instead of 0.3 pu. RVUNL representative also agreed on the same for sensitivity and selectivity point. Forum agreed on the same.

ii. Further, Slope for the differential protection was discussed. Forum agreed on the settings of slopes as proposed in the draft attached as Annexure-VI. Subsequently, criterion for the end section of slopes were discussed. POWERGRID representative mentioned that these settings may be considered based on the relay manufacturer recommendation. Forum agreed on the same.

iii. Setting of Unrestrained operation level was discussed. In draft, it was proposed to keep 10pu. POWERGRID representative mentioned following formula to calculate the same as below-

Pick-up value of high-set diff current = **1/(% impedance) * 1.2 (20% margin)**

By using this formula, the high set comes 9.6pu (near to as proposed in draft settings) for standard impedance- 12%

RVUNL & UPPTCL representative did not agree to keep 20% margin used in the above formula. They rationalized that it is better to trip transformer at early stage.

iv. Max. ratio of 2nd harm. to fundamental harm dif. curr. in % and Max. ratio of 5th harm. to fundamental harm dif. curr. in % were agreed as proposed in the draft. AESL (ADANI) representative stated that in some transformer there is less than 15% of harmonic observed at the time of charging that causes tripping. So, he suggested to keep the ratio as 10% in case of 2nd harmonic. UPPTCL representative mentioned that in 132/33kV transformers, harmonic current dies out at later stage which causes it to become less than 15%.

v. Enabling for Second and fifth harmonics restrain feature and cross block feature were discussed. AGEL representative conveyed that cross block enabling is done for different tank transformer bank. In case of single tank, cross blocking may hinder the actual differential operation. RVUNL representative also highlighted the same. POWERGRID representative commented that at the instant of transformer charging, all the three phases may not have same current. Therefore, disabling the cross block may trip the transformers for maximum cases. UPPTCL representative stated that generally delay of 3 cycles is given for cross blocking but sometimes it is needed to increase it for successful charging of transformers. Forum noted the various comments of utilities and decided to adopt the enabling of Second and fifth harmonics restrain feature and cross block feature. Further, if any case comes to vary these settings, that would be dealt separately.

vi. Further, restricted earth fault protection settings were discussed. Pick up current was proposed as 10% of full load current. POWERGRID commented that in case of 765kV Transformers, pick-up may be considered 15% for 765/400kV transformers due to CT characteristic mismatch and for 400/220kV transformers it may be taken as proposed. Members quoted that it is better to keep 10% of full load current rather than increasing to 15%. Subsequently,

Forum agreed on the proposed setting.

vii. Stabilizing resistor setting was discussed. It was proposed that stabilizing resistor (RSTAB) is obtained by dividing stabilizing voltage (VSTAB) by pick-up current. Stabilizing voltage VSTAB = IF x (RCT + 2RL). RSTAB = VSTAB / IREF and Where, IF = Maximum through fault current, RCT = CT resistance, RL = CT circuit lead resistance. POWERGRID representative stated that measured loop resistance may be used for Rstab calculation to increase accuracy. AESL representative conveyed that low impedance REF relays are also used at substations. EE (P), NRPC commented that it depends on utility to use low impedance or high impedance relay. AEE (P) stated that as per CBIP manual, stability can be improved by selecting Stabilizing voltage (in turn stabilizing resistance) with sufficient security margin i.e. normally 150% of the calculated value. Subsequently, forum decided that the same margin may be adopted in the philosophy.

viii. Further, over current protection scheme was discussed. It was proposed that pick up for low set directional over current relay may be 125-150% of full load current. RVUNL representative opined that such higher current settings are not suitable and recommended to make it at lower side. UPPTCL representative added that range for over current pick up may be considered from 110-125% of full load current. CBIP representative highlighted that the range 125-150% has been selected because if one transformer is out of operation and then over current increases, it will not make the cascading tripping effect. HVPNL representative commented that in case of parallel transformer, this proposed range may be considered and for radial feeders connected transformers, the settings need to be on lower side. Based on the recommendation of utilities, forum decided the range for low set directional over current as 110-150% of full load current with IDMT characteristics and to be coordinated with distance relay zone 3 settings of outgoing feeders.

ix. Further, settings for high set non-directional over current protection were discussed. It was proposed that pick Up may be kept at 110-130% of the through fault level of the transformer. RVUNL, and UPPTCL commented that the proposed setting is higher. HVPNL representative commented that in case of parallel transformers, this proposed range may be considered and for radial

feeders transformers, the settings need to be changed to lower side. Finally, it was decided that settings for radial feeder may be kept at 80-90% of the through fault level of the transformer with Definite Time characteristics of 50 to 100msec. and for other transformers settings were finalized as proposed.

x. Earth Fault protection scheme was discussed. It was proposed that pick up for low set directional earth fault relay may be 20-80% of rated full load current with IDMT characteristics and to be coordinated with earth fault relay settings of outgoing feeders. Forum agreed for the same.

xi. Further, settings for high set non-directional earth fault protection were discussed. It was proposed that pick Up may be kept at 110-130% of the through fault level of the transformer with Definite Time characteristics of 50 to 100msec. Forum agreed for the same.

A.5.3 Subsequently, MS, NRPC suggested that utilities may take some more time to analyze the draft proposal and he suggested utilities to go through the draft and mail the observations/ suggestions within a week. Accordingly, draft may be finalized in next meeting.

Decision taken by Forum:

*Forum requested utilities to submit the recommendations/inputs/suggestions on draft proposed for the settings (**Annexure-VI)** to NRPC Secretariat.*

A.6. Annual protection audit plan for FY 2024-25 (agenda by NRPC Secretariat)

A.6.1 AEE (P), NRPC apprised that as per clause 15 of IEGC 2023;

- *All users shall conduct internal audit of their protection systems annually, and any shortcomings identified shall be rectified and informed to their respective RPC. The audit report along with action plan for rectification of deficiencies detected, if any, shall be shared with respective RPC for users connected at 220 kV and above (132 kV and above in NER).*

- *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.*

A.6.2 He added that in the 48th & 49th PSC meetings, each utility was requested to submit the Annual protection audit plan.

A.6.3 In view of above, some utilities have submitted their annual audit plans (enclosed as **Annexure-VII**). Further it was addressed that the utilities may submit the protection audit report (for audited S/s as per submitted plan) to NRPC Secretariat and may update the compliance status regularly.

A.6.4 MS, NRPC stressed that compliance of IEGC is to be done timely and every utility must adhere to the same. He added that letter for submission of annual internal audit plans for FY-2024-25 may be sent to RE stations separately.

Decision taken by Forum:

Utilities were requested to submit annual audit plan for FY 2024-25 in next 15 days and comply the same timely. Audit report along with action plan for rectification of deficiencies detected, if any may be submitted.

A.7. Constitution of committee for 3rd Party Protection Audit of identified Substations (agenda by NRPC Secretariat)

A.7.1 AEE (P), 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.7.2 Further, a Standard Operating Procedure (S.O.P.) for Protection System Audit (attached as **Annexure-VIII**) was circulated by NPC division of CEA wherein it is recommended to form a committee to conduct 3rd party protection audit of substations.

A.7.3 Accordingly, a letter vide dated 06.02.2024 (**Annexure-IX**) was also sent to all members of NRPC for seeking the nomination(s) for conducting protection audit. The received nominations are attached as **Annexure-X.**

A.7.4 In view of above, discussion was done on formation of committees having members from received nominations to conduct 3rd party protection audit of substations based on the availability of officers of various utilities.

A.7.5 Further, it was also reiterated that as per S.O.P. for Protection System Audit, travel expenses from place of duty to audit location shall be borne by respective auditor's organization. Expenses for boarding and lodging during audit shall be borne by sub-station/generation owner whose audit shall be conducted.

A.7.6 EE (P), NRPC conveyed that as per discussion of 49th PSC meeting, Himachal Pradesh was recommended to have 3rd party protection audit at Kunihar, Baddi. Representative from Himachal updated that 3rd party audit at Kunihar, and Baddi has been taken up and it will be done soon.

A.7.7 It was deliberated that there are a lot of sub-stations in region and 3rd party audit by officers of NR Region may not be adequate approach as relieving officers from their routine work may be difficult for 6-7 days for protection audit. However, if any case arises for urgent audit of the station due to grid disturbances, then committee of officers may audit the station as per recommendation of forum. Otherwise, any third-party vendor may be approached by owner of station for 3rd party audit.

A.7.8 It was deliberated that CPRI, and CBIP also do protection audit. They can also be approached.

A.7.9 CGM, NRLDC stated that auditing for substations having frequent grid incidences may be done by a committee having members from NRLDC, NRPC and other members from received nominations.

Decision taken by Forum:

i. Forum decided that compliance of IEGC 2023 must be done by utilities. Third-party protection audit shall be conducted for each sub-station at 220 kV and above once in five years or earlier as advised by the respective RPC. The utilities shall be responsible to get audit done.

ii. Audit may be done by third party vendor.

iii. Forum may also form committee for audit on case to case basis based on grid disturbances at any sub-station.

A.8. Reports of prolonged non-compliance of the recommendations of the protection audit (agenda by NRPC Secretariat)

A.8.1 AEE (P), NRPC apprised that as per discussion of the 14th meeting of NPC held on 03.02.2024, NPC division, CEA has desired (**Annexure-XI**) to monitor the exception report of prolonged non-compliance of the recommendations of the protection audit. Minutes of the meeting is attached as **Annexure-XII.**

A.8.2 In view of above, utilities are required to send protection audit reports (internal/external) and its compliance status against observation points.

A.8.3 Accordingly, prolonged non-compliance of the recommendations of the protection audit may be identified and same can be furnished to NPC, division by NRPC Secretariat.

A.8.4 MS, NRPC requested utilities to submit the the protection audit reports and compliance status of the audit.

Decision taken by Forum:

All utilities were directed to provide the protection audit reports and compliance status of the same. Utilities were also directed to expedite the necessary required action of compliance of the recommendations of the protection audit.

A.9. External agencies conducting Third Party Protection Audit in Northern region (agenda by NRPC Secretariat)

A.9.1 AEE (P), NRPC apprised that as per discussion of the 14th meeting of NPC held on 03.02.2024, the list of external agencies for conducting Third Party Protection Audit may be prepared by the Protection sub-group of NPC for reference.

A.9.2 In view of above, NRPC Secretariat has to provide the list of external agencies for conducting Third Party Protection Audit to NPC division, CEA.

A.9.3 As per standard practices and previous exercises done by utilities, they were requested to convey the names of external agencies for conducting Third Party Protection Audit to NRPC Secretariat so that same may be conveyed to NPC Division, CEA.

A.9.4 POWERGRID representative commented that CPRI, CBIP have been conducting the third party protection audit.

A.9.5 MS, NRPC stated that utilities may send the list of external agencies that conduct Third Party Protection Audit.

Decision taken by Forum

Forum requested all the utilities to send within a week, list of external agencies that conduct Third Party Protection Audit in their organization.

A.10. Discussion on the comments provided by NRLDC on the SOP for Protection System Audit (agenda by NRPC Secretariat)

A.10.1 AEE (P), NRPC apprised that a Standard Operating Procedure (S.O.P.) for Protection System Audit & to address the Grid Disturbances (GDs)/Grid Incidents (GIs)/any other Protection Trippings (attached as **Annexure-XIII**) was circulated by NPC division of CEA.

A.10.2 Further, the status of implementation of approved SOP was discussed in the 14th NPC meeting held on 03.02.2024, Grid-India has submitted comments (**Annexure-XIV**) on the draft minutes of that meeting regarding approved SOP for protection system audit.

A.10.3 EE (P), NRPC highlighted that based on recommendation of protection experts, the final inputs may be prepared.

A.10.4 Subsequently, detailed discussion was held regarding suggestions/inputs on the GRID-India comments on SOP for protection system audit and finalized version is attached as **Annexure**- **XV**.

A.10.5 Further, some utilities asked some time to provide inputs on the GRID-INDIA comments on SOP of the Grid Disturbances (GDs)/Grid Incidents (GIs)/any other Protection trippings.

A.10.6 MS, NRPC conveyed that utilities may send the inputs on comments of GRID-INDIA on SoP (**Annexure- XVI)** for addressing the Grid Disturbances/Grid Incidents/Tripping's via email within a week. The same shall be discussed in next PSC meeting.

Decision taken by Forum

i. *Forum finalized the inputs on the comments provided by NRLDC on the SOP for Protection System Audit attached as* ***Annexure- XV.***

ii. *Utilities were requested to* send the inputs on comments of GRID-INDIA on SoP for Grid Disturbances/Grid Incidents/Tripping's via email within a week.

A.11. Review of "Procedure and flow chart for approval of Protection Settings by NRPC Secretariat for "First Time Charging" (Agenda by Adani Power Limited, Adani Green Energy Limited & Adani Energy Solution Limited)

A.11.1 AEE (P), NRPC apprised that as per the minutes of 49th PSC meeting issued vide letter dated 08.03.2024, it was decided at the A.4.6 as below:

Subsequently, it was gathered that the FTC procedure will remain same as being done by NRLDC. However, approval of protection settings shall be required from NRPC.

A.11.2 In view of above, Adani Power Limited vide letter dated 18.04.2024 & Adani Green Energy Limited vide letter dated 18.04.2024 & Adani Energy Solution Limited (All are attached as **Annexure**-**XVII**), have highlighted following:

i. Protection settings based on Protection Philosophy are considered as per the NRPC guidelines and further submitted to NRLDC for approval before FTC, therefore seeking separate approval from NRPC may take additional coordination & time.

ii. As per regulation 14(2) (b) of IEGC 2023 approval of concerned RPC is required for i) any revision in settings and ii) implementation of new protection system for 'grid connected users'. Therefore, it is not required during FTC.

iii. requested to re-consider exclusion of this additional approval process from the FTC procedure.

iv. Accordingly, deliberation on re-consideration of the requirements on obtaining approval of protection settings by NRPC in addition to the existing NRLDC approval for the FTC may be done.

A.11.3 Adani representative conveyed that additional approval process for FTC from NRPC

may take additional coordination & time. Therefore, it is requested to reconsider the procedure.

A.11.4 MS, NRPC highlighted that in IEGC there is mandate for obtaining approval of the concerned RPC for i) any revision in settings, and (ii) implementation of new protection system. Since, RPC means the forum, Hence, Protection Sub-committee of NRPC shall grant these approvals. He added that other RPCs protocols may also be referred in this regard.

A.11.5 Further, the protocol prepared by SRPC for Protection Settings & Coordination (available on the website of SRPC under Protection Protocol of SR (attached as **Annexure-XVIII)**) was presented to forum as below-

a. Each Transmission Licensee and Generation Company shall be responsible for settings calculations for protection of elements under its ownership. It shall be the responsibility of the respective asset owner to obtain the inputs (adjacent line settings, infeed values etc.) from STU/Generating Company/ Transmission Licensee necessary for calculation of the settings.

b. STU/Generating Company/Transmission Licensee shall provide the infeed values/latest network model to the requesting entity, within 15 days of receipt of such a request from the entity.

c. Each Generating Company and Transmission Licensee, for voltage levels 400kV and above and interstate lines, shall submit the protection settings as per the format prescribed, along with the calculation sheets, co-ordination study reports and input data, in advance, to SRPC/SRLDC for every new element to be commissioned. The mentioned information shall be submitted to the SRPC/SRLDC two months in advance for all the elements proposed to be commissioned. SRPC shall furnish the approved settings within forty days from the date of submission of the settings by the entity.

d. The PCSC of SRPC shall review the settings to ensure that they are properly coordinated with adjacent system and comply with the existing guidelines. The onus to prove the correctness of the calculated settings shall lie with the respective Transmission licensee/Generation Company. In case, the PCSC feels that the adjacent transmission system settings need to be changed, in

view of the new element, it shall inform the concerned entity for revision of the existing settings.

e. The PCSC of SRPC shall review and approve the settings based on the inputs/ report submitted by the entities.

f. Any change in the existing protection settings, for voltage levels 400kV and above & interstate lines, shall be carried out only after prior approval from the SRPC. The owner entity shall inform all the adjacent entities about the change being carried out.

g. SRPC in consultation with the SRLDC & Southern Regional entities shall undertake review of the protection settings, assess the requirement of revisions in protection settings and revise protection settings, from time to time and at least once in a year. The necessary studies in this regard shall be carried out by the SRPC & SRLDC. The modifications/changes, if any, in protection settings shall be advised to the respective users and STUs.

A.11.6 Further, protocol of WRPC for new transmission line element integration was briefed as below-

a. In case a new transmission line/element is to be synchronized first time, the new element entity should approach respective CTU/STU/concerned utility where it is getting connected, for getting details of line parameter at remote end, and the distance relay's settings and zone timings.

b. The utilities at the remote end should provide the relay settings at their end along with the requisite data for carrying out protection setting of the new transmission line/element.

c. The Bus fault levels of the incidental system to the new elements shall be provided by WRLDC/SLDC, as the case may be, to the utility proposing to connect the new element.

d. The new utility shall then arrive at their settings for distance relays zone reach and timings and for that it shall adopt the overall settings of distance relay as per the guidelines approved in "Model Setting Calculations for typical IEDs, Line Protection Setting guide lines, Protection System Audit check list,

Recommendations for Protection Management sub-Committee on Relay/Protection under Task Force for Power System Analysis under Contingencies" report and the CBIP guidelines on protection system relaying.

e. The zone reaches and timings shall have to be suitably coordinated with the settings adopted in the remote stations. The settings at the remote S/Ss be modified in line with guidelines provided in "Model Setting Calculations for typical IEDs, Line Protection Setting guide lines, Protection System Audit check list, Recommendations for Protection Management sub-Committee on Relay/Protection under Task Force for Power System Analysis under Contingencies" report and the CBIP guidelines on protection system relaying.

f. The new Utility shall consult with all the remote end Utilities, and the setting revisions shall be agreed by all these Utilities. The agreement of these settings be conveyed to WRLDC/WRPC for getting the new element connected to ISTS. WRLDC based on the above information shall allow integration of new element in the system.

g. These settings shall be forwarded to WRLDC/SLDC and with copies to CTU/STU/concerned utility and WRPC.

h. The agreed settings shall be as an interim arrangement which is required to ratified in PCM of WR. The Utility concerned should put up the settings of its system (new element) and remote end settings to WRPC before the next PCM, for getting this approved in PCM of WR.

i. For doubts or disagreement, if any, the matter can be referred to WRPC PCM, after adopting interim settings as above.

A.11.7 The detailed protocol is attached as **Annexure-XIX.**

A.11.8 All participants were asked to provide the comments. NRLDC representative stated that during FTC approval, utilities submit the annexures A & B. Generally, there is always a time gap taken by utilities to send the annexure-B after A. He added that in NERLDC, approved settings are forwarded by NERPC to NERLDC for FTC approval. There are different processes being adopted by different region.

A.11.9 POWERGRID representative commented that there may be a single window for

submission of the data.

A.11.10 MS, NRPC mentioned that final approval for settings is to be provided by NRPC through forum. However, NRLDC may give consent to settings for ISTS elements during FTC subject to NRPC Forum approval. To avoid the delay, utilities have to make sure that data may be submitted to NRLDC giving ample time to NRLDC for scrutiny.

A.11.11 Further, the procedure finalization for approval of protection settings was discussed for STUs elements. Subsequently, it was decided that SLDC may give consent to settings for STUs elements during FTC subject to NRPC forum approval in line with NRLDC for ISTS elements.

A.11.12 After giving consent for settings during FTC, it is responsibility of NRLDC or SLDC (as the case may be) to bring the same in the agenda of next Protection Sub-Committee meeting for approval of settings by forum.

A.11.13 Based on the discussion, the procedure of approval of protection settings was finalized as attached as **Annexure**- **XX.**

A.11.14 It was decided that application for approval of protection settings from HVPN, AYANA, HPPTCL, DTL and PSTCL may be forwarded to NRLDC/respective SLDCs for approval and subsequently, NRLDC/ respective SLDCs may bring the same as agenda in the next Protection Sub-Committee meeting for ratification by forum after giving consent to the settings.

Decision taken by Forum

Forum finalized the procedure for approval of protection settings as attached as ***Annexure****- **XX.***

A.12. Furnishing of details of non-compliant Disturbance Recorder (agenda by NRPC Secretariat)

A.12.1 AEE (P), NRPC apprised that as per clause 17 of IEGC 2023;

The time synchronization of the disturbance recorders shall be corroborated with the PMU data or SCADA event loggers by the respective RLDC. Disturbance recorders which are non- compliant shall be listed out for discussion at RPC.

A.12.2 In the 48th PSC meeting, it was decided that concerned utilities shall do the needful for time synchronization of disturbance recorders with PMU data or SCADA event loggers and shall share the list of DRs which are non-complaint within one month's time.

A.12.3 In view of above, Lucknow Zone, Gorakhpur circle (UPPTCL) and BBMB have provided the required data. Utilities were again requested to share list of DRs which are non-complaint.

Decision taken by Forum

Utilities were again requested to share list of DRs which are non-complaint and do the needful for the compliance.

A.13. Points of NLDC for discussion (agenda by NLDC)

A.13.1 NLDC representative apprised the various issues of Northern Region related to Generation, RE which were discussed and recommended as below-

a. Closing of 220kV Chittorgarh (RS)-Chittorgarh (RS) between 220kV and 400kV Chittorgarh Sub Station (RS) to enhance redundancy of evacuation for RAPP B and RAPP C. Increasing the instantaneous overcurrent setting of 3X315MVA 400/220kV ICTs at Chittorgarh (RS) to 1.1 p.u. This is within standard setting of 1.3 p.u as mentioned in "Recommendation on model setting calculation documents of ICT by Sub- committee on Relay/Protection under Task force for Power system analysis on contingencies". Generation dispatch of KTPS to be coordinated with available evacuation transfer capability of network from KTPS/RAPP complex.

b. Regarding the multiple pole tripping issue of HVDC Champa-Kurukhetra due to lane change over issue and software issue, POWERGRID representative informed that issue is to be taken up with OEM by POWERGRID.

c. In order to address the high loading issue during contingencies suitable SPS provision to be provided in KTPS evacuation lines. The SPS should be made functional based on 220kV line loading logic with suitable generation backing down. Matter may be discussed in OCC forum.

d. The sub synchronous damping controller and SSR controller to be functional

at Champa and Kuruketra end and statcoms at Bhadla, Fatehgarh and Bikaner.

Decision taken by Forum:

Concerned utilities were requested to note and implement the recommendations.

A.14. Review of SPS scheme no. SPS/NR/GEN/01 SPS for reliable evacuation of power from NJPS, Rampur, Swara Kuddu, Baspa Sorang and Karcham Wangtoo HEP (agenda by HPPTCL)

A.14.1 AEE (P), NRPC apprised that HPPTCL vide letter dated 27.03.2024 has submitted proposal for review of SPS for evacuation of power from NJPS, Rampur, Swara Kuddu, Baspa Sorang and Karcham Wangtoo HEP

A.14.2 HPPTCL representative briefed about the review of SPS and the same is attached as **Annexure- XXI.**

A.14.3 NRLDC representative commented that study on this proposal is yet to be done and after having detailed analysis, the comments will be shared.

Decision taken by Forum:

Forum deferred the agenda and NRLDC was requested to scrutinize the case for approval in next PSC meeting.

A.15. Issuance of General Guideline on Power Swing blocking for feeders emanating from generating stations (agenda by RVUNL)

A.15.1 RVUNL representative apprised that a major Grid Disturbance occurred on dated 29.03.2024 resulting in tripping of all the running units of KTPS, Kota on Over Frequency/ Over Speed Protection as not enough corridors was available for power evacuation.

A.15.2 There were 09 no. available 220 KV feeders and during disturbance two of them tripped on power swing.

A.15.3 RVUNL representative conveyed that Power Swing blocking should be done in Zone -1 for feeders emanating from generating stations. Because continuing power swing may lead to pole slip in generator and cause damage to the same. Further, delayed clearing of power swing will also create more power swing.

A.15.4 Forum decided to constitute a dedicated committee having members from NRPC, NLDC, NRLDC, NPCIL, RVUN, KTPS, RVPN and POWERGRID. The committee shall comprehensively review the protection system.

Decision taken by Forum:

It was decided that a committee having members from NRPC, NLDC, NRLDC, NPCIL, RVUN (KTPS), RVPN and POWERGRID shall review the protection settings related to power swing block for feeders emanating from generating stations during the review of protection related aspects in the RAPS, KTPS complex.

A.16. Status of remedial actions recommended during 49th PSC meeting (agenda by NRLDC)

A.16.1 NRLDC representative apprised that as per the discussion in 49th PSC meeting, necessary remedial actions were recommended based on the analysis and discussion of the grid events. Details of the event analysis and recommended points is attached as Annexure- **XXII**. Constituents were requested to share the status of remedial actions taken. Constituents can email the details via mail to NRLDC and NRPC. The followings were discussed as below-

a) Multiple elements tripping at 400/220kV Rosa (UP) on 07th Sept 2023,

49 PSC recommendations: UP-SLDC shall share the report of third-party protection review conducted at 220kV Rosa (UP).

UP representative informed that testing has been done and highlighted issues have been addressed. One major issue was non-operation of bus bar protection due to communication failure which has been resolved. NRLDC representative requested UP to share the report of the testing along with remedial action taken.

b) Multiple elements tripping at 220kV Kunihar(HP) on 06th Sept 2023, 06:44 Hrs

49 PSC recommendations: HP shall expedite the conduct of third-party

protection audit of 220kV Kunihar, Baddi S/s and submit the report to NRPC/NRLDC. Necessary corrective action needs to be taken to minimise occurrence of such events.

HP representative stated that they have approached the POWERGRID for third party protection audit. It will be conducted by next month.

c) Multiple elements tripping at 220kV Hissar_IA(Har) Station on 05th October 2023, 09:28 hrs:

49 PSC recommendations: Haryana & BBMB shall expedite the Implementation of line differential protection in 220kV Hissar_IA- Hissar(BBMB) ckt-1&2.

Haryana representative stated that they have approached the POWERGRID for fibre availability. POWERGRID representative informed that dark fire is available, Haryana may coordinate with the POWERGRID Telecom department. Haryana agreed to conduct feasibility study and coordinate with the POWERGRID to avail the fibre.

d) Multiple elements tripping at 400kV Uri-I & Uri-II (NHPC) on 14th October 2023, 04:23 hrs:

49 PSC recommendations: POWERGRID and NHPC shall review the over current protection in 400kV Uri-II-Uri-I ckt. As per NR protection philosophy, phase over current protection shouldn't be kept in 220kV & above line.

NHPC representative informed that overcurrent protection at both Uri-I and Uri-II has been disabled.

e) Multiple elements tripping at 400kV Dadri (NTPC) and Dadri HVDC on 04th November 2023, 04:03 hrs:

49 PSC recommendations: NTPC shall review the nomenclature of bus name in PMU & SCADA in coordination with POWERGRID.

NTPC agreed for the same.

f) Multiple elements tripping at 220kV Ropar GGSTP (Guru Gobind Singh TPS) on 30th November 2023, 06:51 hrs:

49 PSC recommendations: Single phase auto-reclosing needs to be enabled at

Ropar end to avoid undesired tripping of line during transient fault.

Punjab representative stated that it hasn't been enabled yet. They have taken up with Ropar TPS to enable the A/R operation.

A.17. Status of Bus bar protection (agenda by NRLDC)

A.17.1 NRLDC representative apprised that clause - 4 in schedule - V of Central Electricity Authority (Technical Standards for Construction of Electrical Plants and Electric Lines) Regulations, 2010 reads as

"Bus bar protection and local breaker backup protection shall be provided in 220kV and higher voltage interconnecting sub- stations as well as in all generating station switchyards".

A.17.2 During analysis of many grid incidents/disturbances, it has been found that the Busbar protection at the affected substation was not present or non-operational which resulted in considerably increasing both the number of affected elements and fault clearance time. Accordingly, it becomes critical to monitor and keep Busbar protection at all the 220 kV and above voltage level substations healthy and operational.

A.17.3 Constituents were requested vide NRLDC letter dated 28th Dec 2022 to furnish status of Busbar protection in the following format in your control area. Deliberation on this subject has already been done during previous OCC and 48th PSC meeting.

A.17.4 Details are yet to be received from J&K.

A.17.5 Continuous follow-ups have been done to expedite the commissioning of bus bar protection at 220kV & above stations and also to ensure their healthiness. On the basis of details received till date, it is observed that status of bus bar protection has been improved however, further improvement is desired.

A.17.6 Constituent wise status of bus bar protection where bus bar protection is either not installed or installed but not operational along with present status as per detail received from constituents is attached as Annexure- **XXIII**.

A.17.7 Constituents were requested to share the present status of remedial action taken/to be taken regarding commissioning and healthiness of bus bar protection at 220kV &

above substations and also expedite the implementation of bus bar protection.

A.17.8 NRLDC representative stated that details have been received from UP and Haryana only. Members were asked to appraise the status of bus bar protection in their respective control areas.

A.17.9 Punjab representative informed that commissioning is in process. It will be completed at all the stations by 30th June 2024.

A.17.10 Rajasthan representative informed that bus bar protection has been commissioned at 13 number of stations. Commissioning process at 12 number of stations is being done. The delay was mainly due to the unavailability of cables. Follow up with GE is being done for OEM support to make bus bar protection at Kota Sakatpura operational. Necessary actions are being taken to make bus bar protection operational at all the stations.

A.17.11 NRLDC representative requested other concerned members to share the updated status details by mail. An updated sheet based on detail received is attached as **Annexure-XXIV**.

Decision taken by Forum:

Forum requested all the constituents to update the status of bus bar protection at S/s of their control area and expedite the commissioning and implementation work of bus bar protection system. Members agreed for the same.

A.18. Replacement of electromechanical relays with numerical relays (agenda by NRLDC)

A.18.1 NRLDC representative apprised that clause-37.2(c) of IEGC, clause-15(4) of CEA Grid standards and clause-48(4) of CEA Construction Standards 2022 mandates that *''each line or transformer or reactor or any other bay shall be provided with facility for disturbance recording, event logging and time synchronizing equipment''.*

A.18.2 He added that during analysis of grid incidents/disturbances, it has been found that

there are few stations where electromechanical relays are still in use and thus disturbance recorders are not available there which accounts for violation of Clause-37.2(c) of IEGC, clause-15(4) of CEA Grid Standards and clause 48(4) CEA Construction Standards 2022.

A.18.3 In addition, clause-3 in part III (Grid Connectivity Standards applicable to Transmission Line and Sub-Station) of Standards for Connectivity to the Grid, 2007 reads as

‘’*Two main numerical Distance Protection Schemes shall be provided on all the transmission lines of 220 kV and above for all new sub-stations. For existing sub-stations, this shall be implemented in a reasonable time frame’’*

A.18.4 It is known that Disturbance recorder (DR) is essential for analysis of grid incidents/disturbances. Its non-availability eventually affects the proper analysis of grid incidents/disturbances and monitoring of protection system.

A.18.5 Deliberation on same subject has also been done during 48th PSC. During the meeting, all the constituents/SLDC/STU were requested to review the same in their control area and take expedite actions to replace electromechanical relays with numerical relays.

A.18.6 Constituent wise details of static/electromechanical type protection relays at their respective substations along with its present status per detail received from constituents is attached as **Annexure- XXV**.

A.18.7 Constituents were requested to share the status of remedial action taken/to be taken regarding replacement of static/electromechanical relay with numerical relays at 220kV & above substations and also expedite the process of replacement of static/electromechanical relay with numerical relays.

A.18.8 NRLDC representative stated that details have been received from UP & Haryana only. Other concerned members were requested to share the updated status details by mail.

Decision taken by Forum:

Forum requested all the constituents to update the status of type of protection relays at S/s of their control area and expedite the replacement work of static/electromechanical type protection relays with numerical relays. Members agreed for the same.

A.19. Frequent outage of 800kV HVDC Champa-Kurukshetra inter-regional link (agenda by NRLDC)

A.19.1 NRLDC representative apprised that it has been observed that frequency of tripping of HVDC Champa-Kurukshetra has increased. There are 06 no of events of multiple pole trippings have been observed in this link since January 2024. List of all the tripping of HVDC Champa-Kurukshetra is enclosed as **Annexure- XXVI**. The tripping of this high-capacity link may cause overloading of other parallel transmission lines and further tripping may cause cascade tripping.

A.19.2 It is also well known that, on account of summer, the Northern Region load would remain high till September and therefore, high import requirement exists for the Northern Region. Thus, the HVDC Champa-Kurukshetra inter-regional link is a very important link for fulfilling the Northern Region demand requirement.

A.19.3 It has been observed that major fault is either due to DC line fault, filter protection, software issues, protection mal-operation etc. The reason of most of the tripping seems similar indicating the repetitive nature of fault/tripping.

A.19.4 POWERGRID(NR-1) was requested to elaborate on the issues and status of remedial measures taken/to be taken to avoid frequent tripping of this inter-regional link.

A.19.5 POWERGRID representative stated that continuous follow-up is being done with the GE to rectify the issues. During May-2023, software was upgraded to version 06. However, frequent cases of maloperation have been observed. Work is in progress in coordination with GE to upgrade the software to version 07 and to address the existing issues.

A.19.6 NLDC representative highlighted issues related to oscillations in active power and requested to enable the sub synchronous damping controller at both Champa and Kurukshetra end. It was also asked to install PMU for TCR for effective monitoring of

TCR response.

A.19.7 POWERGRID representative stated that they will take up with the GE whether such feature can be enabled in Active Power Control mode. It was also informed that some modification in TCR software has been done which will try to damp out the oscillations. Regarding installation of PMU for TCR, POWERGRID stated that they will plan to install the PMU for TCR at Kurukshetra.

Decision taken by Forum:

Forum requested POWERGRID to take effective remedial actions to avoid tripping of 800kV HVDC Champa-Kurukshetra inter-regional link which is very important link for fulfilling the Northern Region demand requirement.

A.20. Review of protection system and load management in KTPS, RAPS generation complex in view of event of complete outage of the complex on 5th Jan24 & 29th Mar24 (agenda by NRLDC)

A.20.1 NRLDC representative apprised that on 29th March at 20:22hrs, multiple elements tripping occurred in RAPS, KTPS generation complex. KTPS, RAPS-A, RAPS-B & RAPS-C generation station got blackout during this incident. Initiating incident was blast of R-ph CT at 220kV side of 220/132kV 160MVA ICT-1 at Kota Sakatpura (Raj). As bus bar protection is not available at Kota Sakatpura S/s, few of the 220kV lines tripped on Z-4 protection operation and Z-2 protection operation at Kota Sakatpura & KTPS respectively. Simultaneously, the remaining 220kV lines got significantly overloaded and tripped on distance protection operation during power swing. Thereafter due to lack of evacuation path, over frequency occurred in systems and KTPS units tripped on over frequency. SUTs at RAPS-B tripped for initiation of house load operation but it failed. SUTs of RAPS-C also tripped for switching of auxiliary supply to UTs but it also failed due to mismatch in frequency. It resulted in the tripping of RAPS-B & C units. Island formed with RAPS-A unit with the load of Debari and Chittorgarh which operated till 20:47hrs and later collapsed due to tripping of turbine generator on over fluxing. Detail analysis report of the tripping event is available on the link https://nrldc.in/Websitedata/Docs/Documents/Tripping%20Report/Preminilary%20Report/2024/03%20Mar/2024_03_29_KTPS_RAPS_%20Grid%20event.pdf

A.20.2 He added that similar events of blackout in KTSP, RAPS generation complex occurred on 05th Jaunuary'24. Frequent disturbance in this complex having significant quantum of nuclear generation is serious issue. Necessary remedial actions at RAPS, KTPS and RVPN end need to be expedited to avoid any such event in future. Detail analysis report of the tripping event is available on the link https://nrldc.in/Websitedata/Docs/Documents/Tripping%20Report/Preminilary%20Report/2024/01%20Jan/2024_01_05_Grid%20event%20at%20%20KTPS_RAPS_Rajasthan.pdf

A.20.3 Deliberation on 05th January'24 event was done during 216 OCC meeting. KTPS, RAPS & Rajasthan are requested to take necessary remedial actions to take necessary remedial actions share the details of remedial actions taken as agreed during discussion in 216 OCC meeting. Further, an online meeting was conducted on 05th April 2024, RAPS, KTPS & SLDC-Rajasthan agreed to take following remedial actions:

RAPS:

i. Over flux protection in generator at RAPS-A was 112.5% instantaneously. Now, the time delay has been kept as 4sec on recommendation of NPCIL design team.

ii. During the event, when frequency reached 51.5Hz, SUT of unit-4 at RAPS-B tripped and ATS breaker closed successfully. However, it got blocked as there is tie breaker connected to auxiliary bus feeding unit-3 auxiliary supply.

On recommendation of design team, a logic has been implemented in which tie breaker will also trip along with SUT incomer breaker so that ATS scheme will not get blocked. Further review of ATS logic at RAPS-B is being done by NPCIL design team.

iii. SUT-5&6 tripped on over frequency (51.5Hz with 200msec delay) and initiated the ATS to shift the total auxiliary load on UTs. However, due to mismatch in frequency at both the side of auxiliary bus, ATS failed and units at RAPS-C tripped. Review of ATS logic at RAPS-C is being done by NPCIL design team.

iv. RAPS-C will explore the possibility of keeping total auxiliary load at 400kV side.

v. RAPS will take necessary remedial actions to ensure the healthiness and availability of SCADA data.

Rajasthan:

i. Commissioning of bus bar protection at 220/132kV Kota Sakatpura S/s will be expedited. (Rajasthan informed that material has been arrived, commission is getting delayed to workmanship. It will be commissioned in 2.5-3 months).

ii. 220kV KTPS-Kota (PG) D/C will be kept in closed condition. Rajasthan will prepare a SOP for monitoring of import/export through these lines for any decision making required.

iii. Rajasthan will connect the 220kV Chittorgarh with the 400/220kV Chittorgarh. It will strengthen the connectivity of RAPS with the grid. The possibility to operate 220kV Debari in ring may also be explored. (During 219th OCC meeting, Rajasthan informed that 220kV Chittorgarh has been connected with 400/220kV Chittorgarh on 17th April).

iv. Separate display of RAPS, KTPS generation complex to be made at SLDC control room for effective decision monitoring and decision making. (During 219 OCC meeting, Rajasthan informed that separate display of RAPS, KTPS complex has been made and effective monitoring is being done.).

v. Faulty RTUs also need to be rectified at the earliest to ensure the healthiness and availability of SCADA data.

vi. Rajasthan will further explore the possible load management in this complex to avoid high overloading of 220kV lines.

A.20.4 NRLDC representative stated that in view of aforementioned grid disturbances in this complex, wherein all the reactors at RAPS-A, B & C tripped and went under poison out state, review of protection system and load management in the KTPS, RAPS generation complex (KTPS, RAPS-A, B & C and 220/132kV Kota Sakatpura) needs to be done. Implementation of suitable SPS in KTPS evacuation lines may be explored to address the high loading issue during contingencies in this complex. A separate committee may be formed at RPC forum to review the protection system and load management in the KTPS, RAPS generation complex and to recommend necessary remedial actions to avoid such major grid disturbance in this complex in future.

A.20.5 NPCIL representative stated that on outage of 220kV KTPS-Kota (PG) lines, power flow in 220kV lines from Kota Sakatpura to RAPS-A & B get reversed (towards RAPS) which leads to overloading of 220kV lines at RAPS. Necessary protection scheme may be implemented on the basis of power flow in these lines towards RAPS to actuate the ATS at RAPS-B & C before creation of over frequency scenario in this

complex. As RAPS Unit-7 would also probably commission by end of this year and RAPS Unit-8 during next year, strengthening of protection system in this complex is very much necessary. In addition, island scheme implemented in this complex also need to be reviewed.

A.20.6 RVPNL representative informed that there was O/C E/F protection implemented on bus sectionalizer of Bus-A&B with reduced operating time to isolate the bus during bus fault as bus bar protection is not there. However, it was leading to loss of evacuation path for generation. Now, tripping of bus sectionalizer on O/C E/F has been disabled. Implementation of bus bar protection is in process, same will be expedite.

Decision taken by Forum:

Forum decided to constitute a dedicated committee having members from NRPC, NLDC, NRLDC, NPCIL, RVUN (KTPS), RVPN and POWERGRID. The committee shall comprehensively review the protection system, load management, islanding scheme, SPS requirement, Auto Transfer Scheme at RAPS and other related aspects in the RAPS, KTPS complex. Committee shall visit the sites and submit the detailed report along with their findings/observations.

A.21. Grid disturbance in 220kV Kunihar, Baddi complex during Feb'24 (agenda by NRLDC)

A.21.1 NRLDC representative apprised that frequent event of multiple elements trippings have been reported in recent past (on 02nd Feb, 08th Feb and 16th Feb) in HP control area. Major affected substations were 220kV Kunihar, Baddi and Bhabha. Significant quantum of load in the range of 400-700MW affected during these grid events. Brief of events are attached as **Annexure- XXVIII**.

A.21.2 During Aug-Sept 2023 also, Grid events at Kunihar area were reported. Those events were discussed in 48th PSC meeting and PSC forum had recommended third party protection audit of Kunihar S/s. However, no update on the same have received and multiple events in recent past indicates that issues related to protection system and their coordination at these affected stations are still existing.

A.21.3 DR/EL and detail analysis of any of these events have not received from HP. Therefore, HP is requested to analyse the tripping events in detail and share following details w.r.t. all three grid events occurred in Feb'24:

- Disturbance recorder and event logger details of all the tripped elements.
- Sequence of tripping of elements.
- Details of protection operated along with their protection settings.
- Tripping analysis report along with corrective actions taken / planned to be taken.

A.21.4 As per IEGC clause 37.2 (c), Disturbance Recorder (DR), station Event Logger (EL), Data Acquisition System (DAS) shall be submitted within 24 hrs of the event and as per IEGC clause 37.2 (e), the user shall submit a detailed report in the case of grid disturbance or grid incidence within one (1) week of the occurrence of event to RLDC and RPC.

A.21.5 NRLDC representative highlighted that during 48th & 49th PSC meeting, third party protection audit of this complex i.e., 220kV Kunihar, Baddi, Bhabha was recommended. However, no details in this regard received from HP. HP is requested to take necessary remedial actions on priority. HP may also plan for suitable SPS scheme in this complex to avoid complete outage of the complex during contingency.

A.21.6 HP representative stated that they have approached the POWERGRID for third party protection audit. It will be conducted by next month.

Decision taken by Forum:

PSC forum deliberated that in view of multiple incidents of grid events in this complex, a committee may be constituted for third party protection audit of Kunihar, Baddi complex. HP may also proceed with the process of third-party protection audit and shall share the report of the audit. HP was also requested to plan for suitable SPS scheme in this complex to avoid complete outage of the complex during contingency.

A.22. Availability and Standardization of recording instrument (Disturbance recorder and Station Event Logger) (agenda by NRLDC)

A.22.1 NRLDC representative apprised that as per IEGC clause 17

1) All users shall keep the recording instruments (disturbance recorder and event logger) in proper working condition.

2) The disturbance recorders shall have time synchronization and a standard format for recording analogue and digital signals.

A.22.2 IEGC clause 37.2 (c) also mandates the submission of Disturbance Recorder (DR), station Event Logger (EL), Data Acquisition System (DAS) within 24 hrs of the event.

A.22.3 NRLDC representative stated that data of recording instruments (DR/EL) are very helpful in grid event analysis and is being used in availability verification of transmission lines. Complete and conclusive analysis of any grid event is not possible without these recording instruments and thus their standardisation is very important.

A.22.4 Therefore, availability of disturbance recorder with standardisation, time sync and correct nomenclature and station event logger need to be ensured by users at the station of their respective control area. During grid event analysis it is observed that DRs at many stations are not configured as per standard. Issue of time synchronisation has also been observed.

A.22.5 In view of above, all the constituents were requested share the details w.r.t. availability and standardisation of disturbance recorder and event logger at the station of their respective control area in format attached as **Annexure**- **XXVII**.

A.22.6 NRLDC representative conveyed that the details have been received from Lucknow Zone, Gorakhpur circle and Haryana only.

Decision taken by Forum:

PSC forum requested all the members to share the status of their control area and ensure the standardisation of recording instruments at all the stations of their control area.

A.23. Analysis of the tripping events occurred during January-2024 to March-2024 and status of remedial action taken (agenda by NRLDC)

A.23.1 The list of major tripping events occurred during January-2024 to March-2024 is attached as **Annexure-XXVIII**. Concerned constituents/utilities were requested to share the detailed analysis of the tripping elements along with status of remedial action taken/to be taken.

A.23.2 As per IEGC clause 37.2 (c)*, Disturbance Recorder (DR), station Event Logger (EL), Data Acquisition System (DAS) shall be submitted within 24 hrs of the event and as per IEGC clause 37.2 (e), the user shall submit a detailed report in the case of grid disturbance or grid incidence within one (1) week of the occurrence of event to RLDC and RPC.*

A.23.3 NRLDC representative stated that few stations have been shortlisted based on the past grid events for protection audit/review. Those stations are as follows:

a. KTPS, RAPS generation complex
b. Kunihar, Baddi complex
c. 400/220kV Bareilly(UP)
d. 220kV Hissar(BBMB)

A.23.4 Further the following tripping events were discussed as below-

A. Multiple elements tripping at 400kV Anpara_D TPS (UP) & Anpara TPS (UP) on 27th February 2024, 13:57 hrs

1. Discussion during the meeting:

a. NRLDC representative raised following points during the meeting:

- During antecedent condition, 500MW Anpara-D TPS Unit-1&2 was generating approx. 285MW & 295MW respectively and evacuating from 765kV Anpara_D-Obra_C ckt carrying approx. 582MW.
- As reported, at 13:57hrs, R-N phase to earth fault occurred on 765kV Anpara_D-Obra_C ckt. Fault distance was ~8.5km from Obra_C end, Z-1 from Obra_C end and Z-2 from Anpara_D end. On this fault, 765kV Anpara_D-Obra_C ckt tripped from both ends however, delayed clearance occurred at Anpara_D end.
- At the same time, 765 KV Anpara_C(LAN)-Anpara_D(UP) (UP) Ckt-1 tripped from Anpara_C end and 400 KV Anpara-Anpara_D (UP) Ckt-1&2 tripped from Anpara end on O/C E/F protection operation. Protection setting of O/C E/F protection in these lines need to be reviewed.
- With the tripping of aforementioned lines, 500MW Unit-1&2 at Anpara_D TPS tripped due to loss of evacuation path.

- As per PMU at Anpara TPS, R-N phase to earth fault with delayed clearance of 480ms is observed.
- As per SCADA, loss of generation of approx. 580MW is observed at Anpara_D TPS in UP control area.
- Major observations:
  - Exact location and nature of fault?
  - Reason of delayed clearance of fault from Anpara_D end?
  - Details of A/R operation in line on R-N fault?
  - 765kV Anpara_D-Anpara_C ckt and 400kV Anpara_D-Anpara D/C tripped from remote end on O/C E/F protection within before tripping of main faulted line from Anpara_D end. Anpara_D end CB opened within ~550msec. Proper coordination of main and backup protection need to be ensured to avoid undesired tripping of lines.
  - DR(.dat/.cfg) file of all the tripped elements not received.
  - Detailed report along with remedial action taken details not received.
  - DR time is also not sync with GPS. Standardization (nomenclature, time sync etc) of recording instrument (DR/EL) need to be ensured.

b. UPPTCL representative and others informed the following:

- R-N phase to earth fault occurred on 765kV Anpara_D-Obra_C line at distance ~8km from Obra_C end. Distance protection relay at Obra_C end sensed fault in Z-1 from at Anpara_D end in Z-2.
- Line successfully autoreclosed from Obra_C end however, carrier sent from Obra_C end not received at Anpara_D end led to delayed clearance of fault from Anpara_D end in Z-2 timing which was 500msec during event time.
- Z-2 time delay setting at Anpara_D end has been revised to 350msec. During preliminary inspection, PLCC were found healthy. Shutdown of the line has been planned on 01st May for further review.
- At the same time, 765kV Anpara_C-Anpara_D line tripped on overcurrent protection from Anpara_C end. Overcurrent protection has been disabled at Anpara_C end.
- During same time, 400kV Anapra-Anpara_D D/C also tripped on back up E/F protection from Anpara end. TMS of the IDMT O/C E/F relay

was not properly coordinated with the Z-3 time delay setting. TMS has been revised and set as such that relay operating time would be 1.3sec for 5kA.

- Time of recording instruments (DR/EL) is sync with GPS at Anpara_D.

POWERGRID representative suggested that TMS may be decided according to relay operating time in coordination with Z-3 time delay on worst case scenario (fault current contribution during 3-ph fault at remote bus).

NRLDC representative stated that Anpara TPS and UPPTCL may review the protection settings of transmission lines in this complex and setting may be done with ensuring proper protection coordination. Fault level at these stations may be referred for the same. Protection settings need to be kept in line with the protection philosophy.

2. Forum Recommendations:

- *Anpara_D TPS and UPPTCL shall review the carrier communication issue at Anpara_D end and ensure the healthiness of the same.*
- *Protection settings need to be kept in line with the protection philosophy. Overcurrent protection need to be kept disabled in the lines and protection setting of back up E/F protection need to be kept in coordination with Z-3 distance protection setting.*
- *UP shall ensure the timely submission of DR/EL & tripping report t. Timelines mentioned in IEGC 2023 may be referred.*
- *Time synchronization of recording instruments (DR/EL) need to be ensured.*

B. Multiple elements tripping at 400/220kV Akal(RS) on 02nd Jan 2024, 07:28 hrs

1. Discussion during the meeting:

a. NRLDC representative raised following points during the meeting:

- 400/220kV Akal (RS) has one and half breaker scheme at 400kV level and double main transfer bus scheme at 220kV level.
- As reported, at 07:28hrs, 220 KV Akal (RS)-Bhu(RS) Ckt-1 tripped on B-N phase to earth fault due to heavy fog.
- At the same time, 400/220 kV 500 MVA ICT-1, 2 & 4 and 315MVA ICT-3 at Akal (RS) also tripped. (Exact reason yet to be shared, but it is suspected that there is delay in CB opening due to which ICTs also got tripped. Also, O/C protection settings of ICTs need to be shared.)
- As per DR of 400/220 kV 500 MVA ICT 2 at Akal (RS), O/C E/F protection operated and fault current was Ib=~5.157kA.
- As per DR of 400/220 kV 315 MVA ICT 3 at Akal (RS), O/C E/F protection operated and fault current was Ib=~2.288kA.
- As per SCADA SOE, 220kV Akal (RS)-Barmer (RS) Ckt also tripped during the same time. (Exact reason yet to be shared)
- As per PMU at Jodhpur (RS), two consecutive B-N phase to earth faults are observed with delayed fault clearance time of 320ms and 1400ms respectively.
- As per SCADA, change in demand of approx. 160MW is observed in Rajasthan control area.
- As per SCADA, change in Rajasthan wind generation of approx. 690MW is observed.
- Major observations:
  - As reported, Main bus jumper of 220 KV Akal (RS)-Bhu(RS) Ckt-1 snapped at Akal end. Location and nature of fault? Whether main protection operated or not?
  - Reason of delayed clearance of fault?
  - Exact reason of tripping of 220kV Akal (RS)-Barmer(RS) Ckt need to be shared. (tripped as per SCADA SOE). Details of relay flags, DR etc?
  - As per SOE, 125MVAr bus reactor also tripped. Reason of the same need to be shared.
  - Status of bus bar protection at 220kV Akal (RS)?
  - SCADA data freezed during the event. Availability and healthiness of SCADA data need to be ensured.

- Tripping status of all the tripped elements are not coming in SCADA SOE.
- DR file of all the tripped elements not received.
- Detailed report along with remedial action taken details not received.
- Standardization (nomenclature, time sync etc) of recording instrument (DR/EL) need to be ensured.

b. Rajasthan representative and others informed the following:

- Fault occurred on 220kV Akal-Bhu ckt due to snapping of jumper (between isolator and bus). Fault was of bus fault nature.
- Bus bar protection is not healthy at 220kV Akal due to defect in 04 number of PUs.
- Fault cleared with the tripping of ICTs on O/C E/F protection as they were the only source.
- PUs are being arranged and bus bar protection at 220kV Akal would be made operational by June 2024 tentatively. Time sync would also be ensured during that time.

NRLDC representative raised concern over non-operational of bus bar protection at many of the 220kV stations. Rajasthan was requested to expedite the commissioning of bus bar protection and priority may be given to frequently affected substations.

2. Forum Recommendations:

- *Bus bar protection at 220kV bus at 400/220kV Akal shall be made operational by June 2024.*
- *Time synchronization of recording instruments (DR/EL) need to be ensured.*
- *Timely submission of disturbance recorder (DR) and event logger (EL) files need to be ensured. As per IEGC clause 37.2 (c), Disturbance Recorder (DR), station Event Logger (EL), Data Acquisition System (DAS) shall be submitted within 24 hrs of the event.*

C. Multiple elements tripping at 220 kV Hissar(BBMB) Station at 23rd March 2024, 00:58 hrs

1. Discussion during the meeting:

a. NRLDC representative raised following points during the meeting:

- 220/132/33kV Hissar (BB) S/s has double main bus scheme at 220kV level.
- As reported, at 00:58hrs, bursting of B-ph CT of 220/132kV 100MVA ICT-2 at Hissar (BB) occurred.
- During the same time, all the lines and 220/132kV ICTs connected at 220kV Hissar (BB) also tripped (Exact reason, nature and location of fault yet to be shared).
- Due to tripping of all the elements connected to both the buses, both 220kV Bus-1 & 2 at Hissar (BB) and eventually the complete 220/132/33kV Hissar (BB) S/s became dead.
- As per PMU at Hissar (PG), two consecutive B-N phase to earth faults with fault clearing time of 80ms and 360ms (delayed) are observed.
- As per SCADA, change in demand of approx. 170MW is observed in Haryana control area.
- Major observations:
  - Exact reason, nature and location of fault?
  - Reason of delayed clearance of fault?
  - Status of bus bar protection at Hissar (BB)?
  - Why did Hissar end distance protection sense fault in Z-2 in Sangrur feeders if fault was at Hissar (BB) end?
  - Detailed report along with remedial action taken details not received.
  - Standardization (nomenclature, time sync etc) of recording instrument (DR/EL) need to be ensured.

b. BBMB representative and others informed the following:

- Fault occurred due to blast of B-ph CT at 220kV side of 220/132kV ICT-2 at Hissar (BB).
- ICT tripped on differential protection operation and fault cleared. 1st instance captured in all the DRs which got reset was due to this.

- Due to damage of CT, fire occurred which touched the jack bus and created bus fault. However, bus bar protection didn't operate. Check zone operated but main zone didn't sense the fault.
- Due to this delayed clearance of fault occurred. Fault cleared after tripping of lines from remote end in Z-2.
- Setting of bus bar relay has been reviewed, it was found okay.
- This bus bar relay was commissioned in 2023 only, which is Siemens make. Issue has been taken up with Siemens.
- Routine testing of CT has also been started.

2. Forum Recommendations:

- *Proper operation of protection system needs to be ensured. BBMB shall follow up with the relay engineer and taken necessary remedial actions to avoid such event in future.*
- *Timely submission of disturbance recorder (DR) and event logger (EL) files need to be ensured. As per IEGC clause 37.2 (c), Disturbance Recorder (DR), station Event Logger (EL), Data Acquisition System (DAS) shall be submitted within 24 hrs of the event.*
- *Standardisation of recording instruments (DR/EL) need to be ensured.*

D. Multiple elements tripping at 400/220 kV Ratangarh (RS) Station at 28th January 2024, 14:58 hrs

1. Discussion during the meeting:

a. NRLDC representative raised following points during the meeting:

- As reported, at 14:58hrs, 220kV Isolator (489B) B-phase jumper of 220kV Bus Coupler-1 broke and the fault reflected on the 220kV bus bar at Ratangarh (RS).
- Due to this fault, 400/220 kV 315 MVA ICT 1 at Ratangarh(RS), 220 KV Ratangarh(RS)-Sikar(PG) (PG) Ckt-1, 220 KV Ratangarh(RS)-Sri Dungargarh (RS) Ckt, 220kV Ratangarh-Ratangarh220 (RS) Ckt-1 & 2 tripped (Bus-wise arrangement of elements yet to be shared).

- As per SCADA SOE, 220kV Ratangarh220-Jhunjhunu (RS) Ckt also tripped during the same time. (Exact reason yet to be shared)
- As per PMU at Sikar (PG), Y-N phase to earth fault is observed with delayed fault clearance time of 280 ms (Phase sequence issue is observed).
- As per SCADA, load loss of approx. 540MW is observed in Rajasthan control area.
- Further as reported, broken 220kV Isolator (489B) B-phase jumper of 220kV Bus Coupler-1 was already replaced.
- Major observations:
  - Exact location and nature of fault?
  - Bus-wise arrangements of elements at 220kV Ratangarh.
  - Reason of delayed clearance of fault need to be shared.
  - Phase sequence issue is observed. As per PMU, Y-N fault however, as per DR ff Ratangarh end B-N fault.
  - Details of all tripped elements at 220kV level.
  - Exact reason of tripping of 220kV Ratangarh220-Jhunjhunu (RS) Ckt need to be shared. Relay flag, DR etc.?
  - DR/EL of some of the tripped elements not received.
  - Detailed report along with remedial action taken details not received.

b. Rajasthan representative and others informed the following:

- Fault occurred due to snapping of B-ph jumper of bus coupler.
- Bus bar protection didn't operate on this fault. During inspection it was found that bus bar protection was in blocked state. CT supervision relay had blocked the bus bar protection during past incident of CT circuit faulty and it didn't reset automatically. Now, auto reset mode has been enabled and bus bar protection is healthy.
- Due to non-operation of bus bar relay, fault cleared with the operation of distance protection relay in Z-4.
- Time sync issue yet to be resolved, same would also be rectified on priority.
- Timely submission of DR/EL and tripping details shall be ensured.

2. Forum Recommendations:

- *Healthiness and proper operation of protection system need to be ensured.*
- *Timely submission of disturbance recorder (DR) and event logger (EL) files need to be ensured. As per IEGC clause 37.2 (c), Disturbance Recorder (DR), station Event Logger (EL), Data Acquisition System (DAS) shall be submitted within 24 hrs of the event.*

E. Multiple elements tripping at 400/220 kV Bhadla (RS) Station at 25th February 2024, 12:55 hrs

1. Discussion during the meeting:

a. NRLDC representative raised following points during the meeting:

- During antecedent condition, MVA power flows of 400/220 kV 500 MVA ICT 1, 2 & 3 at Bhadla(RS) were 417MVA, 452MVA and 454MVA respectively as per SCADA.
- As reported, at 12:55hrs, 400/220 kV 500 MVA ICT 1 at Bhadla(RS) tripped due to burning of isolator (exact reason, nature and location of fault yet to be shared)
- Due to this tripping, 400/220 kV 500 MVA ICT 2 and 3 at Bhadla(RS) got overloaded and tripped due to over-current protection operation.
- As per PMU at Bikaner (PG), R-Y phase to phase fault converted to 3-phase fault is observed with delayed fault clearance time of 880 msec.
- As per SCADA, change in demand of approx. 545MW is observed in Rajasthan control area.
- As per SCADA, change in NR total solar generation of approx. 1890MW is observed.
- Major observations:
  - Exact reason, nature and location of fault?
  - As per SCADA SOE, ICT-1 tripped within ~200msec of fault. Fault would have cleared with tripping of this ICT, Then, why did delayed clearance of fault is observed.
  - DR/EL of all three ICTs didn't receive yet.
  - Detailed report along with remedial action taken details not received.

b. Rajasthan representative and others informed the following:

- Fault was of bus fault nature. 220kV bus bar protection at 400/220kV Bhadla (RS) is not healthy
- 400/220kV ICTs were the only source, ICT-1 tripped on O/C E/F protection operation followed by ICT-2 & 3 on overloading.
- Process of bus bar protection at stations where it is not operational has already been started. Bus bar protection at 220kV bus of Bhadla (RS) would also me made operational on priority.

NRLDC representative asked the status of SPS at Bhadla (RS). Implementation of approved SPS at some of the stations in Rajasthan is pending.

Rajasthan representative informed that SPS at Hinduan and Bhilwara has been implemented. SPS would be implemented at STPS within a week. Status of SPS at Bhadla would be shared.

2. Forum Recommendations:

- *Expedite the commissioning of bus bar protection at Bhadla (RS).*
- *Timely submission of disturbance recorder (DR) and event logger (EL) files need to be ensured. As per IEGC clause 37.2 (c), Disturbance Recorder (DR), station Event Logger (EL), Data Acquisition System (DAS) shall be submitted within 24 hrs of the event.*
- *SPS at Bhadla(RS) need to me implemented at the earliest.*

F. Multiple elements tripping at 400/220kV Merta (RS) Station on 14th March 2024, 12:55 hrs

1. Discussion during the meeting:

a. NRLDC representative raised following points during the meeting:

- During antecedent condition, MVA power flows of 400/220 kV 315 MVA ICT 1 & 2 and 220/132kV 100MVA ICT-1, 2 & 3 at Merta(RS) were 275MVA, 261MVA, 60MVA, 55MVA and 54MVA respectively as per SCADA. 220kV Merta(RS)-Makrana(RS) Ckt was not in service.
- As reported, at 12:55hrs, R-phase jumper of 220kV Merta(RS)-Bhopalgarh(RS) Ckt snapped and this broken jumper fell on conductor of ICT

As per DR, 400/220 kV 315 MVA ICT 1 at Merta(RS) tripped on O/C E/F protection operation with Ir=~5.2kA.

- Due to tripping of ICT-1, 400/220 kV 315 MVA ICT 2 at Merta (RS) got over-loaded. As per DR, 400/220 kV 315 MVA ICT 2 at Merta(RS) tripped on phase directional O/C protection operation with Ir=~5.83kA.
- During the same time, LBB of 220kV Merta(RS)-Bhopalgarh(RS) Ckt operated (exact reason for line CB at Merta(RS) end unable to clear the fault yet to be shared).
- Due to LBB operation, all the elements connected to 220kV Bus-1 & 2 at Merta(RS) tripped and both the buses became dead.
- As per PMU at Merta(RS), R-N phase to earth fault is observed with delayed fault clearance time of 880 ms.
- As per SCADA, change in demand of approx. 335MW is observed in Rajasthan control area.
- Major observations:
  - Exact location and nature of fault?
  - DR of 220kV Merta-Bhopalgarh ckt? Relay flags and detail of protection operation/non-operation?
  - Sequence of event?
  - Exact reason of LBB operation? DR of LBB relay?
  - Why did 220kV elements connected at both the 220kV bus trip?
  - DR of ICTs are not time sync.
  - DR time sync issue is observed in DR of 400/220 kV 315 MVA ICT 1 & 2 at Merta(RS). Issue needs to be resolved at the earliest.
  - DR/EL of all the tripped elements along with tripping report of the event need to be shared.
  - Tripping status of all the tripped elements are not coming in SCADA SOE.
  - Detailed report along with remedial action taken details not received.
  - Standardization (nomenclature, time sync etc) of recording instrument (DR/EL) need to be ensured.

b. Rajasthan representative and others informed the following:

- Fault was of bus fault nature howeve, bus bar protection didn't operate on this fault. During inspection it was found that bus bar protection was

in blocked state. CT supervision relay had blocked the bus bar protection during past incident of CT circuit faulty and it didn't reset automatically. Now, auto reset mode has been enabled and bus bar protection is healthy.

NRLDC representative requested Rajasthan to refer remaining highlighted observations w.r.t. this incident and share the input for respective points along with detailed report of the event.

2. Forum Recommendations:

- *Standardisation of recording instruments (DR/EL) need to be ensured.*
- *Healthiness and proper operation of protection system need to be ensured.*
- *Timely submission of disturbance recorder (DR) and event logger (EL) files need to be ensured. As per IEGC clause 37.2 (c), Disturbance Recorder (DR), station Event Logger (EL), Data Acquisition System (DAS) shall be submitted within 24 hrs of the event.*

G. Multiple elements tripping at 400/220kV Bhiwadi (RS) station on 29th March 2024, 17:22 hrs

1. Discussion during the meeting:

a. NRLDC representative raised following points during the meeting:

- 220/132kV Bhiwadi (RS) has double main bus scheme at 220kV side.
- As reported, at 17:10hrs, 400 kV Khetri (PKTSL)-Bhiwadi(PG) (PBTSL) Ckt-2 tripped on Y-N phase to earth fault during heavy wing storm with fault distance of 123.3km from Khetri and fault current of 2.34kA from Khetri and 39.7kA from Bhiwadi.
- As per PMU at Bhiwadi(PG), at 17:10 hrs, Y-N phase to earth fault with unsuccessful A/R followed by R-N fault is observed with fault clearing time of 80ms and 80ms respectively.
- As per SCADA SOE, 132 KV Bhiwadi(RS)-Bhiwadi132(RS) (RS) Ckt-2 tripped at 17:17hrs (exact reason, nature and location of fault yet to be shared). As per PMU, Y-N phase to earth fault with fault clearing time of 80ms is observed during the same time.
- Further, at 17:22hrs, bus bar protection operated at 220kV Bhiwadi(RS) due to failure of B-phase CVT of 220kV Main Bus -II. Due

to this, both 220 KV Bhiwadi(PG)-Bhiwadi(RS) (RS) Ckt-1 & 2 tripped from Bhiwadi(RS) end only.

- 220/132kV 160MVA ICT-1 & 2 and 100MVA ICT-3 at Bhiwadi(RS) also tripped and supply to 132kV feeders connected to Bhiwadi(RS) lost. Complete blackout occurred at 220/132kV Bhiwadi(RS) S/s.
- As per PMU at Bhiwadi(PG), at 17:22hrs, B-N phase to earth fault is observed with fault clearing time of 120ms.
- Again, at 17:26 hrs, 220 KV Bhiwadi(PG)-Kushkhera(RS) (RS) Ckt tripped on R-N phase to earth fault with fault distance of 0.865km from Bhiwadi(PG) end.
- As per DR at Bhiwadi(PG) end of 220 KV Bhiwadi(PG)-Kushkhera(RS) (RS) Ckt, fault current was 24.41kA from Bhiwadi(PG), fault was sensed in zone-1, line was successfully auto-reclosed from Bhiwadi(PG) end and tripped only from Kushkhera end.
- As per PMU at Bhiwadi(PG), at 17:26 hrs, R-N fault followed by R-N fault with unsuccessful A/R is observed with fault clearing time of 120ms and 80ms respectively.
- As per SCADA, change in demand of approx. 120MW in Rajasthan control area is observed.
- Major observations:
  - Nature of fault at 17:22hrs?
  - Why did elements connected at both the 220kV Bus at Bhiwadi(RS) trip on bus bar protection operation?
  - A/R didn't operate at Kushkhera end on R-N fault.
  - DR/EL along with tripping report for each element need to be shared
  - Detailed report along with remedial action taken details not received.

b. Rajasthan representatives and others informed the following:

- The only source is 220kv Bhiwadi(PG)-Bhiwadi(RS) D/C and both the 220kV bus run in parallel. Therefore, both circuits tripped on bus bar protection operation.
- A/R is healthy and operational at Kushkhera end. Further review would be done in reference of this incident.

2. Forum Recommendations:

- *Healthiness and proper operation of protection system need to be ensured.*
- *A/R operation at Kushkhera end need to be reviewed.*
- *Timely submission of disturbance recorder (DR) and event logger (EL) files need to be ensured. As per IEGC clause 37.2 (c), Disturbance Recorder (DR), station Event Logger (EL), Data Acquisition System (DAS) shall be submitted within 24 hrs of the event.*

H. Multiple elements tripping at 765/400kV Unnao (UP) on 20th February 2024 at 21:47hrs and 11th March 2024 at 01:56hrs

1. Discussion during the meeting:

a. NRLDC representative raised following points during the meeting:

20th February 2024 event:

- 765/400/220kV Unnao (UP) has double main and transfer bus scheme at 400kV level.
- During antecedent condition, 400 KV Agra-Unnao (UP) Ckt, 400 KV Unnao-Lucknow (UP) Ckt, 400 KV Bareilly-Unnao (UP) Ckt-2, 400 KV Unnao (UP)-Jehta_Hardoi Road (UP) (PG) Ckt-2, 400/220 kV 315 MVA ICT 1 at Unnao (UP), 765/400 kV 1000 MVA ICT 2 and 3 at Unnao (UP) were connected to 400KV Bus 1 at Unnao (UP) and rest of the elements were connected to 400KV Bus 2 at Unnao (UP).
- As per SCADA, 400/220 kV 315 MVA ICT 1 at Unnao (UP), 765/400 kV 1000 MVA ICT 2 and 3 at Unnao (UP) were carrying approx. 151MW, 518MW and 535MW respectively.
- As reported, at 21:47 hrs, LBB operated due to fault at Main CB of 400 KV Bareilly-Unnao (UP) Ckt-2. Hence all the elements connected to 400KV Bus 1 at Unnao (UP) tripped and 400KV Bus 1 at Unnao (UP) became dead.
- As per DR of 400 KV Bareilly-Unnao (UP) Ckt-2, R-N phase to earth fault is observed with fault current of 6.135kA from Unnao (UP) and

2.197kA from Bareilly (UP). Fault was sensed in zone-1 at Unnao (UP) end. Fault was cleared within 280ms from Unnao (UP) end and 130ms from Bareilly (UP) end.

- As per PMU at Unnao (UP), R-N phase to earth fault is observed with fault clearing time of 280ms.
- As per SCADA, no change in demand is observed in UP control area.

11th March 2024 event:

- During antecedent condition, 400/220 kV 315 MVA ICT 1 & 6 and 765/400kV 1000 MVA ICT 1, 2 & 3 at Unnao(UP) were carrying 138MW, 140MW, 549MW, 551MW and 570MW respectively. 400/220 kV 315 MVA ICT 2 at Unnao(UP) was not in service.
- As reported, at 01:56 hrs, R-N phase to earth fault occurred at 400 kV Bareilly-Unnao (UP) Ckt-2 with fault location of 85 km from Unnao(UP) end. But line CB at Unnao(UP) end of 400 kV Bareilly-Unnao (UP) Ckt-2 failed to clear the fault, hence LBB operated.
- Due to LBB operation, 400 KV Agra-Unnao (UP) Ckt, 400 KV Unnao(UP)-Jehta_Hardoi Road (UP) (PG) Ckt-2, 400/220 kV 315 MVA ICT 1 at Unnao(UP), 765/400 kV 1000 MVA ICT 2 & 3 at Unnao(UP) also tripped and 400kV Bus 1 at Unnao(UP) became dead.
- As per DR of 400 KV Bareilly-Unnao (UP) Ckt-2, zone-1 distance protection operated at Unnao end and fault was sensed in zone-1 (carrier-aided trip) at Bareilly end. Fault was cleared within 245ms at Unnao end and 170ms at Bareilly end. R-N phase to earth fault was observed with fault current of 6.329kA from Unnao end and 2.122kA from Bareilly end.
- As per DR of 400 KV Unnao(UP)-Jehta_Hardoi Road (UP) (PG) Ckt-2, DT received at Jehta_Hardoi Road end.
- As per SCADA SOE, CB of FSC at Unnao(UP) end connected to 400kV Bareilly-Unnao (UP) Ckt-2 closed during the same time. (It is suspected that fault may have initiated due to this. Exact reason of fault need to be shared).
- As per PMU at Agra(PG), R-N phase to earth fault is observed with delayed fault clearing time of 280ms.
- As per SCADA, no load loss of is observed in UP control area.

- Major observations:
  - Exact reason of fault at Main CB of 400 KV Bareilly-Unnao (UP) Ckt-2 ?
  - Why did CB didn't open on tripping command?
  - Status of A/R operation at CB Ganj end?
  - Frequent cases of non-opening of CB have been observed in UP control area. Necessary operation and maintenance actions may be initiated to avoid such events in future.
  - SCADA data at 765/400kV Unnao(UP) was freezed during the event. Availability and healthiness of SCADA data need to be ensured.
  - DR w.r.t. all other tripped elements on LBB not received. Comment received is '' No DR is available as ABB RADSS scheme is in place''. Implementation of numerical relay may be expedited.
  - Tripping status of all the tripped elements are not coming in SCADA SOE.
  - Detailed report along with remedial action taken details not received.
  - Standardization (nomenclature, time sync etc) of recording instrument (DR/EL) need to be ensured.

b. UPPTCL representative and others informed the following:

- Circuit Breaker at Unnao end of 400kV Bareilly-Unnao(UP) ckt-2 is under overhauling which would be restored by 21st May 2024.
- In absence of Main CB line has been charged via transfer bus.
- Issue of SCADA data freezing during tripping events was due to loss of auxiliary supply and battery of UPS was also not healthy. Now, issues related to battery of UPS have been rectified.
- Bus bar relay at Unnao is of static type due to which there is no facility of extracting DR files. Necessary follow ups would be taken to replace the bus bar relay with the numerical relay.

2. Forum Recommendations:

- *Healthiness and proper operation of protection system need to be ensured.*
- *Static bus bar relay at Unnao end need to be replaced with the numerical relay.*
- *Standardisation of recording instruments (DR/EL) need to be ensured.*

I. Multiple elements tripping at 220kV Badarpur (DTL) on 31st January 2024, 21:22 hrs

1. Discussion during the meeting:

a. NRLDC representative raised following points during the meeting:

- During antecedent condition, 220 KV Ballabhgarh (BB)-BTPS(DTL) (BB) Ckt-1 & 2 and 220 KV Tughlakabad(PG)-BTPS(DTL) Ckt-1 & 2 were catering the part load of 220kV Okhla and 220kV Sarita Vihar through 220 KV BTPS(DTL)-Okhla Ckt-1 & 2 and 220 KV BTPS(DTL)-Sarita Vihar Ckt-1 & 2. 220 KV BTPS(DTL)-Alwar Ckt and 220 KV BTPS(DTL)-Noida Sec 38 Ckt were on no-load. 220kV bus coupler at BTPS was in closed condition.
- As reported, at 21:22 Hrs, 220 KV Ballabhgarh(BB)-BTPS(DTL) (BB) Ckt-1 tripped on Y-N phase to ground fault with fault distance of 17.01 km and fault current of 4.2 kA from Ballabgarh end; zone-1 distance protection operated at Ballabgarh end and zone-4 distance protection operated at BTPS end. On inspection, 220kV Bus-2 PT isolator Y-ph LA jumper was found broken at BTPS S/s.
- At the same time, all other 220kV ckts connected at BTPS(DTL) tripped on zone-4 distance protection operation at BTPS end (reason of non-operation of bus bar protection yet to be shared).
- Due to tripping of all 220kV ckts, both the 220kV buses became dead at BTPS(DTL) and blackout occurred at 220kV BTPS(DTL) S/s.
- As reported by SLDC-Delhi, the load of Okhla, Batra, Malviya Nagar, Shivalik, Sirifort, DC Saket, Select City mall, Sarita Vihar, Meethapur, Jamia, Sarai Julena, Jasola got affected.
- As per SCADA, change in demand of approx. 220MW is observed in Delhi control area out of which approx. 90MW is restored within 10

minutes. But as reported by SLDC Delhi, load loss of approx. 160MW is observed.

- As per PMU, Y-N phase to ground fault with delayed fault clearing time of 160ms is observed.
- Further as reported, at 21:29 hrs, load of Okhla was normalized through 220kV Tughlakabad-Okhla Ckt-1 & 2. At 21:45 hrs, load of 220kV Sarita Vihar was attempted to normalize through 220kV Maharanibagh-Sarita Vihar ckt at Sarita Vihar, but line could not hold and a blast occurred in 220kV Bus coupler CB at Sarita Vihar; R-ph pole was found damaged. Later at 23:20 hrs, load of 220kV Sarita Vihar was normalized through 220kV Maharanibagh-Sarita Vihar ckt.
- Major observations:
  - As reported, fault was of bus fault nature. Why did bus bar protection didn't operate?
  - Z-4 time delay setting in lines at Badarpur end?
  - Why did 220kv Ballabhgarh-Badarpur ckt-1 trip from Ballabhgarh end in Z-1? Z-1 overreached is suspected. Reason of the same and detail of remedial action taken is any?
  - SCADA data of 220kV BTPS(DTL) was freezed during the event. Healthiness of the SCADA data need to be ensured.
  - DR/EL of all the tripped elements along with tripping report of the event need to be shared.
  - Tripping status of all the tripped elements are not coming in SCADA SOE.
  - Detailed report along with remedial action taken details not received.
  - Standardization (nomenclature, time sync etc) of recording instrument (DR/EL) need to be ensured.

b. DTL representative and others informed the following:

- Fault was of bus fault nature.
- Bus bar protection was under rebooting state and thus didn't operate.
- Lines tripped on Z-4, Z-4 time delay has been kept as 120msec.
- Bus bar protection scheme is in review, necessary changes in the bus bar scheme would be done to ensure its proper operation.

2. Forum Recommendations:

- *Issues related to bus bar protection need to be rectified. Healthiness and proper operation of protection system need to be ensured.*
- *Standardisation of recording instruments (DR/EL) need to be ensured.*
- *Timely submission of disturbance recorder (DR) and event logger (EL) files need to be ensured. As per IEGC clause 37.2 (c), Disturbance Recorder (DR), station Event Logger (EL), Data Acquisition System (DAS) shall be submitted within 24 hrs of the event.*

J. Multiple elements tripping at 220kV DCRTPP(HR) on 08th February 2024, 16:22 hrs

1. Discussion during the meeting:

a. NRLDC representative raised following points during the meeting:

- During antecedent condition, 220kV DCRTPP-Rampur Ckt-1 was under construction (LILO in place of DCRTPP-Abdullapur Ckt) and 220kV DCRTPP-Rampur Ckt-2 was under shutdown. 220kV DCRTPP(HR)-Joria(HR) ckt -1 & 2, 220kV DCRTPP(HR)-Bakana(HR) ckt -1 & 2 and 220kV DCRTPP(HR)-Unispur(HR) ckt -1 & 2 were carrying approx. 189MW, 183MW, 47MW, 56MW, 30MW and 31MW respectively.
- As reported, at 16:12hrs, 220kV DCRTPP(HR)-Joria(HR) ckt -2 tripped due to snapping of R-ph jumper at tower location no. 8. Simultaneously, 220kV DCRTPP(HR)-Joria(HR) ckt -1 tripped on over-loading.
- After this, load shifted to remaining four ckts. 220kV DCRTPP(HR)-Bakana(HR) ckt -1 & 2 and 220kV DCRTPP(HR)-Unispur(HR) ckt -1 & 2 were carrying approx. 192MW, 202MW, 74MW and 74MW respectively. Power was flowing from 220kV DCRTPP(HR) to Bakana(HR) (through 220kV DCRTPP(HR)-Bakana(HR) D/C) to Salempur(HR) (through 220kV Bakana(HR)-Salempur(HR) D/C) and 220kV DCRTPP(HR) to Unispur(HR) (through 220kV DCRTPP(HR)-Unispur(HR) D/C) to Karnal(HR) (through 220kV Unispur(HR)-Karnal(HR) S/C).

- As further reported, at 16:22hrs, 220kV Karnal (HR)-Unispur(HR) ckt (carrying ~123MW) tripped on transient fault (exact nature and location of fault yet to be shared).
- After this, 220kV DCRTPP(HR)-Bakana(HR) ckt -1 & 2 and 220kV Bakana(HR)-Salempur(HR) ckt -1 & 2 were carrying approx. 253MW, 263MW, 239MW and 233MW respectively.
- During the same time, 220kV Salempur(HR)-Bakana(HR) ckt-2 also tripped due to breaking of Y-ph conductor at tower location no. 83.
- Due to this tripping, DCRTPP(HR)-Bakana(HR) ckt -1 & 2, 220kV Bakana(HR)-Salempur(HR) ckt -1 and 220kV DCRTPP(HR)-Unispur(HR) ckt -1 & 2 tripped on over-loading. Complete blackout occurred at 220KV Bakana(HR) and Unispur(HR) S/s.
- Due to tripping of all the evacuating lines at DCRTPP, 300 MW DCRTPPP (Yamuna Nagar) - UNIT 1 & 2 also tripped and complete blackout occurred at 220KV DCRTPP(HR) S/s.
- As per PMU at Abdullapur(PG), R-Y phase to phase fault is observed with fault clearing time of 80ms.
- As per SCADA, load loss of approx. 160 MW in Haryana control area and generation loss of approx. 547 MW at 220KV DCRTPP Yamunanagar(HR) are observed.
- Supply at 220kV DCRTPP(HR) and Unispur(HR) was restored within 23 minutes and Supply at Bakana(HR) was restored within 30 minutes.
- Major observations:
  - Exact reason, nature and location of fault?
  - Sequence of event?
  - No tripping details have been received yet?
  - SCADA data of 220kV Yamnunanagar S/s freezed during the event. Healthiness of the SCADA data need to be ensured.
  - DR/EL of all the tripped elements along with tripping report of the event need to be shared.
  - Tripping status of all the tripped elements are not coming in SCADA SOE.
  - Detailed report along with remedial action taken details not received.

b. HVPNL representative and others informed the following:

- At 16:12hrs, R-ph jumper of 220kV DCRTPP(HR)-Joria (HR) ckt -2 snapped at Joria end.
- 220kV DCRTPP-Joria ckt-1 tripped from Joria end on back up E/F protection operation and 220kV DCRTPP-Joria ckt-2 tripped from DCRTPP end on back up E/F protection operation.
- During investigation, issue found in PT voltage selection at Joria end. Permanent voltage was persisting before the event also. Issue related to PT voltage selection at Joria end has been rectified.
- Reason of operation of back E/F protection at DCRTPP end not identified yet. Details would be shared.
- Further at 16:22hrs, 220kV Karnal (HR)-Unispur(HR) ckt tripped from Karnal end due to failure of DC supply.
- Further, remaining lines got overloaded. 220kV Salempur(HR)-Bakana(HR) ckt-1 tripped on overcurrent protection operation followed by tripping of 220kV Salempur(HR)-Bakana(HR) ckt-2 due to snapping of conductor.
- Overcurrent protection at Karnal end has been disabled. Only alarm for overcurrent has been kept.

2. Forum Recommendations:

- *Healthiness and proper operation of protection system need to be ensured.*
- *Timely submission of disturbance recorder (DR) and event logger (EL) files need to be ensured. As per IEGC clause 37.2 (c), Disturbance Recorder (DR), station Event Logger (EL), Data Acquisition System (DAS) shall be submitted within 24 hrs of the event.*

K. Multiple elements tripping at 220kV Upperlanangal(HP) on 19th March 2024, 19:18 hrs

1. Discussion during the meeting:

a. NRLDC representative raised following points during the meeting:

- 220/66kV Uperlanangal (HP) S/s have double main bus scheme at 220kV level.
- During antecedent condition, 220 KV Nallagarh(PG)- Uperlanangal (HP) (HPSEB) Ckt-1 & 2 were carrying 260MW each. 220 KV Baddi-Uperlanangal (HP) Ckt was not in service (as per SCADA).
- As reported, at 19:18 hrs, 220 KV Nallagarh(PG)- Uperlanangal (HP) (HPSEB) Ckt-1 & 2 tripped on R-N phase to earth fault. (Exact reason, nature and location of fault yet to be shared)
- As further reported, 220 KV Uperlanangal(HP)-Wardthman (HPSEB) Ckt, 220/66kV 80/100MVA ICT-1 & 2 at Uperlanangal(HP) also tripped during the same time (Exact reason, nature and location of fault yet to be shared). Complete blackout occurred at 220/66kV Uperlanangal(HP) S/s.
- As per PMU at Nallagarh(PG), R-N phase to earth fault is observed with fault clearing time of 120ms.
- As per SCADA, change in demand of approx. 380MW is observed in HP control area.
- Major observations:
  - Exact nature and location of fault?
  - Sequence of event?
  - Details of protection operation at Uperlanangal end (relay flags, DR files etc.)
  - No tripping details received yet.
  - Tripping status of all the tripped elements are not coming in SCADA SOE.
  - Detailed report along with remedial action taken details not received.

b. HPSEBL representative and others informed the following:

- Complete analysis of the event is yet to be done. DR/EL and other details would be shared.

NRLDC representative raised concern over non submission of tripping details and analysis of the grid event at HPSEBL end. HPSEBL was requested to analyse the event on priority, take remedial actions to avoid such event in future and to share the DR/EL & tripping details.

2. Forum Recommendations:

- *Healthiness and proper operation of protection system need to be ensured.*
- *Timely submission of disturbance recorder (DR) and event logger (EL) files need to be ensured. As per IEGC clause 37.2 (c), Disturbance Recorder (DR), station Event Logger (EL), Data Acquisition System (DAS) shall be submitted within 24 hrs of the event.*
- *HPSEBL shall submit the detailed analysis of the event and also take remedial action to avoid such event in future.*

A.23.5 Tripping analysis details of all the tripping discussed during 50th PSC meeting is attached as **Annexure-XXIX.**

A.24. Presentation on Protection & Technical Audit of Substation by CBIP (agenda by CBIP)

A.24.1 CBIP representative briefed about the Protection & Technical Audit of Substation practices and projects done by CBIP.

A.24.2 The presentation given by CBIP is attached as **Annexure**- **XXX.**

Meeting ended with vote of thanks to the chair.

*****

Members of Protection Sub-Committee (FY 24-25)

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*	*Organizations from where nominations are not received for PSC, memebers of NRPC have been mentioned. Nomination for PSC forum may be sent at the earliest.*		

Annexure-P

Attendance sheet of 50th Protection Sub-Committee Meeting on 29.04.2024 (10:00 AM)				
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Annexure-I

सत्यमेव जयते

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

Date: 23.01.2024

सेवा में,
NRLDC/NLDC and SLDCs as per attached list (via e-mail)

Sub: Furnishing of substation details for implementation of Centralized Database for Protection Settings in Northern Region-reg.
Ref: Minutes of 48th TCC and 70th NRPC meeting held on 17th and 18th Nov 2023.

Reference is invited to implementation of Centralized Database for Protection Settings in Northern Region as discussed and approved in 48th TCC & 70th NRPC meeting (held on 17-18 Nov 2023).

In view of preparation of estimate of work for implementation of the same, it is required to know the number of sub-stations and elements for which relay details shall be modelled in Centralized Database.

Therefore, it is requested that following details of all elements connected at 220 kV and above, in your control area, may kindly be provided as under-

	Substations		**Transmission lines**		**ICTs/GT**		**Reactors**	
Voltage Level	No. of Substations	No of Relays in substations	No. of Transmission lines	No of Relays	No. of ICTs	No of Relays	No. of Reactors	No. of Relays
765kV								
400kV								
220kV								
HVDC S/s								

It is requested to provide the above details **latest by 30.01.2024.**

Signed by D. K. Meena
Date: 24-01-2024 18:07:56
Reason: Approved
(डी. के. मीणा)
अधीक्षण अभियंता (संरक्षण)

I/33303/2024

Addressee list				
S. No.	**NRPC Member**	**Category**	**Nominated/ Notified/ Delegated Member**	**E-mail**
1	NLDC	National Load Despatch Centre	Executive Director	scsaxena@grid-india.in
2	NRLDC	Northern Regional Load Despatch Centre	Executive Director	nroy@grid-india.in
3	Delhi SLDC	State Load Despatch Centre	General Manager	gmsldc@delhisldc.org
4	Haryana SLDC		Chief Engineer (SO&C)	cesocomml@hvpn.org.in
5	Rajasthan SLDC		Chief Engineer (LD)	ce.ld@rvpn.co.in
6	Uttar Pradesh SLDC		Director	directorsldc@upsldc.org
7	Uttarakhand SLDC		Chief Engineer	anupam_singh@ptcul.org
8	Punjab SLDC		Chief Engineer	ce-sldc@punjabsldc.org
9	Himachal Pradesh SLDC		Chief Engineer	cehpsldc@gmail.com
10	J&K SLDC		Chief Engineer, JKPTCL	jksldc4@gmail.com; sojpdd@gmail.com

Annexure-II

Centralized database Portal				
Sr. No.	Utility	No. of Substation/Generating Station	No. of Relays	As per 50th PSC relays considered
1	UPPTCL (Lucknow, Jhansi, Praygaraj, Meerut)	129	2798	1400
2	765/400KV ANPARA 'D'TPS SWITCHYARD	2	94	
3	400KV MUNPL Meja (2x660MW)	1	88	
4	DTL	46	1387	
5	BBMB	24	1078	
6	HPPTCL	12	255	
7	NHPC	13	298	
8	Obra	2	115	
9	OCBTL	2	66	
10	Ghatampur Transmission Limited	0	29	
11	PGCIL	96	9172	
12	PTCUL	14	261	
13	Rosa Power Supply Company Ltd	2	77	
14	RVPN	143	7226	
15	JAYPEE VISHNUPRAYAG HYDRO - ELECTRIC PLANT (4X100 MW)	0	14	
16	Western U.P. Power Transmission Co. Ltd	15	356	
17	ALAKNANDA HYDRO POWER COMPANY LIMITED	1	50	
18	ANPARA C	2	118	
19	2X660 MW Adani Power Ltd. Kawai	1	57	
20	Lalitpur Power Generation Company Limited	2	114	
21	AD hydro substation	1	24	
22	RVUNL	11	566	
23	THDC	5	405	
24	NTPC Rihand	3	61	
25	NTPC Unchahar	2	167	
26	NTPC Dadri	2	209	
27	HVPN	90	2340	
28	NUPPL Ghatampur	2	113	
29	UJVNL	2	44	
30	PPGCL	2	97	
31	PSTCL	111	4523	
	Total (based on received details)	**738**	**32202**	**1400**
	Total (after inclusion of tentative no. relays and Substation)	**803**	**33602**	
	* in 803 no. of substations, 65 no. substations (tentative) considered for 2 zones of UPPTCL whose data has not been received			

RP - Sanjiv Goenka Group
Growing Legacies

NPCL
NOIDA POWER COMPANY LIMITED

P-90B/1909

Dated: 22.04.2024

To,

Superintendent Engineer (Protection),

Northern Regional Power Committee (NRPC),

Shaheed Jeet Singh Marg, Qutab Institutional Area,

New Delhi, Delhi 110016

Sub: Agenda for 50th Protection Sub-Committee Meeting.

Ref: 1. NRPC letter dated 15.04.2024.

Sir,

NPCL's agenda items for upcoming 50th Protection Sub-Committee Meeting are provided in **Annexure-A**.

Thanking you,

Yours faithfully,

For Noida Power Company Limited,

Sanket Srivastava

Head (Power Purchase)

NOIDA POWER COMPANY LIMITED
(An ISO 9001:2015, ISO 45001:2018, ISO 50001:2018 & ISO 27001:2013 Certified Company)
Regd. Office: Electric Sub-station, Knowledge Park – IV, Greater Noida, Gautam Buddha Nagar, UP-201310, India
CIN : U31200UP1992PLC014506 Tel.: +91 120 6226601/02, Web: www.noidapower.com, Email: npcl@rpsg.in

Annexure-A

Agenda-1- Line differential protection between 33KV OG feeder at UPPTCL Transmission Substations and 33KV Incomer feeder at NPCL 33KV Sw/s.

1. We would like to intimate you that Relay setting co-ordination at NPCL 33kv GIS switching s/s substation has to be done in accordance with the relay setting of 33 kV OG feeders at UPPTCL Transmission substations (220/132/33Kv Sector-123, 220/33Kv Sec-148, 220/33Kv RC Green & 132/33Kv Surajpur) as 33kv supply for NPCL is emanating from these substations.
2. Currently, Overcurrent & earth fault Protection systems are only used from the 33KV level at the UPPTCL & NPCL network. This protection system of overcurrent/earth fault is not zone-specific and Relay setting is done with time grading at UPPTCL & NPCL

Relay Settings of 33kv OG feeders (for NPCL) at UPPTCL Substations: -

Feeder Detail	Over Current	Earth Fault
33KV Fdr at UPPTCL sec-123 s/s	IDMT I> 400A TMS 0.1	IDMT Ie>80A, TMS 0.1
	DMT I>>> 4000 A with no delay	DMT Ie>>> 4000 A with no delay
	DMT High Set I>> 1400 A with **0.08 sec delay**	DMT High Set Ie>> 400A with **0.08 sec delay**

Relay Settings of 33kv feeder at NPCL 33kv GIS Panel: -

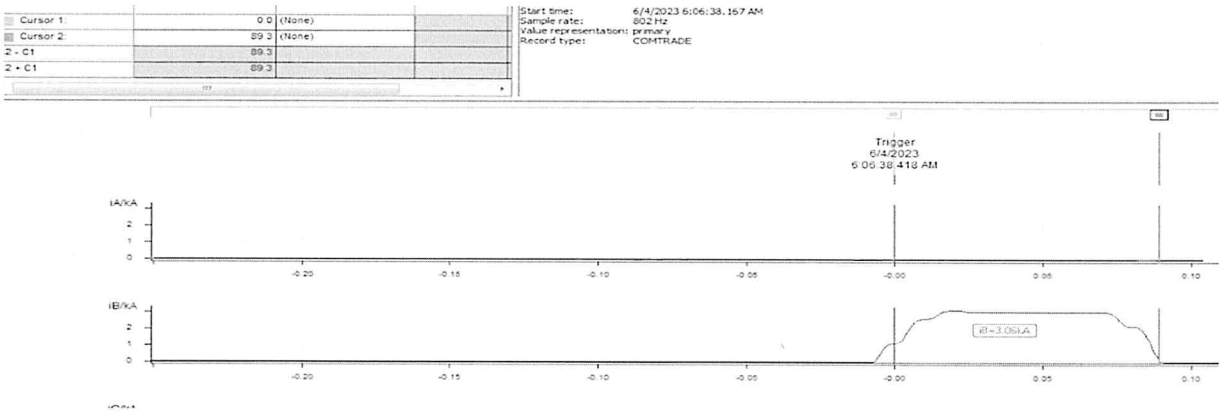
Feeder Detail	Over Current	Earth Fault
33KV OG at NPCL s/s	IDMT I> 300A TMS 0.05	IDMT Ie>40A, TMS 0.05
	DMT I>>> 1000 A with no delay	DMT Ie>>> 300 A with no delay
33KV IC at NPCL s/s	IDMT I> 370A TMS 0.1	IDMT Ie>60A, TMS 0.1
	DMT I>>> 1400 A with 0.1 sec	DMT Ie>>> 400A with 0.1 sec.

3. With the current Relay setting co-ordination, whenever a fault occurs with a Magnitude of 4000A or more at downstream, there will be unnecessary tripping of 33KV feeder at UPPTCL transmission sub-station along with 33kv OG feeder at NPCL s/s and, even trip

with fault current between 1400A to 4000A, considering the very less margin of time delay (0.08s) at 1400A is provided at 33KV OG of UPPTCL.

4. Kindly refer to the relay disturbance record for the Actual Fault isolation time by the 33KV Switchboard (Relay setting I>>> 1000A, T=0ms).

Total Break time recorded = 89.3 ms i.e. 0.089s.



Note that the total time taken by the 33KV switchboard to operate and isolate the fault will be at least a min 0.09 sec. (Relay Operating Time i.e 30ms plus Circuit Breaker Operation Time including arc quenching i.e 45 ms plus 86T relay operating time i.e 10ms plus cumulatively)

5. To increase power reliability in Greater Noida by minimizing such nuisance tripping at 33KV fdr at UPPTCL substation with downstream breaker, **we propose** zone-specific protection 'Line differential protection' (ANSI code- 87) between UPPTCL 33KV fdr and 33KV Incomer fdr at Switching s/s as main protection with IDMT Overcurrent/earth fault as backup protection.
6. This zone-specific protection will not only reduce tripping & outages but also strengthen the protection system of the network since this zone-specific protection will be fast & selective.
7. **Protection Scheme with Differential Protection**: -

The aim for coordination of protection devices should be to maintain the selectivity among the devices involved in several fault possibilities in order to assure safe operation and reliability of the system. In an efficient and coordinated protection system, faults are

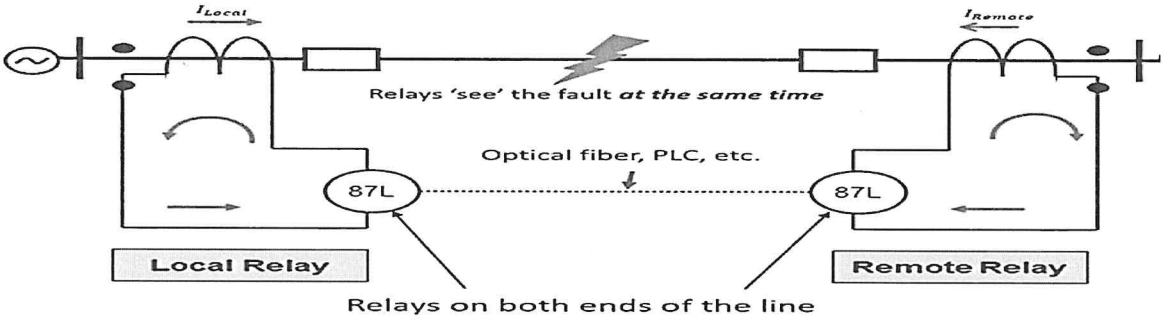
eliminated in the minimum possible time, isolating the **smallest part of the system containing the cause of the fault.**

The criteria for fault clearance must be so that the nearest device to the fault must trip and the isolated area must be as small as possible. To fulfil these criteria, the proposed method relies on the promising features of Line Differential protection and Overcurrent and relays.

The numerical differential protection relay is a Zone-specific short-circuit protection relay for cables and overhead lines in the power supply system. Due to rigorous local selectivity, the protected zone is limited at both ends of the line section and, power system topology and voltage levels play no role.

The differential protection Relay detects short-circuits using a phase-selective comparison of the current values measured by separate relays at both ends of the line in the zone to be protected, including weak current or high-resistance short circuits.

A communication link between both relays is required to exchange the measured values. The relays are designed for a fiber-optic link



Protection at UPPTCL side 33KV OG Feeder
-ANSI 87L differential as the main Protection
-ANSI 50/51 definite-time overcurrent/ earth fault-time protection as backup protection

Protection at NPCL side 33KV Incomer Feeder
-ANSI 87L differential protection
-ANSI 50/51 definite-time overcurrent/ earth fault-time protection
-Instantaneous Overcurrent/earth fault

Due to its selectivity, the differential protection is generally set as non-delayed, instantaneous main protection and hence, no other protection can disconnect the line more quickly and selectively.

For better understanding, kindly refer the below mention Fault Simulation at different fault conditions:

1. Fault occurred at any 33KV consumer or at 33KV downstream line with magnitude of more than 4KA

- 33KV OG VCB at NPCL s/s will trip and isolate the fault.
- But even after isolating the fault, upstream breaker 33KV OG VCB from UPPTCL s/s will trip affecting a very large network.

With the Proposed Scheme: - Only 33KV OG VCB at NPCL S/s will trip and no tripping in any upstream Breaker.

2. Fault occurred at any 33KV consumer or at 33KV downstream line with magnitude between 1400KA to 4000KA

- 33KV OG VCB at NPCL s/s will trip and isolate the fault.
- But even after isolating the fault, upstream breaker 33KV OG VCB from UPPTCL s/s may also trip, considering the very little margin of time delay (0.08s) at 1400A is provided.

With the Proposed Scheme: - Only 33KV OG VCB at NPCL S/s will trip and no chance of tripping of upstream breaker

3. Fault occurred between UPPTCL s/s and NPCL switching Sw/s with magnitude between 1400KA to 4000KA

- No Tripping at NPCL s/s
- 33KV OG VCB from UPPTCL s/s will trip after the delay of 0.08s.

With the Proposed Scheme: - 33KV OG VCB at UPPTCL S/s and 33KV IC VCB at NPCL s/s will trip on differential protection **without any delay** and isolate the fault from both ends.

4. Fault occurred between UPPTCL s/s and NPCL switching Sw/s with magnitude more than 4000KA

- No Tripping at NPCL s/s
- 33KV OG VCB from UPPTCL s/s will trip without any delay.

With the Proposed Scheme: - 33KV OG VCB at UPPTCL S/s and 33KV IC VCB at NPCL s/s will trip on differential protection **without any delay** and isolate the fault from both ends.

5. Fault occurred at any 11KV consumer or at 11KV downstream line with magnitude of more than 12KA

- 11KV OG VCB at NPCL s/s will trip and isolate the fault.
- But even after isolating the fault, upstream breaker 33KV OG VCB from UPPTCL s/s will trip affecting a very large network.

With Proposed Scheme: - Only 11KV OG VCB at NPCL S/s will trip and no tripping in any upstream Breaker

6. Fault occurred at any 11KV consumer or at 11KV downstream line with magnitude between 4.2KA to 12KA

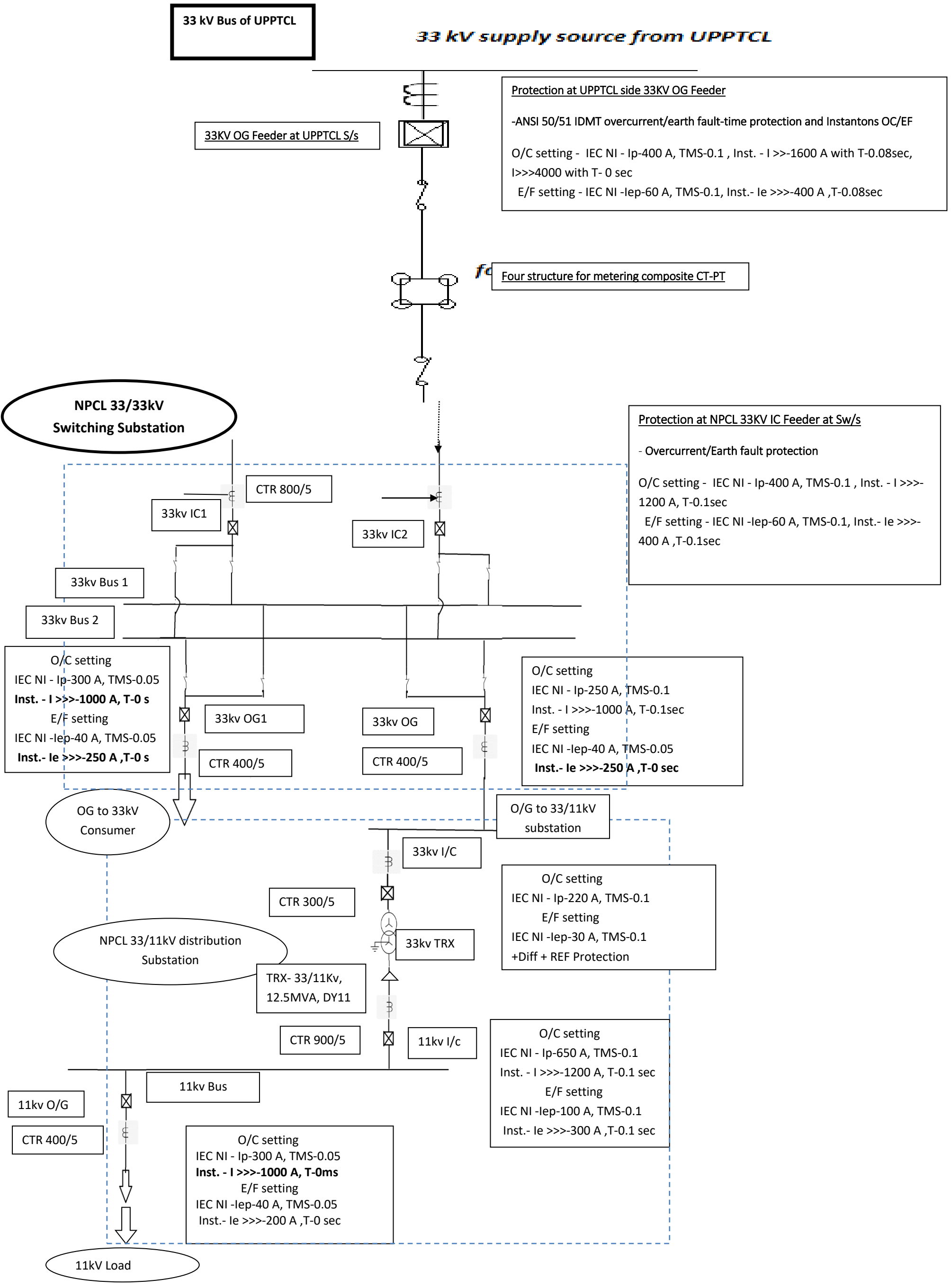
- 11KV OG VCB at NPCL s/s will trip and isolate the fault.
- But even after isolating the fault, upstream breaker 33KV OG VCB from UPPTCL s/s may not trip and maybe trip, considering the very little margin of time delay (0.08s) at 1400A is provided.

With the Proposed Scheme: - Only 11KV OG VCB at NPCL S/s will trip and no tripping in any upstream Breaker.

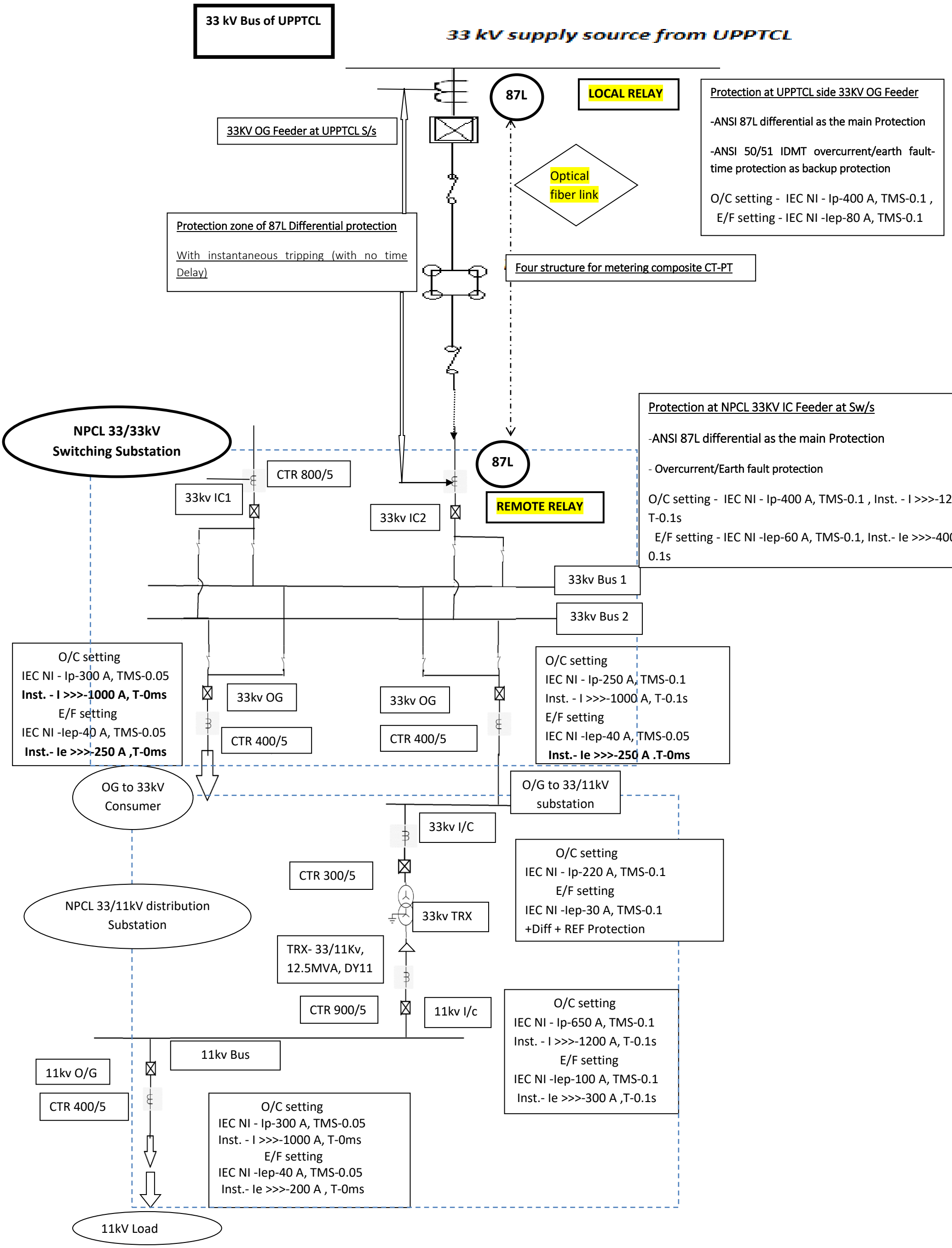
The current Protection schemes and proposed protection schemes with differential protection are enclosed as **Annexure-I** & **Annexure-II** respectively, for reference.

Such protection Scheme is already implemented in Delhi and the same will help NPCL to improve power reliability and relieve the consumers of Greater Noida from unwarranted & recurring trippings of the upstream breaker.

Current Protection Scheme from UPPTCL 33KV OG fdr to NPCL network



Proposed Protection Scheme from UPPTCL 33KV OG fdr to NPCL network with Cable Differential Protection



Report for Performance Indices less than Unity- Jan.2024

Case- 1 80MVAr Bus Reactor (tripped due to fault in 86B relay of Bareilly- Unaao Ckt-2) (UPPTCL)

No. of failures to operate (Nf) – 0

No. of Correct operation (Nc)-4

No. of Unwanted operation (Nu)-3

No. of incorrect operation (Ni) -3

S.I. – 4/7

R.I. – 4/7

Reason for unwanted operation- Fault in 86B relay of Bareilly- Unaao Ckt-2

Corrective action – UPPTCL representative informed that due to incorrect direction sensing of relay of line, the bus reactor is getting tripped for the fault in the line.

Taken- UPPTCL representative informed that checking of corrective action is yet to be taken. The testing of relay will be done in the approved planned shutdown of line.

Case- 2 400/220KV, 315 MVA ICT-II AT 400 KV GSS RATANGARH on 19.01.2024 and 22.01.2024 (RVPN)

No. of Unwanted operation-1

No. of incorrect operation -1

S.I.-0

R.I.-0

Reason for unwanted operation- RVPN representative informed that there was increase in the current of one phase CT only of peripheral unit of Bus bar for both events.

Corrective action – RVPN representative informed that CT of that phase got replaced and now operation of elements at the substation is in order.

Taken- yes

Case-3 Tripping of -425/+550MVAR STATCOM-I FATEHGARH_2 on 23.01.2024(POWERGRID)

No. of Unwanted operation-1

No. of incorrect operation -1

S.I.-0

R.I.-0

Reason for unwanted operation- Tripped during rectification of punch points. Manual error by OEM Engineer.

Corrective action – POWERGRID representative informed that due to manual error at the time of changeover of main and standby system of protection, both the protection system got out and tripping issued. The same was corrected at that time.

Taken- corrected

Case- 4 Tripping of 800KV HVDC CHAMPA-KURUKSHETRA POLE-III on 10.01.2024 (POWERGRID)

No. of Unwanted operation-1

No. of incorrect operation -1

S.I.-0

R.I.-0

Reason for unwanted operation- T-Zone protection due to card of Pole-3 faulty at KKR end.

Corrective action – POWERGRID representative mentioned that detailed tripping analysis will be shared.

Taken- yes/no

Case -5 Tripping of 220Kv Bus Bar at 220kV S/s Sambhal (UPPTCL)

No. of Unwanted operation-1

No. of incorrect operation -1

S.I.-0

R.I.-0

Reason for unwanted operation- Bus Bar operated due to LBB initiation. Cable of 160MVA T/F was damaged.

Corrective action – the damaged cable initiated the LBB and bus bar operated. Subsequently, the damaged cable was rectified.

Taken- yes

Report for Performance Indices less than Unity- Feb. 2024

Case- 1 Bus Bar trip at 220kV ROBERTSGANJ (Prayagraj, UPPTCL)

No. of Unwanted operation-1

No. of incorrect operation -1

S.I. – 0

R.I. – 0

Reason for unwanted operation- There was no representative from the Prayagraj Zone in the 50th PSC meeting.

Corrective action – There was no representative from the Prayagraj Zone in the 50th PSC meeting.

Taken- yes/no- There was no representative from the Prayagraj Zone in the 50th PSC meeting.

Case- 2 220KV Sarsawa, 160 MVA ICT-I tripping (Muzzafarnagar, UPPTCL)

No. of Unwanted operation-1

No. of incorrect operation -1

S.I.-0

R.I.-0

Reason for unwanted operation- False tripping signal issue to OSR due rain water ingress.

Corrective action – UPPTCL representative informed that proper sealing of cable gland has been done to avoid water ingression.

Taken- yes

Case- 3 tripping of 220 KV Nehtaur – Matore line (Moradabad-II, UPPTCL)

No. of Unwanted operation-1

No. of incorrect operation -1

S.I.-0

R.I.-0

Reason for unwanted operation- Instantaneous directional Earth fault stage -IV of instantaneous Earth fault was inadvertently switched on during relay checking.

Corrective action – UPPTCL representative informed that related settings have been corrected.

Taken- yes

Case- 4 tripping of 220kV phozal to ADHPL (HPPTCL)

No. of Unwanted operation-1

No. of incorrect operation -1

S.I.-0

R.I.-0

Reason for unwanted operation- SOTF logic problem in main-1 relay

Corrective action – HPPTCL representative informed that relay engineer will look into the matter

Taken- Yet to be rectified.

Case- 5 tripping of 400KV FATEHABAD-HISAR (NR-1, POWERGRID)

No. of Unwanted operation-1

No. of incorrect operation -1

S.I.-0

R.I.-0

Reason for unwanted operation- Relay panel schematic error after bypassing of 400kV Fatehabad-Hissar and 400kV Hissar-Bhiwani BBMB line.

Corrective action – POWERGRID representative informed that during modification of arrangement for Fatehabad-Hissar-Bhiwani arrangements, wiring error caused the false tripping of the line. Subsequently, scheme was rectified.

Taken-yes

Report of Performance Indices less than Unity- March 2024

Case- 1 Tripping of 400/220kV 240MVA ICT-II, 220kV Snagipur line, 220/132kV 160MVA T/F-I & III (Sultanpur, UPPTCL)

No. of Unwanted operation-1 for each element

No. of incorrect operation -1 for each element

No. of correct operation-1 for each element

S.I. – 1/2

R.I. – 1/2

Reason for unwanted operation- Malfunction/false command issued by DI card of CBF function of 220kV Bus Bar Protection relay installed at 220kV S/S Sultanpur.

Corrective action – There was no representative from Sultanpur, UPPTCL. The same could not be discussed.

Taken- There was no representative from Sultanpur, UPPTCL. The same could not be discussed.

Case- 2 Tripping of 220 kV Sahnewal-Powergrid ckt.II (PSTCL) on 10.03.2024 21:24 Hrs.

No. of failure to operate-1

No. of correct operation-2

No. of unwanted operation-0

No. of incorrect operation -1

D.I. -2/3

S.I.- 2/2

R.I.-2/3

Reason for failure to operate- Auxiliary contacts of CB not wired

Corrective action – Wiring done.

Taken- yes

Case- 3 Tripping of 220 kV Pakhowal-Sandaur ckt. (PSTCL) On 10.03.2024 & 18.03.2024 under zone -2 at Pakhowal and Zone-1 at Sandaur

No. of failure to operate-2

No. of correct operation-0

No. of unwanted operation-0

No. of incorrect operation -2

D.I. -0

S.I.- 0

R.I.-0

Reason for failure to operate- Carrier not healthy.

Corrective action – PSTCL representative informed that carrier made healthy.

Taken- yes

Case- 4 Tripping of 220 kV Sandaur-Barnala ckt. (PSTCL) On 05.03.2024 with zone -1 at Sandaur and zone-2 Barnala

No. of failure to operate-1

No. of correct operation-1

No. of unwanted operation-0

No. of incorrect operation -1

D.I. -1/2

S.I.- 1

R.I.-1/2

Reason for failure to operate- Carrier not healthy.

Corrective action – PSTCL representative informed that carrier made healthy.

Taken- yes

Case- 5 Tripping of 220 kV Sandaur-Malerkotla ckt.2 (PSTCL) on 05.03.2024 with zone-4 at Sandaur and zone-1 at Malerkotla

No. of failure to operate-0

No. of correct operation-0

No. of unwanted operation-1

No. of incorrect operation -1

D.I. -0

S.I.- 0

R.I.-0

Reason for failure to operate- Configuration issue regarding Z4 timer at Sandaur end.

Corrective action – PSTCL representative informed that timer was made available later on the issue.

Taken- yes

Case- 6 Tripping of 220 KV Line Badshahpur-Sultanpur (PSTCL) on 25.03.2024 with zone-2 at Badshahpur and zone-1 at Sultanpur

No. of failure to operate-1

No. of correct operation-1

No. of unwanted operation-0

No. of incorrect operation -1

D.I. -1/2

S.I.- 1

R.I.-1/2

Reason for failure to operate- Carrier was not healthy.

Corrective action – PSTCL representative informed that issue will be sorted out.

Taken-No

Case-7 Tripping of 220 KV Line Kartarpur - PGCIL ckt-1 (PSTCL) at Kartarpur only on 15.03.2024

No. of failure to operate-0

No. of correct operation-0

No. of unwanted operation-1

No. of incorrect operation -1

D.I. -0

S.I.- 0

R.I.-0

Reason for failure to operate- CVT Protection core cable got punctured, due to which tripping occurred at Kartarpur end

Corrective action – PSTCL representative informed that punctured Protection core cable has been replaced.

Taken- yes

Case-8 Tripping of 220 KV Sadiq-Muktsar Line (PSTCL) at Sadiq end only on 01.03.2024

No. of failure to operate-0

No. of correct operation-0

No. of unwanted operation-1

No. of incorrect operation -1

D.I. -0

S.I.- 0

R.I.-0

Reason for failure to operate- Fault was in Sadiq-Ferozepur ckt., Relay started in reverse zone & in relay no timer was mapped with Z4, therefore gave tripping instantaneously when picked in Z4

Corrective action – PSTCL representative informed that timer issue has been rectified.

Taken- yes

Case – 9 Tripping of 220/66 KV, 100 MVA T/F T-6 at 220 KV S/S G1(PSTCL)

No. of failure to operate-0

No. of correct operation-0

No. of unwanted operation-4

No. of incorrect operation -4

D.I. -0

S.I.- 0

R.I.-0

Reason for failure to operate- Mal operation of PRV, REF

Corrective action – PSTCL representative informed that there was issue in the control cable and that has been replaced.

Taken- yes

Case -10 Tripping of 220/66 KV T/F T-1 100 MVA (A-1) & 220/66 KV T/F T-1 100 MVA (A-2) at 220kV s/S Ablowal (PSTCL) on 30.03.2024

No. of failure to operate-0

No. of correct operation-0

No. of unwanted operation-1 for each

No. of incorrect operation -1 for each

D.I. -0

S.I.- 0

R.I.-0

Reason for failure to operate- PSTCL representative informed that there is protection setting coordination issue

Corrective action – PSTCL representative informed that the same is under review.

Taken- no

Case-11 Tripping of 220/66KV 100MVA T-5 at 220KV Civil Line (PSTCL) on 23.03.2024

No. of failure to operate-0

No. of correct operation-0

No. of unwanted operation-1

No. of incorrect operation -1

D.I. -0

S.I.- 0

R.I.-0

Reason for failure to operate- Differential Relay Mal-operated

Corrective action – PSTCL representative informed that reason could not be identified.

Taken- PSTCL representative added that in absence to suitable tripping reason, no corrective action was needed.

Annexure-V

Status of perfomance indices report of Jan. 2024		
S. No.	**Utility**	**Status of Protection Performance indices**
1	PGCIL	Received (NR-1,3)
2	NTPC	Not Recevied
3	BBMB	Not Recevied
4	THDC	Received
5	SJVN	Not Recevied
6	NHPC	Received
7	NPCIL	Recevied (RAP 1-8) NAP-1,2
8	DTL	Received
9	HVPNL	Received
10	RRVPNL	Received
11	UPPTCL	Received from Bareilly, Meerut
12	PTCUL	Not Recevied
13	PSTCL	Not Recevied
14	HPPTCL	Received
15	IPGCL	Not Recevied
16	HPGCL	Not Recevied
17	RRVUNL	Not Recevied
18	UPRVUNL	Received from DTPS Anpara
19	UJVNL	Received
20	HPPCL	Not Recevied
21	PSPCL	Not Recevied
22	HPSEBL	Not Recevied
23	Prayagraj Power Generation Co. Ltd.	Not Recevied
24	Aravali Power Company Pvt. Ltd	Received
25	Apraava Energy Private Limited	Received
26	Talwandi Sabo Power Ltd.	Not Recevied
27	Nabha Power Limited	Received
28	Lanco Anpara Power Ltd	Not Recevied
29	Rosa Power Supply Company Ltd	Received
30	Lalitpur Power Generation Company Ltd	Received
31	MEJA Urja Nigam Ltd.	Received
32	Adani Power Rajasthan Limited	Not Recevied
33	JSW Energy Ltd. (KWHEP)	Not Recevied
34	Greenko Group	Not Recevied
35	Sravanthi Energy Private Ltd	Not Recevied
36	NTPC Renewable Energy wing	Not Recevied
37	RENEW POWER	Not Recevied
38	Adani Power Ltd	Received (Kawai)
39	Avaada Energy	Not Recevied
40	Mahindra Solar	Not Recevied
41	ACME Heeragarh Powertech Pvt. Ltd.	Not Recevied
42	Tata Power Renewable Energy Ltd.	Received
43	Azure Power Pvt. Ltd.	Not Recevied
44	Thar Surya Pvt. Ltd.	Not Recevied
45	Ayana Renewable Power Pvt. LTd.	Not Recevied
46	CSP(J)PL, Hero Future Energies	Not Recevied
47	ABC Renewable Energy(RJ-01) Pvt. Ltd.	Not Recevied
48	Eden Renewable Cite Pvt. Ltd.	Not Recevied
49	UT of J&K	Not Recevied
50	UT of Ladakh	Not Recevied
51	UT of Chandigarh	Not Recevied
52	ATIL	Not Recevied
53	INDIGRID	Not Recevied
54	POWERLINK	Not Recevied
55	ADHPL	Received
56	Sekura Energy Limited	Not Recevied
57	WUPPTCl	Not Recevied
58	SEUPPTCL	Not Recevied
59	Vishnuprayag Hydro Electric Plant (J.P.)	Not Recevied
60	Alaknanda Hydro Electric Plant (GVK)	Not Recevied

Status of perfomance indices report of Feb. 2024		
S. No.	**Utility**	**Status of Protection Performance indices**
1	PGCIL	Received (NR-1,3)
2	NTPC	Received from Tanda(not in format)
3	BBMB	Received (Transmission)
4	THDC	Received from Tehri
5	SJVN	Not Recevied
6	NHPC	Received
7	NPCIL	Received (RAP-1 to 8) , NAP(1-2)
8	DTL	Received
9	HVPNL	Received
10	RRVPNL	Not Recevied
11	UPPTCL	Received from Bareilly, Lucknow(Gomti Nagar, Sarojini Nagar),Gonda, Meerut zone,Sahajahanpur, Prayagraj
12	PTCUL	Not Recevied
13	PSTCL	Not Recevied
14	HPPTCL	Received
15	IPGCL	Not Recevied
16	HPGCL	Not Recevied
17	RRVUNL	Received
18	UPRVUNL	Received from DTPS Anpara
19	UJVNL	Received
20	HPPCL	Not Recevied
21	PSPCL	Not Recevied
22	HPSEBL	Not Recevied
23	Prayagraj Power Generation Co. Ltd.	Not Recevied
24	Aravali Power Company Pvt. Ltd	Received
25	Apraava Energy Private Limited	Not Recevied
26	Talwandi Sabo Power Ltd.	Not Recevied
27	Nabha Power Limited	Received
28	Lanco Anpara Power Ltd	Not Recevied
29	Rosa Power Supply Company Ltd	Received
30	Lalitpur Power Generation Company Ltd	Received
31	MEJA Urja Nigam Ltd.	Not Recevied
32	Adani Power Rajasthan Limited	Not Recevied
33	JSW Energy Ltd. (KWHEP)	Not Recevied
34	Greenko Group	Not Recevied
35	Sravanthi Energy Private Ltd	Not Recevied
36	NTPC Renewable Energy wing	Not Recevied
37	RENEW POWER	Not Recevied
38	Adani Power Ltd	Not Recevied
39	Avaada Energy	Not Recevied
40	Mahindra Solar	Not Recevied
41	ACME Heeragarh Powertech Pvt. Ltd.	Not Recevied
42	Tata Power Renewable Energy Ltd.	Received
43	Azure Power Pvt. Ltd.	Not Recevied
44	Thar Surya Pvt. Ltd.	Not Recevied
45	Ayana Renewable Power Pvt. LTd.	Not Recevied
46	CSP(J)PL, Hero Future Energies	Not Recevied
47	ABC Renewable Energy(RJ-01) Pvt. Ltd.	Not Recevied
48	Eden Renewable Cite Pvt. Ltd.	Not Recevied
49	UT of J&K	Not Recevied
50	UT of Ladakh	Not Recevied
51	UT of Chandigarh	Not Recevied
52	ATIL	Not Recevied
53	INDIGRID	Not Recevied
54	POWERLINK	Not Recevied
55	ADHPL	Received
56	Sekura Energy Limited	Not Recevied
57	WUPPTCL	Received
58	SEUPPTCL	Not Recevied
59	Vishnuprayag Hydro Electric Plant (J.P.)	Received
60	Alaknanda Hydro Electric Plant (GVK)	Not Recevied

Status of perfomance indices report of March 2024		
S. No.	**Utility**	**Status of Protection Performance indices**
1	PGCIL	Received from NR-3
2	NTPC	Not Recevied
3	BBMB	Received (Transmission)
4	THDC	Received from Tehri
5	SJVN	Not Recevied
6	NHPC	Received
7	NPCIL	Received from NAPS (!-2) , RAP (1-8)
8	DTL	Received
9	HVPNL	Received
10	RRVPNL	Received
11	UPPTCL	Received from Bareilly,Gonda,Sahajahanpur, Sultanpur, Lucknow, Meerut
12	PTCUL	Received
13	PSTCL	Received
14	HPPTCL	Received
15	IPGCL	Not Recevied
16	HPGCL	Not Recevied
17	RRVUNL	Received
18	UPRVUNL	Received from DTPS Anpara
19	UJVNL	Received (Dhakatpur, Dharasu)
20	HPPCL	Not Recevied
21	PSPCL	Not Recevied
22	HPSEBL	Not Recevied
23	Prayagraj Power Generation Co. Ltd.	Not Recevied
24	Aravali Power Company Pvt. Ltd	Received
25	Apraava Energy Private Limited	Received
26	Talwandi Sabo Power Ltd.	Not Recevied
27	Nabha Power Limited	Not Recevied
28	Lanco Anpara Power Ltd	Not Recevied
29	Rosa Power Supply Company Ltd	Received
30	Lalitpur Power Generation Company Ltd	Not Recevied
31	MEJA Urja Nigam Ltd.	Received
32	Adani Power Rajasthan Limited	Not Recevied
33	JSW Energy Ltd. (KWHEP)	Not Recevied
34	Greenko Group	Not Recevied
35	Sravanthi Energy Private Ltd	Not Recevied
36	NTPC Renewable Energy wing	Not Recevied
37	RENEW POWER	Not Recevied
38	Adani Power Ltd	Received (Kawai, MTSCL)
39	Avaada Energy	Not Recevied
40	Mahindra Solar	Not Recevied
41	ACME Heeragarh Powertech Pvt. Ltd.	Not Recevied
42	Tata Power Renewable Energy Ltd.	Received
43	Azure Power Pvt. Ltd.	Not Recevied
44	Thar Surya Pvt. Ltd.	Not Recevied
45	Ayana Renewable Power Pvt. LTd.	Not Recevied
46	CSP(J)PL, Hero Future Energies	Not Recevied
47	ABC Renewable Energy(RJ-01) Pvt. Ltd.	Not Recevied
48	Eden Renewable Cite Pvt. Ltd.	Not Recevied
49	UT of J&K	Not Recevied
50	UT of Ladakh	Not Recevied
51	UT of Chandigarh	Not Recevied
52	ATIL	Not Recevied
53	INDIGRID	Received
54	POWERLINK	Not Recevied
55	ADHPL	Received
56	Sekura Energy Limited	Not Recevied
57	WUPPTCL	Received
58	SEUPPTCL	Not Recevied
59	Vishnuprayag Hydro Electric Plant (J.P.)	Received
60	Alaknanda Hydro Electric Plant (GVK)	Not Recevied

Annexure-VI

सत्यमेव जयते

उत्तर क्षेत्रीय विद्युत समिति

NORTHERN REGIONAL POWER COMMITTEE

Protection Philosophy/Protocol of Northern Region

(developed in compliance of IEGC 2023)

~~Version: 2.0~~

~~(approved in 71st NRPC meeting held on 29.01.2024)~~

~~January 2024~~

Contents

1. Transmission line & Cable

S.N.	Protection Setting/ Protocol	Mandated Setting for transmission lines
1	**Protection Scheme**	**220kV and above:** Independent Main-I and Main-II protection (of different make OR different type/different algorithm) of non-switched numerical type is to be provided withcarrier aided scheme. **132kV and below:** One non-switched distance protection scheme and, directional over current and earth fault relays, should be provided as back up.
2	**Distance Protection Zone-1**	Reach: 80% of the protected line; 110% of the protected line (In case of radial lines)Time Setting: Instantaneous.
3	**Distance Protection Zone-2**	Reach: Single Circuit Line: 120% of length of principle line section. Double circuit line: 150% coverage of line totake care of under reaching due to mutual coupling effect. Time setting: i. 0.35 second *(considering LBB time of 200mSec, CB open time of 60ms, resetting time of 30ms and safety margin of 60ms)* ii. 0.5-0.6 second *(For a long line followed by a short line)*

4	**Distance Protection Zone-3**	Reach: Zone-3 should overreach the remote terminal of the longest adjacent line by an acceptable margin (typically 20% of highest impedance seen) for all fault conditions. Time Setting: 800-1000 msec If zone-3 reach transcends to other voltage level, time may be taken upto 1.5 sec.
5	**Distance Protection Zone- 4**	The Zone-4 reverse reach must adequately cover expected levels of apparent bus bar fault resistance.Time may be coordinated accordingly. Where Bus Bar protection is not available, time setting: 160 msec.
6	**Power Swing Blocking**	Block tripping in all zones, all lines. Out of Step tripping to be applied on all inter-regionaltie lines. Deblock time delay = 2s
7	**Protection for broken conductor**	Negative Sequence current to Positive Sequencecurrent ratio more than 0.2 (i.e. I2/I1 ≥ 0.2) Alarm Time delay: 3-20 sec. Tripping may be considered for radial lines to protectsingle phasing of transformers.
8	**Switch on to fault (SOTF)**	Switch on to fault (SOTF) function to be provided in distance relay to take care of line energization onfault.
9	**VT fuse fail detection function**	VT fuse fail detection function shall be correctly setto block the distance function operation on VT fuse failure.
10	**Carrier Protection**	To be applied on all 220kV and above lines with the only exception of radial feeders.

11	**Back up Protection**	1. On 220kV and above lines with 2 Main Protections: • Back up Earth Fault protections alone to beprovided. • No Over current protection to be applied. 2. At 132kV and below lines with only one Main protection: • Back up protection by IDMT O/C and E/F to be applied.
12	**Auto Reclosing with dead time.**	AR shall be enabled for 220 kV and above lines forsingle pole trip and re-closing. Dead time = 1.0s. Reclaim time = 25.0s Auto-recloser shall be blocked for following: i. faults in cables ii. Breaker Fail Relay iii. Line Reactor Protections iv. O/V Protection v. Received Direct Transfer trip signals vi. Busbar Protection vii. Zone 2/3 of Distance Protection viii. Circuit Breaker Problems. CB Pole discrepancy relay time:1.5 sec;for tie breaker: 2.5 sec

13	Line Differential	For cables and composite lines, line differential protection with built in distance back up shall be applied as Main-I protection and distance relay as Main-II protection. For very short line (less than 10 km), line differential protection with distance protection as backup (built- in Main relay or standalone) shall be provided mandatorily as Main-I and Main-II. Differential protection may be done using dark fiber (preferably), or using bandwidth.

14	**Over Voltage Protection**	FOR 765kV LINES/CABLE: Low set stage (Stage-I): 106% - 109% (typically 108%) with a time delay of 5 seconds. High set stage (Stage-II): 140% - 150% with a time delay of 100 milliseconds. 400kV LINES/CABLE: Low set stage (Stage-I): 110% - 112% (typically 110%) with a time delay of 5 seconds. High set stage (Stage-II): 140% - 150% with a time delay of 100 milliseconds. FOR 220 KV LINES: No over-voltage protection shall be used. FOR 220 KV CABLE: Low set stage (Stage-I): 110% - 112% (typically 110%) with a time delay of 5 seconds. High set stage (Stage-II): 140% - 150% with a time delay of 100 milliseconds. Drop-off to pick-up ratio of overvoltage relay: better than 97% Grading: Voltage as well as time grading may be done for multi circuit lines/cable.
15	**Resistive reach setting to prevent load point encroachment**	Following criteria may be considered for deciding load point encroachment: • Maximum load current (Imax) may be considered as 1.5 times the thermal rating of the line or 1.5 times the associated bay equipment current

		rating (the minimum of the bay equipment individual rating) whichever is lower. (Caution: The rating considered is approximately 15minutes rating of the transmission facility). • Minimum voltage (Vmin) to be considered as 0.85pu (85%).
16	**Direct Inter-trip**	To be sent on operation of following: i. Overvoltage Protection ii. LBB Protection iii. Busbar Protection iv. Reactor Protection v. Manual Trip (400 kV and above) vi. Cable Fault (in composite lines)
17	**Permissive Inter-trip**	To be sent on operation of Distance Protection

2. Series Compensated lines

1	**Lines with Series and other compensations inthe vicinity of Substation**	• Zone-1:FSC end: 60% of the protected line. Time: Instantaneous; Remoted end: 60% of the protected line with 100ms-time delay. POR Communication scheme logic is modified suchthat relay trips instantaneously in Zone-1 on carrierreceive. • Zone-2: 120 % of uncompensated line impedance for single circuit line. For Double circuit line, settings may be decided on basis of dynamic study in view of zero sequence mutual coupling. • Phase locked voltage memory is used to copewith the voltage inversion. Alternatively, an intentional time delay may be applied to overcome directionality problems related to voltage inversion. • over-voltage stage-I setting for series compensated double circuit lines may be kept higher at 113%.

3. Busbar protection

1	**Busbar protection**	To be applied on all 220kV and above sub stations with the only exception of 220kV radial fed bus bars.

4. Local Breaker Back-up

1	**Local Breaker Backup (LBB)**	For 220 kV and above level substations as well as generating stations switchyards, LBB shall be provided for each circuit breaker. LBB Current sensor I > 20% In LBB time delay = 200ms In case of variation in CT ratio, setting may be done accordingly.

5. Power Transformer

5.1 Differential Protection

1	Id min (sensitivity) i.e. multiple of trans. HV side rated current	Default: 0.3 pu Or If tap range is -X% to +Y%, then (X+Y)% may be kept as setting.
2	First Slope	around 10%. In case of differential relay with only two slopes, this slope is considered as zero.
3	Second Slope	15% to 25%
4	Third Slope	60% to 80%
5	Unrestrained operation level	10.0 pu special care shall be taken in order to prevent unwanted operation of transformer differential IED for through-faults due to different CT saturation of "T-connected" CTs. In such cases, unrestrained operational level may be taken as 20-25pu.
6	Max. ratio of 2nd harm. to fundamental harm dif. curr. in %	I2/I1Ratio = 15%
7	Max. ratio of 5th harm. to fundamental harm dif. curr. in %	I5/I1Ratio = 25%
8	Second and fifth harmonics restrain feature	Enabled
9	Cross block feature	Enabled

5.2 Restricted earth fault (REF) protection

1	Pick up current (IREF)	10% of Full load current (IFL).
2	Stabilizing resistor (RSTAB)	stabilizing resistor (RSTAB) is obtained by dividing stabilizing voltage (VSTAB) by pick-up current. Stabilizing voltage VSTAB = IF x (RCT + 2RL) RSTAB = VSTAB / IREF Where: IF = Maximum through fault current, RCT = CT resistance, RL = CT circuit lead resistance.

5.3 Over Current Protection

1	Scheme	To be implemented on both sides of ICT
2	Low set Directional	Pick up: 125-150% of full load current Characteristics: IDMT Co-ordination: to be coordinated with distance relay zone 3 settings of outgoing feeders.
3	High Set Non-Directional	Pick Up: 110-130% of the through fault level of the transformer Characteristics: DT; 50 to 100msec

5.4 Earth Fault Protection

1	Scheme	To be implemented on both sides of ICT
2	Low set Directional	Pickup: 20-80% of rated full load current Characteristics: IDMT Co-ordination: to be coordinated with earth fault relay setting of outgoing feeders.
3	High Set Non-Directional	Pick Up: 110-130% of the through fault level of the transformer Characteristics: DT; 50 to 100msec

5.5 Overexcitation protection:

Shall be provided on both HV and LV sides as below:

U/F %	Time set (s)
110	9000
118	90
126	49.5
134	18
142	4
150	1

6. Shunt Reactor protection

6.1 Differential Protection

1	Id min (sensitivity) i.e. multiple of trans. HV side rated current	Default: 0.3 pu Or If tap range is -X% to +Y%, then (X+Y)% may be kept as setting.
2	First Slope	around 10%. In case of differential relay with only two slopes, this slope is considered as zero.
3	Second Slope	15% to 25%
4	Third Slope	60% to 80%
5	Unrestrained operation level	10.0 pu special care shall be taken in order to prevent unwanted operation of transformer differential IED for through-faults due to different CT saturation of "T-connected" CTs. In such cases, unrestrained operational level may be taken as 20-25pu.
6	Max. ratio of 2nd harm. to fundamental harm dif. curr. in %	I2/I1Ratio = 15%
7	Max. ratio of 5th harm. to fundamental harm dif. curr. in %	I5/I1Ratio = 25%
8	Second and fifth harmonics restrain feature	Enabled
9	Cross block feature	Enabled

6.2 Impedance/ Zone protection

1	Setting	60% of reactor impedance
2	Time setting	1 sec

6.3 Phase overcurrent

1	DT	setting of 2.5 times rated current with a time delay of 0.1s
2	IDMT	1.5 times of rated current

6.4 REF/ Residual OC

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Status of Protection Audit Plan for FY 2024 -25

S. No.	NRPC Member	Category	Status
1	PGCIL	Central Government owned Transmission Company	Received (NR-1,3)
2	NTPC	Central Generating Company	Received
3	BBMB		Received
4	THDC		Received
5	SJVN		
6	NHPC		Received
7	NPCIL		
8	DTL	State Transmission Utility	Received
9	HVPNL		Received
10	RRVPNL		
11	UPPTCL		Received for Jhansi, Lucknow, Meerut zone
12	PTCUL		Received
13	PSTCL		
14	HPPTCL		Received
15	IPGCL	State Generating Company	
16	HPGCL		
17	RRVUNL		Received
18	UPRVUNL		
19	UJVNL		
20	HPPCL		
21	PSPCL	State Generating Company & State owned Distribution Company	
22	HPSEBL	Distribution company having Transmission connectivity ownership	
23	Prayagraj Power Generation Co. Ltd.	IPP having more than 1000 MW installed capacity	Received
24	Aravali Power Company Pvt. Ltd		
25	Apraava Energy Private Limited		Received
26	Talwandi Sabo Power Ltd.		
27	Nabha Power Limited		
28	Lanco Anpara Power Ltd		
29	Rosa Power Supply Company Ltd		
30	Lalitpur Power Generation Company Ltd		Received
31	MEJA Urja Nigam Ltd.		
32	Adani Power Rajasthan Limited		
33	JSW Energy Ltd. (KWHEP)		
34	Greenko Group	Other IPP	
35	Sravanthi Energy Private Ltd		
36	NTPC Renewable Energy wing		
37	RENEW POWER		
38	Adani Power Ltd		Received (Kawai)
39	Avaada Energy		
40	Mahindra Solar		
41	ACME Heeragarh Powertech Pvt. Ltd.		
42	Tata Power Renewable Energy Ltd.		
43	Azure Power Pvt. Ltd.		
44	Thar Surya Pvt. Ltd.		
45	Ayana Renewable Power Pvt. LTd.		
46	CSP(J)PL, Hero Future Energies		

47	ABC Renewable Energy(RJ-01) Pvt. Ltd.		
48	Eden Renewable Cite Pvt. Ltd.		
49	UT of J&K	UT of Northern Region	
50	UT of Ladakh		
51	UT of Chandigarh		
52	ATIL	Other transmission licensee in NR	
53	INDIGRID		Received
54	POWERLINK		
55	ADHPL		Received
56	Sekura Energy Limited		
57	WUPPTCl	Other transmission licensee in UP	
58	SEUPPTCL	Other transmission licensee in UP	
59	Vishnuprayag Hydro Electric Plant (J.P.)	Other Generating Units in UP	
60	Alaknanda Hydro Electric Plant (GVK)	Other Generating Units in UP	

Annexure-VIII

सत्यमेव जयते

भारत सरकार/Government of India
विद्युत मंत्रालय/Ministry of Power
केन्द्रीय विद्युत प्राधिकरण/Central Electricity Authority
एन.पी.सी. प्रभाग/National Power Committee Division
Ist Floor, Wing-5 ,West Block-II, RK Puram, New Delhi-66

No.4/MTGS/SG/NPC/CEA/2023/ 353 Date: 18.09.2023

Subject: Standard Operating Procedure for Protection System Audit- reg.

Standard Operating Procedure (S.O.P) for Protection System Audit is enclosed herewith for your kind information and necessary action.

Enclosure: As above

Yours faithfully,

सत्येंद्र 18.09.23

(सत्येंद्र कु. दोतान / Satyendra Kr. Dotan)
Director, NPC & Member Convener (Sub-group)

Standard Operating Procedure for Protection System Audit

A protection system audit is a review and evaluation of the protection systems of a substation with an objective to verify whether required protection systems have been put in place at station by the concerned utility, and to recommend suitable measures to provide for the same.

Ministry of Power, had constituted a Committee under the Chairmanship of Chairperson CEA to examine the grid disturbances on the 30th and the 31st July 2012. One of important recommendation of the committee was conducting of extensive audit of protection system. List of sub-stations where protection audit is to be undertaken on priority basis was prepared and audited across the country. This was the beginning of protection audit across the country and large number of important 400 and 220kV substations were audited.

Keeping in view the importance of Protection System Audit, Standard Operating Procedure has been prepared for the reference purpose. It will provides a step-by-step guide for RPCs to follow during the audit process.

1. All users shall 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.
2. After analysis of any event, each RPC shall identify a list of substations / and generating stations where third-party protection audit is required to be carried out and accordingly advise the respective users to complete third party audit within three months.
3. The third-party protection audit report shall contain information sought in the format as per IEGC 2023 and its further amendments.
4. 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.

5. Criteria for choosing substations for third party protection audit:

The following criteria are generally applied during choosing a substation for protection audit.

i. Substations/ Generating (SS/ GS) stations with frequent grid incidences or frequent maloperations or any grid occurrence in any substation which affected supply to large number of substations and caused significant load loss. In this case, third-party protection audit may be carried out within three months or as decided in the Protection sub-Committee Meeting of the RPC.

ii. Based on request received from utilities for arranging protection audit in certain stations (e.g. for availing PSDF funding for Renovation and Upgradation of Protection system). In this case, preferably third-party protection audit may be carried out within three months.

iii. Important 400kV and 765kV substations (SS) / Generating stations (GS) including newly commissioned SS/ GS. In this case, third-party protection audit may be carried out at a frequency decided in the Protection sub-Committee Meetings of respective RPCs.

6. Protection audit Procedure:

i. After identification of stations for protection audit, the same is communicated to the owner utility seeking nomination of one nodal officer for each Station.
ii. The nodal officer shall provide the details of substation for preparation of protection audit format (in line with IEGC and subsequent amendments).
iii. Meanwhile nominations shall be sought from all utilities to form regional teams for audit. Regional teams comprising of engineers from various utilities /utility (other than the team of host State) of the region shall be formed based on the no. of SS to be audited. (Each team may consists of 3 or 4 engineers from utilities other than the host utility and at the maximum a team will be able to audit 3 to 4 stations in 7-9 days or so)
iv. Once the team details and list of stations to be audited is finalised the details of nodal officers, team members , list of stations to be audited by each team is shared to all for further coordination regarding planning and conduction of audit.
v. Based on the inputs received from nodal officer regarding the list of elements in the substation to be audited, protection audit formats shall be prepared by RPC (in line with IEGC) and circulated to nodal officer. The nodal officer along-with the substation engineers shall fill the audit format and furnish the same along-with various attachments sought as part of the audit format within a week or so. List of attachments shall be given in the covering page of audit format.
vi. The filled in audit format along-with the received annexures shall then forwarded to the audit team by the nodal officer and any further clarification regarding the format or attachments shall be taken up by the audit team with the nodal officer under intimation to RPC.
vii. The SS/ GS shall be audited based on the data filled in audit format checking for compliance of Central Electricity Authority (Technical Standards for Construction of Electrical Plants and Electric Lines) Regulations, 2022, Central Electricity Authority (Technical Standards for Connectivity to the Grid) Regulations, 2007 & CEA (Measures relating to Safety and Electric Supply) Regulations, 2010, CERC regulations and amendments to the same, approved guidelines of RPC, best practices in industry, report of the Task Force on Power System Analysis Under Contingencies and as per the "Model Setting Calculations For Typical IEDs Line Protection Setting Guide Lines Protection System Audit Check List Recommendations For Protection Management Sub-Committee on Relay/Protection Under Task Force For Power System Analysis Under Contingencies" etc.
viii. After conduct of audit, the shortcomings observed in the audit shall be discussed in detail with the nodal officer and substation engineers and recommendations are finalised.
ix. The filled in audit format along-with the recommendations and attachments shall be finalised and final protection audit report RPC (in line with IEGC) shall be compiled.
x. Final protection audit report shall be discussed in Protection Coordination Committee and recommendations may be accepted/deleted/modified as per the scope of audit and compliance of various regulations/guidelines etc.
xi. The recommendations of all SS audited shall be inserted into audit recommendations database and update regarding recommendations shall be sought from respective utilities.
xii. Action plan for rectification of deficiencies detected, if any, shall be submitted to the respective RPC and RLDC and monthly progress will be submitted.

xiii. The travel expense from place of duty to Substation/Generating Station to be audited shall be borne by respective Auditor (Parent Organisation). The expense for boarding, lodging any travel of the team during the audit period shall be borne by the organisation owning the Substation/Generating Station.

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

दिनांक: 06 फ़रवरी, 2024

सेवा में / To,

उ.क्षे.वि.स. के सभी सदस्य (संलग्न सूचीनुसार)
Members of NRPC (As per List)

Subject: Nomination of officer(s) for conducting Third Party Protection Audit of substations in Northern region-reg.

Ref:

1. IEGC 2023
2. Discussion in 48th Protection Sub-Committee (PSC) meeting, held on 11th Oct 2023.

In compliance to clause 15 of IEGC 2023, third party protection audit of each sub-station at 220 kV and above (132 kV and above in NER) is to be conducted once in five years or earlier as advised by the respective RPC. The same was also discussed in 48th Protection Sub-Committee (PSC) meeting, held on 11th Oct 2023.

As per Standard Operating Procedure (S.O.P.) of Protection System Audit circulated (enclosed) by NPC division of CEA, there is requirement for formation of committee at regional level that can do the third party protection audit in Northern region.

In view of above, it is requested to send the nomination of officer(s) related to protection domain (at seo-nrpc@nic.in) with details as below:

Name of officer	Designation	Mobile No.	E-mail Id	Present Posting location

The above nominated officer shall be intimated for 3rd party protection audit of substation of other utilities, as and when required.

Encls: As above

Signed by D. K. Meena
Date: 07-02-2024 10:29:31
Reason: Approved

(डी. के. मीना)
अधीक्षण अभियंता (संरक्षण)

List of addressee (via mail)

NRPC Members for FY 2023-24

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	Member (PS), CEA	Nodal Agency appointed by the Government of India for coordinating cross-border power transactions	Member (PS), CEA	memberpscea@nic.in
3	CTUIL	Central Transmission Utility	Chief Operating Officer	pcgarg@powergrid.in
4	PGCIL	Central Government owned Transmission Company	Director (Operations)	tyagir@powergrid.in
5	NLDC	National Load Despatch Centre	Executive Director	scsaxena@grid-india.in
6	NRLDC	Northern Regional Load Despatch Centre	Executive Director	nroy@grid-india.in
7	NTPC	Central Generating Company	Director (Finance)	jaikumar@ntpc.co.in
8	BBMB		Chairman	cman@bbmb.nic.in
9	THDC		CGM (EM-Design)	akghildiyal@thdc.co.in
10	SJVN		CMD	sectt.cmd@sjvn.nic.in
11	NHPC		Director (Technical)	rajkumar0610.rkc@gmail.com
12	NPCIL		Director (Finance)	df@npcil.co.in
13	Delhi SLDC	State Load Despatch Centre	General Manager	gmsldc@delhisldc.org
14	Haryana SLDC		Chief Engineer (SO&C)	cesocomml@hvpn.org.in
15	Rajasthan SLDC		Chief Engineer (LD)	ce.ld@rvpn.co.in
16	Uttar Pradesh SLDC		Director	directorsldc@upsldc.org
17	Uttarakhand SLDC		Chief Engineer	anupam_singh@ptcul.org
18	Punjab SLDC		Chief Engineer	ce-sldc@punjabsldc.org
19	Himachal Pradesh SLDC		Chief Engineer	cehpsldc@gmail.com
20	DTL	State Transmission Utility	CMD	cmd@dtl.gov.in
21	HVPNL		Managing Director	md@hvpn.org.in
22	RRVPNL		CMD	cmd.rvpn@rvpn.co.in
23	UPPTCL		Managing Director	md@upptcl.org
24	PTCUL		Managing Director	md@ptcul.org
25	PSTCL		CMD	cmd@pstcl.org
26	HPPTCL		Managing Director	md.tcl@hpmail.in
27	IPGCL	State Generating Company	Managing Director	md.ipgpp@nic.in
28	HPGCL		Managing Director	md@hpgcl.org.in
29	RRVUNL		CMD	cmd@rrvun.com
30	UPRVUNL		Director (Technical)	director.technical@uprvunl.org
31	UJVNL		Managing Director	mdujvnl@ujvnl.com
32	HPPCL		Managing Director	md@hppcl.in
33	PSPCL	State Generating Company & State owned Distribution Company	CMD	cmd-pspcl@pspcl.in
34	DHBVN	State owned Distribution Company (alphabetical rotaional basis/nominated by state govt.)	Director (Projects)	directorprojects@dhbvn.org.in
35	Jaipur Vidyut Vitran Nigam Ltd.		Managing Director	md@jvvnl.org
36	Madhyanchal Vidyut Vitaran Nigam Ltd.		Managing Director	mdmvvnl@gmail.com
37	UPCL		Managing Director	md@upcl.org
38	HPSEB		Managing Director	md@hpseb.in
39	Prayagraj Power Generation Co. Ltd.	IPP having more than 1000 MW installed capacity	Head (Commercial & Regulatory)	sanjay.bhargava@tatapower.com
40	Aravali Power Company Pvt. Ltd		CEO	SRBODANKI@NTPC.CO.IN
41	Apraava Energy Private Limited		CEO	rajneesh.setia@apraava.com
42	Talwandi Sabo Power Ltd.		COO	Vibhav.Agarwal@vedanta.co.in
43	Nabha Power Limited		CEO	sk.narang@larsentoubro.com
44	Lanco Anpara Power Ltd		President	sudheer.kothapalli@meilanparapower.com
45	Rosa Power Supply Company Ltd		Station Director	Hirday.tomar@relianceada.com
46	Lalitpur Power Generation Company Ltd		Managing Director	vksbankoti@bajajenergy.com
47	MEJA Urja Nigam Ltd.		CEO	hopmeja@ntpc.co.in
48	Adani Power Rajasthan Limited		COO, Thermal, O&M	jayadeb.nanda@adani.com
49	JSW Energy Ltd. (KWHEP)		Head Regulatory & Power Sales	jyotiprakash.panda@jsw.in
50	RENEW POWER	IPP having less than 1000 MW installed capacity (alphabetical rotaional basis)	CEO	sumant@renew.com
51	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, JKPTCL	sojpdd@gmail.com
52	UT of Ladakh		Chief Engineer, LPDD	cepdladakh@gmail.com
53	UT of Chandigarh		Executive Engineer, EWEDC	elop2-chd@nic.in
54	BYPL	Private Distribution Company in region (alphabetical rotaional basis)	CEO	Amarjeet.Sheoran@relianceada.com
55	Bikaner Khetri Transmission Limited	Private transmission licensee (nominated by cetral govt.)	Vice-President	nihar.raj@adani.com
56	Adani Enterprises	Electricity Trader (nominated by central govt.)	Head Power Sales & Trading	anshul.garg@adani.com
57	Ajmer Vidyut Vitran Nigam Ltd.	Special Invitee	Managing Director	md.avvnl@rajasthan.gov.in

Special Invitees:

RE Holding companies in NR with installed capacity of more than 1000 MW (provsional members as decided in 59th NRPC meeting)

Annexure-X

Nominations for 3rd Part Protection Audit Plan					
Sr. No	**Utility**	**Name of officer**	**Designation**	**E-mail Id**	**Present Posting location**
1	NHPC	Swarup Kumar Das	GSM(E)	onm-protection@nhpc.nic.in	HQ/RQ
2		Jaganath Pani	SM(E)	onm-protection@nhpc.nic.in	HQ/RQ
3	Jhajjar Power Limited	Prabhat Kumar Mishra			
4	RPSCL	Atul Nigam	DGM	atul.v.nigam@relianceada.com	Shahjahapur, UP
5	APCPL	NIRBHAY KUMAR	SR. MANAGER-EMD	nirbhaymishra01@apcpl.co.in	APCPL IGSTPP Jhajjar
6	Nabha Power Limited	Chandresh Saxena	Joint General Manger	chandresh.saxena@larsentoubro.com	Nabha Power Plant
7	SJVN	Vaibhav Vivek	Sr. Manager (E)	vaibhav.vivek@sjvn.nic.in	Rampur HPS
8		Vinay Painuly	Manager (E)	vinay.painuly@sjvn.nic.in	Rampur HPS
9		Basant Lal Kohli	Sr. Manager	basant.lal@sjvn.nic.in,	Nathpa Jhakri Hydro Power Station
10	HPPTCL	Rajat Sharma	Sr. Manager (E)	smprot1.tcl@hpmail.in	Hamirpur
11	HVPNL	Vinay Attri	EE	xenmpccfbd@hvpn.org.in	Faridabad
12		Sunil Tanwar	AEE	sunil.tanwar68@hvpn.org.in	Panipat
13	RVPN (Jodhpur)	Sh. Sunil Saini	Executive Engineer	xen.mpts.hgarh@rvpn.co.in	XEN (MPT&S), RVPN, Hanumangarh
14		Sh. Mukesh kumar	Assistant Engineer	aen.mpts.rtg@rvpn.co.in	AEN (MPT&S), Ratangarh
15		Sh. N.K. Thanvi	Assistant Engineer	xen.mpts.jodh@rvpn.co.in	O/o XEN (MPT&S), RVPN, Jodhpur
16	RVPN (Jaipur)	Sh. D.K. S. Rathore	Assistant Engineer	xen1.prot.jaipur@rvpn.co.in	XEN (MPT&S) RVPN, Jaipur
17		Sh. Umesh Sharma	Assistant Engineer	aen2.mpts.alwar@rvpn.co.in	AEN-2 (MPT&S) RVPN, Alwar
18		Sh. Dinesh Saini	Assistant Engineer	aen.mpts.tonk@rvpn.co.in	AEN (MPT&S) RVPN, Tonk
19	RVPN (Ajmer)	Sh. Raghavendra Tiwari	Assistant Engineer	tiwari.raghavendra@rvpn.co.in	ACE (MPT&S) RVPN, Ajmer
20		Sh. Dinesh Kumar Parashar	Assistant Engineer	parasharrvpn@gmail.com	AEN-2 (MPT&S) RVPN, Ajmer
21		Sh. Suresh Chandra Garg	Executive Engineer	xen.mpts.bhl@rvpn.co.in	XEN (MPT&S) RVPN, Bhilwara
22	LPGCL	Abhimanyu Upadhyay	General Manager-EMD	aupadhyay.ltp@lpgcl.com	LPGCL Lalitpur
23	Adani Energy Solution Limited (Transmission BU)	Mr. Ritesh Gupta	Asso. Manager	ritesh.gupta@adani.com	HO-Ahmedabad
24	JVK	Shri Niladri Mandal	Dy. Head- O&M	niladri.mandal@jvk.com	GVK
25		Shri Bishwambar Bag	Manager (Electrical)	bishwambar.bag@gvk.com	GVK
26	POWERGRID NR-2 (J&K)	Sh Burhanul Majeed	Asst Manager	burhan2366@powergrid.in	New Wanpoh
27	POWERGRID NR-2 (Punjab)	Sh Anil Kumar Yadav	Engineer	anil.yadav@powergrid.in	Amritsar
28	POWERGRID NR-2 (Haryana)	Sh Sahil Garg	Asst Manager	sahil.garg@powergrid.in	Kaithal
29	POWERGRID NR-2 (HP)	Sh Anil Kumar Verma	Ch Mgr	anilverma111@powergrid.in	Chamba
30	UPPTCL	Er. Mohd Raza Ahmed	Superintending Engineer	setncalbd@upttcl.org	Praygraj
31		Er. Sushil Kumar Verma	Executive Engineer	eeetncdlko@upttcl.org	Lucknow
32		Er. Siddharth Bhorhari	Assitant Engineer	bhorhari2011@gmail.com	Orai
33		Er. Manish Kumar	Assitant Engineer	aetncgn@gmail.com	Greater Noida
34	UPRVUNL	Er. Manoj Kumar	Executive Engineer	ee.emcd_7.dtps.anpara@uprvunl.org	Anpara
35	DTL	Sh Parveen Kumar	Dy. Manager	kumarparveendtl@gmail.com	Delhi
36		Mohd Azhar	Dy. Manager	dtl.azhar@gmail.com	Delhi
37		Yashwant Singh Rawat	Dy. Manager	ysrawat1991@gmail.com	Delhi
38	NTPC	Sh. R.K Singh	DGM (OS)	rameshsingh@ntpc.co.in	Lucknow
39	UPRVUNL (Jal Vidyut Unit)	Sh. Ajit Saxena	Executive Engineer	eedsignenm@upjvn.org	Lucknow
40		Sh. Ajit Pratap Singh	Executive Engineer	eetest@upjvn.org	Lucknow

Annexure-XI

Email **Reeturaj Pandey**

Fwd: Exception report of prolonged non-compliance of the recommendations of the protection audit-reg.

From : Sh V K Singh <ms-nrpc@nic.in> Wed, Feb 28, 2024 04:00 PM

Subject : Fwd: Exception report of prolonged non-compliance of the recommendations of the protection audit-reg.

To : Dharmendra Kumar Meena <dharmendra.cea@gov.in>, Reeturaj Pandey <pandeyr.cea@gov.in>

From: cenpccea@gmail.com

To: "Sh V K Singh" <ms-nrpc@nic.in>, "N. S. Mondal" <mserpc-power@nic.in>, "MEMBER SECRETARY" <mssrpc-ka@nic.in>, "Deepak Kumar" <ms-wrpc@nic.in>, "Member Secretary NERPC" <ms-nerpc@gov.in>, "SE P WRPC" <prc-wrpc@nic.in>, asitsingh@rediffmail.com, nsmondal34@gmail.com, vksinghcea@gmail.com

Cc: "rishika sh" <rishika_sh@yahoo.com>, skdotan21@gmail.com, "Himanshu Lal" <himanshulal.cea@gov.in>

Sent: Wednesday, February 28, 2024 4:03:31 PM

Subject: Exception report of prolonged non-compliance of the recommendations of the protection audit-reg.

Madam/Sir,

Kindly refer to the Minutes of the 14th meeting of NPC held on 03.02.2024 at Bangalore (Link for MoM : https://cea.nic.in/wp-content/uploads/nat_power_com/2024/02/Minutes_of_the_14th_NPC_meeting_held_on_03_02_2024_at_Bangalore-1.pdf). It was decided in the meeting that the exception report of prolonged non-compliance of the recommendations of the protection audit may be monitored by NPC on the basis of reports submitted by RPCs on a half yearly basis.

Therefore,it is requested to provide the reports of prolonged non-compliance (upto December 2023) of the recommendations of the protection audit by **18.03.2024.**

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Regards,

O/o Chief Engineer

(National Power Committee Division)
Central Electricity Authority
Phone No: 011-26732014
New Delhi - 110066.

Annexure-XII

सत्यमेव जयते

भारत सरकार/Government of India
विद्युत मंत्रालय/Ministry of Power
केन्द्रीय विद्युत प्राधिकरण/Central Electricity Authority
एन.पी.सी. प्रभाग/National Power Committee Division
Ist Floor, Wing-5 ,West Block-II, RK Puram, New Delhi-66

No. CEA-GO-15-14/1/2021-NPC Division 83 - 104 Date: 27.02.2024

To
(As per distribution list)

विषय: 03.02.2024 को बैंगलोर में आयोजित एनपीसी की 14वीं बैठक के कार्यवृत्त के संबंध में।
Subject: Minutes of the 14th Meeting of NPC held on 03.02.2024 at Bangalore-reg.

कृपया 03.02.2024 को बैंगलोर में आयोजित एनपीसी की 14वीं बैठक का कार्यवृत्त आपकी जानकारी और आवश्यक कार्रवाई के लिए संलग्न है। यह सीईए वेबसाइट पर भी उपलब्ध है।

The Minutes of the 14th meeting of NPC held on 03.02.2024 at Bangalore is enclosed herewith for your kind information and necessary action, please. The same is also available on CEA website.

भवदीय/Yours faithfully

27/02/24

(ऋषिका शरण/Rishika Sharan)
मुख्य अभियन्ता एवं सदस्य सचिव,रा.वि.स /
Chief Engineer & Member Secretary, NPC

Encl: As above

Distribution List (Members of NPC):

1. Shri. Chowna Mein, Hon'ble Dy. Chief Minister and I/C Power, Govt. of Arunachal Pradesh, Block No.2, 5th Floor, A.P. Civil Secretariat, Itangar-791111. [Email: chowna.mein@gov.in]
2. Shri Ginko Lingi, Chairman, TCC, NERPC & Chief Engineer (P), TPMZ , Department of Power, Govt. of Arunachal Pradesh, Vidyut Bhawan, zero Point, Itanagar-791111. [Email: ginko.lingi@gmail.com]
3. Shri K Vijayanand, Chairperson, SRPC, Chairman & Managing Director , Transmission Corporation of Andhra Pradesh Limited, Vidyut Soudha, Gunadala, Eluru Rd, Vijayawada, Andhra Pradesh 520004.[Email: cmd.aptransco@aptrandco.in ; vjanand@nic.in]
4. Shri AKV Bhaskar, Chairperson TCC, Director (Trasmission & Grid Management), Transmission Corporation of Andhra Pradesh Limited, Vidyut Soudha, Gunadala,Eluru Rd, Vijayawada, Andhra Pradesh 520004. [Email: kannanvenkatabhaskar.angulabharanam@aptransco.co.in]
5. Shri Vishal Kumar Dev, IAS, Chairman ERPC, Principal Chief Secretary to Govt., Department of Energy, Govt. of Odisha, Bhubaneswar. [Email-chairman@gridco.co.in]
6. Shri Trilochan Panda, Managing Director, GRIDCO, Chairperson TCC ERPC, GRIDCO Limited, Regd. Office: Janpath, Bhubaneswar – 751022.
7. Shri Mohammed Shayin, IAS, Chairperson, NRPC, Managing Director, HVPNL, Shakti Bhawan, C-4, sector-6, Panchkula-134109. [Email: md@hvpn.org.in]
8. Shri Manmohan Matta, Director (Projects), Chairman TCC, NRPC, Shakti Bhawan, C-4, sector-6, Panchkula-134109. [Email: directorprojects@hvpn.org.in]
9. Shri Sanjay Dubey, Chairman WRPC & Principal Secretary (Energy), GoMP, VB-2, Vallabh Bhawan Annex, Mantralay, Bhopal-462001(M.P.).[Email: psenergyn@gmail.com]
10. Shri Raghuraj Rajendran, Chairman-TCC & Managing Director MPPMCL, Block No-15, Shakti Bhawan, Vidyut Nagar, Rampur, Jabalpur-482008. [Email-md@mppmcl.com]
11. Shri N.S. Mondal, Member Secretary, ERPC,14,Golf Club Road, ERPC Building, Tollygunje,Kolkata-700033. [Email: mserpc-power@nic.in]
12. Shri V.K.Singh, Member Secretary, NRPC, 18-A, Shaheed Jeet Singh Marg, Katwaria Sarai, New Delhi-110066.[Email: ms-nrpc@nic.in]
13. Shri Asit Singh, Member Secretary, SRPC, No.29, Race Course Cross Road, Bengaluru-560009. [Email: mssrpc-ka@nic.in]
14. 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]
15. Shri K B Jagtap, Member Secretary, NERPC, NERPC Complex, Dong Parmaw, Lapalang, Shillong-793006. [Email: ms-nerpc@gov.in]

Special Invitees:

1. CMD, GRID-INDIA, B-9, Qutab Institutional Area, Katwaria Sarai, New Delhi -110016.

2. CMD, NTPC, NTPC Bhawan, SCOPE Complex, Institutional Area, Lodhi Road, New Delhi-110003.
3. CMD, PowerGrid, Saudamini, Plot No.2, Sector-29, Gurugram-122001.
4. COO, CTU, Saudamini, Plot No.2, Sector-29, Gurugram-122001
5. Chief Engineer, GM Division, Sewa Bhawan, CEA, New Delhi.

Copy for kind information to:-

1. SA to Chairperson, CEA, New Delhi
2. SA to Member(Go&D),CEA, New Delhi

******

केंद्रीय विद्युत प्राधिकरण
Central Electricity Authority

राष्ट्रीय विद्युत समिति
National Power Committee

Minutes of 14th Meeting of
National Power Committee (NPC)
held on 03.02.2024
At Bangalore.

Minutes of 14th Meeting of National Power Committee (NPC) chaired by Chairperson, CEA held on 03.02.2024 at Bangalore.

1. Introduction

a. The 14th meeting of National Power Committee (NPC) was held on 03.02.2024 (Saturday) at Bangalore. The meeting was hosted by SRPC. The list of participants is at **Annexure-A.**

b. **Member Secretary, SRPC** extended warm and hearty welcome to Shri Ghanshyam Prasad, Chairperson CEA, Shri K Vijayanand, Chairperson SRPC, Chairperson TCC of WRPC, NRPC & SRPC, COO CTUIL, Director (SO), Grid-India, Director (SLDC), OPTCL, ED, PGCIL, Member Secretaries of NPC & RPCs, Members of NPC, Special Invitees and delegates to this 14th NPC meeting being hosted by SRPC at the Garden City, Bengaluru. He expressed heartfelt thanks Chairperson NPC for providing inspiring leadership to the NPC forum. He also thanked Chairperson SRPC for providing his guidance to conduct this meeting. He informed that SR demand has touched around 64 GW of maximum demand while SR may reach 100 GW by 2031-32 as per NEP. Out of SR Installed capacity of 290 GW, RE may be 219 GW by 2031-32. Till now Solar peak of 18.5 GW out of 22 GW, Wind peak of 16 GW out of 20 GW and simultaneous peak of 28 GW out of 42 GW has been achieved in Southern Region. Demand wise SR has achieved 61 % while energy wise in a day 32% of RE integration. He pose the challenges of increasing RE capacity in southern region and that it would be a big challenge which needs support of stake holders like SLDCs, RLDCs, Grid India, and CEA.

c. **Chairperson NPC in his opening remarks emphasized that** there is a need to take power sector to the next level amid the changing scenario like integration of renewable energy, cyber security issues in power system which throws main challenges in the today's time. He stated that a few years ago, the conventional generators were major part of the installed capacity, but in present years there are transition in the power sector and it is also the need of the hour in order to align our system with global level. He also stated that with the increase in the RE integration, the challenge become more when we don't have other capacity to balance during the non-solar hours or non-wind season. In order to address such issue which are having implications at national level, the role of National Power Committee become more prominent. Historically, we integrated the generators and transmission lines within a state and formed multiple intra-state system. Next was the formation of the regional grids by making inter-state system there and eventually the concept of one nation one grid was become a reality. This brought flexibility in the system and the benefits from a region can be taken by any other part of the country. He further stated that there is a regional diversity of demands and generation in the different regions of the country. There is a need to develop a mechanism to utilise this diversity of demands and generation. A uniform mechanism can be formed to use the surplus generation of a region to the deficit region. He opined that gradually we are moving towards the flexible tie-ups regime. It may be helpful in the cost optimization of the power for the consumers. The depth of the power market may likely to increase in the upcoming times. He informed that in the 13th meeting of

NPC, the focus was on the need for harmonization and uniformity of the different procedures, philosophies and modalities which were being followed by various RPCs and RLDCs in fields of energy accounting, protection aspect, operational aspects and communication system of the grid. He further informed that the inter-regional exchange of energy has been increasing and there is need to enhance inter-regional capacity and subsequently preparing National Energy Account i.e. NEA, which is also one of the agenda items to be discussed during the meeting. He requested MS NPC to take up the agenda of the meeting.

d. **MS NPC also welcomed Chairperson, CEA & NPC, all the members, special invitees and participants to the 14th meeting of National Power.** She thanked Chairperson, CEA for his able guidance for conducting the 14th NPC meeting. She thanked MS SRPC for arranging the meeting and for their warm hospitality at Bengaluru.

2. Confirmation of Minutes of 13th Meeting of NPC

a. The Minutes of 13th Meeting of NPC held on 05.07.2023 at Kolkata was circulated vide letter No. CEA-GO-15-14/1/2021-NPC division/237 dated 31.07.2023.

b. **MS NERPC** informed that in MoM of 13th NPC at item no. *"**9. Review of Status of Islanding scheme***, it is mentioned that, *"MS NERPC informed that DPR of Assam-II was sent to NLDC and DPR of Tripura IS under preparation stage. MS NPC informed that the DPR of Assam-II IS has not been received by NPC Division for PSDF funding"*.

c. **MS NERPC** suggested to modify the above para/information as below:

MS NERPC informed that the DPR of Guwahati Islanding scheme (approximate estimate of Rs 84 Cr) was placed at 23rd RPC meeting for approval. However, the same has been referred back to subcommittee of NERPC by 23rd NERPC to review the estimate as the cost was exorbitant. The subcommittee is re-examining the islanding scheme of Guwahati and the DPR with revised estimate will be finalized at the earliest and after taking of approval of RPC, it will be sent to PSDF by Assam State. Further he informed that Tripura islanding Scheme is also under review.

d. **The Committee confirmed the Minutes of 13th NPC with the following modification:**

Item no. "9. Review of Status of Islanding scheme" as per approved MoM of 13th NPC	**Modified part of Item no. "9. Review of Status of Islanding scheme as per comments of MS NERPC**

MS NERPC informed that DPR of Assam-II was sent to NLDC and DPR of Tripura IS under preparation stage. MS NPC informed that the DPR of Assam-II IS has not been received by NPC Division for PSDF funding.	**MS NERPC informed that the DPR of Guwahati Islanding scheme (approximate estimate of Rs 84 Cr) was placed at 23rd RPC meeting for approval. However, the same has been referred back to subcommittee of NERPC by 23rd NERPC to review the estimate as the cost was exorbitant. The subcommittee is re-examining the islanding scheme of Guwahati and the DPR with revised estimate will be finalized at the earliest and after taking of approval of RPC, it will be sent to PSDF by Assam State. Further he informed that Tripura islanding Scheme is also under review.**

3. Best practices/procedures being followed by RPC

a. **MS NPC** briefed the agenda to the Committee. She informed that the Subgroups of Operation, Protection, Communication and Commercial was constituted by the NPC to discuss best practices/procedures being followed by RPC as per the direction of Chairperson, CEA. It was decided in the 13th NPC meeting that draft S.O.P for Protection System Audit, Grid disturbance analysis, Communication outage, and Communication audit for S/s may be prepared by the concerned Subgroups. Accordingly, after due deliberations in the various meetings and based on inputs from RPCs, the following SOPs are finalised:

i. **SOP for Protection System Audit:** SOP (Attached at **Annexure-I**) was approved and circulated to all RPCs to implement. All RPCs have adopted the SOP and started to form the annual calendar for the same.

ii. **SOP for Grid Disturbances/Grid Incidents/Tripping's:** Subgroup finalized the SOP (Attached at **Annexure-II**) in the meeting held on 10.10.2023 and circulated to RPCs on 10.10.2023.

iii. **S.O.P for Communication Audit for Substations:** Subgroup finalized the SOP (Attached at **Annexure-III**) in the meeting held on 11.10.2023 and circulated to RPCs on 11.10.2023.

iv. **SOP for Communication System Outage Planning**: Subgroup finalized the SOP (Attached at **Annexure-IV**) in the meeting held on 03.11.2023 and circulated to RPCs on 03.11.2023.

b. She further informed that in the pre-meeting among MS, RPCs and MS, NPC held on 29.01.2024, MS SRPC was of view that some of utilities wanted to conduct Third Party Protection Audit by external agencies in line with IEGC 2023 and they may be permitted to engage Third Party Auditors.

c. **Chairperson NPC** queried whether the external agencies are certified or having expertise in conducting protection audit. MS SRPC informed that the external agencies are not certified however, they are having experience of conducting third party protection audit.

d. **Chairperson NPC** opined that the utilities may conduct the third party protection audit as per the SOP finalised by the subgroup since the audit team will be formed excluding the member for the utility whose protection system is to be audited and therefore it may be considered as third party audit. He further opined that a list of external agencies for conducting third party protection audit may be prepared by protection sub-group of NPC for reference. He also suggested that exception report of prolonged non-compliance of the recommendations of the protection audit may be monitored by NPC on the basis of reports submitted by RPCs.

e. **Chairperson NPC** suggested that Protection System Analysis Group (PSAG) may be constituted at RPC level consisting of the members from RPC, NPC, NLDC, RLDC, PGCIL, and a Protection Expert from the region along with the Entity under whose jurisdiction GD/GI occurred to analyse Grid Disturbances/Grid Incidents occurred at major/critical substations or at substations that affected critical/essential/strategic loads. The PSAG may exist always to analyse such GD/GI in a region.

f. Further, GRID-India vide email dated 19.02.2024 submitted suggestions on SOP for protection system audit, Grid Disturbances/Grid incidents/Tripping's, Communication audit for substations, and communication system outage planning. The copy of suggestions is attached at **Annexure-B.** GRID-India suggestions may be discussed in the respective subgroup of NPC and if agreed by the subgroup, suggestions of GRID-India may be incorporated suitably.

g. **Decisions of the Committee:**

i. SOPs finalised by the respective subgroups were approved by the Committee, if any changes suggested by members of the subgroup, will be incorporated suitably and circulated to RPCs for implementation/adoption. The same may be ratified in the next meeting of NPC.

(Action: Respective subgroups of NPC / NPC)

ii. The list of external agencies for conducting Third Party Protection Audit may be prepared by Protection sub-group of NPC for reference.

(Action: Protection Subgroup of NPC)

iii. Protection System Analysis Group (PSAG) may be constituted at RPC level consisting of the members from RPC, NPC, NLDC, RLDC, PGCIL, a Protection Expert from the region along with the Entity under whose jurisdiction GD/GI occurred to analyse Grid Disturbances/Grid Incidents occurred at major/critical substations or at substations that affected critical/essential/strategic loads. The PSAG may exist always to analyse such GD/GI in a region.

(Action: RPCs Secretariat)

iv. **The exception report of prolonged non-compliance of the recommendations of the protection audit may be monitored by NPC on the basis of reports submitted by RPCs on half yearly basis.**

(Action: NPC/RPCs)

4. Unified Accounting Software (UAS) for RPCs

a. **MS NPC** informed that in the 13th meeting of NPC held on 05th July 2023, it was decided that the commercial subgroup of NPC would recommend on the standardization of the formats and software of the commercial accounts. The standard formats and software finalised by the commercial sub-group would be placed in next NPC meeting.

b. She further informed that two meetings of commercial sub-group was held on 8.8.23 and 30.10.23. Based on the inputs/comments of ERPC and SRPC, the standardised output formats was discussed and the Final standard output formats (attached as **Annexure-V**) were circulated to all RPCs. The **Standard Output formats contains** the formats of the **Weekly account** (i.e. DSM Settlement Account, Ancillary Service Account (SRAS, TRAS) and Reactive Energy Account), **Monthly Account (i.e.** Regional Energy Account, RTA/RTDA, Ramping Account Format, SCED Account, Delayed payment accounts) and Additional formats of some commercial account. Further, a meeting to discuss the implementation of the Unified Accounting Software for RPCs under the chairmanship of Member (GO&D), CEA was held on 20.11.2023 at Sewa Bhawan, New Delhi in hybrid mode. (MoM is attached at **Annexure-VI).** In this meeting, the implementation of the Unified Accounting Software for RPCs were discussed in detail and the following decisions were taken:

i. ERPC shall be the Nodal RPC for implementation of Unified Accounting Software for RPCs.

ii. A Joint Committee shall be formed with representatives (Director/Superintending Engineer/ Deputy Director Level) from all RPCs, GM Division, CEA and NPC Secretariat. Superintending Engineer, ERPC would be the Member Convener of Joint Committee with following Term of Reference (TOR):

- Hiring of consultant for preparation of DPR
- Identifying the possible source of funding i.e. through PSDF or RPC funds.
- Preparation of NIT and other documents related to tendering.
- Selection of vendor for commercial account software.
- Execution of work order and certification of completion of work.
- Recommend on O&M/AMC/Ownership of project.
- Any other matter related to Unified Accounting Software.

c. She further informed that in the pre-meeting among MS, RPCs and MS, NPC held on 29.01.2024, MS SRPC suggested that the development of Unified Accounting Software may be carried out in two phases. In Phase –I, Technical specifications and scope of work for commercial accounts may be finalised and in the Phase –II, Additional formats for information or analysis of operational data, report formations may be carried out.

MS SRPC also suggested the working level officers may be involved in the finalisation of technical specifications. In pre-meeting, NRPC representative suggested that the parallel efforts may also be carried out for identifying non uniformity in Commercial accounts wrt different RPCs so that same may be accommodated simultaneously in process finalisation. Further, a dedicated team/committee may also be formed at RPC for carrying out changes required after implementation of the UAS.

d. The standard output formats of commercial accounts and constitution of the Committee along with its ToR was proposed for approval of the Committee.

e. **Chairperson SRPC** raised the issue of funding for the Uniform Accounting Software and suggested that the PSDF funding may be provided for the smoother implementation of the project considering the importance of Accounts. It was suggested to plan the implementation of the UAS in the comprehensive manner considering the interoperability and uniformity among all the regions of the country.

f. **Chairperson NPC queried regarding the cost estimates for implementation of the Unified Accounting Software for all RPCs. MS NRPC** informed that RPCs may share the cost for hiring of consultant and preparation of DPR, however, the project cost may be funded through PSDF.

g. **Director (System Operation) Grid-India** informed that the cost of implementation for Uniform WBES software was around Rs. 20 crore including the cost of AMC. Accordingly, UAS may cost around Rs. 20-30 crore and the provision of migrating to 5 min scheduling was made in their WBES and other applications. It was opined that similar provision need to be made in Unified Accounting Software (UAS) of RPCs.

h. **Chairperson NPC** suggested to prepare a proposal for UAS and thereafter, the PSDF funding may be sought. The project may be considered as critical project under PSDF guidelines for bringing interoperability uniformity in the system and importance of timely and accuracy of Regional accounts. ERPC will be nodal RPC for implementation of the UAS and the ToR of the Joint Committee may be revised considering the NEA and for carrying out changes required post implementation of the UAS. He also suggested to include the NTPC and some states as member of the Joint Committee.

i. **Decisions of the Committee:**

i. The standard output formats of commercial accounts were approved.

ii. ERPC will be nodal RPC for implementation of the UAS and the ToR of the Joint Committee may be revised considering the NEA, provisions of migrating to 5 min scheduling and for carrying out changes required post implementation of the UAS. NTPC and some states may be included as member of the Joint Committee.

(Action: ERPC/JC/NPC)

iii. A proposal for UAS may be prepared and thereafter, the DPR may be submitted to nodal agency i.e. NLDC for PSDF funding. The project may be considered as critical item under PSDF guidelines for bringing interoperability and uniformity in the system and importance of timely and accuracy of

Regional accounts. The cost for hiring of consultant and preparation of DPR will be shared equally by all RPCs.

(Action: ERPC/JC/RPCs)

iv. The following timeline was decided in the meeting:

- **Hiring of consultant- 45 days**
- **Preparation of DPR- 60 days**
- **Further timelines may be depending upon scope of work as per DPR.**

(Action: ERPC/JC)

5. National Energy Account (NEA)

a. **MS NPC** briefed the agenda to the Committee. She informed that MoP vide letter dated 30.11.2016 (**attached as Annexure-VII**) observed that considering the changing scenarios, the functions of NPC may also be broadened including the functions to maintain the National Energy Account (NEA) involving the trans-national and inter-regional transmission transactions. The issue of National Energy Account was deliberated in various meetings (8^{th}, 9^{th}, 10^{th}, 11^{th}, 12^{th} and 13^{th}) of NPC and in the 11th meeting of NPC held on 28.02.2022, NPC and RPCs agreed that in future, if NEA would be mandated by CERC, the directions may be followed accordingly. It was also informed that the mock exercise of NEA was conducted by NLDC.

b. **MS NPC** opined that since the Uniform Accounting Software (UAS) is being under discussion and in order to make the system futuristic, the provision of NEA may also be incorporated in the UAS. The proposed statement of account to be covered under NEA are as follows:

i. DSM account statement of inter-regional and cross border entities.

ii. Reactive Energy account statement of cross border entities.

iii. National SCED account statement which is currently issued by NLDC.

iv. SRAS and TRAS account statement.

The output formats of these statement of account are attached at **Annexure-VIII.** It was noted in pre-meeting among MS, RPCs and MS, NPC held on 29.01.2024 that Schedule of Inter Country transactions may be included in NEA.

c. **Decisions of the Committee:**

i. **It was decided that the Joint Committee constituted for implementation of the UAS may also consider the NEA in the UAS software to make the system futuristic.**

(Action: ERPC/JC)

ii. **The Schedule of Inter Country transactions may also be included in NEA.**

(Action: ERPC/JC)

6. Protection Setting Protocol (WRPC Agenda)

a. **MS WRPC** informed that in 48th WRPC meeting it was suggested that the protection setting protocol for WR shall be drafted by WRPC within a month and the same shall be forwarded to NPC. The objective of protection setting protocol is to provide and maintain effective protection system having reliability, selectivity, speed and sensitivity to isolate faulty section and protect element(s). MS WRPC requested to prepare a uniform protection setting protocol for all regions, in consultation with all RPCs. The draft protection setting protocol prepared by WRPC is attached at **Annexure-IX.**

b. **MS NPC** proposed to form a sub-committee with representations from all RPCs, NPC and RLDCs to finalise a uniform protection setting protocol for all regions.

c. **MS SRPC** informed that Protection Protocol in compliance to IEGC 2023 has been prepared for southern region in consultation with stake holders and has been implemented in SR from 01.10.2023 and same has been informed to Commission. In IEGC it is mentioned that the Protection Protocol in particular system may vary based on operational experience. A sub group to analyse the proposed settings and recommend the settings to the respective entity has been constituted. The recommended settings are vetted in the monthly PCSC meetings.

d. **Chairperson NPC** opined that the Protection Setting Protocol of WR and SR may be referred and a Uniform Protection Protocol and Uniform Protection Setting Procedure may be prepared for all the regions.

e. It was decided that the protection subgroup of NPC may finalise a Uniform Protection Protocol and Uniform Protection Setting Procedure for all regions in consultation with RLDCs/GRID-India. The subgroup may submit its report within 5 months.

f. **Decision of the Committee:**

The protection subgroup of NPC may finalise a Uniform Protection Protocol and Uniform Protection Setting Procedure for all regions in consultation with RLDCs/GRID-India. The subgroup may submit its report within 5 months.

(Action: Protection subgroup of NPC /RLDCs/GRID-India)

7. SOP for Voice over Internet Protocol (VOIP) connectivity to utilities from RLDC (NRPC Agenda)

a. **MS NRPC** informed that a meeting was held under the chairmanship of Member Secretary (NRPC) on 06.07.2023 regarding provision of VOIP connectivity to the control centre / coordination centre of Indigrid & Sterlite with NRLDC. In this meeting, CTU was advised to prepare a draft SOP for providing the VOIP connectivity to control centres of TSPs/ Gencos etc. The draft SOP was deliberated in 23rd TeST meeting of NRPC held on 21.09.2023 wherein it was decided that SOP needs to be finalized for all regions as TSPs in other regions may also come up with such requirements. Hence,

issue may be taken up for deliberation in upcoming NPC meeting. (Draft SOP enclosed at **Annexure-X**).

b. **CTU representative** informed that inputs related to cyber security has been incorporated as per CEA guidelines and it shall be further looked into for requisite compliance.

c. **MS NPC** proposed to form a sub-committee with representations from all RPCs, CEA, RLDCs/Grid India, CTU, POWERGRID and concerned private entities to finalise a draft SOP for providing the VOIP connectivity to control centres of TSPs/ Gencos etc. She also informed that in the pre-meeting among MS, RPCs and MS, NPC held on 29.01.2024, it was suggested that representative from PCD Division, CEA may also be included as a member of sub-committee.

d. **Director (System Operation), Grid-India** opined that there is need for expansion/up-gradation of exiting system since it was conceptualized way long back in year 2012. CTU stated that they are already planning a new VOIP system to replace the existing one as being deliberated in the RPCs.

e. **Chairperson NPC/CEA** suggested that assessment of the system requirements needs to be ascertained considering the existing and the future requirements. CTU shall take up the same during planning of VOIP system.

f. After detailed deliberations, it was decided that a sub-committee may be constituted under chairmanship of MS NRPC with representations from all RPCs, PCD Division, CEA, NPC, RLDCs/Grid India, CTU, POWERGRID and concerned private entities to finalise SOP at national level for providing the VOIP connectivity to control centres of TSPs/ Gencos etc. The sub-committee may submit its report within 4 months.

g. **Decision of the Committee:**

i. A sub-committee may be constituted under chairmanship of MS NRPC with representations from all RPCs, PCD Division, CEA, NPC, RLDCs/Grid India, CTU, POWERGRID and concerned private entities to finalise SOP at national level for providing the VOIP connectivity to control centres of TSPs/ Gencos etc. The sub-committee may submit its report within 4 months.

(Action: NPC Secretariat/NRPC)

ii. The assessment of the system requirements needs to be ascertained considering the existing and the future requirements by CTU. CTU shall take up the same during planning of VOIP system.

(Action: CTU)

8. Report on Automatic Under Frequency Load Shedding (AUFLS) and df/dt scheme

A. Report on AUFLS and df/dt scheme

a. **MS NPC** briefed the agenda to the committee. She informed that in the 13th NPC meeting, it was decided that a task force under chairmanship of MS, SRPC with

members from Grid India, RPCs/NPC may be formed to review the report in order to address following suggestions of CMD, GRID-INDIA and MS,SRPC.

i. The first stage will be set at 49.4 Hz.

ii. Total 25% relief will be planned in 4 stages-49.4 Hz, 49.2 Hz, 49.0 Hz & 48.8 Hz.

iii. Pumping load will be tripped before first stage (> 49.4 Hz). Battery energy system in charging mode will go in discharging mode (> 49.4 Hz), no storage will be in storage/charging mode at frequency < 49.4 Hz.

b. She further informed that NPC Secretariat constituted task force on Automatic under Frequency Load Shedding (AUFLS) and df/dt scheme with the representatives from RPCs, NPC and GRID-INDIA. Accordingly, the meeting of the taskforce was held on 11.09.2023 under the chairmanship of MS, SRPC and based on the deliberations in the meeting and further comments received from members, the final Report of the Task Force (Attached **at <u>Annexure-XI</u>**) was prepared/ circulated among the Members and submitted to NPC by SRPC.

c. Total 25% relief would be planned in four stages: Stage as shown in the table below:

S.No.	**Stage of UFR Operation**	**Frequency (Hz)**	**% of Quantum Relief**
1	***Stage-1***	**49.40**	**5%**
2	***Stage-2***	**49.20**	**6%**
3	***Stage-3***	**49.00**	**7%**
4	***Stage-4***	**48.80**	**7%**
Total			**25%**

d. **She summarised the recommendation of the report as below:**

i. NPC Secretariat will communicate region wise relief quantum (based on Regional Peak Demand Met during the previous FY) by 31st of May to RPCs for implementation in the next Financial Year (FY).

ii. Distribution of relief among State/UT to be carried out based on Regional relief and demand contribution in the average of Peak demand met ratio and demand met (consumption) ratio of State/UT in the previous FY by RPCs.

iii. Guidelines for identification of AUFLS feeders: Stage-1 & Stage-2 for downstream network at 11/22/33 kV level and Stage-3 & Satge-4 for upstream network at EHV (66/110/132 kV) level.

iv. Prioritization of the loads under the AUFLS and df/dt scheme: Feeders catering to critical loads are to be avoided. VIP areas, Airport, Metro, Railways, Defence etc. has been prioritized.

v. Quantum Identification for AUFLS by States/UT and monthly vetting: Each SLDC shall carry out month-wise Stage-wise analysis and furnish to RPC/RLDC. Actual Relief for the month and recommended Relief for the month for each Stage. The

data would be vetted by RLDC and discussed in OCC Meetings of RPC. As a general Guideline Actual Relief for the month should be 10% more than the recommended Relief for the month considering the Relay/breaker issues and a resilient safety net.

vi. Analysis of AUFLS Event and discussion in OCC Meetings of RPC.

vii. Mapping of AUFLS feeder at SLDC and RLDC level.

viii. SLDCs shall download the data and store it for two years. The Data should be made available to RPCs/RLDCs/CEA/CERC for further studies or analysis.

ix. Settings of UFR for Pumping load/Energy Storage Systems: All Energy Storage Systems would change from charging mode to discharging mode at 49.50 Hz. If it is not possible then they would be tripped at 49.50 Hz. If ESS is injecting active power at 49.50 Hz not to be tripped. Pumping load will be tripped before AUFLS first stage. Irrigation Pumps would be tripped at 49.50 Hz.

x. All the relays procured in future to have a sampling period ranging from three (03) cycles to five (05) Cycles. No additional time delay to be incorporated in the relay other than the inherent measuring time.

xi. Testing/Inspection of UFR: SLDCs responsible for testing and chalk out a plan of relays testing schedule before 1st of December and submit the same to RPC/RLDC. The periodicity of testing of relays shall be twice in a year at 110 / 132 kV level and above Substations and once in a year at 66 kV level and below Substations.

xii. RPC would carry UFR inspection randomly on sample basis by the RPC Secretariat or through RLDC.

xiii. df/dt Scheme: It is specific to regions and therefore, the quantum of load shedding may be discussed at regional levels in the RPCs in consultation with the stakeholders.

e. **Director SLDC (Odisha)** opined that the starting frequency/first stage of AUFLS may be considered at 49.5 Hz instead of 49.4 Hz keeping in view the operation of automatic demand side management at 49.9 Hz. MS SRPC clarified that the issue was discussed in detail in the UFR report under Chairmanship of MS, WRPC and the resilience of single grid needs to be harnessed before going for AUFLS load relief.

f. **Chairperson NPC** queried whether the feeders under AUFLS are being monitored. MS NPC informed that the feeders are being monitored and RPCs shares the status update on the feeder monitoring to the NPC Secretariat. Chairperson NPC emphasised upon the monitoring of feeders under AUFLS and suggested that it may be made part of regular agenda in the appropriate RPC forum.

g. **Chairperson NPC** queried if a feeder under AUFLS is under outage, then how the desired load shedding can be obtained. MS SRPC informed that in the report, it has been recommended that the actual load relief should be 10% more than the desired relief considering the Relay/breaker issues and a resilient safety net. He also informed that the load flow of feeders under AUFLS being monitored regularly by the SLDCs.

h. **Chairperson SRPC** stated that the utilities generally kept agriculture feeders under AUFLS and feeders connected to city load are not covered under AUFLS.

i. **MS NPC** informed that the reports recommended that the guidelines for identification of AUFLS feeders and prioritization of the loads under the AUFLS and df/dt scheme.

j. Further, GRID-India vide email dated 19.02.2024 submitted following suggestions on implementation of AUFLS:

i. The Distribution connected RE (DRE) rich areas shall not be included as loads for shedding under AUFLS.

ii. AUFLS relay operation may also be standardized such as measurement, delay and operation time.

iii. The mapping of feeders need to be carried out at all RLDCs also.

k. **Decisions of the Committee:**

i. The report of Task Force on Automatic under Frequency Load Shedding (AUFLS) and df/dt scheme was approved by the Committee. The same needed to be taken up for implementation by RPCs. In order to address the views of Director SLDC (Odisha) and suggestions of GRID-India, a meeting may be convened by NPC Secretariat with stakeholders and if any further changes are suggested it shall be brought to next meeting of NPC.

(Action: NPC Secretariat)

ii. The monitoring of feeders under AUFLS may be prioritised by SLDC/RLDC/NLDC and it may be made part of regular agenda in the appropriate RPC forum to assess the performance.

(Action: RPC Secretariat)

B. Settings of AUFLS schemes:

a. **MS NPC** informed that in line with the recommendations of the sub-committee and further revision suggested by the Taskforce, the quantum of load shedding in different stages of AUFLS has been calculated based on the peak demand met of the region in the financial year (2022-23). The region wise peak demand met is as follows:

Region	NR	SR	WR	ER	NER
Peak Demand Met (MW)	76561	64337	71677	27218	3603

b. The quantum of load shedding in different stages of AUFLS has been calculated based on the peak demand met of the region in the financial year (2022-23) as follows:

S. No.	**Stage**	**Frequency (Hz)**	**Demand Disconnection (%)**	**Quantum of Load shed in MW**					
AUFLS Set Points and Percentage Quantum of Relief				**NR**	**SR**	**WR**	**ER**	**NER**	**All India Load shed**

1	Stage 1	49.4	5.00%	3828.05	3216.85	3583.85	1360.9	180.15	12169.8
2	Stage 2	49.2	6.00%	4593.66	3860.22	4300.62	1633.08	216.18	14603.76
3	Stage 3	49.0	7.00%	5359.27	4503.59	5017.39	1905.26	252.21	17037.72
4	Stage 4	48.8	7.00%	5359.27	4503.59	5017.39	1905.26	252.21	17037.72
	Total (in MW)			**19140.3**	**16084.25**	**17919.25**	**6804.5**	**900.75**	**60849**

c. **Decisions of the Committee:**

If any change is recommended in the meeting by NPC secretariat to look into the suggestion of Director SLDC (Odisha), for new stage of AUFLS at 49.5 Hz with 1-2% of Load relief, the same will be put upto to NPC and after approval of NPC the same would be communicated to RPCs for implementation.

(Action: NPC Secretariat)

9. Unified Real Time Dynamic State Measurement (URTDSM) project phase-II (PowerGrid Agenda)

a. **MS NPC** informed that in the 13th NPC meeting, the report of subcommittee on uniform philosophy of PMU locations, new analytics and requirement of up gradation of Control Center under "Unified Real Time Dynamic State Measurement" (URTDSM) project phase-II under the chairmanship of MS, WRPC was approved by NPC. It was also decided that the PowerGrid may prepare the DPR of URTDSM project phase-II in accordance with the recommendation of the committee 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.

b. **PowerGrid representative** informed that based on the recommendation of the report and the inputs received from entities, around 4000 PMUs will be installed in phase-II. The scope of work also includes the development of new analytics, up-gradation of existing analytics and integration of existing PMUs of phase-I etc. He further informed that the budgetary quotations were sought from 3 prospective bidders. All the bidders have informed about constraints in design & providing estimated cost because of large number of PMUs, large size of PDC & historian and new analytic applications in the Project. Till now, two budgetary quotations were received and based on that, cost estimates for phase-II have been worked out and it came around Rs. 3700 crore which includes Rs. 2300 crore for project implementation and rest amount for 7 years AMC.

c. **MS ERPC** informed that the in ER, the state of Jharkhand is having majority of transmission lines at 132 kV level, however, the report of URTDSM phase-II recommends to install PMUs on 220 kV and above lines. He requested to considered 132kv lines of state of Jharkhand for PMU installation under phase-II. Chairperson NPC suggested to send their inputs with proper justification.

d. **Chairperson NPC stated for** optimising number of PMUs to be installed under Phase II based on importance of PMUs location required for grid operations in consultation with the users like RLDC, SLDC.

e. **Director (System Operation) GRID-India** informed that as per Central Electricity Authority (Technical Standards for Construction of Electrical Plants and Electric Lines) Regulations, 2022, the PMUs need to be installed in all the new substation and therefore all such new substation may be excluded from the scope for URTDSM phase-II.

f. **ED (AM) PGCIL** informed that the IT components of phase –I will serve their useful life by 2026 (URTDSM phase I was commissioned in year 2018), therefore, these components may also include in the phase-II. Chairperson NPC stated to exclude such components from the scope of phase-II.

g. **MS NPC** opined that the software analytics/reports under Phase-II may be finalised in consultation with the RLDCs/RPCs. The new technology options like AI, ML and big data analytics may be explored by RLDCs/RPCs/CTUIL while designing analytics software. **CTU representatives** appreciated the views of MS NPC and further added that URTDSM systems is critical for the increased complexity of power system network in light of large amount of renewable integration in the vast integrated Indian grid. The grid behaviours captured by PMUs and analysed by the applications may be empowered with Machine learning & Artificial Intelligence for adaptive solutions. The applications may generate meaningful reports periodically for separate zones depending upon its uniqueness. And the system database & intelligence may be periodically (every quarter or configurable for applicable administrative responsibility areas) revalidated for more realistic results and report generation.

h. **CTU representative** suggested to reduce the storage time period of the data under URTDSM phase-II to optimise the cost estimates and in this context the input from Grid India may be taken for assessing the phase I storage requirements and historical data usage.

i. **Chairperson TCC (SR)** stated that the analytics under phase-I are not of much use. He suggested that capacity building programs related to PMUs and its software analytics may be organised for the SLDCs**. Chairperson NPC** stated that a course may be designed on PMUs and its software analytics by NPTI.

j. **ED (AM) PGCIL** informed that the AMC contract for software URTDSM phase-I needs to extend with IIT Mumbai for further years. **MS ERPC** informed that extension of contract has already been approved for ER**. MS SRPC** informed that SRPC forum is not satisfied with analytics and support of the IIT Mumbai and therefore, they may not be ready to extend the AMC contract further. **Chairperson NPC** opined that GRID-India may coordinate among RLDCs to have a consensus on whether to extend the AMC contract with IIT Mumbai for the software analytics for URTDSM phase-I.

k. **Director SLDC (Odisha)** informed that the state of Odisha is implementing a separate WAMS projects. He requested the analytics which has been provided to them under URTDSM phase-I may be allowed to use for their separate WAMS project. The cost of customisation of analytics under URTDSM phase-I to make them for the use of WAMS of Odisha may be borne by the Odisha. PowerGrid informed that they will examine

whether it is possible as per their agreement with IIT Mumbai and coordinate with Odisha.

l. **Decision of the Committee:**

i. **PGCIL may revise the scope of DPR in line with above suggestions ((d) to (h)) and submit the DPR by March 2024.**

(Action: PGCIL)

ii. **PowerGrid will inform whether the customisation of analytics under URTDSM phase-I to make them for the use of WAMS of Odisha is possible as per their agreement with IIT Mumbai.**

(Action: PGCIL)

iii. **A course may be designed on PMUs and its software analytics for the SLDCs by NPTI.**

(Action: HRD Division, CEA/NPTI)

iv. **GRID-India may coordinate among RLDCs to have a consensus on whether to extend the AMC contract with IIT Mumbai for the software analytics for URTDSM phase-I.**

(Action: GRID-India)

10. Introduction of MPLS Technology in ISTS Communication (Agenda from CTU):

a. **MS NPC** informed that in line with decision of the 13th NPC meeting, NPC Secretariat constituted the committee on 24.08.2023 with representative from RPCs, PCD Division CEA, GRID-INDIA, RLDCs, POWERGRID, CTU and some prominent states Kerala, Chhattisgarh, West Bengal .As of now the Joint Committee has held four (4) numbers of meetings on 19.09.2023, 17.10.2023, 05.12.2023 and 23.01.2024.

b. **CTU representative** informed that the vendors of MPLS technology state that they are not able to meet the Make In India requirements completely and therefore, they are reluctant to go for PoC. However, CTU is consistently trying for the same.

c. **Chairperson SRPC** opined that the MPLS technology may be implemented for the new and upcoming system and in the old and exiting system SDH technology may be used. He suggested to use hybrid approach with interoperability to slowly integrate the new technology.

d. **Chairperson NPC** emphasised that the importance of trusted vendor for the communication system. He opined that whether the migration from SDH technology to MPLS technology is required need to be deliberated further. He suggested to develop a comprehensive plan for the future, considering the existing/available technology.

e. **Decision of the Committee:**

CTU may submit the report on Introduction of MPLS Technology in ISTS system by July 2024.

(Action: CTU)

11. PUShP portal (For Flexibilisation of PPA for Optimal Utilization of Resources & Reduction in Cost of Power for Consumers):

a. **MS NPC** informed that the PUShP portal was launched on 09th March, 2023 by Hon'ble Minister of Power and NRE. The transaction on the portal has been started w.e.f. 03.04.2023. Twenty (20) Nos of States & UTs have started using the portal for declaration and requisition of surplus power. She informed that as on 03.02.2024, 94 number of request completed for allocation on portal. The status of successful transactions on the PUShP portal is attached at **Annexure-XII.** She further informed that the following new Provision/Feature were added on the PUShP portal**:**

i. Updating power requirement by the Buyers: As of now, some of the states-Bihar, Rajasthan, Andhra Pradesh, Jharkhand, Maharashtra, Odisha, Tamil Nadu, Uttar Pradesh, Haryana and Assam have updated their power requirement on the portal as and when required by them.

ii. Provision of Banking of Power feature under the PUShP Portal: In the PUShP Portal, a facility/provision has been provided to the States through which the States may intimate/declare the surplus power quantum which they are willing to bank for a certain period of duration. Any other state who wants to acquire this surplus power in deficit scenario and willing to undergo for banking with the surplus state, may give requisition for this surplus power for a same duration in the PUShP Portal as per their mutual agreement. **PUShP Portal shall be acting as match-making platform for banking of power.**

b. She further informed that in a meeting held on 7.12.2023 with the nodal officers, Punjab representative informed that NTPC is insisting for separate PPA for transactions on the PUShP portal. In this meeting, NTPC informed that beneficiaries are required to enter into a generic PPA for the power allocated to them through PUShP portal and to comply the scheduling requirements as per the provisions of act and regulations. NTPC has submitted the draft PPA format. In the minutes of the meeting held on 07.12.2023, it was concluded that the allocation of power through PUShP portal is of temporary nature and the original allocation of power gets reinstated once the temporary allocation cease to exist. Further, the PUShP portal facilitates the temporary allocation of power for a certain period which was earlier done by MoP/RPCs. In case of temporary re-allocation of power being done by MoP/RPCs, separate/another PPAs with the states/buyers was not required. In line with this, the separate PPA for the power allocated through PUShP portal may not be necessary for creation of contracts and scheduling of power.

c. She further informed that a buyer having adequate LC/PSM/advance payment with a CGS/Gencos, the existing adequate LC/PSM/advance payment may be considered as valid PSM by CGS/Gencos for both short term and long term temporary power allocation through PUShP portal. However, in absence of adequate LC/PSM/advance

payment, CGS/Gencos may review the existing LC/PSM on regular interval and request buyer to enhance LC/PSM/advance payment or ask for additional LC/PSM/advance payment for the short term and long term temporary power allocated through PUShP portal. ED (commercial), NTPC agreed for the same.

d. **Chairperson NPC** opined that there are terms and condition which an entity has to agree before login to the PUShP portal. NTPC may add any specific points in these terms and condition and there is no need to enter into separate PPA with the states for the PUShP portal.

e. **Chairperson TCC (SR)** informed that the APERC has not approved the payments for the power taken by the state from the unallocated share of CGS from whom the state is not having firm share.

f. **Decision of the Committee:**

i. There are terms and condition which an entity has to agree before login to the PUShP portal. NTPC may add any specific points in these terms and condition and there is no need to enter into separate PPA with the states for the PUShP portal.

(Action: NTPC)

ii. A buyer having adequate LC/PSM/advance payment with a CGS/Gencos, the existing adequate LC/PSM/advance payment may be considered as valid PSM by CGS/Gencos for both short term and long term temporary power allocation through PUShP portal. However, in absence of adequate LC/PSM/advance payment, CGS/Gencos may review the existing LC/PSM on regular interval and request buyer to enhance LC/PSM/advance payment or ask for additional LC/PSM/advance payment for the short term and long term temporary power allocated through PUShP portal.

12. Establishment of State-of- the-Art National Unified Network Management System (N-UNMS) in main & backup configuration integrating all the regional UNMSs. (CTUIL Agenda)

a. **CTU representative** briefed the agenda to the Committee. She informed that in line with CERC, CEA Regulations and RPC's deliberation, establishment of State-of Art U-NMS for ISTS and State Utility Communication System for all the Regions have been envisaged for five Regional systems and one National system integrating all the regional ones; in main & backup configuration. This will facilitate centralized reporting/collection of PAN India communication Network of ISTS as well as State level system including cross border links at National Level. She informed the status of UNMS for each region as below:

Region	Vendor	Date of award	Control Center Location	Status
NR	Sterlite	09.08.2021	**Main:** Delhi, **Backup:** Lucknow	Commissioned

NER	Sterlite	09.08.2021	**Main:** Guwahati, **Backup:** Shillong	Commissioned
ER	NMS works	29.06.2022	**Main:** Kolkata, **Backup:** Patna	Commissioning in Feb'24/March' 24
SR	NMS works	17.01.2024	**Main:** Bangalore, **Backup:** Hyderabad	Awarded
WR	NA	NA	**Main:** Mumbai, **Backup:** Vadodara	Tender opened in Jan'24
National	NA	NA	**Main:** NLDC, Delhi, **Backup:** RLDC, Kolkata	Approval for NPC

b. **Chairperson SRPC** opined that the regional UNMS system will monitor the inter-state and intra-state communication system, the objective of implementing the national UNMS is also similar.

c. **Chairperson NPC** informed that national UNMS will be helpful in the monitoring of PAN India communication Network of ISTS as well as State level system including cross border links at National Level. A data repository will be created at national level which will be helpful in the communication system planning.

d. It was suggested that the tariff of UNMS project at national level may be included as national component.

e. RPCs opined that the agenda for implementation of national UNMS needs deliberations at RPC level.

f. **Decision of the Committee:**

The agenda for implementation of national UNMS needs deliberations at RPC level for taking the views of RPCs. CTU may take up agenda for implementation of national UNMS in the upcoming meeting of RPCs. The cost booking under National Component may be included in proposal.

(Action: CTU/RPCs)

13. Membership of RE Generators in RPC (ERPC- Agenda)

a. **MS NPC** informed that it was decided in the 13th meeting of NPC that the associations of solar and wind generators both on rotational basis may become the members of the RPCs. The participation of associations would be limited to technical and operational issues. GM Division, CEA would nominate the associations to RPCs in similar line of Traders/Private Transmission Licensees.

b. **Deputy Director GM Division (CEA)** informed that the regulations and resolution on basis of which the membership of RPCs is being considered are applicable for conventional generators only.

c. **Chairperson NPC suggested that GM Division may take up the matter in CEA.**

14. Any Other Agenda Items with the permission of Chairperson, NPC

14.1 Five (5) min Interface Energy Meters along with AMR system for PAN India (for all Five regions) (CTU Agenda)

a. **CTU representative** informed that the proposal of the scheme "5 min Interface Energy Meter along with AMR system" for Southern Region was put up to 17th NCT meeting held on 31st Jan'2024. After deliberation, it was decided that the same scheme shall be worked out for complete PAN India National level. He **further** informed that the SRPC has proposed for the PSDF funding for "5 min Interface Energy Meter along with AMR system" for Southern Region.

b. **Grid-India** informed that the provision of migrating to 5 min scheduling was made in their WBES and other applications. It was opined that similar provision need to be made in Unified Accounting Software (UAS) of RPCs.

c. **Chairperson NPC** was of the view that 5 min IEM with AMR system may be implemented for pan India for smoother transition from 15 min to 5 min regime. **He further** opined that the proposal/DPR for 5 min IEM with AMR system for pan India may be prepared by PGCIL based on the input provided by CTUIL regarding the ISTS metering points in consultation with Grid India. CTU may prepare the roadmap and activities to be done for transition from 15 min to 5 min regime based on the previous studies/ reports in present context. He emphasized that the timeline of the activities may also be prepared and it may be in sync and coordination with each activities for smoother implementation of the project. The PSDF funding may not be possible because limited funds in PSDF. The funding of the project may be decided in the NCT meeting.

d. **Decision of the Committee:**

i. **The agenda for 5 min Interface Energy Meters along with AMR system for PAN India (for all five regions) needs deliberations in all RPC. Agenda may be taken up in the upcoming meetings of all RPCs.**

(Action: CTU/RPCs/POWERGRID)

ii. **The proposal/DPR for 5 min IEM with AMR system for pan India may be prepared by PGCIL based on the input provided by CTUIL regarding the ISTS metering points in consultation with Grid India.**

(Action: POWERGRID/CTU/GRID-India)

iii. **CTU may prepare the roadmap and activities to be done for transition from 15 min to 5 min regime based on the previous studies/ reports in present context. The timeline of the activities may also be prepared and it may be in sync and coordination with each activities for smoother implementation of the project.**

(Action: CTU)

14.2 Mismatch between RTU-SCADA real time data and IEM data

a. **Director SLDC (Odisha)** informed that in the special meeting of NPC held on 24.06.2022 it was decided that the pilot project of Integration of Interface Energy Meters (IEMs) into SCADA/EMS system for telemetry of meter data to MP SLDC was agreed to be implemented for the standby meters at MP side at the ISTS interface points. It was also agreed that the similar projects may be implemented at the two ISTS substations (one at new system and other at old system) in each region. He informed that such pilot project has not implemented in the ER due to various issues raised by PGCIL.

b. **PGCIL representative** informed that the pilot project has the cyber security issues. Further, it will also add burden to the IEM, it may affect the commercial accounting.

c. **Grid –India representative** stated that the difference in SEM and SCADA was less than 1%. The SCADA issues needs to be addressed by the entities rather than taking one more input from existing IEMs.

d. **MS NPC** informed that the provision of telemetry of 1 min instantaneous MW power flow data from IEMs to SLDC for efficient drawl management has been made in the Technical Specification of 5 Min IEM, AMR and MDP system.

e. **Chairperson NPC** suggested to form a sub-committee under chairmanship of MS WRPC with the representation from PGCIL, states, RPCs, RLDCs, CTUIL, NPC to look into the issue **SCADA vs SEM mismatch**, reason thereof and also study the pilot project being done by MP. The sub-committee may submit its report within 4 months.

f. **Decision of the Committee:**

A sub-committee may be constituted under chairmanship of MS WRPC with the representation from PGCIL, RPCs, RLDCs, CTUIL, NPC and states to look into the issue SCADA vs SEM mismatch, reason thereof and also study the pilot project being done by MP. The sub-committee may submit its report within 4 months.

(Action: NPC Secretariat)

14.3 Agenda of operational Issues of DISCOMs at RPC level

a. **Chairperson SRPC** opined that the RPC forum are being used mainly for addressing the issues of Generators, Transmission Licensee, PGCIL, CTU etc. however, the issues of the DISCOMs are not being deliberated at RPC level. He suggested to earmark some time and forum to discuss the issues of DISCOMs**.**

b. **MS ERPC** informed that generally DISCOMs are not raising their issues in the RPC meetings because generally states are being represented in the RPCs by their transmission wing.

c. **Chairperson TCC (WR)** stated that guidelines at Enterprise Level (Discom Level) needs to be brought out for number of operational/planning aspects of DISCOMs by central agencies like CEA.

d. **Chairperson NPC** informed that Electricity Distribution Network Planning Criteria 2023 and Draft Distribution Perspective Plan 2030 has been published on CEA website and focus is there on Distribution aspects. He opined that DISCOMs have forums to

raise their infrastructural issues, however, there is no appropriate forum to discuss the operational issues of the DISCOMs. He suggested to earmark time and forum of RPC to take up the agenda related to operational issues of DISCOMs.

e. **Decision of the Committee:**

DP&T Divisions, CEA in coordination with the NPC to take lead in this aspect and Region-wise meeting may be held. RPCs may facilitate these meetings at regional level.

(Action: DP&T Divisions, CEA)

15. Status Update of the following Agenda items: The Status update on the following agenda items as received from RPCs is given below:

Agenda items	Decision/Deliberations in the 13th NPC Meeting	Status Update
Preparation of an annual calendar for conducting the protection system audits.	RPCs are requested to update the preparation of an annual calendar for conducting the protection system audits	The status provided by RPCs are as follows:- • **SRPC**- SRPC has completed the Regional Protection Audit of 30 Substations for the FY 2023-24 during the Months of December 2023 & January 2024. As per IEGC Regulations, entities are required to furnish the third party audit plan for the next financial year to RPC by 31st October. Third Party Audit calendar for Southern Region would be prepared for FY 2024-25 after receipt of the audit plans from all SR entities. • **WRPC**- Tentative Annual calendar (will be firmed up shortly) enclosed at **Annexure –XIII** • **NERPC**- An annual calendar for protection audits of 132kV level & above substations has been prepared by NERPC. The same is being reviewed in monthly Protection sub-committee meetings. • **NRPC**- Utilities were sensitized for provision of IEGC 2023 that Annual audit plan for the next financial year shall be submitted by the users to their respective RPC by 31st October. NRPC Secretariat has received annual audit plan from 6 utilities till the date.

		Input is still awaited from ERPC.
Development of communication outage portal in RPCs	The communication outage portal developed by SRLDC shall be discussed with RPCs/NPC at Communication subgroup of NPC and RLDCs for implementation in other regions.	The status provided by RPCs are as follows:- • **SRPC-** Communication outage portal developed by SRLDC. • **ERPC-**Communication outage portal development is in process with ERLDC in consultation with SRLDC. • **NERPC-** NERPC requested NERLDC to develop communication outage portal similar in line with SRPC portal. NERLDC is in the process of development of the communication outage portal. • **NRPC &WRPC**-initiated discussion with RLDC for the development of the portal.
	Deliberation/Decisions in 14th NPC Meeting: All RLDC/RPC may develop the common communication outage portal in line with SRLDC portal.	
Conducting Cyber Security Audits	It was also decided in the 13th NPC meeting that periodicity of conducting Cyber Security Audits - 6 months for IT audit and 1 year for OT audit may be followed by RPCs.	The status provided by RPCs are as follows:- • **WRPC**- A Regional Sub-Committee and Central Cyber Security Coordination Forum for CERT-GO as per provision of Regulation 53 of Indian Electricity Grid Code has been formed and nominations provided by WRPC. • **SRPC**- SR entities are insisted to carry out the cyber security audits for their IT as well as OT systems at least once in every 6 (six) months as per CEA (Cyber Security Guidelines) 2021. • **NERPC-** Cyber Security Audits for OT system is being done annual basis. However Cyber Security Audits for IT system is being planned by constituents. Matter will be taken up in the next NETeST Meeting. • **NRPC**- In accordance with Regulations 53 of IEGC, 2023, Northern Regional Cyber Security Co-

		ordination forum is formed by NRLDC. 1st meeting of committee is scheduled to be held on 8th Feb, 2024. **Input is still awaited from ERPC**.
Review of Status of Islanding schemes	a. RPCs may handhold the states for timely implementation of the islanding scheme and the timeline may be given by RPC to each states for DPR preparation and implementation of Islanding Scheme. b. RPCs are requested to update the progress of each Islanding Scheme in the MIS report.	The detailed MIS report (as per information available in NPC Secretariat is attached at **Annexure-XIV**). The updated MIS report has been received from WRPC, NERPC, NRPC and SRPC Input is still awaited from ERPC.
Mapping of Feeders under AUFLS schemes on SCADA system	It was again requested to expedite the work by WRPC, NRPC and NERPC to conduct meetings with their DISCOMs to find solutions for feeder mapping and expedite it in their regions.	The status available with NPC Secretariat is attached at **Annexure-XV.** **Summary of status of mapping of feeders:-** • **In SR**- As on 31.12.2023 mapping was 95% in SR. Andhra Paradesh-92 %, Telangana-87%, Karnataka-96%, Kerala-100%, Tamil Nadu-97%, Puducheery-100%. • **In WR**- Madhya Pradesh: 100 %, Gujarat: NIL, Maharashtra: NIL, Goa: NIL, Chhattisgarh: NIL, DDDNH-NIL. • **In NER**- Assam-100 %, Meghalaya-100%, Nagaland-100%, Arunachal Pradesh – Nil Manipur – Nil, Mizoram – Nil (to be completed by Dec'23),Tripura – 20%. However, NERPC informed that States are being regularly sensitized in OCC forum for ensuring complete mapping of UFR feeders. Lack of RTUs at 33kV substations is a major hurdle. Shifting of feeders are underway.

		• **In NR-** UP-77.35 %, Punjab-90%, Haryana-99%, Delhi-100%, HP-86.9%, Rajasthan-0%. Input is still awaited from ERPC.
Ensuring Proper Functioning of Under Frequency Relays (UFR) & df/dt Relays	a. The annual calendar and SOP for periodic inspection of AUFLS and df/dt relays to be prepared by RPCs. b. RPCs may also ensure to conduct the periodic inspections of AUFLS and df/dt relays as per the annual calendar.	• **SRPC** had prepared Annual Calendar for periodic inspection of AUFLS and df/dt for the year 2023-24. Total 26 S/Ss were identified for Inspection in five States and UT. Inspection was carried out in 16 number of Sub Stations. Details are attached at **Annexure-XVI.** The SLDCs/S/Ss are advised on the actions to be taken based on the observations by SRPC. Action taken report also were sought. • **WRPC** had prepared Annual Calendar for periodic inspection of AUFLS and df/dt for the year 2023-24. Inspection was carried out in 8 number of Sub Stations. Details are attached at **Annexure-XVI.** • **NERPC** has prepared annual audit calendar for inspection of UFRs in the region. Inspection of UFR at 132kV Azara substation was conducted on 24.08.2023. Other sites of Assam have been identified for inspection, to be carried along with the protection audit in January'24. • Utilities submit report of mock exercises for healthiness of UFRs on quarterly basis to NRPC Secretariat. The compliance is monitored in monthly OCC meetings. NRPC has also conducted UFR inspection of 220 kV Rishikesh S/s of PTCUL recently. IEGC, 2023 requires RPC to carry out random inspection of the under-frequency relays. In view of this calendar for periodic inspection has not been prepared in NRPC. Further, a pre-prepared periodic inspection calendar would rule out the possibility of surprise inspection.

		Input is still awaited from ERPC.
Report on Power System Stabilizers (PSS) tuning	The report of the sub-committee was accepted by the NPC. The reports may be circulated for the stakeholders' consultation before implementation of recommendations of the report.	**WRPC updated that the PSS tuning report was circulated with concerned stakeholders via email dated 18.08.2023. However, no update has been received regarding comments from stakeholder on the report. The report may adopted by RPCs.**
	Deliberation in 14th NPC Meeting: **The Report may be adopted by RPCs.**	

16. Meeting ended with vote of thanks to Chair.

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Annexure-I 14th NPC

सत्यमेव जयते

भारत सरकार/Government of India
विद्युत मंत्रालय/Ministry of Power
केन्द्रीय विद्युत प्राधिकरण/Central Electricity Authority
एन.पी.सी. प्रभाग/National Power Committee Division
Ist Floor, Wing-5 ,West Block-II, RK Puram, New Delhi-66

No.4/MTGS/SG/NPC/CEA/2023/ 353 Date: 18.09.2023

Subject: Standard Operating Procedure for Protection System Audit- reg.

Standard Operating Procedure (S.O.P) for Protection System Audit is enclosed herewith for your kind information and necessary action.

Enclosure: As above

Yours faithfully,

सत्येंद्र 18.09.23

(सत्येंद्र कु. दोतान / Satyendra Kr. Dotan)
Director, NPC & Member Convener (Sub-group)

Standard Operating Procedure for Protection System Audit

A protection system audit is a review and evaluation of the protection systems of a substation with an objective to verify whether required protection systems have been put in place at station by the concerned utility, and to recommend suitable measures to provide for the same.

Ministry of Power, had constituted a Committee under the Chairmanship of Chairperson CEA to examine the grid disturbances on the 30th and the 31st July 2012. One of important recommendation of the committee was conducting of extensive audit of protection system. List of sub-stations where protection audit is to be undertaken on priority basis was prepared and audited across the country. This was the beginning of protection audit across the country and large number of important 400 and 220kV substations were audited.

Keeping in view the importance of Protection System Audit, Standard Operating Procedure has been prepared for the reference purpose. It will provides a step-by-step guide for RPCs to follow during the audit process.

1. All users shall 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.
2. After analysis of any event, each RPC shall identify a list of substations / and generating stations where third-party protection audit is required to be carried out and accordingly advise the respective users to complete third party audit within three months.
3. The third-party protection audit report shall contain information sought in the format as per IEGC 2023 and its further amendments.
4. 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.

5. Criteria for choosing substations for third party protection audit:

The following criteria are generally applied during choosing a substation for protection audit.

i. Substations/ Generating (SS/ GS) stations with frequent grid incidences or frequent maloperations or any grid occurrence in any substation which affected supply to large number of substations and caused significant load loss. In this case, third-party protection audit may be carried out within three months or as decided in the Protection sub-Committee Meeting of the RPC.

ii. Based on request received from utilities for arranging protection audit in certain stations (e.g. for availing PSDF funding for Renovation and Upgradation of Protection system). In this case, preferably third-party protection audit may be carried out within three months.

iii. Important 400kV and 765kV substations (SS) / Generating stations (GS) including newly commissioned SS/ GS. In this case, third-party protection audit may be carried out at a frequency decided in the Protection sub-Committee Meetings of respective RPCs.

6. Protection audit Procedure:

i. After identification of stations for protection audit, the same is communicated to the owner utility seeking nomination of one nodal officer for each Station.
ii. The nodal officer shall provide the details of substation for preparation of protection audit format (in line with IEGC and subsequent amendments).
iii. Meanwhile nominations shall be sought from all utilities to form regional teams for audit. Regional teams comprising of engineers from various utilities /utility (other than the team of host State) of the region shall be formed based on the no. of SS to be audited. (Each team may consists of 3 or 4 engineers from utilities other than the host utility and at the maximum a team will be able to audit 3 to 4 stations in 7-9 days or so)
iv. Once the team details and list of stations to be audited is finalised the details of nodal officers, team members , list of stations to be audited by each team is shared to all for further coordination regarding planning and conduction of audit.
v. Based on the inputs received from nodal officer regarding the list of elements in the substation to be audited, protection audit formats shall be prepared by RPC (in line with IEGC) and circulated to nodal officer. The nodal officer along-with the substation engineers shall fill the audit format and furnish the same along-with various attachments sought as part of the audit format within a week or so. List of attachments shall be given in the covering page of audit format.
vi. The filled in audit format along-with the received annexures shall then forwarded to the audit team by the nodal officer and any further clarification regarding the format or attachments shall be taken up by the audit team with the nodal officer under intimation to RPC.
vii. The SS/ GS shall be audited based on the data filled in audit format checking for compliance of Central Electricity Authority (Technical Standards for Construction of Electrical Plants and Electric Lines) Regulations, 2022, Central Electricity Authority (Technical Standards for Connectivity to the Grid) Regulations, 2007 & CEA (Measures relating to Safety and Electric Supply) Regulations, 2010, CERC regulations and amendments to the same, approved guidelines of RPC, best practices in industry, report of the Task Force on Power System Analysis Under Contingencies and as per the "Model Setting Calculations For Typical IEDs Line Protection Setting Guide Lines Protection System Audit Check List Recommendations For Protection Management Sub-Committee on Relay/Protection Under Task Force For Power System Analysis Under Contingencies" etc.
viii. After conduct of audit, the shortcomings observed in the audit shall be discussed in detail with the nodal officer and substation engineers and recommendations are finalised.
ix. The filled in audit format along-with the recommendations and attachments shall be finalised and final protection audit report RPC (in line with IEGC) shall be compiled.
x. Final protection audit report shall be discussed in Protection Coordination Committee and recommendations may be accepted/deleted/modified as per the scope of audit and compliance of various regulations/guidelines etc.
xi. The recommendations of all SS audited shall be inserted into audit recommendations database and update regarding recommendations shall be sought from respective utilities.
xii. Action plan for rectification of deficiencies detected, if any, shall be submitted to the respective RPC and RLDC and monthly progress will be submitted.

xiii. The travel expense from place of duty to Substation/Generating Station to be audited shall be borne by respective Auditor (Parent Organisation). The expense for boarding, lodging any travel of the team during the audit period shall be borne by the organisation owning the Substation/Generating Station.

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Annexure-II 14th NPC

Final Standard Operating Procedure (SOP) to address the Grid Disturbances (GDs)/Grid Incidents (GIs)/any other Protection Trippings

1. Immediately following an event (grid disturbance/incidence as defined in the CEA (Grid Standards) Regulations 2010 and subsequent amendment in the system, the concerned user/entity or SLDC shall inform to the RLDC through voice message.
2. Written flash report shall be submitted to RLDC and SLDC by the concerned user/entity within the time line specified in **Table 8** below, as per the IEGC, 2023.
3. In compliance of IEGC, 2023, All the Users, STU/SLDC are required to furnish the following information in respect of Grid Occurrences(GD/GI) within the time line specified in **Table 8** below, to RLDC/ RPC:
   (i) First Information Report (FIR)
   (ii) Event Logger (EL) output
   (iii)Disturbance Recorder (DR) output
   (iv)Trip event analysis report-TR (with pre and post fault system conditions)
   (v) Data Acquisition System (DAS)
4. RLDC shall report the event (grid disturbance or grid incidence) to CEA, RPC and all regional entities within twenty-four (24) hours of receipt of the flash report.
5. After a complete analysis of the event, the user/entity shall submit a detailed report in the case of grid disturbance or grid incidence within one (1) week of the occurrence of event to RLDC and RPC.
6. Based on the above detailed report submitted to RLDC by the entities, RLDC shall Categorize Grid Occurrences into grid incidents (GIs) and grid disturbance (GDs) based on criteria as per the CEA (Grid Standards) Regulations 2010 and subsequent amendment. RLDC shall also submit the Auto Reclosure (A/R) failure events, PLCC related events, any other protection related events to RPCs on monthly basis.
7. RLDCs and NLDC (for events involving more than one region) shall prepare a draft report of each grid disturbance or grid incidence including simulation results and analysis along with associated PMU plots of appropriate resolution, which shall be discussed and finalized at the Protection sub-committee/sub-group of RPC as per the timeline specified in **Table-8** below.

TABLE 8 : REPORT SUBMISSION TIMELINE

Sr. No.	Grid Event^ (Classification)	Flash report submission deadline (users/ SLDC)	Disturbance record and station event log submission deadline (users/ SLDC)	Detailed report and data submission deadline (users/ SLDC)	Draft report submission deadline (RLDC/ NLDC)	Discussion in protection committee meeting and final report submission deadline (RPC)
1	GI-1/GI-2	8 hours	24 hours	+7 days	+7 days	+60 days
2	Near miss **event**	8 hours	24 hours	+7 days	+7 days	+60 days
3	GD-1	8 hours	24 hours	+7 days	+7 days	+60 days
4	GD-2/GD-3	8 hours	24 hours	+7 days	+21 days	+60 days
5	GD-4/GD-5	8 hours	24 hours	+7 days	+30 days	+60 days

^*The classification of Grid Disturbance (GD)/Grid Incident (GI) shall be as per the* CEA Grid Standards.

(**The above table is as per the IEGC 2023**)

8. RPCs shall circulate all the GDs, GIs, near miss events, A/R events, PLCC mal-operation events, any other protection related event etc. along with the Agenda for Protection Co-Ordination Sub-Committee (PCSC) of RPCs. PCSC meetings are to be held in every month.
9. The implementation of the recommendations of the final report shall be monitored by the protection sub-committee of the RPC. Tripping portals deployed for reporting of the GDs & GIs on RLDCs portal, shall also have compliances reporting of PCSC recommendations on this portal. NLDC shall disseminate the lessons learnt from each event to all the RPCs for necessary action in the respective regions.
10. Constituents/entities shall furnish the following details to RPCs/RLDCs in respect of all the grid occurrences for analysis:

    a) Detailed analysis of the events
    b) SLD or equivalent pictorial representation clearly showing:
        i. Location of fault with distance
        ii. Fault details with type & relay indications
        iii. CT/PT/CVT rating details with location
        iv. Bus-bar arrangement/ Configuration of feeders and other information related to the ratings of the information required for analysis of the disturbance.
        v. CB positions (OPEN/ CLOSE) before and after fault
        vi. Isolator & Earth-switch positions (OPEN/CLOSE)
        vii. Voltage, frequency & power flows with direction at the time of fault
    c) Output of Event logger & Disturbance recorder
    d) Remedial Action(s) taken
    e) Relay setting details

HVDC Station Disturbance : Any additional data such as HVDC transient fault

record, switchyard equipment and any other relevant station data required for carrying out analysis of an event by RPC, NLDC, RLDC and SLDC shall be furnished by the users including RLDC and SLDC, as the case may be, within forty- eight (48) hours of the request. All users shall also furnish high-resolution analog data from various instruments including power electronic devices like HVDC, FACTS, renewable generation (inverter level or WTG level) on the request of RPCs, NLDC, RLDCs or SLDCs.

Generating Station Disturbance: Generating Station shall furnish high-resolution analog data from various instruments including AVR response, PSS response required for analysis of disturbance.

11. The respective entities (for which the Grid occurrence is placed in the PCSC agenda) shall present the Grid Occurrence which shall cover all related aspects such as:

    a) Antecedent conditions,
    b) Bus-configuration,
    c) Reasons of GD/ GI occurrence,
    d) Relevant Diagrams showing location of the fault,
    e) Bus bar arrangement/configuration of feeders and other connected equipment with proper CB positions (OPEN/ CLOSE) at the time of occurrence of the fault,
    f) Type of protections operated,
    g) Substantiation of the protections operated by relevant DRs & ELs,
    h) Reasons for protection systems mal-operation/non-operation,
    i) Remedial measures taken/ proposed, etc.

12. In respect of failure or Non-operation of A/R events, PLCC mal-operation events, any other protection related event as given in the PCSC agenda the concerned entities, shall furnish the reasons along with remedial action taken to RPCs/RLDCs. The same would be analyzed by the PCSC.
13. In the PCSC meetings, all the GDs, GIs, near miss events, A/R non-operation/mal-operation, PLCC mal-operations, other protection related trippings/events as circulated in the agenda shall be analyzed in detail by the PCSC forum and conclude the suitable recommendations to avoid the recurrence of such incidents in the future.
14. The action plan by the entities shall be furnished to RPC for implementation of the PCSC recommendations along with the timelines.
15. The implementation of the PCSC recommendations shall be followed up in the monthly PCSC meetings of RPC.
16. When grid disturbances or grid incidents occurred at major/critical substations and at substations that affected critical/essential/strategic loads, a Protection System Analysis Group (PSAG) shall be constituted consisting of the members from RPC, NLDC, RLDC, PGCIL, a Protection Expert from the region along with the Entity under whose jurisdiction GD/GI occurred to analyze the GD/GI in detail by visiting the respective substation/substations physically and conducting the meetings. PSAG would finalize the remedial actions and recommendations after deliberations and detailed analysis. The progress of implementation of the PSAG shall be followed up in the monthly PCSC Meetings.
17. In case any user/entity fails to undertake remedial action identified by the RPC within the specified timelines as decided by PCSC of RPC, the concerned RPC may approach the Commission with all relevant details for suitable directions.

18. A date depository of the event as maintained by the RLDC shall be accessible to every entity and the entity shall upload all the relevant documents on the RLDC portal of trippings.

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GRID-INDIA Comments on Draft MOM of 14th NPC Meeting

Annexure-XIV

Para no.	Para heading	GRID-INDIA Comments	Rationale
2.(i)	**SOP for Protection System Audit:**	i. IEGC 2023 mandates third party protection audit and same may be added in the background for reference.	IEGC 2023 contains detailed provisions for carrying out protection audit and therefore may be added as reference.
		ii. Self audit alongwith third party audit need to be carried out by the stations . This is missing in agenda and therefore may be added.	Annual self audit has to be carried out by entities, the findings of self-audit may help in third party protection audit.
		iii. The audit shall also review the Site Responsibility Schedule in the stations where multiple agencies are involved.	In the projects based on TBCB scheme, it is possible that line owner is different from substation owning entity. CEA standards specify a Site Responsibility schedule containing allocation of responsibilities among different entities. Protection audit may review the SRS for bringing out clarity in implemetation.
		iv. CBIP manual on power system protection may be referred.	CBIP manual on protection audit is also standard document and several custom clauses of this manual may be useful in Indian power system.
		v. The audit shall also review the withstand capability of physical structures for possible cyclones, wind speeds, humidity, earthquake etc.	Protection audit may contain the resiliency aspects such that station can withstand extreme weather and envioronmental conditions.
		vi. The reliability indices shall also be considered as one of the factors for carrying out audit.	As per IEGC reliability indices have to be computed and this parameter may be considered for carrying out protection audit.
		vii. IEGC 2023 recommends detailed requirement as ANNEXURE – 1 THIRD PARTY PROTECTION SYSTEM CHECKING & VALIDATION TEMPLATE FOR A SUBSTATION .This may be added in the SoP.	This template may be added for tabulating the results and data obtained in protection audit.
		viii. The protection details of nearby stations, lines and generators may also be required alongwith subject station for coordination purposes.	A template may be prepared for obtaining the details from nearby sttaions for coordination purposes.
		ix. The station shall share the readable files of DR/EL during any previous disturbance.	DR/EL records for previous disturbance may be one of the prerequisites to be submitted alongwith protection settings.
		x. In the SoP of protection audit, the audit of inter-regional line/HVDC is missed. The HVDC where tripping of all poles takes place shall be considered a candidate for audit. FACTS devices shall also be included for separate audit.	HVDC stations are missing in the SOP and since most of the HVDC links are inter-regional and high power carrying links, it is important that focussed audit shall be carried out for them.
		xi. The protection audit of IR lines may be conducted jointly by involved RPCs.	IR lines involve two regions and therefore, a joint audit by respective RPCs may be required.
		xii. The RE pooling stations need to be audited at higher frequency since addition/modification of elements within or nearby station take place at regular intervals. The philosophy adopted for auditing RE station may be added	RE pooling stations witness frequent addition of generation as well as transmission and this may involve the necessity to review the protection settings more frequently.
		xiii. The audit shall also contain review of practice being followed for activation/archival of DR (FOR committee report can be referred).	Forum of Regulators has released detailed report on standardisation of DR/Eland same may be refrred during feedback to entity owner.
		xiv. All RE plants, together with their external compensating equipment (if any) should be audited	RE generation stations shall be audited alongwith external compensation equipment e.g STATCOM, Capacitor banks etc. .
		xv.Power and control Cable testing results, Frequency of DC earth fault to be included in periodic protection audit.	The cable testing, DC earth fault detection are rarely tested in site which may cause multiple tripping.
		xvi.Highest Flood levels Measurement and random inspection of tower strength assessment may be conducted in protection audit checklist.	Due to road construction/repairing there is possibility of mismatch between substation level and road level which may create flooding of substations in high rainy seasons.The strength of tower assessment is needed to detect any chance of tower collapse condition.

2.(ii)	**SOP for Grid Disturbances/Grid Incidents/Tripping's:**	i.RE plants shall also share the high resolution data for validation of plant performance after a grid disturbance. The details shall be shared for any event involving change in generation of the plant by more than 10 percent.	RE plant being inverter based resource may be observed vide high resolution data. RE plants shall submit details for events where change in generation during a step is more than 10%.
		ii. After a major grid disturbance, the feedback to transmission planners shall be shared and planners shall also submit the necessary remedial measures in the form of transmission addition etc.	In case during GD it emerges that any network related inadequacy contributed to the GD, the feedback shall be shared with planners as well.
		iii.In Sl. No. 9 , it is mentioned that NLDC shall disseminate the lessons learned, it is suggested to modify " RLDC alongwith NLDC shall disseminate the lessons learned".	It seems that role of RLDCs got missed, therefore RLDCs have been added.
		iv.The event involving more than one region shall be discussed in both RPCs .	The GD/GI/Near-miss involving more than one region may require deliberation in respective RPCs.
		v. Few cascade tripping have been observed due to failure of auto changeover of auxiliary supply from one source to the other (refer Rajasthan – RAPS case). During event reporting, reliability of auxiliary scheme shall be checked.	The event analysis shall provide details of auxillary supply and in case of blackout , reliable operation of auxillary supply may be reviewed.
		vi. Grid disturbance analysis shall also review any loss of data at respective RLDC during event.	It is observed during events that there is partial/complete loss of telemetry at RLDC/NLDC. The analysis may also factor the continuity of telemetry.
2.(iii)	**S.O.P for Communication Audit for Substations:**	i.Audit shall validate the Performance requirement. - Communication system shall be able to conform the data interval time as specified in Schedule-I of CEA Technical standards for communication 2020.	These are added in line with CEA Technical Standards for Communication System in Power System Operations) Regulations, 2020 and IEGC 2023.
		ii. A site responsibility schedule for every interface point shall be prepared by the owner of the communication interface equipment at the interfacing location.	
		iii. Audit shall check whether the retention of historical data for ninety days has been kept or not.	
		iv.In Audit format status of integration with U-NMS may be kept.	
		v. Audit shall also check compliance to Cyber Security guidelines.	
2.(iv)	**SOP for Communication System Outage Planning:**	i. There is an annexure to the format for communication outage portal, as per process mentioned in portal , there is only option of self-declaration by requester i.e. there is no mechanism for checking the accuracy of details.	It is important that there is some mechanism for validation of data entered in portal.
		ii) In Sl No 5 of SOP it is mentioned that a Web Portal named as "Communication System Outage Planning Portal" shall be developed by respective RLDCs. It is requested that this point may be deleted from SOP	Such clause can be deleted from SOP . Also as per Communication Regulations 2017 Outage planning is the responsibility of RPC.
		ii.In Sl. No. 13 of SoP , it is mentioned that user has to obtain code from RLDC. Outages can be approved by Communication Outage planning committee. However, a fomat may be included where owner can submit information after availing outages. iii. Central Electricity Authority (Technical Standards for Communication System in Power System Operations) Regulations, 2020 has identified RPC as nodal agency for the purpose. "Monthly outage shall be planned and got approved by the owner of communication equipment in the concerned regional power committee, as per detailed procedure finalised by the respective regional power committee" .	It may be difficult for RLDC to monitor and handle so many codes for communication.
		The below points may be inserted suitably in the NPC SOP regarding AGC. iv. All the AGC communications links between NLDC and the power plants (2 links each between NLDC and the respective power plant) may be added to the outage monitoring list. In the SOP only "inter-regional AGC links" are mentioned.	AGC links are typically point to point connections between NLDC and the power plant. Hence, instead of focusing on inter-regional AGC links, links between NLDC and the power plant may be monitored.
		v. In case of a planned outage of an intermediate part of a communication link/channel/path, an alternate link may be planned to be configured to the extent possible, to avoid disruption of communication.	AGC links are supposed to operate with 99.99% availability. Alternate links to the extent posible may be created in advance, in case of planned outages.

		vi. NLDC Detailed Procedure for Secondary Reserve Ancillary Services (SRAS) prepared in line with the CERC (Ancillary Services) Regulations, 2022, provides roles and a standard operating procedure for AGC communication failure identification and rectification. The same is available at https://grid-india.in/en/download/detailed-procedure-for-secondary-reserve-ancillary-services-sras-2022/?wpdmdl=49193 and shall be adhered to in the real-time AGC system operation.	There is an operational SOP created by NLDC inline with CERC (Ancillary Services) Regulations, 2022. The same may be mentioed in the planning SOP to make the document holistic.
		vii.NLDC may submit the monthly communication availability report of the AGC communication links, as measured from the NLDC router to the plant router. However, this metric would also include the communication failure caused due to power plant side issues, apart from the CTUIL/POWERGRID (ULDC)/NLDC side issues. Wherever necessary, NLDC-submitted statistics may be analysed together with the power plant-submitted statistics (plant router to plant RTU, plant router to NLDC router), and POWERGRID-submitted statistics (NLDC MUX to plant MUX), to find the root cause and solutions.	This is inline with the NLDC SOP for SRAS/AGC. This ensures that NLDC, POWERGRID and the Power plants claim responsibility for their portion of communication availability for AGC.

Inputs of NRPC for GRID- INDIA comments on SOP for Protection System Audit (under draft MOM of 14th NPC Meeting)

Sr. No.	GRID-INDIA Comments	Rationale given by GRID-INDIA	Decision of 50th PSC forum of Northern Region
1	IEGC 2023 mandates third party protection audit and same may be added in the background for reference.	IEGC 2023 contains detailed provisions for carrying out protection audit and therefore may be added as reference	Forum agreed to include.
2	Self-audit along with third party audit need to be carried out by the stations. This is missing in agenda and therefore may be added.	Annual self-audit has to be carried out by entities; the findings of self-audit may help in third party protection audit.	Forum agreed to include.
3	The audit shall also review the Site Responsibility Schedule in the stations where multiple agencies are involved.	In the projects based on TBCB scheme, it is possible that line owner is different from substation owning entity. CEA standards specify a Site Responsibility schedule containing allocation of responsibilities among different entities. Protection audit may review the SRS for bringing out clarity in implementation.	Forum decided that there is no need for audit team to review the Site Responsibility Schedule. However, audit team shall be allowed access to all elements in premises of station irrespective of ownership.
4	CBIP manual on power system protection may be referred.	CBIP manual on protection audit is also standard document and several custom clauses of this manual may be useful in Indian power system.	Forum agreed to include.
5	The audit shall also review the withstand capability of physical structures for possible cyclones, wind speeds, humidity, earthquake etc.	Protection audit may contain the resiliency aspects such that station can withstand extreme weather and environmental conditions.	Forum rejected as withstand capability estimation requires a different skill set than protection.
6	The reliability indices shall also be considered as one of the factors for carrying out audit.	As per IEGC reliability indices have to be computed and this parameter may be considered	Forum rejected as basis of GD/GI already covers reliability aspect.

		for carrying out protection audit.	
7	IEGC 2023 recommends detailed requirement as ANNEXURE – 1 THIRD PARTY PROTECTION SYSTEM CHECKING & VALIDATION TEMPLATE FOR A SUBSTATION. This may be added in the SoP.	This template may be added for tabulating the results and data obtained in protection audit.	Forum agreed to include.
8	The protection details of nearby stations, lines and generators may also be required along with subject station for coordination purposes.	A template may be prepared for obtaining the details from nearby stations for coordination purposes.	Forum agreed to include.
9	The station shall share the readable files of DR/EL during any previous disturbance.	DR/EL records for previous disturbance may be one of the pre requisites to be submitted alongwith protection settings.	Forum agreed to include.
10	In the SoP of protection audit, the audit of inter-regional line/HVDC is missed. The HVDC where tripping of all poles takes place shall be considered a candidate for audit. FACTS devices shall also be included for separate audit.	HVDC stations are missing in the SOP and since most of the HVDC links are inter-regional and high power carrying links, it is important that focused audit shall be carried out for them.	Forum agreed to include.
11	The protection audit of IR lines may be conducted jointly by involved RPCs.	IR lines involve two regions and therefore, a joint audit by respective RPCs may be required.	Forum decided that audit shall be responsibility of owner.
12	The RE pooling stations need to be audited at higher frequency since addition/modification of elements within or nearby station take place at regular intervals. The philosophy adopted for auditing RE station may be added	RE pooling stations witness frequent addition of generation as well as transmission and this may involve the necessity to review the protection settings more frequently.	Forum rejected. As IEGC 2023 has already mentioned frequency.
13	The audit shall also contain review of practice being followed for activation/archival of DR	Forum of Regulators has released detailed report on standardization of DR/EL and same may be referred during feedback to entity owner.	Forum agreed to include.

	(FOR committee report can be referred).		
14	All RE plants, together with their external compensating equipment (if any) should be audited	RE generation stations shall be audited along with external compensation equipment e.g. STATCOM, Capacitor banks etc.	Forum agreed to include.
15	Power and control Cable testing results, Frequency of DC earth fault to be included in periodic protection audit.	The cable testing, DC earth fault detection are rarely tested in site which may cause multiple tripping.	Forum rejected.
16	Highest Flood levels Measurement and random inspection of tower strength assessment may be conducted in protection audit checklist.	Due to road construction/repairing there is possibility of mismatch between substation level and road level which may create flooding of substations in high rainy seasons. The strength of tower assessment is needed to detect any chance of tower collapse condition.	Forum rejected as it requires different domain of experts than protection engineer.

Annexure-II 14th NPC

Final Standard Operating Procedure (SOP) to address the Grid Disturbances (GDs)/Grid Incidents (GIs)/any other Protection Trippings

1. Immediately following an event (grid disturbance/incidence as defined in the CEA (Grid Standards) Regulations 2010 and subsequent amendment in the system, the concerned user/entity or SLDC shall inform to the RLDC through voice message.
2. Written flash report shall be submitted to RLDC and SLDC by the concerned user/entity within the time line specified in **Table 8** below, as per the IEGC, 2023.
3. In compliance of IEGC, 2023, All the Users, STU/SLDC are required to furnish the following information in respect of Grid Occurrences(GD/GI) within the time line specified in **Table 8** below, to RLDC/ RPC:
   (i) First Information Report (FIR)
   (ii) Event Logger (EL) output
   (iii)Disturbance Recorder (DR) output
   (iv)Trip event analysis report-TR (with pre and post fault system conditions)
   (v) Data Acquisition System (DAS)
4. RLDC shall report the event (grid disturbance or grid incidence) to CEA, RPC and all regional entities within twenty-four (24) hours of receipt of the flash report.
5. After a complete analysis of the event, the user/entity shall submit a detailed report in the case of grid disturbance or grid incidence within one (1) week of the occurrence of event to RLDC and RPC.
6. Based on the above detailed report submitted to RLDC by the entities, RLDC shall Categorize Grid Occurrences into grid incidents (GIs) and grid disturbance (GDs) based on criteria as per the CEA (Grid Standards) Regulations 2010 and subsequent amendment. RLDC shall also submit the Auto Reclosure (A/R) failure events, PLCC related events, any other protection related events to RPCs on monthly basis.
7. RLDCs and NLDC (for events involving more than one region) shall prepare a draft report of each grid disturbance or grid incidence including simulation results and analysis along with associated PMU plots of appropriate resolution, which shall be discussed and finalized at the Protection sub-committee/sub-group of RPC as per the timeline specified in **Table-8** below.

TABLE 8 : REPORT SUBMISSION TIMELINE

Sr. No.	Grid Event^ (Classification)	Flash report submission deadline (users/ SLDC)	Disturbance record and station event log submission deadline (users/ SLDC)	Detailed report and data submission deadline (users/ SLDC)	Draft report submission deadline (RLDC/ NLDC)	Discussion in protection committee meeting and final report submission deadline (RPC)
1	GI-1/GI-2	8 hours	24 hours	+7 days	+7 days	+60 days
2	Near miss **event**	8 hours	24 hours	+7 days	+7 days	+60 days
3	GD-1	8 hours	24 hours	+7 days	+7 days	+60 days
4	GD-2/GD-3	8 hours	24 hours	+7 days	+21 days	+60 days
5	GD-4/GD-5	8 hours	24 hours	+7 days	+30 days	+60 days

^*The classification of Grid Disturbance (GD)/Grid Incident (GI) shall be as per the* CEA Grid Standards.

(**The above table is as per the IEGC 2023**)

8. RPCs shall circulate all the GDs, GIs, near miss events, A/R events, PLCC mal-operation events, any other protection related event etc. along with the Agenda for Protection Co-Ordination Sub-Committee (PCSC) of RPCs. PCSC meetings are to be held in every month.
9. The implementation of the recommendations of the final report shall be monitored by the protection sub-committee of the RPC. Tripping portals deployed for reporting of the GDs & GIs on RLDCs portal, shall also have compliances reporting of PCSC recommendations on this portal. NLDC shall disseminate the lessons learnt from each event to all the RPCs for necessary action in the respective regions.
10. Constituents/entities shall furnish the following details to RPCs/RLDCs in respect of all the grid occurrences for analysis:

    a) Detailed analysis of the events
    b) SLD or equivalent pictorial representation clearly showing:
        i. Location of fault with distance
        ii. Fault details with type & relay indications
        iii. CT/PT/CVT rating details with location
        iv. Bus-bar arrangement/ Configuration of feeders and other information related to the ratings of the information required for analysis of the disturbance.
        v. CB positions (OPEN/ CLOSE) before and after fault
        vi. Isolator & Earth-switch positions (OPEN/CLOSE)
        vii. Voltage, frequency & power flows with direction at the time of fault
    c) Output of Event logger & Disturbance recorder
    d) Remedial Action(s) taken
    e) Relay setting details

HVDC Station Disturbance : Any additional data such as HVDC transient fault

record, switchyard equipment and any other relevant station data required for carrying out analysis of an event by RPC, NLDC, RLDC and SLDC shall be furnished by the users including RLDC and SLDC, as the case may be, within forty- eight (48) hours of the request. All users shall also furnish high-resolution analog data from various instruments including power electronic devices like HVDC, FACTS, renewable generation (inverter level or WTG level) on the request of RPCs, NLDC, RLDCs or SLDCs.

Generating Station Disturbance: Generating Station shall furnish high-resolution analog data from various instruments including AVR response, PSS response required for analysis of disturbance.

11. The respective entities (for which the Grid occurrence is placed in the PCSC agenda) shall present the Grid Occurrence which shall cover all related aspects such as:

    a) Antecedent conditions,
    b) Bus-configuration,
    c) Reasons of GD/ GI occurrence,
    d) Relevant Diagrams showing location of the fault,
    e) Bus bar arrangement/configuration of feeders and other connected equipment with proper CB positions (OPEN/ CLOSE) at the time of occurrence of the fault,
    f) Type of protections operated,
    g) Substantiation of the protections operated by relevant DRs & ELs,
    h) Reasons for protection systems mal-operation/non-operation,
    i) Remedial measures taken/ proposed, etc.

12. In respect of failure or Non-operation of A/R events, PLCC mal-operation events, any other protection related event as given in the PCSC agenda the concerned entities, shall furnish the reasons along with remedial action taken to RPCs/RLDCs. The same would be analyzed by the PCSC.
13. In the PCSC meetings, all the GDs, GIs, near miss events, A/R non-operation/mal-operation, PLCC mal-operations, other protection related trippings/events as circulated in the agenda shall be analyzed in detail by the PCSC forum and conclude the suitable recommendations to avoid the recurrence of such incidents in the future.
14. The action plan by the entities shall be furnished to RPC for implementation of the PCSC recommendations along with the timelines.
15. The implementation of the PCSC recommendations shall be followed up in the monthly PCSC meetings of RPC.
16. When grid disturbances or grid incidents occurred at major/critical substations and at substations that affected critical/essential/strategic loads, a Protection System Analysis Group (PSAG) shall be constituted consisting of the members from RPC, NLDC, RLDC, PGCIL, a Protection Expert from the region along with the Entity under whose jurisdiction GD/GI occurred to analyze the GD/GI in detail by visiting the respective substation/substations physically and conducting the meetings. PSAG would finalize the remedial actions and recommendations after deliberations and detailed analysis. The progress of implementation of the PSAG shall be followed up in the monthly PCSC Meetings.
17. In case any user/entity fails to undertake remedial action identified by the RPC within the specified timelines as decided by PCSC of RPC, the concerned RPC may approach the Commission with all relevant details for suitable directions.

18. A date depository of the event as maintained by the RLDC shall be accessible to every entity and the entity shall upload all the relevant documents on the RLDC portal of trippings.

****

adani
Power

APML/NRPC/FTC/50th PSC/APL - Kawai/01 Date -: - 18.04.2024

To,
The Superintending Engineer - Protection
Northern Region Power Committee,
New Delhi.

Sub: - Request for review of "Procedure and flow chart for approval of Protection Settings by NRPC Secretariat for "First Time Charging".

Ref: - Point no. A4, Clause no. A.4.6 (page no.12) of minutes of 49th Protection Sub Committee Meeting dated 08/03/2024.

Dear Sir / Madam,

As per above cited sub & ref from the minutes of 49th Protection Sub Committee meeting dated 08/03/2024, we would like to deliberate on re-consideration of the requirements on obtaining approval of protection settings by NRPC in addition to the existing NRLDC approval for the FTC in 50th meeting of Protection Sub-committee to be held on April 29, 2024.

Since protection settings based on Protection Philosophy are considered as per the NRPC guidelines and further submitted to NRLDC for approval before FTC, therefore seeking separate approval from NRPC may take additional coordination & time.

We request the forum to re-consider exclusion of this additional approval process from the FTC procedure.

Thanking you,
Yours Faithfully,

For Adani Power Limited

Manoj Taunk
Associate Vice President (Protection and Metering).

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Renewables

Ref: AGEL/NRPC/FTC/2024/01 **Date: 18-Apr-2024**

To,
The Superintending Engineer – Protection,
Northern Regional Power Committee,
New Delhi.

Sub: To include Agenda Item for the 50th meeting of Protection Sub-committee to be held on 29/04/2024 – matter as 'Review of requirement for Procedure and flow chart for approval of Protection Settings by NRPC Secretariat for FTC.

Reference: -

1. NRPC notice of meeting dated 15/04/2024.
2. Minutes of 49th Protection Sub Committee meeting dated 08/03/2024, point no. A4, clause no. A.4.6 (page no.12)

Dear Sir / Madam,

In reference to the Minutes of the 49th Protection Sub-Committee meeting dated 08-03-2024, point A4, clause A.4.6 (page 12), we propose adding an agenda item to the upcoming 50th meeting on 29-04-2024, to discuss and review the mentioned clause. This pertains to seeking approval for protection settings from NRPC, in addition to the existing procedure from RLDC for FTC

As per the minutes referred above, which states that *"Subsequently, it was gathered that the FTC procedure will remain same as being done by NRLDC. However, approval of protection settings shall be required from NRPC"* (Page No 12 of 46).

Sir, as a developer and utility, we suggest not to include the approval of NRPC as a FTC requirement, regarding which, we place our views and concerns to kindly revalidate and revise the recently finalized procedure mentioned above. Our point wise representation is as under,

1. Protection settings approval from NRPC will be redundant activity as RLDC reviews the same during FTC approval.
2. All the settings and philosophy of protections fully comply as per NRPC laid guidelines and requirements, which is strictly validated by RLDC to meet all technical aspects related.
3. Due to redundant procedure, adding another step for FTC approval, It will delay the charging of the transmission / Substation elements as forum approval will take extra time and coordination with NRPC and RLDC. This will be a difficult situation to handle the volume of all FTC clearances in due time.

Continues...

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4. There is development of Large RE generators which will be coming in NR region and FTC of one plant are to be taken in many tranches and each time NRPC approval for so many applications and installations will take much time to handle, may lead to difficult situation.
5. As per Regulation 14 (2) (b) of IEGC 2023, approval of the concerned RPC is required for (i) any revision in settings, and (ii) implementation of new protection system for grid connected users and it is not required during FTC.
6. Suggestions include submitting all settings directly to NRPC or RLDC can pass them post-FTC.

It is again requested to kindly revisit the change of the FTC procedure and to maintain the existing procedure to avoid any delay and coordination for the same.

Thanking you
Yours faithfully

For Adani Green Energy Limited

Authorized Signatory

(Sanjay Bhatt)

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adani
Energy Solutions

Ref: AESL/NRPC/FTC/2024/01 **Date: 18-Apr-2024**

The Superintending Engineer - Protection,
Northern Regional Power Committee,
New Delhi.

Sub: - To include Agenda Item for the 50th meeting of Protection Sub-committee to be held on 29/04/2024 - matter as 'Review of requirement for Procedure and flow chart for approval of Protection Settings by NRPC Secretariat for FTC.

Reference: - (1) NRPC notice of meeting dated 15/04/2024.
(2) Minutes of 49th Protection Sub Committee meeting dated 08/03/2024, point no. A4, clause no. A.4.6 (page no.12)

Dear Sir / Madam,

Greetings from **Adani Energy Solutions Limited**!

In reference to the Minutes of the 49th Protection Sub-Committee meeting dated 08-03-2024, point A4, clause A.4.6 (page 12), we propose adding an agenda item to the upcoming 50th meeting on 29- 04-2024, to discuss and review the mentioned clause. This pertains to seeking approval for protection settings from NRPC, in addition to the existing procedure from RLDC for FTC.

As per the minutes referred above, which states that "Subsequently, it was gathered that the FTC procedure will remain same as being done by NRLDC. However, approval of protection settings shall be required from NRPC"(Page No 12 of 46).

Sir, as a developer and utility, we suggest not to include the approval of NRPC as a FTC requirement, regarding which, we place our views and concerns to kindly revalidate and revise the recently finalized procedure mentioned above. Our point wise representation is as under,

1. Protection settings approval from NRPC will be redundant activity as RLDC reviews the same during FTC approval.

2. All the settings and philosophy of protections fully comply as per NRPC laid guidelines and requirements, which is strictly validated by RLDC to meet all technical aspects related.

3. Due to redundant procedure, adding another step for FTC approval, It will delay the charging of the transmission / Substation elements as forum approval will take extra time and coordination with NRPC and RLDC. This will be a difficult situation to handle the volume of all FTC clearances in due time.

4. There is development of Large RE generators which will be coming in NR region and FTC of one plant are to be taken in many tranches and each time NRPC approval for so many applications and installations will take much time to handle, may lead to difficult situation.

5. As per Regulation 14 (2) (b) of IEGC 2023, approval of the concerned RPC is required for (i) any revision in settings, and (ii) implementation of new protection system for grid connected users and it is not required during FTC.

Continues...

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6. Suggestions include submitting all settings directly to NRPC or RLDC can pass them post-FTC.

It is again requested to kindly revisit the change of the FTC procedure and to maintain the existing procedure to avoid any delay and coordination for the same.

Thanking you.

Yours Faithfully,

For Adani Energy Solutions Limited

Authorized Signatory

(Sunil Raval)

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SOUTHERN REGIONAL POWER COMMITTEE

BENGALURU

PROTECTION PROTOCOL OF SOTHERN REGION

Prepared in Compliance to

Clause 12(2) and Clause 13 of Central Electricity Regulatory Commission Indian Electricity Grid Code Regulations, 2023

[Rev_1]

By

SRPC Secretariat

(Effective from 01.10.2023)

Contents

PROTECTION PROTOCOL OF SOUTHERN REGION

1. Background

1.1. The Protection Protocol of Southern region is prepared in accordance with Clauses 12(2) & 13 of the Indian Electricity Grid Code, 2023 (IEGC 2023) notified by the Central Electricity Regulatory Commission.

1.1.1. **The clause 12(2) of the IEGC 2023:**

"There shall be a uniform protection protocol for the users of the grid:

a) for proper co-ordination of protection system in order to protect the equipment/system from abnormal operating conditions, isolate the faulty equipment and avoid unintended operation of protection system;

b) to have a repository of protection system, settings and events at regional level;

c) specifying timelines for submission of data;

d) to ensure healthiness of recording equipment including triggering criteria and time synchronization; and

e) to provide for periodic audit of protection system."

1.1.2. **The clause 13 of the IEGC 2023:**

"13. Protection protocol

(1) *All users connected to the integrated grid shall provide and maintain effective protection system having reliability, selectivity, speed and sensitivity to isolate faulty section and protect element(s) as per the CEA Technical Standards for Construction, the CEA Technical Standards for Connectivity, the CEA (Grid Standards) Regulations, 2010, the CEA Technical Standards for Communication and any other applicable CEA Standards specified from time to time.*

(2) *Back-up protection system shall be provided to protect an element in the event of failure of the primary protection system.*

(3) *RPC shall develop the protection protocol and revise the same, after review from time to time, in consultation with the stakeholders in the concerned region, and in doing so shall be guided by the principle that minimum electrical protection functions for equipment connected with the grid shall be provided as per the CEA Technical Standards for Construction, the CEA Technical Standards for Connectivity, the CEA Technical Standards for Communication, the CEA (Grid Standards) Regulations, 2010, the CEA (Measures relating to Safety and Electric Supply)*

Regulations, 2010, and any other CEA standards specified from time to time.

(4) *The protection protocol in a particular system may vary depending upon operational experience. Changes in protection protocol, as and when required, shall be carried out after deliberation and approval of the concerned RPC.*

(5) *Violation of the protection protocol of the region shall be brought to the notice of concerned RPC by the concerned RLDC or SLDC, as the case may be."*

1.2. The Protection Protocol of Southern Region stipulates General Protection Philosophy of Protection System, Protection Schemes for Generators & various Transmission Elements in Power System, Protection Settings & their Coordination among entities, Disturbance Monitoring, Analysis and Reporting, Time Synchronization of Protection Systems, Protection Audit Plan, Performance of Protection Systems & Compliance Monitoring.

2. Applicability

The Protection Protocol of Southern Region shall be applicable to all Southern Regional entities, State/Central/Private Generating Companies/ Generating Stations including REGs, RHGS, integrated RE with Pumped Storage Plant (PSP), SLDCs, SRLDC, CTU, STUs, Transmission Licensees and SRPC.

3. Definitions

Words and expressions used in this Protection Protocol are defined in the Act or any other regulations specified by the Central Commission or Central Electricity Authority shall, unless the context otherwise requires, have the meanings assigned to them under the Act or other regulations specified by the Central Commission, as the case may be.

4. General Philosophy of Protection System

4.1. Protection philosophy shall be in accordance with below mentioned objectives, design criteria and other details. However, protection design in a particular system may vary depending upon judgment and experience in the broad contours of the protection philosophy. Consideration must also be given to the type of equipment to be protected as well as the importance of this equipment to the system. Further, protection must not be defeated by the failure of a single component.

4.1.1. **Objectives**:

The basic objectives of any protection schemes should be to:

(i) Automatically isolate the faulty element.

(ii) Mitigate the effect of short circuit and other abnormal conditions in minimum possible time and area.

(iii) Indicate the location and type of fault and

(iv) Provide effective tools to analyse the fault and decide remedial measures.

4.1.2. **Design Criteria:**

To accomplish the above objectives, the four design criteria for protection that should be considered are:

(i) fault clearance time/speed;
(ii) selectivity;
(iii) sensitivity and
(iv) reliability (dependability and security)

4.1.2.1. **Fault clearance time/speed**: In order to minimize the effect on customers and maintain system stability, Fault clearance time shall be as per CEA Grid Standard Regulations 2010, as amended to date.

4.1.2.2. **Selectivity:** To ensure Selectivity, coordination shall be ensured with the adjacent protection schemes including breaker failure, transformer downstream relays, generator protection and station auxiliary protection.

4.1.2.3. **Sensitivity**: To ensure Sensitivity, the settings must be investigated to determine that they will perform correctly for the minimum fault current envisaged in the system, yet remain stable during transients and power swings from which the system can recover.

4.1.2.4. **Reliability**: To ensure Reliability, two independent auxiliary direct current-supplies shall be provided for Main-I and Main-II relays. The Main-I and Main-II relays should be from two different makes or operating with different algorithm. The CB´s shall have two independent trip coils and two independent trip circuits. Each protection device should trip at least one of them by independent auxiliary DC- supplies.

4.1.2.5. **Security**: To ensure Security, the protection shouldn't limit the maximum transmission capacity of the element. Distance protection in particular could cause spurious tripping due to specific grid conditions, in case of high load operation. Therefore, any special topologies must be known and considered for protection parameterization. For parallel Over Head Lines it is necessary to consider the rapid increase of load current in the healthy line when the faulty line trips and the protection operation must allow such conditions The load encroachment detection function of the relays must be used, when the highest distance zone resistance reach conflicts with the maximum transmitted load on the protected element.

4.2. All generating units shall have standard protection system to protect the units not only from faults within the units and within the Station but also from faults in sub-stations and transmission lines.

4.3. The generator, generator transformer, unit auxiliary transformer shall be provided with protection systems connected to two independent channels or groups, such that one

channel or group shall always be available for any type of fault in the generator and these transformers;

4.4. Protection relays shall be configured in such a way that digital input points shall not pick up due to stray voltages.

4.5. Protective relays shall be used to detect electrical faults, to activate the alarms and disconnect or shut down the faulted apparatus to provide for safety of personnel, equipment and system.

4.6. Electrical faults shall be detected by the protective relays arranged in overlapping zones of protection.

4.7. The protection relays for the generators, motors, transformers and the transmission lines shall generally be of numerical type.

4.8. All relays used shall be suitable for operation with CTs secondary rated for one ampere or five amperes as per relevant Indian Standards or International Electrotechnical Commission or Institute of Electrical and Electronics Engineers standards.

4.9. Relevant Indian Standards or International Electrotechnical Commission or Institute of Electrical and Electronics Engineers standards shall be applied for protection of generators, transformers and motors.

5. Protection Schemes

The electrical protection functions for equipment connected with the grid shall be provided as per the Central Electricity Authority (Technical Standards for Construction of Electrical Plants and Electric Lines) Regulations 2022 amended to date, the CEA (Technical Standards for connectivity to the Grid) Regulations 2007 amended to date, the CEA (Technical Standards for Communication System in Power System Operation) Regulations 2020 amended to date, the CEA (Grid Standards) Regulations 2010 amended to date, the CEA (Measures relating to Safety and Electric Supply) Regulations 2023 amended to date, and any other CEA standards specified from time to time.

5.1. **Thermal Generating Units**

The electrical protection functions for generator, generator transformer, unit auxiliary transformer and station transformer shall be provided in accordance with but not limited to the list given in **SCHEDULE-I** of CEA (Technical Standards for Construction of Electrical Plants and Electric Lines) Regulations 2022 amended to date.

5.2. **Hydro Generating Units**

5.2.1. For the generating units with a rating of more than one hundred megawatt, protection system shall be configured into two independent sets of protection (Group A and B) acting on two independent sets of trip coil fed from independent DC supplies, using separate sets of instrument transformers, and segregated cables of current transformers and voltage transformers.

5.2.2. The protection functions for Generator, Excitation Transformer, Generator Transformer, Generator and Generator Transformer, Unit Auxiliary Transformer, and Station Auxiliary Transformer shall be provided in accordance with but not limited to the list given in SCHEDULE-IV of CEA (Technical Standards for Construction of Electrical Plants and Electric Lines) Regulations 2022 amended to date except for variable speed units which will have specialized protection functions.

5.3. **REGs/RHGS/BESS**

Protection Schemes for Renewable Energy (RE) Power Plants of Solar power generation, Wind power generation, Battery Energy Storage System (BESS) and Hybrid of these connected with grid at voltage level above 650 volts shall be in accordance with the Central Electricity Authority (Technical Standards for Construction of Renewable Energy Power Plants) Regulations, 2023 from the date as & when these regulations are notified (Presently the finalization of these Standards by CEA is under progress).

5.4. **Substations & Transmission System Elements**

5.4.1. All major protection relays for the Voltage levels 66 kV and above shall be of numerical type and communication protocol shall be as per IEC-61850.

5.4.2. Grouping of Protection systems for the voltage level 66 kV and above:

i. The protection circuits and relays shall be electrically and physically segregated into two groups each being independent and capable of providing uninterrupted protection even in the event of one of the protection group fails or taken out for maintenance.

ii. Interconnection between these two groups shall not generally be attempted. However, such interconnection shall be kept to the bare minimum, if found absolutely necessary.

5.4.3. The protections required in respect of transmission lines, transformers, reactors and bus bars but not limited to shall be in accordance with **SCHEDULE-V** of CEA (Technical Standards for Construction of Electrical Plants and Electric Lines) Regulations 2022 amended to date.

5.4.4. **Bus Bar Protection and Local Breaker Backup Protection (breaker failure protection):**

i) Bus bar protection and local breaker backup protection shall be provided in 220 kV and higher voltage interconnecting sub- stations as well as in all generating station switchyards.

ii) Duplication of bus bar protection shall be done for all main buses of 400kV and above voltage class.

iii) The bus bar protection scheme shall be centralized or distributed type and have provision for planned future expansion.

5.5. **HVDC Terminals/ Stations**

5.5.1. **Classical HVDC Terminals/ Stations**

i) HVDC system protection shall consist of two parts:

(A) AC side protection:

AC side protection function shall cover the zone for converter transformer, AC filters, shunt capacitors, shunt reactors, and bus bars. These protections shall generally follow the same philosophy as in a typical substation i.e. detection of fault by relay and tripping of circuit breaker.

(B) DC side protection:

DC side protection shall cover the zones consisting of the valve hall, DC switchyard including smoothing reactor and DC filters, DC line, DMR line / electrode line and ground electrode. The protection equipment shall be designed to be fail safe and shall ensure high security to avoid mal-operation/ unwanted shutdown due to protection equipment failures.

ii) Following a DC Line fault, the HVDC System shall have the facility to restart, one or more times, the faulted pole at a variable pre-selected DC voltage level(s), not below 80% of the nominal voltage rating. The DC transmission system shall be capable of recovery in a controlled and stable manner without commutation failures during recovery following ac and dc system faults. The post fault power order shall be equal to the pre-fault power order unless AC/ DC systems dictate otherwise.

iii) Protection system required in respect of Classical HVDC Terminals/ Stations but not limited to shall be in accordance with 13 (b) of Part A of **SCHEDULE-VI** of CEA (Technical Standards for Construction of Electrical Plants and Electric Lines) Regulations 2022 amended to date.

iv) Software based controls and protection shall be used to permit flexibility in effecting modifications. Protection and controls shall be duplicated for reliability. The control & protection shall provide fast controllability of the HVDC system.

5.5.2. **Voltage Source Converter (VSC) based HVDC Terminals/Stations**

i) The protection equipment shall be designed to be fail-safe and shall ensure high security to avoid mal-operation/ unwanted shutdown due to protection equipment failures.

ii) Protection system required in respect of Voltage Source Converter (VSC) based HVDC Terminals/ Stations but not limited to shall be in accordance with 8 (b) of Part B of **SCHEDULE-VI** of CEA (Technical Standards for Construction of Electrical Plants and Electric Lines) Regulations 2022 amended to date.

iii) Software based controls and protection shall be used to permit flexibility in effecting modifications. Protection and controls shall be duplicated for

reliability. Protection shall be provided by numerical relays to suit the requirement of the HVDC system.

5.6. **Philosophy of Transmission Line Protection**

5.6.1. Transmission circuit construction can be considered in three main categories viz.: Overhead construction, Underground cable construction and Composite (overhead plus underground) construction. The requirements of overhead line and cable protection systems vary greatly, due to the exposure of transmission circuits to a wide variety of environmental hazards and are subjected to the wide variations in the format, usage and construction methodologies of transmission circuits. The type of protection signalling (tele- protection) or data communication systems required to work with the protection systems will also influence protection scheme requirements.

5.6.2. Transmission circuit Main protection is required to provide primary protection for the line and clear all type of faults on it within shortest possible time with reliability, selectivity and sensitivity. Transmission circuit back-up protection shall cater for failure of any main protection system to clear any fault that it is expected to clear. A protection function that offers back-up for most faults may also provide main protection for some fault conditions. Combinations of main and back-up protection systems should be used to address the main and application specific requirements for transmission circuits.

5.6.3. **Design Criterions:** While designing the scheme for protection of transmission lines following criteria shall be considered:

i) The systems applied must be capable of detecting all types of faults, including maximum expected arc resistance that may occur at any location on the protected line.

ii) The protection should be set not to trip under system transient conditions, which are not short circuits. Conversely where the short circuit current is low due to local grid conditions (weak network) or due to high resistance of the arc, this must be taken into consideration to trip the relay by using the most appropriate criterion, without jeopardizing the unwanted tripping during heavy load conditions.

iii) The design and settings of the transmission line protection systems must be such that, with high probability, operation will not occur for faults external to the line or under non-fault conditions.

iv) The over current protection for the transmission lines 220 kV and above voltage levels shall generally be in disabled condition.

5.6.4. **Reliability Criterions:**

i) **For transmission line having voltages at 220kV and above:** High speed Duplicated Main Protection (Main-I and Main-II) shall be provided. Main-I protection shall be carrier aided non-switched distance protection.

Main-II protection shall be carrier aided non-switched distance protection, or phase segregated line differential protection. For very short line (less than 10 km), cable or combination of overhead line and cable, line differential protection with distance protection as backup (built-in Main relay or standalone) shall be provided mandatorily as Main-I and Main-II.

In addition to above, following shall also be provided:

a) Auto reclose relay suitable for 1 ph or 3 ph (with deadline charging and synchro- check facility) reclosure.

b) Inverse Definite Minimum Time (IDMT) directional E/F relay (standalone or as built-in function of Main-I & Main-II relay).

c) Inverse Definite Minimum Time (IDMT) Directional over current for 220 kV lines if Main-II is not provided.

Main Protection shall have following features:

a) The Main-I and Main-II protection shall be numerical relays of different makes or employ different fault detection algorithm.

b) Each distance relay shall protect four/five independent zones (three/four forward zones and one reverse zone). It shall be provided with carrier aided tripping.

c) The relays should have sufficient speed so that they will provide the clearing times as defined in the CEA Grid Standards Regulations amended time to time.

d) The Main-I and Main-II relays shall be powered by two separate DC sources.

e) Both, Main-I and Main-II shall send initiation signal to Breaker Failure Relay / LBB Protection system.

f) Internal Directional Earth Fault function shall be set to trip the line in case of high resistance earth faults.

g) The Broken Conductor detection shall be used for alarm purpose only.

h) The internal overvoltage function shall be used to protect the line against over voltages. Two stage over voltage protection for the transmission lines (Stage-I as Voltage and Time graded & Stage-II @ 140% of Nominal Voltage with time delay 100ms) shall be implemented for the transmission lines of voltage levels 400kV and above. The OVR grading, Voltage and Time graded, for the Stage-I over voltage protection shall be as recommended by SRPC/SRLDC. The lines emanating from same substation shall be provided with pick-up as well as time grading to avoid concurrent trippings. The overvoltage relay shall have better than 98% drop-off to pick-up ratio (the ratio of the limiting values of the characteristic quantity at which

the relay resets and operates). For over voltage detection, though Ph-to-N voltage is preferable to Ph-to-Ph voltage, to achieve required discrimination for OVR grading on account of limitation imposed by voltage resolution of the relay, Ph-to-Ph voltage to be used for Over Voltage detection.

ii) **For transmission lines having voltages at 132kV/110kV:** There should be at least one carrier aided non-switched four/five zone distance protection scheme. Carrier aided zone protection may be optional for the radial feeders and feeders having intermittent loads In addition to this, another non-switched/switched distance scheme or directional over current and earth fault relays should be provided as back up. Main protection should be suitable for single or three phase tripping. Additionally, auto-reclose relay suitable for 1 ph or 3 ph (with dead line charging and synchro-check facility) reclosure shall be provided. In case of both line protections being Distance Protections, IDMT type Directional E/F relay (standalone or as built-in function of Main-I & Main-II relay) shall also be provided additionally.

5.6.5. Following types of protection scheme to be adopted to deal with faults on the lines:

i) **Distance Protection Scheme:** The scheme shall be based on the measuring the impedance parameters of the lines with basic requirements as below:

a) Each distance relay shall protect four/five independent zones (three/four forward zones and one reverse zone). It shall be provided with carrier aided tripping.

b) Each Distance Relay:

i. Shall include power swing detection feature for selectively blocking, as required.

ii. Shall include suitable fuse-failure protection to monitor all types of fuse failure and block the protection.

iii. Shall include load encroachment prevention feature like Load blinder.

iv. Shall include Out of Step trip function.

v. Distance relay as Main protection should always be complemented by Directional ground protection to provide protection for high resistive line faults.

vi. Shall be capable to protect the series compensated lines from voltage inversion, current inversion phenomenon. Special measures must be taken to guard against these phenomenon.

ii) **Line Differential Protection**: The scheme shall be based on the comparing the electrical quantities between input and output of the protected system. Provided that:

a) Due to the fact that short lines (less than 10kM) and/or cables do not have enough electrical length, the current differential relay should always be used.

b) For Cables, at least a differential line protection shall be used in order to guarantee fast fault clearing while maintaining security. The reason being that there are many sources of errors associated to other protection principles, especially for ground faults in cables.

c) The differential protection shall have following requirements:

i. Line differential as Main-I with inbuilt Distance Protection shall be installed for all the lines irrespective of length (subject to technical limitations). Zone-I protection feature shall get automatically enabled in case of communication failure observed by the differential relay.

ii. The differential relays provided in 220kV and above system must operate in less than 30 ms.

iii. The current differential protection should a reliable type (preferably digital). The protection should be of the segregate phase type, i.e. it should be able to detect the phase in fault and therefore for the case of single line-ground (SLG) faults to trip only the phase in fault (also to establish single phase A/R). The synchronization of the measured values is done via a communication system. The communication system for differential line protection should be based on fibre optic and any equipment should comply with the IEC 60834.

5.6.6. **Auto Reclosing**:

The single phase high speed auto-reclosure (HSAR) at 220 kV level and above (except for the composite feeders: overhead plus underground) shall be implemented, including on lines emanating from generating stations. If 3-phase auto reclosure is adopted in the application of the same on lines emanating from generating stations should be studied and decision taken on case to case basis.

i) **AR Function Requirements:**

It shall have the following attributes:

a) Have single phase or three phase reclosing facilities.

b) Incorporate a facility of selecting single phase/three phase/single and three phase auto-reclose and non-auto reclosure modes.

c) Have facilities for selecting check synchronizing or dead line charging features.

d) Be of high speed single shot type

e) Suitable relays for SC and DLC should be included in the overall auto-reclose scheme if three phase reclosing is provided.

f) Should allow sequential reclosing of breakers in one and half breaker or double breaker arrangement.

It may have the following attributes as well:

a) Have a continuously variable single phase dead time.

b) Have continuously variable three phase dead time for three phase reclosing.

c) Have continuously variable reclaim time.

ii) **Scheme Special Requirements:**

a) Modern numerical relays (IEDs) have AR function as built-in feature. However, standalone AR relay or AR function of Bay control unit (BCU) for 220kV and above voltage lines may be used. For 132kV/110kV lines, AR functions built-in Main distance relay IED can be used.

b) Fast simultaneous tripping of the breakers at both ends of a faulty line is essential for successful auto-reclosing. Therefore, availability of protection signalling equipment is a pre-requisite.

c) Starting and Blocking of Auto-reclose Relays:

Some protections start auto-reclosing and others block. Protections which start A/R are Main-I and Main-II line protections. Protections which block A/R are:

i. Breaker Fail Relay
ii. Line Reactor Protections
iii. O/V Protection
iv. Received Direct Transfer trip signals
v. Busbar Protection
vi. Zone 2/3 of Distance Protection
vii. Carrier Fail Conditions
viii. Circuit Breaker Problems.
ix. Phase to Phase Distance Trip
x. AR selection switch in OFF position
xi. Logic AR OFF in SAS
xii. Phase Distance Start (when Auto reclosure is in progress)

When a reclosing relay receives start and block A/R impulse simultaneously, block signal dominates. Similarly, if it receives 'start' for 1-phase fault immediately followed by multi- phase fault the later one dominates over the previous one.

iii) **Requirement for Multi breaker Arrangement:**

Following schemes shall be adhered to multi-breaker arrangements of one and half breaker or double breaker arrangement:

a) In a multi-Circuit Breaker (C.B.) arrangement one C.B. can be taken out of operation and the line still be kept in service. After a line fault only those C.Bs which were closed before the fault shall be reclosed.

b) In multi-C.B. arrangement it is desirable to have a priority arrangement so as to avoid closing of both the breakers in case of a permanent fault.

c) A natural priority is that the C.B. near the busbar is reclosed first. In case of faults on two lines on both sides of a tie C.B. the tie C.B. is reclosed after the outer C.Bs. The outer C.Bs. do not need a prioritizing with respect to each other.

iv) **Setting Criteria:**

a) Auto reclosing requires a dead time which exceeds the de-ionising time. The circuit voltage is the factor having the predominating influence on the de-ionising time. Single phase dead time of 1.0 sec. is recommended for 765 kV, 400 kV and 220 kV system. For the lines emanating from generating stations single-phase dead time upto 1.5 sec may be adopted.

b) According to IEC 62271-101, a breaker must be capable of withstanding the following operating cycle with full rated breaking current:

O - 0.3 s - CO - 3 min - CO

O stands for Open

CO stands for Close-Open

The rated operating cycle of the circuit breaker consisting of an opening, a holding time of 0.3 seconds, a CO cycle, a 3-minute wait, and another CO cycle.

The recommended operating cycle at 765kV, 400 kV and 220 kV is as per the IEC standard. Therefore, reclaim time of 25 Sec. is recommended.

5.6.7. **Power Swing Blocking and Out of Step (OOS) Function**

Large interconnected systems are more susceptible to Power Swings in comparison to the erstwhile smaller standalone systems. Inter-area Power Swings can be set up even due to some event in far flung locations in the system. During the tenure of such swings, outage of any system element may aggravate

the situation and can lead to instability (loss of synchronism). It is hence extremely important that unwanted tripping of transmission elements need to be prevented, under these conditions. Distance protection relays demand special consideration under such a situation, being susceptible to undesirable mis-operation during Power swings which may be recoverable or irrecoverable power swings. Following steps may be adopted to achieve above objective:

i) **Block all Zones except Zone-I**

This application applies a blocking signal to the higher impedance zones of distance relay and allows Zone 1 to trip if the swing enters its operating characteristic. Breaker application is also a consideration when tripping during a power swing. A subset of this application is to block the Zone 2 and higher impedance zones for a preset time (Unblock time delay) and allow a trip if the detection relays do not reset.

In this application, if the swing enters Zone 1, a trip is issued, assuming that the swing impedance entering the Zone-1 characteristic is indicative of loss of synchronism. However, a major disadvantage associated with this philosophy is that indiscriminate line tripping can take place, even for recoverable power swings and risk of damage to breaker.

ii) **Block All Zones and Trip with Out of Step (OOS) Function**

This application applies a blocking signal to all distance relay zones and order tripping if the power swing is unstable using the OOS function (function built in modern distance relays or as a standalone relay). This application is the recommended approach since a controlled separation of the power system can be achieved at preselected network locations. Tripping after the swing is well past the 180-degree position is the recommended option from CB operation point of view.

Normally relay is having Power Swing Un-block timer which unblocks on very slow power swing condition (when impedance locus stays within a zone for a long duration). Typically, the Power swing un-blocking time setting is 2sec.

However, on detection of a line fault, the relay has to be de-blocked.

iii) **Placement of OOS trip Systems**

Out of step tripping protection (Standalone relay or built-in function of Main relay) shall be provided on all the selected lines. The locations where it is desired to split the system on out of step condition shall be decided based on system studies.

The selection of network locations for placement of OOS systems can best be obtained through transient stability studies covering many possible operating conditions. Based on these system studies, either of the option above may be adopted after the approval of PCSC of SRPC.

While applying Power Swing Blocking (PSB) in the distance protection relay a few other important aspects also need to be considered:

- PSB function should not block if negative sequence or zero sequence currents are present. Once blocked, the PSB should unblock if negative sequence or zero sequence currents are detected. Power Swing is a balanced three phase phenomenon and unbalance can only occur in the case of an asymmetrical fault.
- It will be desirable that during tenure of PSB, the distance protection is capable of detecting a fault and tripping. If such a feature is not available in the relay, PSB should be unblocked after a time delay, corresponding to the half cycle period of the slowest expected Swing Frequency (usually 2s corresponding to the slowest swing frequency of 0.25Hz is considered as default), to avoid the protection remaining perpetually blocked.

5.7. **Transmission Relay Loadability**

Transmission Relay Loadability means the loading permitted in the transmission line by the relay including a security margin. The relay loadability is to be arrived in such a way as far as possible not to interfere with system operator actions, while allowing for short-term overloads, with sufficient margin to allow for inaccuracies in the relays and instrument transformers. Transmission relay do not prematurely trip the transmission elements out-of-service and allow the system operators from taking controlled actions consciously to alleviate the overload.

5.7.1. Protective relay settings shall

i) Not limit transmission loadability;

ii) Not interfere with system operators' ability to take remedial action to protect system reliability and;

iii) Be set to reliably detect all fault conditions and protect the electrical network from the faults.

5.7.2. The protective functions which could trip with or without time delay, on load current i.e. load responsive phase protection systems including but not limited to:

i) Phase distance.

ii) Out-of-step tripping.

iii) Switch-on-to-fault.

iv) Overcurrent relays.

v) Communications aided protection schemes including but not limited to:

- Permissive overreach transfer trip (POTT).

- Permissive under-reach transfer trip (PUTT).
- Directional comparison blocking (DCB).
- Directional comparison unblocking (DCUB).

vi) Phase overcurrent supervisory elements (i.e., phase fault detectors) associated with current based, communication-assisted schemes (i.e., pilot wire, phase comparison, and line current differential) where the scheme is capable of tripping for loss of communications.

5.7.3. Each Transmission Licensee and Generating Company, shall use any one of the following criteria for any specific circuit terminal to prevent its phase protective relay settings from limiting transmission system loadability while maintaining reliable protection of the Grid for all fault conditions. Relay loadability at 0.85 per unit voltage and a power factor angle of 30 degrees shall be evaluated.

i) For Distance protection relays of transmission lines, the Zone-3 shall prevent load encroachment, considering the following criteria:

a) Maximum load current (I_{max}) may be considered as 1.5 times the thermal rating of the line or 1.5 times the associated bay equipment current rating (the Minimum of the bay equipment individual rating) whichever is lower.

(The rating considered is approximately 15 minutes rating of the Transmission facility).

b) For setting angle for load blinder, a value of 30 degree may be adequate in most cases.

c) The Distance protection relays shall have provision for load blinder characteristic or load encroachment detection.

ii) For Directional Overcurrent relays, wherever used in a transmission line (132/110 kV level), the following shall be adopted:

a) An overload alarm shall be set at 110% of the thermal rating of the line with sufficient delay. This alarm shall allow the operator to take corrective action.

b) The Directional Overcurrent relay shall allow the line to carry 1.2 times of the thermal rating of the associated line or bay equipment (whichever is lower) at least 10 minutes.

iii) For transformer protection relays the following shall be adopted:

- Set the definite time transformer overload relay at 105% of the transformer ratings with sufficient delay. It shall be wired for alarm purpose only to allow the operator to take corrective action. No tripping shall be issued from this relay.

- The back-up overcurrent relays shall use IDMT characteristics and be suitably coordinated with the upstream transmission network.
- Install supervision for the transformer using either a top oil or simulated winding hot spot temperature element. The alarm and trip settings for these relays shall be set by individual entities based on the manufacturer's recommendation.

Thermal ratings as specified in the prevailing CEA's Manual on Transmission Planning Criterion shall be used for above requirement.

6. Protection Settings & Coordination

The purpose is to ensure system protection is coordinated among the grid connected entities. The Protection systems coordination comprises the following:

i) Each Transmission Licensee, Load Dispatch Centre (LDC) and Generating Company shall keep themselves familiarized with the purpose and limitations of Protection System schemes applied in its area of control.

ii) Each Transmission licensee shall coordinate its Protection System schemes with concerned transmission system, sub-transmission system and generators.

iii) Each Generating Company shall coordinate its Protection System schemes with concerned transmission system and station auxiliaries.

iv) Each Transmission Licensee and Generation Company shall be responsible for settings calculations for protection of elements under its ownership. It shall be the responsibility of the respective asset owner to obtain the inputs (adjacent line settings, infeed values etc.) from STU/Generating Company/ Transmission Licensee necessary for calculation of the settings.

v) STU/Generating Company/Transmission Licensee shall provide the infeed values/latest network model to the requesting entity, within 15 days of receipt of such a request from the entity.

vi) Each Generating Company and Transmission Licensee, for voltage levels 400kV and above and interstate lines, shall submit the protection settings as per the format prescribed, along with the calculation sheets, co-ordination study reports and input data, in advance, to SRPC/SRLDC for every new element to be commissioned. The mentioned information shall be submitted to the SRPC/SRLDC two months in advance for all the elements proposed to be commissioned. SRPC shall furnish the approved settings within forty days from the date of submission of the settings by the entity.

vii) The PCSC of SRPC shall review the settings to ensure that they are properly coordinated with adjacent system and comply with the existing guidelines. The onus to prove the correctness of the calculated settings shall lie with the respective Transmission licensee/Generation Company. In case, the PCSC feels that the adjacent

transmission system settings need to be changed, in view of the new element, it shall inform the concerned entity for revision of the existing settings.

viii) The PCSC of SRPC shall review and approve the settings based on the inputs /report submitted by the entities.

ix) The approved settings shall be implemented by the entity and proper record of the implemented settings shall be kept. The modern numerical relays have several settings for various features available in the relay. It shall be ensured that only the approved features and settings are enabled in the relay. No additional protection/setting shall be enabled without the prior approval of SRPC.

x) Each Transmission licensee and Generating Company shall co-ordinate the protection of its station auxiliaries to ensure that the auxiliaries are not interrupted during transient voltage decay.

xi) Any change in the existing protection settings, for voltage levels 400kV and above & interstate lines, shall be carried out only after prior approval from the SRPC. The owner entity shall inform all the adjacent entities about the change being carried out.

xii) In case of failure of a protective relay or equipment failure, the Generating Company and Transmission Licensee shall inform appropriate LDC/SRLDC/SRPC. The Generating Company and Transmission Licensee shall take corrective action as soon as possible.

xiii) Each Transmission Licensee shall coordinate Protection Systems on major transmission lines and interconnections with neighbouring Generating Company, Transmission Licensee and appropriate LDC.

xiv) SRPC in consultation with the SRLDC & Southern Regional entities shall undertake review of the protection settings, assess the requirement of revisions in protection settings and revise protection settings, from time to time and at least once in a year. The necessary studies in this regard shall be carried out by the SRPC & SRLDC. The modifications/changes, if any, in protection settings shall be advised to the respective users and STUs.

xv) SRPC shall maintain a centralized database and update the same on periodic basis in respect of their respective region containing details of relay settings for grid elements connected to 220 kV and above. SRLDC also shall maintain such database. Respective Transmission licensee/Generating Company/Entities are responsible for ensuring to make available the implemented protection settings in the centralized database within fifteen days from the date of commissioning.

xvi) If System Protection Schemes(SPS) is recommended to be implemented by the appropriate forum/Sub-Committee of SRPC on account of operational & system constraints, the same shall be implemented by the concerned Transmission licensee/Generating Company/Entities within the specified timelines.

7. Disturbance Monitoring, Analysis and Reporting

The Purpose is to ensure that adequate disturbance data is available to facilitate Grid event analysis. The analysis of power system disturbances is an important function that monitors the performance of protection system, which can provide information related to correct behaviour of the system, adoption of safe operating limits, isolation of incipient faults,

7.1. **The Disturbance Monitoring Requirements include the following:**

i) Each Transmission Licensee and Generating Company shall provide Sequence of Event (SOE) recording capability by installing Sequence of Event recorders or as part of another device, such as a Supervisory Control and Data Acquisition (SCADA) Remote Terminal Unit (RTU), a generator plants Digital (or Distributed) Control System (DCS) or part of Fault recording equipment.

This capability shall be provided at all substations and at locations to record all the events in accordance with CEA Grid Standard Regulations, 2010 amended to date. The following shall also be monitored at each location:

a) Transmission and Generator circuit breaker positions

b) Protective Relay tripping for all Protection Groups that operate to trip circuit breakers identified in (a) above.

c) Tele protection keying and receive

ii) In either case, a separate work station PC shall be identified to function as the event logger front end. The event logger work-station PC should be connected to UPS (Uninterrupted Power Supply).

The event logger signals shall include but not limited to

- All Circuit Breaker and isolator switching Operations
- Auxiliary supply (AC, DC and DG) supervision alarms
- Auxiliary supply switching signals
- Fire-fighting system operation alarms
- Operation signals (Alarm/Trip from all the protection relays.)
- Communication Channel Supervision Signals.
- Intertrip signals receipt and send.
- Global Positioning System (GPS) Clock healthiness.
- Control Switching Device healthiness (if applicable).
- RTU/Gateway PC healthiness
- All Circuit Breaker Supervision Signals.
- Trip Circuit Supervision Signals.

iii) Each Transmission Licensee/Generating Company/Users shall provide Disturbance recording capability for the following Elements at facilities:

- All transmission lines (Each line shall be provided with facility for distance to fault locator)
- Autotransformers or phase-shifters connected to busses.
- Shunt capacitors, shunt reactors.
- Individual generator line interconnections.
- Dynamic VAR Devices.
- HVDC terminals.
- Bus Bars

iv) The Disturbance recording feature shall be enabled and configured in all the numerical relays installed. Disturbance recording system shall have minimum recording time of 3 seconds (0.5 seconds for pre-fault and 2.5 seconds for post fault).

v) Each Generating Company shall provide Disturbance recording capability for Generating Plants in accordance with Central Electricity Authority (Technical Standards for Construction of Electrical Plants and Electric Lines) Regulations 2022 amended to date, the CEA (Technical Standards for connectivity to the Grid) Regulations 2007 amended to date.

vi) Each Transmission Licensee and Generating Company shall record for Faults, sufficient electrical quantities for each monitored Element to determine the following:

- Three phase-to-neutral voltages. (Common bus-side/line side voltages may be used for lines.)
- Three phase currents and neutral currents.
- Polarizing currents and voltages, if used (As applicable).
- Frequency (As applicable).
- Real and reactive power (As applicable).

The Minimum parameters to be monitored in the Fault record shall be specified by the PCSC of SRPC.

vii) Each Transmission Licensee and Generating Company shall provide Disturbance recording with the following capabilities:

- The Disturbance recorders shall have time synchronization and a standard format for recording analogue and digital signals (DR labels to be standardized as per the Report of FOLD Working Group - 3 on DR Parameter Standardization). The data files shall be capable of being viewed,

read, and analysed with a generic COMTRADE analysis tool as per the latest revision of IEEE Standard C37.111.

- Each Fault record duration and the trigger timing shall be settable and set for a minimum 3 second duration including 0.5 seconds for pre-fault and 2.5 seconds for post fault
- Each Fault recorder shall have sampling frequency of 1 kHz or better.
- Each Fault recorder shall be set to trigger for at least the following:

  Internal protection trip signals, external trigger input and additional triggers may be assigned as necessary.

viii) Each Transmission Licensee and Generating Company shall keep the recording instruments (disturbance recorder and event logger) in proper working condition and shall establish a maintenance and testing program for Disturbance Recorder (DR) that includes

- Maintenance and testing intervals and their basis.
- Summary of maintenance and testing procedures.
- Monthly verification of communication channels used for accessing records remotely (if the entity relies on remote access and the channel is not monitored to a control centre staffed around the clock, 24 hours a day, 7 days a week (24/7)).
- Monthly verification of time synchronization (if the loss of time synchronization is not monitored to a 24/7 control centre).
- Monthly verification of active analog quantities.
- A requirement to return failed units to service within 90 days. If a Disturbance Recorder (DR) will be out of service for greater than 90 days, the Transmission Licensee and Generating Company shall keep a record of efforts aimed at restoring the DR to service.

ix) The time synchronization of the disturbance recorders shall be corroborated with the PMU data or SCADA event loggers by SRLDC. SRLDC shall list out for Disturbance recorders which are non- compliant for discussion in PCSC meetings of SRPC.

x) Each Transmission Licensee and Generating Company shall submit the data files to the SRLDC conforming to the following format requirements:

- The data files shall be submitted in COMTRADE and PDF format.
- File shall have contained the name of the Relay, name of the Bay, station name, date, time resolved to milliseconds, event point name, status.

The DR archives shall be retained for a period of three years.

xi) A separate work-station PC, powered through UPS (Uninterrupted Power Supply) shall be identified with access to all the relays for extraction of DR. Auto-Download facility shall be established for automatic extraction of the DR files to a location on the work- station PC.

xii) **Time Synchronization Equipment**

a) Time Synchronizing Equipment complete with antenna, all cables and processing equipment shall be provided to receive synchronizing pulse through Global Positioning System or Indian Regional Navigation Satellite System Navic compatible for synchronization of event logger, disturbance recorder, Phasor Measurement Units, and Supervisory Control and Data Acquisition System or Substation Automation System.

b) Each substation shall have time synch equipment to synchronize all the numerical relays installed. Before any extension work, the capability of the existing Time-sync equipment shall be reviewed to ensure the synchronization of upcoming numerical relays.

c) The status of healthiness of the time-sync device shall be wired as "Alarm" to SCADA and as an "Event" to Event Logger.

d) The time synch status of all the installed numerical relays and event logger shall be monitored monthly and recorded. The Monthly records for relays not in time-sync shall be reported to SRLDC and SRPC. This record shall be archived for a period of three years by each concerned agency.

e) Remedial action shall be taken by the concerned substation/ Protection department immediately to make the relays in time synchronization with reference to external time source.

f) All the new Grid elements/Bay extension shall have accurate and precise Time synchronization equipment.

7.2. **Disturbance Analysis and Reporting**

i) Immediately following an event (grid disturbance or grid incidence as defined in the CEA Grid Standards) in the system, the concerned user or SLDC shall inform SRLDC through voice message.

ii) Written flash report shall be submitted to SRLDC and appropriate SLDC by the concerned Transmission Licensee/Generating Company/User within eight (8) hours from Grid event.

iii) Disturbance Recorder (DR), station Event Logger (EL), Data Acquisition System (DAS) shall be submitted by the respective Transmission licensee and Generating Company within twenty-four (24) hours from Grid event. These records shall be uploaded by the respective Transmission licensee and Generating Company in the Web Based Tripping Portal of SRLDC.

iv) SRLDC shall classify the grid incidents and grid disturbances according to CEA (Grid Standards) Regulations, amended to date. SRLDC shall report the event (grid disturbance or grid incidence) to CEA, SRPC and all regional entities within twenty-four (24) hours of receipt of the flash report.

v) After a complete analysis of the event, the Transmission licensee and Generating Company/User shall submit a detailed report in the case of grid disturbance or grid incidence within one (1) week of the occurrence of event to SRLDC and SRPC.

vi) SRLDC shall prepare a draft report of each grid disturbance or grid incidence including simulation results and analysis which shall be discussed and finalized in the PCSC meetings of SRPC as per the timeline specified in Table below.

Sl. No	Grid Event (GD/GI Classification as per the CEA Grid Standards)	Flash report submission deadline (Users/ SLDC)	Disturbance record and station event log submission deadline by Users/ SLDC)	Detailed report and data submission deadline by Users/ SLDC)	Draft report submission deadline by SRLDC	Discussion in PCSC and final report submission deadline by SRPC
1	GI-1/GI-2	8 hours	24 hours	+7 days	+7 days	+60 days
2	Near miss event	8 hours	24 hours	+7 days	+7 days	+60 days
3	GD-1	8 hours	24 hours	+7 days	+7 days	+60 days
4	GD-2/GD-3	8 hours	24 hours	+7 days	+21 days	+60 days
5	GD-4/GD-5	8 hours	24 hours	+7 days	+30 days	+60 days

vii) The analysis reports submitted by SRLDC shall be discussed in the Protection Coordination Sub-Committee (PCSC) meetings of the SRPC. The PCSC shall identify the lessons learnt during the events being discussed. The PCSC shall scrutinize the correctness of operation of subject protection systems put in place by the concerned Constituents and the final analysis repot along with the recommendations shall be concluded. It shall also recommend the appropriate remedial measures for system improvement.

viii) The implementation of the recommendations of the final report shall be monitored by the PCSC of SRPC.

ix) Any additional data such as

- Single line diagram (SLD)
- Protection relay settings,
- HVDC transient fault record,
- Location of fault with distance
- Fault details with type & relay indications
- CT/PT/CVT rating details with location

- Bus-bar arrangement/ Configuration of feeders
- CB positions (OPEN/ CLOSE) at the time of fault
- Isolator & Earth-switch positions (OPEN/CLOSE)
- Voltage, frequency & power flows with direction at the time of fault
- DR&EL records
- switchyard equipment

and any other relevant station data required for carrying out analysis of an event by SRPC, SRLDC and concerned SLDC shall be furnished by the Users including SRLDC and respective SLDC, as the case may be, within forty- eight (48) hours of the request. All Users shall also furnish high-resolution analog data from various instruments including power electronic devices like HVDC, FACTS, renewable generation (inverter level or WTG level) on the request of SRPCs, NLDC, SRLDCs or SLDCs.

x) Triggering of STATCOM, TCSC, HVDC run-back, HVDC power oscillation damping, generating station power system stabilizer and any other controller system during any event in the grid shall be reported to the SRLDC and SRPC if connected to ISTS and to the concerned SLDC if connected to an intra-state system. The transient fault records and event logger data shall be submitted to the SRLDC or concerned SLDC within 24 hours of the occurrence of the incident. Generating stations shall submit 1 second resolution active power and reactive power data recorded during oscillations to SRLDC or concerned SLDC within 24 hours of the occurrence of the oscillations.

xi) A monthly report on events of unintended operation or non-operation of the protection system shall be prepared and submitted by each user/owner of important elements in the regional grid, as identified by the appropriate forum of SRPC including those in the State grids that are critical for regional grid operation to SRPC and SRLDC within the first week of the subsequent month.

xii) The detailed analysis reports shall be archived periodically. The archive shall be retained for a period of three years by each concerned agency.

8. Protection Audit Plan

i) All Users/Entities connected at 220 kV and above, shall conduct internal audit, as per the prescribed audit checklist, of their protection systems annually, and any shortcomings identified shall be rectified and informed to SRPC. The audit report along with action plan for rectification of deficiencies detected, if any, shall be shared with SRPC.

ii) All Users /Entities shall also conduct third party protection audit of each sub-station at 220 kV and above once in five years.

iii) After analysis of any event, PCSC of SRPC may identify a list of substations / and generating stations where third-party protection audit is required to be carried out and accordingly advise the respective users to complete third party audit within three months.

iv) The third party audit report shall contain all the information as in *Annexure-1(Third Party Protection System Checking & Validation Template for a Substation) of CERC (Indian Electricity Grid Code), Regulations 2023).* The protection audit reports, along with action plan for rectification of deficiencies detected, if any, shall be submitted to the respective SRPC and SRLDC or respective SLDC, as the case may be, within a month of submission of third party audit report. The necessary compliance to such protection audit report shall be followed up regularly in the PCSC meetings of SRPC.

v) SRPC shall keep all compliance monitoring reports/audit reports at least for five years.

vi) Annual audit plan for the next financial year shall be submitted by the Users/entities to SRPC by 31st October of every year. The users shall adhere to the annual audit plan and report compliance of the same to SRPC.

9. Performance Monitoring of the Protection Systems

9.1. Users/Entities shall submit the following protection performance indices of previous month to SRPC and SRLDC on monthly basis for 220 kV and above by 15th # of the subsequent month and the same shall be reviewed in the ensuing PCSC meeting of SRPC.

[#amended as per the MoM of 111th PCSC Meeting held on 05.10.2023]

a) The Dependability Index defined as

$$D = \frac{N_C}{(N_C + N_F)}$$

Where, N_C is the number of correct operations at internal power system faults and N_F is the number of failures to operate at internal power system faults.

b) The Security Index defined as

$$S = \frac{N_C}{(N_C + N_U)}$$

Where, N_C is the number of correct operations at internal power system faults and N_U is the number of unwanted operations.

c) The Reliability Index defined as

$$R = \frac{N_C}{(N_C + N_I)}$$

Where, N_C is the number of correct operations at internal power system faults and N_I is the number of incorrect operations and is the sum of N_F and N_U

9.2. Users/Entities shall furnish the reasons for performance indices less than unity of individual element wise protection system to the SRPC and action plan for corrective measures. The action plan will be followed up regularly in the PCSC Meetings.

10. Compliance Monitoring

10.1. The Protection Protocol of SR shall be reviewed as and when required, in consultation with the stakeholders of the Southern Region.

10.2. Violation of the Protection Protocol of the Southern Region shall be brought to the notice of SRPC by the SRLDC or concerned SLDC, as the case may be.

10.3. In case any User/Entity fails to comply with the Protection Protocol or fails to undertake remedial action identified by the PCSC of SRPC within the specified timelines, the SRPC would approach the Commission with all relevant details for suitable directions.

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The SOP of the NPC is enclosed at Annexure 1.2

Roles and Responsibilities:

All utilities of WR connected with ISTS system should plan the TPPA of the substations in their control area and submit it to WRPC.

WRPC & WRLDC to monitor the TPPA implementation of ISTS licensees and IPPs substations.

SLDCs to monitor the TPPA implementation of state-owned substations of GENCOs and TRANSCOs.

4) Protocol 4 : Database

The relay settings should be available at the STU-HQ/CTU for the State Substations/ISTS-substations and the same be forwarded to SLDCs/WRLDC, and WRPC for voltage levels of 400kV & above and ISTS lines (of all kV levels). A database of all the above elements of State and Inter-Regional network should be maintained at WRLDC/CTU/SLDC/STU/WRPC as the case may be (in addition to being maintained by respective utilities for their systems).

Roles and Responsibilities:

Implementation of this protocol should be done by All utilities of WR

Relay setting data maintaining responsibility : SLDCs/STU, CTU, WRLDC and WRPC

5) Protocol 5 : New Transmission line Element Integration

a) In case a new transmission line/element is to be synchronized first time, the new element entity should approach respective CTU/STU/concerned utility where it is getting connected, for getting details of line parameter at remote end, and the distance relay's settings and zone timings.

b) The utilities at the remote end should provide the relay settings at their end along with the requisite data for carrying out protection setting of the new transmission line/element.

c) The Bus fault levels of the incidental system to the new elements shall be provided by WRLDC/SLDC, as the case may be, to the utility proposing to connect the new element.

d) The new utility shall then arrive at their settings for distance relays zone reach and timings and for that it shall adopt the overall settings of distance relay as per the guidelines approved in *"Model Setting Calculations for typical IEDs, Line Protection Setting guide lines, Protection System Audit check list, Recommendations for Protection Management sub-Committee on Relay/Protection under Task Force for Power System Analysis under Contingencies" report and the CBIP guidelines on protection system relaying.*

e) The zone reaches and timings shall have to be suitably coordinated with the settings adopted in the remote stations. The settings at the remote S/Ss be modified in line with guidelines provided in *"Model Setting Calculations for typical IEDs, Line Protection Setting guide lines, Protection System Audit check list, Recommendations for Protection Management sub-Committee on Relay/Protection under Task Force for Power System Analysis under Contingencies" report and the CBIP guidelines on protection system relaying.*

f) The new Utility shall consult with all the remote end Utilities, and the setting revisions shall be agreed by all these Utilities. The agreement of these settings be conveyed to WRLDC/WRPC for getting the new element connected to ISTS. WRLDC based on the above information shall allow integration of new element in the system.

g) These settings shall be forwarded to WRLDC/SLDC and with copies to CTU/STU/concerned utility and WRPC.

h) The agreed settings shall be as an interim arrangement which is required to ratified in PCM of WR. The Utility concerned should put up the settings of its system (new element) and remote end settings to WRPC before the next PCM, for getting this approved in PCM of WR.

i) For doubts or disagreement, if any, the matter can be referred to WRPC PCM, after adopting interim settings as above.

Roles and Responsibilities:

(i) New Utility:

- should consult the settings with the remote end Utilities and get it agreed among themselves.
- Should submit the proposed settings of their end to all the remote end utilities.
- Should get the settings agreed among all the remote end utilities. This shall be treated as interim settings. The agreement shall be conveyed to WRLDC/WRPC for time first time charging.
- The settings adopted and change in remote end settings along with all the parameters considered for the settings be conveyed to WRPC before the next PCM for including it as agenda point in PCM.

(ii) WRLDC:

- After receipt of agreement of all the remote end Utilities and relevant data (as given under (i) above), WRLDC shall allow integration of the new element in the system.

(iii) WRPC :

- In case of disagreement of the settings, after receipt of such communication from the new entity shall arrange meeting of all the stake holders to resolve the issue.

6) Protocol 6: Network changes

In case of any network changes such as due to Protocol 5 above or otherwise, the existing utilities need to review the reaches and timings for the distance relay. For this the utility whose substation configuration is getting changed due to the network change/ addition, shall indicate to all remote ends and next to remote ends S/Ss, the new configuration of their network along with line lengths, conductor configuration etc. and their existing zone reaches and timings. It is then the responsibility of all the utilities, to apply the reaches (as per the guidelines provided in *"Model Setting Calculations for typical IEDs, Line Protection Setting guide lines, Protection System Audit check list, Recommendations for Protection Management sub-Committee on Relay/Protection under Task Force for Power System Analysis under Contingencies" and the CBIP guidelines on protection*

system relaying. Revise time settings so that it is coordinated for lines from their S/S for the changed configuration. They shall follow the proposer/approver model as per Protocol (1).

Roles and Responsibilities:

(i) Utility/Utilities incidental to the network changes:

- should consult the settings with the remote end Utilities and get it agreed among themselves.
- Should submit the proposed settings of their end to all the remote end utilities.
- Should get the settings agreed among all the remote end utilities. This shall be treated as interim settings. The agreement shall be conveyed to WRLDC/WRPC.
- The settings adopted and change in remote end settings along with all the parameters considered for the settings be conveyed to WRPC before the next PCM for including it as agenda point in PCM.

(ii) WRLDC:

- After receipt of agreement of all the remote end Utilities and relevant data (as given under (i) above), WRLDC shall allow change of configurations in the system.

(iii) WRPC:

- In case of disagreement of the settings, after receipt of such communication from the new entity shall arrange meeting of all the stake holders to resolve the issue.

7) Protocol 7 :

a) The Protocol 5 & 6, envisages in a detailed manner what data shall be provided and by whom. The responsibility of adopting a setting in line with *"Model Setting Calculations for typical IEDs, Line Protection Setting guide lines, Protection System Audit check list, Recommendations for Protection Management sub-Committee on Relay/Protection under Task Force for Power System Analysis under Contingencies" and the CBIP guidelines on protection system relaying,* rests with the utility, for which the Utility should be provided

with the required data. The utility shall accordingly set the relays and convey the settings along with relevant data considered for arriving at the settings be conveyed to WRLDC/WRPC CTU & STU/SLDC. The settings/revision of settings adopted by the Utilities be agreed among themselves and the settings are only for the interim period (from the time the new element/network changes of the new utility or existing utility, till the next PCM). The final settings will be approved in the PCM.

b) Further if it is not a new utility, then existing STU/SLDC/CTU/WRLDC/utilities are responsible for their jurisdictions. The main purpose is to establish a procedure for coordination of the settings among utilities of WR regarding the protection relay settings.

c) In case of complicated settings changes or disagreement among the Utilities concerned, then a small group of PCM members can meet and decide the interim settings and put up in the next PCM. Once the PCM vets these settings the settings approved in PCM shall be a permanent arrangement.

d) The whole idea is to guide a new utility to adopt the settings as per guidelines provided in *"Model Setting Calculations for typical IEDs, Line Protection Setting guide lines, Protection System Audit check list, Recommendations for Protection Management sub-Committee on Relay/Protection under Task Force for Power System Analysis under Contingencies" and the CBIP guidelines on protection system relaying* for the flow of information.

8) Protocol 8: Vetting of the settings:

a) All the Utilities whose setting are getting because of integration of new element, changes in network shall be responsible putting up an agenda point to PCM.

b) PCM shall vet the settings and recommend for final setting implementation.

c) Utilities concerned shall submit all the relevant data assumed for arriving the interim setting and final setting.

d) They shall also submit the Raw Relay setting files of interim and final settings immediately after implementation of the same to WRPC and WRLDC for updating the relay setting database of WRPC & WRLDC.

Roles and Responsibilities:

All Utilities concerned.

Procedure for Approval of Protection Settings in Northern Region

(Finalized in 50th PSC meeting held on 29.04.2024)

1. ISTS users shall submit proposal for new/revised protection settings to NRLDC and similarly non-ISTS users shall submit to concerned SLDCs in the prescribed formats (of NRLDC/SLDC) in 2 weeks advance.
2. Further, NRLDC/SLDC (as the case may be) will scrutinize the proposal and any deficiency/additional data may be asked by NRLDC/NLDC. If required, NRLDC/SLDC may convene a meeting/interaction with stakeholders.
3. After scrutiny, NRLDC/SLDC will convey to user within 10 days (after receiving proposal) the accepted settings for implementation at site.
4. After implementation of approved settings, stakeholder will intimate to NRPC Secretariat via e-mail at seo-nrpc@nic.in within a fortnight.
5. NRLDC/SLDCs shall place all accepted settings as agenda in upcoming PSC meeting for final approval of forum.

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Annexure-XXI

HPPTCL-PLG-/9/2023-Planning Cell-HPPTCL HQ/374853/2024

I/374853/2024

HIMACHAL PRADESH POWER TRANSMISSION CORPORATION LTD.

(A State Govt. Undertaking)
Regd. Office: HimfedBhawan, New ISBT Road, Panjari, Shimla-171005
Ph.:- 0177-2831283, 2831284 FAX:-0177-2831284
Web: - www.hpptcl.com
(CIN):U40101HP2008SGC030950
(GSTIN):02AACCH1548M1ZP

Date 27/03/2024

The

Member Secretary,
NRPC,
18-A, Shaheed Jeet Singh Marg, Katwaria Sarai,
New Delhi-110016

Sub: Review of SPS scheme No. SPS/NR/GEN/01 SPS for reliable evacuation of power from NJPS, Rampur, Sawra Kuddu, Baspa Sorang and Karcham Wangtoo HEP- Regarding agenda for 49TCC & 72nd NRPC.

Sir,

HPPTCL had submitted the subject cited agenda for inclusion in 216th OCC committee vide email dated- 06.02.2024. The agenda item was not included in 216th OCC meeting. It is requested that matter may please be placed in upcoming **49TCC & 72nd NRPC for deliberations and discussions. The agenda item is attached along with for necessary action at your end please.**

Yours Faithfully

DGM (Plg & IT)
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Panjari, Shimla -05
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Agenda: Review of SPS scheme No. SPS/NR/GEN/01 SPS for reliable evacuation of power from NJPS, Rampur, Sawra Kuddu, Baspa Sorang and Karcham Wangtoo HEP.

BACKGROUND:

The System Protection Scheme is currently in operation i.r.o. reliable evacuation of the generation of Sawra Kuddu, Rampur, Karcham, Baspa, Sorang & Jhakri HEP, six outgoing circuits two from Jhakri/ Gumma, two from Rampur and two from Karcham Wangtoo are being used to evacuate power of these projects , which is adequate to take care of 'N-1' contingency of outgoing lines from Karcham/Jhakri/ Gumma & Rampur. The total injection of complex is as follows-

Sr. No.	Name of Project	Capacity including 10% O/L
1.	Baspa	330
2.	Karcham Wangtoo	1200
3.	Sorang	110
4.	Nathpa Jhakri	1650
5.	Rampur	453
6.	Sawra Kuddu	122
7.	Natwar Mori	66
8.	Small IPPs replecting at Gumma	55
9.	Max injection Wangtoo	150
10.	Total	4136

The modelling of SPS under operation is as follows-

1. **Case-1:** Load on any of the lines at Jhakri, Rampur or Gumma towards Nalagarh or Panchkula exceeds 850 MW.

   Action: Trip 1 unit of Karcham Wangtoo HPS, 1 unit of Jhakri HEP, 1unit of Rampur HEP and 1 unit of Sawra Kuddu (Gumma) HEP.

2. **Case-2:** 400 kV bus voltage at Karcham Wangtoo drops below 395 kV.

Action : Trip 2 units of Karcham Wangtoo HPS.

3. **Case-3:** Any two outgoing lines of Jhakri (Jhakri-Rampur or Jhakri Gumma) or Rampur HPS (Rampur-Nalagarh D/C) or Gumma (Gumma-Panchkula) trip except in case of tripping of one ckt of 400 kV Jhakri-Gumma and one ckt of Gumma-Panchkula ckt or one ckt of Jhakri-Rampur and one ckt of RampurNalagarh ckt.

Action-1: Trip 2 units of Jhakri

Action-2: 2 units of Rampur HPS and

Action-3: 2 units of Karcham Wangtoo HPS

Action-4: 2 units of Sawra Kuddu (Gumma) HPS

No need to trip 2 units of Sawra-Kuddu HEP in case of tripping of 400kV JhakriGumma D/C as Sawra Kuddu generation will evacuate easily through 400 kV Gumma-Panchkula D/C.

4. **Case-4:** Both Karcham Wangtoo-Wangtoo(HP) lines trip or 400 kV Wangtoo(HP)-Kala Amb and 400kV Wangtoo(HP)-Sorang trip.

Action: Trip 2 units of Karcham Wangtoo HPS.

5. **Case-5:** Power Flow of any outgoing line of Rampur or Jhakri or Gumma Substation exceed by 800MW.

Action: Initiate the Alarm to the operators at Jhakri, Rampur, Karcham Wangtoo, Sorang HEP & Sawra Kuddu HEP.

6. **Case-6:** Both 400kV Kala Amb-Abdullapur lines trip or 400 kV Wangtoo(HP)- Kala Amb and 400kV Sorang HEP- Kala Amb trip.

Action: Trip 2 units of Karcham Wangtoo HPS & 1 unit of Sorang HEP.

The three corridors are as follows-

1. 400 kV D/C Jhakhri-Gumma-Panchkula- Abdullapur (Triple Snowbird)
2. 400 kV D/C Jhakri- Rampur- Nalagarh (Triple Snowbird)

3. 400 kV Karcham Wangtoo- Wangtoo-Kala Amb- Abdullapur (Quad Moose)
4. 400 kV interconnecting line between Nathpa Jhakhri and Karcham Wangtoo (Triple Snowbird).

As such there are two 400 kV D/C triple snowbird corridors to Nalagarh and Panchkula respectively and One 400 kV Quad Moose Corridor to Abdullapur/Kala Amb from Karcham Wangtoo interconnected with Jhakhri through 400 kV D/C triple snowbird line. The triple snowbird lines under N-1 contigency shall be sufficient to carry around **1500 to 1600 MVA power at 45 Degree Ambient Temperature and 85 Degree conductor temperature**. The 400 kV Quad Moose has capacity to transfer 2100 MVA to 2200 MVA at **45 Degree Ambient Temperature and 85 Degree conductor temperature** power under N-1 contigency. The limit of 850 MW load on any of the 400 kV triple Snowbird line from Jhakri, Rampur or Gumma towards Nalagarh or Panchkula seems to be on highly conservative side. It is therefore proposed that these limits may be got reviewed keeping in view the overall transmission system. Review of these limits can result in-

1. Removal/Revison of SPS from the generation complex of various HEPs in the region thereby ensuring no loss of generation.
2. Avoiding construction of 400 kV Trasnmission line from 400/220 kV Wangtoo Substation to Panchkula. (Planned for evacuation of Hydro projects in upper Satluj Basin). This apart from savings on account of Capital investcmcnt shall also save valuable R.O.W.

Proposal- Considering above it is proposed that SPS scheme No. SPS/NR/GEN/01 for reliable evacuation of power from NJPS, Rampur, Sawra Kuddu, Baspa Sorang and Karcham Wangtoo HEP in state of Himachal Pradesh may be got reviewed keeping in view present system conditions.

Annexure-XXII ~~Annexure-I~~

Status of actions points recommended during 49 PSC meeting (to be discussed in 50 PSC meeting)			
Agenda No.	**Agenda**	**Remdial actions recommended/agreed during 49 PSC meeting**	**Status of remedial ations taken (to be shared by concerned utility)**
A.12	Multiple elements tripping at 400/220kV Rosa (UP) on 07th Sept 2023, 12:37 hrs	UP-SLDC may share the report of third-party protection review conducted at 220kV Rosa (UP).	
	Multiple elements tripping at 220kV Kunihar(HP) on 06th Sept 2023, 06:44 hrs	HP shall expedite the conduct of third-party protection audit of 220kV Kunihar, Baddi S/s and submit the report to NRPC/NRLDC. Necessary corrective action needs to be taken to minimise occurrence of such events	
	Multiple elements tripping at 220kV Hissar_IA(Har) Station on 05th October 2023, 09:28 hrs	Haryana & BBMB shall expedite the Implementation of line differential protection in 220kV Hissar_IA- Hissar(BBMB) ckt-1&2.	
	Multiple elements tripping at 400kV Uri-I & Uri-II (NHPC) on 14th October 2023, 04:23 hrs	POWERGRID and NHPC shall review the over current protection in 400kV Uri-II-Uri-I ckt. As per NR protection philosophy, phase over current protection shouldn't be kept in 220kV & above line.	
	Multiple elements tripping at 400kV Dadri (NTPC) and Dadri HVDC on 04th November 2023, 04:03 hrs	NTPC shall review the nomenclature of bus name in PMU & SCADA in coordination with POWERGRID	
	Multiple elements tripping at 220kV Ropar GGSTP (Guru Gobind Singh TPS) on 30th November 2023, 06:51 hrs	Single phase autoreclsoing need to be enabled at Ropar end to avoid undesired tripping of line during transient fault.	

Status of Bus bar protection				
Constituent Name	**Name of Station**	**Status of Bus bar protection(as reported)**	**Expected date of revival(as reported)**	**Present Status**
Uttarakhand	220 KV Substation, Ramnagar, Roorkee	Blocked due to more elements added at 220 KV Voltage level.		
	220 KV Sub Station, SIDCUL, Haridwar			
	220kV Jhajhra, Dehradun	Not commissioned yet		
	400KV Kashipur (220kV side)	Available but Non operational	31-Mar-24	Work is under process.
	220kv Haldwani	Not Available	31 December 2024	Budget for FY 2023-24.
	220kv Pantnagar	Available but Non operational	31-Mar-24	Work is under process.
	220kV Rishikesh	Available but Non operational	31 December 2024	It has been Taken in Budget for FY 2023-24.
	220kV Chamba	Not commissioned yet	31 December 2024	It has been Taken in Budget for FY 2023-24.
Haryana	**220kV S/Stn Badshahpur**	**Installed and Operational**		**Commissioned on 20.02.2023**
	220kV S/Stn Sec-52A, Gurgaon	Not Installed	31.03.2024	Panel has been installed. Commissioning pending due to non- availability of shutdown.
	220kV S/Stn Sec-1 Manesar	**Installed and Operational**		**Commissioned on 26.02.2023**
	220kV S/Stn Panchgaon	**Installed and Operational**		**Commissioned on 05.01.2024**
	220kV S/Stn Rewari	Not Installed	31.03.2024	Material is not allocated so far. Installation will be carried out after allocation of material.
	220kV S/Stn Narnaul	Not Installed	31.03.2024	Panel has been installed. Work in progress on turnkey basis. Isolators of 220 kV TFs have to be replaced thereafter the work shall be completed.
	220kV S/Stn Mohinder Garh	**Installed and Operational**		**Commissioned on 28.10.2023**
	220 KV S/Stn Palwal	Not Installed	30.06.2024	Panel has been installed. Commissioning is pending.
	220 KV S/Stn Rangala Rajpur	**Installed and Operational**		**Commissioned on 22.06.2023**
	220 kV Unispur	Installed but Non-Operational	31.03.2024	5 Nos. Peripheral relay of bus bar protection are defective. The same shall be made operational by 31.03.2024.
	220 kV Nissing	Installed but Non-Operational	31.03.2024	Existing Bus bar panel is of old and obsolete design. New Bus Bar protection scheme panel has been drawn from the store & Commissioning& installation are pending. The same shall be made operational by 31.03.2024.
	220KV Pehowa	Installed but Non-Operational	31.03.2024	Old & Obsolete, Allocation of New BBP and allied material awaited.
	220kV Kaithal	Not Installed	31.03.2024	Control Cable for Bus-Bar Protection Scheme has been drawn from DD Stores, 220kV Bus-Bar Protection panel is awaited.
	220 KV Sonepat	Not Installed	31.05.2024	220 KV Bus Bar Protection Scheme will be installed / commissioned within 45 days after the availability of the necessary material i.e 220kV Duplex, Directional, Bus Bar Cum Bus Coupler C and R Panel, Auxiliary Voltage 220V DC (without SAS) required for commissioning. It has been gathered from the P&M wing that the material is likely to be available in DD stores by April 2024.
	220 KV REGC, Sonepat	Not Installed	15.03.2024	The 220kV C&R Panel for Bus Bar Protection has been drawn from DD Store on dated 20.04.2023 and the work for installation of Bus Bar protection scheme is under progress. Erection work & wiring work completed with all respect. Testing of relays is pending at the end of Firm M/s Shifang and Bus Bar protection scheme will be commissioned dt 15.03.2024.
	220KV Jind	**Installed and Operational**		**Commissioned on dated 27.06.23.**
	220 KV Fatehabad	**Installed and Operational**		**Commissioned on dated 22.07.23**
	220 KV Hukmawali	Installed but Non-Operational	30.10.2023	Bus-coupler CB defective & new panel withdrawn from DD store. Errection work under progress & the same will be completed 31.08.23.
	220 KV Bhuna	Installed but Non-Operational	31.12.2024	The Siemens make Bus Bar protection Scheme installed at the time of commissioning of the substation went out of order. The higher authority decided to replace with new one. M/s Schneider make new Scheme was then allocated and drawn from DDS Ballabgarh and installed at site, but while testing of same, three out of four relays of the Bus Bar Panel found faulty for which matter is under pursuance with firm.
	220 KV Sirsa	Not Installed		Not required being single source of supply
	220 KV Rania	Not Installed	31.03.2024	Estimate for Bus Bar Protection is sanctioned but C&R panel is not available in store.
	220 KV Bhiwani	Not Installed	31.03.2024	Bus Bar Protection scheme has been proposed in integrated planning meeting and requirement of material have been generated in PR.
	220kV Madanpur	Not Installed	31.03.2024	Material is not allocated so far. Installation will be carried out after allocation of material.
	220kV Tepla	Installed but Non-Operational	31.03.2024	material allocation is awaited.
	220kV Rajokheri	Installed but Non-Operational	31.03.2024	The S/Stn. Is being constructed on turnkey, BBP has been installed. Commissioning is yet to be completed by the firm. Matter is taken up with bus-bar protection firm engineer for commissioning.
BBMB	**220kV Charkhi Dadri**	**Installed and Operational**		**commissioned on 31.01.2023**
	220kV Samaypur	**Installed and Operational**		**made operational on 23.12.2023**
	220kV Dhulkote	Not Installed		Not feasible
	220kV Jagadhari	Not Installed		
	220kV Barnala	Not Installed		
UP	220kV Parichha	Installed but Non-Operational	30.06.2023	
	220kV Partapur	Installed but Non-Operational	Jan-23	
	220kV Bareilly (400/220kV Bareilly)	Installed but Non-Operational	Dec-23	Old panel capacity exhausted. New relay panel supplied & need to be
	220kV Pilibhit	Not Installed	Dec-23	New Relay panel supplied & need to be commissioned by Service Engineer
	220kV Amariya	**Installed and Operational**		**commissioned on 15th July 2023**
	220kV Sultanpur	Installed but Non-Operational		Isolator contact status are not received due to damage of contacts on every
	220kV New Tanda	Not Installed		Busbar protection panel available on 03.03.2023 but not commissioned
	220kV Shahjhanpur	Installed but Non-Operational		NC/No switch status of bus isolator were improper & require control cable for
	220kV Ajijpur	Installed but Non-Operational		1. HV side 220kV CT of 160MVA T/F-I & II has bot proper ratio for bus bar
	220kV Nirpura	Installed but Non-Operational	Jan-23	
	220kV IITGNL	Installed but Non-Operational	Mar-23	
	220kV Rampur	Installed but Non-Operational	31.03.2024	
	220kV Barahua	Installed but Non-Operational		As Per Ex-En Transmission Approvel is Pending at HQ Level As Per Ex-En
	220kV Bansi	**Installed and Operational**		**commissioned on 10th August 2023**
	220 KV S/S Azamgarh-2(Bargahan)	Installed but Non-Operational		
	220kV Chandausi	**Installed and Operational**		**made operational on 13.10.2023**
	220kV Rampur	Installed but Non-Operational	30.04.2024	Main relay of bus bar protection is not working. Firm engineer visit is awaited
	220kV Sec. - 148, Noida	Installed but Non-Operational	31.01.2024	Work has been completed. Testing is due.
	220kV sec. 38A, Botanicla Garden	Not Installed	31.03.2024	Bus Bar protection panel not alloted
	220kV sec.-62, Noida	**Installed and Operational**		**made operational on 12.10.2023**
	220kV Dadri	Installed but Non-Operational	28.02.2024	Wiring work is in process.
	400kV S/S Agra	**Installed and Operational**		**commissioned on 13th September 2023**
	220kV S/S Bah	Not Installed		
	220kV Sirsaganj	Not Installed		
	220kV S/S Farrukhabad (New)	**Installed and Operational**		**commissioned on 25th August 2023**
	220kV Boner	Not Installed	31.03.2024	Tender under process
	220kV Kasganj (Soron)	**Installed and Operational**		
	220kV Khair	Installed but Non-Operational	31.03.2024	Tender under process; (New ICT-3 is not configured in bus bar relay)

	220kV Kidwainagar	Installed but Non-Operational		
	220kV Chhata	Installed but Non-Operational	31.03.2024	Tender under process; (New ICT-3 is not configured in bus bar relay)
	220kV Harduaganj	Installed but Non-Operational	31.12.2023	
	220kV Lalitpur	Not Installed	23-Apr	INSTALLATION IS NOT DONE DUE TO UNAVAILABLE OF CABLES. CABLE REQUEST HAS BEEN SENT TO LUCKONW HQ.
	220kV Sarnath	Installed but Non-Operational	Nov-23	
	220kV Sirathu, Kaushambi	Not Installed	Mar-23	
	220kV substation Fatehpur	Installed but Non-Operational	Mar-23	
	220kV S/S Bhelupur	Not Installed	Mar-23	
	220kV Hardoi Road, Lucknow	**Installed and Operational**		**commissioned on 08th October 2023**
	220kV CG City, Lucknow	Installed but Non-Operational	31.08.2023	Configurational error
	220kV Barabanki	Installed but Non-Operational	30.09.2023	Relay configuration is required for addtitional 220kV Jehta 1 &2 bays
	220kV Kursi Road, Lucknow	Installed but Non-Operational	30.09.2023	1- 87BB Auxilliary busbar relay at 160MVA T/F not available
	220kV BKT, Lucknow	Installed but Non-Operational	31.08.2023	Mian bus bar relay defective
	220kV Gomti Nagar, Lucknow	Installed but Non-Operational		Mal opoerating
	400 KV Substation Sarnath	**Installed and Operational**		**Now operational**
	220kV S/S Raja Talab	Installed but Non-Operational	15.11.2023	RELAY DEFECTIVE
	20kV S/S Harahua	Installed but Non-Operational	31.11.2023	NOT COMMISSIONED
	220kV S/S Sahupuri	Installed but Non-Operational	Requirement for panel has been raised,not received from	Defective
	220kV S/S Mirzapur	Not Installed	3 Month	-
	220kV Chamba	**Installed and Operational**		**commissioned in Jan-2024**
	220kV MattaSidh	Installed but Non-Operational	31.03.2024	Work in under progress
HP	220kV kangoo	Installed but Non-Operational		
	220kV Nangal	Installed but Non-Operational		
	220kV Katha Baddi	Installed but Non-Operational		
	220 KV S/S Kotlisurat Malhi	Not Installed		
	220 KV S/S Maur	Not Installed		
	220 KV S/S Science city	Not Installed		
	220 KV S/S Banga	Not Installed		
Punjab	220 KV S/S Hoshiarpur	Not Installed	31.03.2024	There is delay due to availability of OEM engineer
	220 KV S/S Goraya	Not Installed		
	220 KV S/S Badhni kalan	Not Installed		
	220 KV S/S Bhari	Not Installed		
	220 KV S/S Bhawanigarh	Not Installed		
	765 KV GSS Phagi	Installed but non operational		CU of Alstom make Bus-Bar is defective. Purchas case will be taken up
	220 kV GSS Vatika	Not installed		As M/s ER did not finished the project, so it was awarded to M/s Kaycee infra on risk-cost basis , however the bus bar scheme has not been commissioned yet. Matter has been taken up with firm
	220 kV GSS Niwana	Not installed		To be commissioned shortly
	220 kV GSS Alwar	Not installed	Dec-23	CU defective in existing ABB make Bus bar Scheme. Matter has been taken up with firm
	220 kV GSS Bansur	Not installed		To be commissioned shortly
	220 kV GSS Behror	Not installed		To be commissioned shortly
	220KV GSS Hindaun	Not installed		To be commissioned shortly
	220KV GSS Dooni	Not installed		To be commissioned shortly
	220KV GSS Bhawanimandi	Not installed		**commissioned**
	220 KV GSS Sakatpura, Kota	Not installed		Work is pending on the part of M/s GE and S.E. (T&C), RVPN, Kota due to defective Central Control Unit. CU will be send to firm for repair
	400 KV GSS Ajmer (220 KV BUS)	Installed but non operational		Isolator status of in 87BB of respective 220 KV bay No. 213,214, 215 & 216 was not avaliable due to this 220 KV Main Bus-bar-II is out of ckt. work under progress
	220 kV GSS, Beawar	Not installed		New Bus Bar protection commissioning work is ongoing of M/S Danish. Case has been taken up with firm
	220 KV GSS Jethana	Not installed		New Bus Bar protection commissioning work is ongoing of M/S Danish. To be commissioned shortly
	220 KV GSS Kuchaman City	Installed but non operational	Dec-23	due to problem in Central Unit Relay (87CU) Since 28.01.2022 , CU has been removed due to defective & replacement / repair under process at GSS Part. Case has been taken up with firm
	220 KV GSS Bherunda	Not installed		New Bus Bar protection commissioning work is ongoing of M/S Danish. To be commissioned shortly
	220 KV GSS Kuchera	Not installed		New Bus Bar protection commissioning work is ongoing of M/S Danish. To be commissioned shortly
	220 KV GSS Reengus	Installed but non operational		New Bus Bar Scheme has been proposed and approved for replacement from defective Bus-Bar Scheme. The Replacement work will be carried out by firm shortly
Rajasthan	220 KV GSS Laxmangarh	Not installed		**Commissioned**
	220KV GSS Khetri Nagar	Installed but non operational		The newly Bus bar protection scheme has been proposed and approved for replacement of deffective bus bar scheme. hence the work of replacement will be carried out by the firm shortly
	400 KV GSS, Babai	Installed but non operational	Dec-23	PU of 315 MVA ICT-III is defective with error code 0X83720007. Matter has been taken up with firm
	220 KV GSS Chittorgarh	Installed but non operational		All bay units of the BUS BAR scheme are defective. Matter has been taken up with firm
	400 KV GSS BHILWARA(220 KV BUS)	Installed but non operational		BAY UNIT OF 220 KV TBC DEFECTIVE. Matter has been taken up with firm
	220 KV GSS MANDALGARH	Not installed		**commissioned**
	220KV GSS Debari	Not installed		Going to be install / commission new bus bar protection scheme supply by Danish.
	220KV GSS Amberi	Not installed		Going to be install / commission new bus bar protection scheme supply by Danish.
	220KV GSS Madri	Not installed		Going to be install / commission new bus bar protection scheme supply by Danish.
	400 KV GSS Surpura (Jodhpur) 220 KV	Installed but non operational		Allotted & Panel Received
	400 KV GSS Akal (Jaisalmer) 220 KV	Installed but non operational		One PU defective. Case has been taken up with firm
	220 KV GSS Jodhpur	Installed but non operational		A&FS and TS issued. Case has been send for approval
	220 KV GSS NPH Jodhpur	Not installed		To be commissioned shortly
	220 KV GSS Badisid	Not installed	Dec-23	Allotted & Panel Received. To be commissioned shortly
	220 KV GSS Bhadla	Not installed		Allotted & Panel Received. To be commissioned shortly
	220 KV GSS Pali	Installed but non operational		New bays to be incorporated and GPS defective. work under progress
	220 KV GSS Ramgarh	Not installed		Allotted & Panel Received. To be commissioned shortly
	220 KV GSS Balotra	Installed but non operational		Isolator status issue. work under progress
	220 KV GSS Sayla	Not installed		Allotted & Panel Received. To be commissioned shortly
	400 KV GSS Bikaner 400 KV BUS	Installed but non operational		Not operational (Areva Make) Communication fiber error. Matter has been
	220 KV GSS Ratangarh	Not installed		Allotted & Panel Received. To be commissioned shortly
	220 KV GSS Sujangarh	Not installed		Allotted & Panel Received. To be commissioned shortly
	220 KV GSS Halasar	Not installed		Allotted & Panel Received. To be commissioned shortly
	220 KV GSS Tehandesar	Not installed		Allotted & Panel Received. To be commissioned shortly
	220 KV GSS Rawatsar	Not installed		Allotted & Panel Received. To be commissioned shortly

Status of Bus bar protection				
Constituent Name	**Name of Station**	**Status of Bus bar protection(as reported)**	**Expected date of revival(as reported)**	**Present Status**
Uttarakhand	220 KV Substation, Ramnagar, Roorkee	Blocked due to more elements added at 220 KV Voltage level.		
	220 KV Sub Station, SIDCUL, Haridwar			
	220kV Jhajhra, Dehradun	Not commissioned yet		
	400KV Kashipur (220kV side)	Available but Non operational	31-Mar-24	Work is under process.
	220kv Haldwani	Not Available	31 December 2024	Budget for FY 2023-24.
	220kv Pantnagar	Available but Non operational	31-Mar-24	Work is under process.
	220kV Rishikesh	Available but Non operational	31 December 2024	It has been Taken in Budget for FY 2023-24.
	220kV Chamba	Not commissioned yet	31 December 2024	It has been Taken in Budget for FY 2023-24.
Haryana	**220kV S/Stn Badshahpur**	**Installed and Operational**		**Commissioned on 20.02.2023**
	220kV S/Stn Sec-52A, Gurgaon	Not Installed	31.03.2024	Panel has been installed. Commissioning pending due to non- availability of shutdown.
	220kV S/Stn Sec-1 Manesar	**Installed and Operational**		**Commissioned on 26.02.2023**
	220kV S/Stn Panchgaon	**Installed and Operational**		**Commissioned on 05.01.2024**
	220kV S/Stn Rewari	Not Installed	31.03.2024	Material is not allocated so far. Installation will be carried out after allocation of material.
	220kV S/Stn Narnaul	Not Installed	31.03.2024	Panel has been installed. Work in progress on turnkey basis. Isolators of 220 kV TFs have to be replaced thereafter the work shall be completed.
	220kV S/Stn Mohinder Garh	**Installed and Operational**		**Commissioned on 28.10.2023**
	220 KV S/Stn Palwal	Not Installed	30.06.2024	Panel has been installed. Commissioning is pending.
	220 KV S/Stn Rangala Rajpur	**Installed and Operational**		**Commissioned on 22.06.2023**
	220 kV Unispur	Installed but Non-Operational	31.03.2024	5 Nos. Peripheral relay of bus bar protection are defective. The same shall be made operational by 31.03.2024.
	220 kV Nissing	Installed but Non-Operational	31.03.2024	Existing Bus bar panel is of old and obsolete design. New Bus Bar protection scheme panel has been drawn from the store & Commissioning& installation are pending. The same shall be made operational by 31.03.2024.
	220KV Pehowa	Installed but Non-Operational	31.03.2024	Old & Obsolete, Allocation of New BBP and allied material awaited.
	220kV Kaithal	Not Installed	31.03.2024	Control Cable for Bus-Bar Protection Scheme has been drawn from DD Stores, 220kV Bus-Bar Protection panel is awaited.
	220 KV Sonepat	Not Installed	31.05.2024	220 KV Bus Bar Protection Scheme will be installed / commissioned within 45 days after the availability of the necessary material i.e 220kV Duplex, Directional, Bus Bar Cum Bus Coupler C and R Panel, Auxiliary Voltage 220V DC (without SAS) required for commissioning. It has been gathered from the P&M wing that the material is likely to be available in DD stores by April 2024.
	220 KV REGC, Sonepat	Not Installed	15.03.2024	The 220KV C&R Panel for Bus Bar Protection has been drawn from DD Store on dated 20.04.2023 and the work for installation of Bus Bar protection scheme is under progress. Erection work & wiring work completed with all respect. Testing of relays is pending at the end of Firm M/s Shifang and Bus Bar protection scheme will be commissioned dt 15.03.2024.
	220KV Jind	**Installed and Operational**		**Commissioned on dated 27.06.23.**
	220 KV Fatehabad	**Installed and Operational**		**Commissioned on dated 22.07.23**
	220 KV Hukmawali	Installed but Non-Operational	30.10.2023	Bus-coupler CB defective & new panel withdrawn from DD store. Errection work under progress & the same will be completed 31.08.23.
	220 KV Bhuna	Installed but Non-Operational	31.12.2024	The Siemens make Bus Bar protection Scheme installed at the time of commissioning of the substation went out of order. The higher authority decided to replace with new one. M/s Schneider make new Scheme was then allocated and drawn from DDS Ballabgarh and installed at site, but while testing of same, three out of four relays of the Bus Bar Panel found faulty for which matter is under pursuance with firm.
	220 KV Sirsa	Not Installed		Not required being single source of supply
	220 KV Rania	Not Installed	31.03.2024	Estimate for Bus Bar Protection is sanctioned but C&R panel is not available in store.
	220 KV Bhiwani	Not Installed	31.03.2024	Bus Bar Protection scheme has been proposed in integrated planning meeting and requirement of material have been generated in PR.
	220kV Madanpur	Not Installed	31.03.2024	Material is not allocated so far. Installation will be carried out after allocation of material.
	220kV Tepla	Installed but Non-Operational	31.03.2024	allocation is awaited.
	220kV Rajokheri	Installed but Non-Operational	31.03.2024	The S/Stn. Is being constructed on turnkey, BBP has been installed. Commissioning is yet to be completed by the firm. Matter is taken up with bus-bar protection firm engineer for commissioning.
BBMB	**220kV Charkhi Dadri**	**Installed and Operational**		**commissioned on 31.01.2023**
	220kV Samaypur	**Installed and Operational**		**made operational on 23.12.2023**
	220kV Dhulkote	Not Installed		Not feasible
	220kV Jagadhari	Not Installed		
	220kV Barnala	Not Installed		
	220kV Parichha	Installed but Non-Operational	30.06.2023	
	220kV Partapur	Installed but Non-Operational	Jan-23	
	220kV Bareilly (400/220kV Bareilly)	Installed but Non-Operational	Dec-23	Old panel capacity exhausted. New relay panel supplied & need to be
	220kV Pilibhit	**Installed and Operational**		**commissioned on 28.10.2023**
	220kV Amariya	**Installed and Operational**		**commissioned on 15th July 2023**
	220kV Sultanpur	**Installed and Operational**		**commissioned on 02.03.2024**
	220kV New Tanda	**Installed and Operational**		**commissioned on 20.04.2024**
	220kV Shahjhanpur	Installed but Non-Operational	30.06.2024	Cable partially received, work will start soon
	220kV Ajijpur	Installed but Non-Operational		1. HV side 220kV CT of 160MVA T/F-I & II has bot proper ratio for bus bar
	220kV Nirpura	Installed but Non-Operational	Jan-23	
	220kV IITGNL	Installed but Non-Operational	Mar-23	
	220kV Rampur	Installed but Non-Operational	31.03.2024	
	220kV Barahua	**Installed and Operational**		**made operational on 28.01.2024**
	220kV Bansi	**Installed and Operational**		**commissioned on 10th August 2023**
	220 KV S/S Azamgarh-2(Bargahan)	**Installed and Operational**		**made operational on 28.01.2024**
	220kV Chandausi	**Installed and Operational**		**made operational on 13.10.2023**
	220kV Rasara	Not Installed		
	220kV Rampur	Installed but Non-Operational	Jun-24	1) Central unit of bus bar protection faulty 2) Bus bar relay fefective of 100MVA T/F-III
	220kV Sec. - 148, Noida	Installed but Non-Operational	31.01.2024	Work has been completed. Testing is due.

	220kV sec. 38A, Botanicla Garden	Not Installed		Panel allotment pending
	220kV sec.-62, Noida	**Installed and Operational**		**made operational on 12.10.2023**
	220kV Dadri	Installed but Non-Operational	Apr-24	Wiring work has been completed.BB relay testing is due.
UP	**400kV S/S Agra**	**Installed and Operational**		**commissioned on 13th September 2023**
	220kV S/S Bah	Not Installed		Requirement sent to design circle, awaited fro allotment.
	220kV Sirsaganj	Not Installed		Requirement sent to design circle, awaited fro allotment.
	220kV S/S Farrukhabad (New)	**Installed and Operational**		**commissioned on 25th August 2023**
	220kV Boner	**Installed and Operational**		**commissioned on 19.03.2024**
	220kV Kasganj (Soron)	**Installed and Operational**		
	220kV Khair	Installed but Non-Operational	30.04.2024	New 160MVA transformer-3 is not configured with bus bar
	220kV Kidwainagar	Installed but Non-Operational		
	220kV Chhata	Installed but Non-Operational	30.04.2024	New 160MVA transformer-3 is not configured with bus bar
	220kV Harduaganj	Installed but Non-Operational	31.12.2023	
	220kV Lalitpur	**Installed and Operational**		**commissioned on 09.02.2024**
	220kV Mahoba	Installed but Non-Operational		Relay is faulty since 29.01.2024
	220kV Sarnath	Installed but Non-Operational	Nov-23	
	220kV Sirathu, Kaushambi	Not Installed	Mar-23	
	220kV substation Fatehpur	**Installed and Operational**		Operational
	220kV S/S Bhelupur	Not Installed		Radial feeder
	220kV Hardoi Road, Lucknow	**Installed and Operational**		**commissioned on 08th October 2023**
	220kV CG City, Lucknow	Installed but Non-Operational	31.05.2024	Agency M/s. Electro Power is decided.
	220kV Barabanki	Installed but Non-Operational	31.05.2024	Agency M/s. Electro Power is decided. 02 no. Peripheral unit found defective.
	220kV Kursi Road, Lucknow	Installed but Non-Operational	31.05.2024	Retrofitting work of auxilliary relay completed. Dut to non-functioning of new
	220kV BKT, Lucknow	Installed but Non-Operational	31.05.2024	LOI issued on Dt. 28.02.24
	220kV Gomti Nagar, Lucknow	Installed but Non-Operational	31.05.2024	Agency M/s. Electro Power is decided.
	400 KV Substation Sarnath	**Installed and Operational**		**Now operational**
	220kV S/S Raja Talab	Installed but Non-Operational	May-24	Relay Defective, concern firm service engineer is awaited
	20kV S/S Harahua	Installed but Non-Operational	Jun-24	NOT COMMISSIONED
	220kv Rewa Road	Installed but Non-Operational	Jun-24	Due to Isolator & CB status not Proper. Informed to Transmission wing but they
	220kV S/S Sahupuri	Installed but Non-Operational	Jun-24	Defective, Requirement for New panel has been raised, not received from head
	220kv Robertganj	partillay operational	May-24	Line and bus coupler and T/F-I under cover but T/F-II not cover
	220kV S/S Mirzapur	Not Installed	Jun-24	Bubar Protection Panel has been Recived, construction of Tr
	220kV Chamba	**Installed and Operational**		**commissioned in Jan-2024**
HP	220kV MattaSidh	Installed but Non-Operational	31.03.2024	Work in under progress
	220kV kangoo	Installed but Non-Operational		
	220kV Nangal	Installed but Non-Operational		
	220kV Katha Baddi	Installed but Non-Operational		
	220 KV S/S Kotlisurat Malhi	Not Installed		
	220 KV S/S Maur	Not Installed		
	220 KV S/S Science city	Not Installed		
	220 KV S/S Banga	Not Installed		
Punjab	220 KV S/S Hoshiarpur	Not Installed	30.06.2024	Commissioning is in process.
	220 KV S/S Goraya	Not Installed		
	220 KV S/S Badhni kalan	Not Installed		
	220 KV S/S Bhari	Not Installed		
	220 KV S/S Bhawanigarh	Not Installed		
	765 KV GSS Phagi	Installed but non operational		CU of Alstom make Bus-Bar is defective. Purchas case will be taken up
	220 kV GSS Vatika	Not installed		As M/s ER did not finished the project, so it was awarded to M/s Kaycee infra on risk-cost basis , however the bus bar scheme has not been commissioned yet. Matter has been taken up with firm
	220 kV GSS Niwana	Not installed		To be commissioned shortly
	220 kV GSS Alwar	Not installed	Dec-23	CU defective in existing ABB make Bus bar Scheme. Matter has been taken up with firm
	220 kV GSS Bansur	Not installed		To be commissioned shortly
	220 kV GSS Behror	Not installed		To be commissioned shortly
	220KV GSS Hindaun	Not installed		To be commissioned shortly
	220KV GSS Dooni	Not installed		To be commissioned shortly
	220KV GSS Bhawanimandi	Not installed		**commissioned**
	220 KV GSS Sakatpura, Kota	Not installed		Work is pending on the part of M/s GE and S.E. (T&C), RVPN, Kota due to defective Central Control Unit. CU will be send to firm for repair
	400 KV GSS Ajmer (220 KV BUS)	Installed but non operational		Isolator status of in 87BB of respective 220 KV bay No. 213,214, 215 & 216 was not avaliable due to this 220 KV Main Bus-bar-II is out of ckt. work under progress
	220 kV GSS, Beawar	Not installed		New Bus Bar protection commissioning work is ongoing of M/S Danish. Case has been taken up with firm
	220 KV GSS Jethana	Not installed		New Bus Bar protection commissioning work is ongoing of M/S Danish. To be commissioned shortly
	220 KV GSS Kuchaman City	Installed but non operational	Dec-23	due to problem in Central Unit Relay (87CU) Since 28.01.2022 , CU has been removed due to defective & replacement / repair under process at GSS Part. Case has been taken up with firm
	220 KV GSS Bherunda	Not installed		New Bus Bar protection commissioning work is ongoing of M/S Danish. To be commissioned shortly
	220 KV GSS Kuchera	Not installed		New Bus Bar protection commissioning work is ongoing of M/S Danish. To be commissioned shortly
	220 KV GSS Reengus	Installed but non operational		New Bus Bar Scheme has been proposed and approved for replacement from defective Bus-Bar Scheme. The Replacement work will be carried out by firm shortly
Rajasthan	220 KV GSS Laxmangarh	Not installed		**Commissioned**
	220KV GSS Khetri Nagar	Installed but non operational		The newly Bus bar protection scheme has been proposed and approved for replacement of deffective bus bar scheme. hence the work of replacement will be carried out by the firm shortly
	400 KV GSS, Babai	Installed but non operational	Dec-23	PU of 315 MVA ICT-III is defective with error code 0X83720007. Matter has been taken up with firm
	220 KV GSS Chittorgarh	Installed but non operational		All bay units of the BUS BAR scheme are defective. Matter has been taken up with firm
	400 KV GSS BHILWARA(220 KV BUS)	Installed but non operational		BAY UNIT OF 220 KV TBC DEFECTIVE. Matter has been taken up with firm
	220 KV GSS MANDALGARH	Not installed		**commissioned**
	220KV GSS Debari	Not installed		Going to be install / commission new bus bar protection scheme supply by Danish.
	220KV GSS Amberi	Not installed		Going to be install / commission new bus bar protection scheme supply by Danish.
	220KV GSS Madri	Not installed		Going to be install / commission new bus bar protection scheme supply by Danish.
	400 KV GSS Surpura (Jodhpur) 220 KV	Installed but non operational		Allotted & Panel Received
	400 KV GSS Akal (Jaisalmer) 220 KV BUS	Installed but non operational		One PU defective. Case has been taken up with firm
	220 KV GSS Jodhpur	Installed but non operational		A&FS and TS issued. Case has been send for approval
	220 KV GSS NPH Jodhpur	Not installed		To be commissioned shortly
	220 KV GSS Badisid	Not installed		Allotted & Panel Received. To be commissioned shortly
	220 KV GSS Bhadla	Not installed	Dec-23	Allotted & Panel Received. To be commissioned shortly
	220 KV GSS Pali	Installed but non operational		New bays to be incorporated and GPS defective. work under progress
	220 KV GSS Ramgarh	Not installed		Allotted & Panel Received. To be commissioned shortly
	220 KV GSS Balotra	Installed but non operational		Isolator status issue. work under progress
	220 KV GSS Sayla	Not installed		Allotted & Panel Received. To be commissioned shortly
	400 KV GSS Bikaner 400 KV BUS	Installed but non operational		Not operational (Areva Make) Communication fiber error. Matter has been taken
	220 KV GSS Ratangarh	Not installed		Allotted & Panel Received. To be commissioned shortly
	220 KV GSS Sujangarh	Not installed		Allotted & Panel Received. To be commissioned shortly
	220 KV GSS Halasar	Not installed		Allotted & Panel Received. To be commissioned shortly
	220 KV GSS Tehandesar	Not installed		Allotted & Panel Received. To be commissioned shortly
	220 KV GSS Rawatsar	Not installed		Allotted & Panel Received. To be commissioned shortly

Annexure-XXV

~~Annexure-III~~

Status of protection relay type				
Constituent Name	**Name of Station**	**Element Name**	**Present Status**	**Remark**
Uttarakhand	220kV Rishikesh	SIDCUL line	Main-II is not installed	
		Chamba line		
		Dharasu line-2		
	220kV Chamba	Rishikesh line		
HP	220kV MattaSidh	220kV transformer bank-1 & 2	Static relay	
Rajasthan	220 kV GSS Sanganer	220 kV HEERAPURA	Static	
	220 kV GSS Phulera	220 KV HEERAPURA	Static	
		220 kV Makrana	Static	
	220 KV GSS CHOMU	220 kV Heerapura	Static	
		220 kV Reengus Line	Static	
	220 kV GSS Kukas	220 kV Manoharpur Line	Static	
		220 kV Alwar Line	Static	
	220kV GSS Dausa	220 kV SawaiMadhopur Line	Static	
		220 kV Bassi-I Line	Static	
		220 kV Bassi-II Line	Static	
		220 kV Alwar Line	Static	
		220 kV Mandawar Line	Static	
	220KV BHARATPUR GSS	220 KV DHOLPUR	Static	
	220 KV GSS SAKATPURA	220 kV ANTA(NTPC)	Static	
	220 KV DAHRA	220 kV BARAN	Static	
		220 kV SAKATPURA	Static	
	220KV GSS MODAK	220 kV RANPUR	Static	
		220 kV Jhalawar	Static	
	220 KV GSS JHALAWAR	220 kV Modak	Static	
	220KV GSS HINDAUN	220KV Sikrai Line	Static	relay defective
	220KV GSS DHOLPUR	220 kV DCPP	Static	
	220 KV GSS Reengus	220 KV Laxmangarh	Static	
	220 KV GSS Nagour	220KV NOKHA	Static	
		220KV KUCHERA	Static	
	220KV GSS Kankroli	220 KV PGCIL-I	Static	
	220 KV GSS SIROHI	220 KV (400) KV PGCIL Bhinmal	Static	
	220 KV GSS SIROHI	220 KV Jalore	Static	
	220 KV GSS BHINMAL	220 KV (400) KV PGCIL Bhinmal-I	Static	
	220 KV GSS BALI	220kV Sirohi	Static	
	220 KV GSS Suratgarh	220 KV STPS-I	Static	
		220 KV STPS-II	Static	
		220 KV Hanumangarh Line	Static	
	220 KV GSS Sri Ganganagar	220 KV Hanumangarh Line	Static	
	220 KV GSS Hanumangarh	220 KV Suratgarh	Static	
	220KV GSS Ratangarh	220KV Rawatsar	Static	
	220KV GSS Ratangarh	220KV Halasar	Static	
	220KV GSS Ratangarh	220KV InterConnector-I	Static	
	220KV GSS Ratangarh	220KV InterConnector-II	Static	
	220KV GSS Sujangarh	220KV Ratangarh	Static	
	220 KV GSS Bikaner	220 KV Badnu Line	Static	
	220 KV GSS Bikaner	220 KV Interconnector-I Line	Static	
	220 KV GSS Bikaner	220 KV Spare Line	Static	
	220kV Madanpur	220/66kV 100 MVA PTF T-1	Electromechanical	Working properly, need to be replace with numerical relay
		220/66kV 100 MVA PTF T-1 A	Electromechanical	Working properly, need to be replace with numerical relay
		220kV Bus-Coupler	Backup relay -Numerical all other relays are Electromechanical	Working properly, need to be replace with numerical relay
		220/66kV 100 MVA PTF T-1 A	Electromechanical Execept Differential relay (Numerical)	Working properly, need to be replace with numerical relay
	220 KV S/Stn Shahbad	100 MVA 220/66 KV T/F T-1	Electrostatic	Working properly, need to be replace with numerical relay
		220 KV Bus Coupler	Electrostatic	Working properly, need to be replace with numerical relay
		Incomer of 220/66 KV T/F T-1	Electrostatic	Working properly, need to be replace with numerical relay
		Incomer of 220/66 KV T/F T-2	Electrostatic	Working properly, need to be replace with numerical relay
	220 KV S/STnTepla	220KV Bus Coupler	Electromechanical	Working properly, need to be replace with numerical relay
	220KV S/Stn Jorian	220KV Jorian -DCRTPP Ckt-1	Main-1 & Main-2 = Numerical all other Electromechanical	Working properly, need to be replace with numerical relay
		220KV Jorian -DCRTPP Ckt-2	Main-1 & Main-2 = Numerical all other Electromechanical	Working properly, need to be replace with numerical relay
		220KV Jorian -Shahbad Ckt-1	Main-1 & Main-2 = Numerical all other Electromechanical	Working properly, need to be replace with numerical relay
		220KV Jorian -Shahbad Ckt-2	Main-1 & Main-2 = Numerical all other Electromechanical	Working properly, need to be replace with numerical relay
		220KV Jorian -Abdullapur Ckt-1	Main-1 & Main-2 = Numerical all other Electromechanical	Working properly, need to be replace with numerical relay

		220KV Jorian -Abdullapur Ckt-2	Main-1 & Main-2 = Numerical all other Electromechanical	Working properly, need to be replace with numerical relay
		220/66, 160MVA T/F T-1	Defferntial Relay = Numerical all other Electromechanical	Working properly, need to be replace with numerical relay
		220/66, 100MVA T/F T-2	All Electromechanical	Working properly, need to be replace with numerical relay
		220/66, 100MVA T/F T-3	Defferntial & REF Relay = Numerical all other Electromechanical	Working properly, need to be replace with numerical relay
	220 kv Salempur	220 KV BAKANA–SALEMPUR CKT-I	All electromechanical type,except DPR relays	Working properly, need to be replace with numerical relay
		220 KV BAKANA–SALEMPUR CKT-II	All electromechanical type,except DPR relays	Working properly, need to be replace with numerical relay
		220 KV SALEMPUR-NISSING CKT-I	All electromechanical type,except DPR relays	Working properly, need to be replace with numerical relay
		220 KV SALEMPUR-NISSING CKT-II	All electromechanical type,except DPR relays	Working properly, need to be replace with numerical relay
		220 KV BUS-COUPLER	All electromechanical type	Working properly, need to be replace with numerical relay
		220/66 KV 100MVA T/F T-I	All electromechanical type,except Differential relays	Working properly, need to be replace with numerical relay
		220/66 KV 100MVA T/F T-2	All electromechanical type,except Differential relays	Working properly, need to be replace with numerical relay
Haryana		220kV Nissing-PTPS Ckt-I	All electromechanical type,except DPR relays	
		100 MVA 220/132kV T-8	All electromechanical type,except Differential relay	Differential relay replcaed with Numerical type
		220 kV Bus-coupler	All electromechanical type	C&R panel will be replaced soon
	TS Division Karnal	220 KV DCRTPP–UNISPUR CKT-I	All electromechanical type,except DPR relays	
		220 KV DCRTPP–UNISPUR CKT-II	All electromechanical type,except DPR relays	
		220 KV KARNAL–UNISPUR LINE	All electromechanical type,except DPR relays	
		220/132 KV 100 MVA T/F T-1	All electromechanical type,except R.E.F & Differential relay	
		220/132 KV 100 MVA T/F T-2	All electromechanical type,except R.E.F & Differential relay	
		220/132 KV 160 MVA T/F T-4	All electromechanical type,except R.E.F & Differential relay	
	220kV S/Stn Palla	100MVA 220/66kV T-1	REF & backup Electromechnical	
		100MVA 220/66kV T-2	REF & backup Electromechnical	
		100MVA 220/66kV T-7	Diff & Backup lectromechnical and REF static	
		220kV Palla - Sector 78	backup Electromechnical	
		220kV Palla - FGPP ckt-II	backup Electromechnical	
	220 kV S/Stn. Pali	100 MVA 220/66 kV T-1	REF & backup Electromechnical	
		100 MVA 220/66 kV T-3	REF & backup Electromechnical	
		220 kV Pali-BBMB Samaypur Ckt 1	backup Electromechnical	
		220 kV Pali-BBMB Samaypur Ckt 2	backup Electromechnical	
		220 kV Pali-Sector 46 Ckt 1	backup Electromechnical	
		220 kV Pali-Sector 46 Ckt 2	backup Electromechnical	
		220 kV Pali-Sector 65 Ckt 1	backup Electromechnical	
		220 kV Pali-Badshahpur Ckt 2	backup Electromechnical	
		220 kV Pali-Sector 56 Ckt 1	backup Electromechnical	
		220 kV Pali-Sector 56 Ckt 2	backup Electromechnical	
	220kV S/Stn Palwal	220/66kV 160MVA T-1 T/F	REF & backup Electromechnical	
		220/66kV 100MVA T-2 T/F	Diff, REF & Backup Electromechnical	
		220kV Prithala Palwal Ckt I	backup Electromechnical	
		220kV Prithala Palwal Ckt II	backup Electromechnical	
	220kv S/Stn. Sector 52A GGM	Sec 56-Sec 52A ckt 1	NUMERICAL RELAY qty 02 and electromechanical qty 01 (backup)	LINE IS PROVIDED WITH 2 MAIN NUMERICAL DPR AND 01 ELECTROMECHANICAL FOR BACKUP
		Sec 56-Sec 52A ckt 2	NUMERICAL RELAY qty 02 and electromechanical qty 01 (backup)	LINE IS PROVIDED WITH 2 MAIN NUMERICAL DPR AND 01 ELECTROMECHANICAL FOR BACKUP
		Sec 72-Sec 52A	NUMERICAL RELAY qty 02 and electromechanical qty 01 (backup)	LINE IS PROVIDED WITH 2 MAIN NUMERICAL DPR AND 01 ELECTROMECHANICAL FOR BACKUP
		Sec 57-Sec 52A	NUMERICAL RELAY qty 02 and electromechanical qty 01 (backup)	LINE IS PROVIDED WITH 2 MAIN NUMERICAL DPR AND 01 ELECTROMECHANICAL FOR BACKUP
	220KV S/Stn. Sonepat		(Diff.-3 , REF-3, O/C/E/F-4 , Electromechnical Relays	The electromechanical differential and DPR are not available in the store. However, the same shall be replaced after availability in the store.
	220kV Rohtak		(REF-2, O/C/E/F-12) Electromechnical Relays	
	400 KV S/S Moradabad	400 KV MORADABAD - RAMPUR LINE	LBB- ABB(RAICA) / STATIC	UNDER PGCIL
		400 KV MORADABAD - KASHIPUR LINE	LBB- English Electric(CTIG) / Electromechnical	Will be replaced by July24
		400 KV, TRANSFER BUS	LBB- English Electric(CTIG) / Electromechnical	
		400 KV, BUS COUPLER	LBB- English Electric(CTIG) / Electromechnical	
	220kV S/S BARAUT	220/132kV 200MVA TRANSFORMER-1	REF Protection - Electromechanical	
	220kV S/S BAGHPAT	220/132kV 160MVA TRANSORMER-1	Backup (L.V. Side) - Electromechanical	
	220 kV KHURJA	220/132Kv 200MVA Transformer-I	REF-Static	
	220 kV DEBAI	220/132Kv 100MVA Transformer-I	Numerical	
	220 kV Jahangirabad	220/132Kv 160MVA Transformer-I	REF-Static	
	400KV S/S MURAD NAGAR	220KV LONI LINE	O/C & E/F RELAY IS ELECTROMECHANICAL.	
		220KV FARID NAGAR LINE	O/C & E/F RELAY IS ELECTROMECHANICAL.	
		220KV INTER CONNECTOR-I MURAD NAGAR LINE	O/C & E/F RELAY IS ELECTROMECHANICAL.	
		220KV INTER CONNECTOR-II MURAD NAGAR LINE	O/C & E/F RELAY IS ELECTROMECHANICAL.	
		220KV SAHIBABAD LINE	O/C & E/F RELAY IS ELECTROMECHANICAL.	

UP		220KV PRATAP VIHAR LINE	O/C & E/F RELAY IS ELECTROMECHANICAL.	
		220KV TBC	O/C & E/F RELAY IS ELECTROMECHANICAL.	
		400KV TBC	O/C & E/F RELAY IS ELECTROMECHANICAL.	
		400KV ALIGARH LINE	LBB RELAY IS ELECTROMECHANICAL.	
		400KV ATOUR LINE	LBB RELAY IS ELECTROMECHANICAL.	
	220KV S/S MURAD NAGAR	220KV BUS COUPLER	O/C RELAY IS ELECTROMECHANICAL	
	400KV S/S Gorakhpur	400KV TBC	Electromechanical	
		220KV TBC	Electromechanical	
	220KV S/S Barahua	220KV PGCIL	Back up relay electromechenical	
	220KV S/S Basti	220 KV Basti Tanda line	67N(2TJM12)(Electromechanical)	
		63MVA Transformer-II	HV Side directional o/c&e/f(Electromechanical)	
	400 KV SS Kasara,Mau	200MVA, 400/132KV ICT-1st	REF & Over flux relay Electromechanical	
		200MVA, 400/132KV ICT-2nd	REF & Over flux relay Electromechanical	
	220 KV SS Substation Hafizpur Azamgarh	160 MVA ICT -1	Electromechanical(EE Make)	Replaced with Siemens make numerical relay on 16.10.2023
	220kV Khara		Electromechanical	process of replacing electrochemical relay with numerical relay has been started, it will be completed within 2-3 months.
	220kV Gokul	160MVA ICT-1	Electromechanical (Diff and O/C)	New panels are available at S/s and replacement work is under process
	220kV Meetai	200MVA ICT-1	Electromechanical (E/F and O/C), Diff:Static	
		200MVA ICT-2	Electromechanical (E/F and O/C), Diff:Static	
	220kV Atrauli	160MVA ICT-1	Electromechanical + Numerical	Tender process is complete.
		160MVA ICT-2	Electromechanical + Numerical	
	220kV Mainpuri	160MVA ICT-1	Electromechanical(REF) + Numerical	New panels are available at S/s and replacement work is under process
		160MVA ICT-2	Electromechanical(REF) + Numerical	
	220kV Panki	220kV Bus coupler	Electromechanical	Under process
	400kV S/S Sultanpur	240 MVA ICT-II	Non Numerical	
		50 MVAR Obra Line Reactor	Non Numerical	
	220kV S/S Sultanpur	220kV B/C	Non Numerical	
		160 MVA T/F-I	Non Numerical	
NPCIL	220kV RAPPC	220KV Anta line	Backup relay: Static relay(RAPDK3)	Procurement of Numerical relay is in progress for replacement of Static relay (Backup protection).
	220kV NAPP	NAPP-SAMBHAL		Main-2 distance protection is under procurement. ECD- June2024
		NAPP-SIBHOLI		Main-2 distance protection is under procurement. ECD- June2024
		NAPP-DIBAI		Main-2 distance protection is under procurement. ECD- June2024
		NAPP-KHURJA		Main-2 distance protection is under procurement. ECD- June2024
		NAPP-ATRAULI		

Annexure-XXVI

~~Annex-IV~~

HVDC Champa-Kurukshetra Outages during 2024

S.No.	Category of Grid Disturbance (GD-I to GD-V)	Name of Elements (Tripped/Manually opened)	Affected Area	Owner/ Agency	Outage		Event (As reported)	Loss of generation / loss of load during the Grid Disturbance		Fault Clearance time (in ms)
					Date	Time		Generation Loss(MW)	Load Loss (MW)	
1	GI-2	1) 800 KV HVDC Kurukshetra(PG) Pole-01 2) 800 KV HVDC Kurukshetra(PG) Pole-02 3) 800 KV HVDC Kurukshetra(PG) Pole-03 4) 800 KV HVDC Kurukshetra(PG) Pole-04	Haryana	PGCIL	9-Jan-24	14:01	i) During antecedent condition, 800kV HVDC Champa-Kurukshetra Bipole was carrying total 2500MW (625MW each pole). ii) As reported at 14:00:20hrs, "commutation failure detected" and "Pole 4 Instability Detected by SSAD" protection latched in Pole 4 which initiated CAT A2 sequence for blocking of Pole 4 and isolated Pole 4 from parallel Pole 2. iii) Further after ~800msec of initiation of CAT A2 sequence by Pole 4 on Instability protection, opening sequence to HVHS at both ends didn't initiate which led to failure of protective isolation of faulty Pole 4 and generated CAT B alarm leading to tripping of parallel Pole 2 also. iv) Further at 14:01:17 hrs, "Instability detected" protection latched in Pole 1 also which initiated CAT A2 sequence for protective isolation from Pole 3. v) Further at 14:01:18hrs, like Pole 4, CAT A2 sequence in Pole 1 also failed to initiate HVHS opening leading to protective sequence failure which generated CAT B alarm that resulted in tripping of parallel Pole 3. vi) Due to tripping of all four (04) poles, power order reduced from 2500MW to 0MW. vii) As per PMU, fluctuation in power order was observed.	0	0	NA
2	GI-2	1) 800 KV HVDC Kurukshetra(PG) Pole-2 2) 800 KV HVDC Kurukshetra(PG) Pole-4	Haryana	PGCIL	2-Mar-24	19:24	i)During antecedent condition, 800kV HVDC Champa-Kurukshetra was carrying total 600MW (approx. 150MW by each Pole). ii)As reported at 19:24hrs, 800 KV HVDC Kurukshetra (PG) Pole-01 and Pole-03 tripped due to DC differential protection operated at Kurukshetra(PG) end (further details yet to be received form PowerGrid). iii)Due to tripping of two poles (Pole-01 and Pole-03), power shifted to other two Poles(Pole-02 and Pole-04) and power order remained same 600MW. iv)As per PMU, fluctuation in voltage was observed. v)As per SCADA, no change in demand is observed in Haryana control area.	0	0	NA
3	GI-2	1) 800 kV HVDC Kurukshetra(PG) Pole-02 2) 800 kV HVDC Kurukshetra(PG) Pole-04	Haryana	PGCIL	21-Mar-24	18:19	i)During antecedent condition, 800kV HVDC Champa-Kurukshetra was carrying total 1440MW (Pole 01- 490MW, Pole 02- 490MW, Pole 03- 230MW, Pole 04- 230MW). ii)As reported at 18:19hrs, 800 KV HVDC Kurukshetra (PG) Pole-02 and Pole-04 tripped due to DC supply failure from Champa end (further details yet to be received form PowerGrid). iii)Due to tripping of two poles (Pole-02 and Pole-04), power order reduced from 1440MW to 1370MW and shifted to the other two Poles. iv)As per PMU, fluctuation in voltage was observed. v)As per SCADA, no change in demand is observed in Haryana control area.	0	0	NA
4	GI-2	1) 800 kV HVDC Kurukshetra(PG) Pole-02 2) 800 kV HVDC Kurukshetra(PG) Pole-04	Haryana	PGCIL	27-Mar-24	15:04	i)During antecedent condition, 800kV HVDC Champa-Kurukshetra was carrying total 1460MW (approx. 365MW by each Pole). ii)As reported at 15:04hrs, 800 KV HVDC Kurukshetra (PG) Pole-02 and Pole-04 were blocked due to unavailability of Lane-1 and 2 caused by software issue at Champa end (further details yet to be received form PowerGrid). iii)Due to tripping of two poles (Pole-02 and Pole-04), power order slightly reduced from 1460MW to 1400MW and shifted to the other two Poles. iv)As per PMU, fluctuation in voltage was observed. v)As per SCADA, no change in demand is observed in Haryana control area.	0	0	NA
5	GI-2	1) 800 kV HVDC Kurukshetra(PG) Pole-02 2) 800 kV HVDC Kurukshetra(PG) Pole-04	Haryana	PGCIL	29-Mar-24	20:26	i)During antecedent condition, 800kV HVDC Champa-Kurukshetra was carrying total 1450MW (Pole 01- 725MW, Pole 02- 365MW, Pole 03- 0MW, Pole 04- 360MW). ii)As reported at 20:26hrs, 800 KV HVDC Kurukshetra(PG) Pole-02 and Pole-04 tripped due to unavailability of Lane-1 and 2 caused by software issue at Champa end. Further details yet to be received form PowerGrid. iii)Due to tripping of two poles (Pole-02 and Pole-04), power order reduced from 1450MW to 1370MW and shifted to the Pole-01. iv)As per PMU, fluctuation in voltage was observed. v)As per SCADA, no change in demand is observed in Haryana control area.	0	0	NA
6	GI-2	1) 800 kV HVDC Kurukshetra(PG) Pole-01 2) 800 kV HVDC Kurukshetra(PG) Pole-03	Haryana	PGCIL	7-Apr-24	18:07	i)During antecedent condition, 800kV HVDC Champa-Kurukshetra was carrying total 1940MW (approx. 485MW by each Pole). ii)As reported at 18:07hrs, 800 kV HVDC Kurukshetra (PG) Pole-01 blocked on T-zone protection operation at Kurukshetra end. iii)During the same time, 800 kV HVDC Kurukshetra (PG) Pole-03 also blocked on CAT-B sequence initiated by parallel Pole-01 due to latching of T-zone protection. iv)As further reported, sequence of event is as follows: a.17:52:34:291 –Pole-1 lane 2 to Bipole1 Lane 1 and Lane 2 Optic link was toggling (This link is used to transmit parallel pole data between Pole-1 and Pole-3) b.17:52:34:290 –Pole-1 lane 2 become unavailable c.17:57:48:481 – Pole-1 lane 2 Main 1 and Main 2, T-Zone protection got latched due to toggling of optic between Pole-1 Lane-2 and Bipole-1 d.18:07:13:502 – Pole-1 lane 2 become available automatically, due to already latched T-Zone protection, 2 out of 4 logic got satisfied after availability of Pole-1 Lane-2 and it initiated CAT B protection. e.18:07:13:502 – CAT-B got latched in Pole-1 lane 2 because of T-Zone protection f.18:07:13:639 – Pole-1 blocked g.18:07:13:594 – Pole-3 blocked v)Due to tripping of two poles (Pole-01 and Pole-03), power order reduced from 1940MW to 1855MW and shifted to the other two Poles. vi)As per PMU, fluctuation in voltage was observed. vii)As per SCADA, no change in demand is observed in Haryana control area. viii)As toggling of optics can be due to several reasons, so the 5003 card of Pole-1 Lane-2 where both the fiber were connected was replaced and Pole-1 Lane-2 was kept in maintenance mode for observation.	0	0.000	80

Annexure-XXVII

~~Annex-V~~

Status of Recording Instruments (220kV & above stations)						
Sr. No	Station Name	Voltage Level	Disturbance Recorder/Station Event logger healthy (Yes or No)	Standardisation (Yes or No)	Time Sync (Yes or No)	Remarks

Annexure-XXVIII

~~Annexure-VI~~

Tripping events to be discussed in 50th PSC Meeting

S.No.	Category of Grid Disturbance (GD-I to GD-V)	Name of Elements (Tripped/Manually opened)	Affected Area	Owner/ Agency	Outage		Event (As reported)	Loss of generation / loss of load during the Grid Disturbance		Fault Clearance time (in ms)	Remarks
					Date	Time		Generation Loss(MW)	Load Loss (MW)		
1	GI-2	1) 400/220 kV 500 MVA ICT 1 at Akal(RS) 2) 400/220 kV 500 MVA ICT 2 at Akal(RS) 3) 400/220 kV 315 MVA ICT 3 at Akal(RS) 4) 400/220 kV 500 MVA ICT 4 at Akal(RS)	Rajasthan	RVPNL	2-Jan-24	07:28	i) 400/220kV Akal(RS) has one and half breaker scheme at 400kV level and double main transfer bus scheme at 220kV level. ii) As reported, at 07:28hrs, 220 KV Akal(RS)-Bhu(RS) Ckt-1 tripped on B-N phase to earth fault due to heavy fog. iii) At the same time, 400/220 kV 500 MVA ICT-1, 2 & 4 and 315MVA ICT-3 at Akal(RS) also tripped. (Exact reason yet to be shared, but it is suspected that there is delay in CB opening due to which ICTs also got tripped. Also O/C protection settings of ICTs need to be shared.) iv) As per DR of 400/220 kV 500 MVA ICT 2 at Akal(RS), O/C E/F protection operated and fault current was Ib=~5.157kA. v) As per DR of 400/220 kV 315 MVA ICT 3 at Akal(RS), O/C E/F protection operated and fault current was Ib=~2.288kA. vi) As per SCADA SOE, 220kV Akal(RS)-Barmer(RS) Ckt also tripped during the same time. (Exact reason yet to be shared) vii) As per PMU at Jodhpur(RS), two consecutive B-N phase to earth faults are observed with delayed fault clearance time of 320ms and 1400ms respectively. viii) As per SCADA, change in demand of approx. 160MW is observed in Rajasthan control area. ix) As per SCADA, change in Rajasthan wind generation of approx. 690MW is observed.	690	160	1400	i)Fault was in 220 KV Akal(RS)-Bhu(RS) Ckt-1, but all four ICTs at Akal(RS) also tripped on this fault. Hence it is suspected that there is delay in CB opening due to which ICTs also got tripped. Exact reason of tripping along with O/C protection settings of ICTs need to be shared. ii)Reason of delayed clearance of fault need to be shared. iii)Exact reason of tripping of 220kV Akal(RS)-Barmer(RS) Ckt need to be shared. (tripped as per SCADA SOE) iv)SCADA data was freezed during the event. Availability and healthiness of SCADA data need to be ensured. v)DR/EL of each element along with tripping report need to be shared from both the ends. DR of only ICT-2 & 4 have been submitted which are also not time synced. Detail report not received yet. vi)Remedial action taken report to be shared.
2	GI-2	1) 400/220 kV 315 MVA ICT 1 at Ratangarh(RS) 2) 220 kV Ratangarh(RS)-Sikar(PG) (PG) Ckt-1 3) 220 kV Ratangarh(RS)-Sri Dungargarh (RS) Ckt 4) 220kV Ratangarh-Ratangarh220 (RS) Ckt-1 5) 220kV Ratangarh-Ratangarh220 (RS) Ckt-2	Rajasthan	RVPNL, PGCIL	28-Jan-24	14:58	i) As reported, at 14:58hrs, 220kV Isolator (489B) B-phase jumper of 220kV Bus Coupler-1 broke and the fault reflected on the 220kV bus bar at Ratangarh(RS). ii) Due to this fault, 400/220 kV 315 MVA ICT 1 at Ratangarh(RS), 220 KV Ratangarh(RS)-Sikar(PG) (PG) Ckt-1, 220 KV Ratangarh(RS)-Sri Dungargarh (RS) Ckt, 220kV Ratangarh-Ratangarh220 (RS) Ckt-1 & 2 tripped (Bus-wise arrangement of elements yet to be shared). iii) As per SCADA SOE, 220kV Ratangarh220-Jhunjhunu (RS) Ckt also tripped during the same time. (Exact reason yet to beshared) iv) As per PMU at Sikar(PG), Y-N phase to earth fault is observed with delayed fault clearance time of 280 ms (Phase sequence issue is observed). v) As per SCADA, load loss of approx. 540MW is observed in Rajasthan control area. vi) Further as reported, broken 220kV Isolator (489B) B-phase jumper of 220kV Bus Coupler-1 was already replaced.	0	540	280	i) Exact nature and location of fault need to be shared. ii) Reason of delayed clearance of fault also need to be shared. iii)Phase sequence issue at Sikar(PG)/Ratangarh(RS) need to be resolved at the earliest. iv)Exact reason of tripping of 220kV Ratangarh220-Jhunjhunu (RS) Ckt need to be shared. v)DR/EL of all the tripped elements are not received. Detail report also not received. DR time sync issue also observed on submitted DR. vi) Remedial action taken report need to be shared.
3	GD-1	1) 220 KV Ballabhgarh(BB)-BTPS(DTL) (BB) Ckt-1 2) 220 KV Ballabhgarh(BB)-BTPS(DTL) (BB) Ckt-2 3) 220 KV Tughlakabad(PG)-BTPS(DTL) Ckt-1 4) 220 KV Tughlakabad(PG)-BTPS(DTL) Ckt-2 5) 220 kV BTPS(DTL)-Okhla Ckt-1 6) 220 kV BTPS(DTL)-Okhla Ckt-2 7) 220 KV BTPS(DTL)-Sarita Vihar Ckt-1 8) 220 KV BTPS(DTL)-Sarita Vihar Ckt-2 9) 220 KV BTPS(DTL)-Alwar Ckt 10) 220 KV BTPS(DTL)-Noida Sec 38 Ckt	Delhi	BBMB, DTL, PGCIL	31-Jan-24	21:22	i) During antecedent condition, 220 KV Ballabhgarh(BB)-BTPS(DTL) (BB) Ckt-1 & 2 and 220 KV Tughlakabad(PG)-BTPS(DTL) Ckt-1 & 2 were catering the part load of 220kV Okhla and 220kV Sarita Vihar through 220 KV BTPS(DTL)-Okhla Ckt-1 & 2 and 220 KV BTPS(DTL)-Sarita Vihar Ckt-1 & 2. 220 KV BTPS(DTL)-Alwar Ckt and 220 KV BTPS(DTL)-Noida Sec 38 Ckt were on no-load. 220kV bus coupler at BTPS was in closed condition. ii) As reported, at 21:22 Hrs, 220 KV Ballabhgarh(BB)-BTPS(DTL) (BB) Ckt-1 tripped on Y-N phase to ground fault with fault distance of 17.01 km and fault current of 4.2 kA from Ballabgarh end; zone-1 distance protection operated at Ballabgarh end and zone-4 distance protection operated at BTPS end. On inspection, 220kV Bus-2 PT isolator Y-ph LA jumper was found broken at BTPS S/s. iii) At the same time, all other 220kV ckts connected at BTPS(DTL) tripped on zone-4 distance protection operation at BTPS end (reason of non-operation of bus bar protection yet to be shared). iv) Due to tripping of all 220kV ckts, both the 220kV buses became dead at BTPS(DTL) and blackout occurred at 220kV BTPS(DTL) S/s. v) As reported by SLDC Delhi, the load of Okhla, Batra, Malviya Nagar, Shivalik, Sirifort, DC Saket, Select City mall, Sarita Vihar, Meethapur, Jamia, Sarai Julena, Jasola got affected. vi) As per SCADA, change in demand of approx. 220MW is observed in Delhi control area out of which approx. 90MW is restored within 10 minutes. But as reported by SLDC Delhi, load loss of approx. 160MW is observed. vii) As per PMU, Y-N phase to ground fault with delayed fault clearing time of 160ms is observed. viii) Further as reported, at 21:29 hrs, load of Okhla was normalized through 220kV Tughlakabad-Okhla Ckt-1 & 2. At 21:45 hrs, load of 220kV Sarita Vihar was attempted to normalize through 220kV Maharanibagh-Sarita Vihar ckt at Sarita Vihar, but line could not hold and a blast occurred in 220kV Bus coupler CB at Sarita Vihar; R-ph pole was found damaged. Later at 23:20 hrs, load of 220kV Sarita Vihar was normalized through 220kV Maharanibagh-Sarita Vihar ckt.	0	160	160	i)Status of bus bar protection at 220kV BTPS(DTL)? ii)Reason of delayed clearance of fault need to be shared. iii)SCADA data of 220kV BTPS(DTL) was freezed during the event. Healthiness of the SCADA data need to be ensured. iv)DR/EL of all the tripped elements along with tripping report of the event need to be shared. v)Remedial action taken report to be shared.
4	GD-1	1) 220kV Baddi(HP)-Pinjore(HV) (HPPTCL) Ckt-1 2) 220kV Baddi(HP)-Pinjore(HV) (HPPTCL) Ckt-2 3) 220 kV Baddi-Kunihar(HP) Ckt-1 4) 220 kV Baddi-Kunihar(HP) Ckt-2 5) 220 kV Baddi-Upper Nangal(HP) Ckt 6) 220 kV Baddi-Madhala(HP) Ckt 7) 220 kV Baddi-Wardthman(HP) Ckt 8) 220 kV Madhala -Upper Nangal(HP) Ckt 9) 220 kV Bhabha-Kunihar(HP) ckt 10) 220 kV Jeori-Kunihar(HP) Ckt	Himachal Pradesh	HPPTCL, HVPNL	2-Feb-24	15:27	i) As reported, at 15:27 hrs, 220kV Baddi(HP)-Pinjore(HV) (HPPTCL) Ckt-1 & 2 tripped on R-Y phase to phase fault; zone-1 disatnce protection operated at Pinjore end. (Exact reason, nature and location of fault yet to be shared) ii) Due to tripping of aforementioned lines, 220 kV Baddi-Kunihar(HP) Ckt-1 & 2, 220 kV Baddi-Upper Nangal(HP) Ckt, 220 kV Baddi-Madhala(HP) Ckt and 220 kV Baddi-Wardthman(HP) Ckt tripped due to over-loading and 220/66kV Baddi(HP) S/s became dead. iii) During the same time, 220 kV Madhala -Upper Nangal(HP) Ckt, 220 kV Bhabha-Kunihar(HP) ckt and 220 kV Jeori-Kunihar(HP) Ckt also tripped on over-loading. iv) Further, at 15:34 hrs, all 132kV lines from Kunihar(HP) tripped on over-loading and 220/132kV Kunihar(HP) S/s became dead. v) As per PMU, R-Y phase to phase fault is observed with delayed fault clearing time of 400ms. vi) As per SCADA, total change in demand of approx. 785MW in HP control area is observed.	0	785	400	i) Exact location and nature of fault? ii) Reason of delayed clearance of fault? Iii) sequence of tripping? iii) DR/EL of all the tripped elements need to be shared. iv) Remedial action taken report to be shared
5	GD-1	1) 220 kV Bhabha-Kunihar(HP) ckt 2) 220 kV Jeori-Kunihar(HP) Ckt 3) 220 kV Baddi-Kunihar(HP) Ckt-1 4) 220 kV Baddi-Kunihar(HP) Ckt-2 5) 220 kV Baddi-Upper Nangal(HP) Ckt 6) 220 kV Baddi-Madhala(HP) Ckt 7) 220 kV Baddi-Wardthman(HP) Ckt	Himachal Pradesh	HPPTCL	8-Feb-24	10:41	i) During antecedent condition, as per SCADA, power was flowing towards Kunihar through 220 kV Bhabha-Kunihar(HP) ckt and 220 kV Baddi-Kunihar(HP) Ckt-1 & 2 carrying approx. 143MW, 115MW and 115MW. Approx. 31MW was going from Kunihar to Jeori through 220 kV Jeori-Kunihar(HP) Ckt and 220/132kV 80/100MVA ICT-1 & 2 at Kunihar(HP) were carrying approx. 170MW each. Bus coupler was in off position at 220kV Baddi(HP). ii) As reported, at 10:41 hrs, 220 kV Bhabha-Kunihar(HP) ckt tripped on B-N phase to earth fault. (Exact reason, nature and location of fault yet to be shared) iii) Due to tripping of this line, 220 kV Baddi-Kunihar(HP) Ckt-1 & 2 and 220 kV Jeori-Kunihar(HP) Ckt tripped due to over-loading and 220/66kV Kunihar(HP) S/s became dead. iv) During this time, 220 kV Baddi-Upper Nangal(HP) Ckt, 220 kV Baddi-Madhala(HP) Ckt and 220 kV Baddi-Wardthman(HP) Ckt also tripped due to over-loading and 220kV Bus-1 at Baddi(HP) became dead. v) As per SCADA SOE, 220/66kV 31.5MVA ICT-1 at Jeori(HP) tripped during the same time. (Exact reason yet to be shared) vi) As per PMU, B-N phase to earth fault is observed with fault clearing time of 80ms. vii) As per SCADA, change in demand of approx. 525MW in HP control area is observed.	0	525	80	i)Exact reason of tripping of 220/66kV 31.5MVA ICT-1 at Jeori(HP) need to be shared. ii)Sequence of tripping? iii)Exact reason, nature and location of fault need to be shared. iv)Over-current protection settings of tripped elements need to be shared. v)DR/EL need to be shared for all the tripped elements for both ends. vi)Remedial action taken report need to be shared.
6	GD-1	1) 220kV DCRTPP(HR)-Joria(HR) ckt -2 2) 220kV DCRTPP(HR)-Joria(HR) ckt -1 3) 220kV Karnal(HR)-Unispur(HR) ckt 4) 220kV Salempur(HR)-Bakana(HR) ckt-2 5) 220kV DCRTPP(HR)-Unispur(HR) ckt -1 6) 220kV DCRTPP(HR)-Unispur(HR) ckt -2 7) 220kV Salempur(HR)- Bakana(HR) ckt-1 8) 220kV DCRTPP(HR) – Bakana(HR) ckt -1 9) 220kV DCRTPP(HR) – Bakana(HR) ckt-2 10) 300 MW DCRTPPP (Yamuna Nagar) - UNIT 1 11) 300 MW DCRTPPP (Yamuna Nagar) - UNIT 2	Haryana	HVPNL	8-Feb-24	16:22	i) During antecedent condition, 220kV DCRTPP-Rampur Ckt-1 was under construction (LILO in place of DCRTPP-Abdullapur Ckt) and 220kV DCRTPP-Rampur Ckt-2 was under shutdown. 220kV DCRTPP(HR)-Joria(HR) ckt -1 & 2, 220kV DCRTPP(HR)-Bakana(HR) ckt -1 & 2 and 220kV DCRTPP(HR)-Unispur(HR) ckt -1 & 2 were carrying approx. 189MW, 183MW, 47MW, 56MW, 30MW and 31MW respectively. ii) As reported, at 16:12hrs, 220kV DCRTPP(HR)-Joria(HR) ckt -2 tripped due to snapping of R-ph jumper at tower location no. 8. Simultaneously, 220kV DCRTPP(HR)-Joria(HR) ckt -1 tripped on over-loading. iii) After this, load shifted to remaining four ckts. 220kV DCRTPP(HR)-Bakana(HR) ckt -1 & 2 and 220kV DCRTPP(HR)-Unispur(HR) ckt -1 & 2 were carrying approx. 192MW, 202MW, 74MW and 74MW respectively. Power was flowing from 220kV DCRTPP(HR) to bakana(HR) (through 220kV DCRTPP(HR)-Bakana(HR) D/C) to Salempur(HR) (through 220kV Bakana(HR)-Salempur(HR) D/C) and 220kV DCRTPP(HR) to Unispur(HR) (through 220kV DCRTPP(HR)-Unispur(HR) D/C) to Karnal(HR) (through 220kV Unispur(HR)-Karnal(HR) S/C). iv) As further reported, at 16:22hrs, 220kV Karnal(HR)-Unispur(HR) ckt (carrying ~123MW) tripped on transient fault (exact nature and location of fault yet to be shared). v) After this, 220kV DCRTPP(HR)-Bakana(HR) ckt -1 & 2 and 220kV Bakana(HR)-Salempur(HR) ckt -1 & 2 were carrying approx. 253MW, 263MW, 239MW and 233MW respectively. vi) During the same time, 220kV Salempur(HR)-Bakana(HR) ckt-2 also tripped due to breaking of Y-ph conductor at tower location no. 83. vii) Due to this tripping, DCRTPP(HR)-Bakana(HR) ckt -1 & 2, 220kV Bakana(HR)-Salempur(HR) ckt -1 and 220kV DCRTPP(HR)-Unispur(HR) ckt -1 & 2 tripped on over-loading. Complete blackout occurred at 220KV Bakana(HR) and Unispur(HR) S/s. viii) Due to tripping of all the evacuating lines at DCRTPP, 300 MW DCRTPPP (Yamuna Nagar) - UNIT 1 & 2 also tripped and complete blackout occurred at 220KV DCRTPP(HR) S/s. ix) As per PMU at Abdullapur(PG), R-Y phase to phase fault is observed with fault clearing time of 80ms. x) As per SCADA, load loss of approx. 160 MW in Haryana control area and generation loss of approx. 547 MW at 220KV DCRTPP Yamunanagar(HR) are observed. xi) Supply at 220kV DCRTPP(HR) and Unispur(HR) was restored within 23 minutes and Supply at Bakana(HR) was restored within 30 minutes.	547	160	80	i)Exact reason, nature and location of fault need to be shared for each instance. ii)Sequence of tripping? iii)Over-current protection settings of all the lines need to be shared. iv)DR/EL along with tripping report need to be submitted for all the tripped elements from both the ends. v)Remedial action taken report to be shared.
7	GD-1	1) 220 kV Bhabha-Kunihar(HP) ckt 2) 220 kV Jeori-Kunihar(HP) Ckt 3) 220 kV Baddi-Kunihar(HP) Ckt-1 4) 220 kV Baddi-Kunihar(HP) Ckt-2 5) 220 kV Baddi-Upper Nangal(HP) Ckt 6) 220 kV Baddi-Madhala(HP) Ckt 7) 220 kV Baddi-Wardthman(HP) Ckt 8) 220 kV Jeori-Bhaba(HP) Ckt	Himachal Pradesh	HPPTCL	16-Feb-24	11:30	i) During antecedent condition, as per SCADA, power was flowing towards Kunihar through 220kV Jeori-Kunihar(HP) Ckt, 220 kV Wangtoo-Bhabha-Kunihar(HP) ckt (T-connection) and 220 kV Baddi-Kunihar(HP) Ckt-1 & 2 carrying approx. 91MW, 99MW, 57MW and 58MW. 220/132kV 80/100MVA ICT-1 & 2 at Kunihar(HP) were carrying approx. 150MW each. Bus coupler was in off position at 220kV Baddi(HP). ii) As reported, at 11:30 hrs, 220kV Jeori-Kunihar(HP) Ckt tripped from Jeori end on R-N phase to earth fault with fault current of 1.537kA and fault distance of 39.7km from Jeori end. (Exact reason of fault yet to be shared). At the same time, 220kV Jeori-Bhaba(HP) Ckt also tripped on the same fault resulting into blackout at 220/66kV Jeori(HP) S/s. iii) On inspection it was found that a stone crusher office was laying internet cable near Bayal below tower no. 110 span, due to which 220kV Jeori-Kunihar(HP) Ckt came in induction zone of the line and the line tripped. It was also reported that a person got injured due to same and notice by concerened office was served to the defaulting party. iv) As further reported, bus coupler was in on position at that time at Bhaba(HP). Hence fault was sensed by 220 kV Wangtoo-Bhabha-Kunihar(HP) ckt (T-connection) and line tripped from Wangtoo end. v) Due to tripping of these two lines, 220 kV Baddi-Kunihar(HP) Ckt-1 & 2 tripped due to over-loading and 220/66kV Kunihar(HP) S/s became dead. vi) During this time, 220 kV Baddi-Upper Nangal(HP) Ckt, 220 kV Baddi-Madhala(HP) Ckt and 220 kV Baddi-Wardthman(HP) Ckt also tripped due to over-loading and 220kV Bus-1 at Baddi(HP) became dead. vii) As per SCADA SOE, 220/66kV 31.5MVA ICT-1 at Jeori(HP) and 220/11kV 3X13MVA ICT-2 at Mori(HP) tripped during the same time. (Exact reason yet to be shared) viii) As per PMU, R-N phase to earth fault is observed with delayed fault clearing time of 560ms. ix) As per SCADA, change in demand of approx. 510MW and change in generation of approx. 50MW in HP control area is observed. But as reported by, SLDC-HP, load loss of ~400MW (320MW at Kunihar feeding load of Solan and Shimla) and generation loss of ~40MW (20MW in Bhaba and 20MW in Giri) occurred in HP control area.	40	400	560	i)Exact reason, nature and location of fault need to be shared. ii)Exact reason of tripping of 220/66kV 31.5MVA ICT-1 at Jeori(HP) and 220/11kV 3X13MVA ICT-2 at Mori(HP) need to be shared. iii)SCADA data freezed at 220kV Bhaba(HP) and 220/66kV Baddi(HP) during the event. Availability and healthiness of SCADA data need to be ensured. iv)Reason of delayed clearance of fault also need to be shared. v)DR/EL need to be shared for all the tripped elements for both ends. vi)Remedial action taken report need to be shared.
8	GI-2	1) 400 KV Agra-Unnao (UP) Ckt 2) 400 KV Unnao-Lucknow (UP) Ckt 3) 400 KV Bareilly-Unnao (UP) Ckt-2 4) 400 KV Unnao(UP)-Jehta_Hardoi Road (UP) (PG) Ckt-2 5) 400/220 kV 315 MVA ICT 1 at Unnao(UP) 6) 765/400 kV 1000 MVA ICT 2 at Unnao(UP) 7) 765/400 kV 1000 MVA ICT 3 at Unnao(UP) 8) 400KV Bus 1 at Unnao(UP)	Uttar Pradesh	UPPTCL, PGCIL	20-Feb-24	21:47	i) 765/400/220kV Unnao(UP) has double main and transfer bus scheme at 400kV level. ii) During antecedent condition, 400 KV Agra-Unnao (UP) Ckt, 400 KV Unnao-Lucknow (UP) Ckt, 400 KV Bareilly-Unnao (UP) Ckt-2, 400 KV Unnao(UP)-Jehta_Hardoi Road (UP) (PG) Ckt-2, 400/220 kV 315 MVA ICT 1 at Unnao(UP), 765/400 kV 1000 MVA ICT 2 and 3 at Unnao(UP) were connected to 400KV Bus 1 at Unnao(UP) and rest of the elements were connected to 400KV Bus 2 at Unnao(UP). iii) As per SCADA, 400/220 kV 315 MVA ICT 1 at Unnao(UP), 765/400 kV 1000 MVA ICT 2 and 3 at Unnao(UP) were carrying approx. 151MW, 518MW and 535MW respectively. iv) As reported, at 21:47 hrs, LBB operated due to fault at Main CB of 400 KV Bareilly-Unnao (UP) Ckt-2. Hence all the elements connected to 400KV Bus 1 at Unnao(UP) tripped and 400KV Bus 1 at Unnao(UP) became dead. v) As per DR of 400 KV Bareilly-Unnao (UP) Ckt-2, R-N phase to earth fault is observed with fault current of 6.135kA from Unnao(UP) and 2.197kA from Bareilly(UP). Fault was sensed in zone-1 at Unnao(UP) end. Fault was cleared within 280ms from Unnao(UP) end and 130ms from Bareilly(UP) end. vi) As per PMU at Unnao(UP), R-N phase to earth fault is observed with fault clearing time of 280ms. vii) As per SCADA, no change in demand is observed in UP control area.	0	0	280	i)Exact reason of fault at Main CB of 400 KV Bareilly-Unnao (UP) Ckt-2 need to be shared and resolved at the earliest. ii)Reason of delayed clearance of fault need to be shared. iii)SCADA data at 765/400kV Unnao(UP) was freezed during the event. Availability and healthiness of SCADA data need to be ensured. iv)DR/EL need to be shared for all the elements from both the ends. v)Remedial action taken report need to be shared.

S.No.	Category of Grid Disturbance (GD-I to GD-V)	Name of Elements (Tripped/Manually opened)	Affected Area	Owner/ Agency	Outage		Event (As reported)	Loss of generation / loss of load during the Grid Disturbance		Fault Clearance time (in ms)	Remarks
					Date	Time		Generation Loss(MW)	Load Loss (MW)		
9	GI-2	1) 400/220 kV 500 MVA ICT 1 at Bhadla(RS) 2) 400/220 kV 500 MVA ICT 2 at Bhadla(RS) 3) 400/220 kV 500 MVA ICT 3 at Bhadla(RS)	Rajasthan	RVPNL	25-Feb-24	12:55	i) During antecedent condition, MVA power flows of 400/220 kV 500 MVA ICT 1, 2 & 3 at Bhadla(RS) were 417MVA, 452MVA and 454MVA respectively as per SCADA. ii) As reported, at 12:55hrs, 400/220 kV 500 MVA ICT 1 at Bhadla(RS) tripped due to burning of isolator (exact reason, nature and location of fault yet to be shared) iii) Due to this tripping, 400/220 kV 500 MVA ICT 2 and 3 at Bhadla(RS) got overloaded and tripped due to over-current protection operation. iv) As per PMU at Bikaner(PG), R-Y phase to phase fault converted to 3-phase fault is observed with delayed fault clearance time of 880 ms. v) As per SCADA, change in demand of approx. 545MW is observed in Rajasthan control area. vi) As per SCADA, change in NR total solar generation of approx. 1890MW is observed.	1890	545	880	i)Exact reason, nature and location of fault need to be shared. ii)Reason of delayed clearance of fault need to be shared. iii)DR/EL along with tripping report need to be submitted from both the ends. DR not received yet. iv)Remedial action taken report need to be shared.
10	GD-1	1) 765 KV Anpara_D(UP) - Bus 1 2) 765 KV Anpara_D(UP) - Bus 2 3) 765/400 kV 1000 MVA ICT 1 at Anpara_D(UP) 4) 765 KV Obra_C TPS-Anpara_D (UP) ckt 5) 765 KV Anpara_C(LAN)-Anpara_D(UP) (UP) Ckt-1 6) 500 MW Anpara-D TPS - UNIT 1 7) 500 MW Anpara-D TPS - UNIT 2 8) 400 KV Anpara-Anpara_D (UP) Ckt-1 9) 400 KV Anpara-Anpara_D (UP) Ckt-2	Uttar Pradesh	UPPTCL	27-Feb-24	13:57	i) During antecedent condition, 500MW Anpara-D TPS Unit-1&2 were generating approx. 285MW & 295MW respectively and evacuating from 765kV Anapara_D-Obra_C ckt carrying approx 582MW. ii) As reported, at 13:57hrs, R-N phase to earth fault occurred on 765kV Anapara_D-Obra_C ckt. Fault distance was ~8.5km from Obra_C end, Z-1 from Obra_C end and Z-2 from Anpara_D end. On this fault, 765kV Anapara_D-Obra_C ckt tripped from both ends however, delayed clearance occurred at Anpara_D end. iii) At the same time, 765 KV Anpara_C(LAN)-Anpara_D(UP) (UP) Ckt-1 tripped from Anpara_C end and 400 KV Anpara-Anpara_D (UP) Ckt-1&2 tripped from Anpara end on O/C E/F protection operation. Protection setting of O/C E/F protection in these lines need to be reviewed. iv) With the tripping of aforementioned lines, 500MW Unit-1&2 at Anpara_D TPS tripped due to loss of evacuation path. v) As per PMU at Anpara TPS, R-N phase to earth fault with delayed clearance of 480ms is observed. vi) As per SCADA, loss of generention of approx. 580MW is observed at Anpara_D TPS in UP control area.	580	0	480	i)Exact reason of fault need to be shared. ii)Reason of delayed clearance of fault need to be shared. iii)As per SOE, delayed clearance from Anpara_D is observed. Reason of the same need to be shared. iv)DR(.dat/.cfg) file of all the tripped elements need to be shared. v)Remedial action taken report to be shared.
11	GI-2	1) 400 KV Bareilly-Unnao (UP) Ckt-2 2) 400 KV Agra-Unnao (UP) Ckt 3) 400 KV Unnao(UP)-Jehta_Hardoi Road (UP) (PG) Ckt-2 4) 400/220 kV 315 MVA ICT 1 at Unnao(UP) 5) 765/400 kV 1000 MVA ICT 2 at Unnao(UP) 6) 765/400 kV 1000 MVA ICT 3 at Unnao(UP) 7) 400kV Bus 1 at Unnao(UP)	Uttar Pradesh	UPPTCL, PGCIL	11-Mar-24	01:56	i)During antecedent condition, 400/220 kV 315 MVA ICT 1 & 6 and 765/400kV 1000 MVA ICT 1, 2 & 3 at Unnao(UP) were carrying 138MW, 140MW, 549MW, 551MW and 570MW respectively. 400/220 kV 315 MVA ICT 2 at Unnao(UP) was not in service. ii)As reported, at 01:56 hrs, R-N phase to earth fault occurred at 400 kV Bareilly-Unnao (UP) Ckt-2 with fault location of 85 km from Unnao(UP) end. But line CB at Unnao(UP) end of 400 kV Bareilly-Unnao (UP) Ckt-2 failed to clear the fault, hence LBB operated. iii)Due to LBB operation, 400 KV Agra-Unnao (UP) Ckt, 400 KV Unnao(UP)-Jehta_Hardoi Road (UP) (PG) Ckt-2, 400/220 kV 315 MVA ICT 1 at Unnao(UP), 765/400 kV 1000 MVA ICT 2 & 3 at Unnao(UP) also tripped and 400kV Bus 1 at Unnao(UP) became dead. iv)As per DR of 400 KV Bareilly-Unnao (UP) Ckt-2, zone-1 distance protection operated at Unnao end and fault was sensed in zone-1 (carrier-aided trip) at Bareilly end. Fault was cleared within 245ms at Unnao end and 170ms at Bareilly end. R-N phase to earth fault was observed with fault current of 6.329kA from Unnao end and 2.122kA from Bareilly end. v)As per DR of 400 KV Unnao(UP)-Jehta_Hardoi Road (UP) (PG) Ckt-2, DT received at Jehta_Hardoi Road end. vi)As per SCADA SOE, CB of FSC at Unnao(UP) end connected to 400kV Bareilly-Unnao (UP) Ckt-2 closed during the same time. (It is suspected that fault may have initiated due to this. Exact reason of fault need to be shared). vii)As per PMU at Agra(PG), R-N phase to earth fault is observed with delayed fault clearing time of 280ms. viii)As per SCADA, no load loss of is observed in UP control area.	0	0	280	i)Exact reason, nature and location of fault need to be shared. ii)Reason of delayed clearance of fault need to be shared. iii)SCADA data at 765/400kV Unnao(UP) freezed during the event. Availability and healthiness of SCADA data need to be ensured. iv)Remedial action taken report to be shared.
12	GI-2	1) 400/220 kV 315 MVA ICT 1 at Merta(RS) 2) 400/220 kV 315 MVA ICT 2 at Merta(RS) 3) 220kV Merta(RS)-Bhopalgarh(RS) Ckt 4) 220kV Merta(RS)-Kuchera(RS) Ckt 5) 220kV Merta(RS)-Jethana(RS) Ckt 6) 220/132kV 100MVA ICT-1 at Merta(RS) 7) 220/132kV 100MVA ICT-2 at Merta(RS) 8) 220/132kV 100MVA ICT-3 at Merta(RS)	Rajasthan	RVPNL	14-Mar-24	12:55	i)During antecedent condition, MVA power flows of 400/220 kV 315 MVA ICT 1 & 2 and 220/132kV 100MVA ICT-1, 2 & 3 at Merta(RS) were 275MVA, 261MVA, 60MVA, 55MVA and 54MVA respectively as per SCADA. 220kV Merta(RS)-Makrana(RS) Ckt was not in service. ii)As reported, at 12:55hrs, R-phase jumper of 220kV Merta(RS)-Bhopalgarh(RS) Ckt snapped and this broken jumper fell on conductor of ICT 1. As per DR, 400/220 kV 315 MVA ICT 1 at Merta(RS) tripped on O/C E/F protection operation with Ir~=5.2kA. iii)Due to tripping of ICT-1, 400/220 kV 315 MVA ICT 2 at Merta(RS) got over-loaded. As per DR, 400/220 kV 315 MVA ICT 2 at Merta(RS) tripped on phase directional O/C protection operation with Ir~=5.83kA. iv)During the same time, LBB of 220kV Merta(RS)-Bhopalgarh(RS) Ckt operated (exact reason for line CB at Merta(RS) end unable to clear the fault yet to be shared). v)Due to LBB operation, all the elements connected to 220kV Bus-1 & 2 at Merta(RS) tripped and both the buses became dead. vi)As per PMU at Merta(RS), R-N phase to earth fault is observed with delayed fault clearance time of 880 ms. vii)As per SCADA, change in demand of approx. 335MW is observed in Rajasthan control area.	0	335	880	i)Exact reason of LBB operation need to be shared. ii)Reason of delayed clearance of fault need to be shared. iii)DR time sync issue is observed in DR of 400/220 kV 315 MVA ICT 1 & 2 at Merta(RS). Issue need to be resolved at the earliest. iv)DR/EL along with tripping report need to be submitted from both the ends. v)Remedial action taken report need to be shared.
13	GD-1	1) 220 KV Nallagarh(PG)- Uperlanangal (HP) (HPSEB) Ckt-1 2) 220 KV Nallagarh(PG)-Uperlanangal(HP) (HPSEB) Ckt-2 3) 220 KV Uperlanangal(HP)-Wardthman (HPSEB) Ckt 4) 220/66kV 80/100MVA ICT-1 at Uperlanangal(HP) 5) 220/66kV 80/100MVA ICT-2 at Uperlanangal(HP)	Himachal Pradesh	PGCIL, HPPTCL	19-Mar-24	19:18	i)220/66kV Uperlanangal(HP) S/s have double main bus scheme at 220kV level. ii)During antecedent conditon, 220 KV Nallagarh(PG)- Uperlanangal (HP) (HPSEB) Ckt-1 & 2 were carrying 260MW each. 220 KV Baddi- Uperlanangal (HP) Ckt was not in service (as per SCADA). iii)As reported, at 19:18 hrs, 220 KV Nallagarh(PG)- Uperlanangal (HP) (HPSEB) Ckt-1 & 2 tripped on R-N phase to earth fault. (Exact reason, nature and location of fault yet to be shared) iv)As further reported, 220 KV Uperlanangal(HP)-Wardthman (HPSEB) Ckt, 220/66kV 80/100MVA ICT-1 & 2 at Uperlanangal(HP) also tripped during the same time (Exact reason, nature and location of fault yet to be shared). Complete blackout occurred at 220/66kV Uperlanangal(HP) S/s. v)As per PMU at Nallagarh(PG), R-N phase to earth fault is observed with fault clearing time of 120ms. vi)As per SCADA, change in demand of approx. 380MW is observed in HP control area.	0	380	120	i)Exact reason, nature and location of fault need to be shared. ii)DR, EL & tripping report need to be shared from both the ends. iii)Remedial action taken report to be shared.
14	GD-1	1)220 KV Hissar(BB)-Hissar IA(HV) (HVPNL) Ckt-1 2)220 KV Hissar(BB)-Hissar IA(HV) (HVPNL) Ckt-2 3)220 KV Bhiwani-Hissar (BB) Ckt-1 4)220 KV Bhiwani-Hissar (BB) Ckt-2 5)220 KV Hissar-Sangrur (BB) Ckt-1 6)220 KV Hissar-Sangrur (BB) Ckt-2 7)220 KV Hissar(BB)-Jindal Steel(HR) (HVPNL) Ckt 8)220 KV Hissar(BB)-Chirawa(RS) (BB) Ckt 9)220 KV Barnala-Sangrur(BB) Ckt 10)220/132kV 100MVA ICT-1 at Hissar(BB) 11)220/132kV 100MVA ICT-2 at Hissar(BB) 12)220/132kV 100MVA ICT-3 at Hissar(BB)	Haryana	BBMB, HVPNL	23-Mar-24	00:58	i)220/132/33kV Hissar(BB) S/s has double main bus scheme at 220kV level. ii)As reported, at 00:58hrs, bursting of B-ph CT of 220/132kV 100MVA ICT-2 at Hissar(BB) occured. iii)During the same time, all the lines and 220/132kV ICTs connected at 220kV Hissar(BB) also tripped (Exact reason, nature and location of fault yet to be shared). iv)Due to tripping of all the elements connected to both the buses, both 220kV Bus-1 & 2 at Hissar(BB) and eventually the complete 220/132/33kV Hissar(BB) S/s became dead. v)As per PMU at HissarPG), two consecutive B-N phase to earth faults with fault clearing time of 80ms and 360ms (delayed) are observed. vi)As per SCADA, change in demand of approx. 170MW is observed in Haryana control area.	0	170	360	i)Exact reason, nature and location of fault need to be shared. ii)Reason of delayed clearance of fault need to be shared. iii)DR/EL of all the tripped elements along with tripping report of the event need to be shared. iv)Remedial action taken report to be shared.
15	GD-1	1) 400 KV Khetri (PKTSL)-Bhiwadi(PG) (PBTSL) Ckt-2 2) 220 KV Bhiwadi(PG)-Bhiwadi(RS) (RS) Ckt-1 3) 220 KV Bhiwadi(PG)-Bhiwadi(RS) (RS) Ckt-2 4) 220/132kV 160MVA ICT-1 at Bhiwadi(RS) 5) 220/132kV 160MVA ICT-2 at Bhiwadi(RS) 6) 220/132kV 100MVA ICT-3 at Bhiwadi(RS) 7) 220 KV Bhiwadi(PG)-Kushkhera(RS) (RS) Ckt	Rajasthan	PKTSL, PGCIL, PBTSL, RVPNL	29-Mar-24	17:22	i)220/132kV Bhiwadi(RS) has double main bus scheme at 220kV side. ii)As reported, at 17:10hrs, 400 kV Khetri (PKTSL)-Bhiwadi(PG) (PBTSL) Ckt-2 tripped on Y-N phase to earth fault during heavy wing storm with fault distance of 123.3km from Khetri and fault current of 2.34kA from Khetri and 39.7kA from Bhiwadi. iii)As per PMU at Bhiwadi(PG), at 17:10 hrs, Y-N phase to earth fault with unsuccessful A/R followed by R-N fault is observed with fault clearing time of 80ms and 80ms respectively. iv)As per SCADA SOE, 132 KV Bhiwadi(RS)-Bhiwadi132(RS) (RS) Ckt-2 tripped at 17:17hrs (exact reason, nature and location of fault yet to be shared). As per PMU, Y-N phase to earth fault with fault clearing time of 80ms is observed during the same time. v)Further, at 17:22hrs, bus bar protection operated at 220kV Bhiwadi(RS) due to failure of B-phase CVT of 220kV Main Bus -II. Due to this, both 220 KV Bhiwadi(PG)-Bhiwadi(RS) (RS) Ckt-1 & 2 tripped from Bhiwadi(RS) end only. vi)220/132kV 160MVA ICT-1 & 2 and 100MVA ICT-3 at Bhiwadi(RS) also tripped and supply to 132kV feeders connected to Bhiwadi(RS) lost. Complete blackout occurred at 220/132kV Bhiwadi(RS) S/s. vii)As per PMU at Bhiwadi(PG), at 17:22hrs, B-N phase to earth fault is observed with fault clearing time of 120ms. viii)Again, at 17:26 hrs, 220 KV Bhiwadi(PG)-Kushkhera(RS) (RS) Ckt tripped on R-N phase to earth fault with fault distance of 0.865km from Bhiwadi(PG) end. ix)As per DR at Bhiwadi(PG) end of 220 KV Bhiwadi(PG)-Kushkhera(RS) (RS) Ckt, fault current was 24.41kA from Bhiwadi(PG), fault was sensed in zone-1, line was successfully auto-reclosed from Bhiwadi(PG) end and tripped only from Kushkhera end. x)As per PMU at Bhiwadi(PG), at 17:26 hrs, R-N fault followed by R-N fault with unsuccessful A/R is observed with fault clearing time of 120ms and 80ms respectively. xi)As per SCADA, change in demand of approx. 120MW in Rajasthan control area is observed.	0	120	120	i)As per PMU, one R-N fault is observed at 17:10 hrs. Exact reason and location of fault need to be shared. ii)As per SCADA SOE, 132 KV Bhiwadi(RS)-Bhiwadi132(RS) (RS) Ckt-2 tripped at 17:17hrs. Exact reason, nature and location of fault need to be shared. iii)DR/EL along with tripping report for each element need to be shared from both the ends. iv)Remedial action taken report to be shared.

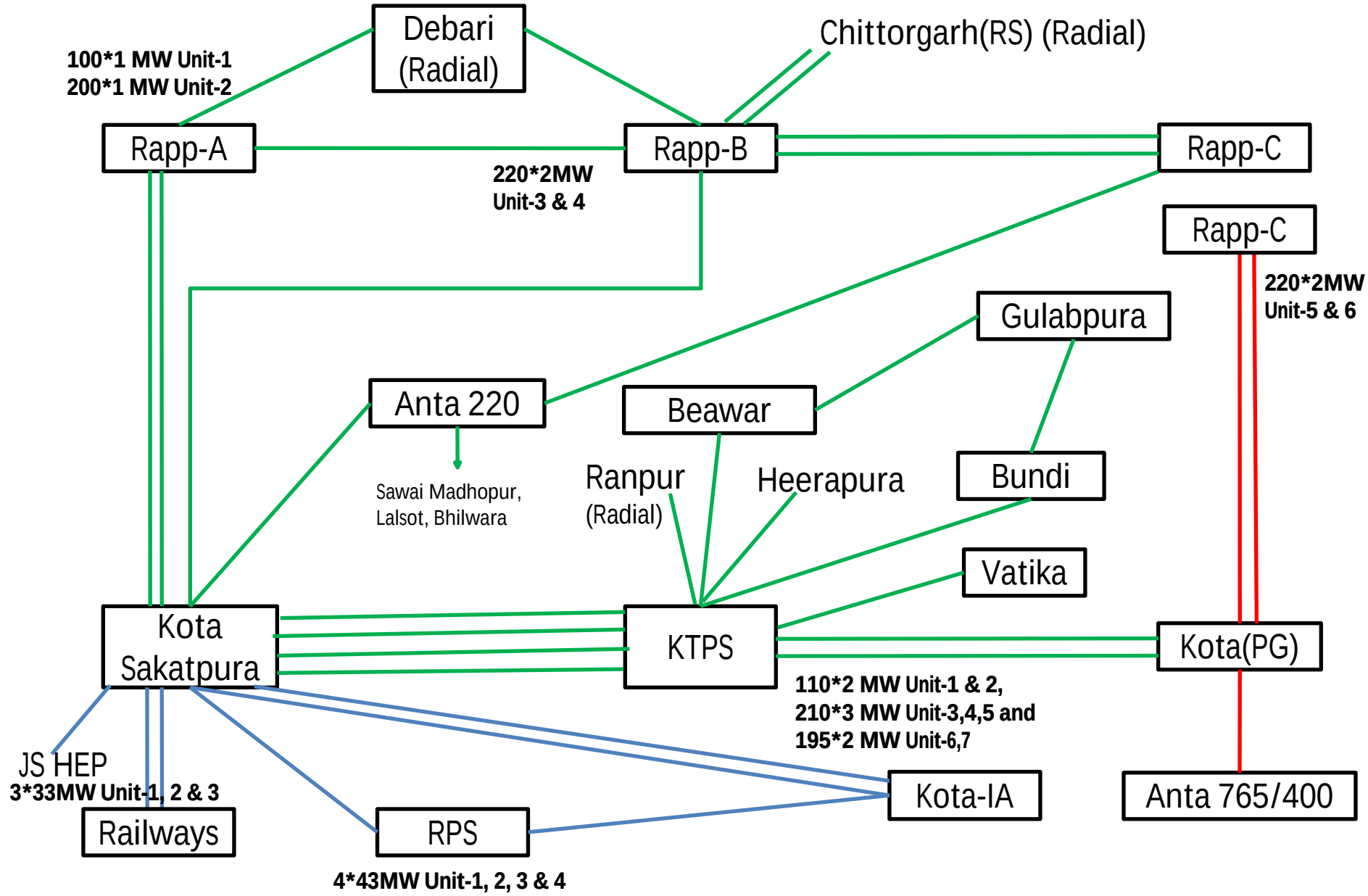
Utilities are requested to prepare detailed analysis report and present the event details during 50th PSC meeting. Events involving more than one utility may be jointly prepared and presented.

Annexure-XXIX

MULTIPLE ELEMENTS TRIPPING AT KTPS(RS), RAPP-A, RAPP-B AND RAPP-C

AT 05:16HRS ON 05TH JAN'2024

Connection Diagram between KTPS, RAPP-A, RAPP-B & RAPP-C



Antecedent condition

At 220kV KTPS:

- **220 KV Kota(PG)-KTPS(RVUN) (RS) Ckt-1 & 2** were **out of service**. Lines were out since 09-09-2023 on emergency shutdown to attend/repair damaged 220kV main Bus- 4 of KTPS, Kota (as intimated, lines were kept out to avoid damage to the bus interconnector.
- **220kV KTPS-Heerapura ckt** was under **shutdown** (tripped on 01st Jan on phase to earth fault).
- **220kV KTPS-Beawar ckt** tripped at **~04:05hrs** on fault.
- 110MW Unit-2 and 210MW Unit-3 were under shutdown
- 110MW Unit-1, 210MW Unit-4&5 and 195MW Unit-6&7 were under service (generating total **~803MW**)

At RAPS-A:

- **220 KV Debari(RS)-RAPS_A(NP) (RS) Ckt** tripped at **04:57 hrs** on B-N fault.
- 220MW Unit-2 was in service and generating ~200MW.

At RAPS-B:

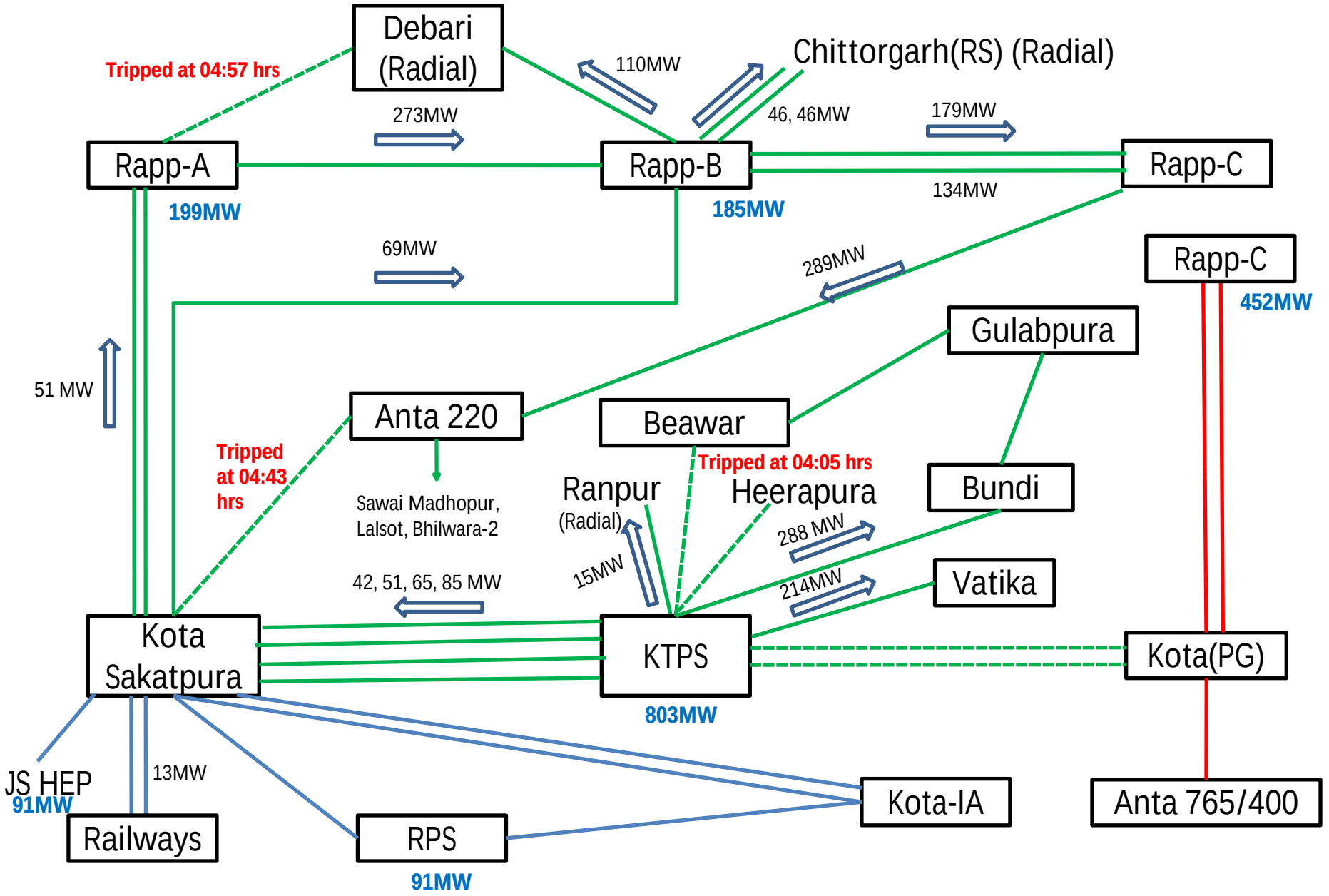
- 220MW Unit-4 was in service and generating ~185MW.
- 220MW Unit-3 was not in service.

At RAPS-C:

- 220MW Unit-5&6 was in service and generating ~452MW

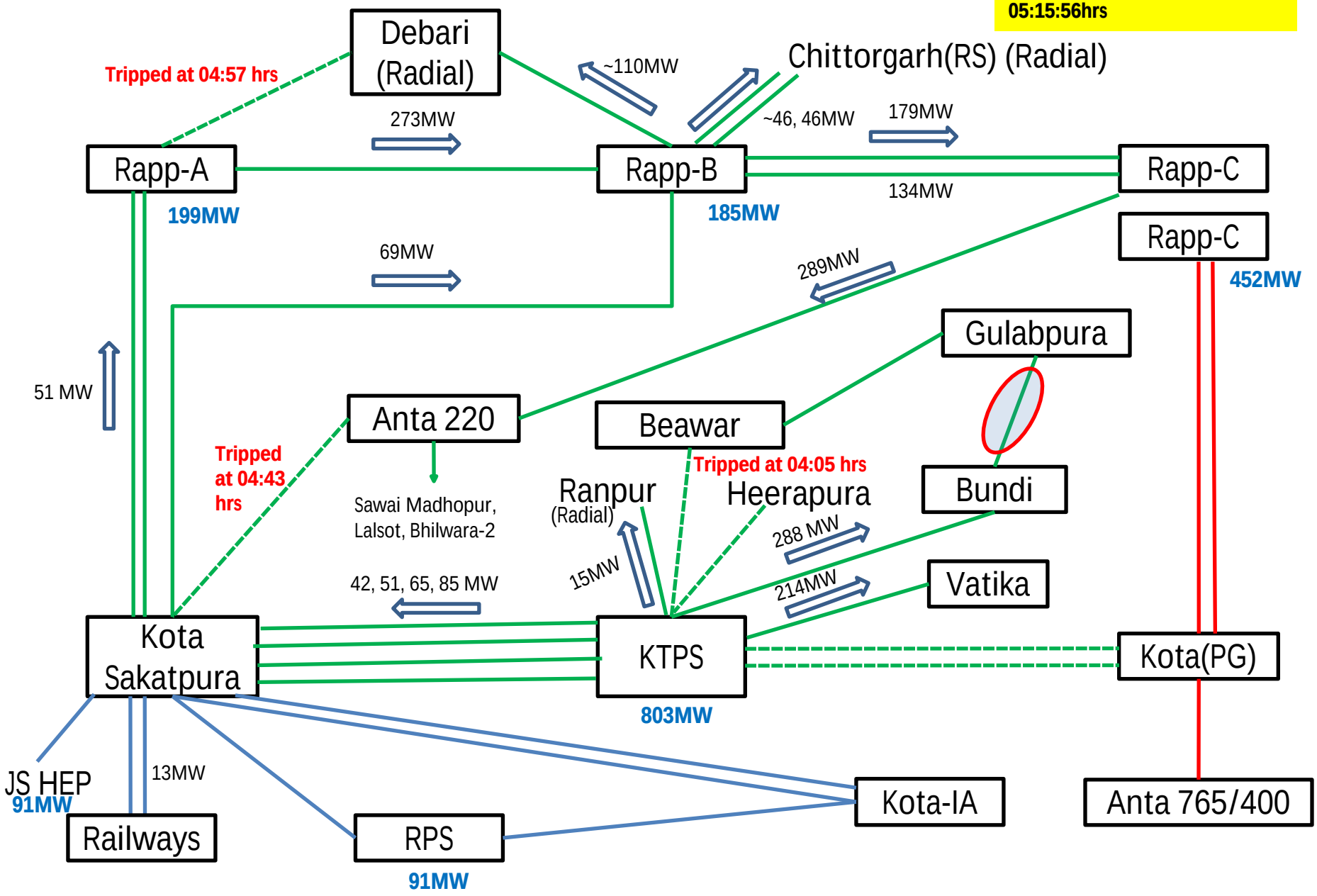
220 KV Anta(NT)-Sakatpura(RS) (RS) Ckt tripped at 04:43hrs on B-N fault.

Antecedent scenario (at 05:15 hrs)



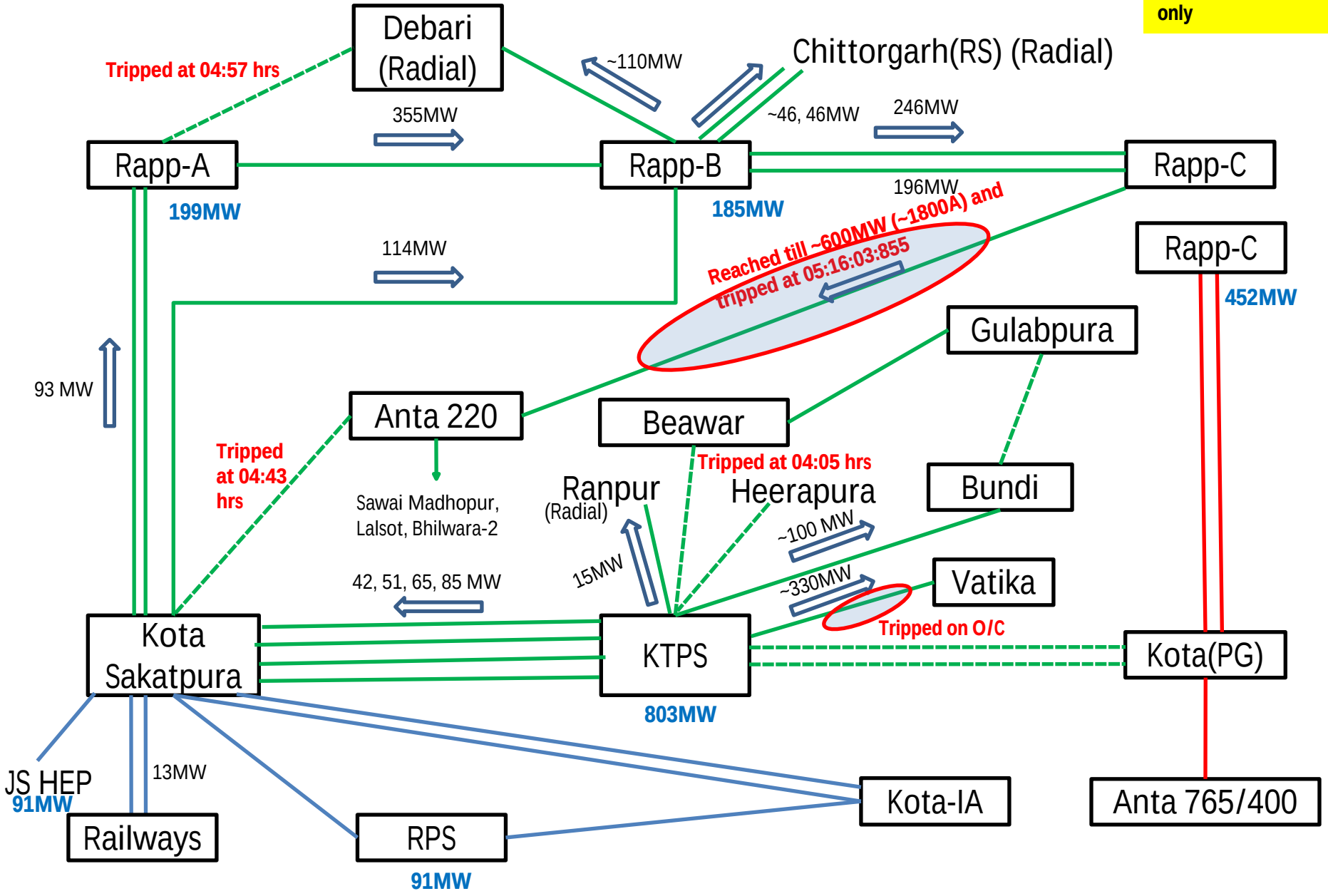
Triggering incident

Triggering incident: opening of 220kV Bundi-Gulabpura ckt at 05:15:56hrs

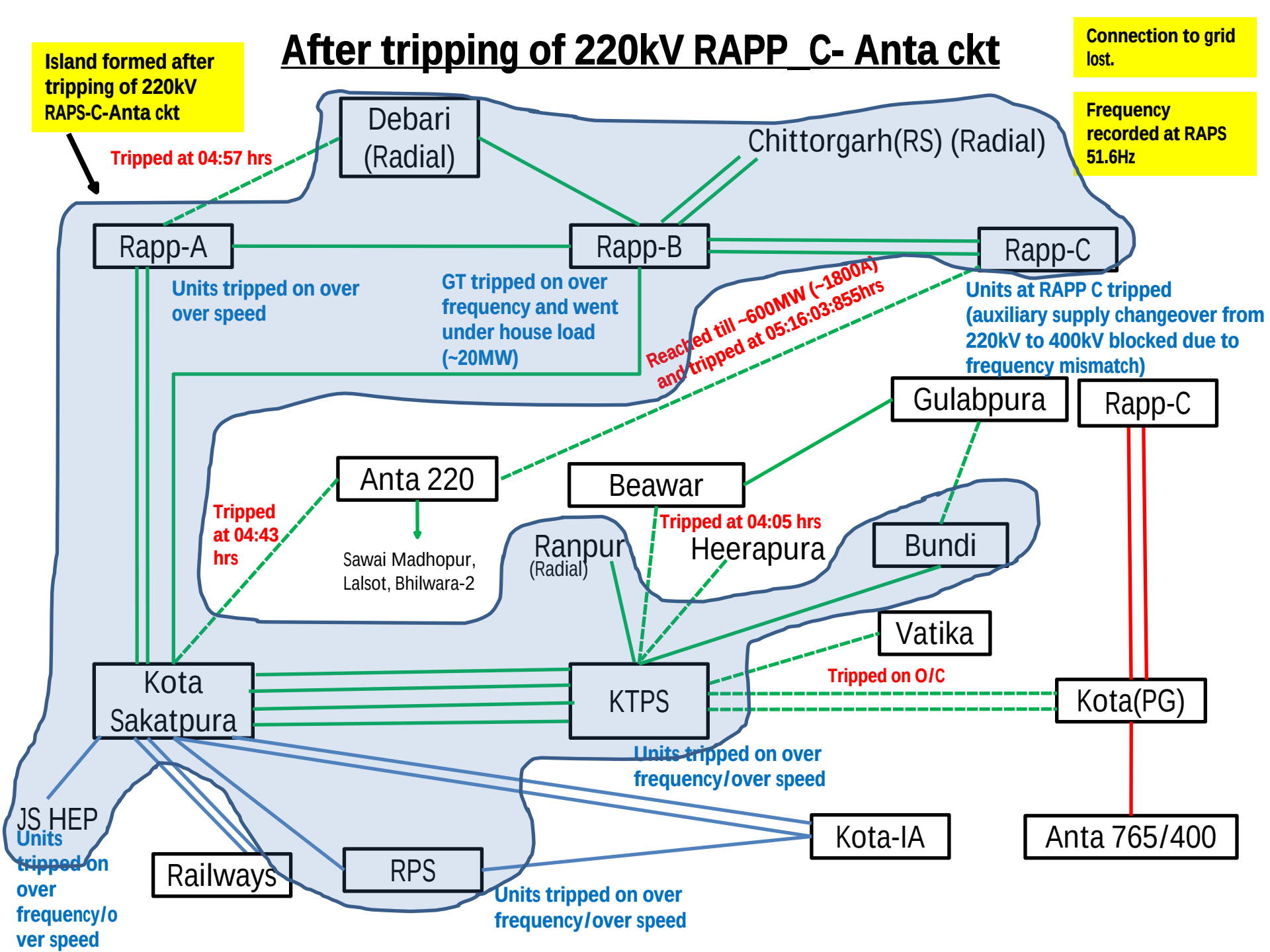


After opening of 220kV Bundi-Gulabpura ckt

System was connected to grid via Anta and Vatika only



After tripping of 220kV RAPP_C- Anta ckt



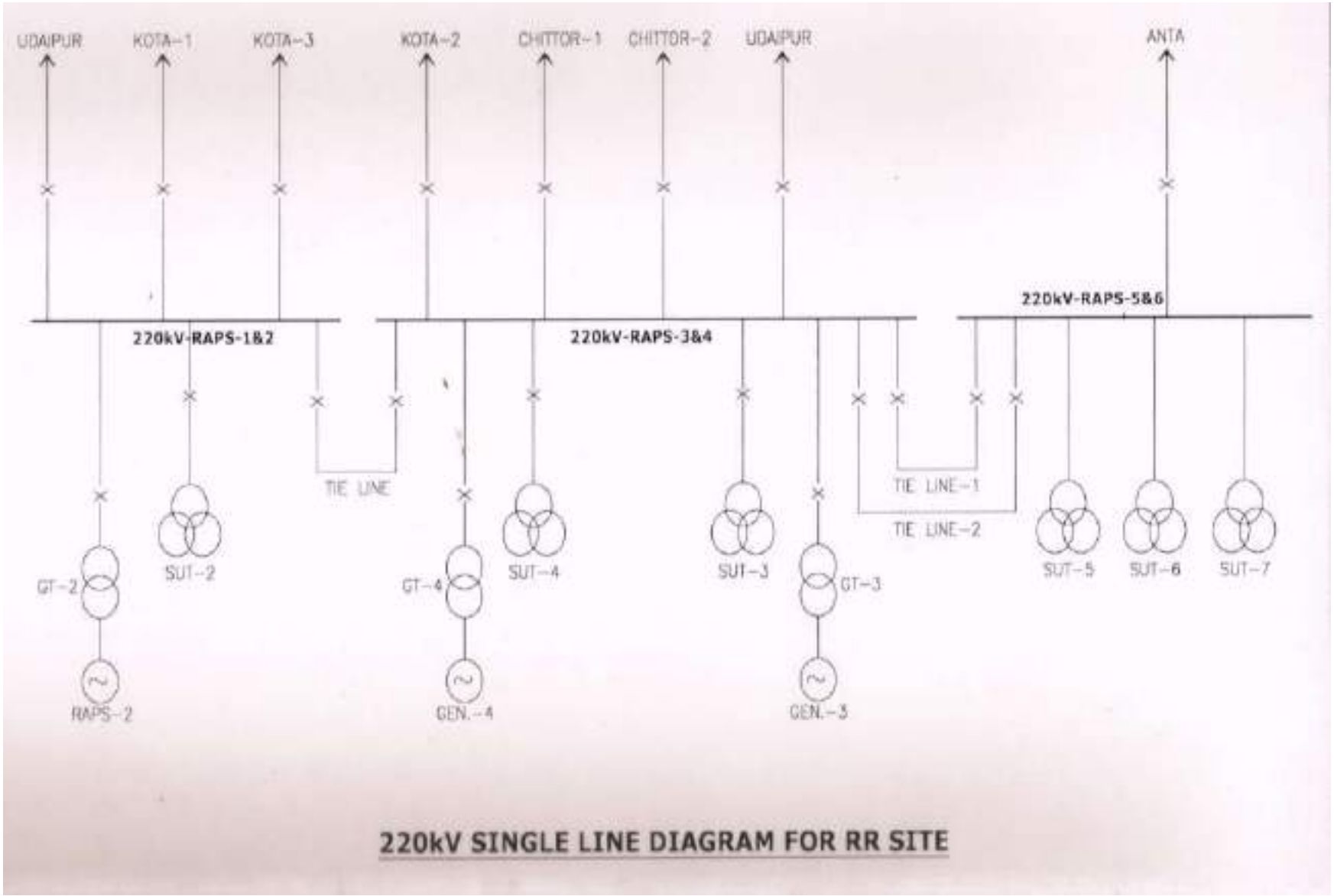
Sequence of event

- **04:05 hrs:** 220kV KTPS-Beawar ckt tripped
- **04:43:37:340 hrs:** 220 KV Anta(NT)-Sakatpura(RS) (RS) Ckt tripped on B-N fault. (A/R operated at Sakatpura end, 3-ph trip from Anta end)
- **04:57:13:227 hrs:** 220 KV RAPS_A(NP)- Debari(RS) (RS) Ckt tripped on B-N fault. (A/R off in line)
- **05:15:56 hrs:** 220kV Bundi-Gulabpura (RS) ckt was manually opened on SLDC instruction to avoid line tripping on overloading.
- **05:16 hrs:** 220kV KTPS-Vatika ckt tripped on over current protection from KTPS end. (antecedent current ~850A (~320MW) as per DR.
- **05:16:03:855 hrs:** 220kV RAPS_C(NP)-Anta(NT) ckt tripped due to over loading (antecedent current ~1800A (~600MW) as per DR, exact protection operation yet to be received)
- Due to tripping of above lines, connectivity to main load centre was cut off and only radial load available for RAPS-A, RAPS-B and KTPS generation was 220kV Debari and 220kV Chittorgarh and system got isolated from main Grid.
- Above load generation scenario led to over frequency occurred. Frequency reached to **51.63Hz.**
- Subsequent to this, **RAPS-B unit-4** tripped on over frequency and came to **house load**.
- RAPS-A unit-2 tripped on over speed protection.
- KTPS units also tripped on over frequency protection.
- RAPS-C unit-5&6 tripped due to loss of auxiliary supply (auxiliary supply changeover from 220kV to 400kV blocked due to frequency mismatch.
- RAPS-B unit-4 operated on house load for approx. 1.5 hours but couldn't able to come back to grid mode due to issue in governing system (as intimated by RAPS)

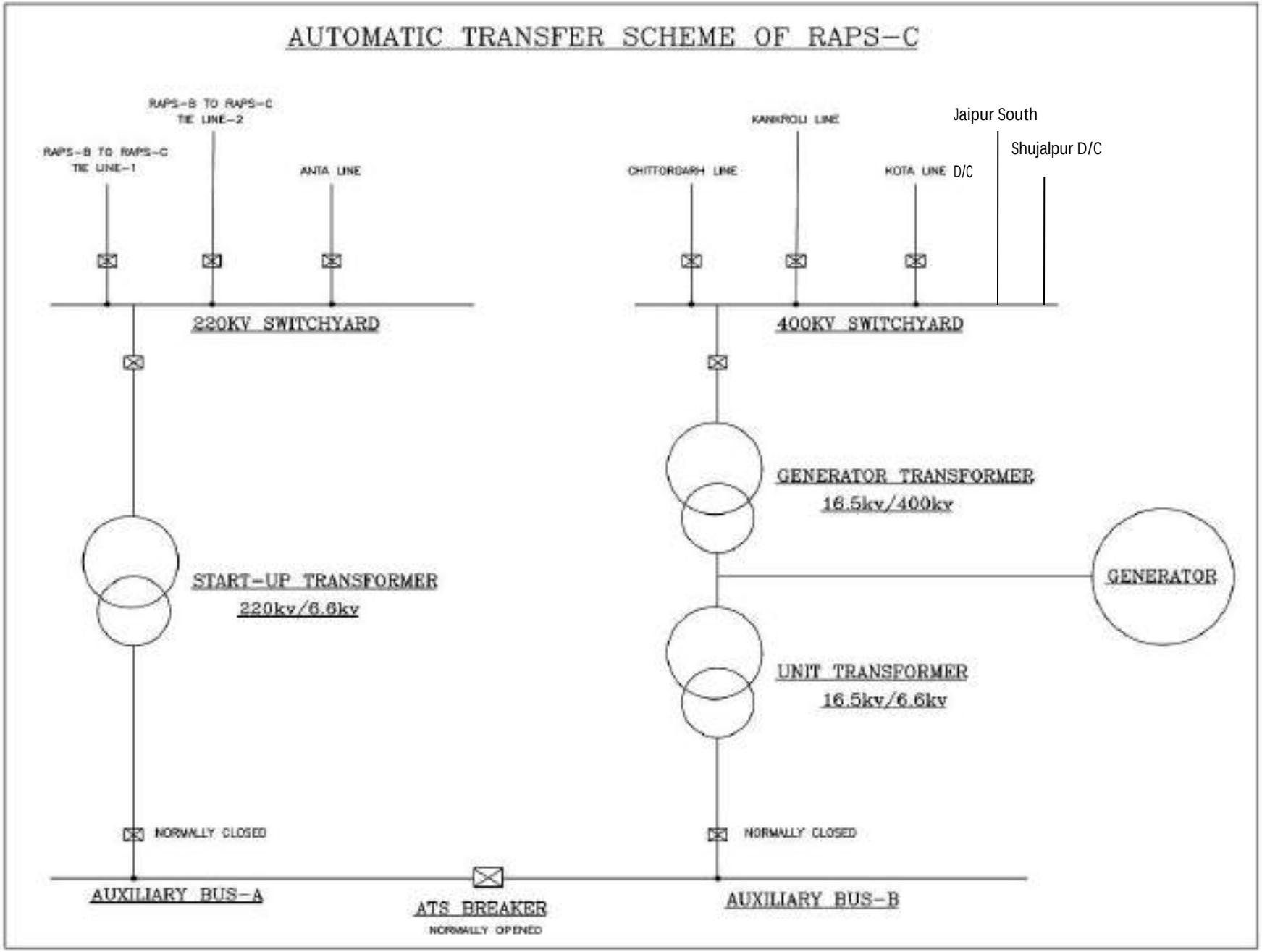
Observations

- 220 KV Anta(NT)-Sakatpura(RS) (RS) Ckt and 220 KV RAPS_A(NP)- Debari(RS) (RS) Ckt were already **under forced outage** before the grid event.
- Few lines were already in overloading condition during 220kV RAPS_A-RAPS_B ckt (interconnector) carrying **~273MW**, 220kV RAPS_C(NP)-Anta(NT) ckt carrying **~289MW**, 220kV KTPS-Vatika ckt carrying **~214MW** and 220kV KTPS-Bundi (RS) ckt carrying **~288MW.**
- **Limited connectivity with the grid** was available. **(220kV Vatika, Bundi, Anta)**
- **RAPS-B Unit-4 successfully came to house load** however couldn't able to revive back to grid mode due to some issue **(issue in governing system/turbine speed gear as intimated by RAPS)**
- **Switchover of auxiliary supply** from 220kV side of RAPS-C to 400kV side was **unsuccessful**. (changeover system got blocked suspected due to frequency mismatch between 220kV & 400kV side, as intimated by RAPS)
- **SCADA data at RAPS-A, RAPS_B & RAPS-C** got **freezed** just after the event.
- **Tripping status and MW flow value** in few of the line was **not correct** (220kB RAPS_A-Debari ckt from RAPP-A and 220kV RAPS_A-RAPS_B ckt from RAPS-A end.

SLD and connectivity of RAPS- A, RAPS-B & RAPS-C



AUTOMATIC TRANSFER SCHEME OF RAPS-C

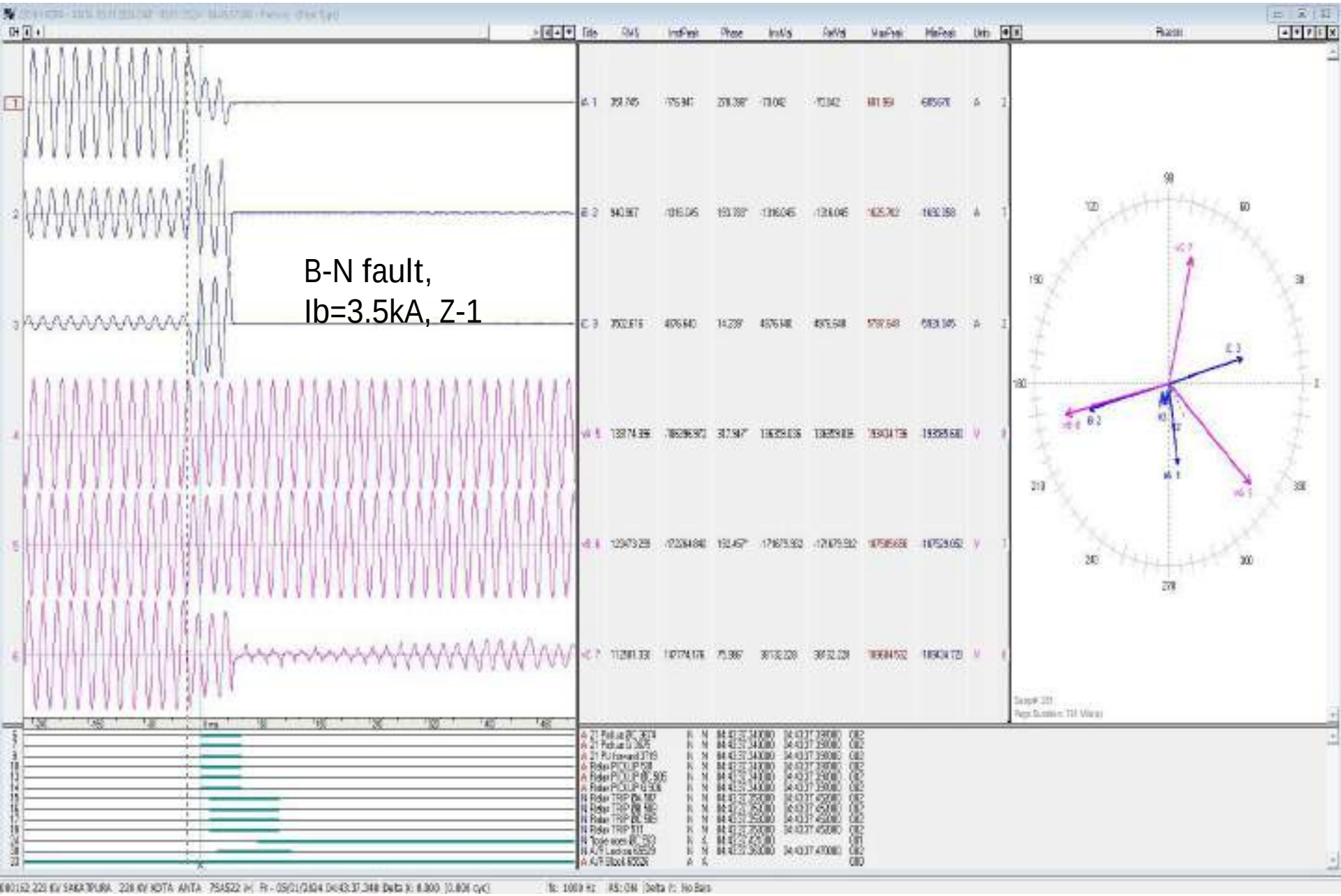


Digital recording system of RAPS-A during the event (shared by RAPS)

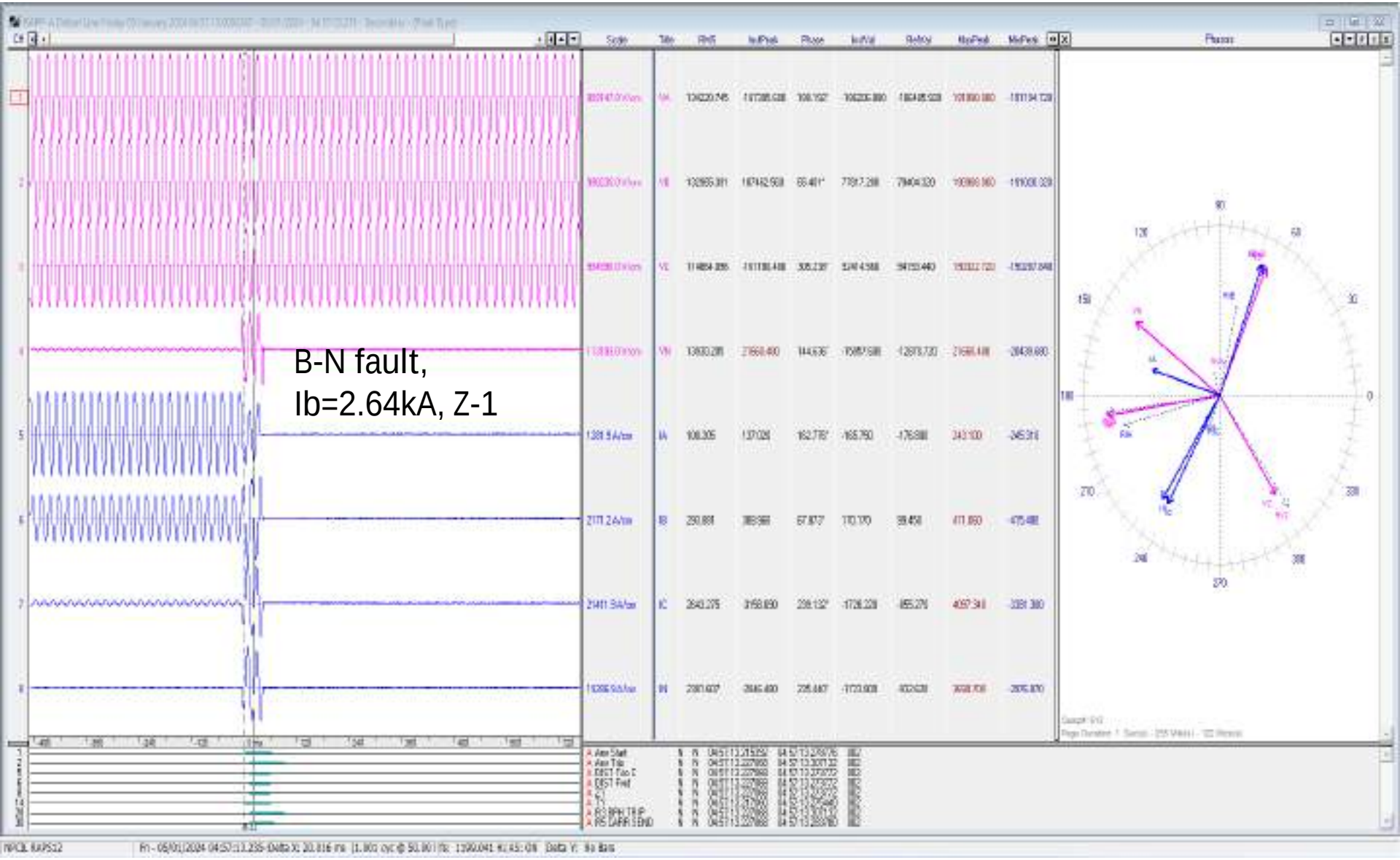
Generation plot of RAPS-B unit-4 (shared by RAPS)

- **RAPS-B unit-4 came on house load and operated for approx. 1.5hrs.**
- **However, Unit couldn't able to synchronize with the grid due to issue in turbine speeder gear (as reported by RAPS)**

DR of 220kV Anta-Sakatpura(end) ckt (04:43hrs)

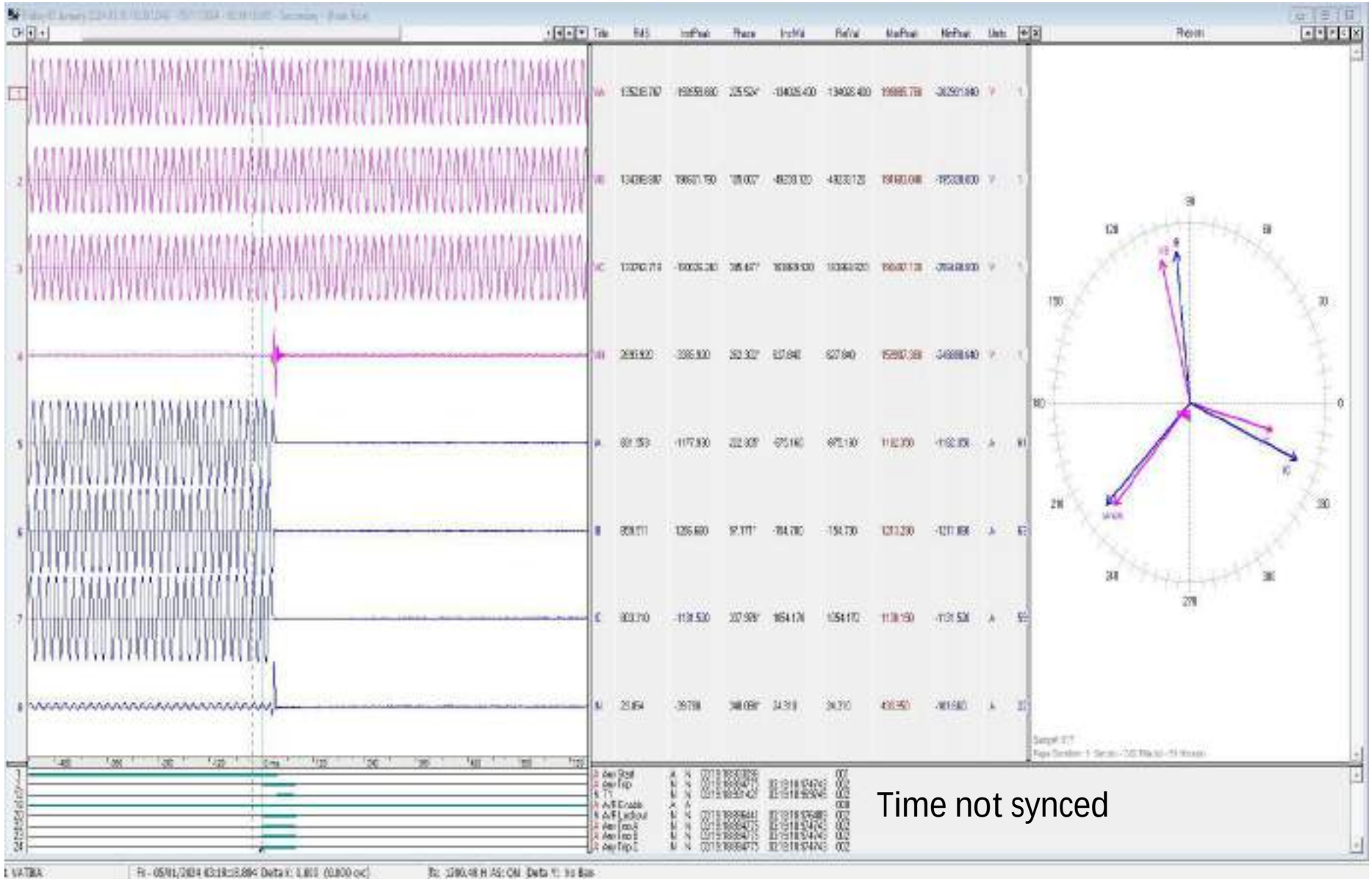


DR of 220kV RAPS_A(end)-Debari ckt (04:57hrs)



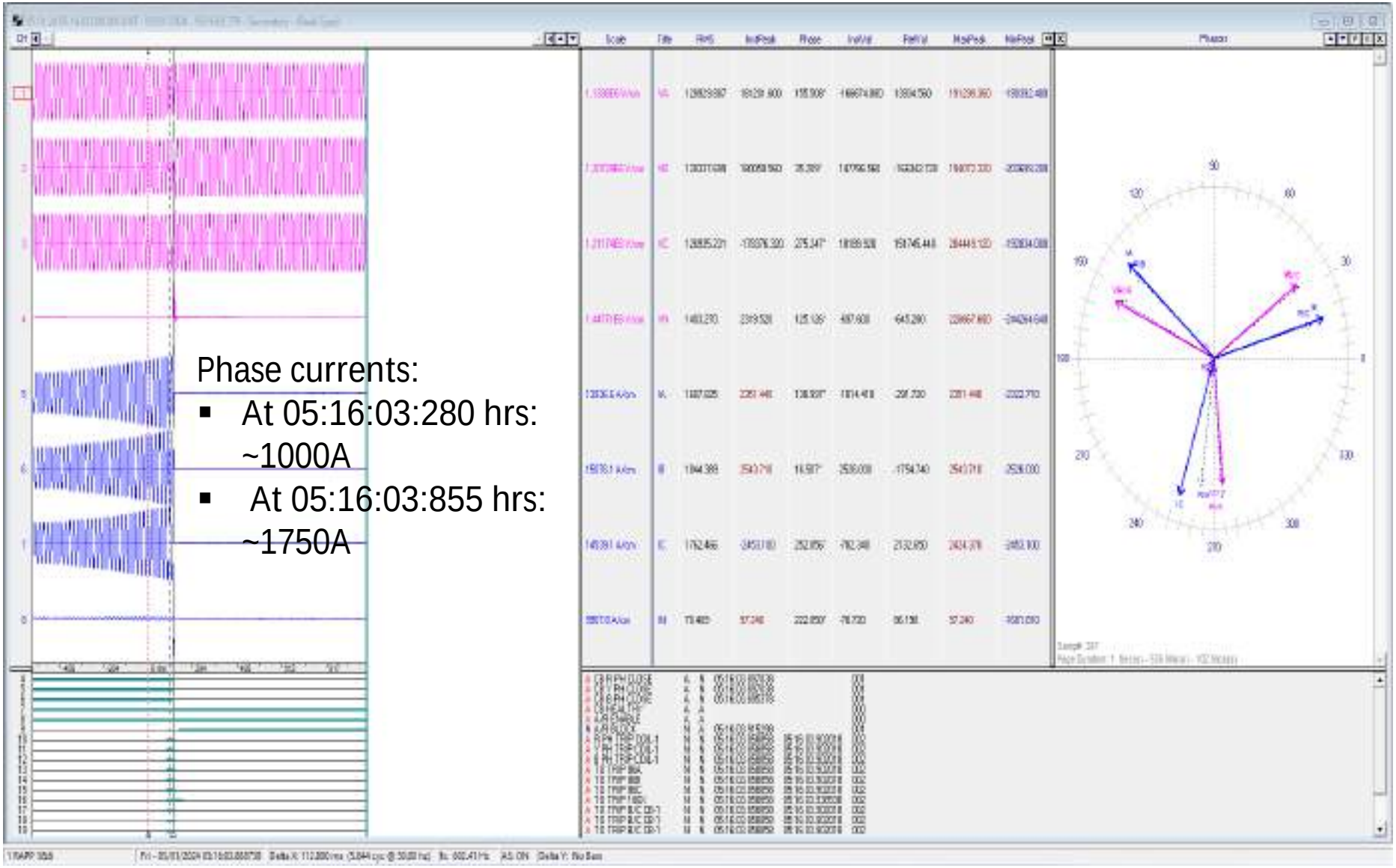
Tripping time: **04:57:13:227**; B-N fault, Z-1, Ib: 2.6kA; (A/R operation is OFF in line)

DR of 220kV KTPS-Vatika(end) ckt



Antecedent loading just before the tripping: **~324MW (as reported, tripped on O/C)**

DR of 220kV RAPS_C(end)-Anta ckt



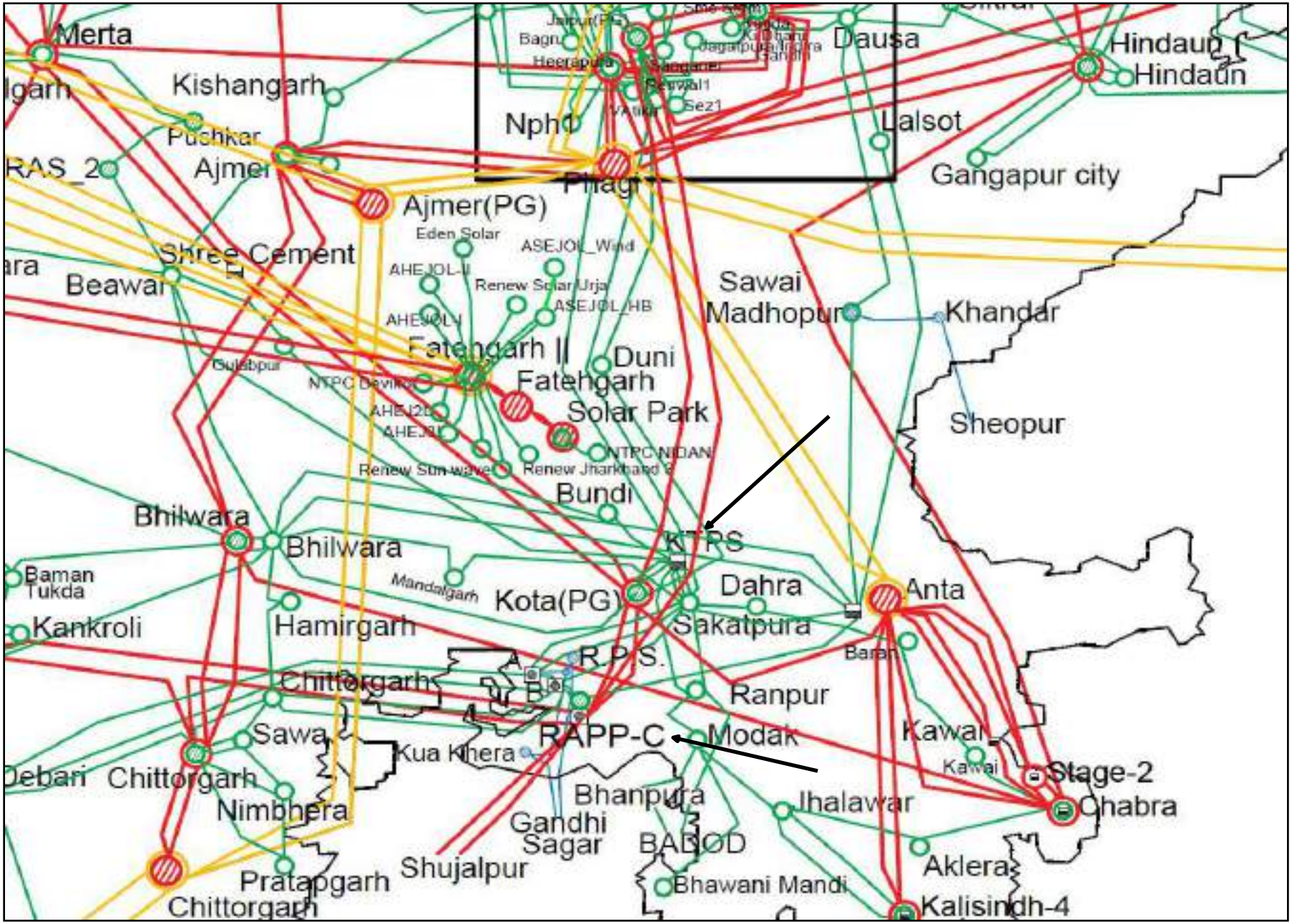
Tripping time: **05:16:03:855**; Antecedent loading just before the tripping: **~660MW**

SCADA SOE

Time	Station Name	Voltage	Element Name	Element Type	Element Status	Remarks
05:15:55,853	GULPR_RS	220kV	02KTPS1	Circuit Breaker	disturbe	
05:15:56,058	GULPR_RS	220kV	02KTPS1	Circuit Breaker	Open	Line CB at Gulabpura(RS) end of 220kV Bundi(RS)-Gulabpura(RS) Ckt opened
05:16:03,939	RAPPC_NP	220kV	02ANTA	Circuit Breaker	Open	Line CB at Rapp-C(NP) end of 220kV RAPP-C(NP)-Anta(NT) Ckt opened
05:16:04,983	RAPPB_NP	220kV	07SUTR4	Circuit Breaker	Open	Line CB at Rapp-B(NP) end of 220kV RAPP-B(NP)-SUT4 Ckt opened
05:16:05,233	RAPPB_NP	220kV	06G4	Circuit Breaker	Open	CB at 220kV side of 220MW Unit-4 at Rapp-B(NP) opened
05:16:06,049	RAPPA_NP	220kV	11G2	Circuit Breaker	Open	CB at 220kV side of 220MW Unit-2 at Rapp-A(NP) opened
05:16:07,774	DYRA__RS	132kV	06ANTA	Circuit Breaker	disturbe	
05:16:08,572	DYRA__RS	132kV	11IA	Circuit Breaker	Open	Line CB at Dahara(RS) end of 132kV Dahara(RS)-Kota IA Ckt opened
05:16:08,609	DYRA__RS	220kV	04KOTAS	Circuit Breaker	disturbe	
05:16:08,611	DYRA__RS	220kV	02BARAN	Circuit Breaker	Open	Line CB at Dahara(RS) end of 220kV Dahara(RS)-Baran Ckt opened
05:16:08,742	RPS___RS	132kV	06MBC	Circuit Breaker	Open	Bus coupler CB at 132kV RPS(RS) opened
05:16:12,851	UCMNT_RS	132kV	02DEBAR1	Circuit Breaker	disturbe	
05:16:12,859	UCMNT_RS	132kV	02DEBAR1	Circuit Breaker	Open	Line CB at UCW(RS) end of 132kV UCW(RS)-Debari(RS) Ckt opened
05:16:15,666	RPS___RS	132kV	09U3	Circuit Breaker	Open	CB at 132kV side of 43MW Unit-3 at RPS(RS) opened
05:16:16,104	RPS___RS	132kV	10U4	Circuit Breaker	Open	CB at 132kV side of 43MW Unit-4 at RPS(RS) opened
05:16:22,001	RPS___RS	132kV	04U1	Circuit Breaker	Open	CB at 132kV side of 43MW Unit-1 at RPS(RS) opened

SLD/Network and Graphs

Network Diagram



Antecedent condition

Antecedent Condition: 220kV RAPP-A(NP)-Debari(RS) Ckt and 220kV Sakatpura(RS)-Anta(NT) Ckt were out of service.

Triggering Incident (as per SCADA SOE): Opening of line CB at Gulabpura end of 220kV Bundi(RS)-Gulabpura(RS) Ckt

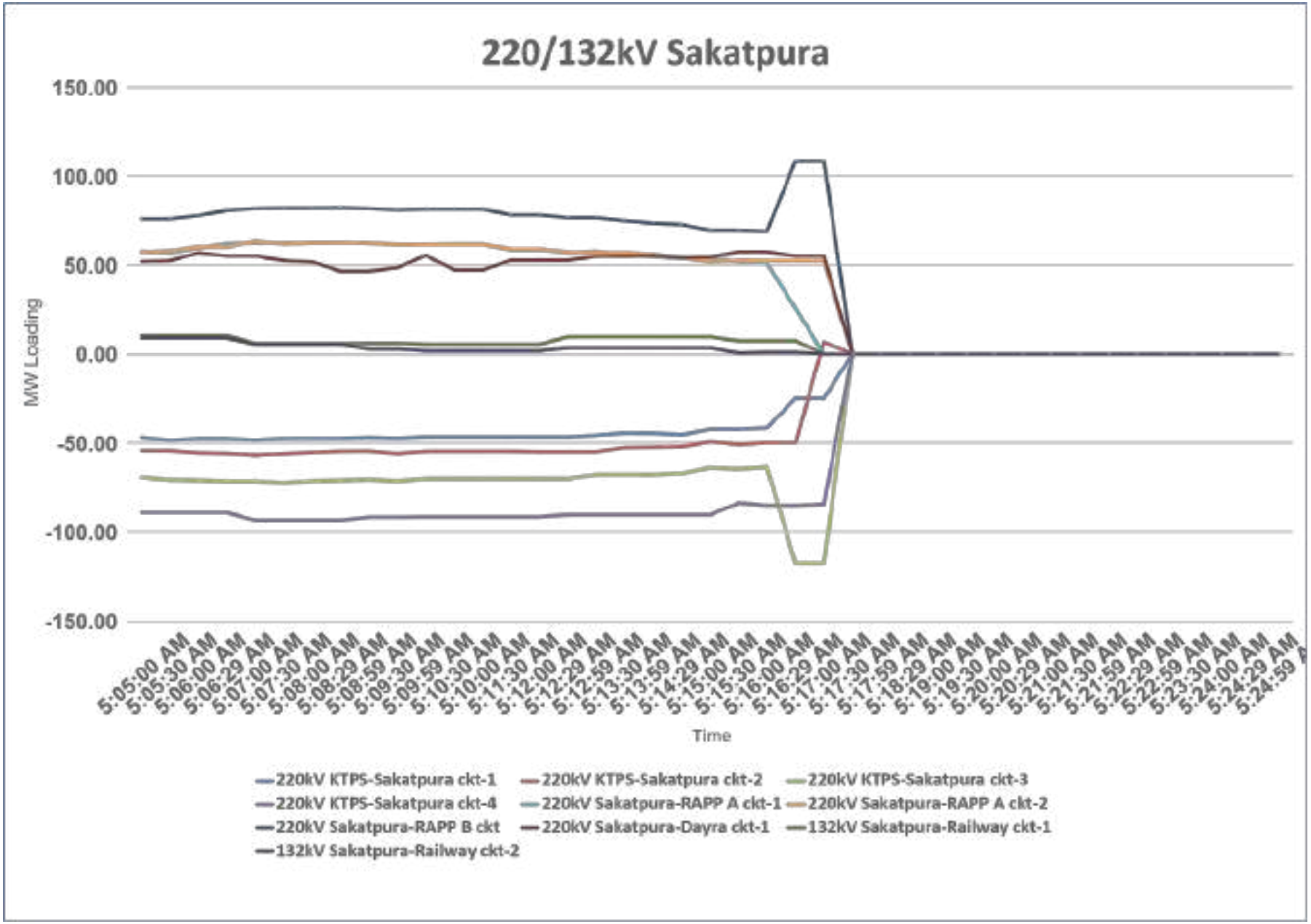
Change in MW loading of lines:

1. 220kV Sakatpura-RAPP-A Ckt: 51MW to 93MW
2. 220kV Sakatpura-RAPP-B Ckt: 69MW to 114MW
3. 220kV RAPP-A-RAPP-B Ckt: 273MW to 355MW
4. 220kV RAPP-B-RAPP-C Ckt-1: 134MW to 196MW
5. 220kV RAPP-B-RAPP-C Ckt-2: 179MW to 246MW

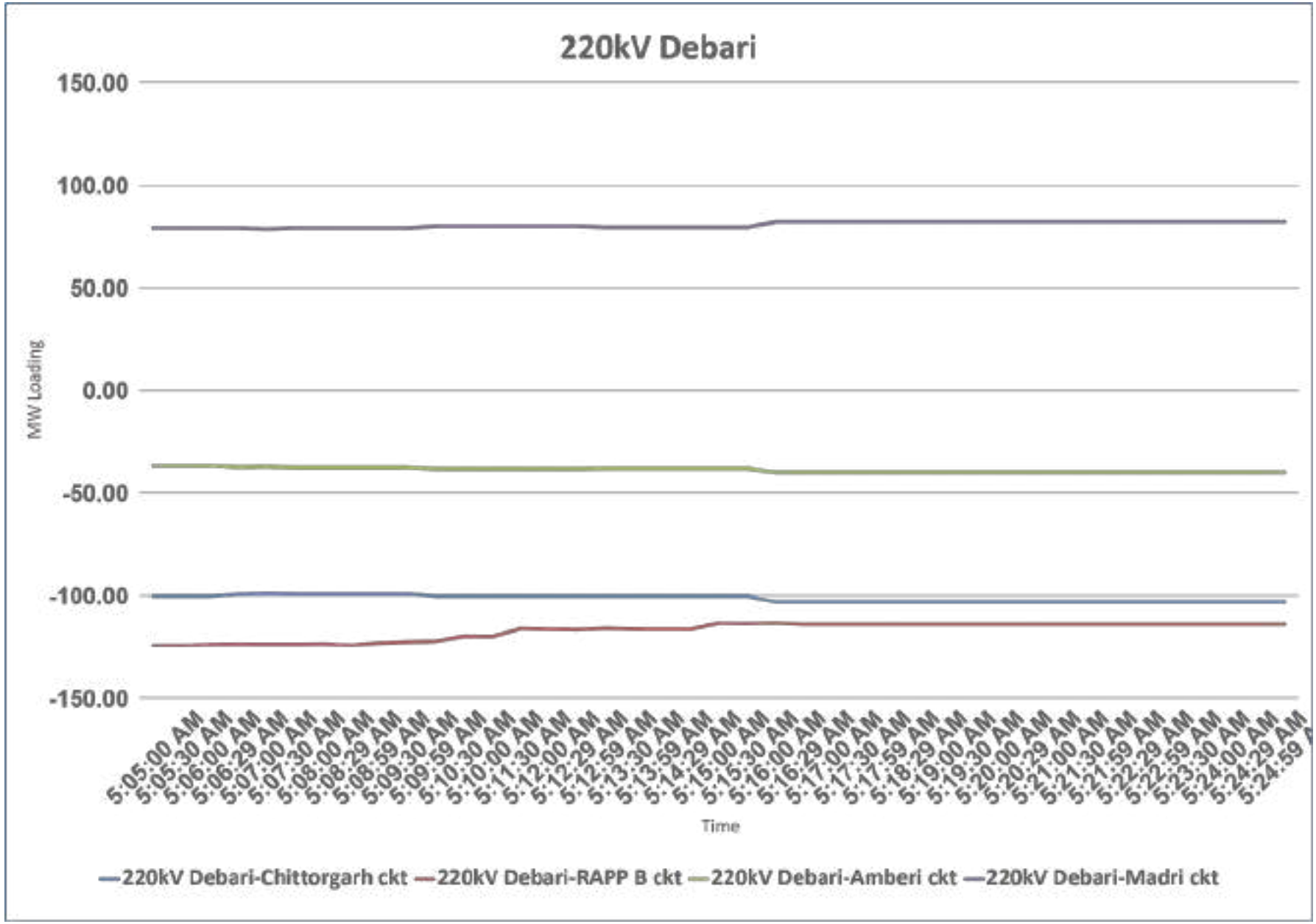
Major Observations:

1. Opening of line CB at Gulabpura end of 220kV Bundi(RS)-Gulabpura(RS) Ckt caused increase in loading of other connected lines as mentioned above **(Refer connection diagram)**.
2. Over-loading of lines led to cascaded tripping.
3. SCADA data of RAPP-A, RAPP-B and RAPP-C was freezed after the event.
4. SCADA SOE was not available for KTPS.
5. Details yet to be received from SLDC-Rajasthan and NPCIL.

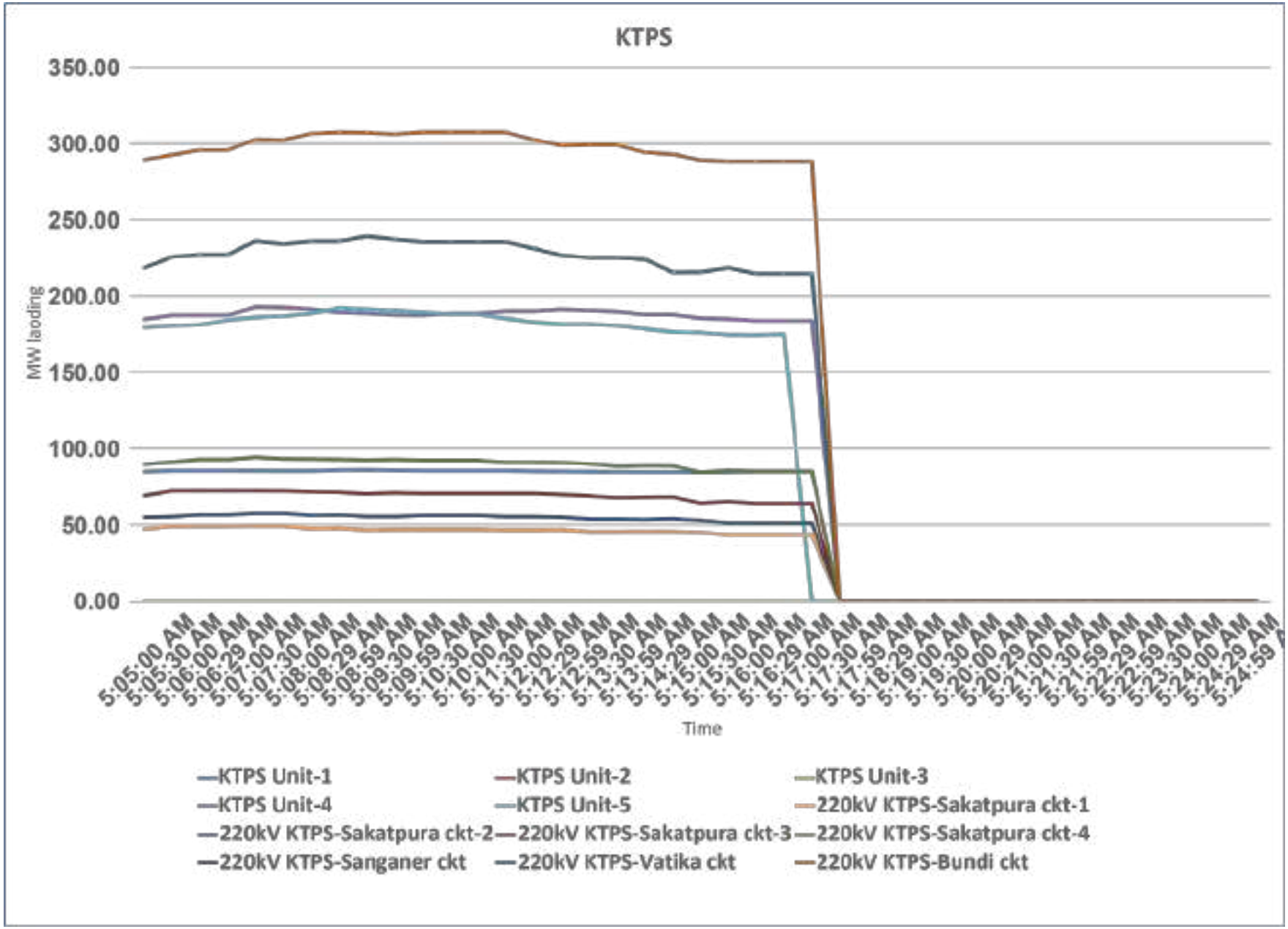
Element wise MW load flow



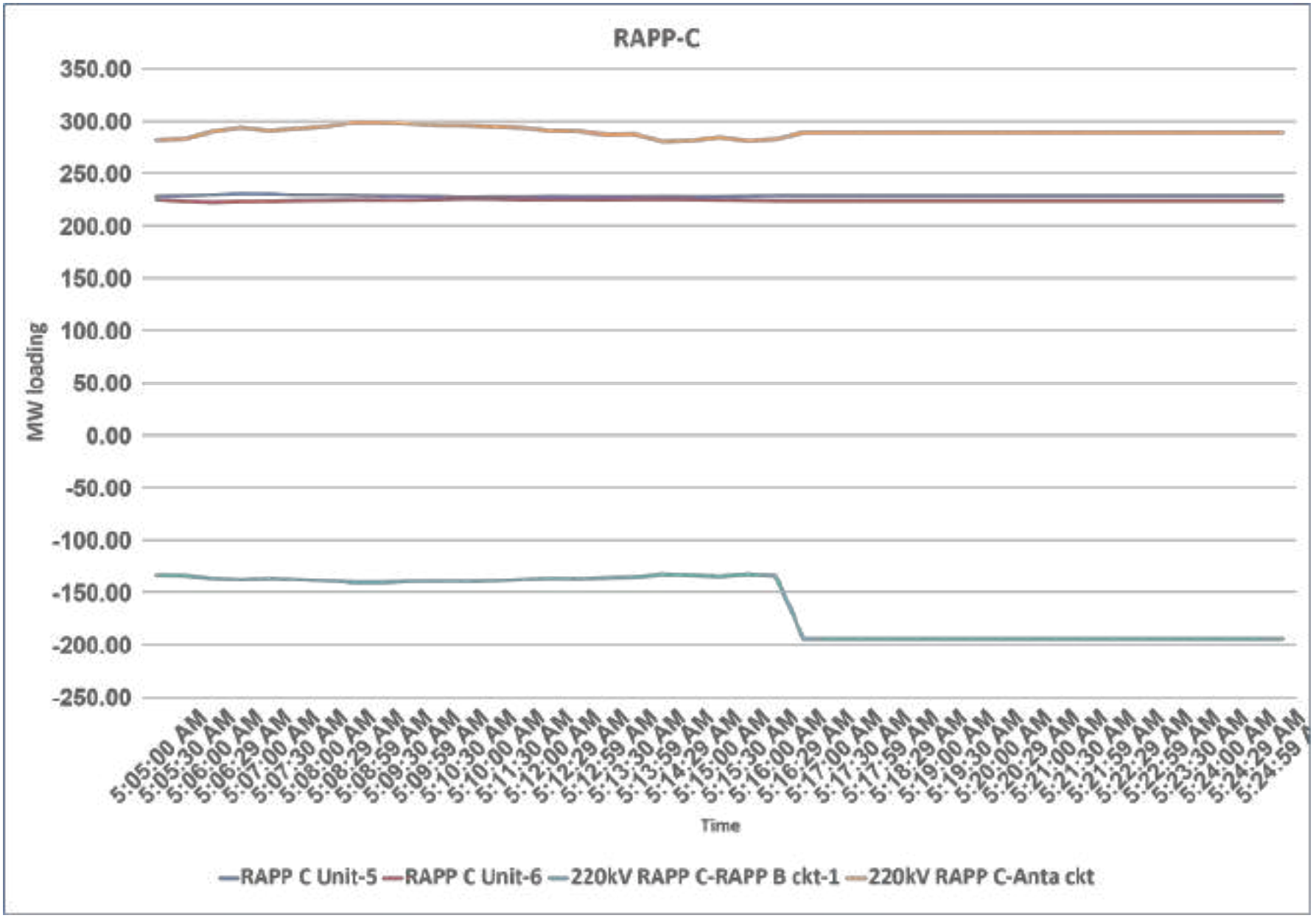
Element wise MW load flow



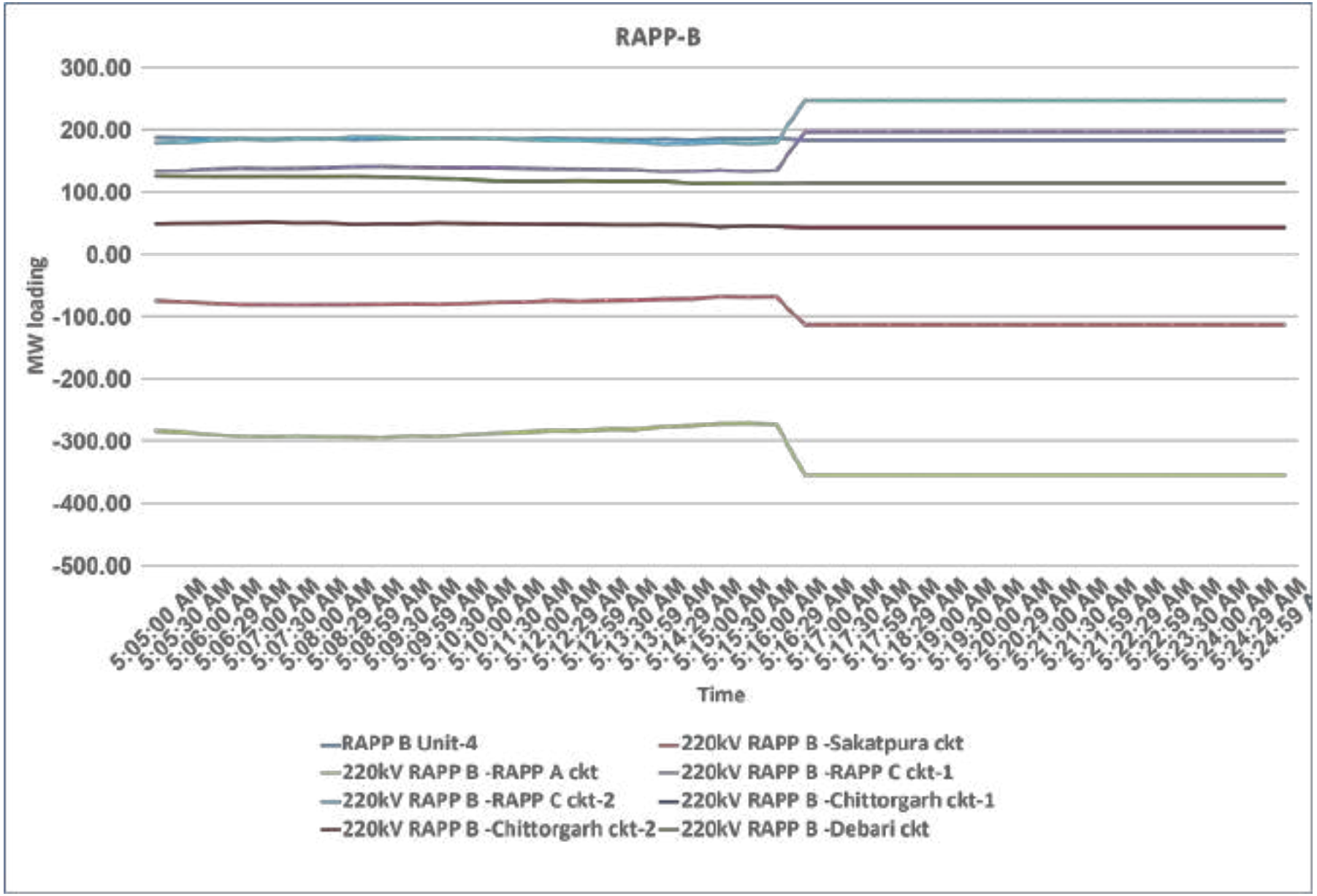
Element wise MW load flow



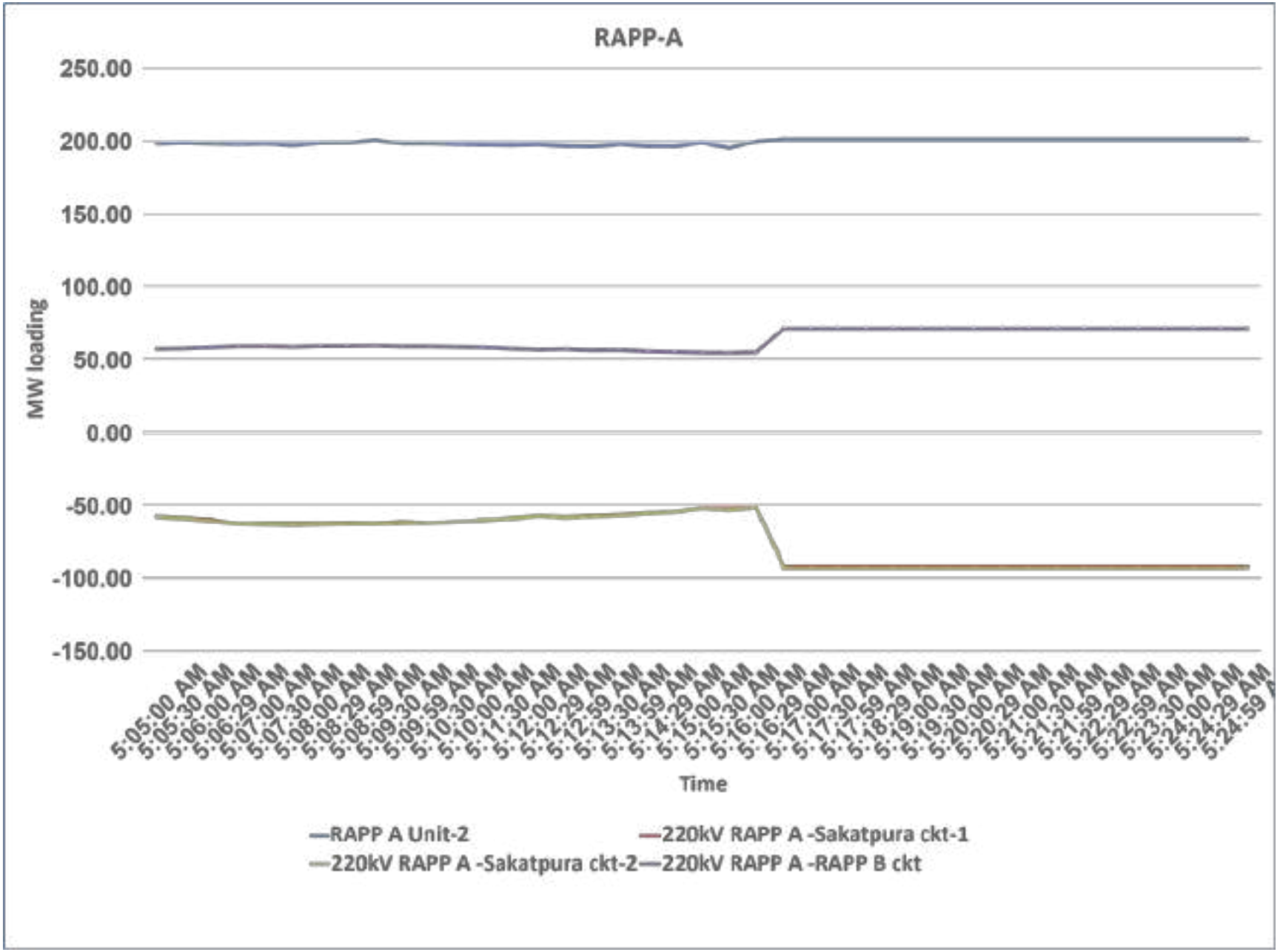
Element wise MW load flow



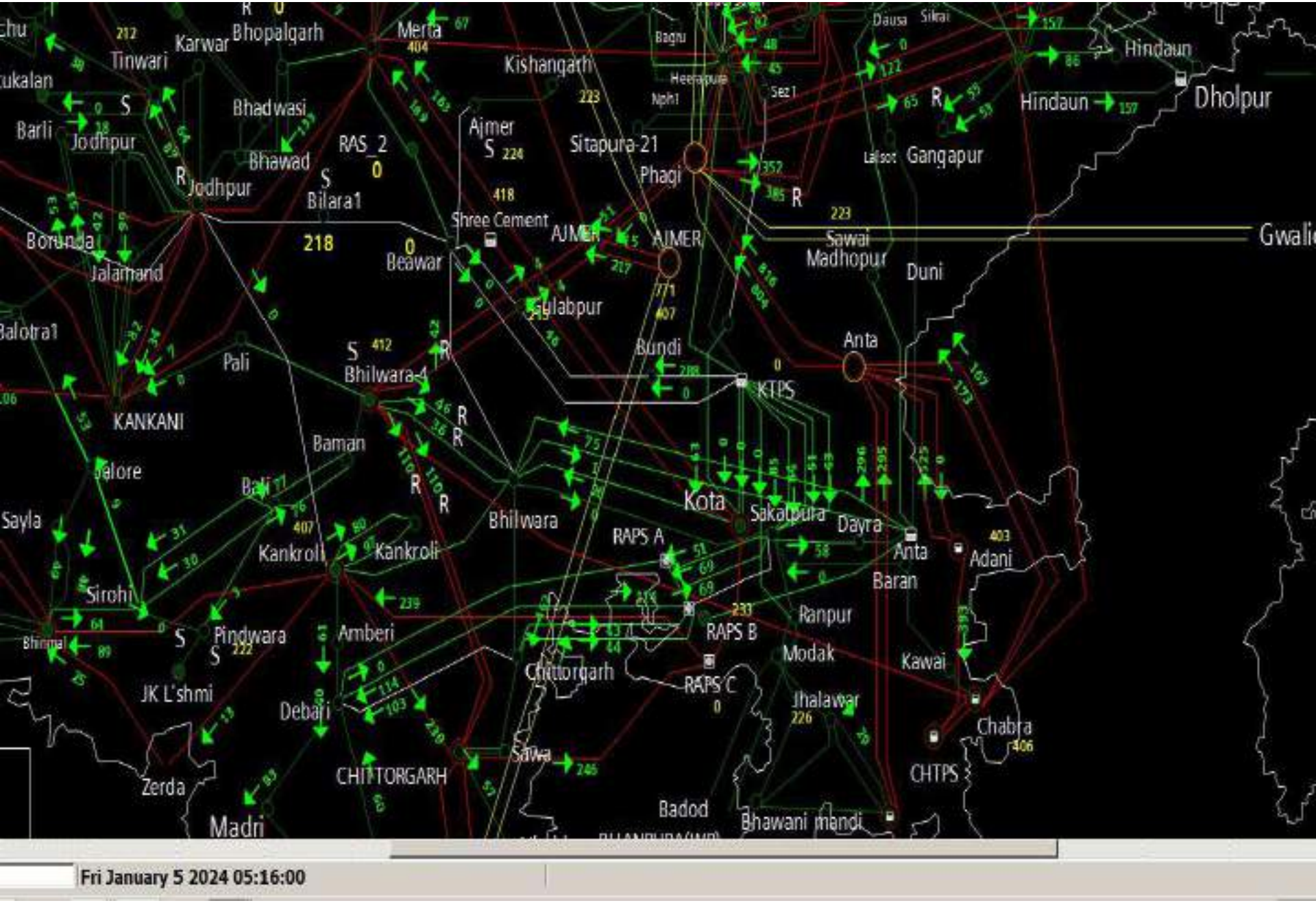
Element wise MW load flow



Element wise MW load flow

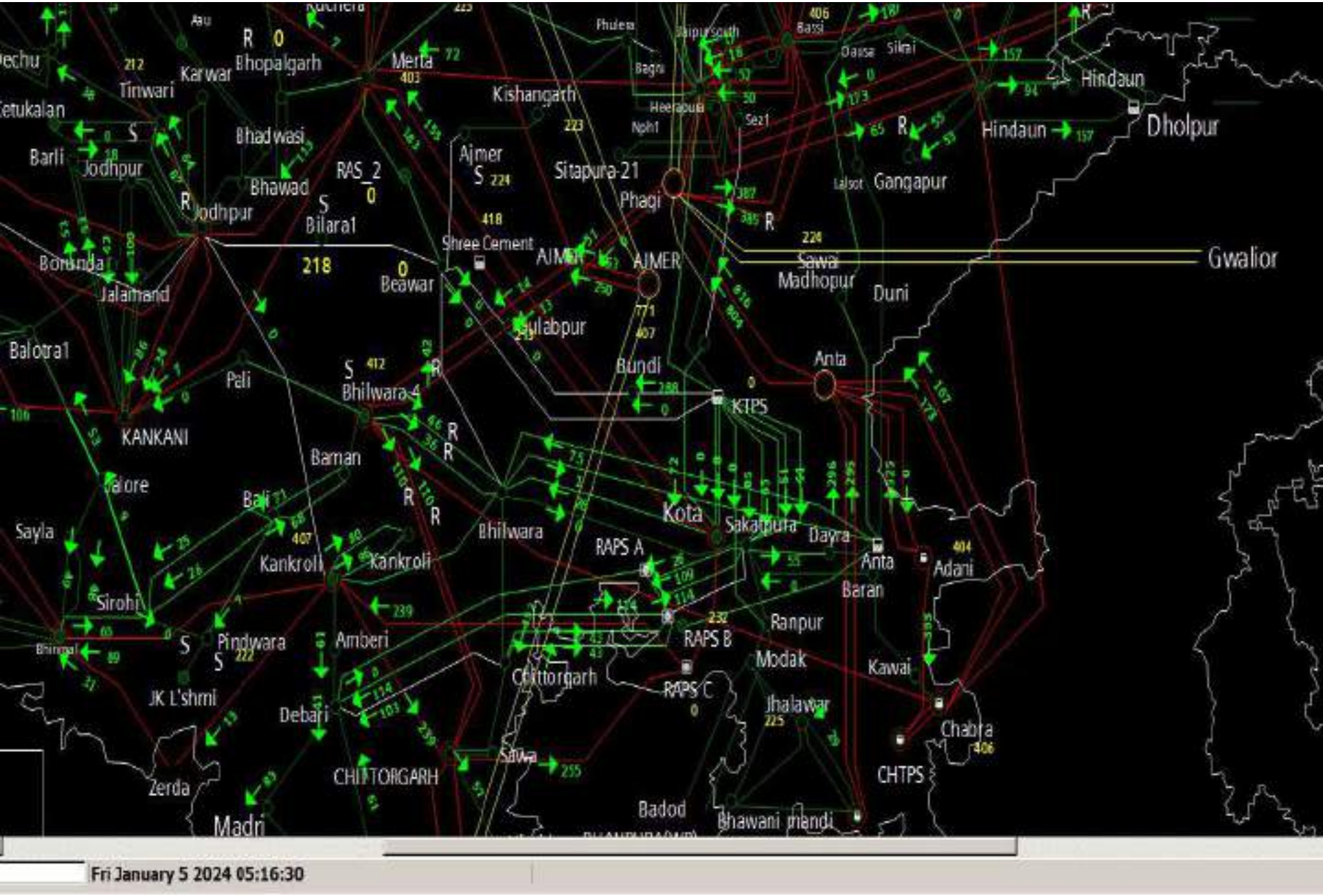


Network diagram @05:16:00hrs

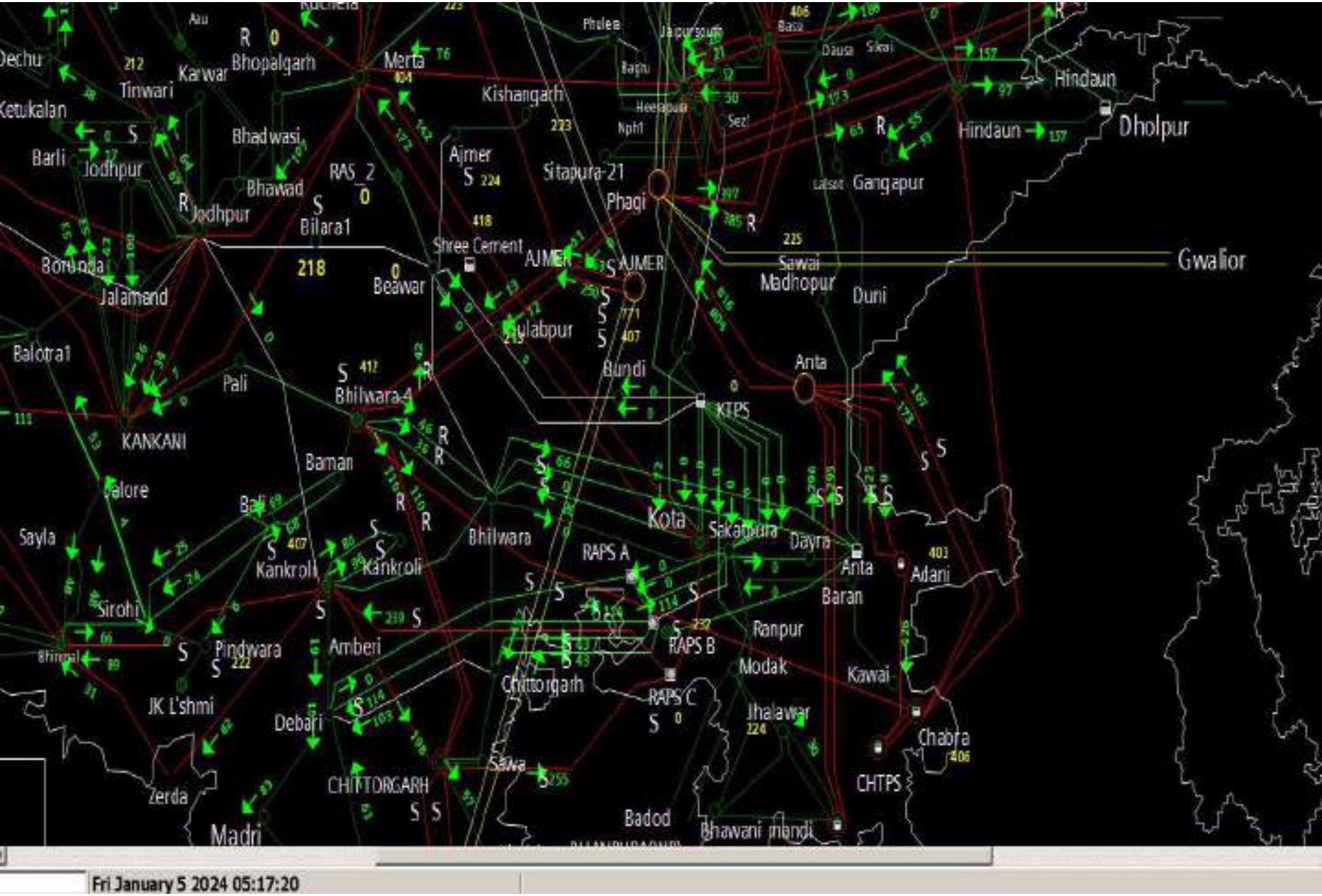


Fri January 5 2024 05:16:00

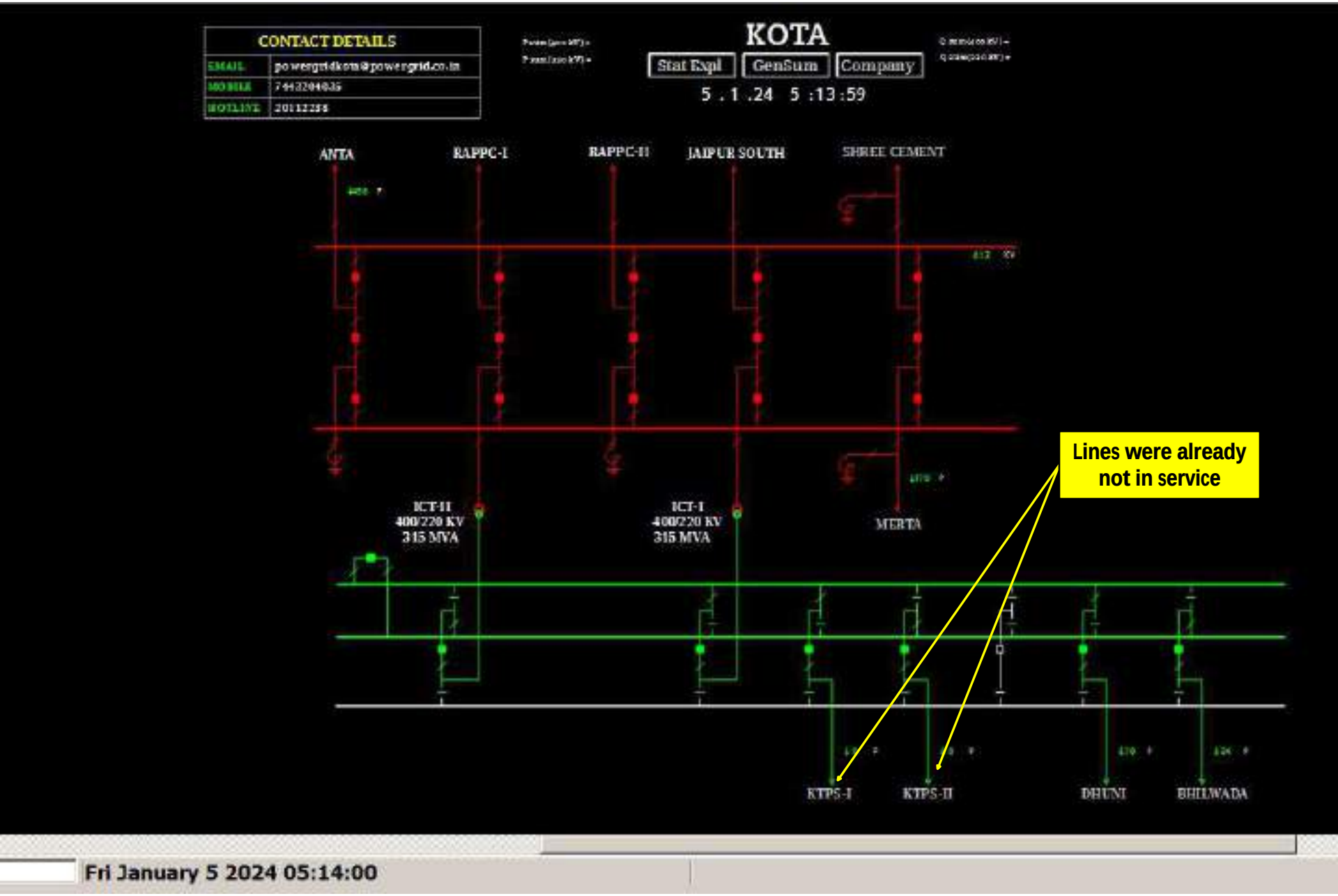
Network diagram @05:16:30hrs



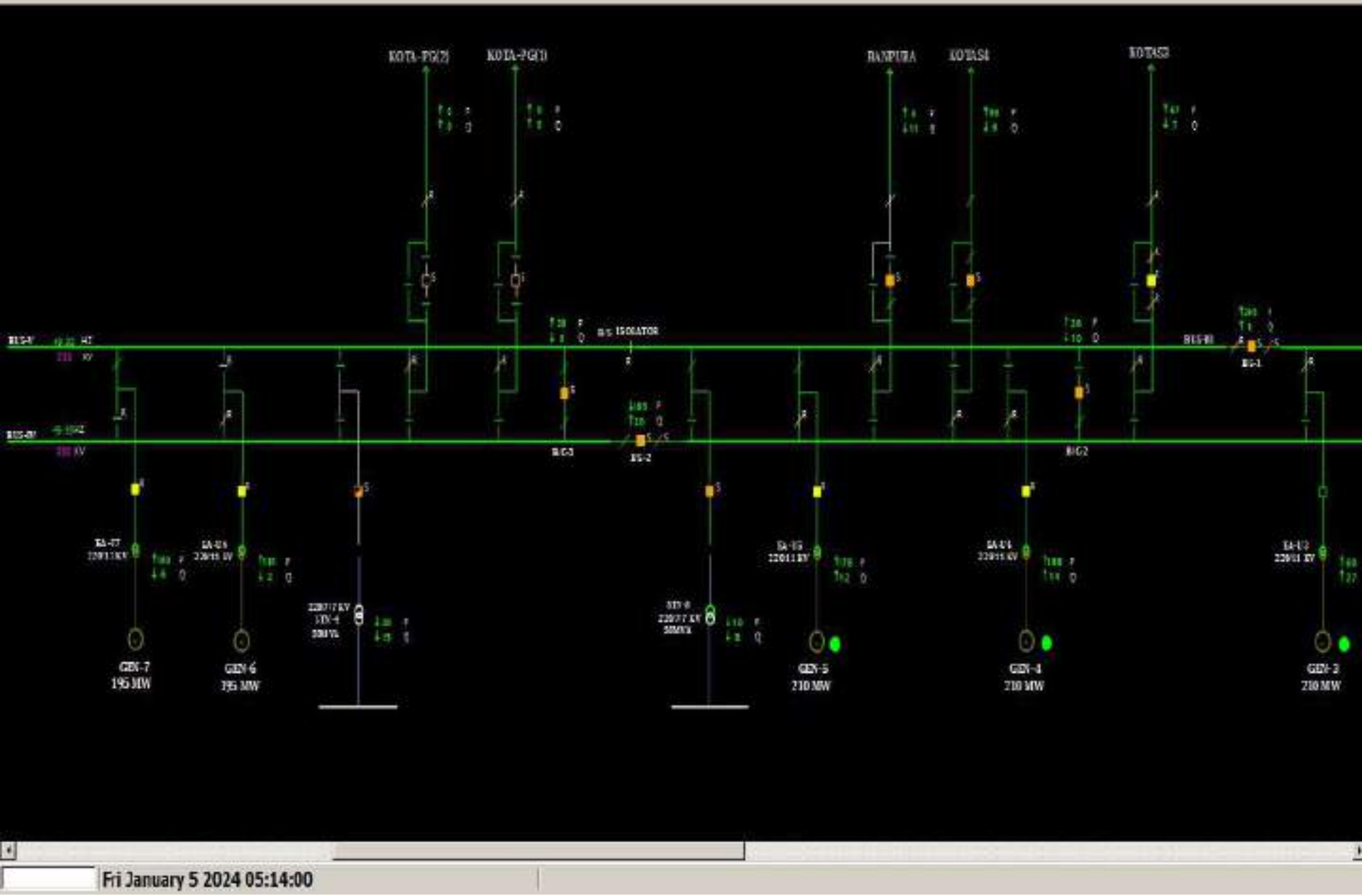
Network diagram @05:17:20hrs



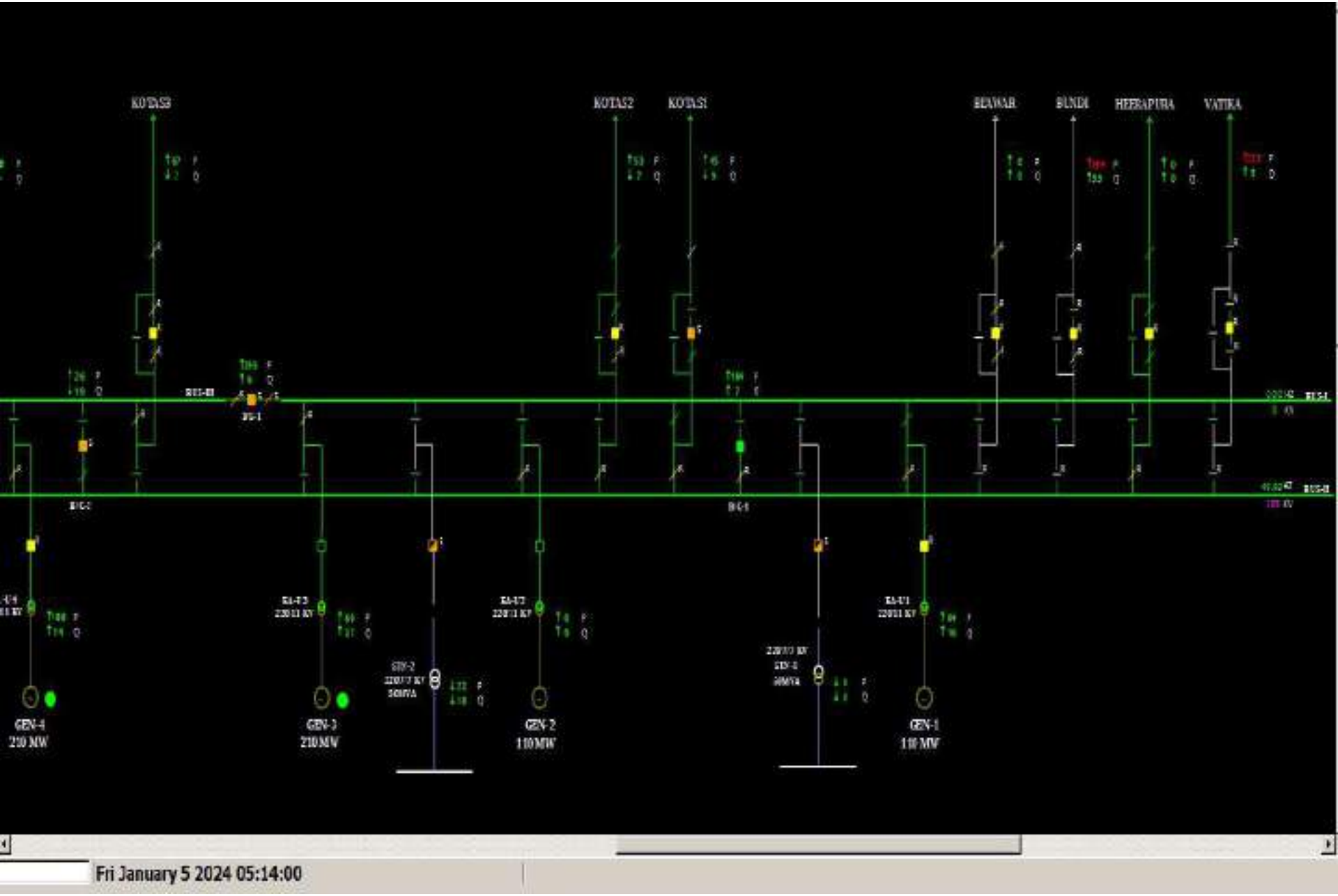
SLD of 400/220kV Kota(PG) before the event



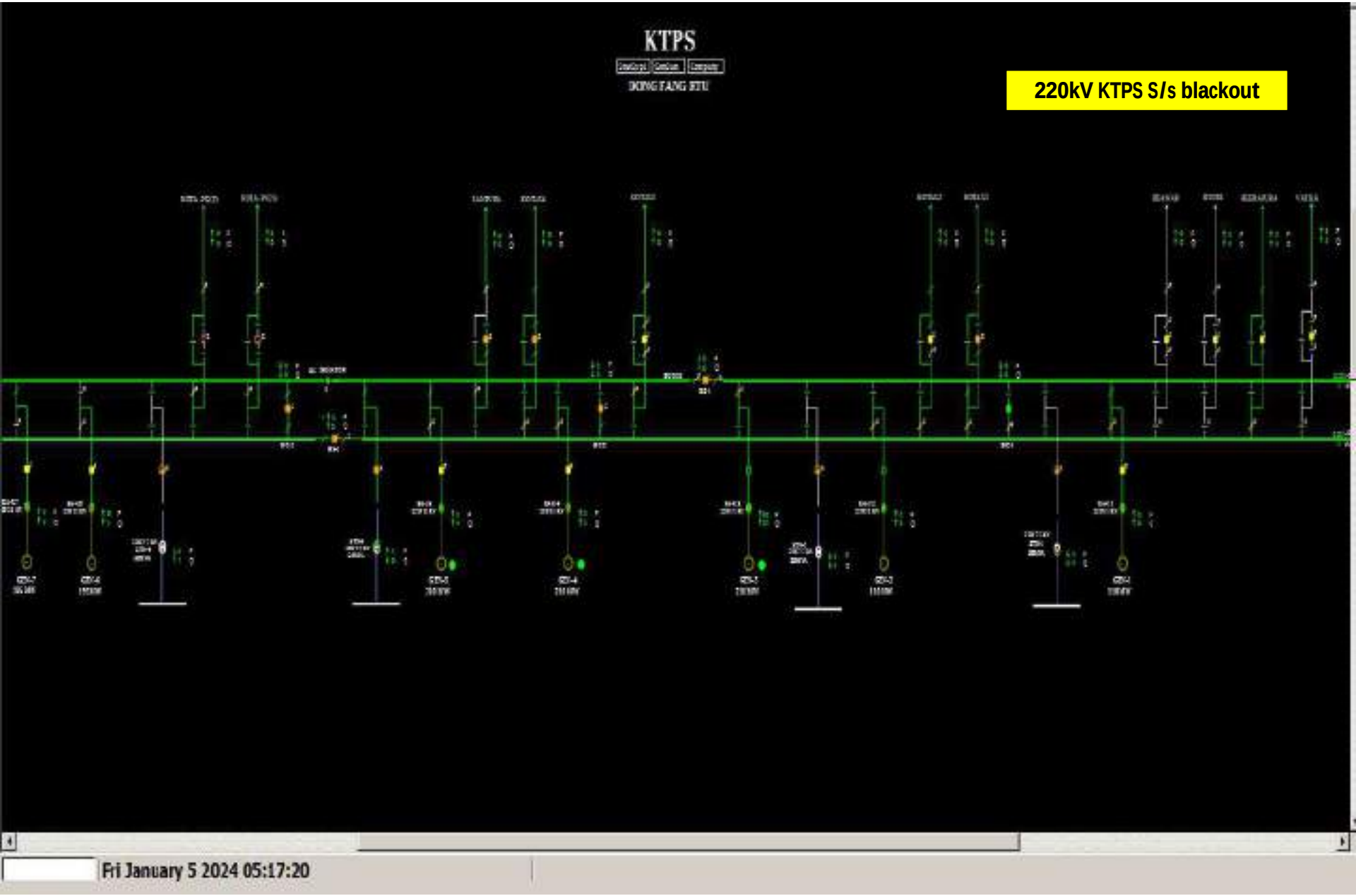
SLD of 220kV KTPS before the event (1/2)



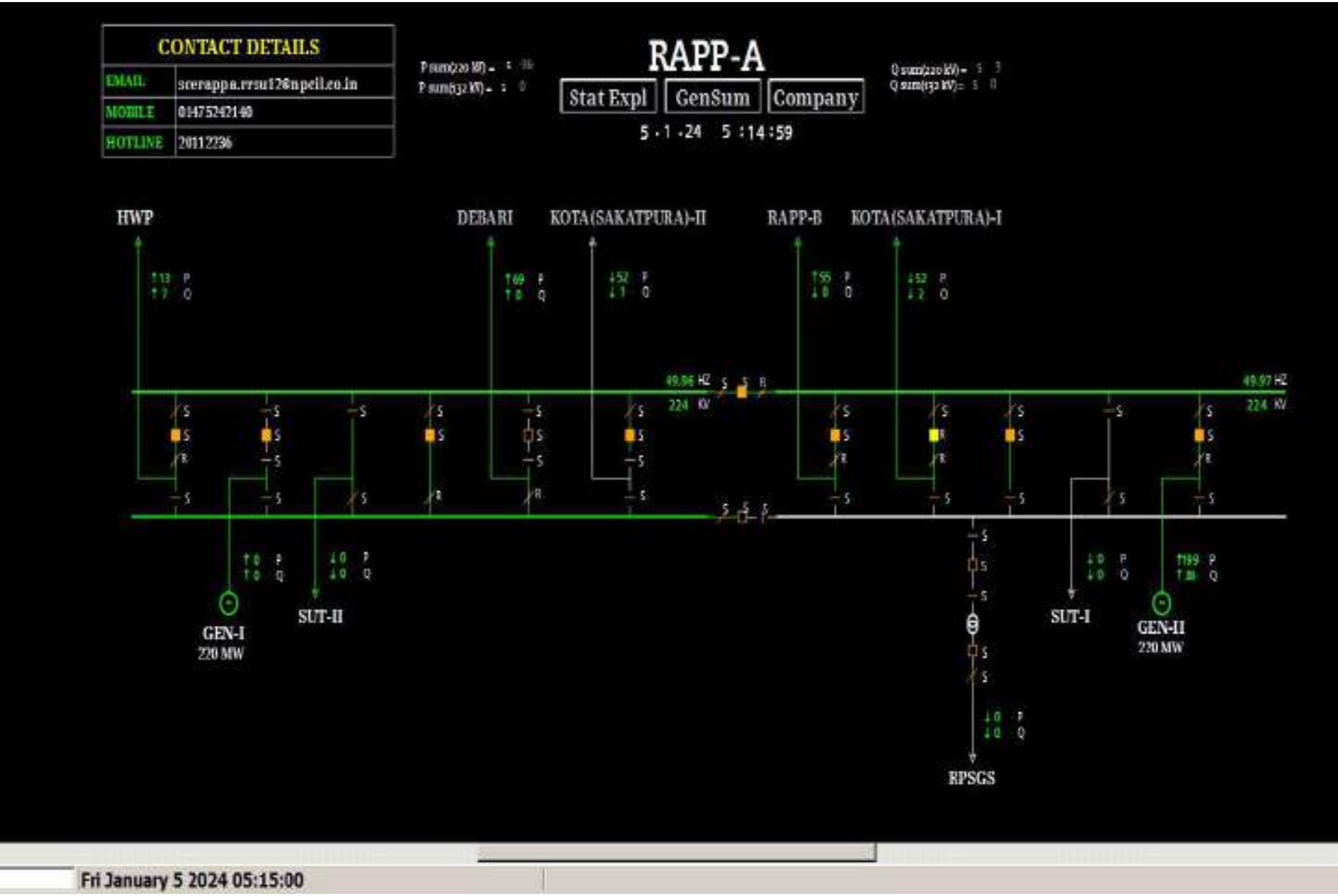
SLD of 220kV KTPS before the event (2/2)



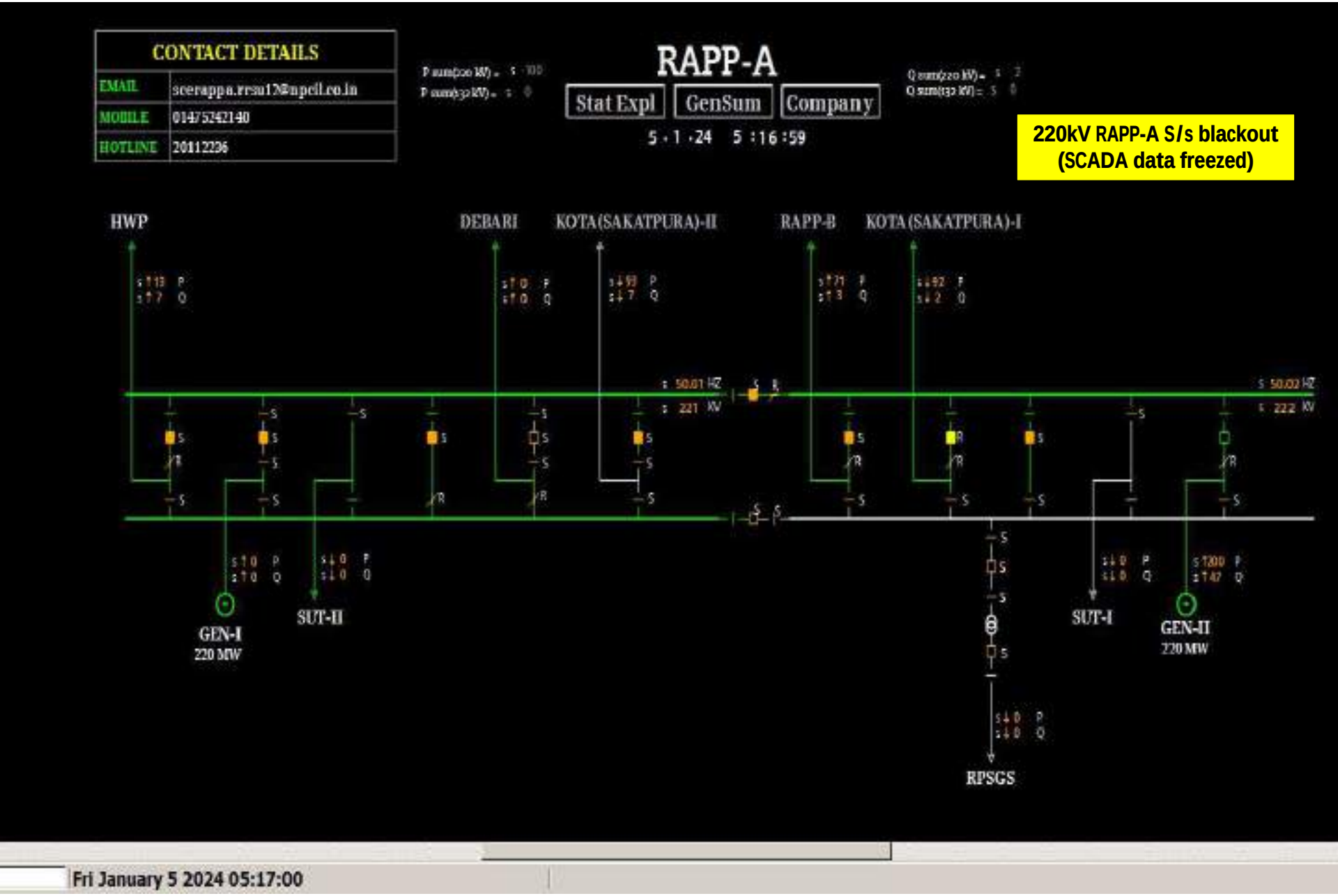
SLD of 220kV KTPS after the event



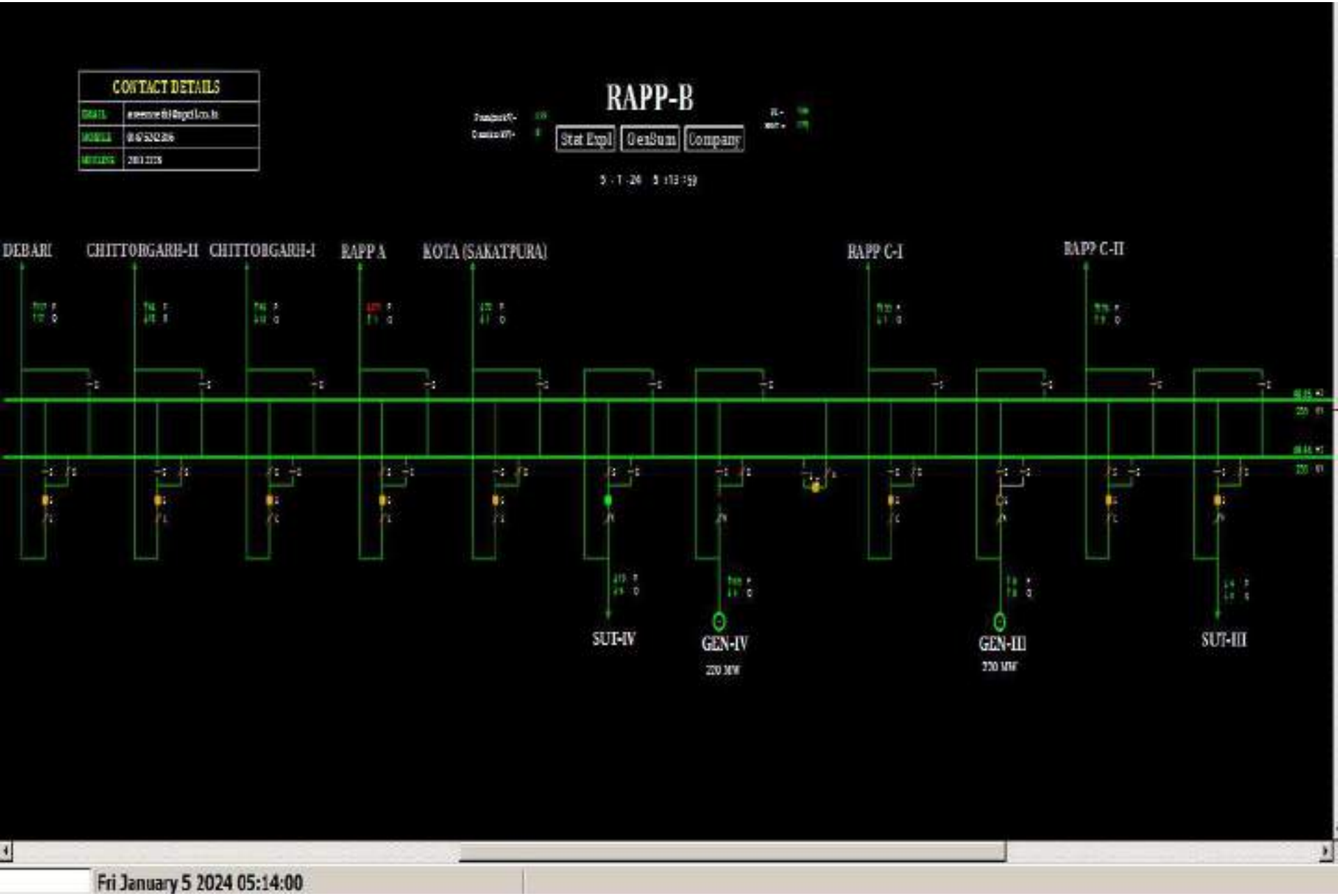
SLD of 220kV RAPP-A(NP) before the event



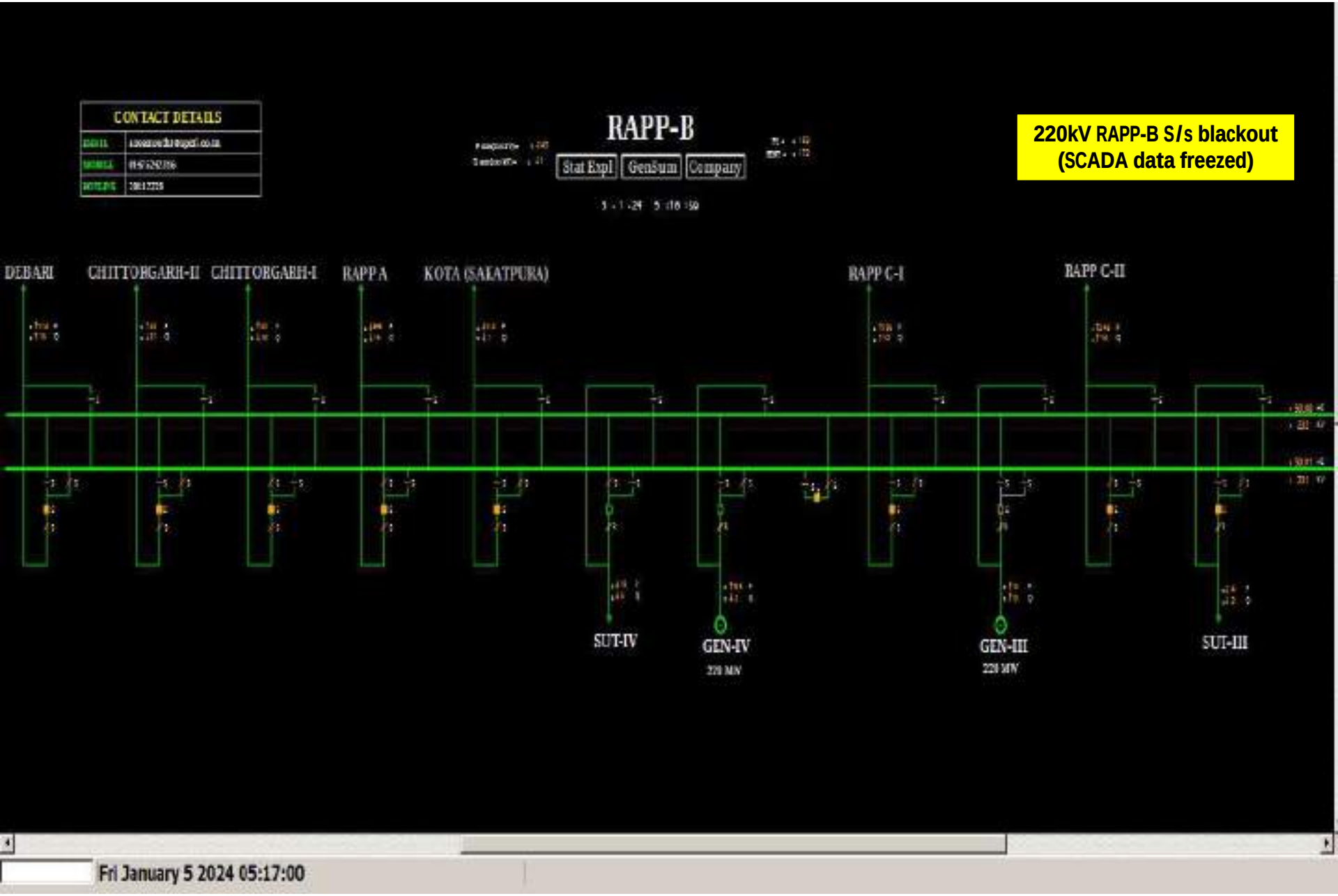
SLD of 220kV RAPP-A(NP) after the event



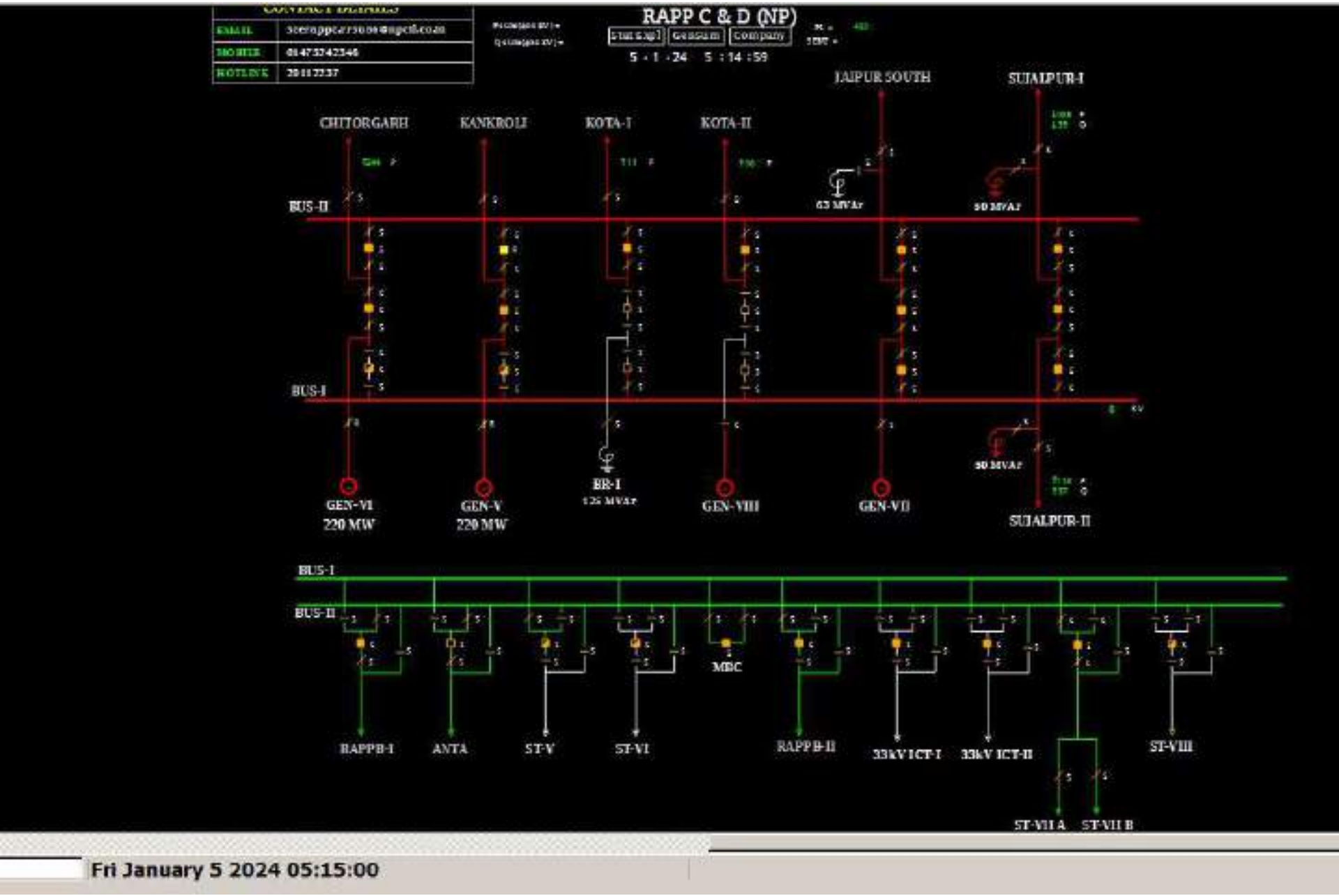
SLD of 220kV RAPP-B(NP) before the event



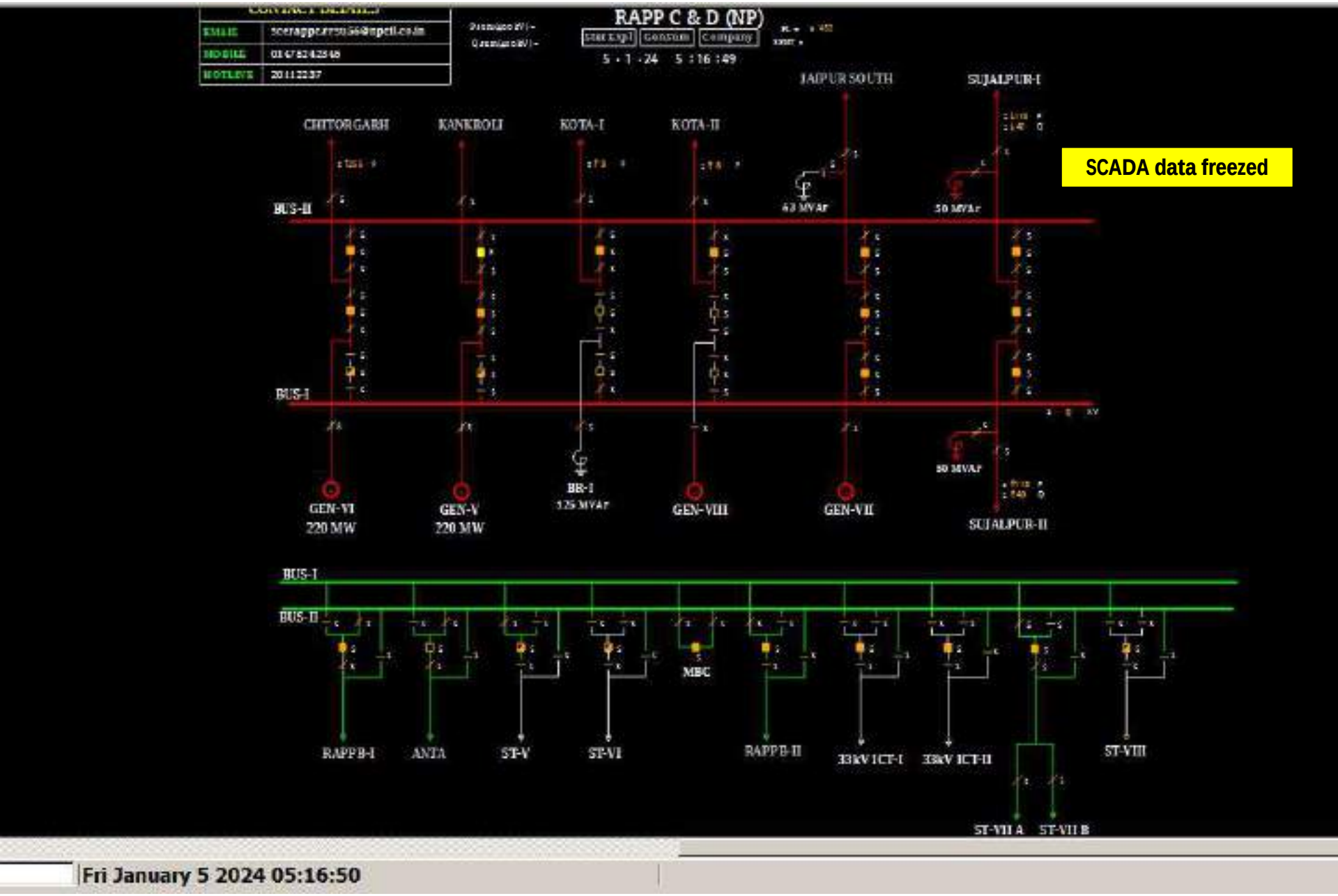
SLD of 220kV RAPP-B(NP) after the event



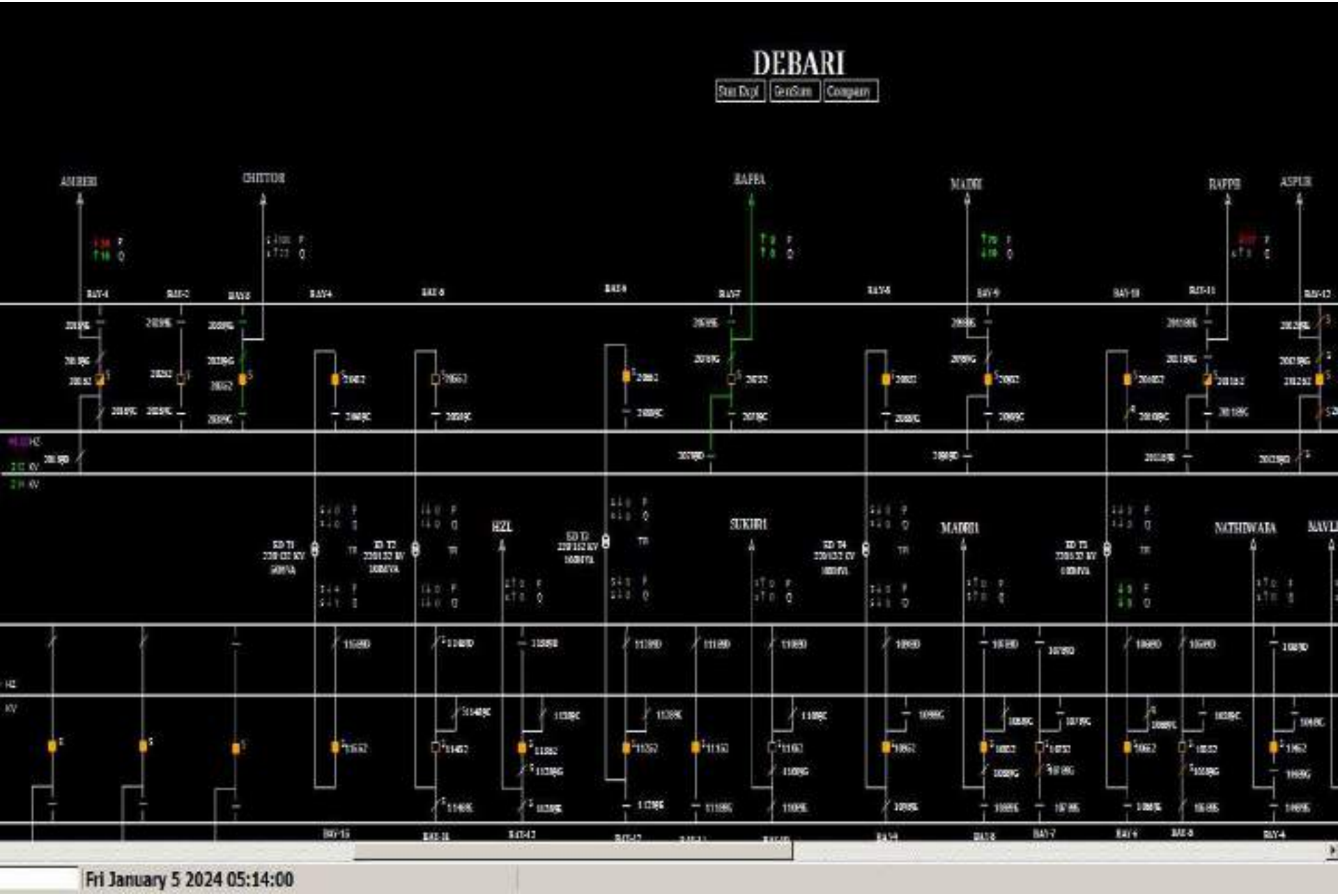
SLD of 400/220kV RAPP-C(NP) before the event



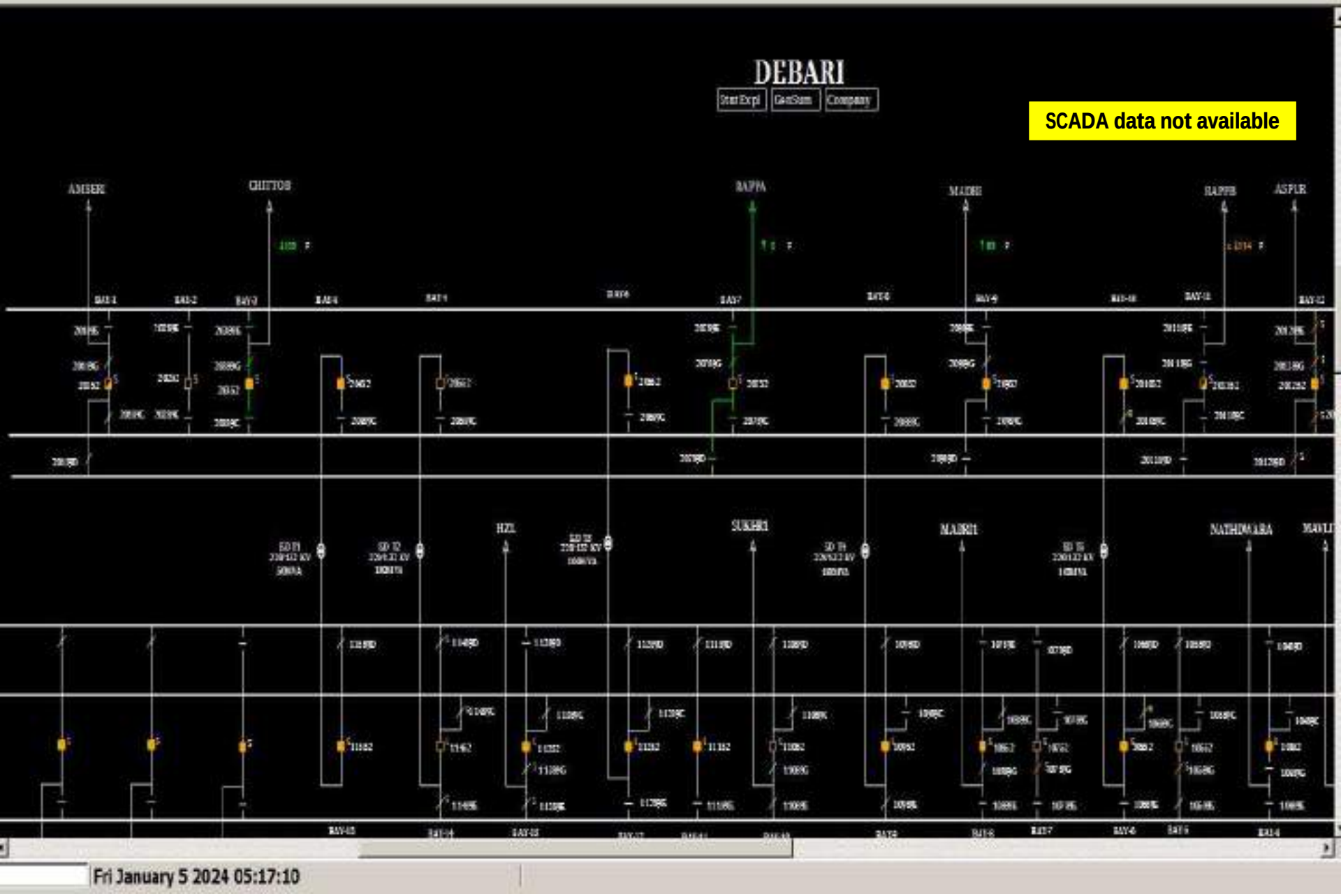
SLD of 400/220kV RAPP-C(NP) after the event



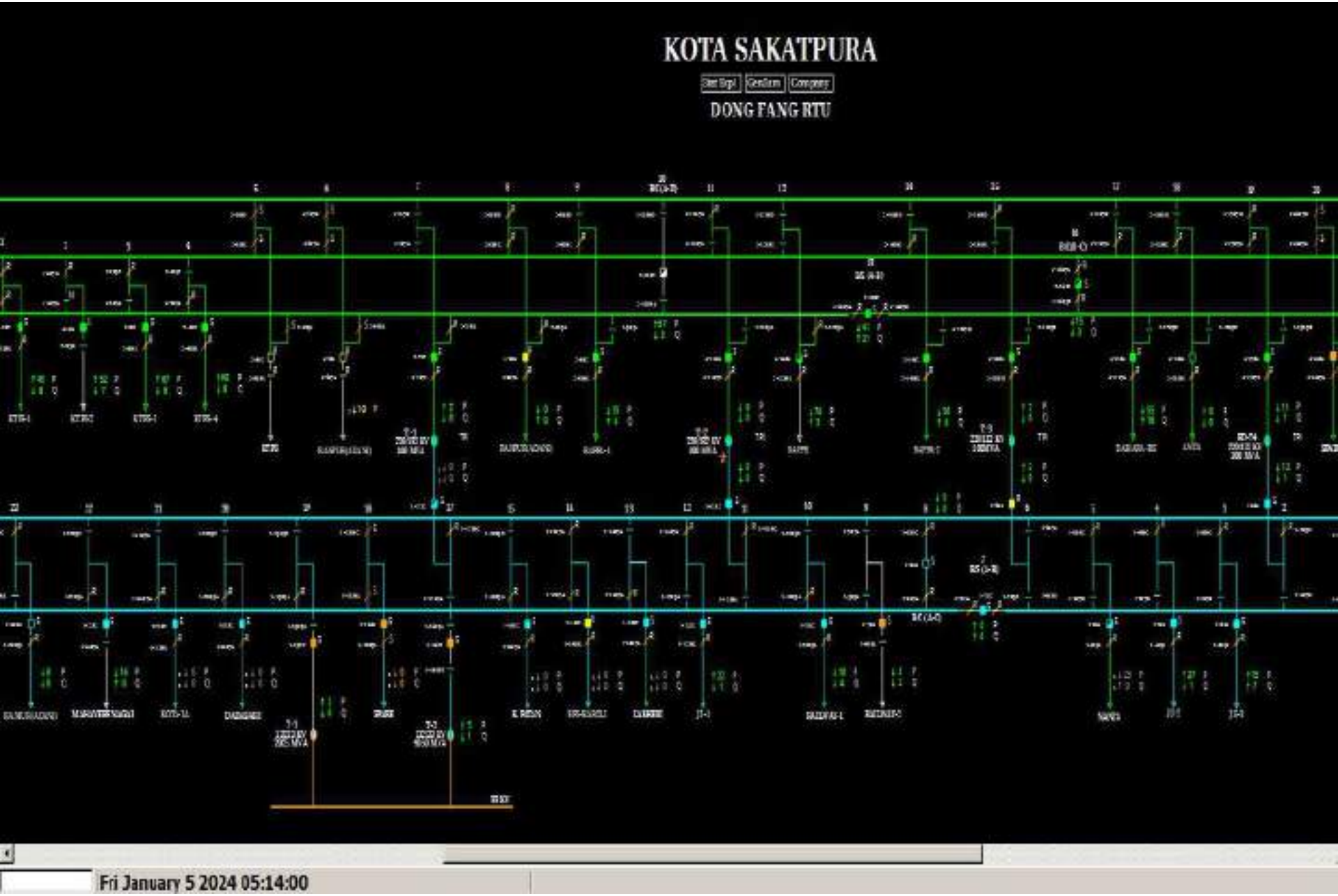
SLD of 220/132kV Debari(RS) before the event



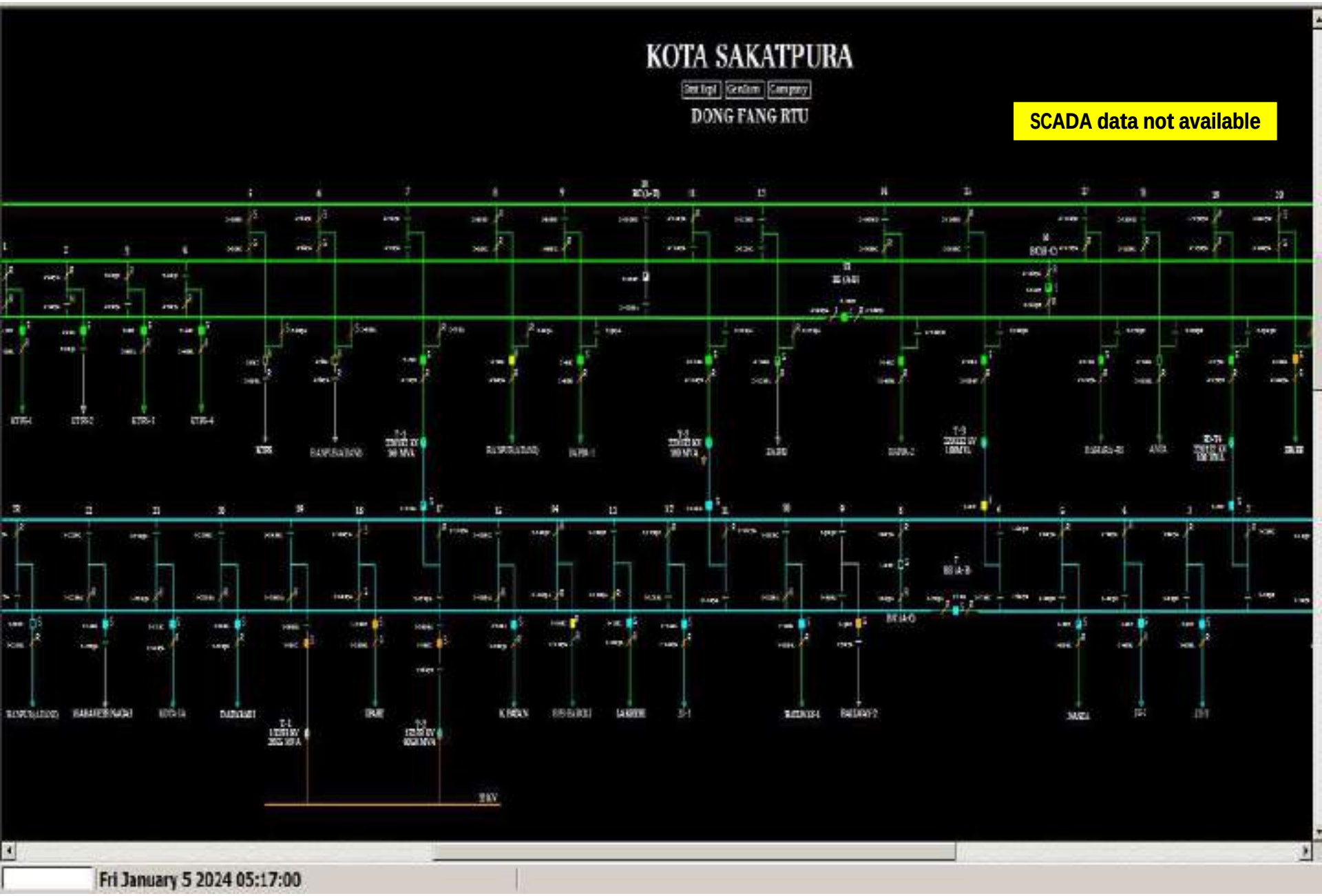
SLD of 220/132kV Debari(RS) after the event



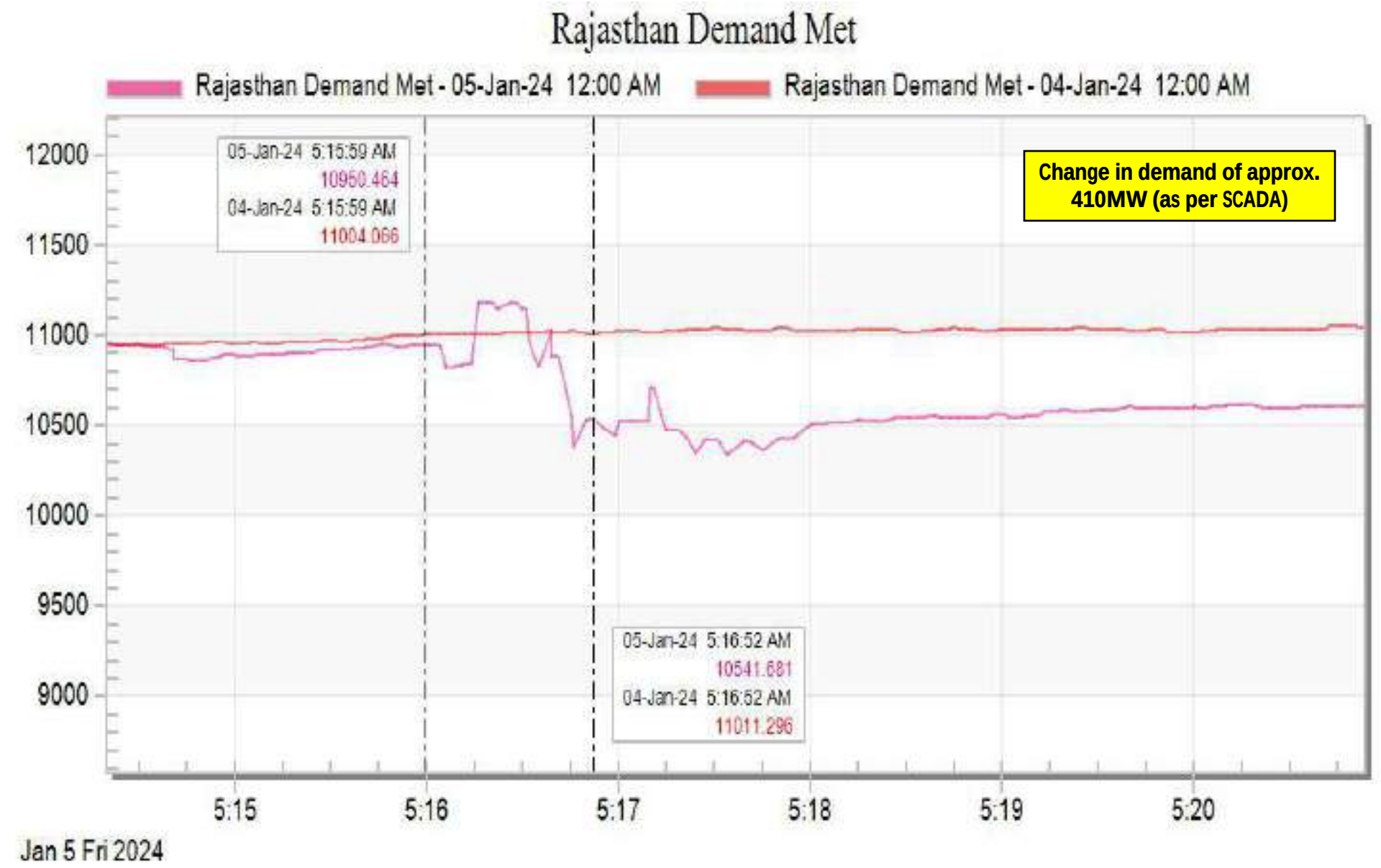
SLD of 220/132kV Kota Sakatpura(RS) before the event



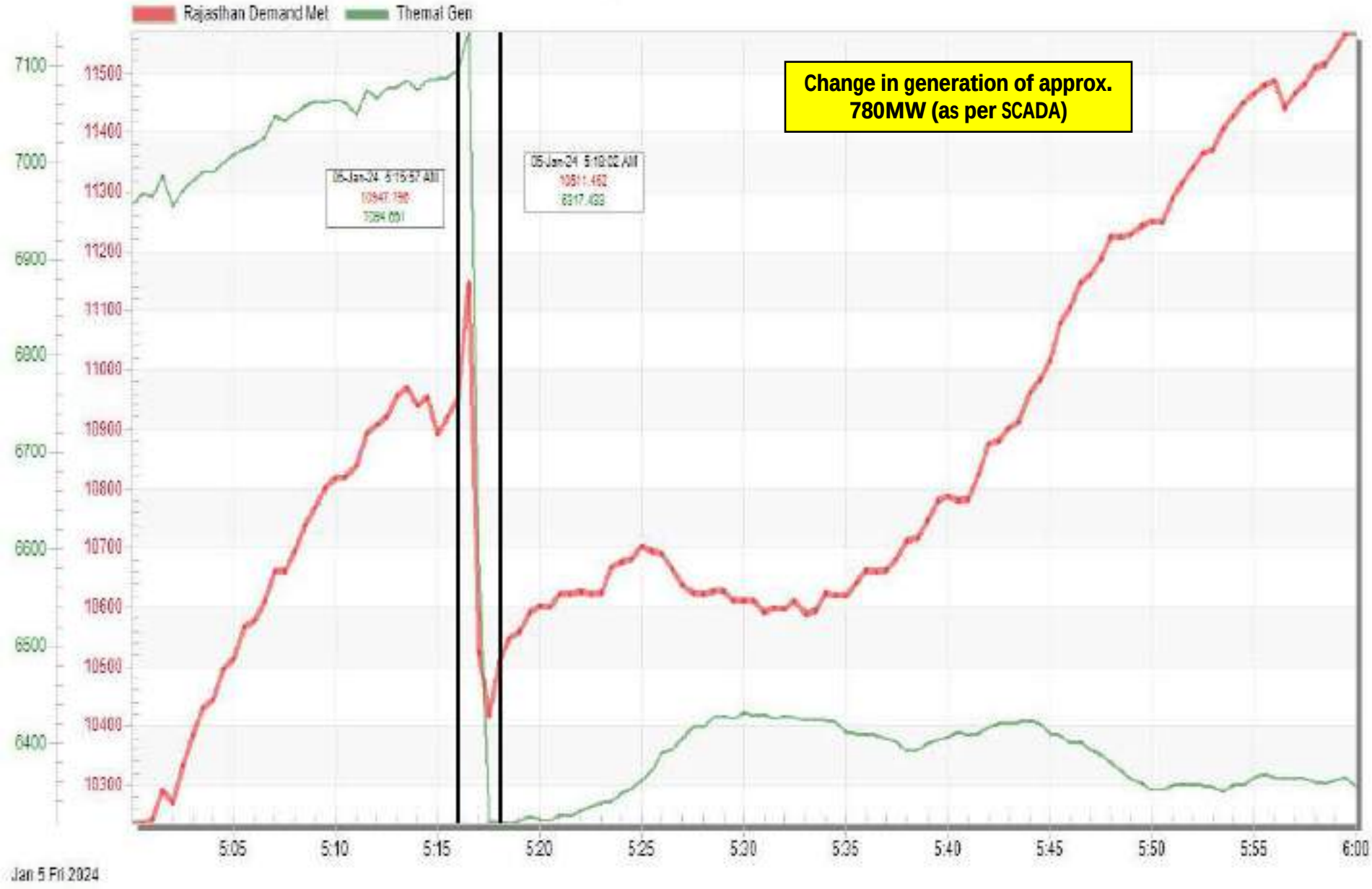
SLD of 220/132kV Kota Sakatpura(RS) after the event



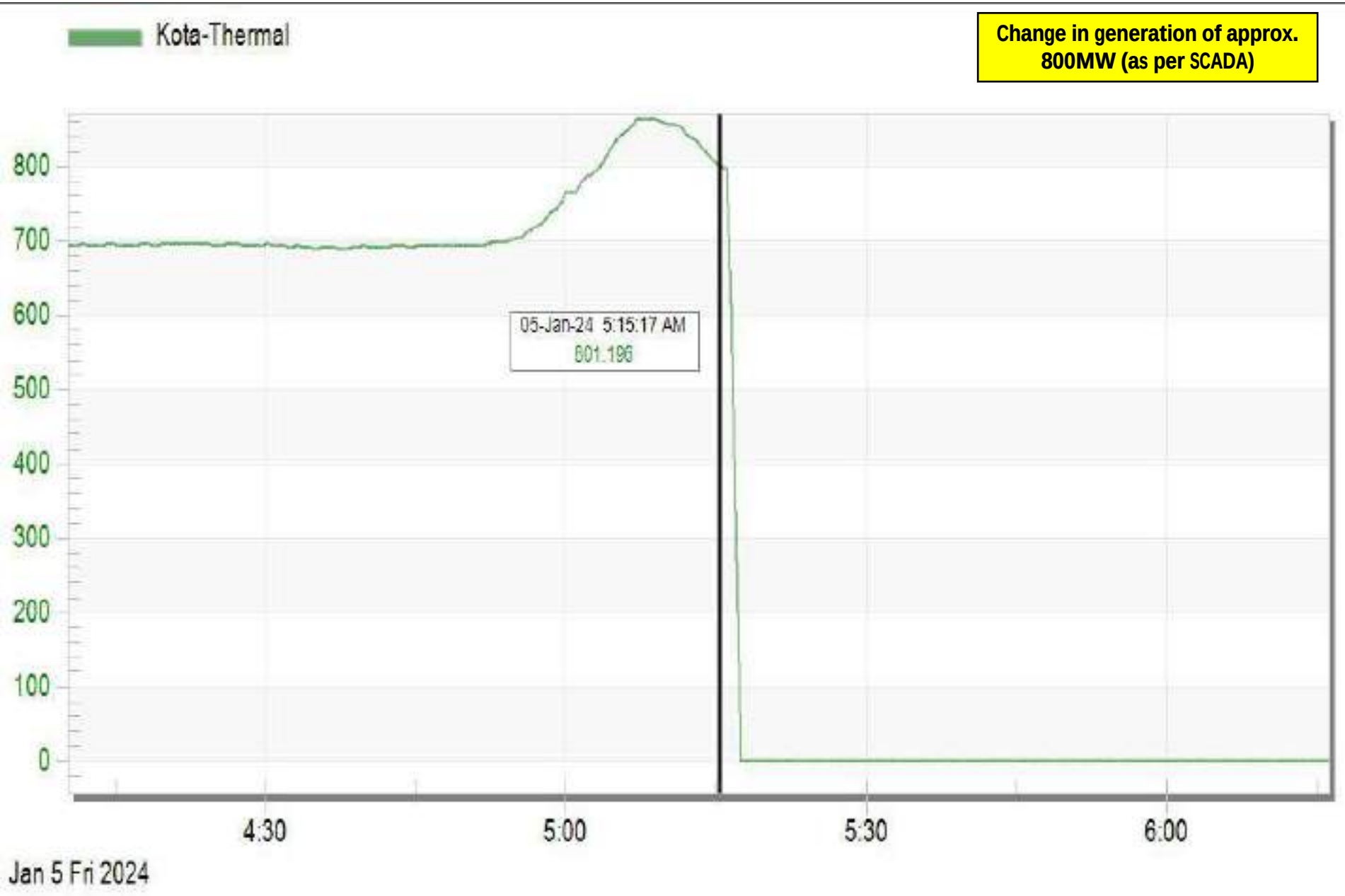
Rajasthan demand during the event



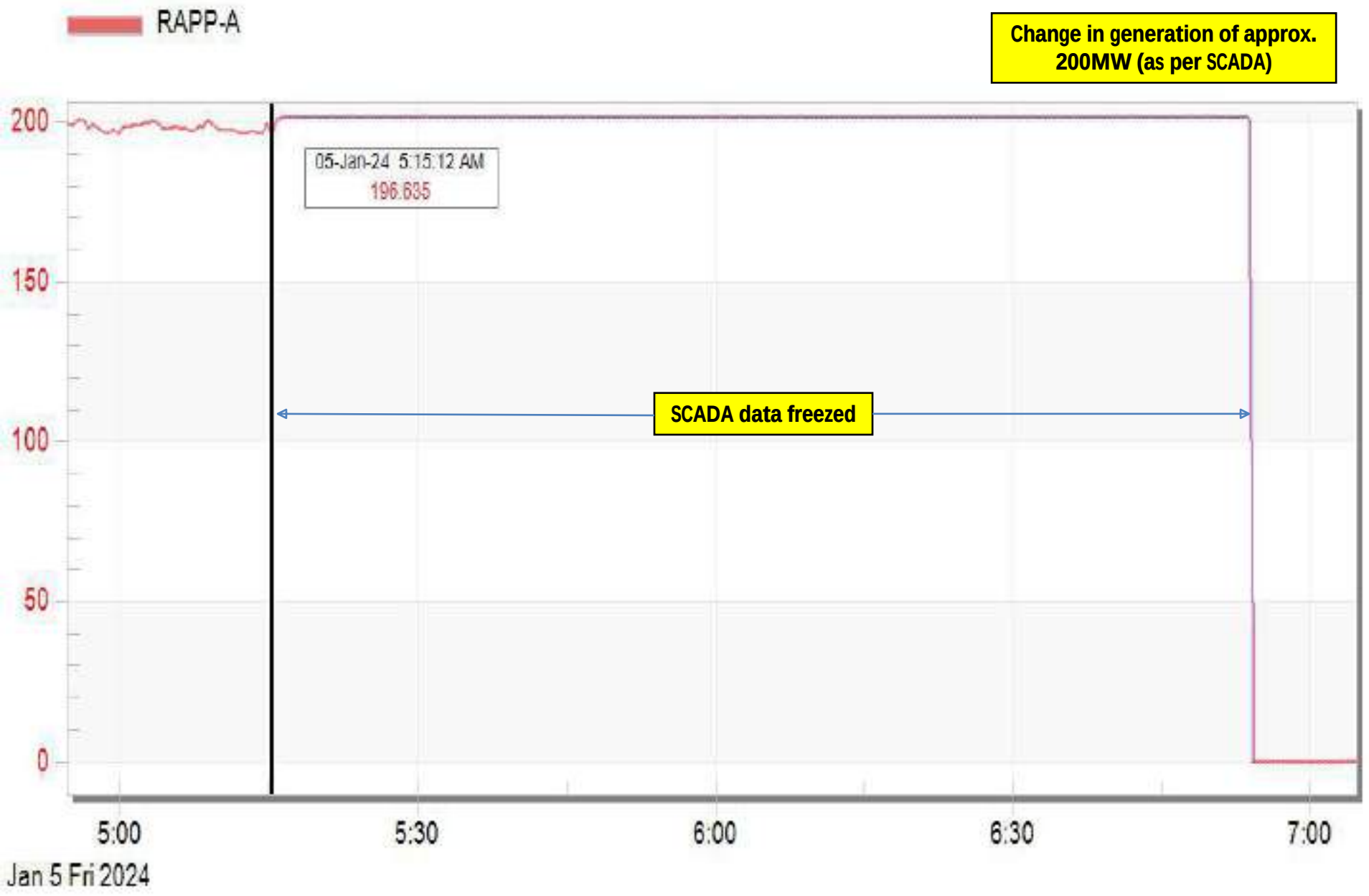
Rajasthan demand vs generation during the event



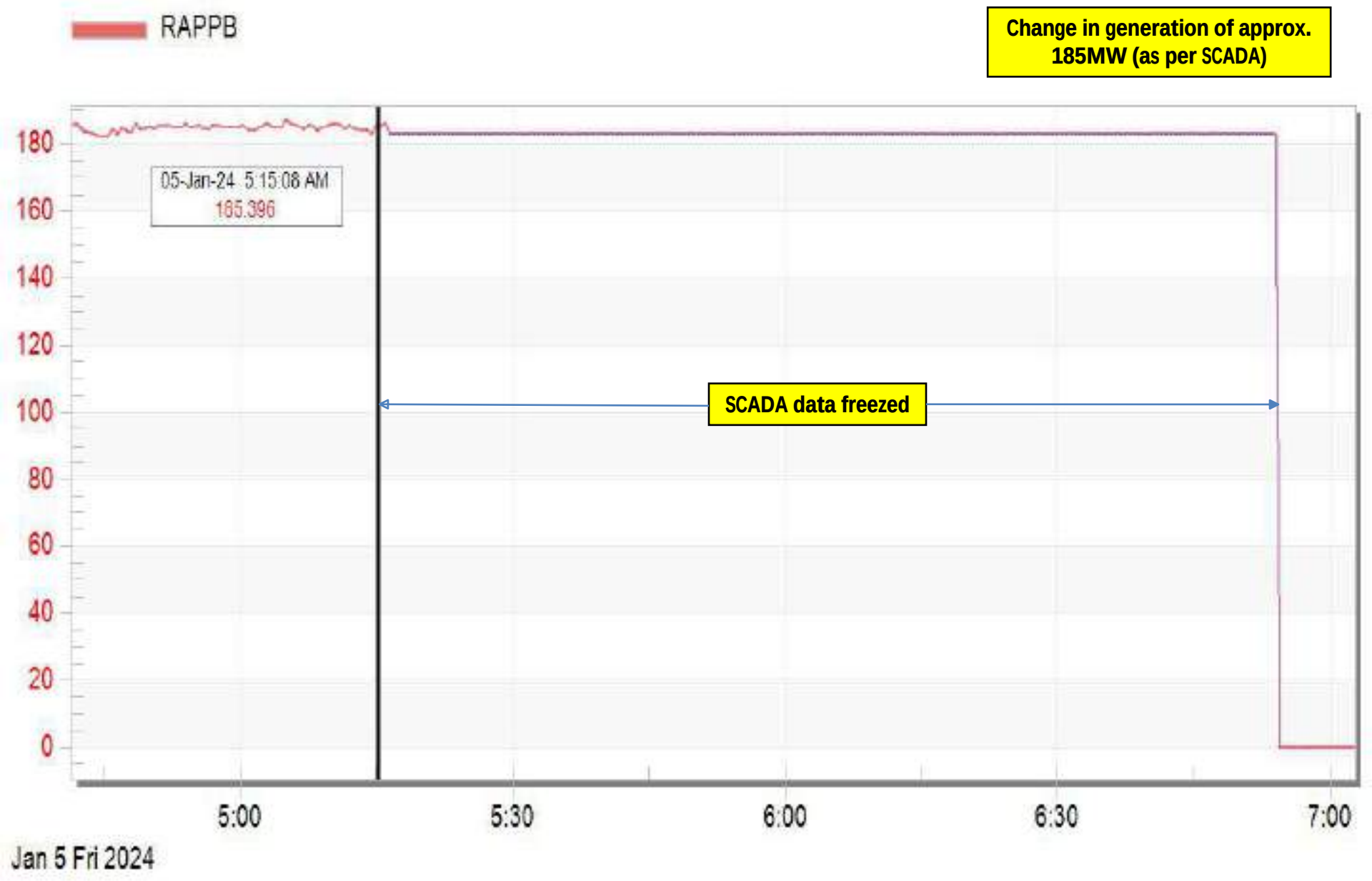
KTPS generation during the event



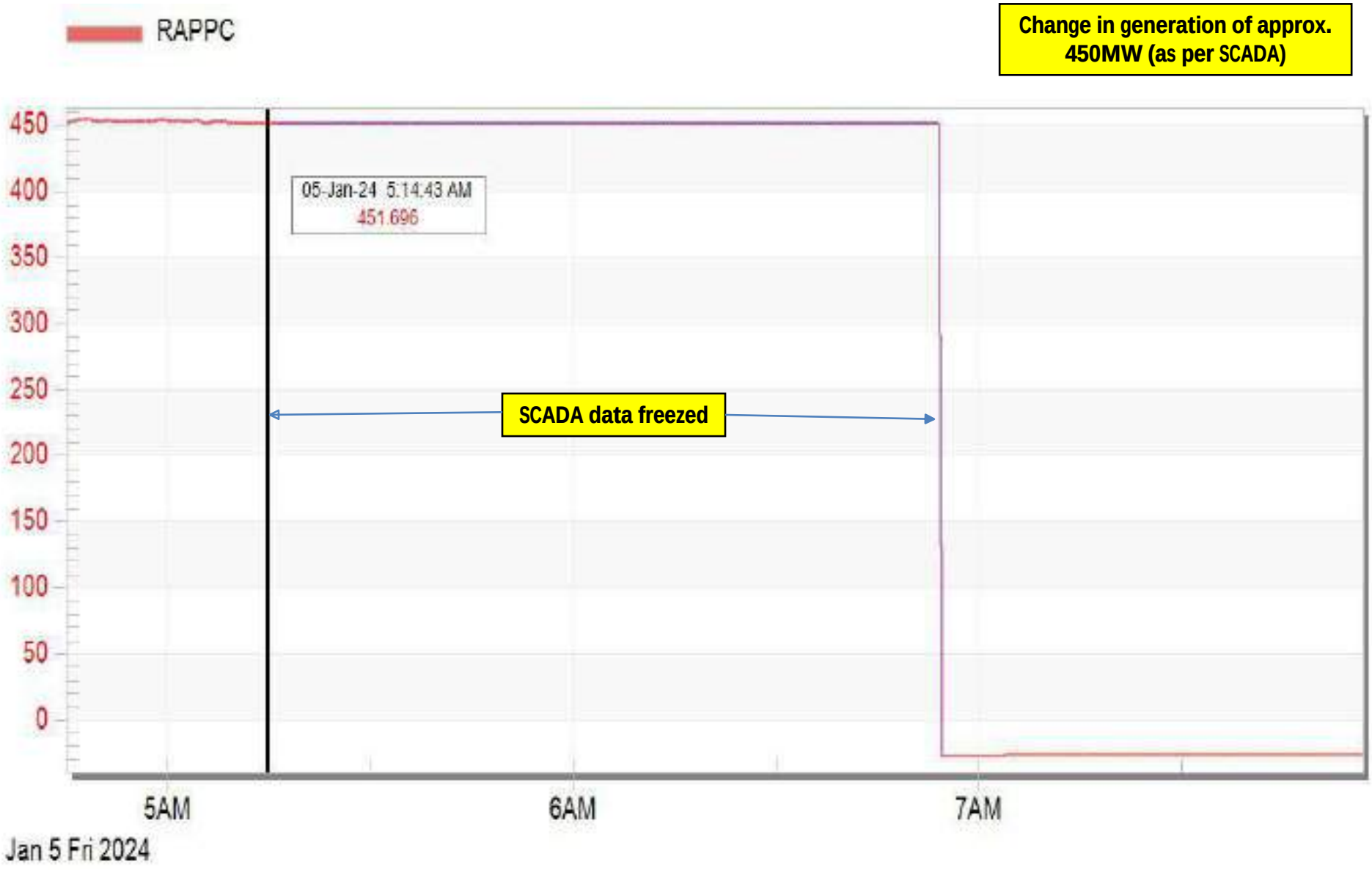
RAPP-A(NP) generation during the event



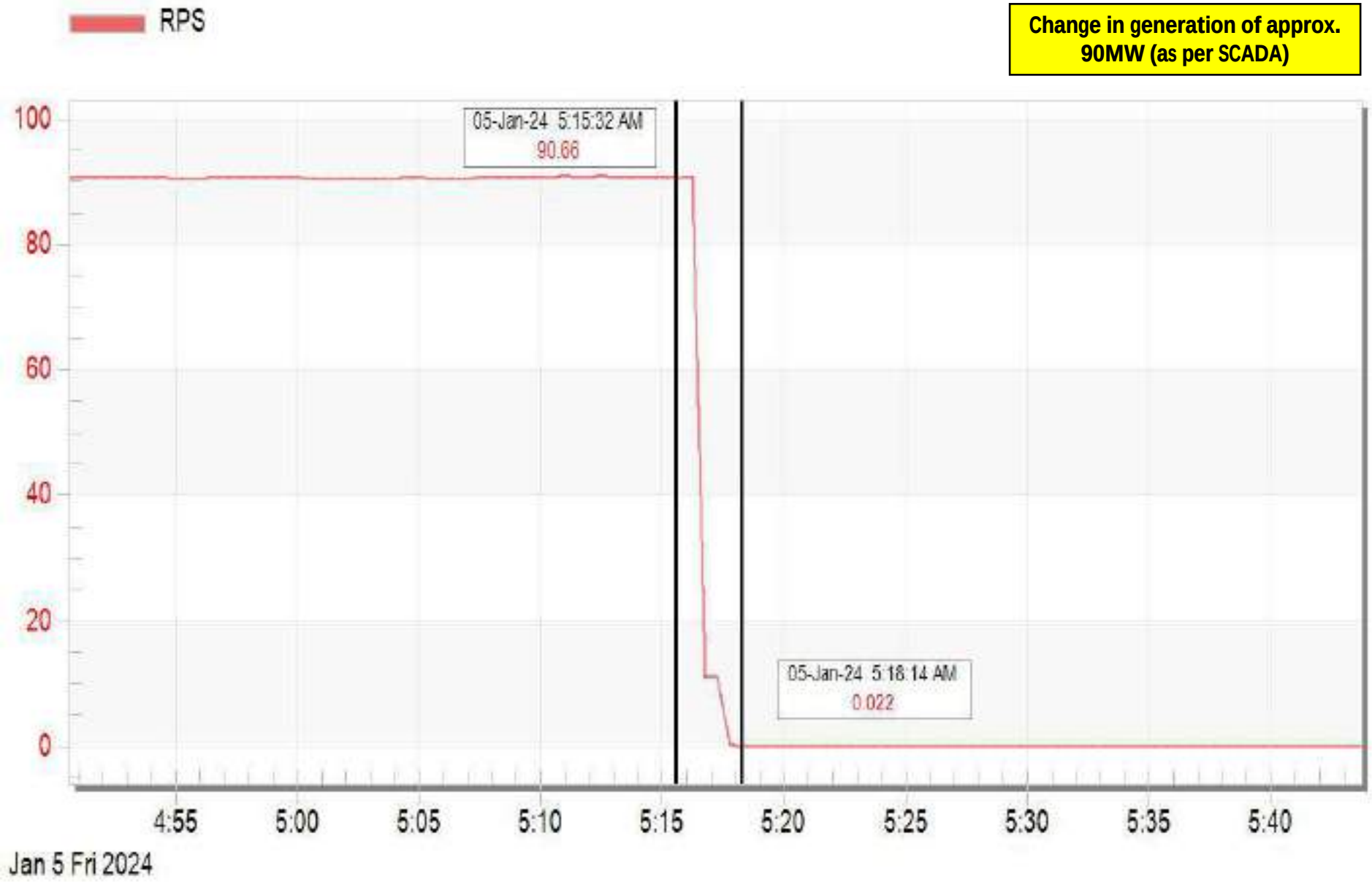
RAPP-B(NP) generation during the event



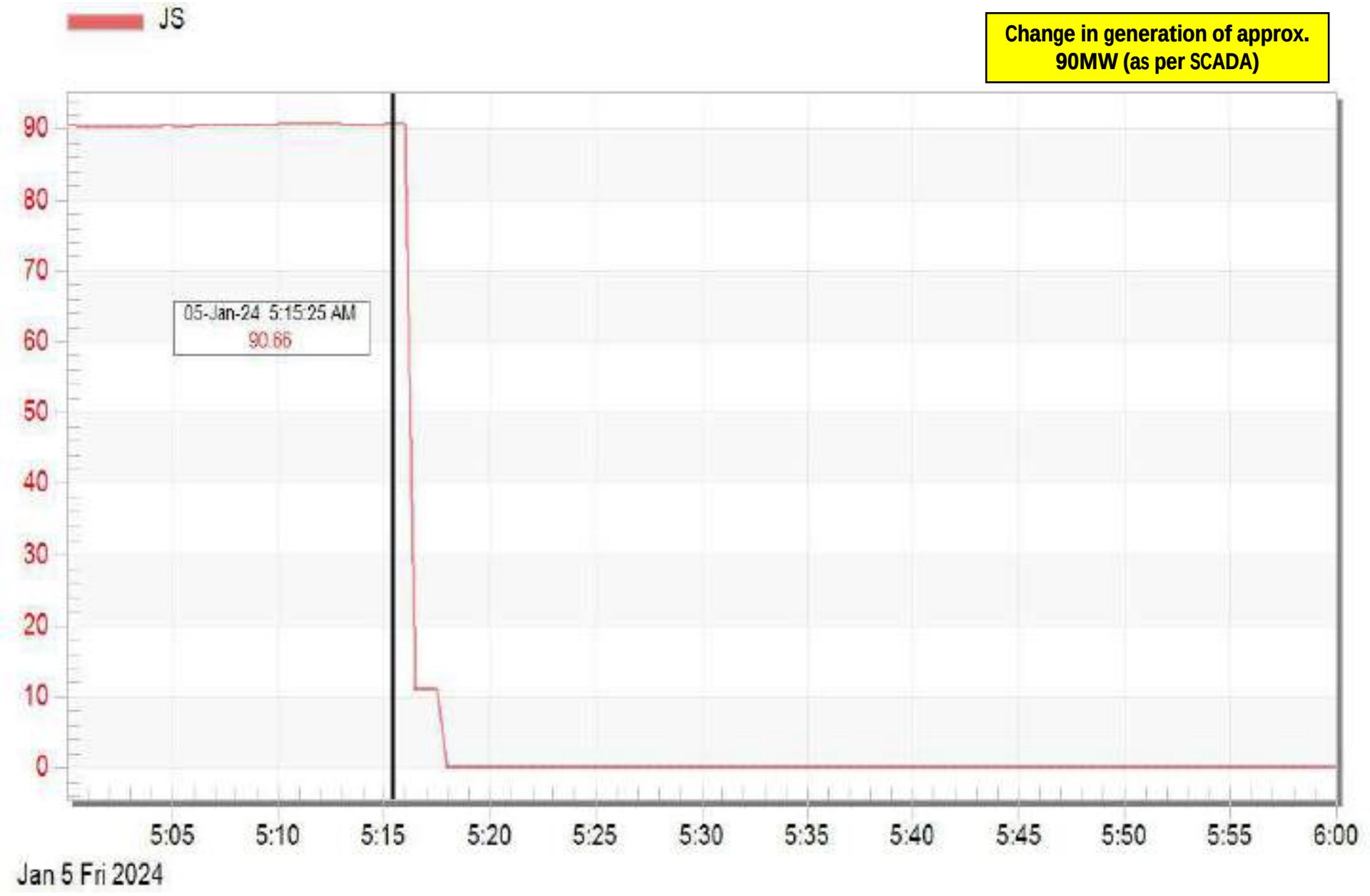
RAPP-C(NP) generation during the event



RPS HEP generation during the event



JS HEP generation during the event

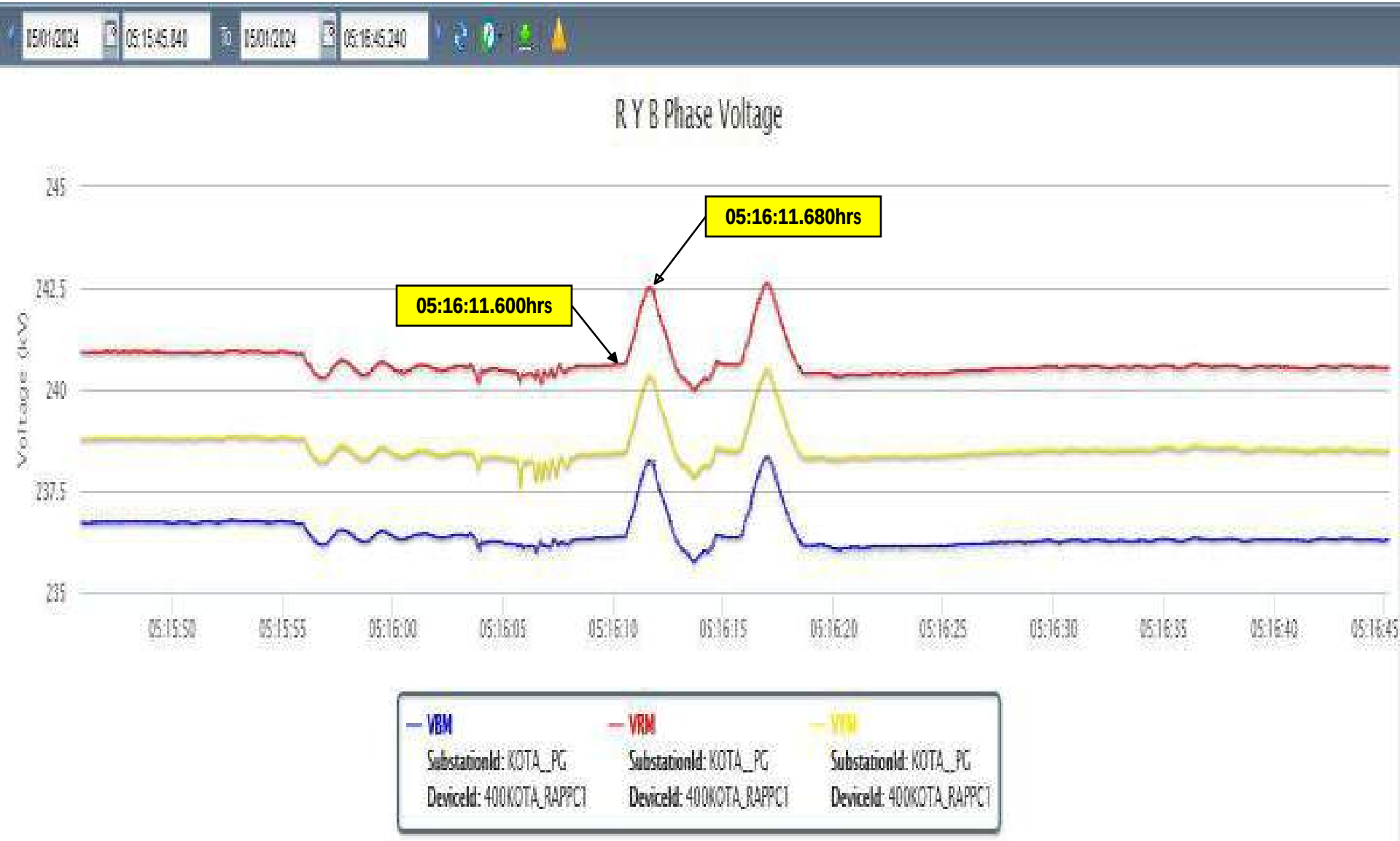


PMU Plot of frequency at Kota(PG)

05:16 hrs/05-Jan-24

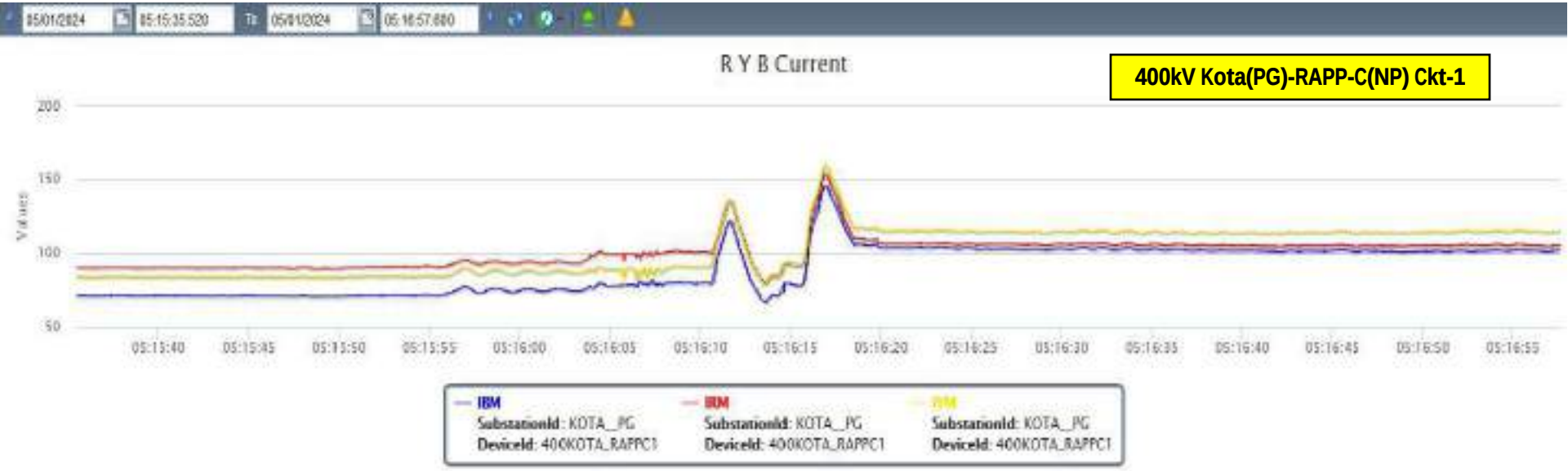
PMU Plot of phase voltage magnitude at Kota(PG)

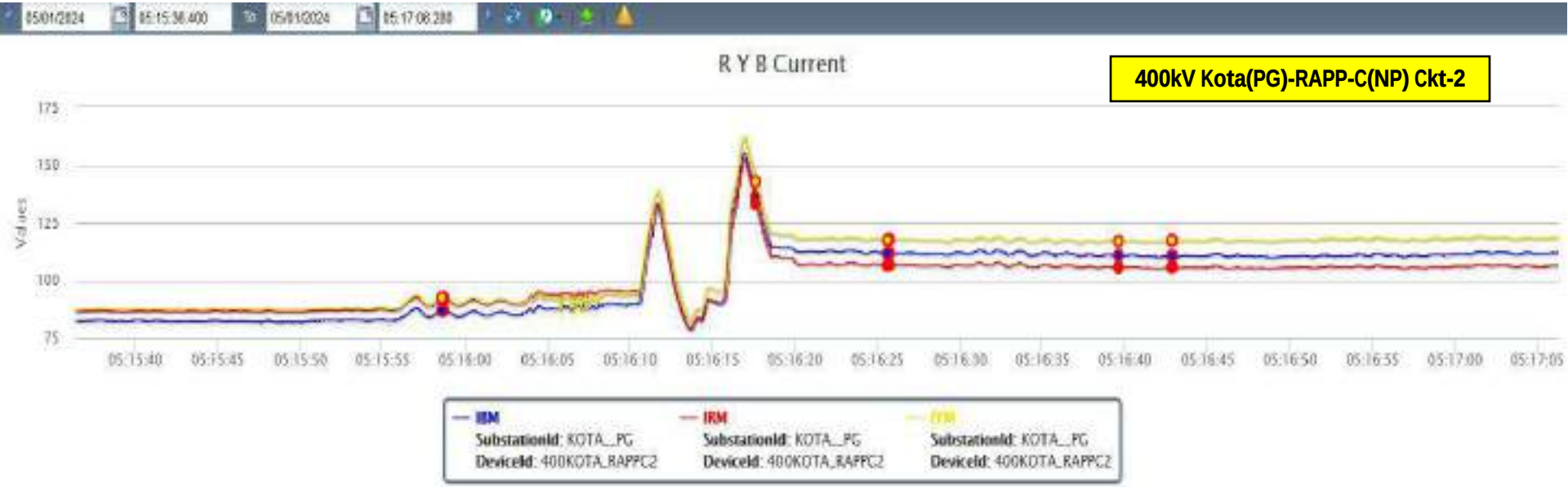
05:16 hrs/05-Jan-24



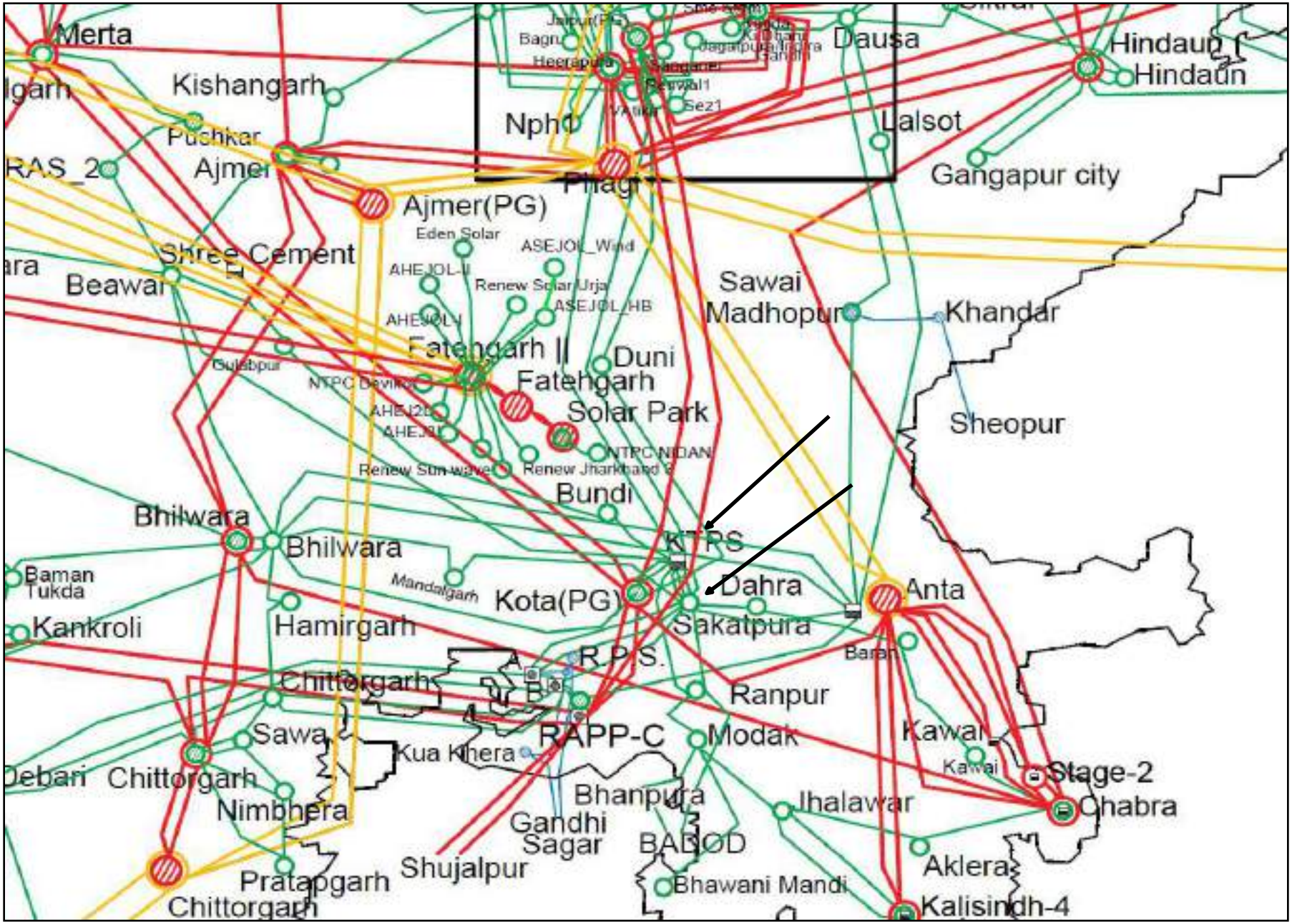
PMU Plot of phase current magnitude at Kota(PG)

05:16 hrs/05-Jan-24

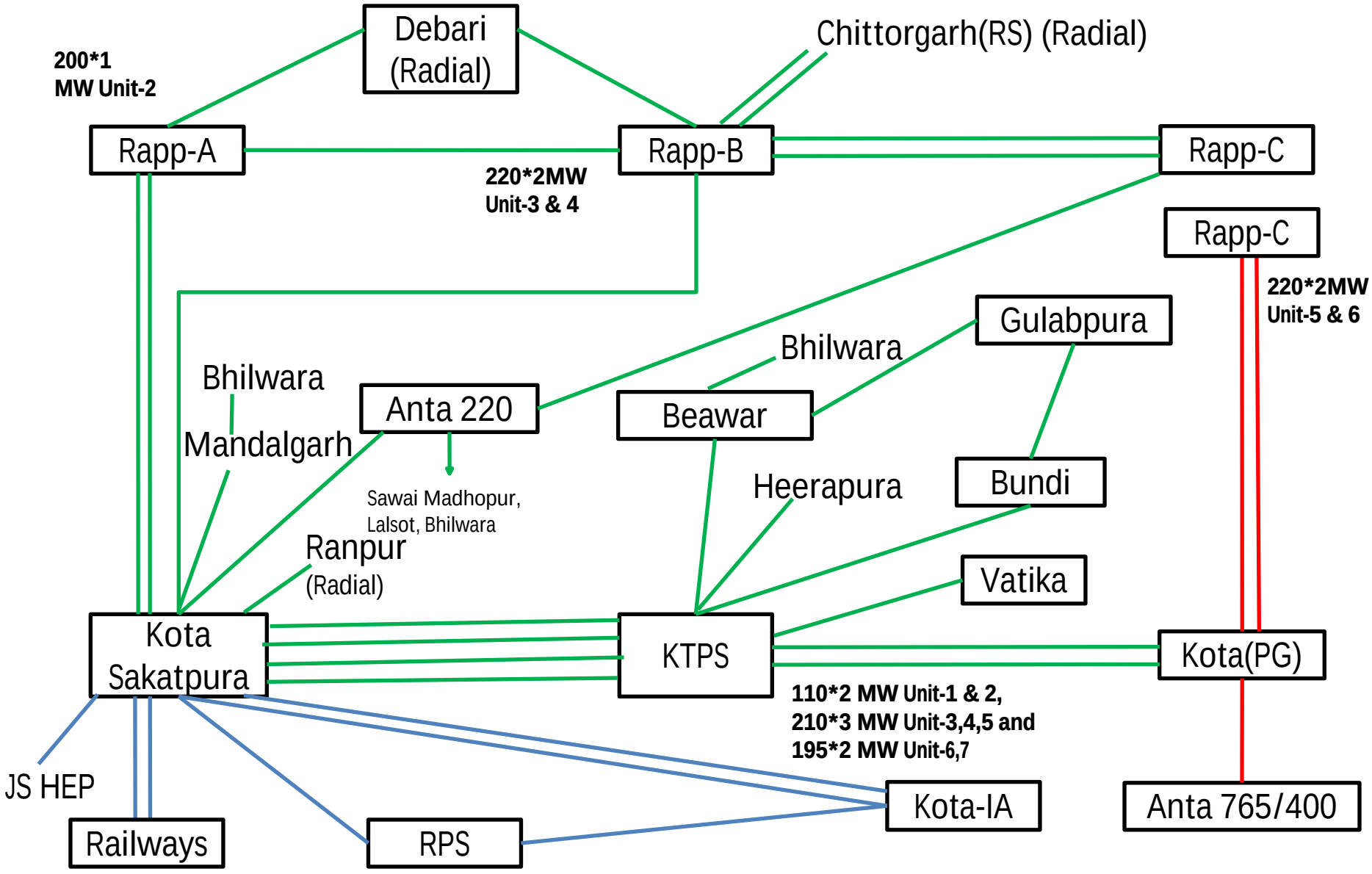




Network Diagram

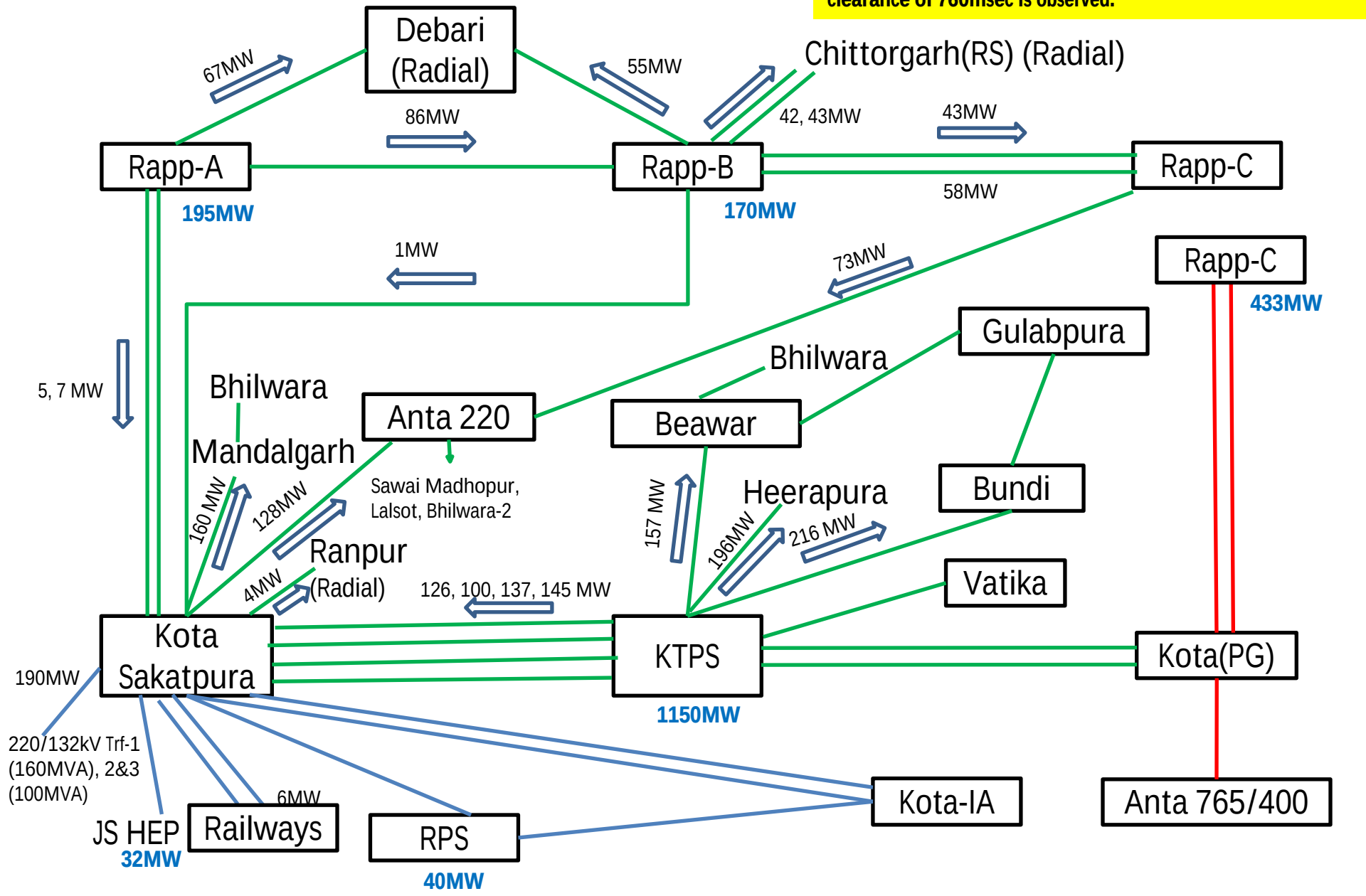


Connection Diagram between KTPS, RAPS generation complex



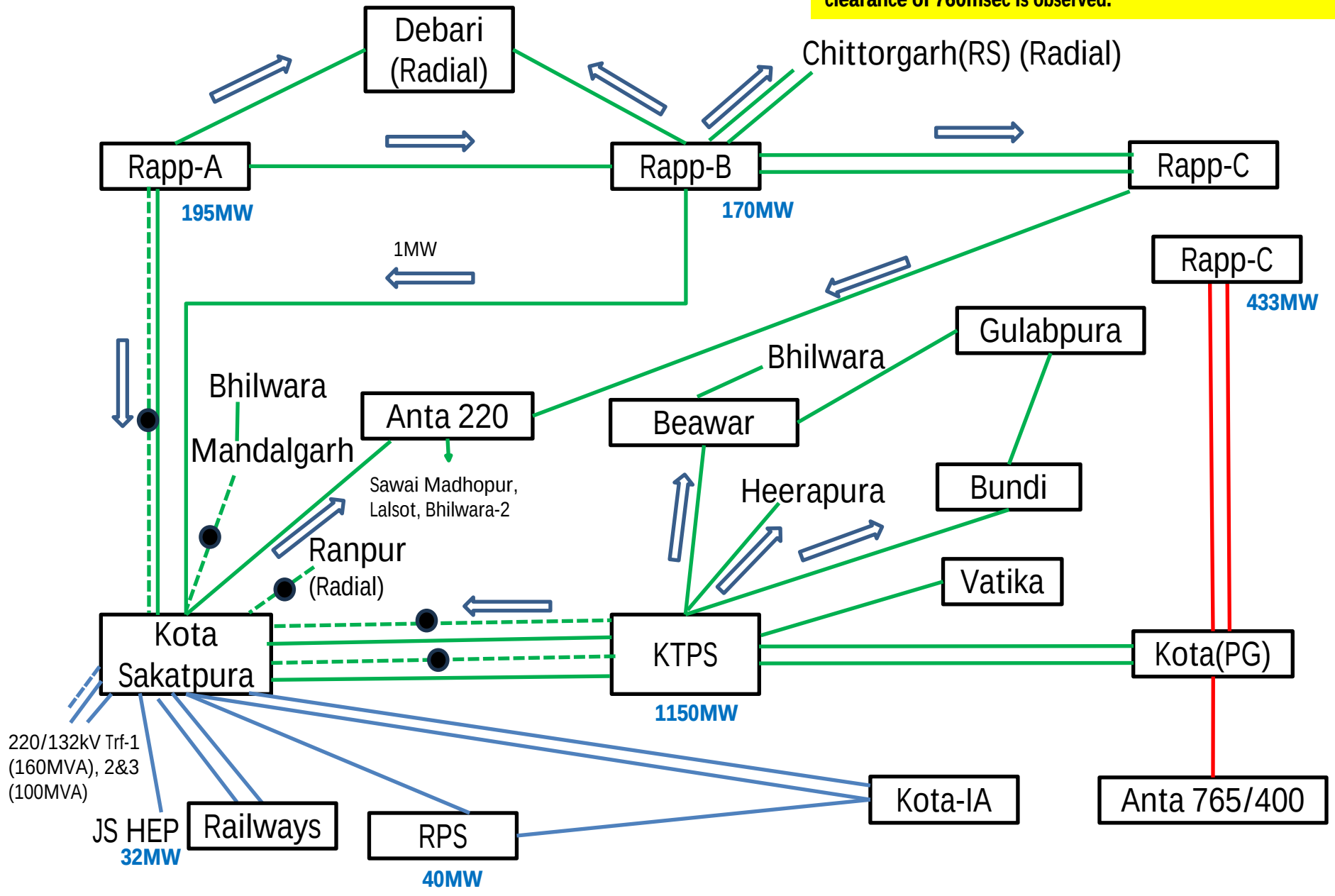
Antecedent scenario (at 20:21 hrs)

Triggering incident: R-ph CT (220 kV side) of 220 kV/132 kV ICT-1 at Kota Sakatpura blast. As per PMU, R-N fault at 20:21:52:280hrs converted into 3-ph fault with delayed clearance of 760msec is observed.



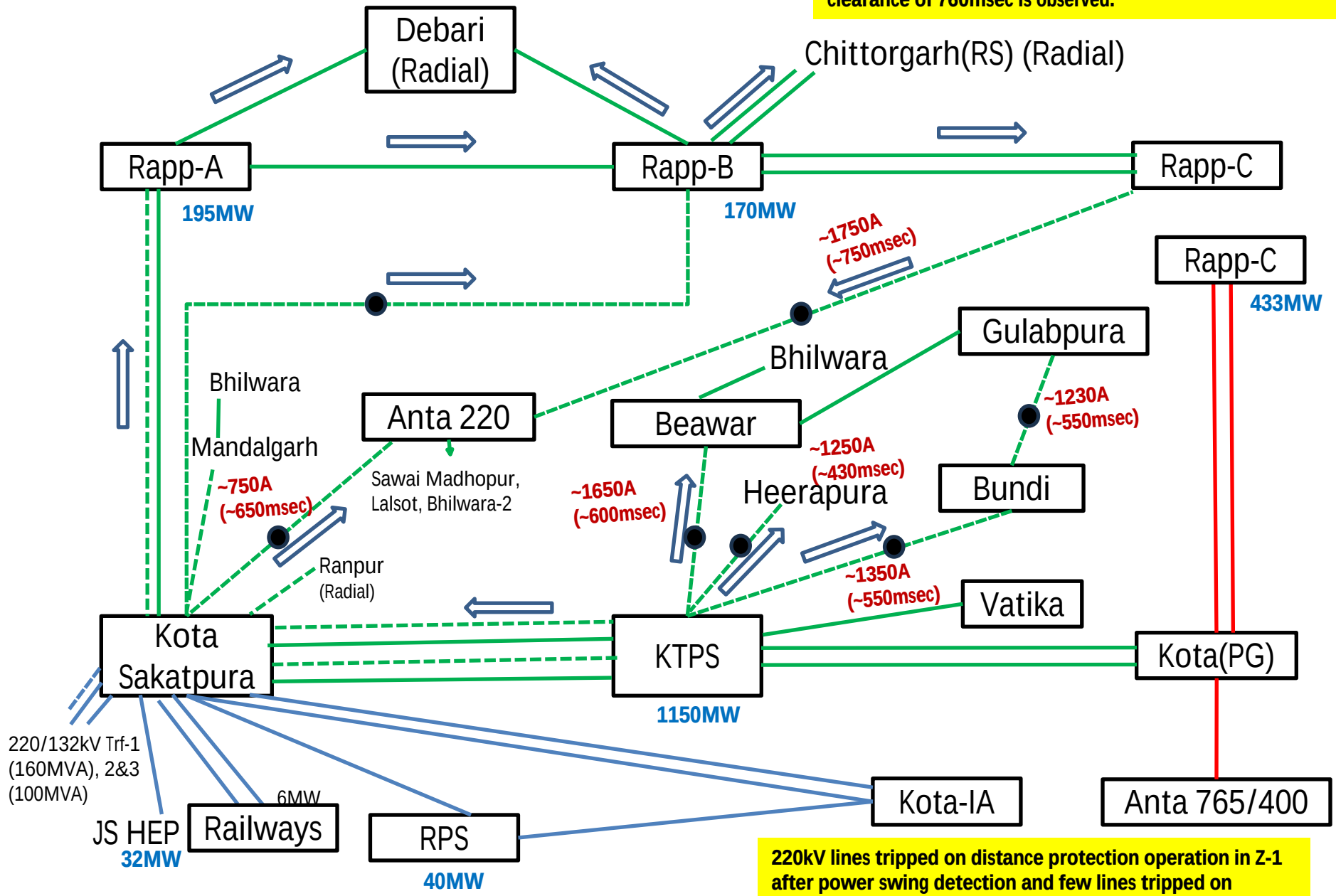
Tripping of multiple 220kV lines in complex (within 200msec of fault time (20:21:52:280hrs))

Triggering incident: R-ph CT (220 kV side) of 220 kV/132 kV ICT-1 at Kota Sakatpura blast. As per PMU, R-N fault at 20:21:52:280hrs converted into 3-ph fault with delayed clearance of 760msec is observed.



Tripping of multiple 220kV lines in complex (within 600-650msec of fault time (20:21:52:280hrs))

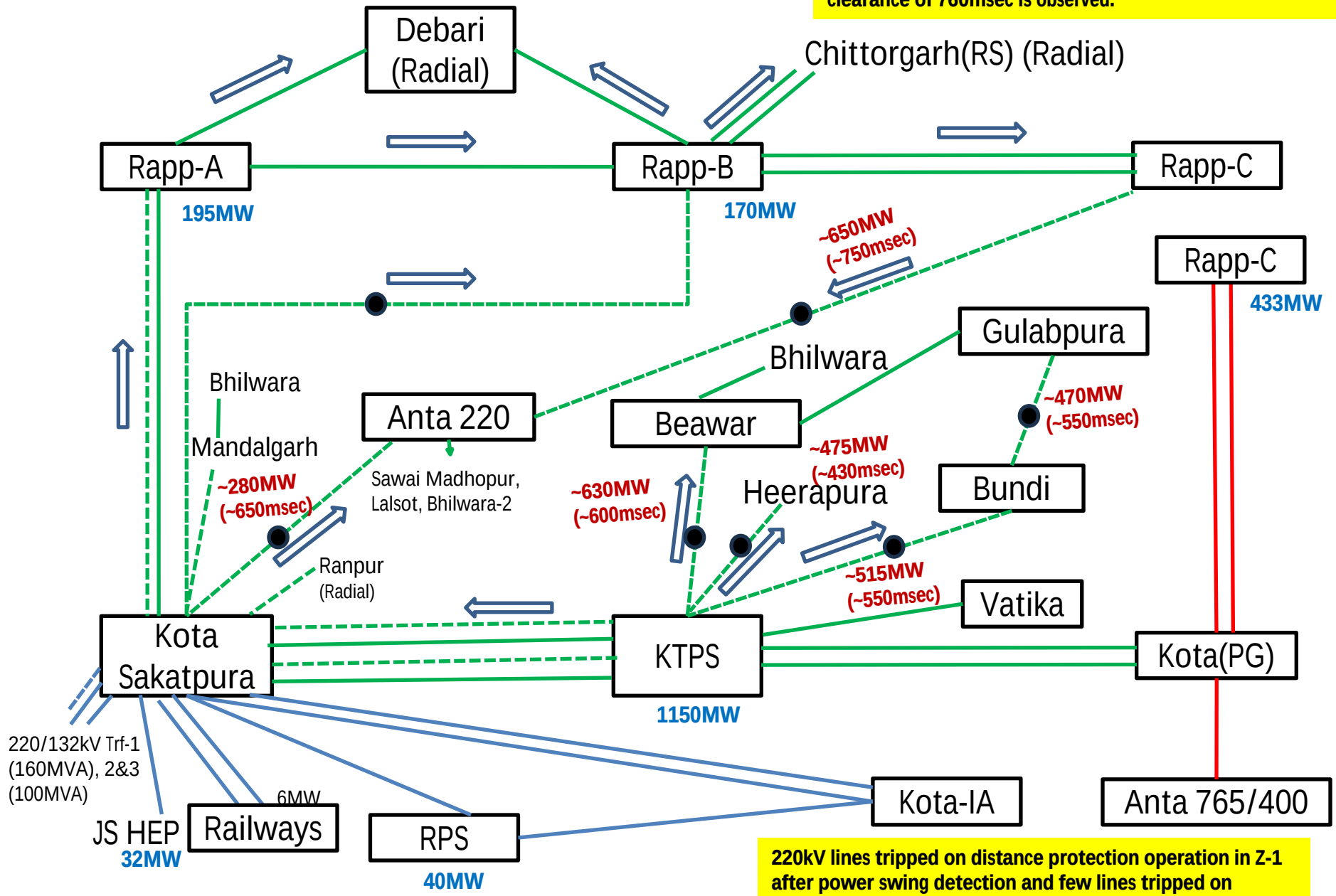
Triggering incident: R-ph CT (220 kV side) of 220 kV/132 kV ICT-1 at Kota Sakatpura blast. As per PMU, R-N fault at 20:21:52:280hrs converted into 3-ph fault with delayed clearance of 760msec is observed.



220kV lines tripped on distance protection operation in Z-1 after power swing detection and few lines tripped on distance protection operation on load encroachment

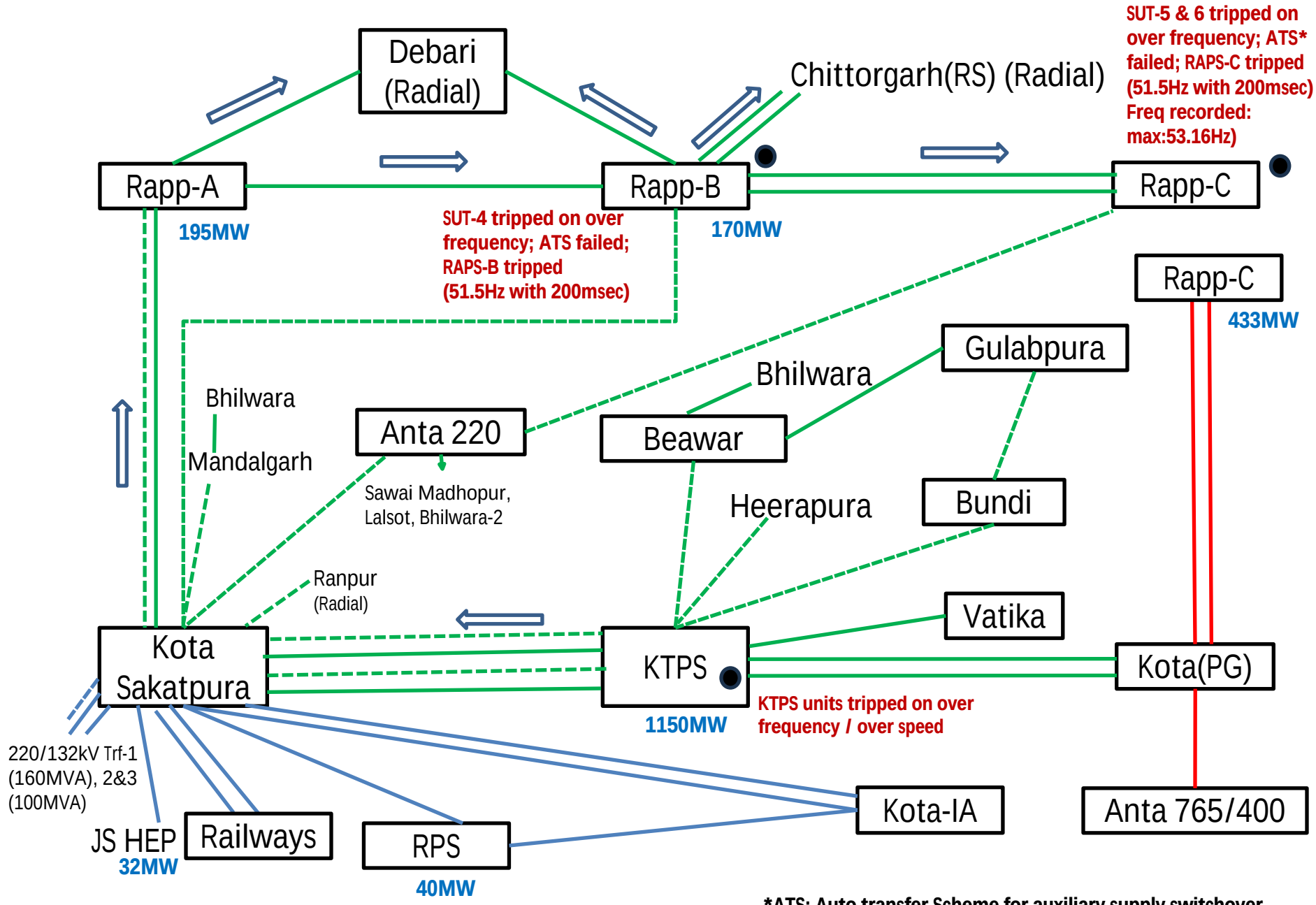
Tripping of multiple 220kV lines in complex (within 600-650msec of fault time (20:21:52:280hrs))

Triggering incident: R-ph CT (220 kV side) of 220 kV/132 kV ICT-1 at Kota Sakatpura blast. As per PMU, R-N fault at 20:21:52:280hrs converted into 3-ph fault with delayed clearance of 760msec is observed.



220kV lines tripped on distance protection operation in Z-1 after power swing detection and few lines tripped on distance protection operation on load encroachment

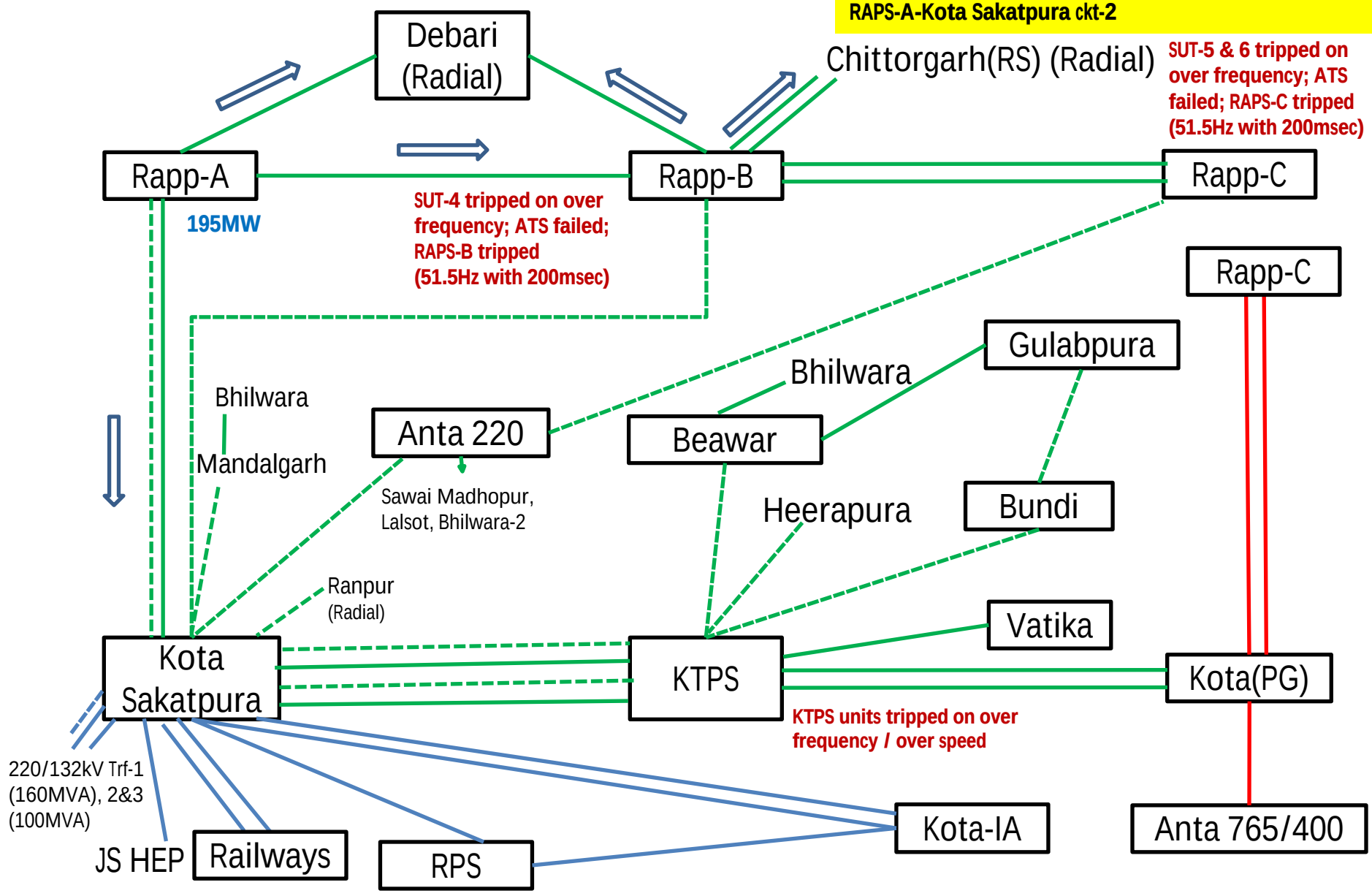
RAPS-B, RAPS-C & KTPS units tripped (within 1-2sec of fault time (20:21:52:280hrs))



*ATS: Auto transfer Scheme for auxiliary supply switchover

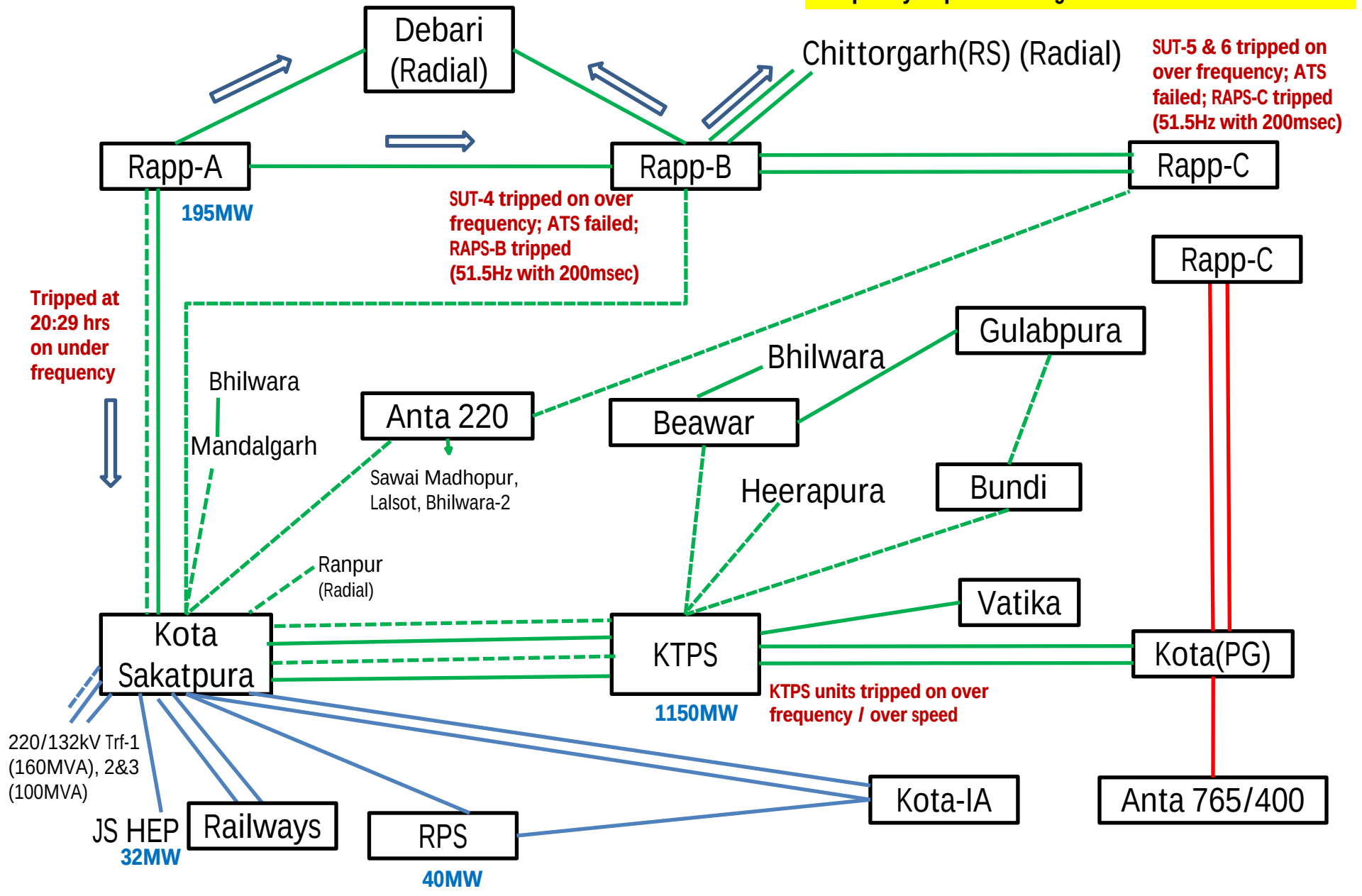
After tripping of multiple 220kV lines and KTPS & RAPS-B in complex (after ~2sec sec of fault time (20:21:52:280hrs)

RAPS-A unit-2 was available which was feeding 220kV Debari, 220kV Chittorgarh via 220kV RAPS-A-RAPS-B tie line and load at 220/132kV Kota Sakatpura via 220kV RAPS-A-Kota Sakatpura ckt-2



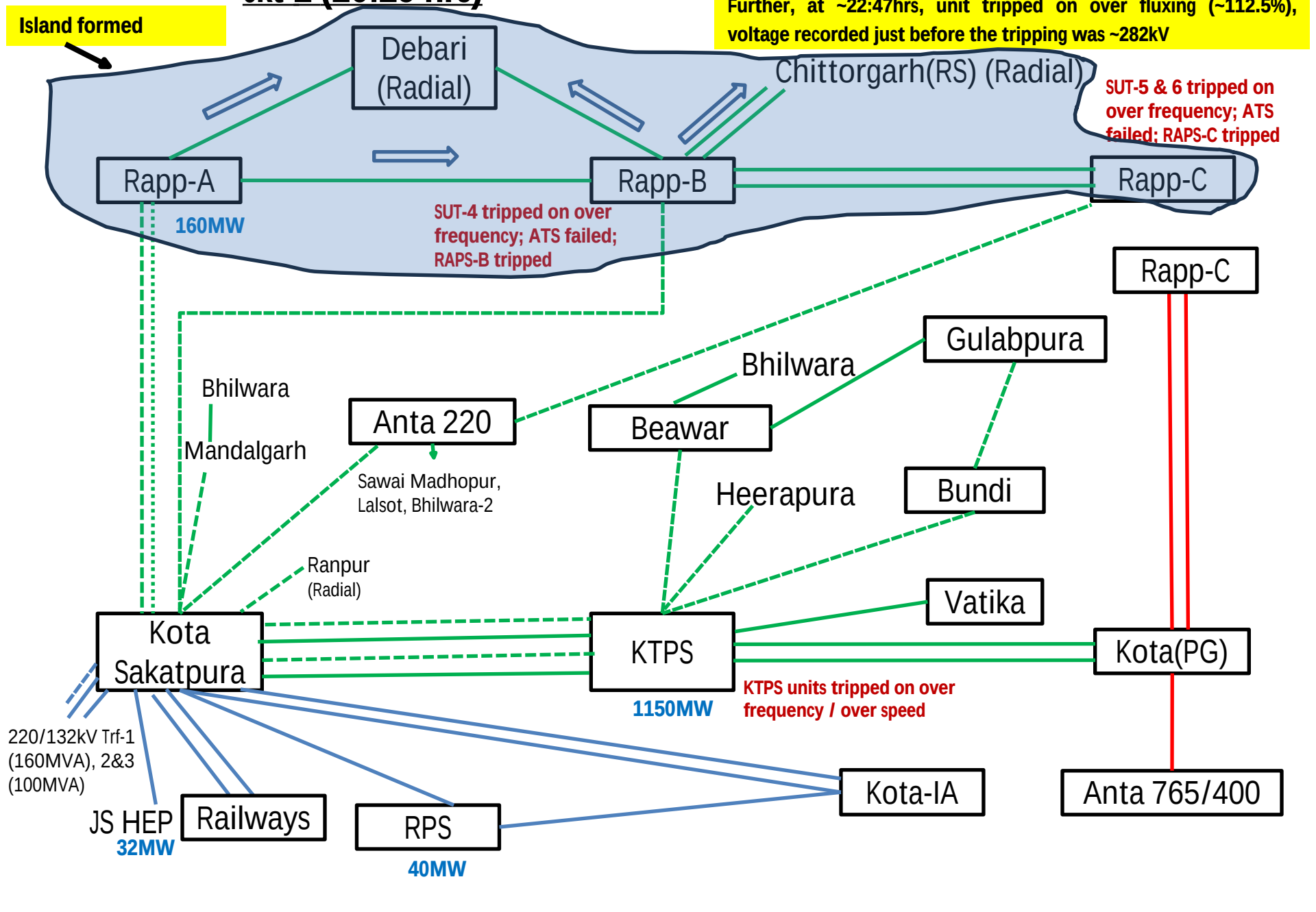
After tripping of multiple 220kV lines and KTPS & RAPS-B in complex (after ~2sec sec of fault time (20:21:52:280hrs)

Further at 20:29hrs, frequency decreased to 47.8Hz and 220kV RAPS-A-Kota Sakatpura ckt-2 tripped on under frequency as per islanding scheme.



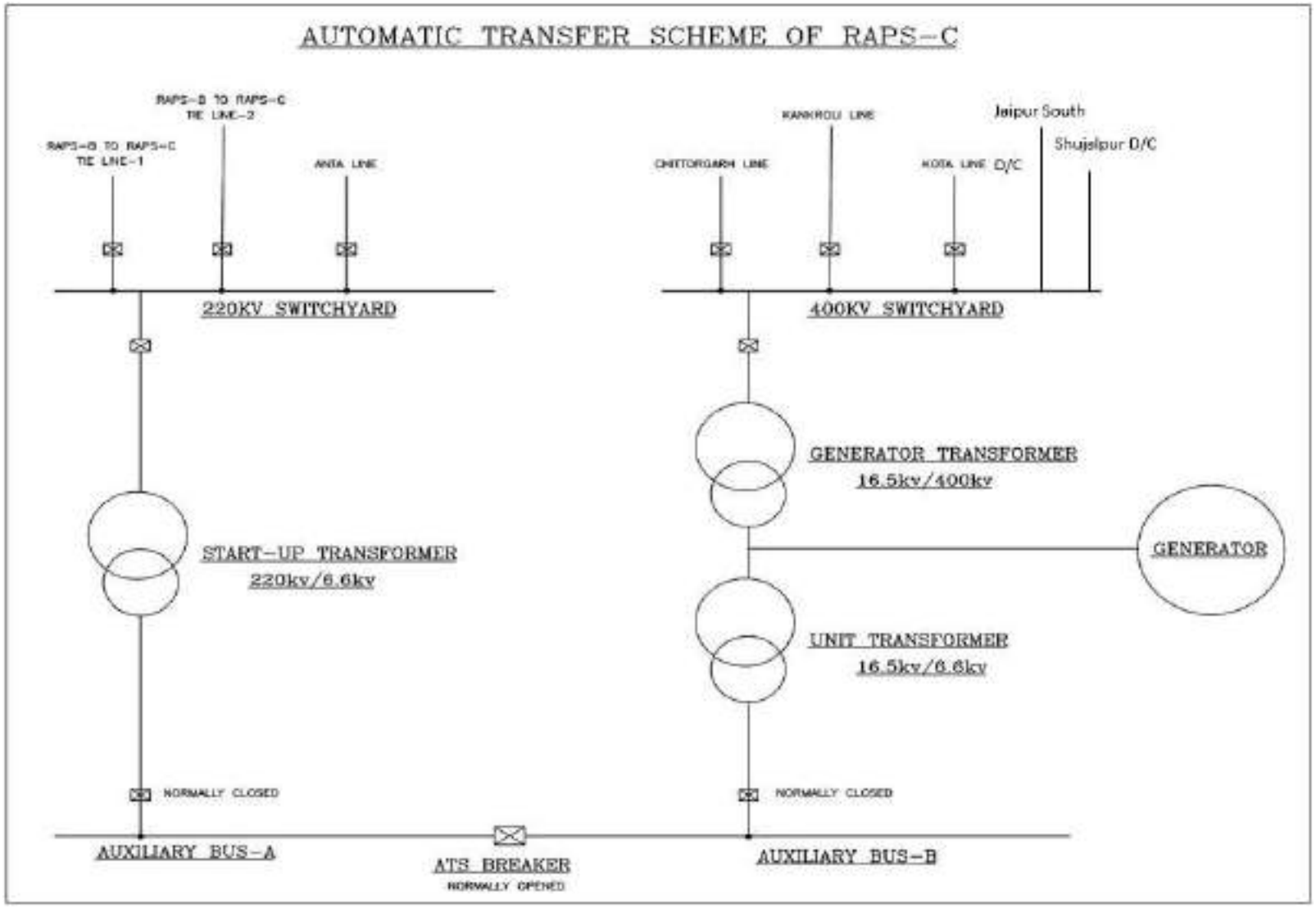
After tripping 220kV RAPS-A-Kota Sakatpura ckt-2 (20:29 hrs)

RAPS-A generation was reduced to 160MW. Island operated till approx. 22:47hrs, frequency (51-52Hz) and voltage (230-240kV). Further, at ~22:47hrs, unit tripped on over fluxing (~112.5%), voltage recorded just before the tripping was ~282kV

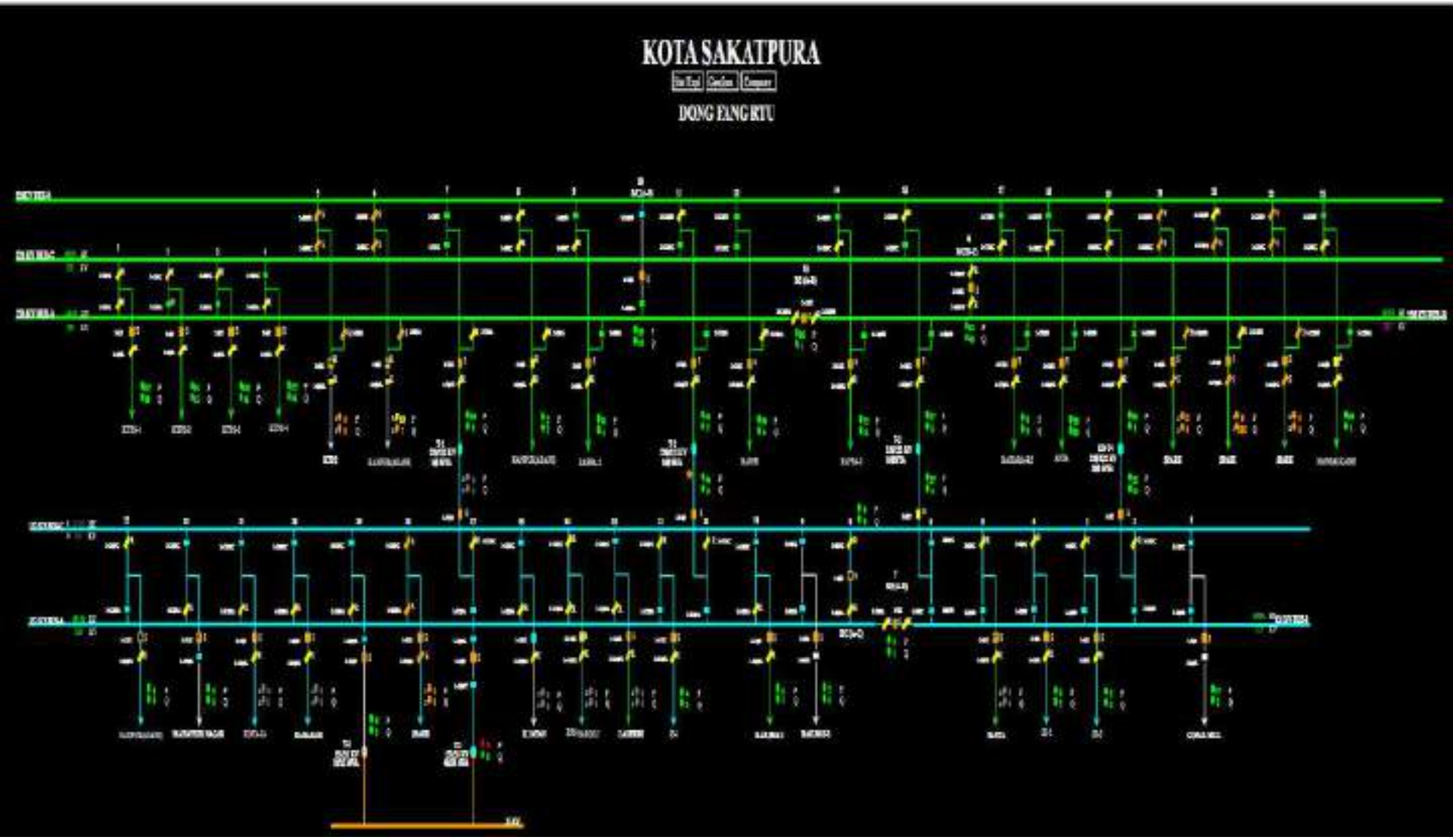


SLD and connectivity of RAPS- A, RAPS-B & RAPS-C

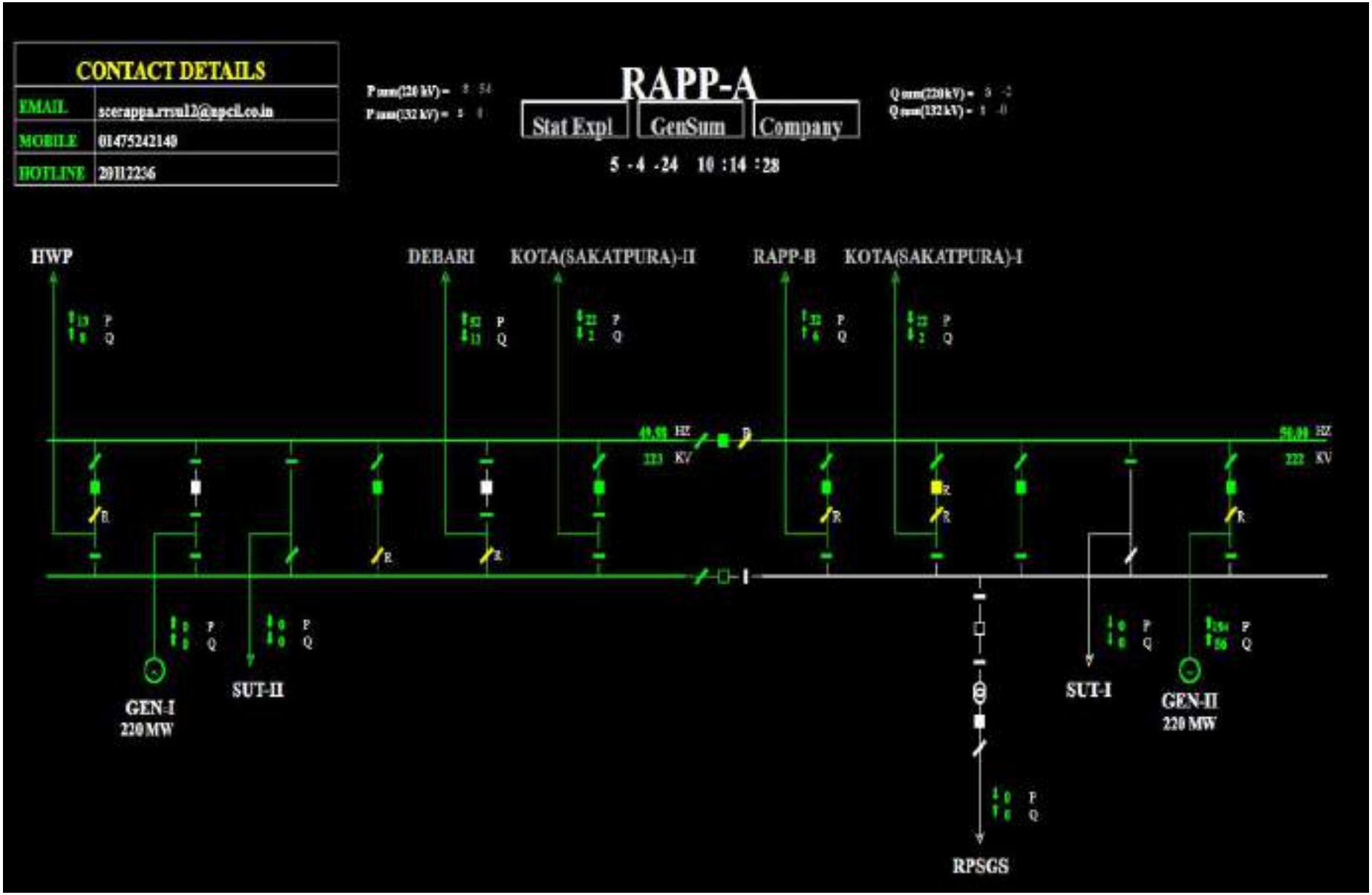
Auto Transfer Scheme at RAPS-C



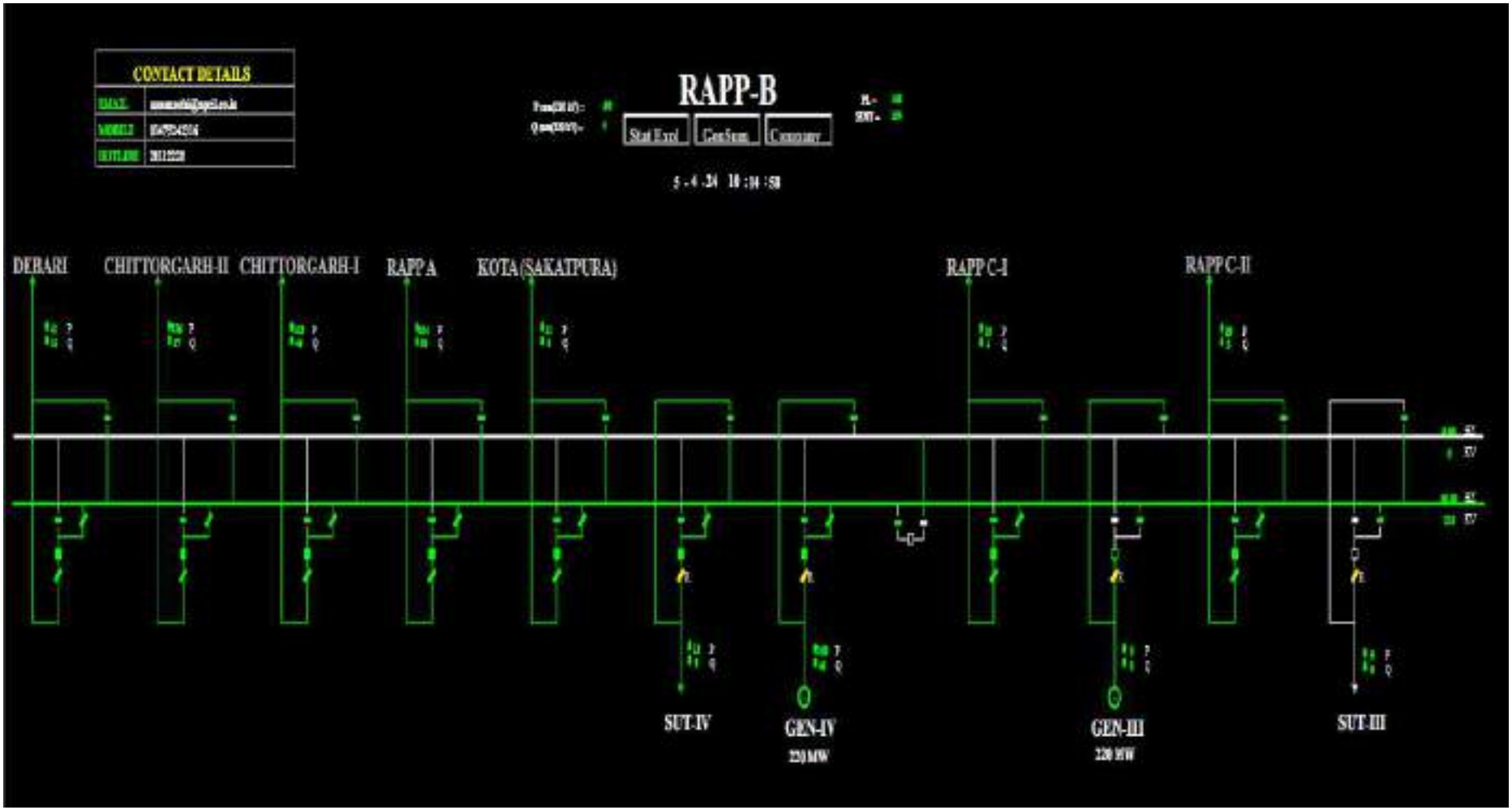
SLD of 220/132kV Kota Sakatpura



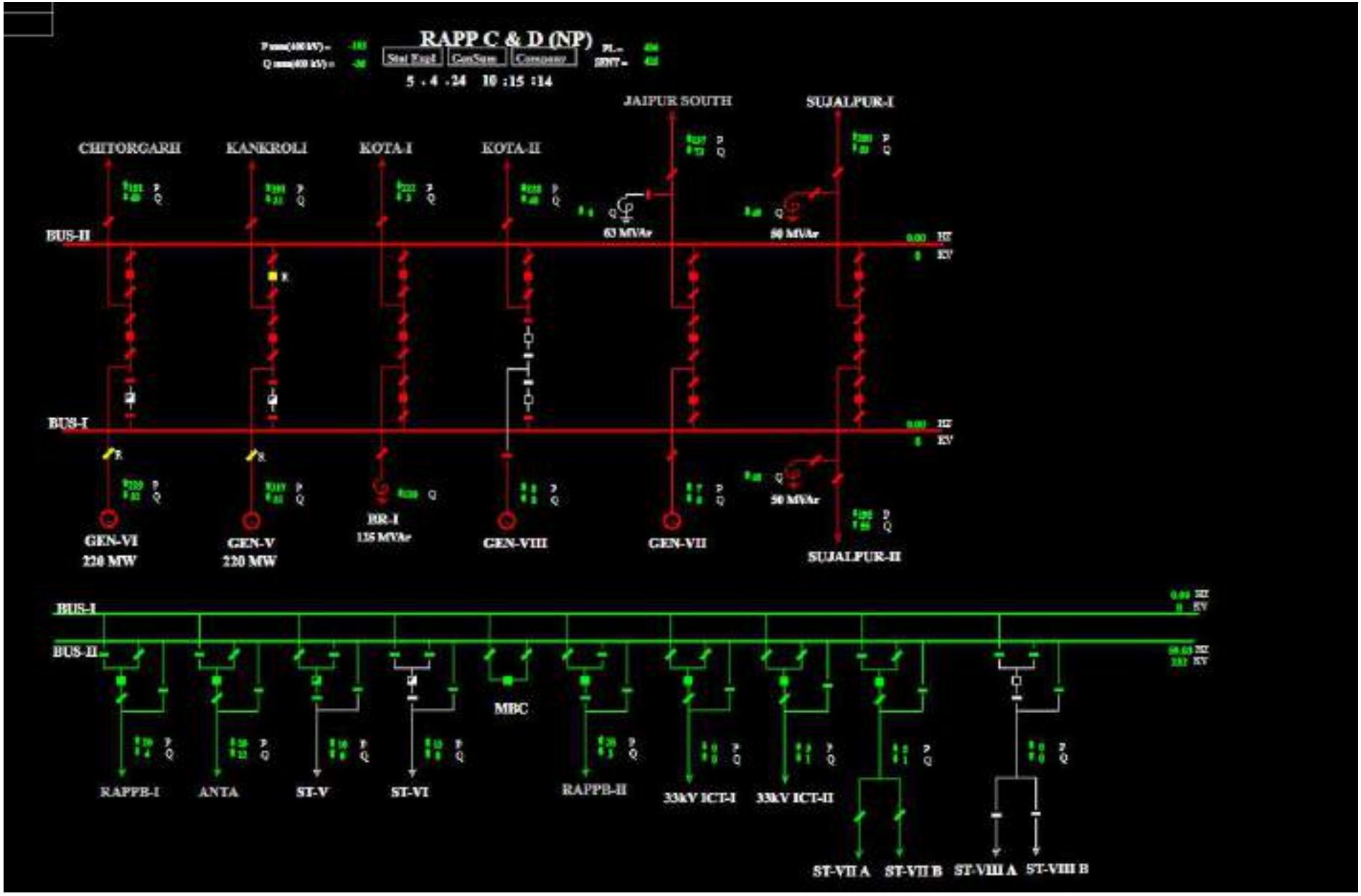
SLD of 220kV RAPS-A(NPCIL)



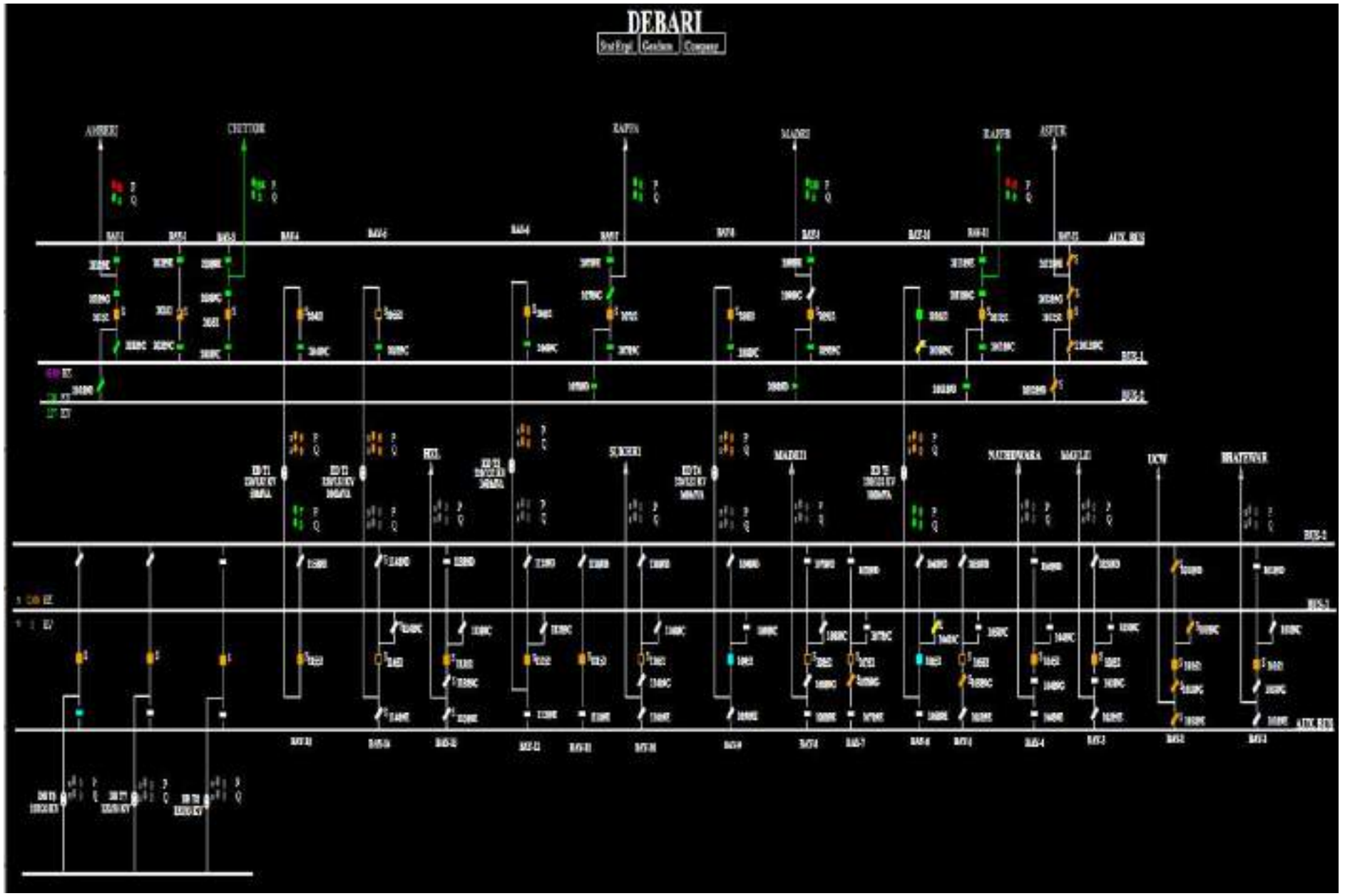
SLD of 220kV RAPS-B(NPCIL)



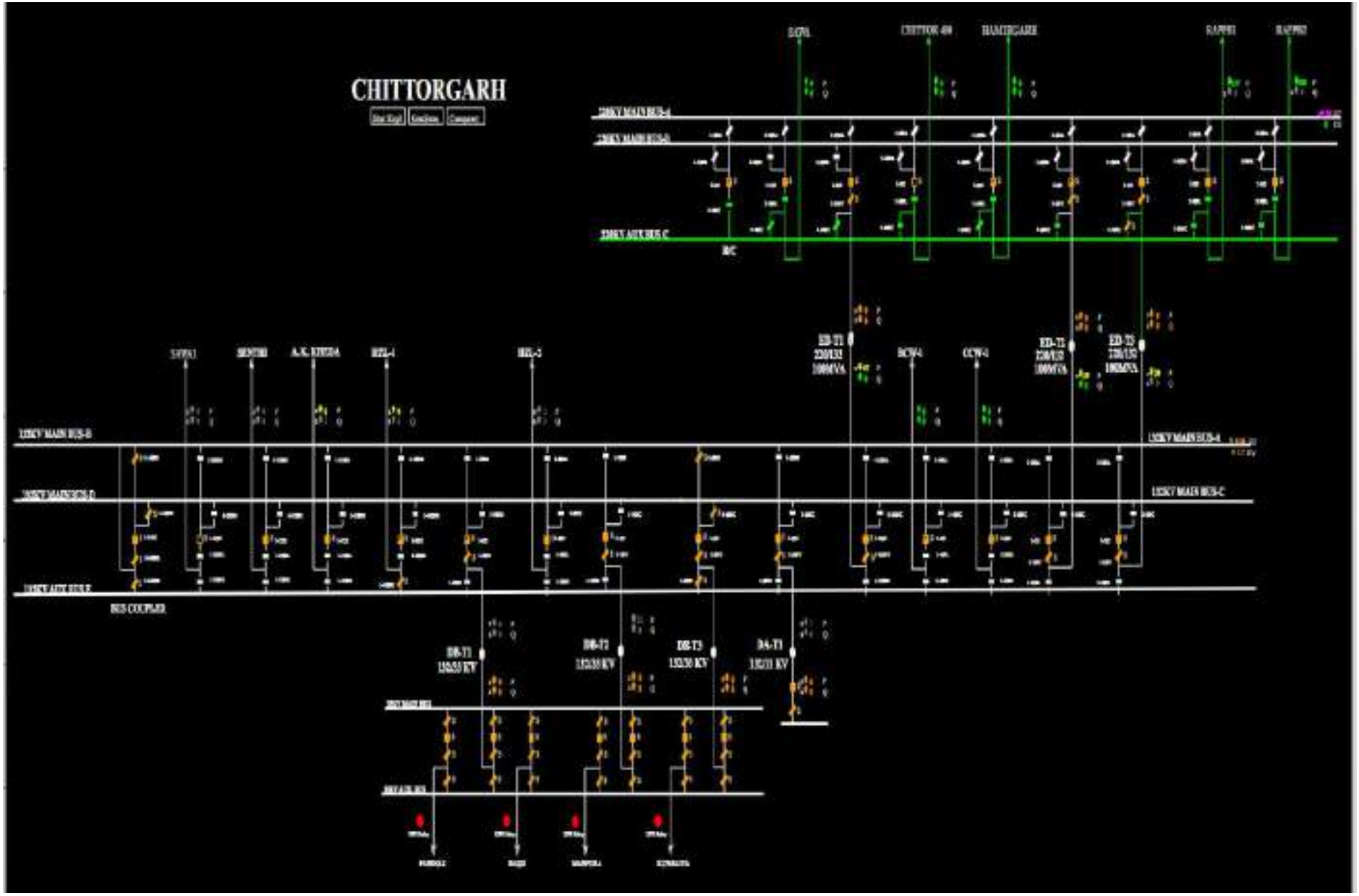
SLD of 220kV RAPS-C(NPCIL)



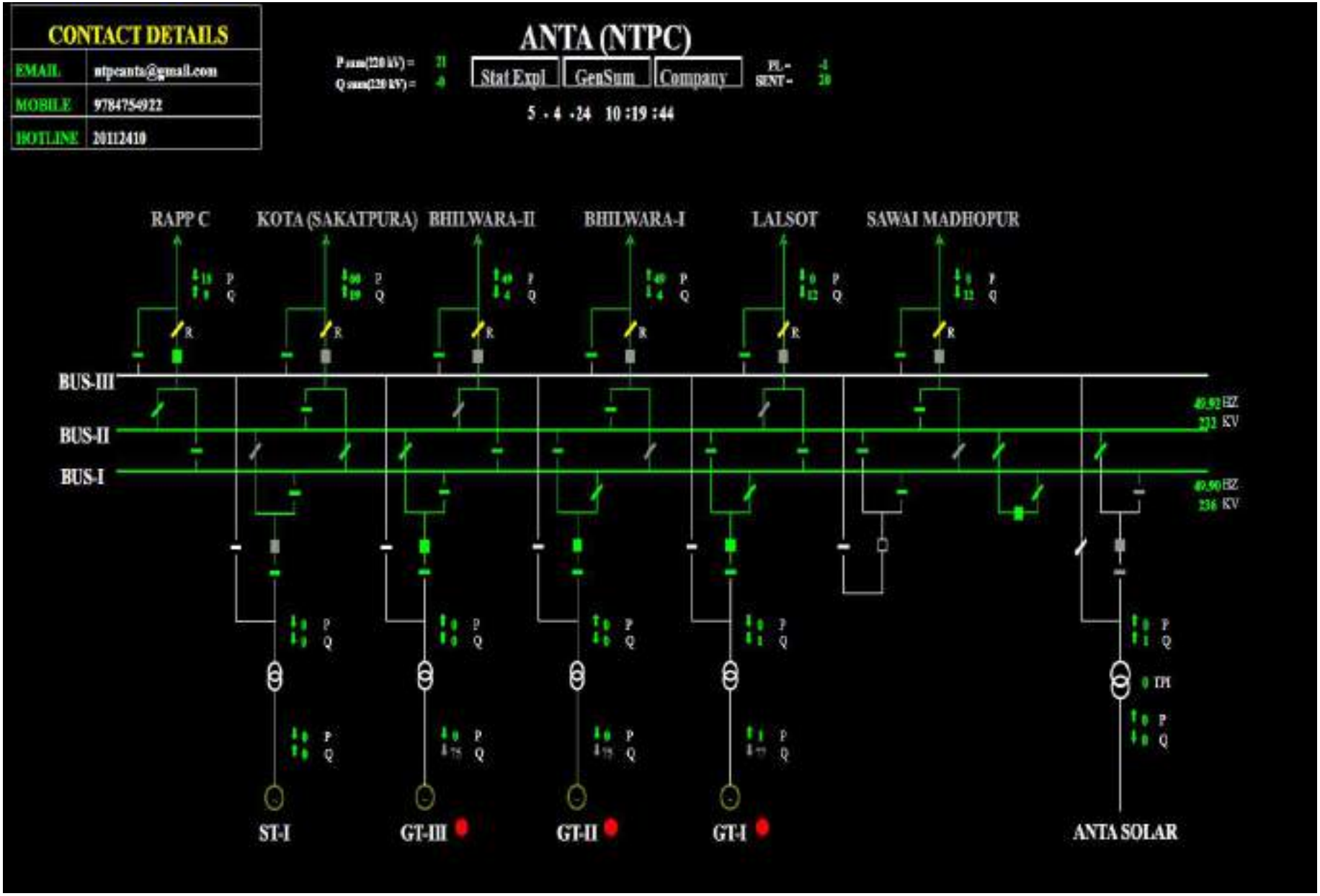
SLD of 220/132kV Debari



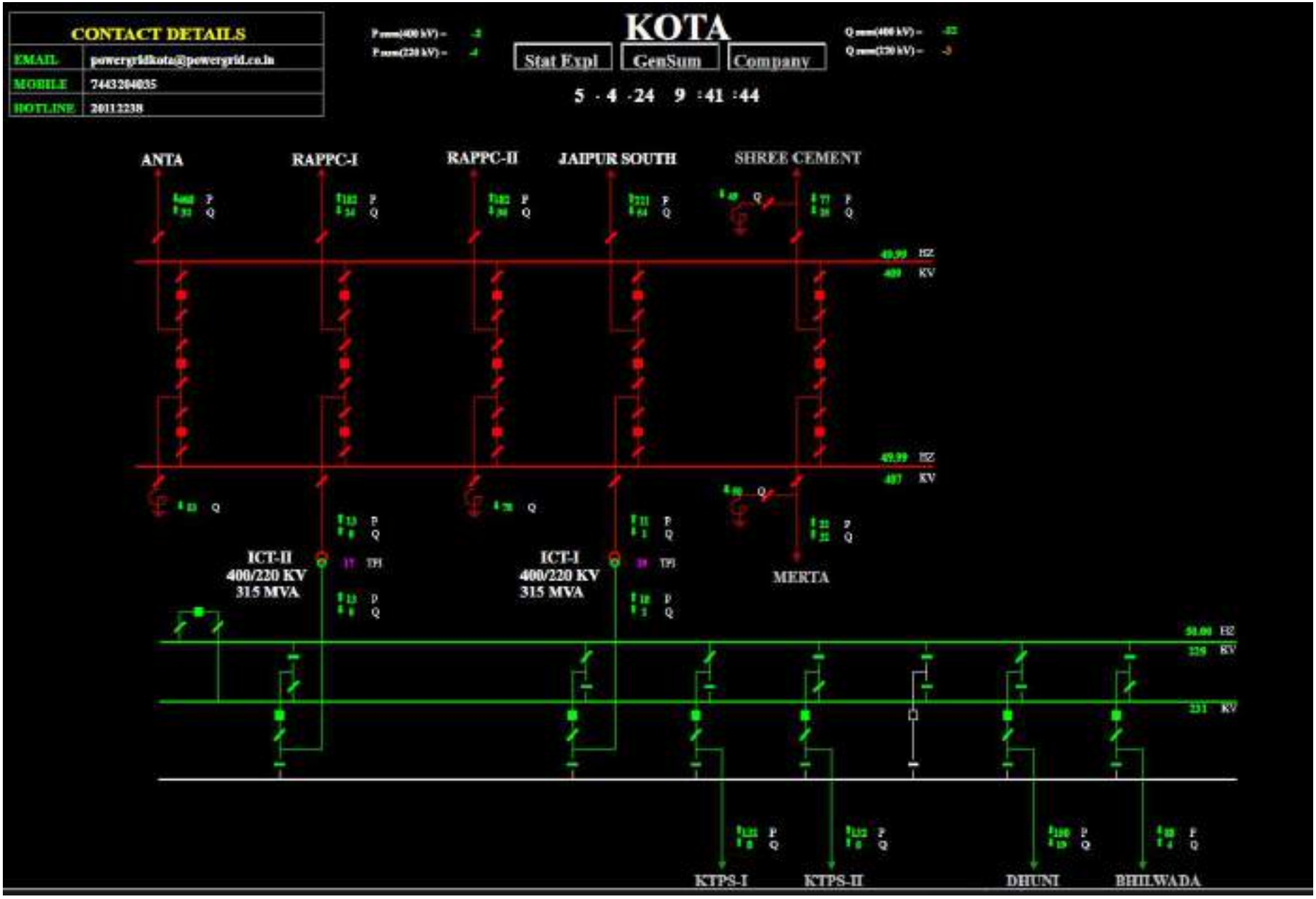
SLD of 220/132kV Chittorgarh



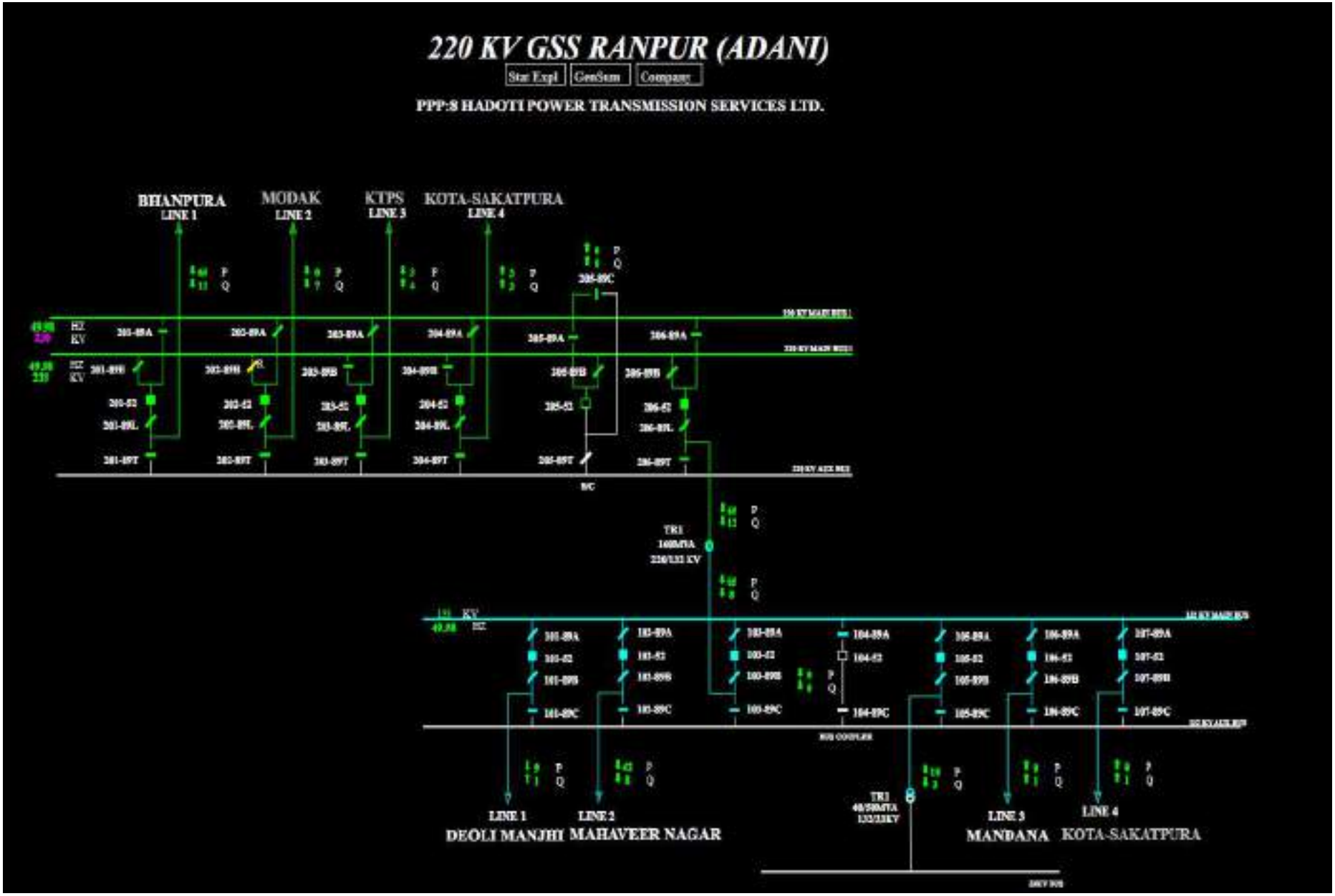
SLD of 220kV Anta(NTPC)



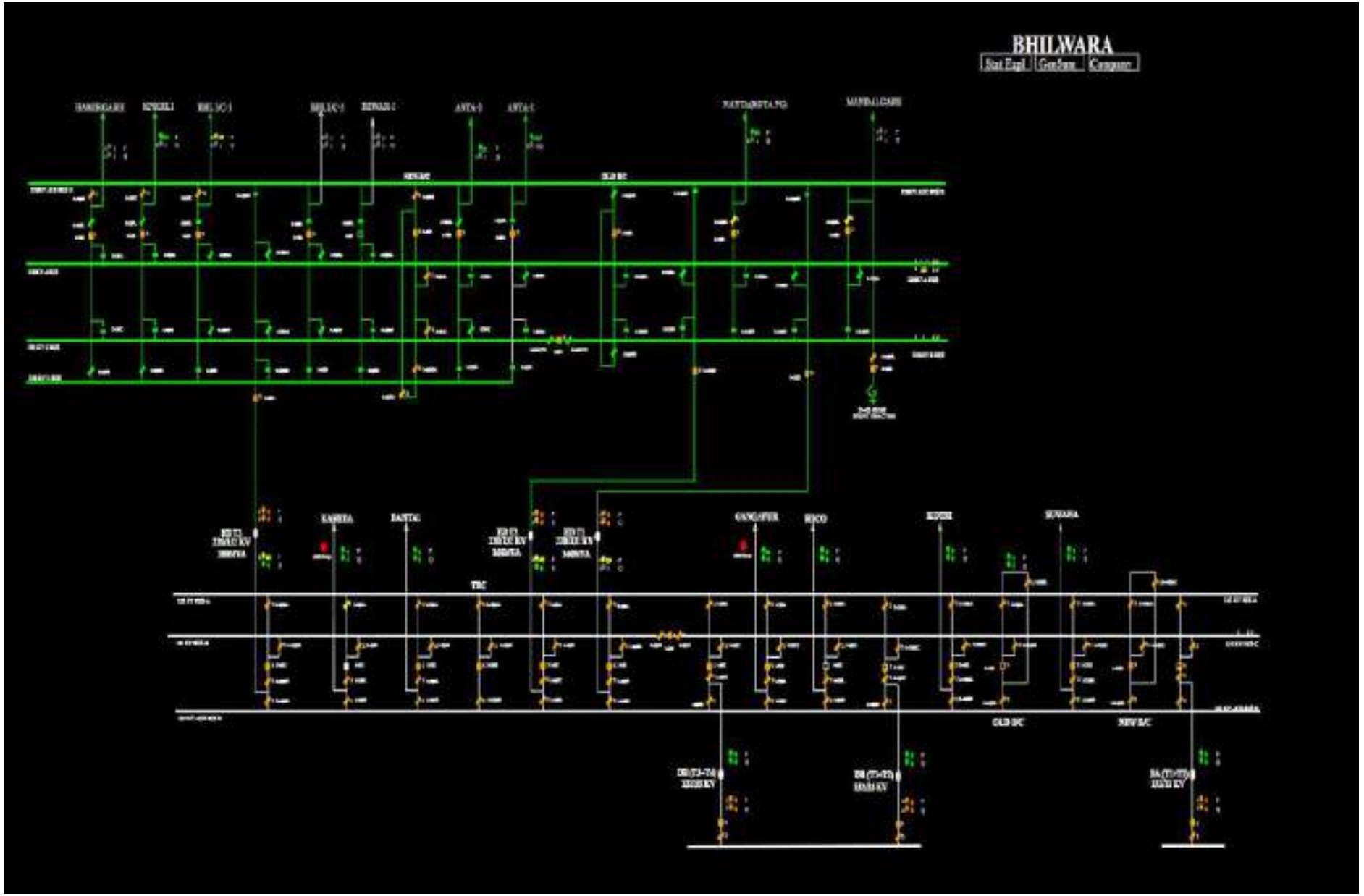
SLD of 400/220kV Kota(PG)



SLD of 220/132kV Ranpur

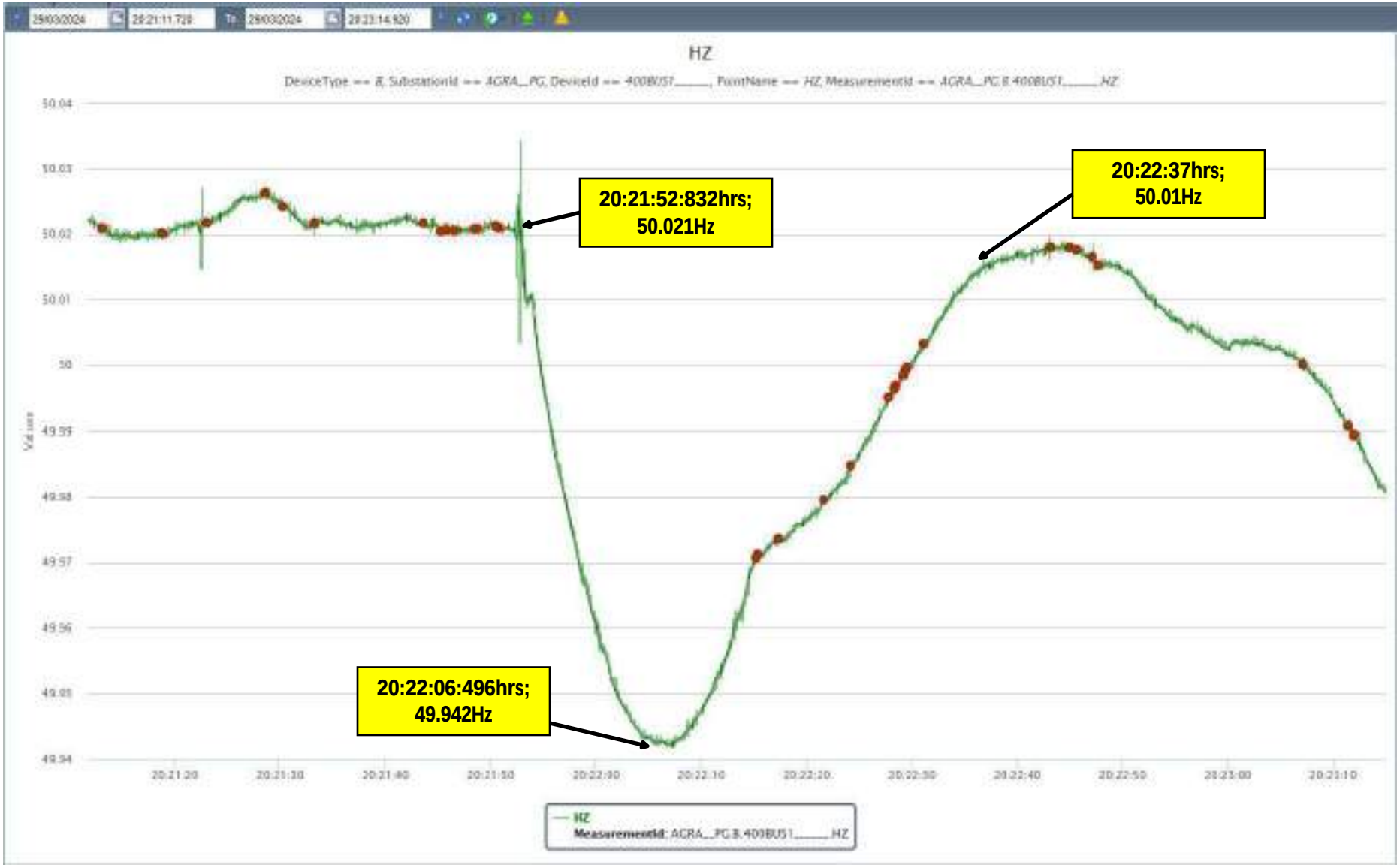


SLD of 220/132kV Bhilwara



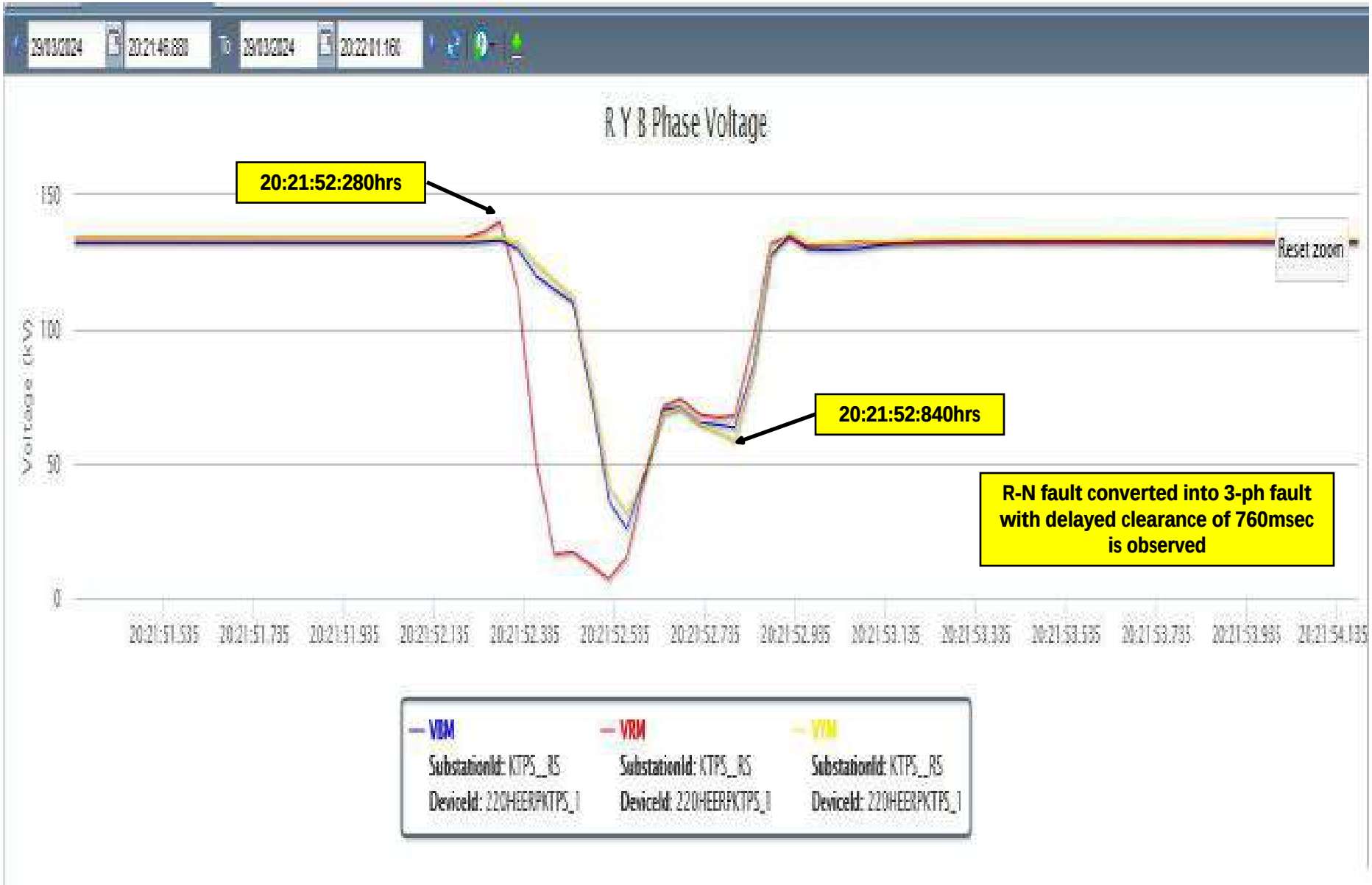
PMU Plot of frequency at Agra(PG)

20:22 hrs/29-Mar-24

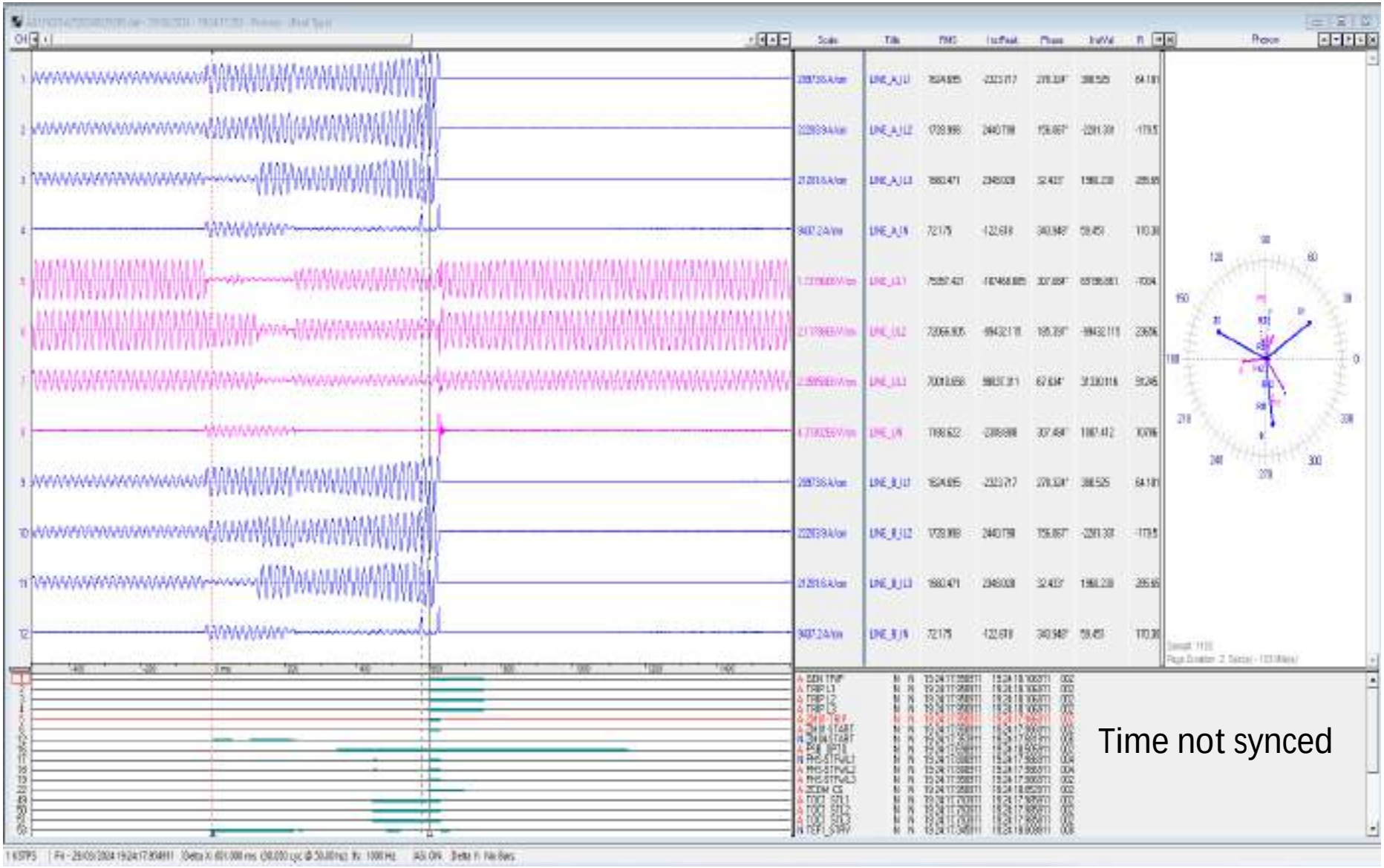


PMU Plot of voltage of 220kV KTPS-Heerapur ckt at KTPS(RVVN)

20:22 hrs/29-Mar-24

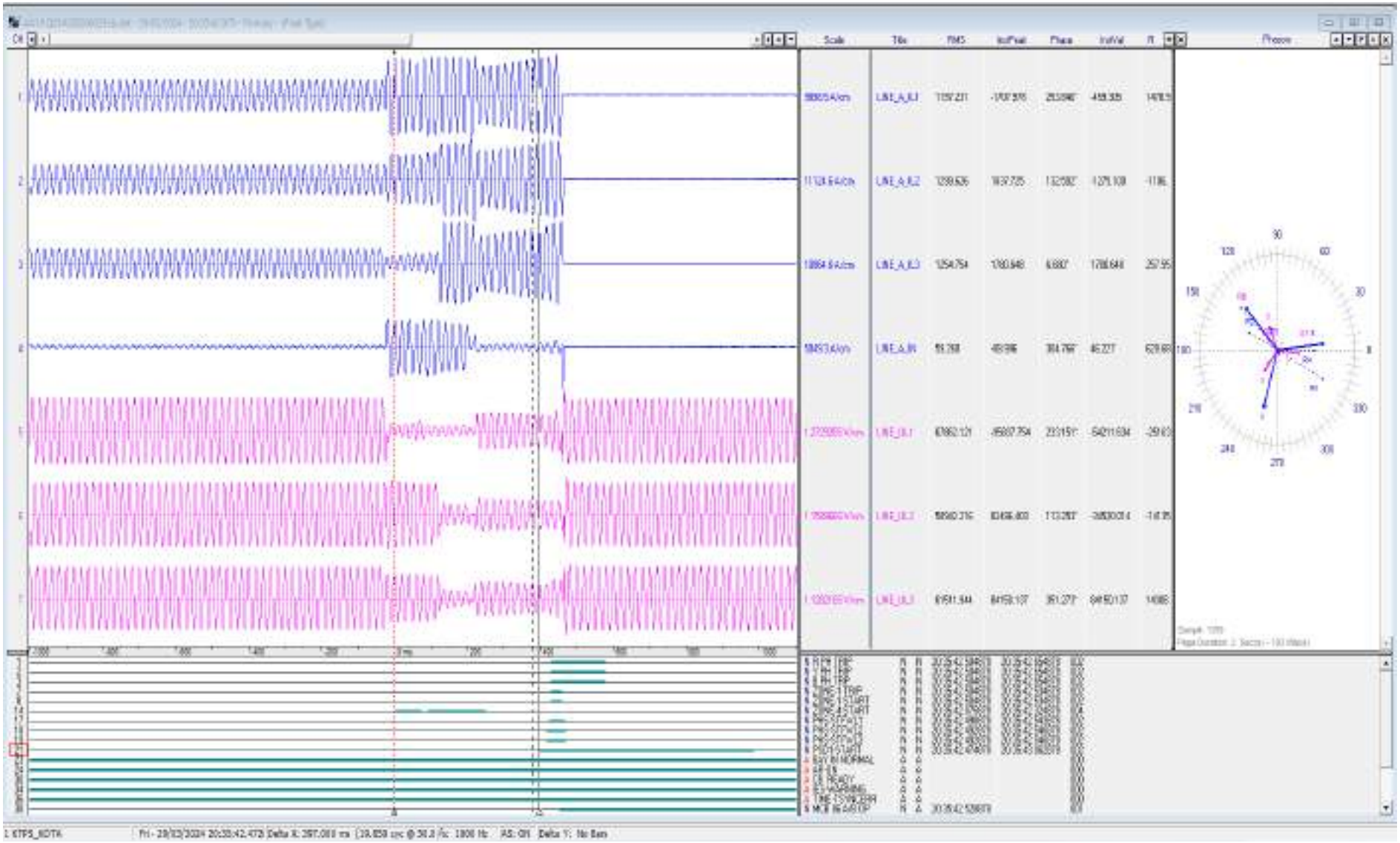


DR of 220kV KTPS(end)-Beawar ckt



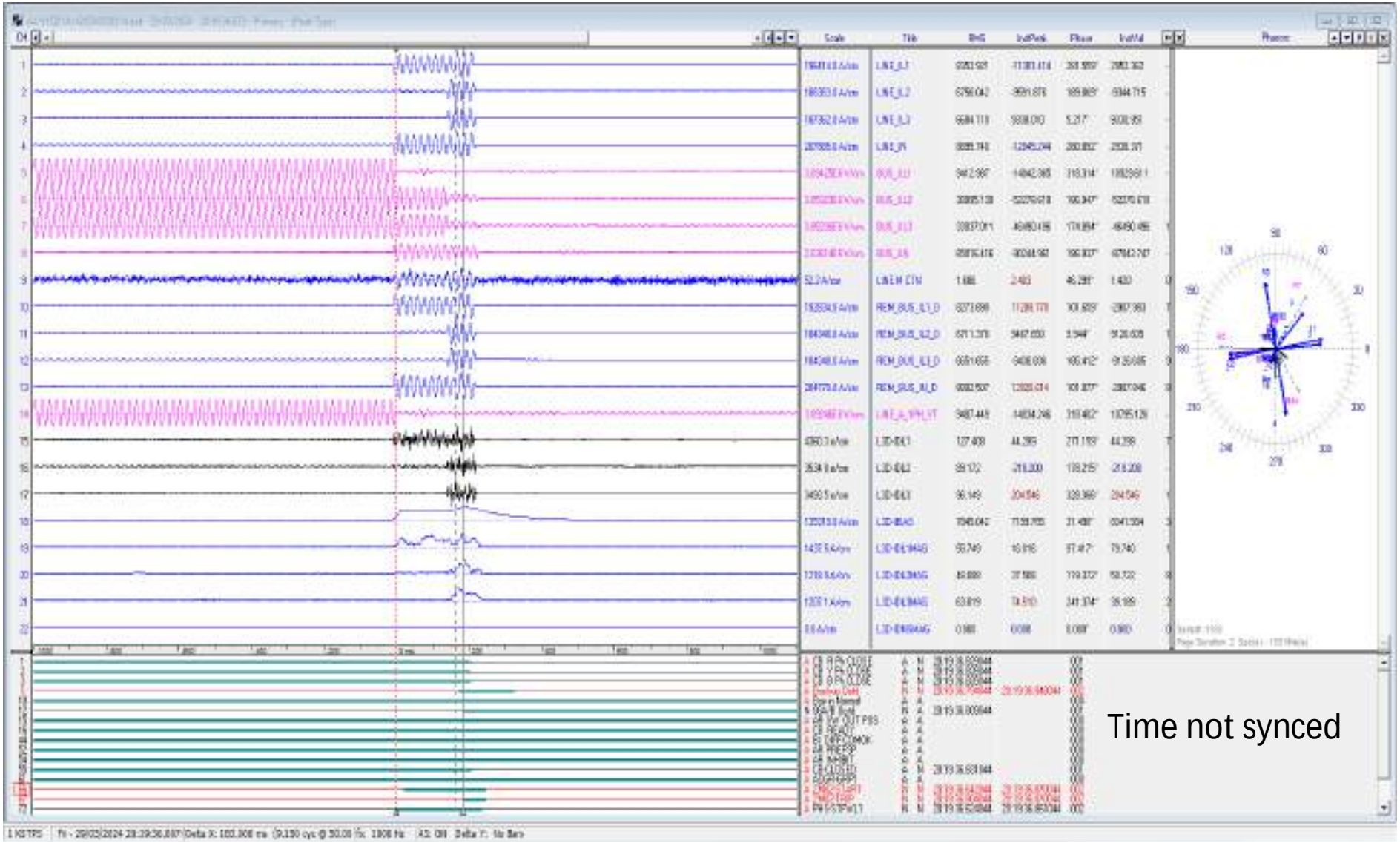
After ~350msec of R-N fault, power swing blocking operated and ~600msec of R-N fault, line tripped on Z-1 distance protection operation.

DR of 220kV KTPS(end)-Heerapura ckt



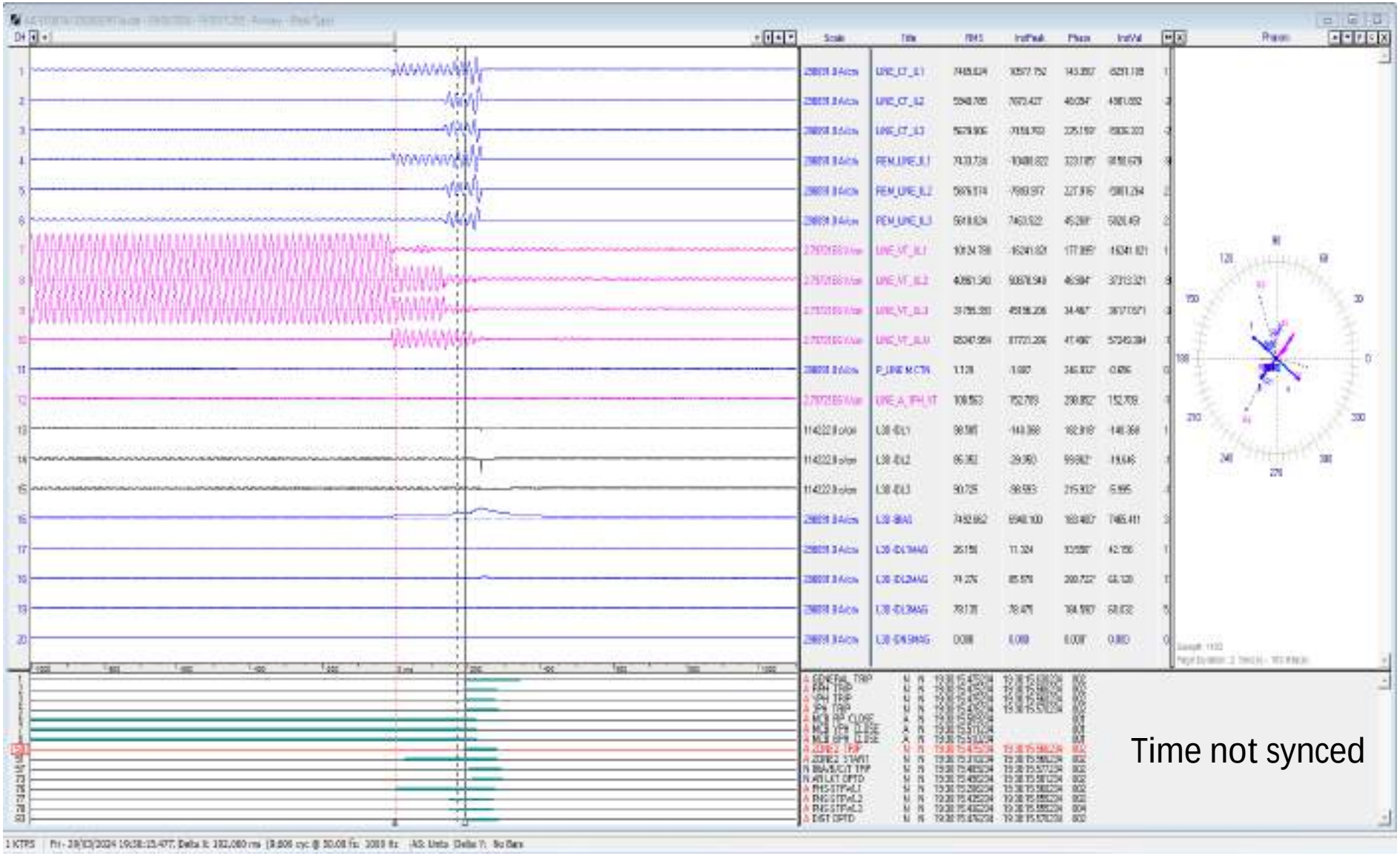
After ~400msec of R-N fault, power swing blocking operated and ~430msec of R-N fault, line tripped on Z-1 distance protection operation. Time not synced

DR of 220kV KTPS(end)-Kota Sakatpura ckt-1



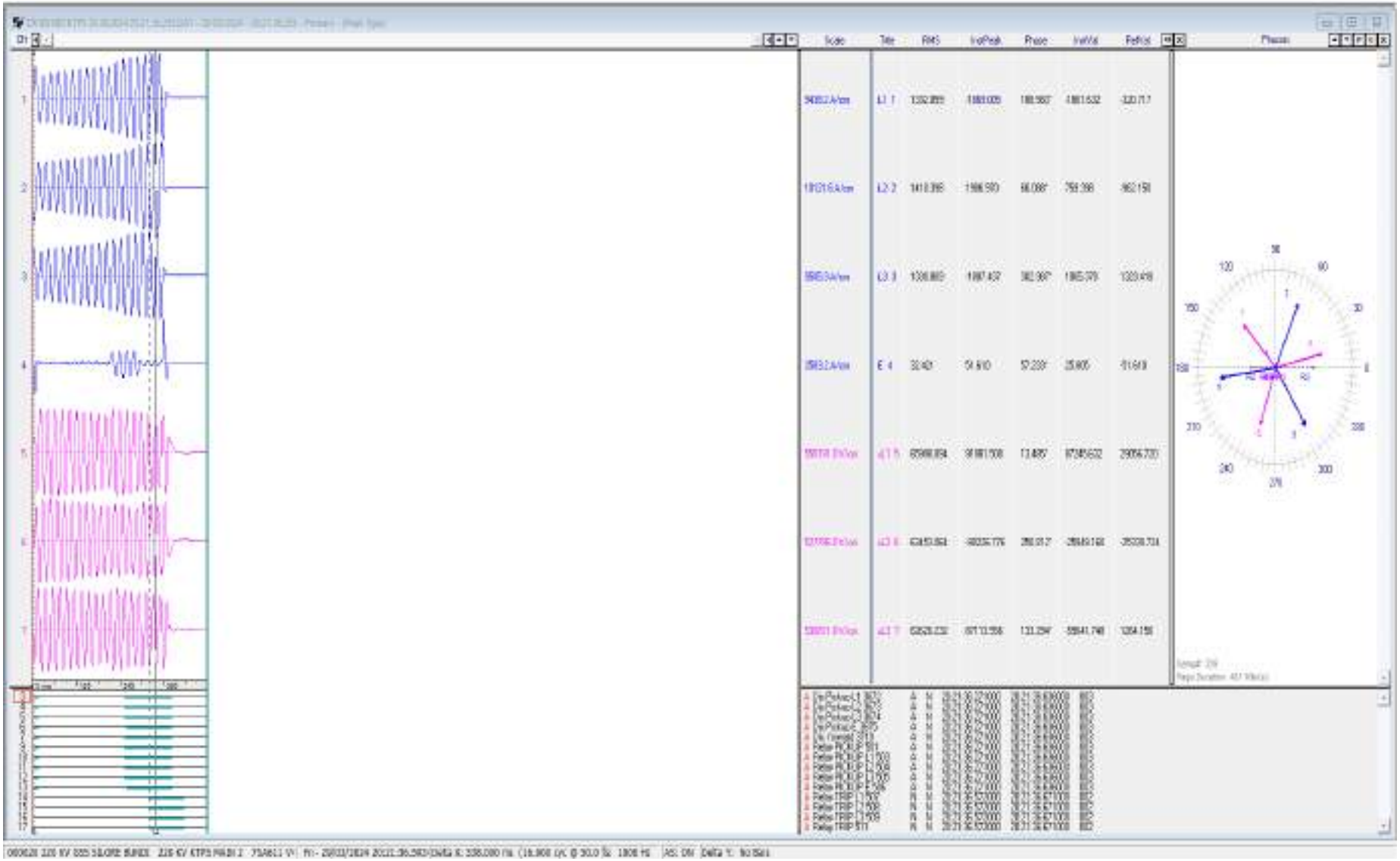
After ~20msec of R-N fault, distance protection sensed fault in Z-2 and after ~200msec of R-N fault, line tripped on Z-2 distance protection operation.

DR of 220kV KTPS(end)-Kota Sakatpura ckt-3



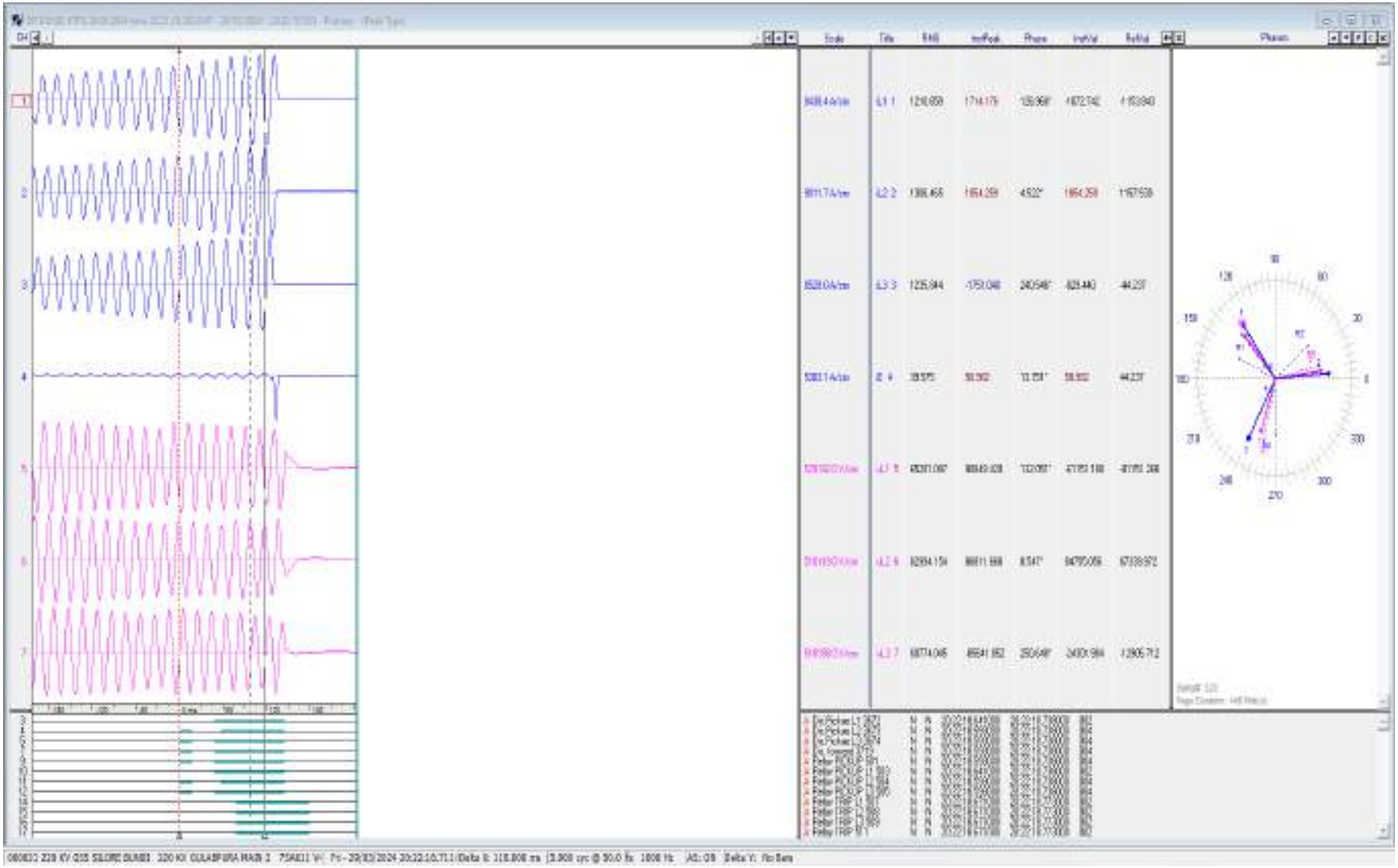
After ~20msec of R-N fault, distance protection sensed fault in Z-2 and after ~200msec of R-N fault, line tripped on Z-2 distance protection operation.

DR of 220kV KTPS-Bundi(end) ckt



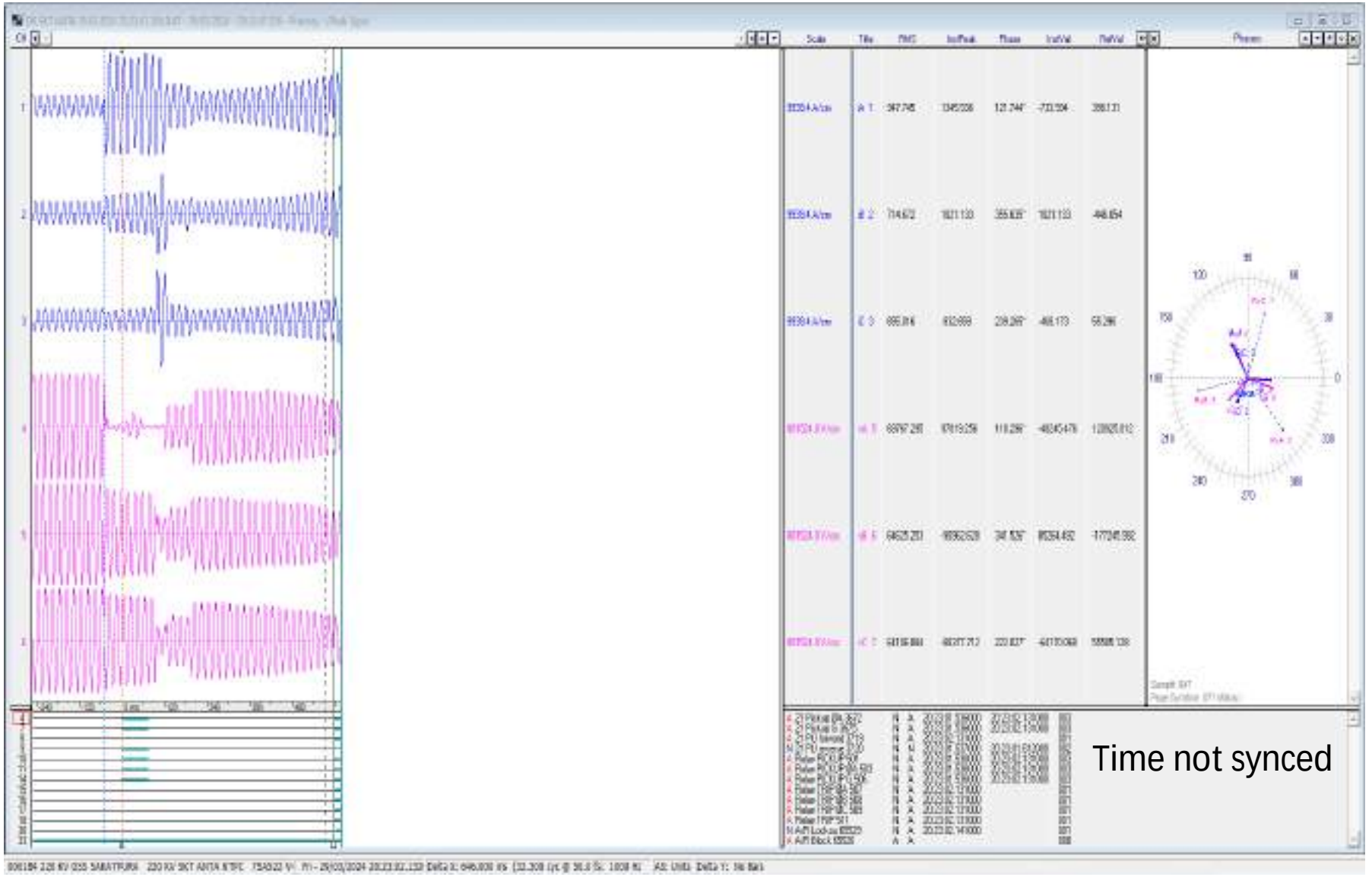
After ~550msec of R-N fault detection, line tripped on distance protection operation; phase currents in the range of 1330-1410A.

DR of 220kV Bundi(end)-Gulabpura ckt



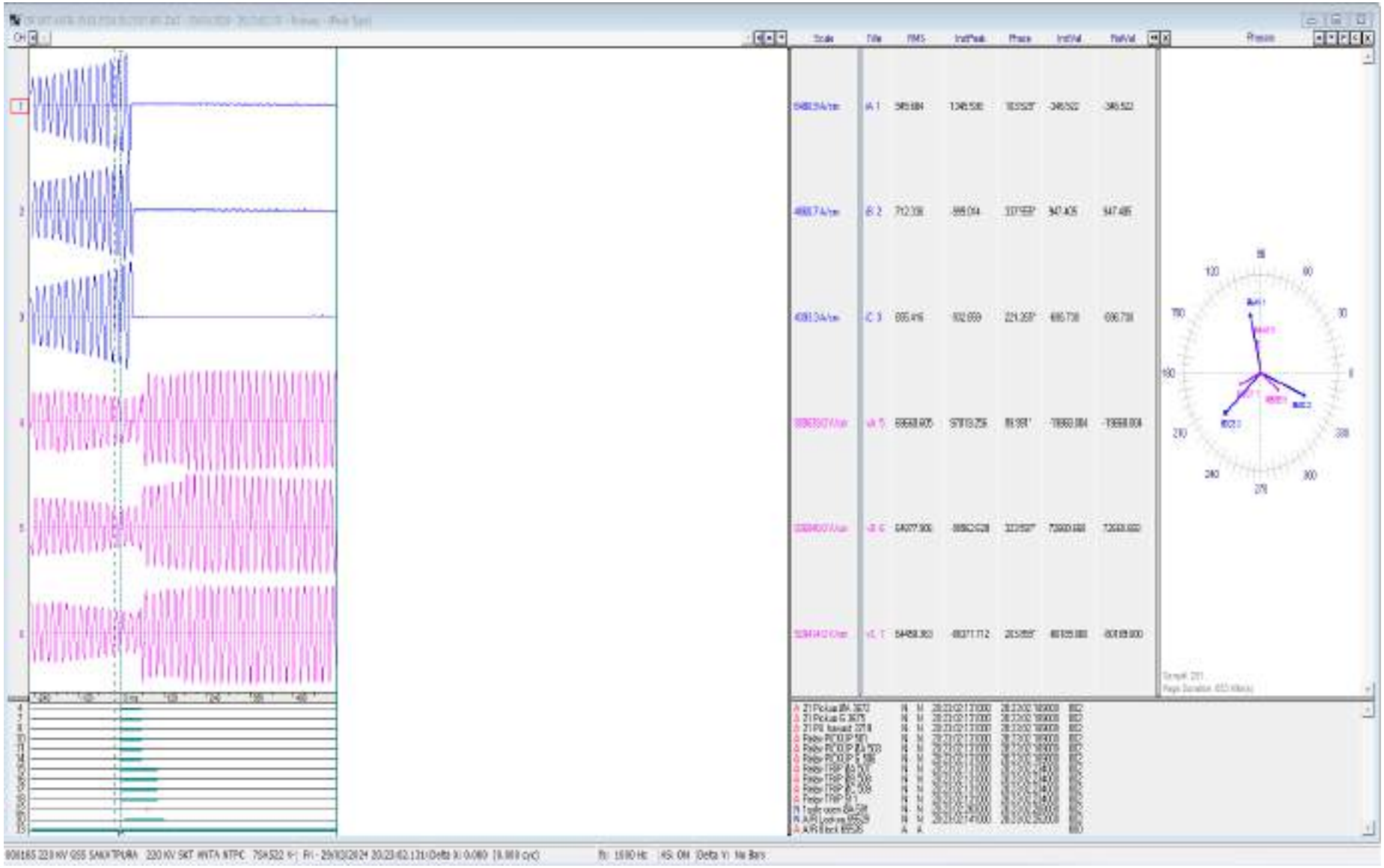
Line tripped on distance protection operation; phase currents in the range of 1200-1300A.

DR of 220kV Kota Sakatpura(end)-Anta ckt



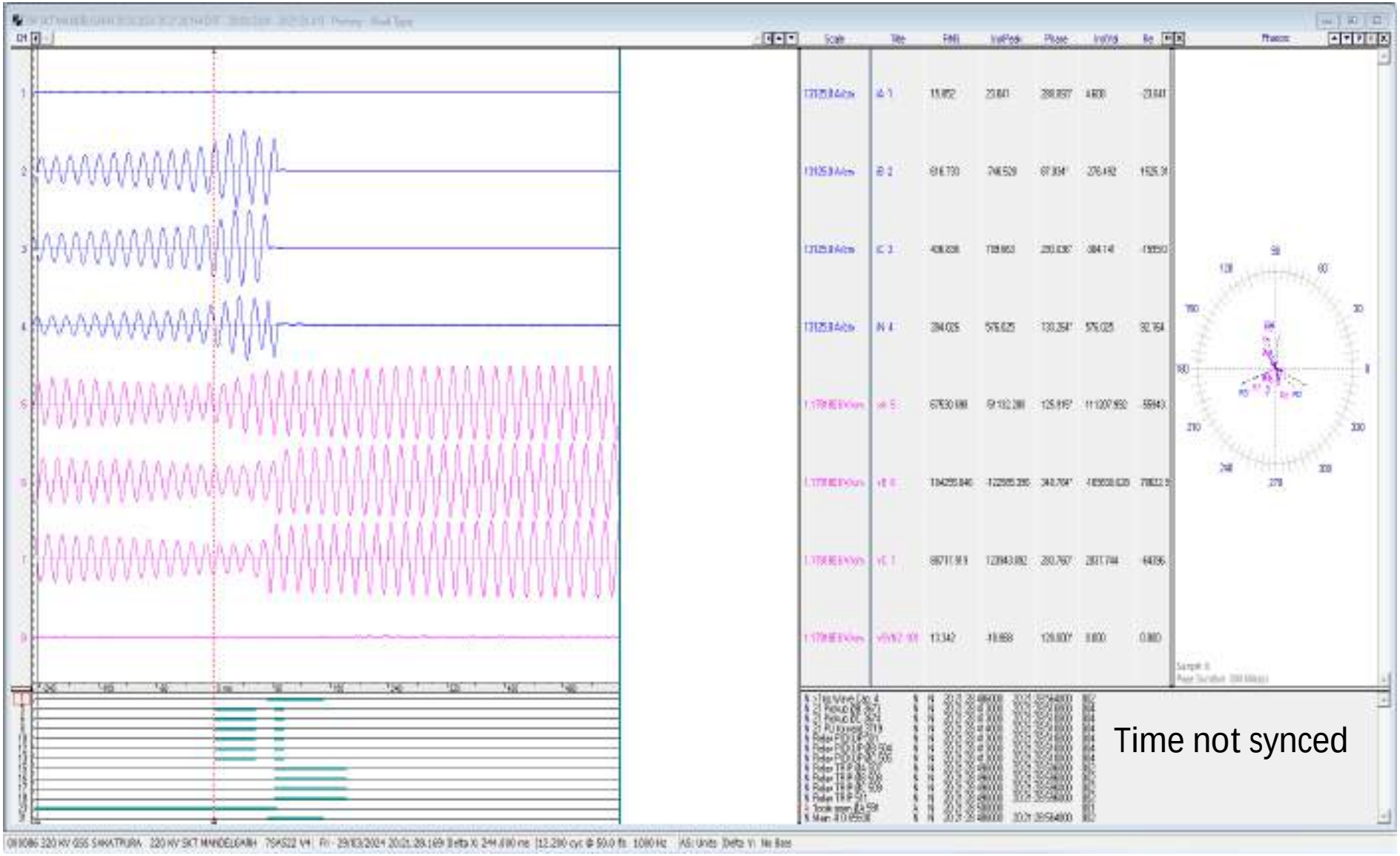
Sensed fault in Z-4 and reset and after ~650msec of R-N fault, line tripped on distance protection operation.

DR of 220kV Kota Sakatpura(end)-Anta ckt



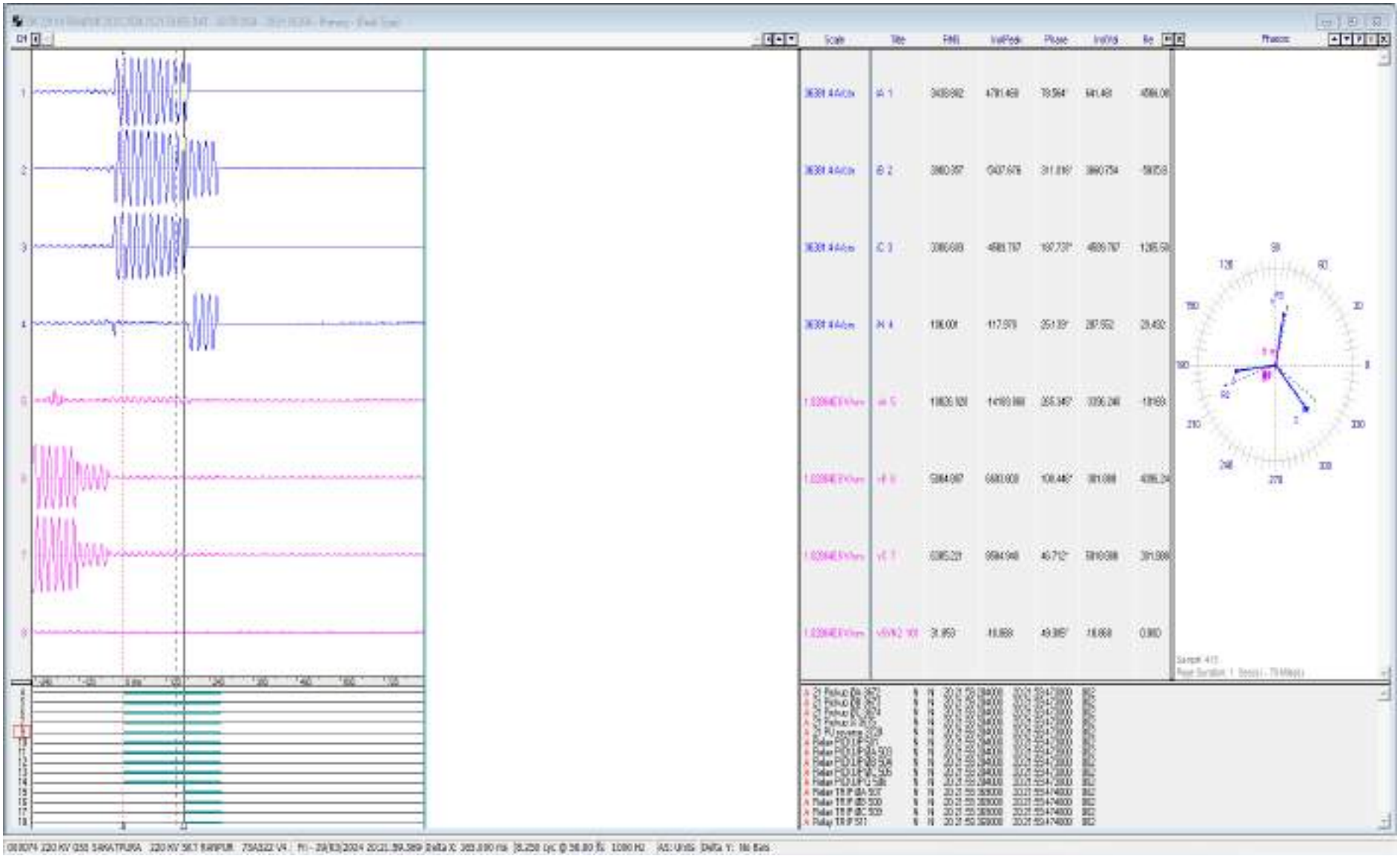
Sensed fault in Z-4 and reset and after ~650msec of R-N fault, line tripped on distance protection operation.

DR of 220kV Kota Sakatpura(end)-Mandalgarh ckt



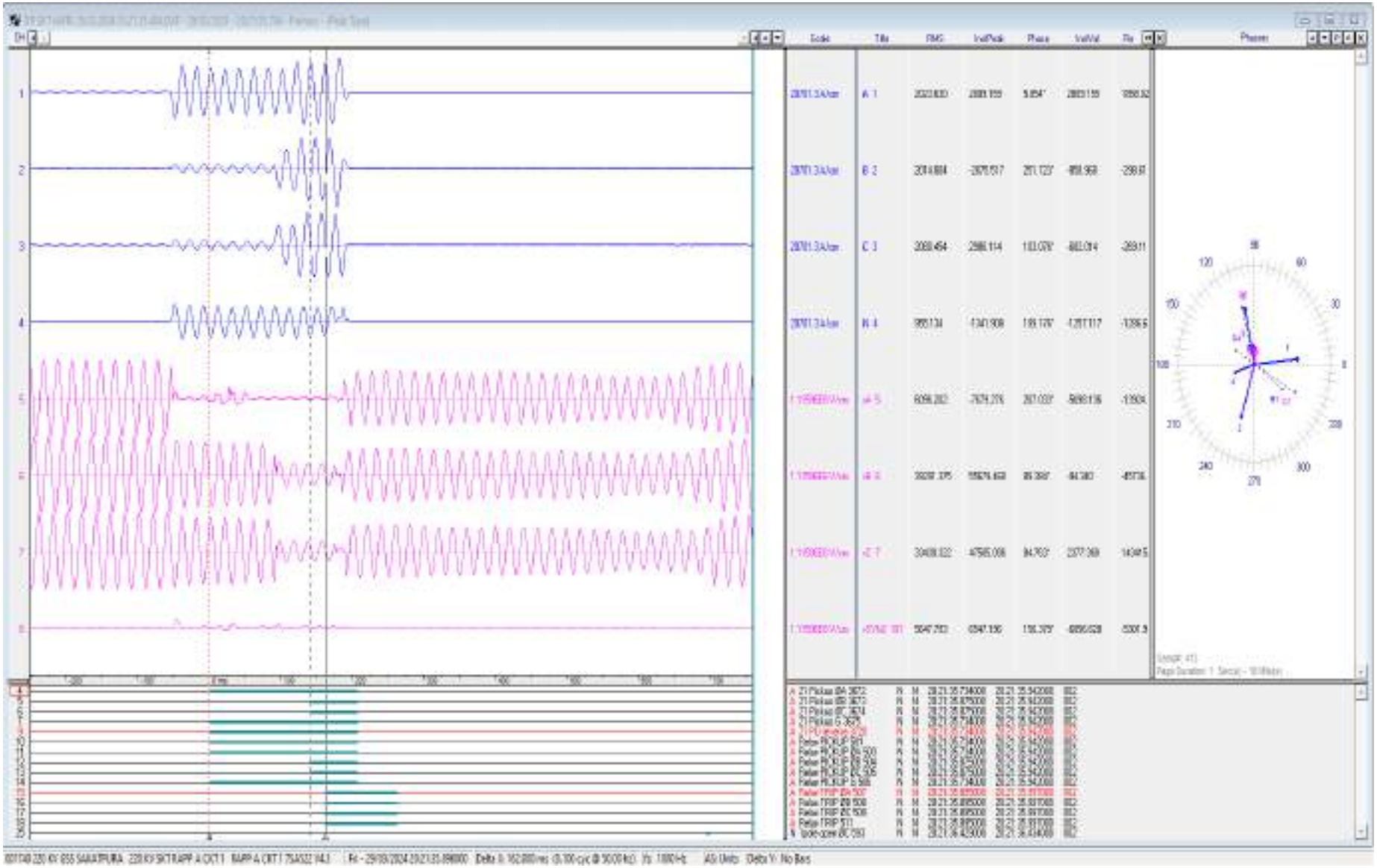
R-ph pole tripping followed by 3-ph trip observed.

DR of 220kV Kota Sakatpura(end)-Ranpur ckt



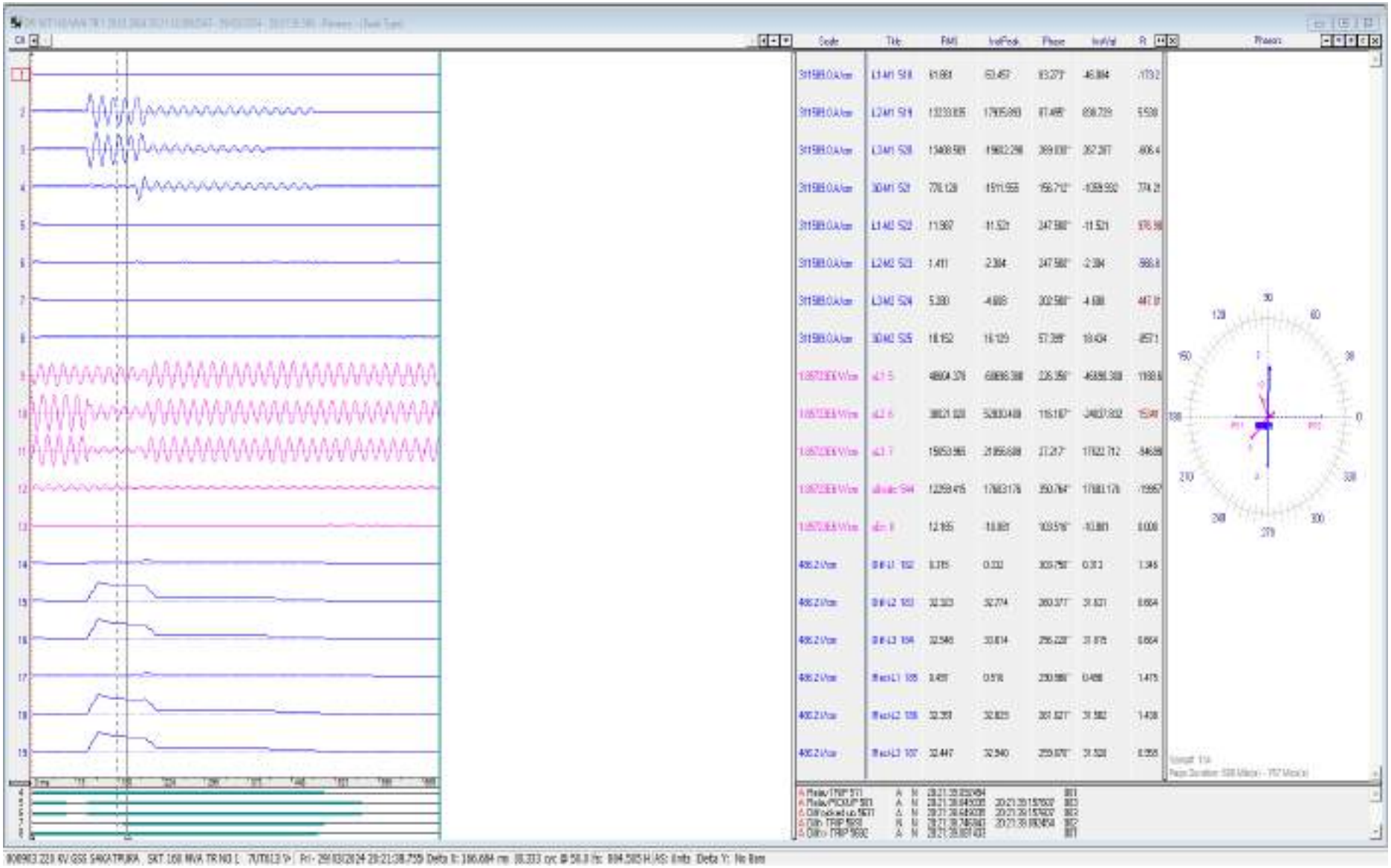
Fault sensed in Z-4, 3-ph trip after ~160msec of fault is observed.

DR of 220kV Kota Sakatpura(end)-RAPS-A ckt-1



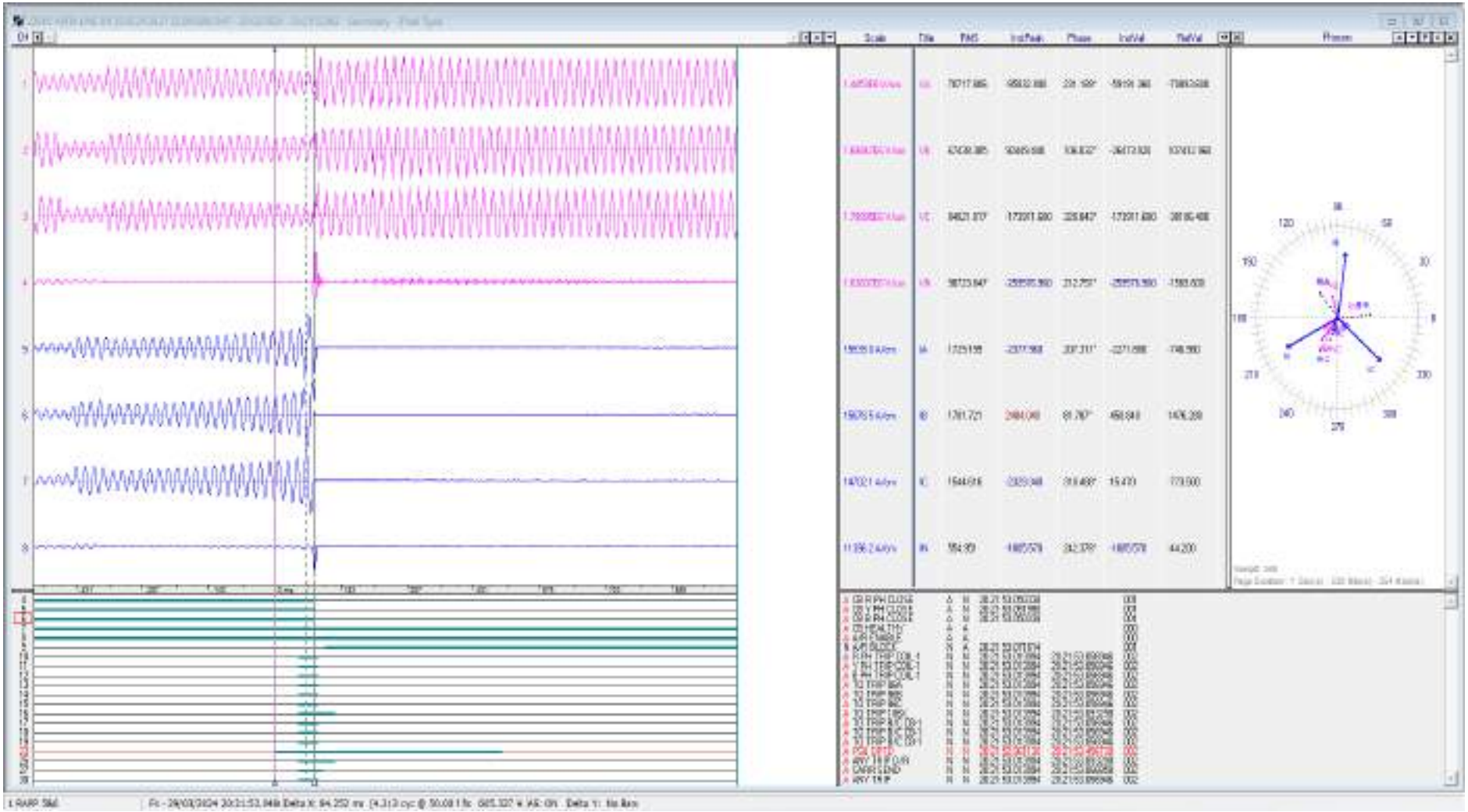
Fault sensed in Z-4, 3-ph trip after ~160msec of fault is observed.

DR of 220/132kV ICT-1 at Kota Sakatpura



Differential protection operated

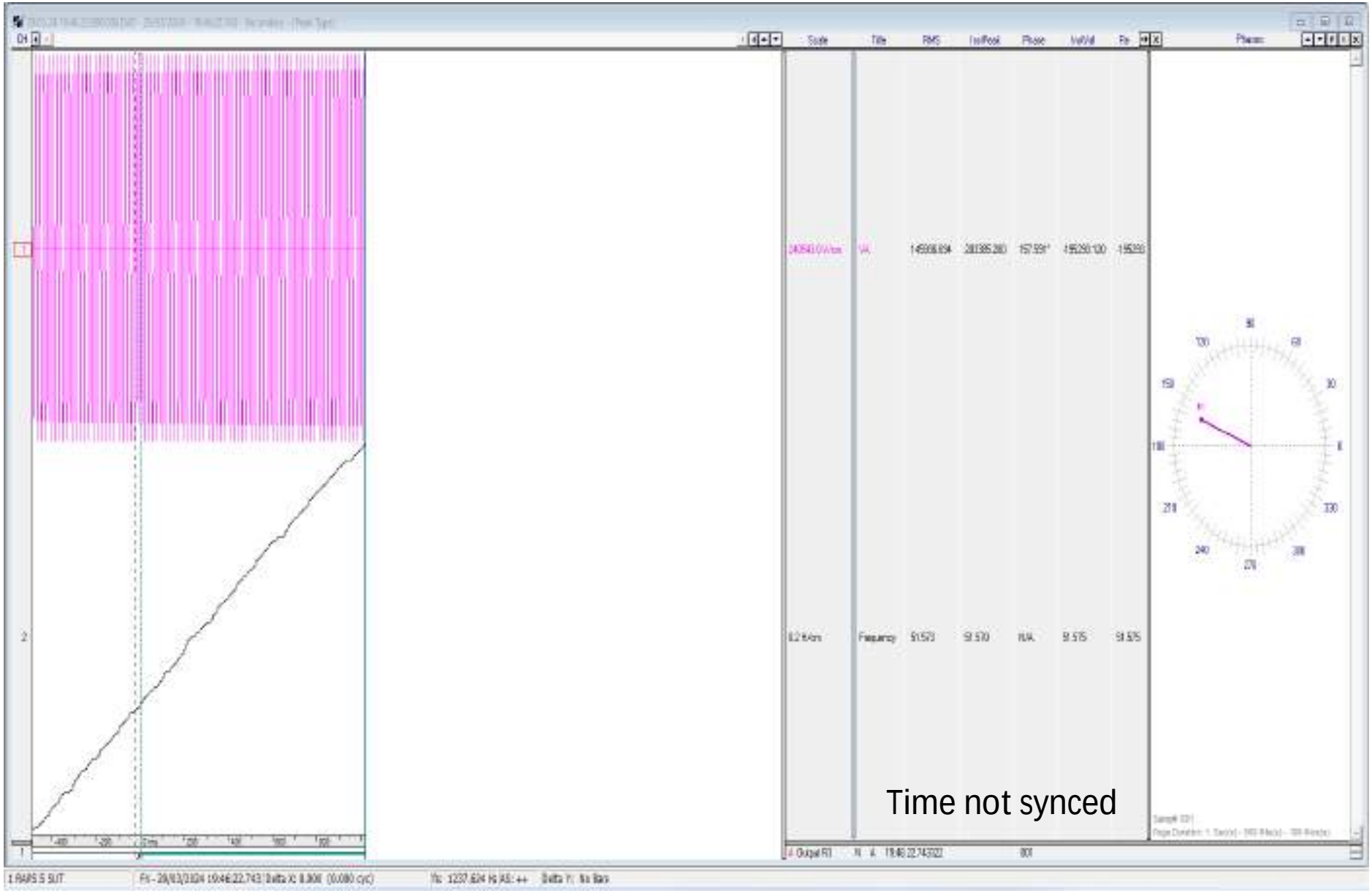
DR of 220kV RAPS_C(end)-Anta ckt



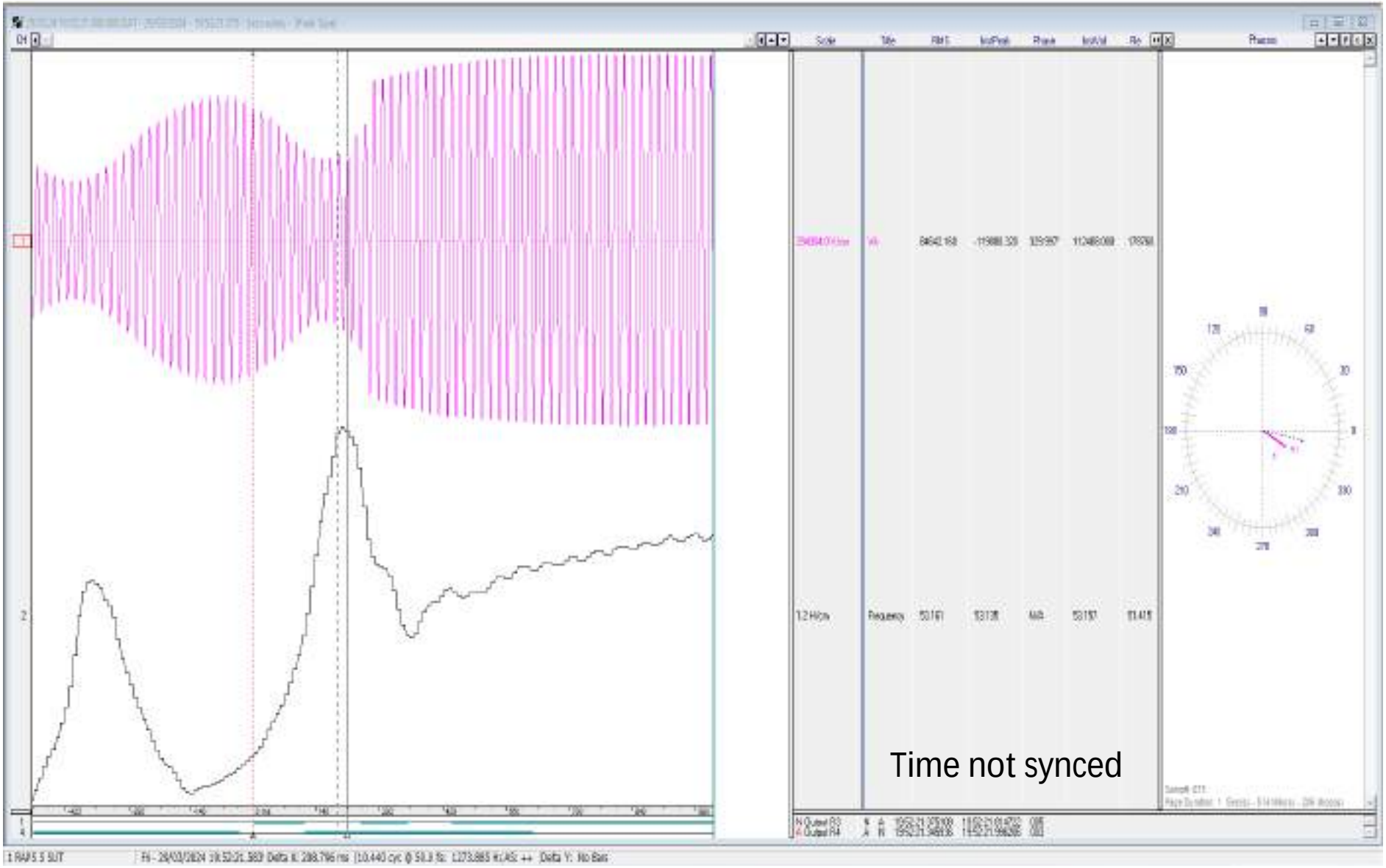
Phase currents:

- At 20:21:52:519 hrs: ~270-290A (~106MW)
- At 20:21:52:962 hrs: Power swing blocking operated: ~900-1000A (~350MW)
- At 20:21:53:048 hrs: ~1600-1800A (~650MW); breaker opened; Z-1 distance protection operated

DR of SUT-5 at RAPP-B

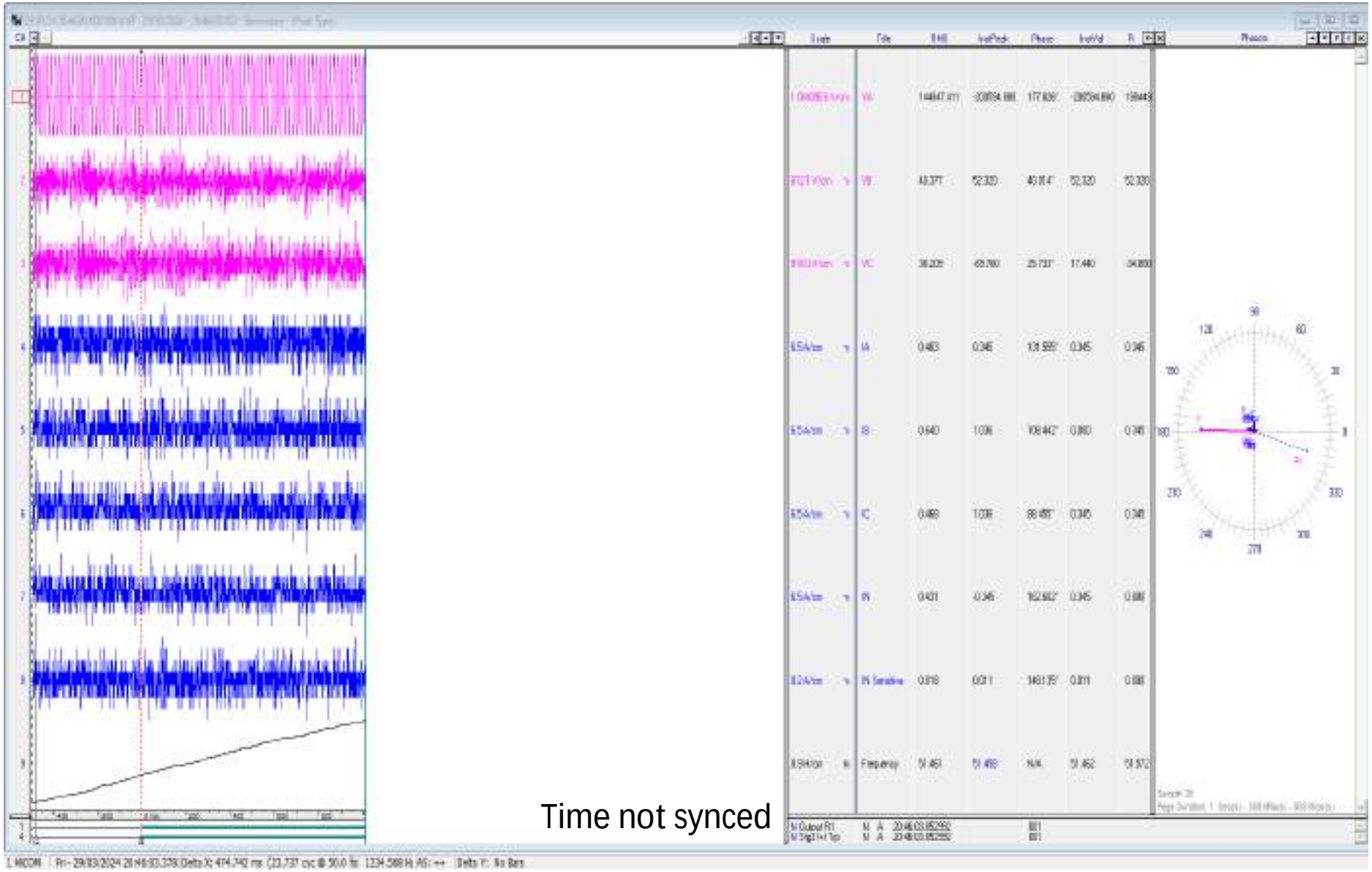


DR of SUT-5 at RAPP-B



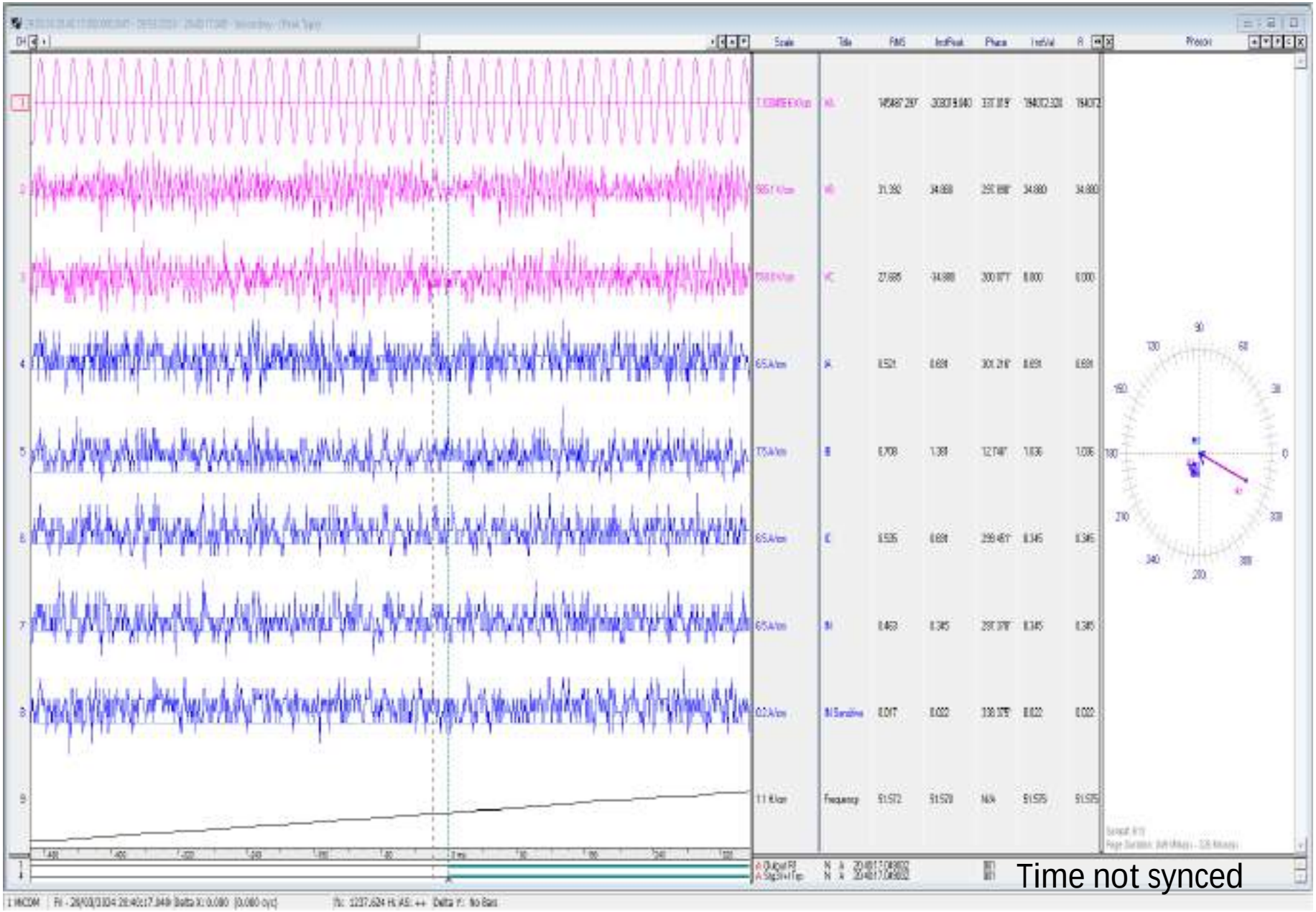
Max. frequency recorded:53.15Hz

DR of SUT-6 at RAPP-B



Time not synced

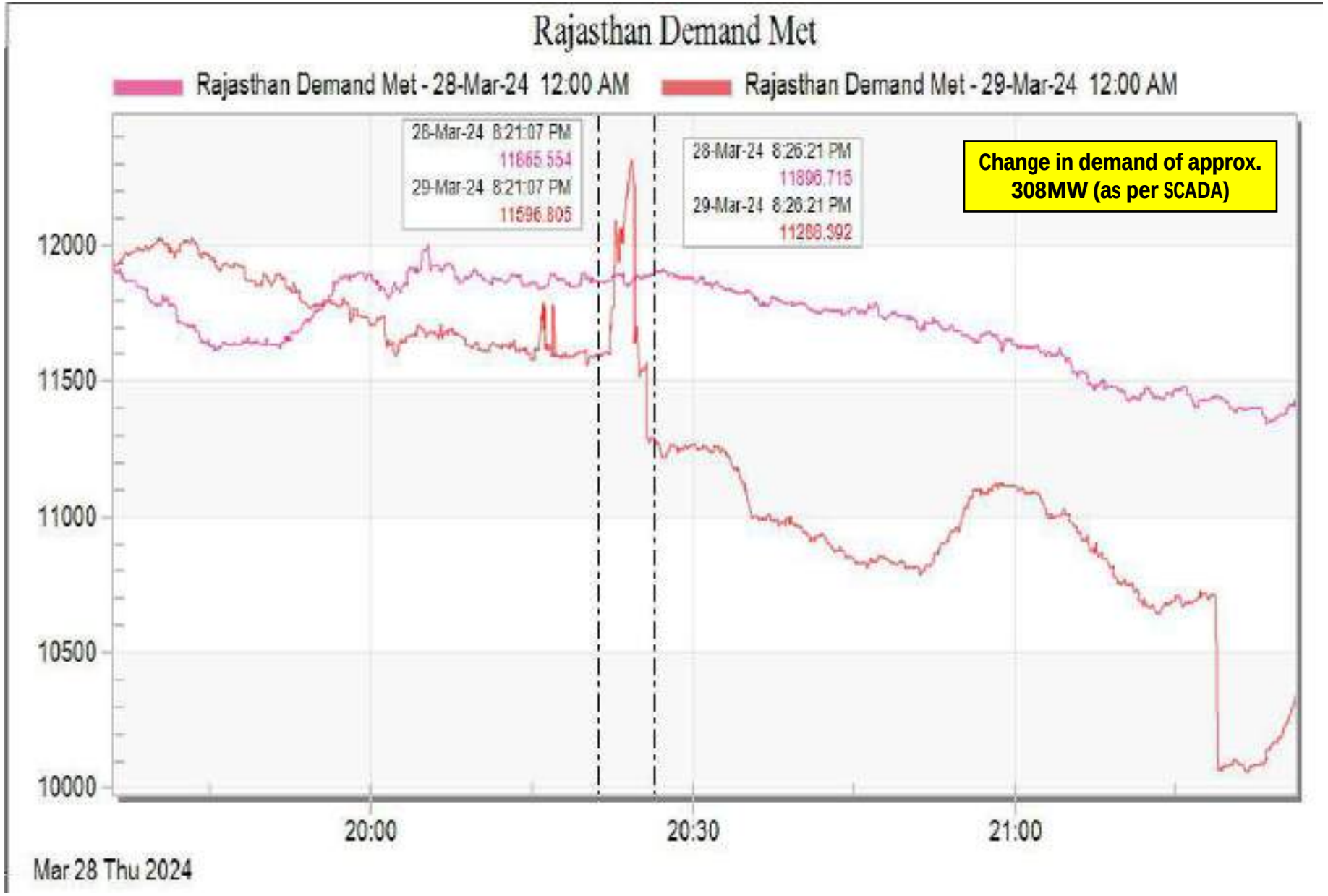
DR of SUT-6 at RAPP-B



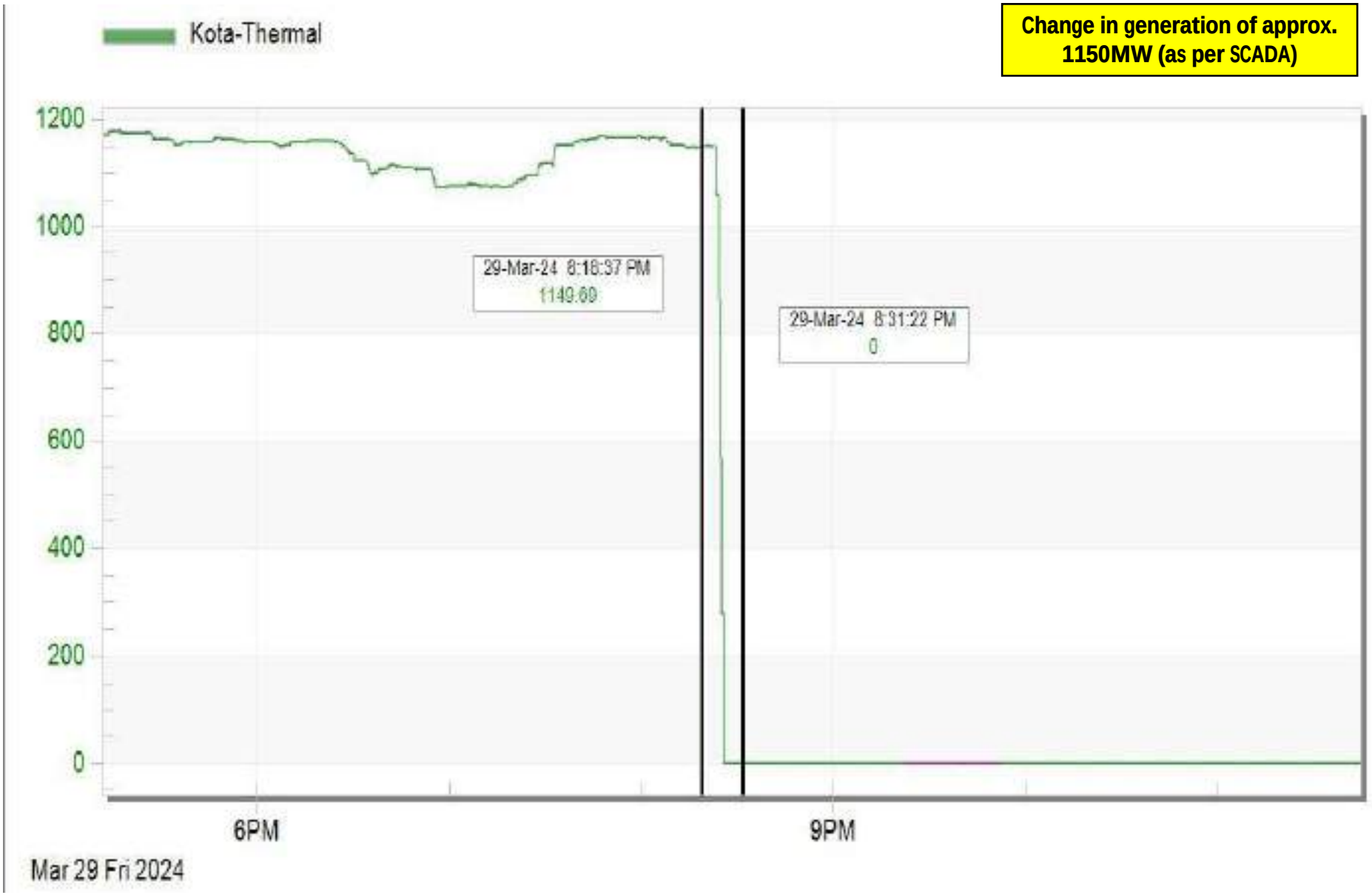
SCADA SOE

Time	Station Name	Voltage	Element	Element Type	Element Status	Remarks
20:21:51,605	KTPS	220kV	08KOTAS1	Circuit Breaker	Open	Line CB at KTPS end of 220kV KTPS-Sakatpura ckt-1
20:21:51,942	BUND2_R	220kV	04GULAB	Circuit Breaker	Open	Line CB at Bundi end of 220kV Bundi-Gulabpura ckt
20:21:51,953	BUND2_R	220kV	03KTPS	Circuit Breaker	Open	Line CB at Bundi end of 220kV Bundi-KTPS ckt opened
20:21:52,090	MANDL_R	220kV	02KOTAPG	Circuit Breaker	Open	Line CB at Manadalgarh end of 220kV Kota Sakatpura-
20:21:52,796	KTPS	220kV	10U2	Circuit Breaker	Open	KTPS Unit-2 CB opened
20:21:52,897	RANPR_R	220kV	04KOTAS	Circuit Breaker	disturbe	Line CB at Ranpur end of 220kV Kota Sakatpura-Ranpur
20:21:53,107	RAPP3 4	220kV	08KOTAS	Circuit Breaker	Open	Line CB at RAPS-B end of 220kV RAPS-B-Kota Sakatpura
20:21:58,259	KTPS	220kV	12U3	Circuit Breaker	Open	KTPS Unit-3 CB opened
20:21:58,685	KOTA	132kV	20DADAB	Circuit Breaker	Open	
20:21:58,685	KOTA	220kV	09RAPP1	Circuit Breaker	Open	Line CB at Kota Sakatpura end of 220kV RAPS-A-Kota
20:21:58,685	KOTA	220kV	18ANTA	Circuit Breaker	Open	Line CB at Kota Sakatpura end of 220kV Kota Sakatpura-
20:21:58,685	KOTA	132kV	17T1	Circuit Breaker	Open	
20:21:58,685	KOTA	220kV	16MBC	Circuit Breaker	Open	
20:21:58,685	KOTA	220kV	07T1	Circuit Breaker	Open	
20:21:58,685	KOTA	220kV	10MBC	Circuit Breaker	Open	
20:21:58,685	KOTA	220kV	13BS	Circuit Breaker	Open	
20:21:59,972	KOTA	132kV	07BS	Circuit Breaker	Open	
20:22:08,354	RPS	132kV	10U4	Circuit Breaker	Open	
20:22:09,249	RAPP3 4	220kV	07SUTR4	Circuit Breaker	Open	
20:22:09,858	RAPP3 4	220kV	06G4	Circuit Breaker	Open	

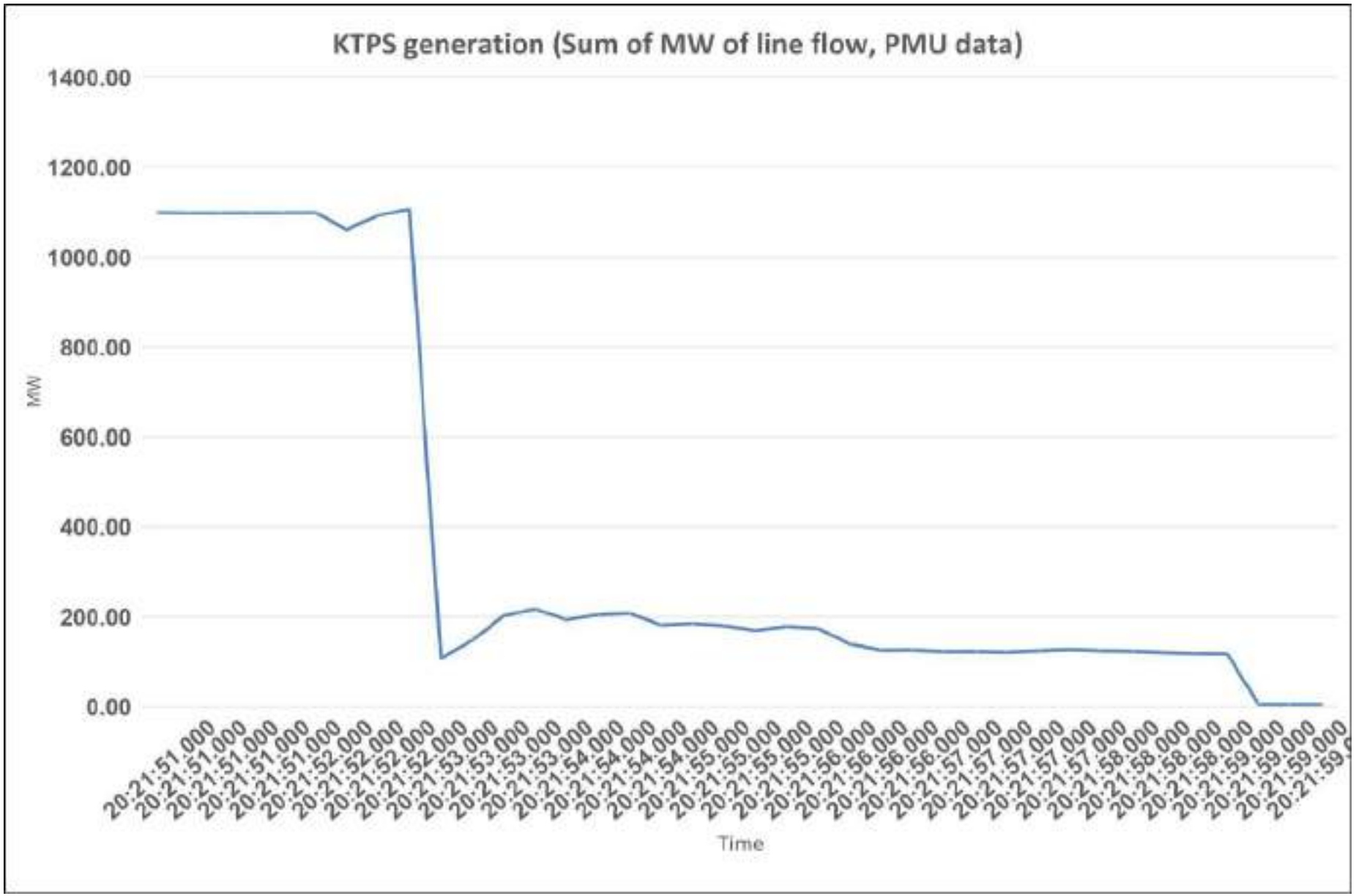
Rajasthan demand during the event



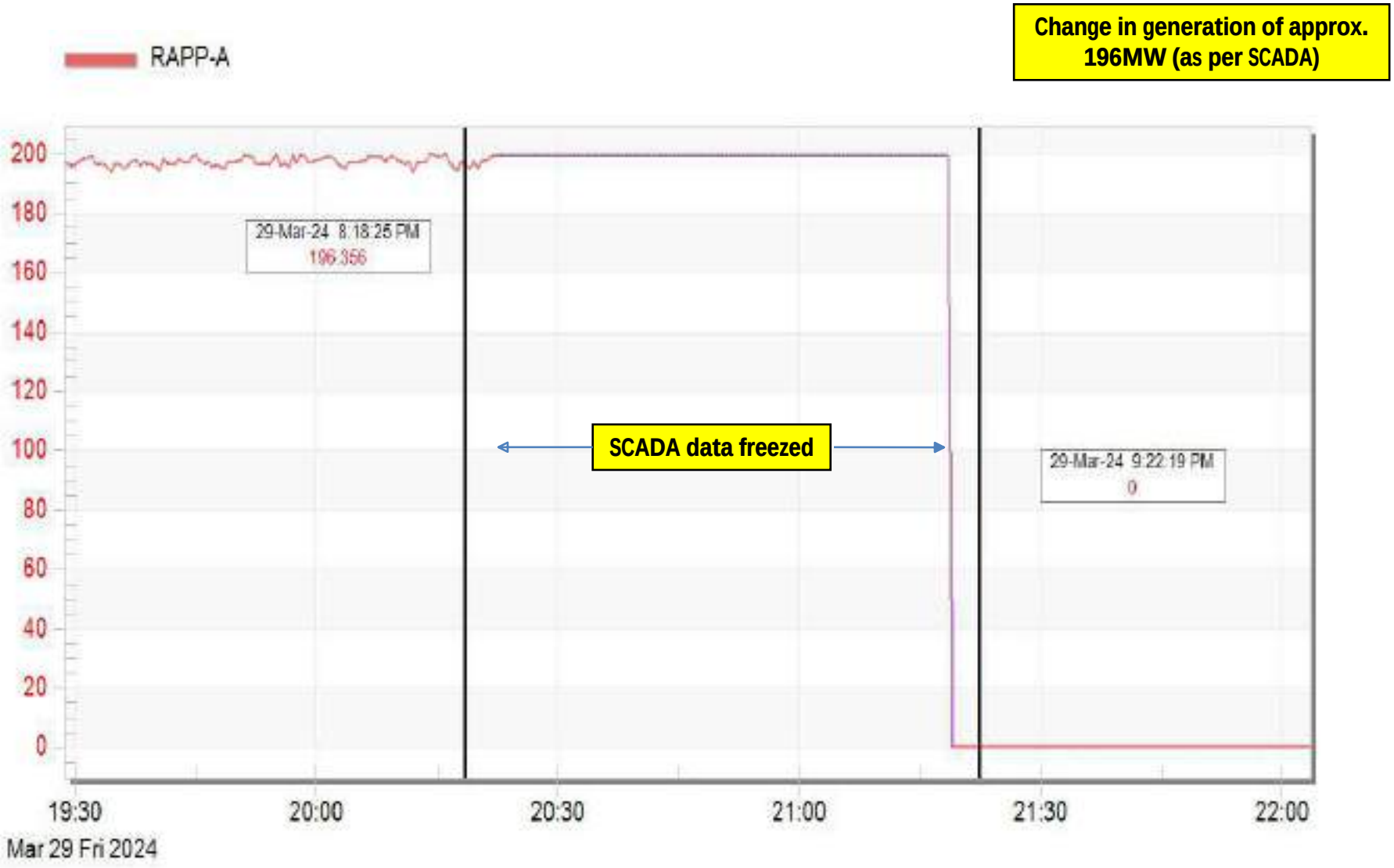
KTPS generation during the event(SCADA data)



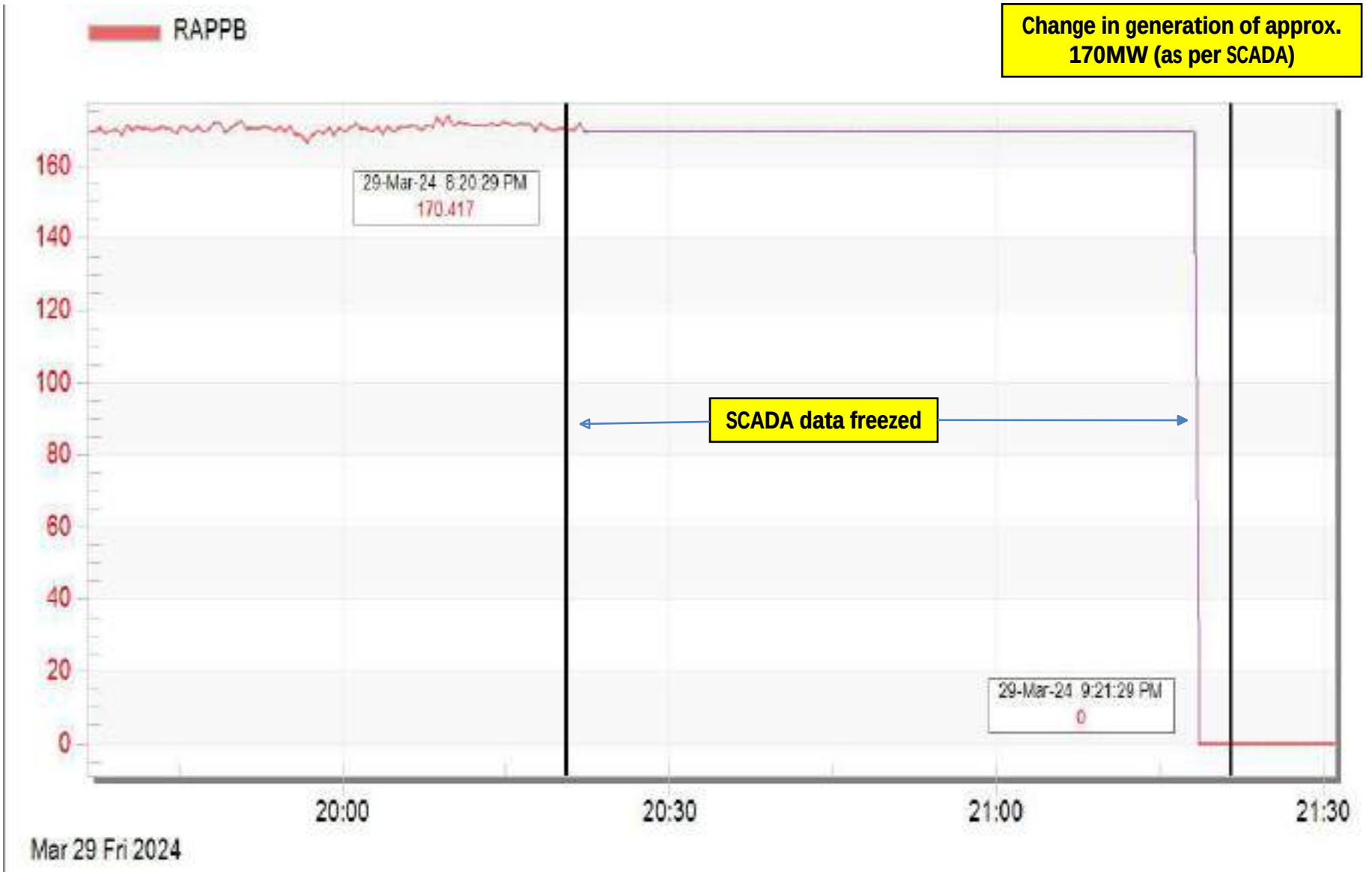
KTPS generation during the event (PMU data)



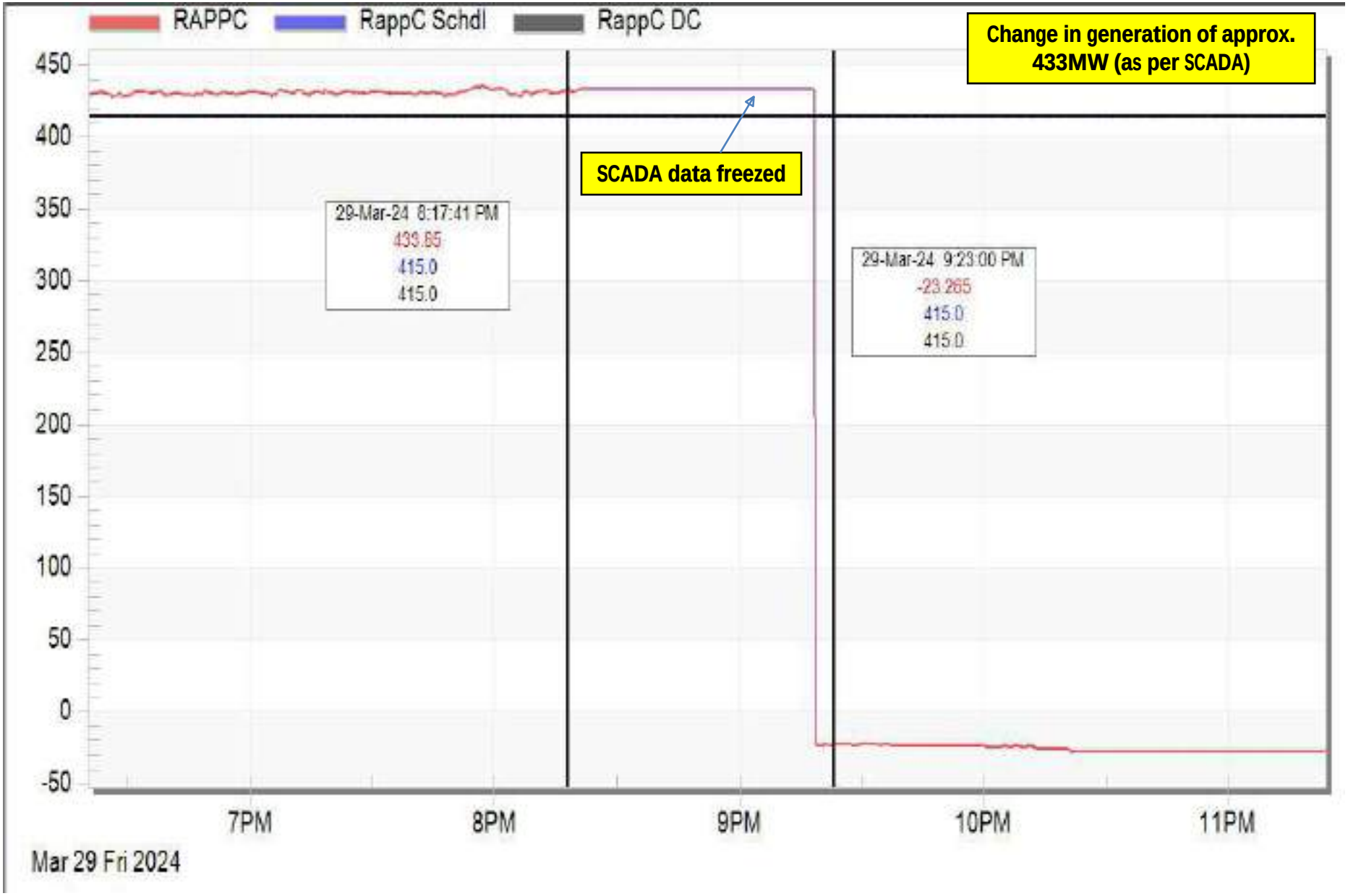
RAPP-A(NP) generation during the event



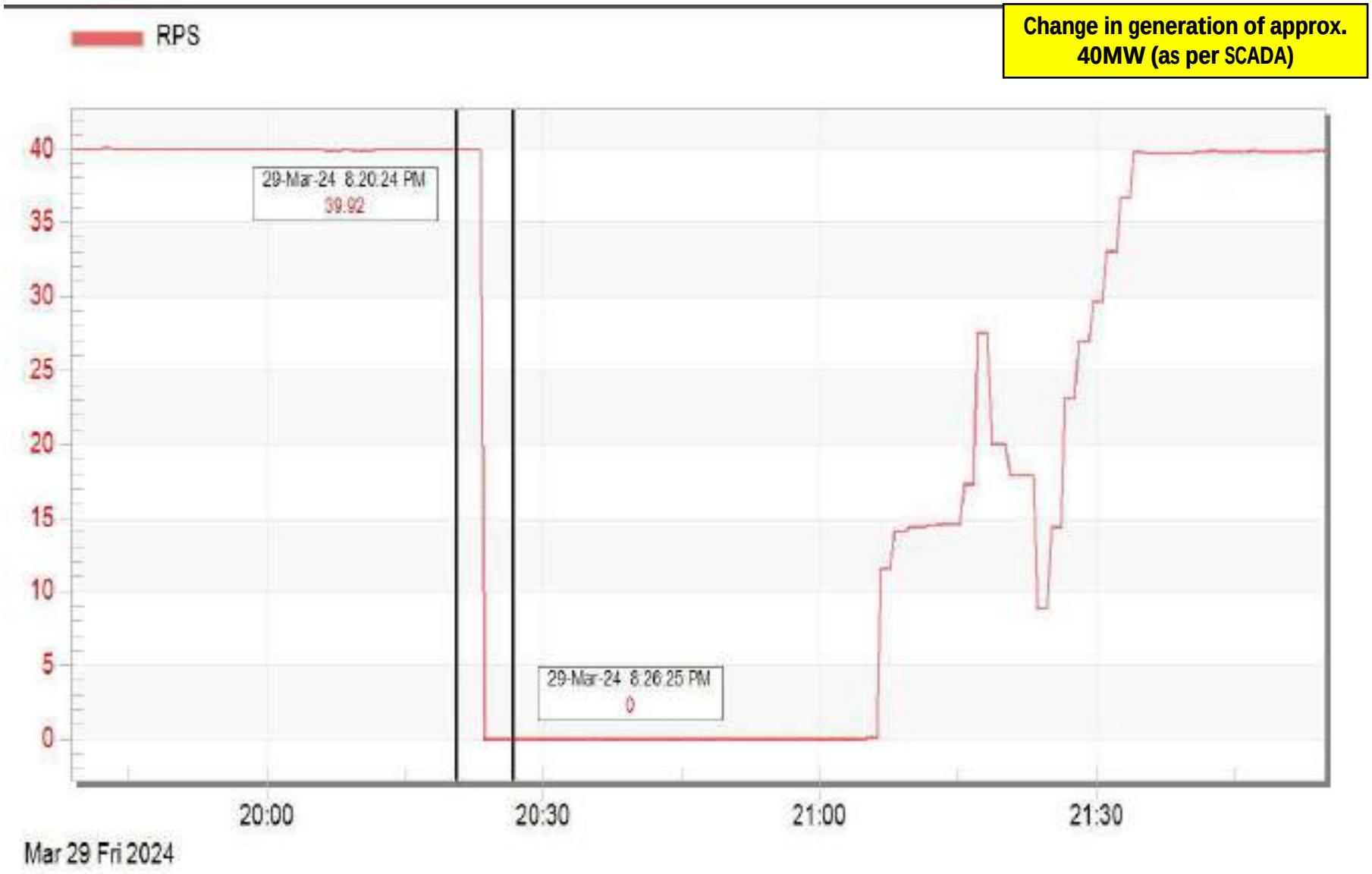
RAPP-B(NP) generation during the event



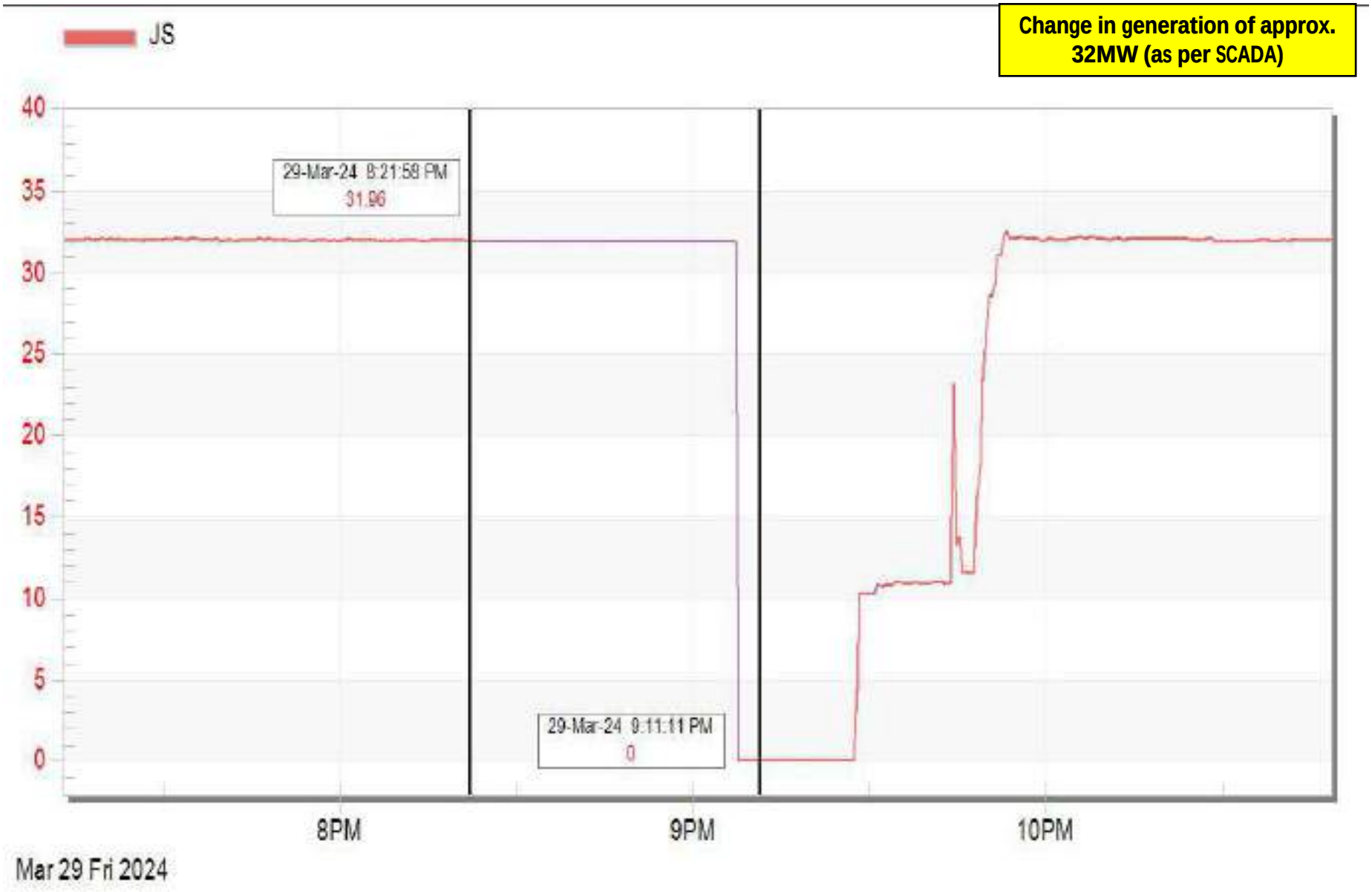
RAPP-C(NP) generation during the event



RPS HEP generation during the event



Jawahar Sagar HEP generation during the event



Multiple elements tripping at 220/132kV Kunihar(HP) 02nd February 2024

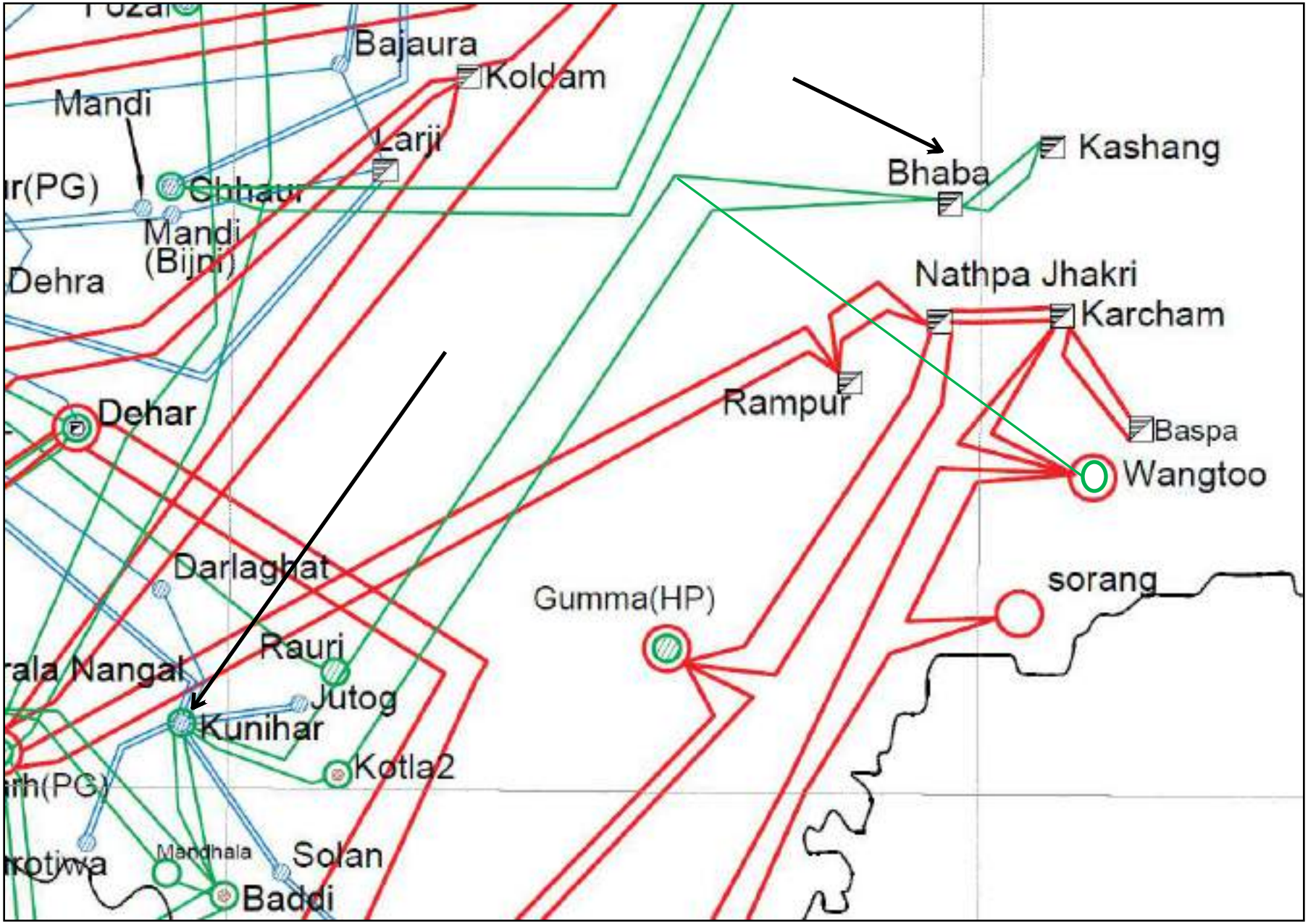
Brief of event:

- As reported, at 15:27 hrs, 220kV Baddi(HP)-Pinjore(HV) (HPPTCL) Ckt-1 & 2 tripped on R-Y phase to phase fault; zone-1 disatnce protection operated at Pinjore end. (Exact reason, nature and location of fault yet to be shared)
- Due to tripping of aforementioned lines, 220 kV Baddi-Kunihar(HP) Ckt-1 & 2, 220 kV Baddi-Upper Nangal(HP) Ckt, 220 kV Baddi-Madhala(HP) Ckt and 220 kV Baddi-Wardthman(HP) Ckt tripped due to over-loading and 220/66kV Baddi(HP) S/s became dead.
- During the same time, 220 kV Madhala -Upper Nangal(HP) Ckt, 220 kV Bhabha-Kunihar(HP) ckt and 220 kV Jeori-Kunihar(HP) Ckt also tripped on over-loading.
- Further, at 15:34 hrs, all 132kV lines from Kunihar(HP) tripped on over-loading and 220/132kV Kunihar(HP) S/s became dead.
- As per PMU, **R-Y phase to phase fault** is observed with **delayed fault clearing time of 400ms**.
- As per SCADA, total change in demand of approx. 785MW in HP control area is observed.

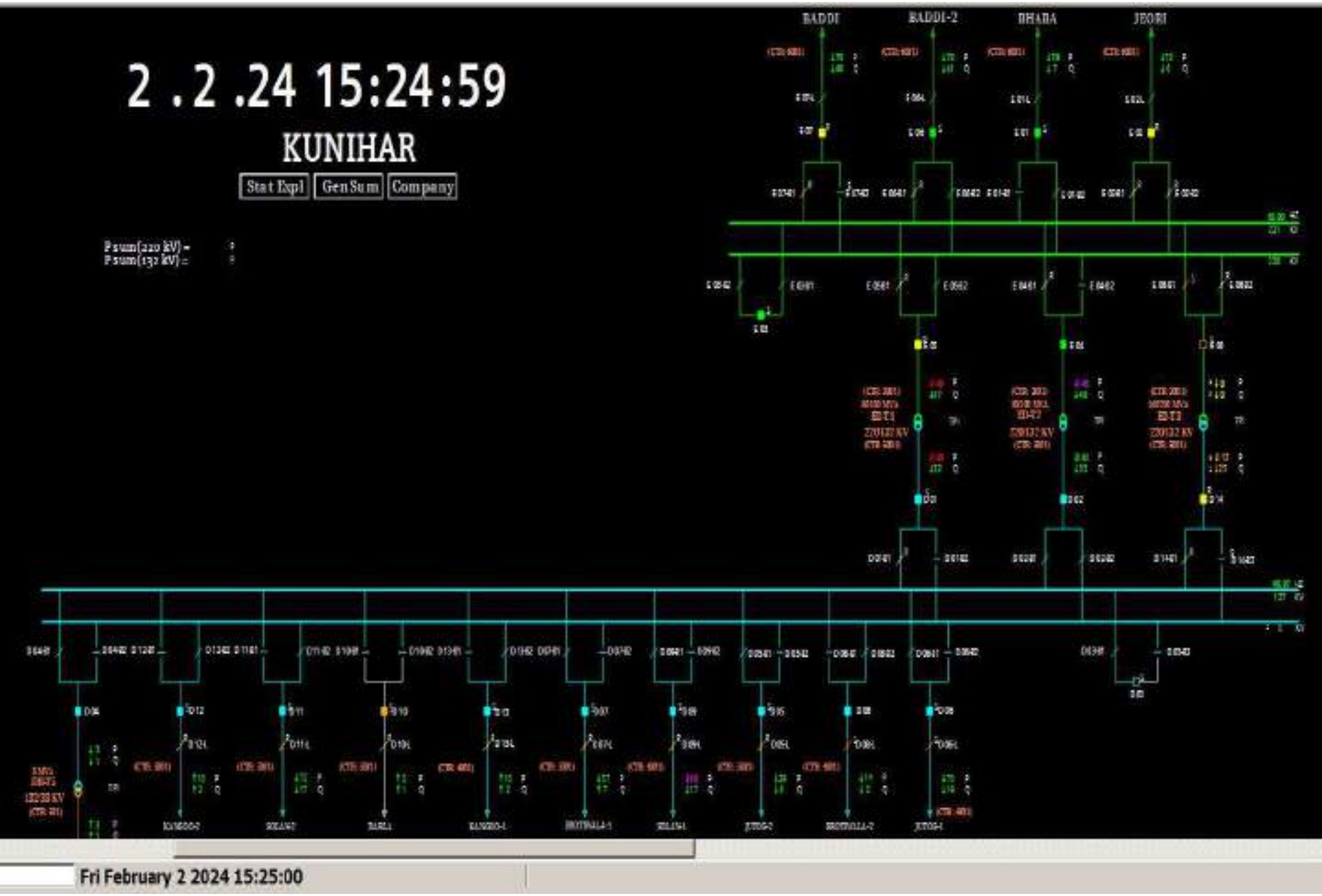
Elements tripped:

i. 220kV Baddi(HP)-Pinjore(HV) (HPPTCL) Ckt-1
ii. 220kV Baddi(HP)-Pinjore(HV) (HPPTCL) Ckt-2
iii. 220 kV Baddi-Kunihar(HP) Ckt-1
iv. 220 kV Baddi-Kunihar(HP) Ckt-2
v. 220 kV Baddi-Upper Nangal(HP) Ckt
vi. 220 kV Baddi-Madhala(HP) Ckt
vii. 220 kV Baddi-Wardthman(HP) Ckt
viii. 220 kV Madhala -Upper Nangal(HP) Ckt
ix. 220 kV Bhabha-Kunihar(HP) ckt
x. 220 kV Jeori-Kunihar(HP) Ckt

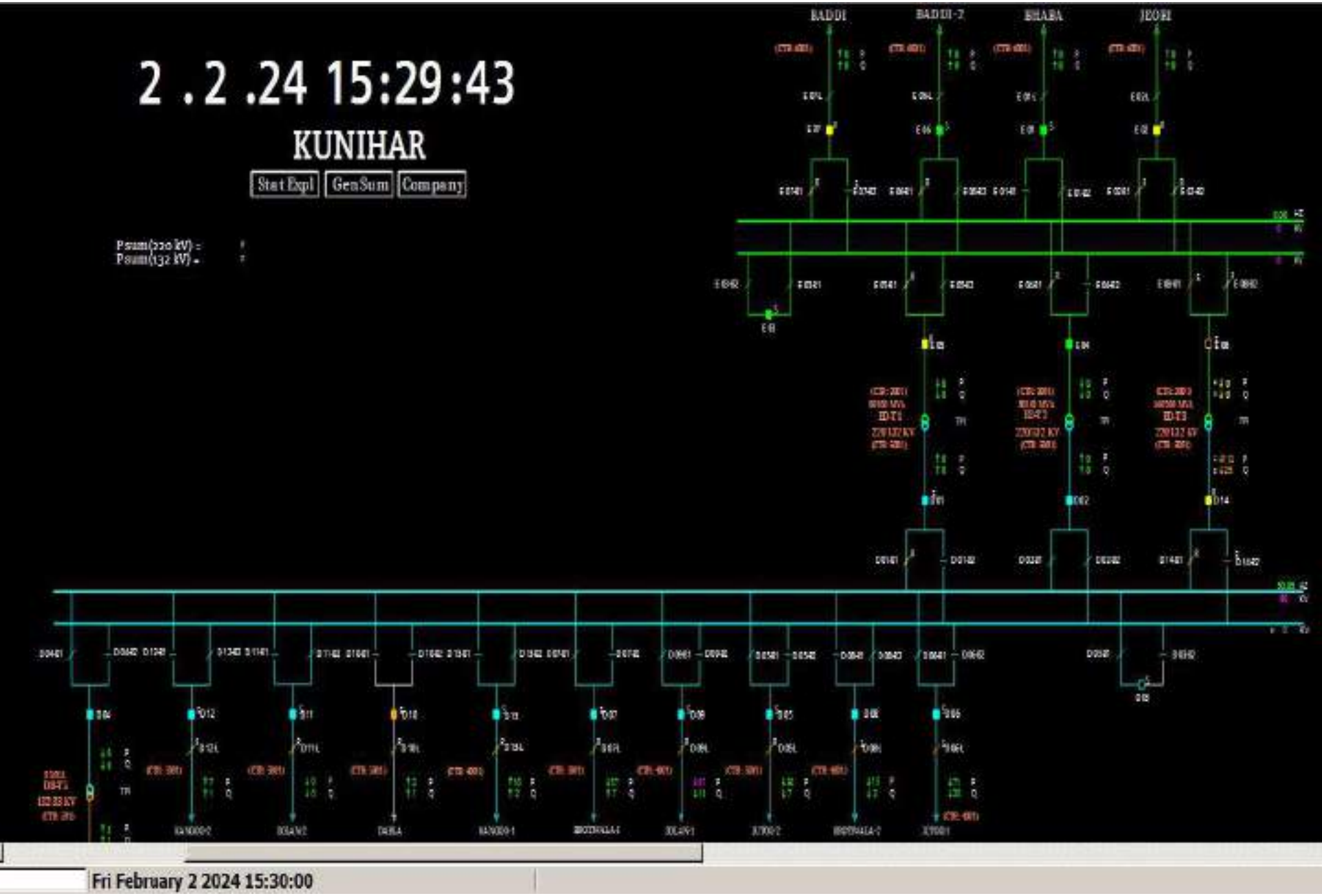
Network Diagram



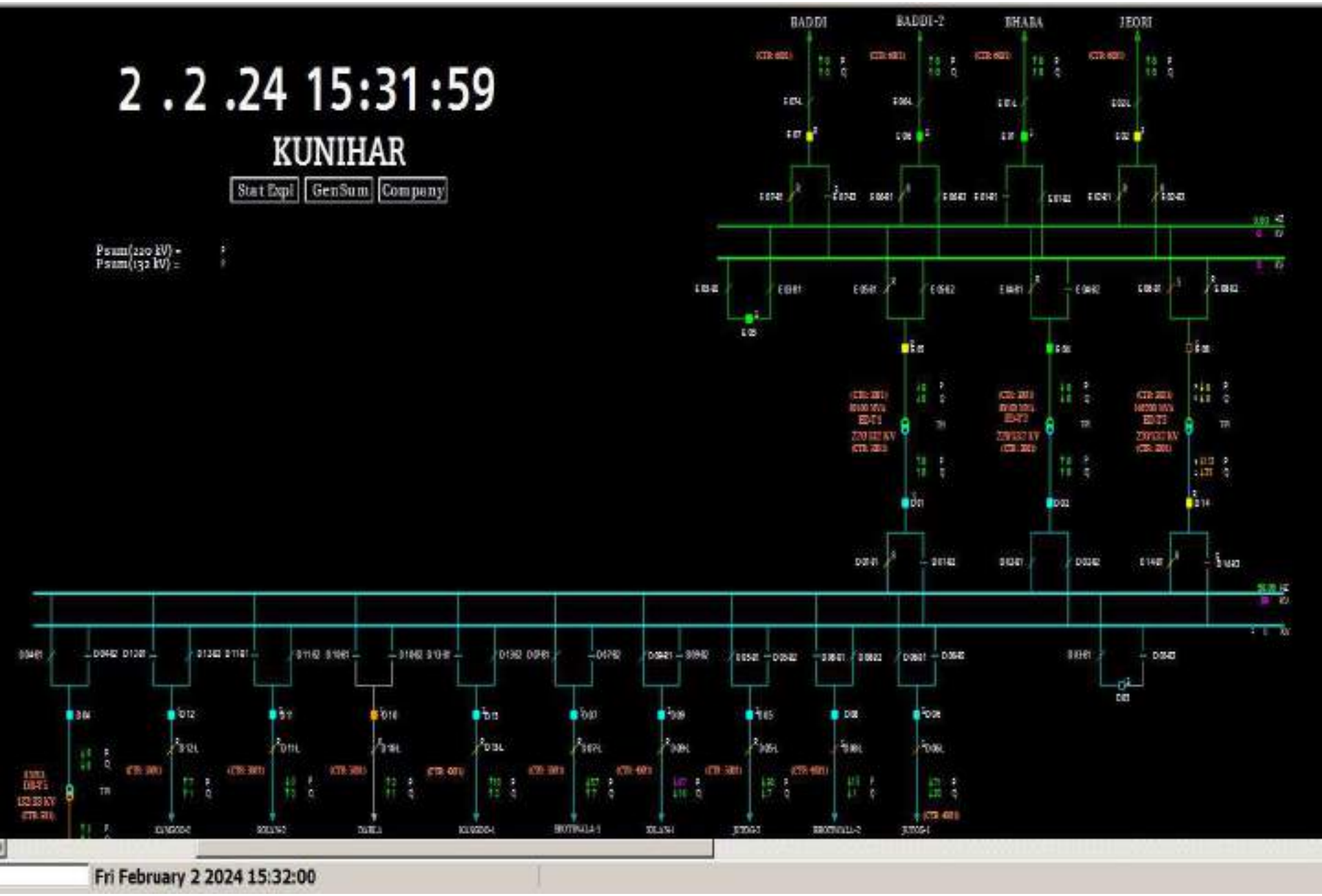
SLD of 220/132kV Kunihar(HP) at 15:25 hrs



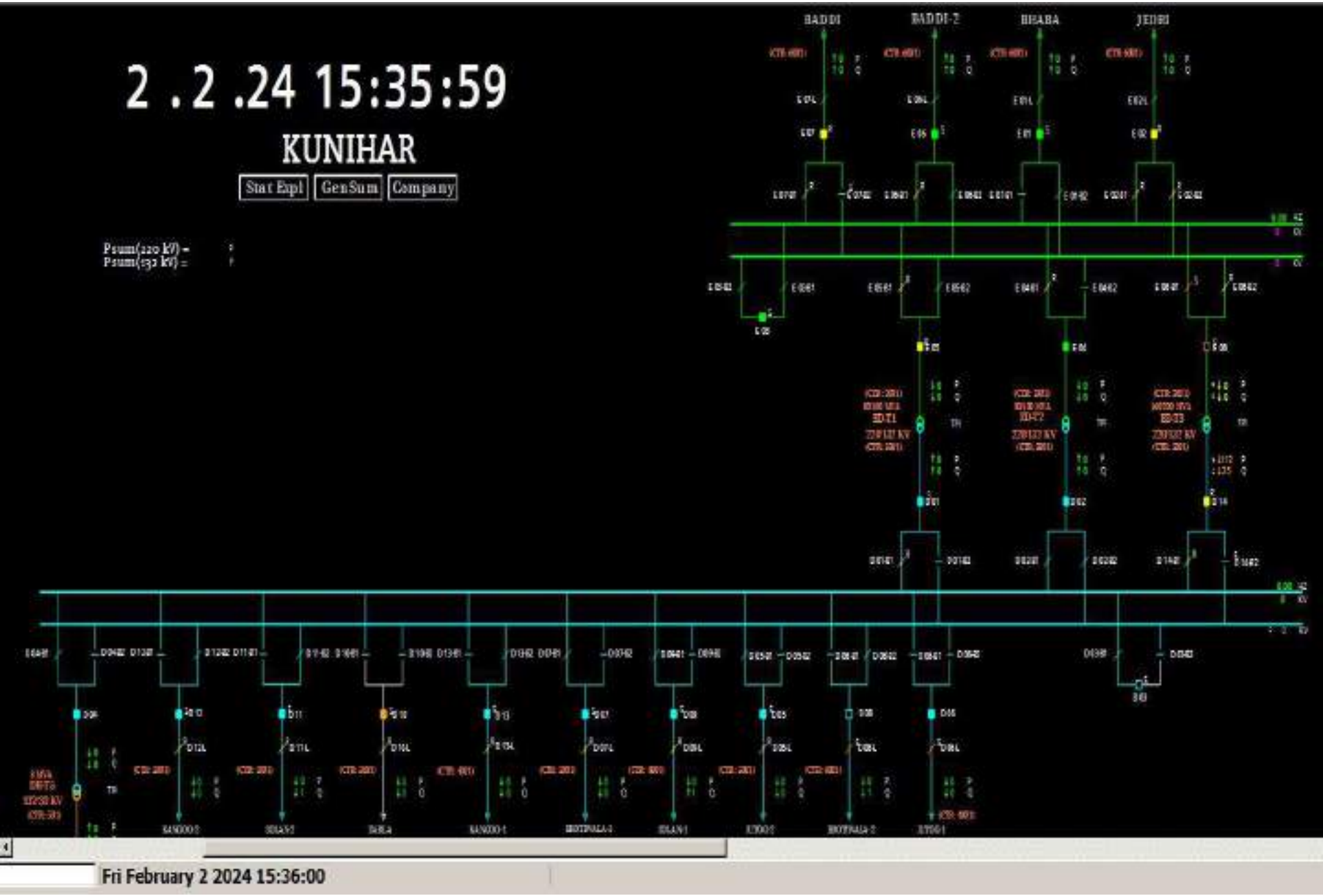
SLD of 220/132kV Kunihar(HP) at 15:30 hrs



SLD of 220/132kV Kunihar(HP) at 15:32 hrs

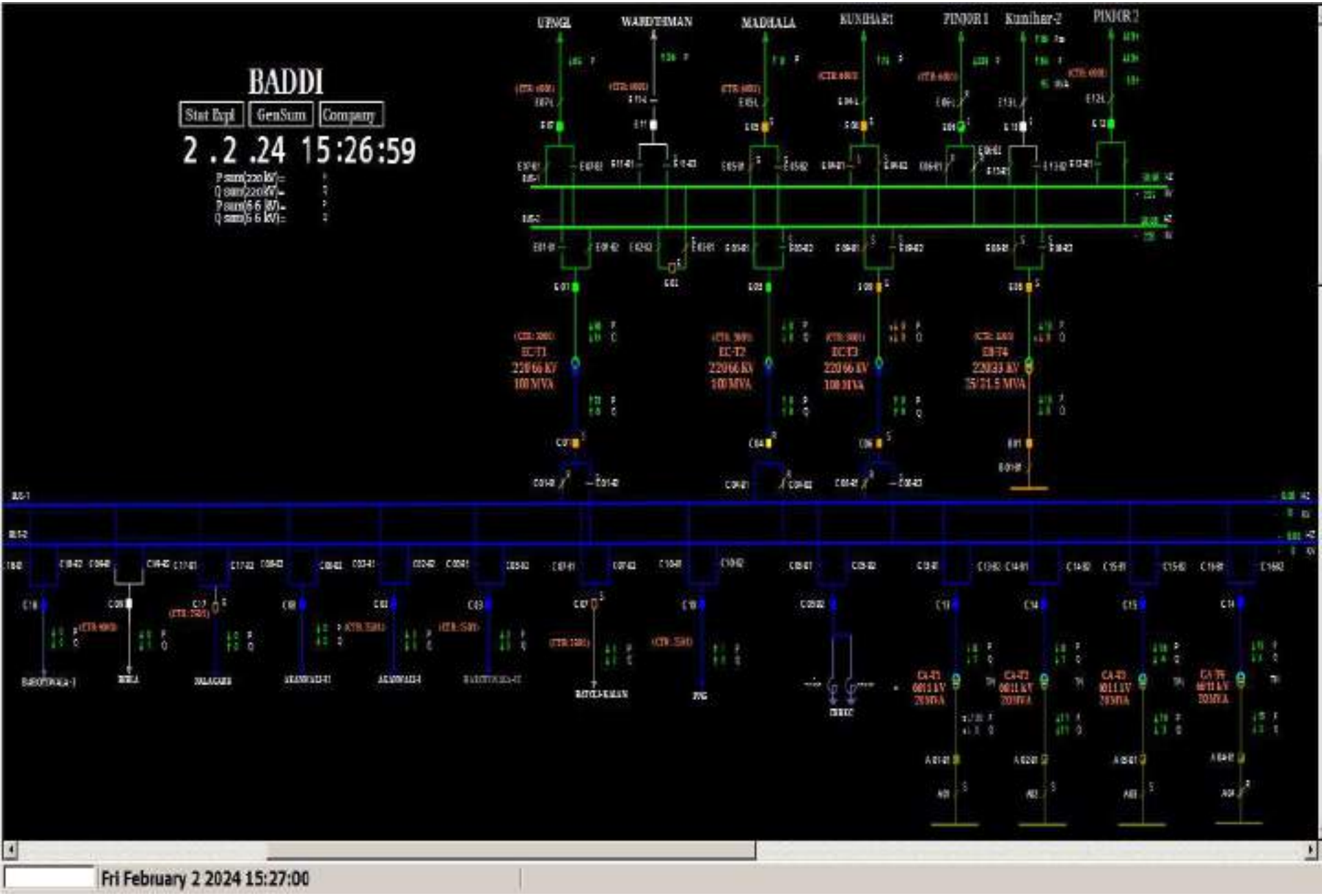


SLD of 220/132kV Kunihar(HP) at 15:36 hrs

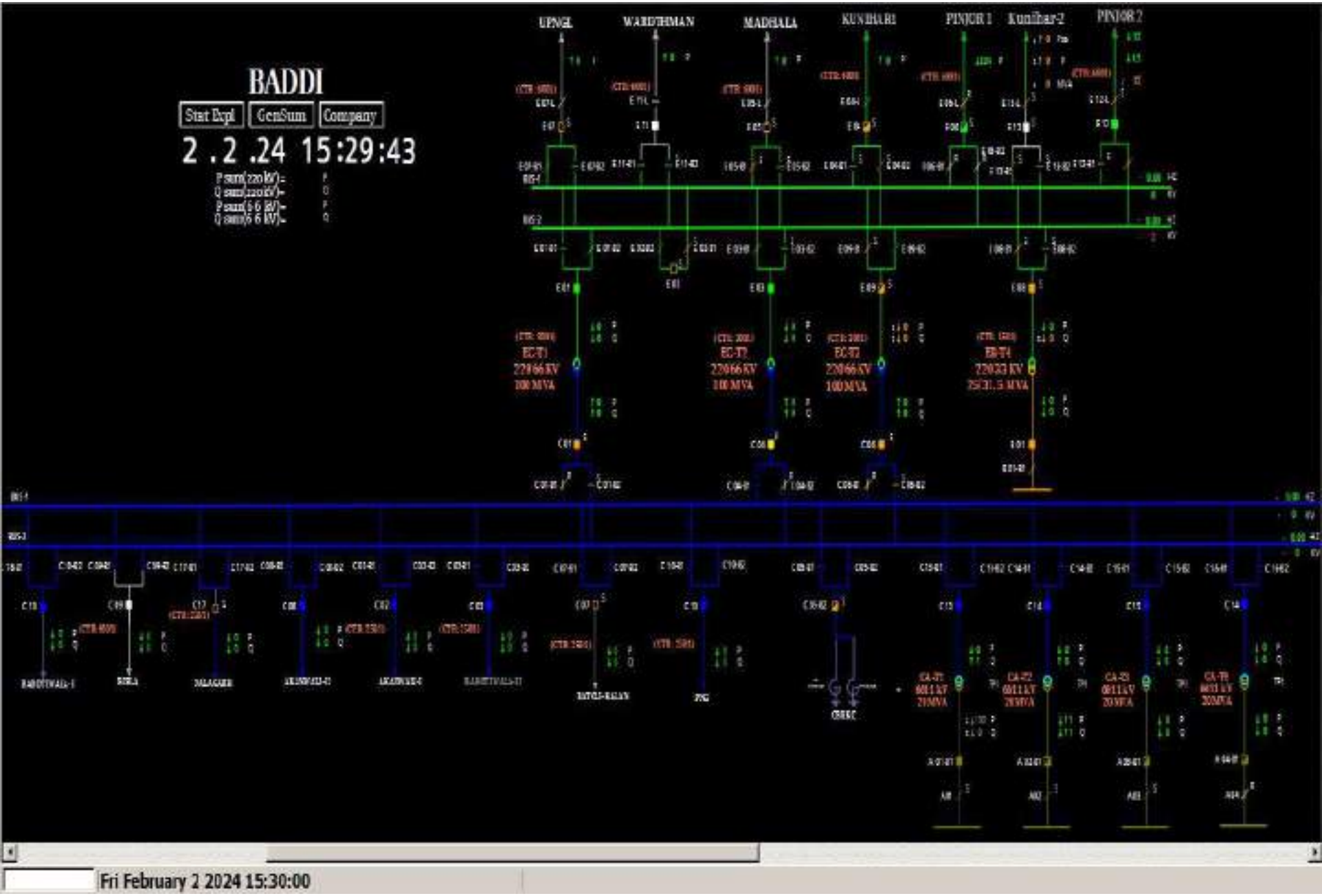


SLD of 220/66kV Baddi(HP) at 15:25 hrs

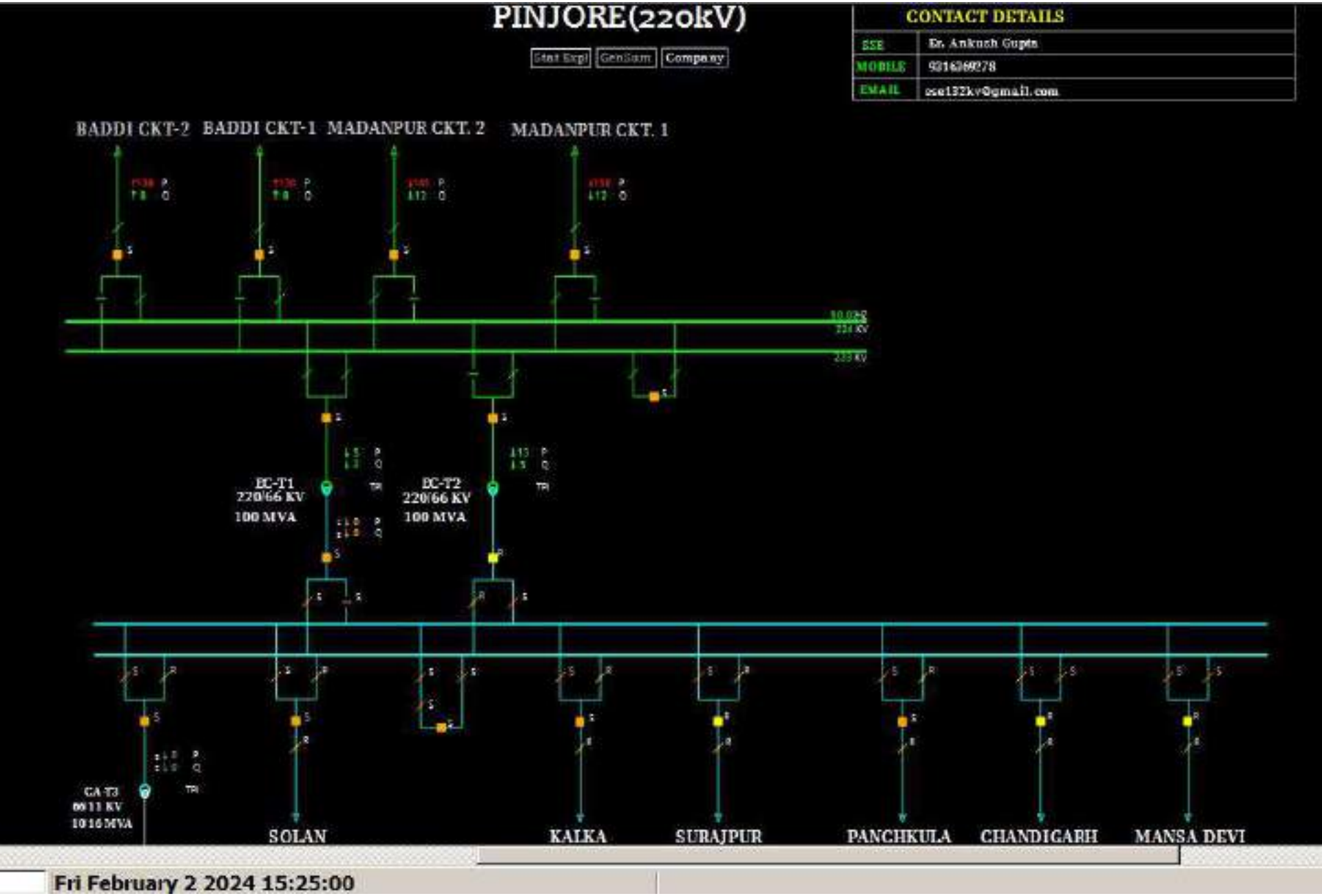
SLD of 220/66kV Baddi(HP) at 15:27 hrs



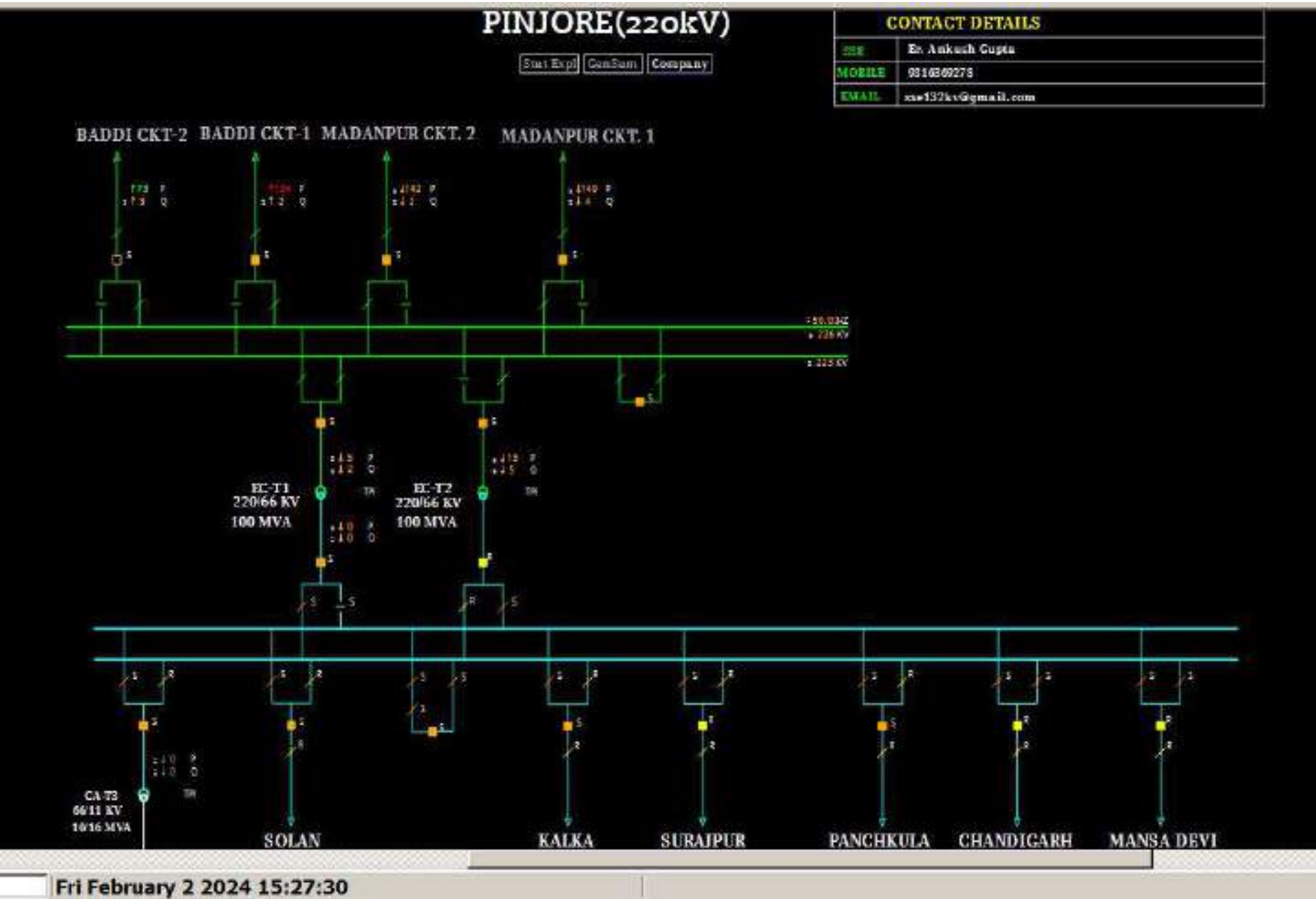
SLD of 220/66kV Baddi(HP) at 15:30 hrs



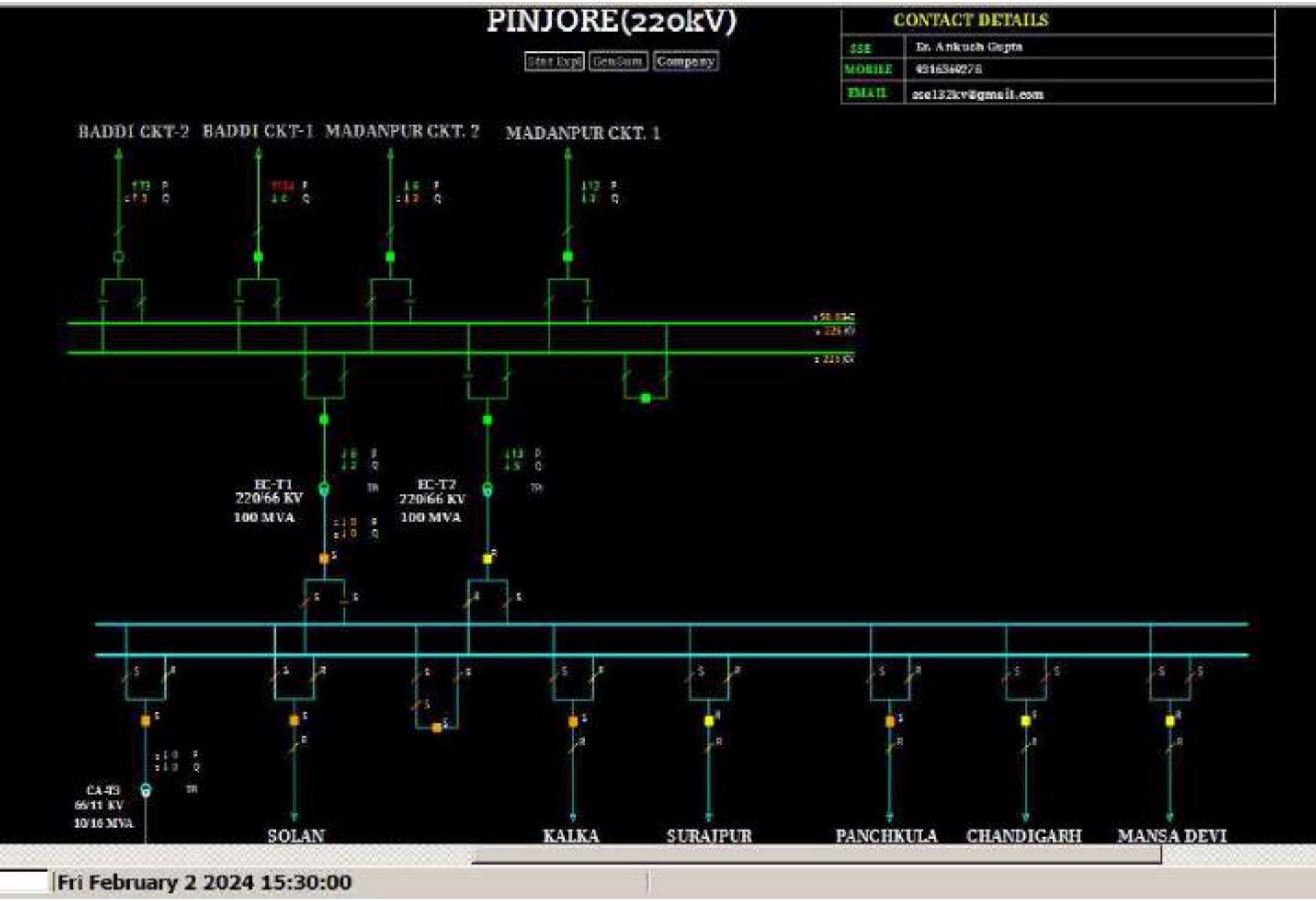
SLD of 220/132kV Pinjore(HS) at 15:25 hrs



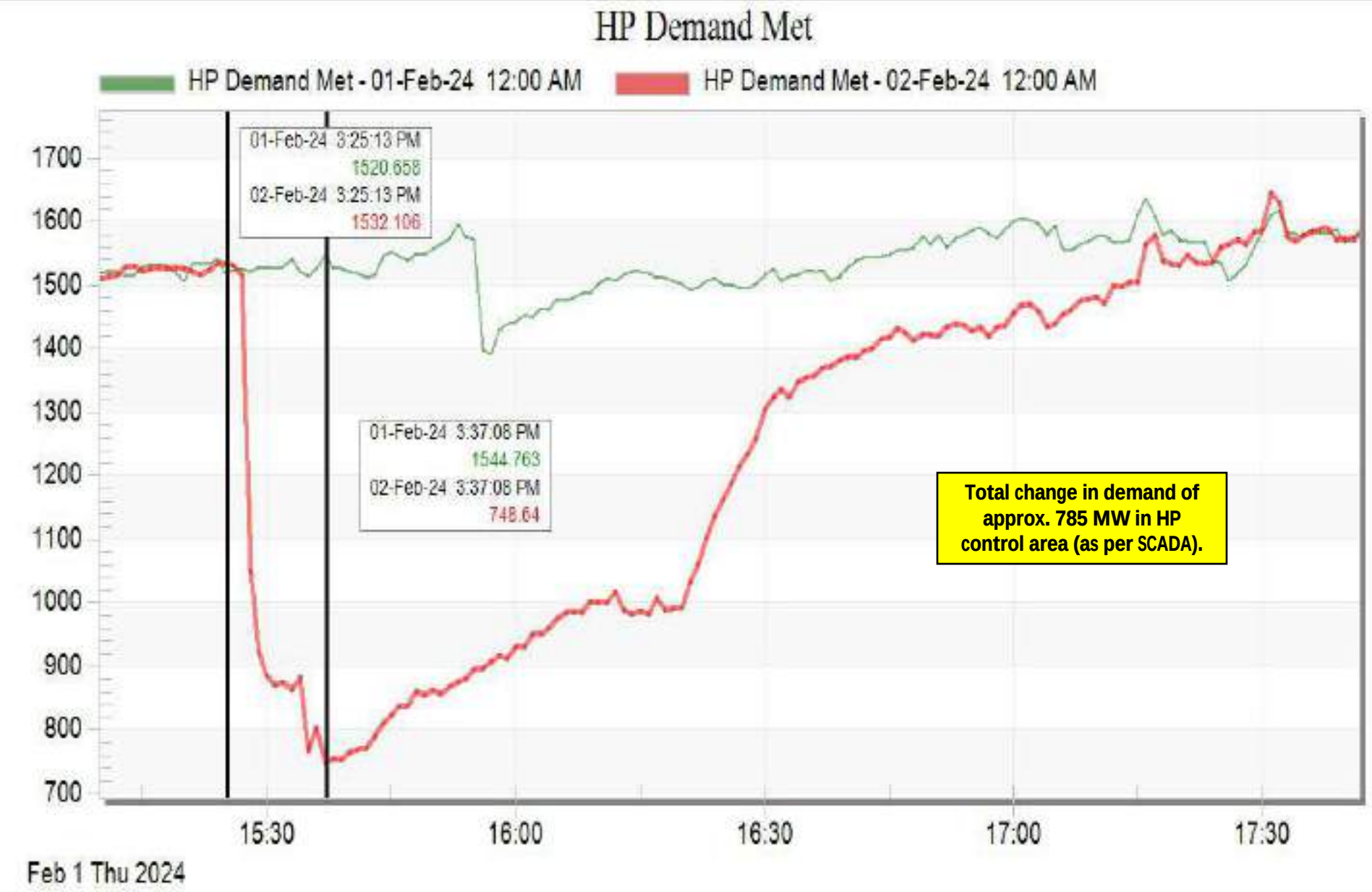
SLD of 220/132kV Pinjore(HS) at 15:27 hrs



SLD of 220/132kV Pinjore(HS) at 15:30 hrs

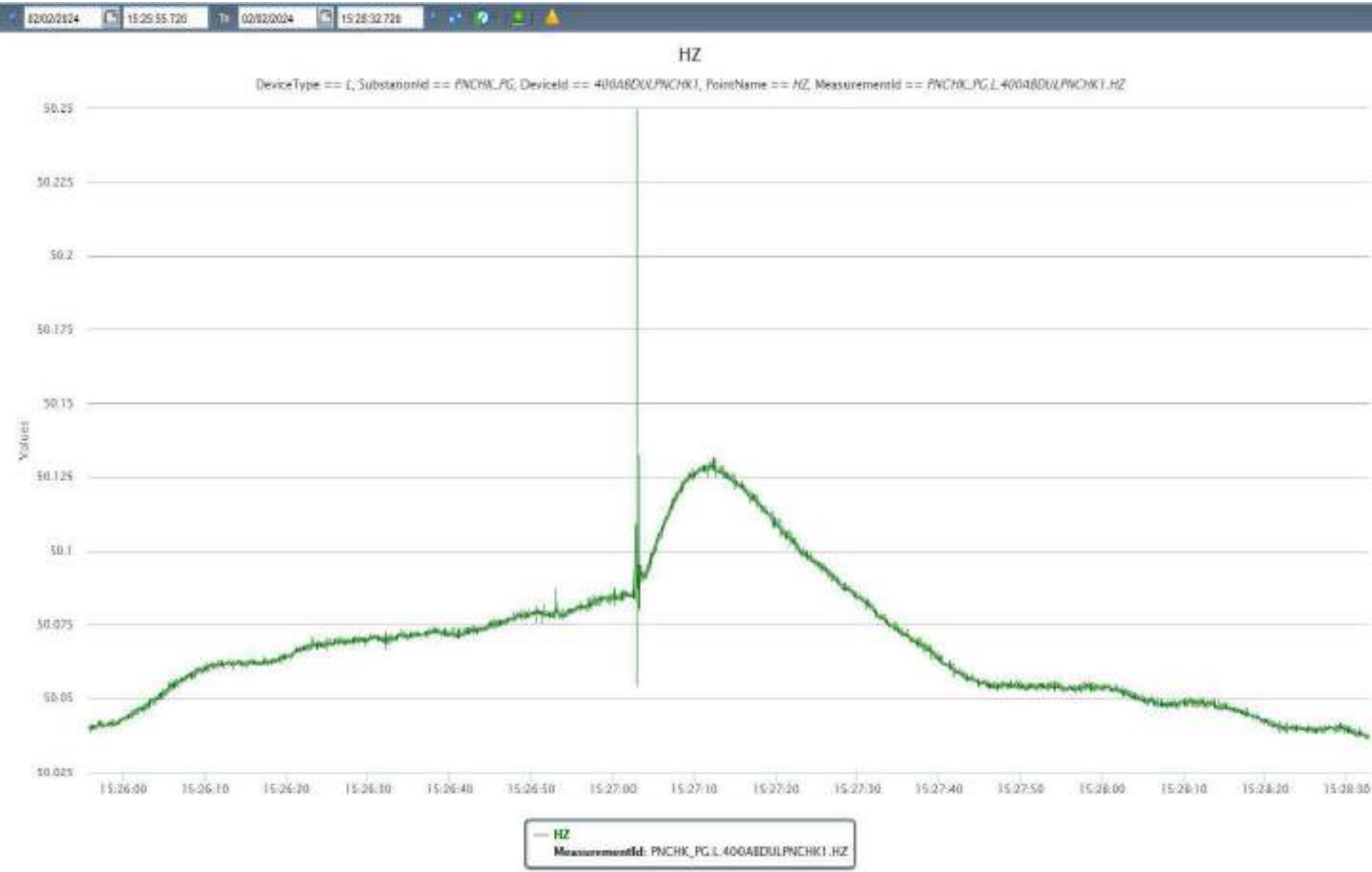


Himachal Pradesh demand during the event



PMU Plot of frequency at Panchkula(PG)

15:27 hrs/02-Feb-24



PMU Plot of phase voltage magnitude at Panchkula(PG)

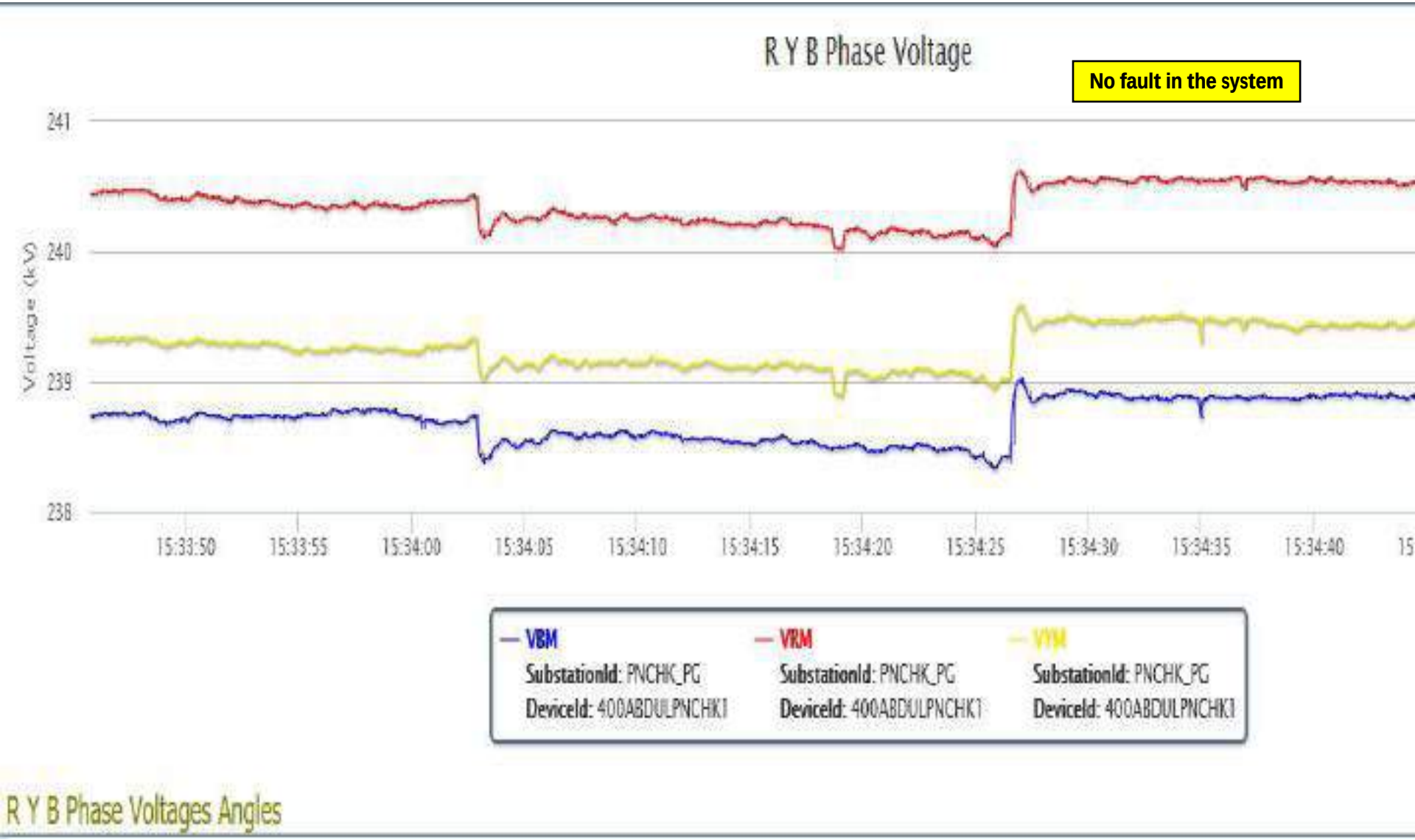
15:27 hrs/02-Feb-24

PMU Plot of frequency at Panchkula(PG)

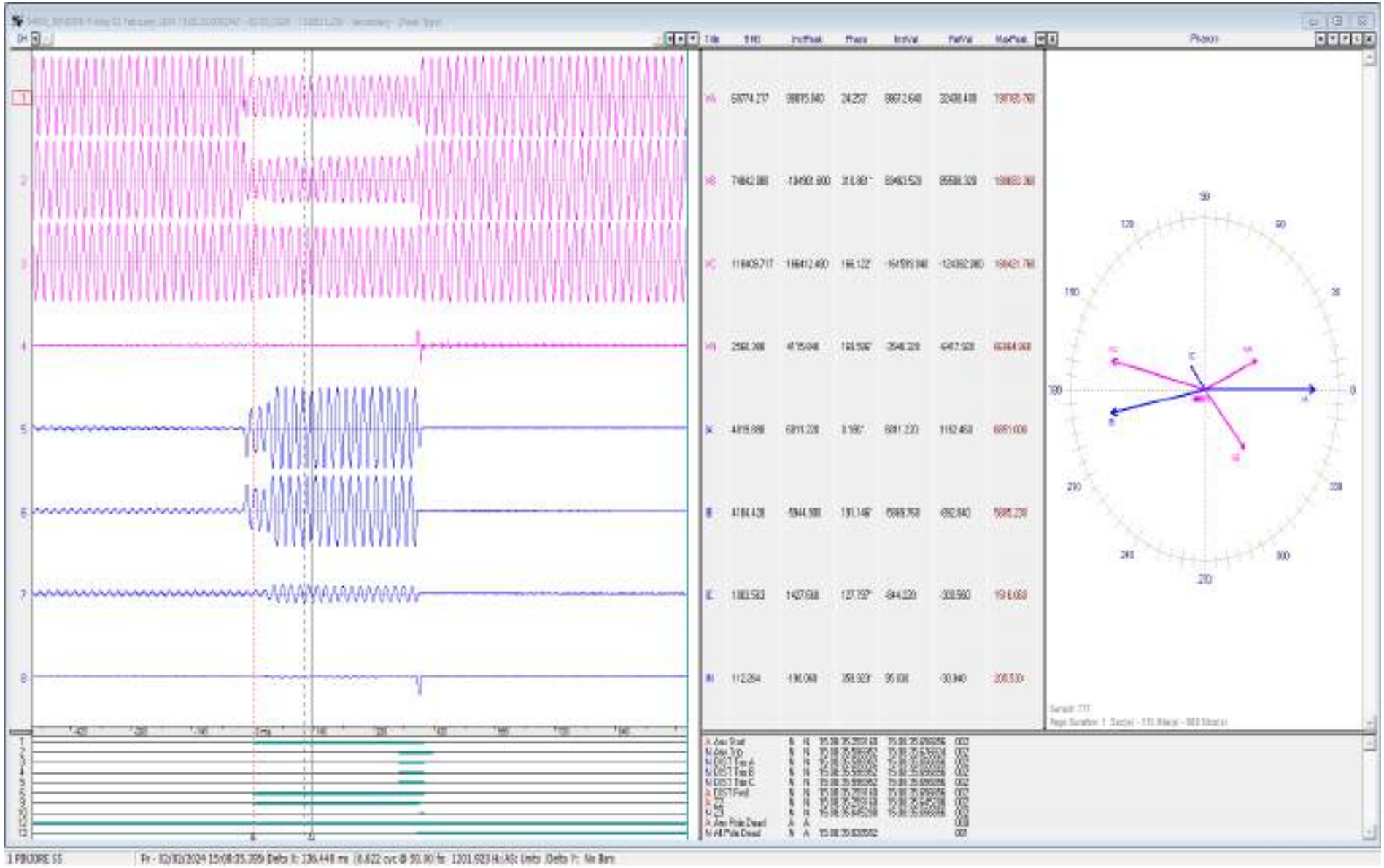
15:34 hrs/02-Feb-24

PMU Plot of phase voltage magnitude at Panchkula(PG)

15:27 hrs/02-Feb-24



DR of 220 KV Baddi(HP)-Pinjore (HV)(end) (HPPTCL) Ckt-2



- ✓ *R-Y phase to phase fault.*
- ✓ *Fault sensed in Zone-2.*
- ✓ *Fault currents: Ir= 4.8kA & Iy= 4.2kA. Fault clearing time= 410ms.*
- ✓ *Time not Synced*

SCADA SOE

Time	Station Name	Voltage	Element Name	Element Type	Element Status	Remarks
15:25:29,495	BADDI_HP	220kV	02MBC	Circuit Breaker	Open	Main bus coupler CB at 220kV Baddi(HP) opened
15:27:03,182	BADDI_HP	220kV	05MNDAL	Circuit Breaker	Open	Line CB at Baddi(HP) end of 220 kV Baddi-Madhala(HP) Ckt opened
15:27:03,350	BADDI_HP	220kV	07UPNGL1	Circuit Breaker	Open	Line CB at Baddi(HP) end of 220 kV Madhala -Upper Nangal(HP) Ckt opened
15:27:03,636	BHABA_HP	220kV	01H01	Circuit Breaker	Open	CB at 220kV side of Unit-1 at Bhaba(HP) opened
15:32:44,273	KUNIH_HP	132kV	06JUTOG1	Circuit Breaker	Open	Line CB at Kunihar(HP) end of 132 kV Kunihar-Jutog(HP) Ckt-1 opened
15:34:27,075	KUNIH_HP	132kV	08BAROT2	Circuit Breaker	Open	Line CB at Kunihar(HP) end of 132 kV Kunihar-Solan(HP) Ckt-2 opened

Point of discussion

- Exact nature and location of fault?
- Reason of delayed clearance of fault?
- DR of only 220kV Baddi-Pinjore ckt-2 of Pinjore end received. DR of other tripped elements not received.
- Tripping status of all the tripped elements are not coming in SCADA SOE.
- Sequence of event?
- Detailed report along with remedial action taken details not received.
- Standardization (nomenclature, time sync etc) of recording instrument (DR/EL) need to be ensured.
- In view of frequent tripping in this region wherein cascade tripping occurred due to overloading, suitable SPS may be planned by HP in this complex.

Multiple elements tripping at 220/132kV Kunihar(HP) 8th February 2024

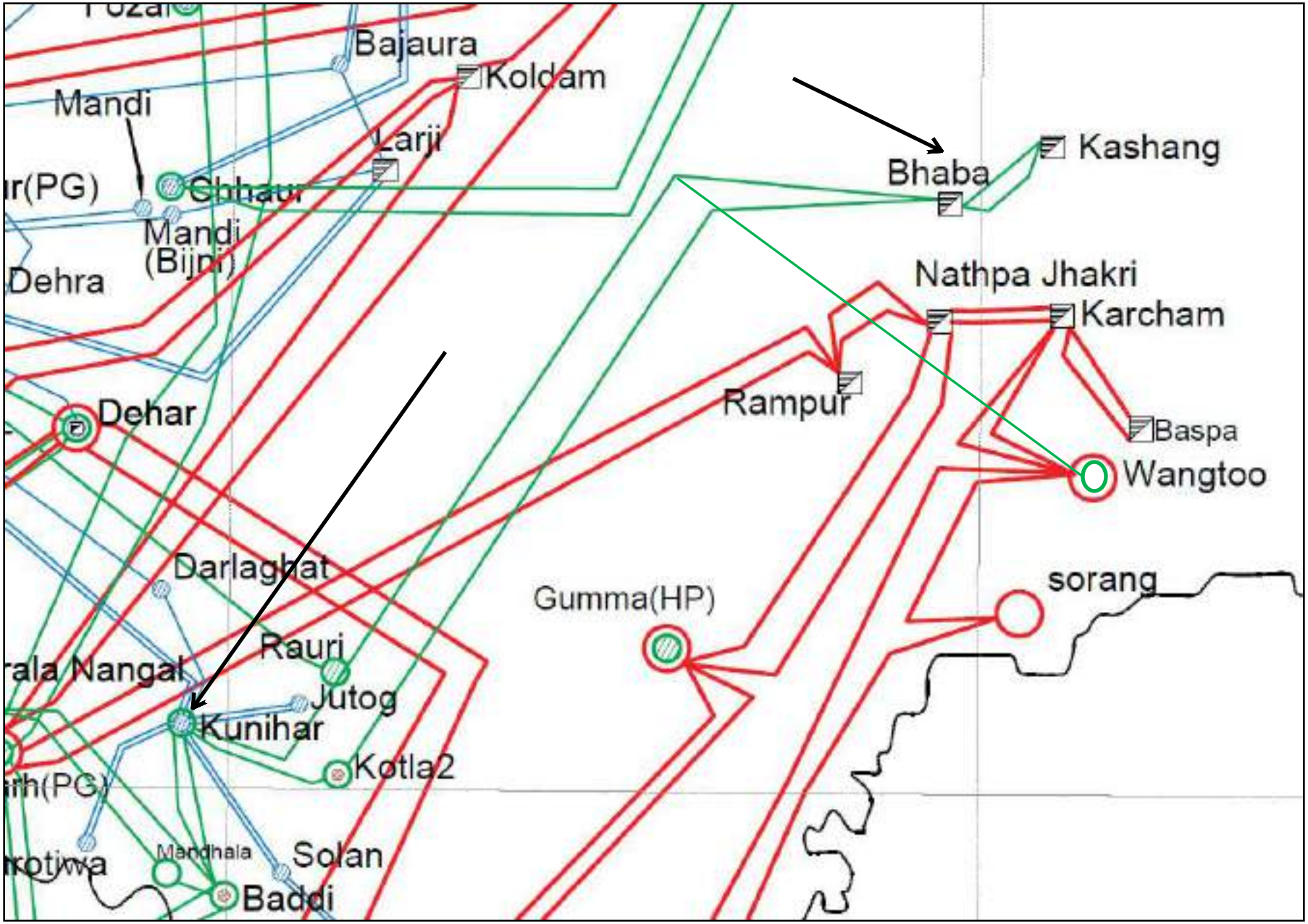
Brief of event:

- During antecedent condition, as per SCADA, power was flowing towards Kunihar through 220 kV Bhabha-Kunihar(HP) ckt and 220 kV Baddi-Kunihar(HP) Ckt-1 & 2 carrying approx. 143MW, 115MW and 115MW. Approx. 31MW was going from Kunihar to Jeori through 220 kV Jeori-Kunihar(HP) Ckt and 220/132kV 80/100MVA ICT-1 & 2 at Kunihar(HP) were carrying approx. 170MW each. Bus coupler was in off position at 220kV Baddi(HP).
- As reported, at 10:41 hrs, 220 kV Bhabha-Kunihar(HP) ckt tripped on B-N phase to earth fault. (Exact reason, nature and location of fault yet to be shared)
- Due to tripping of this line, 220 kV Baddi-Kunihar(HP) Ckt-1 & 2 and 220 kV Jeori-Kunihar(HP) Ckt tripped due to over-loading and 220/66kV Kunihar(HP) S/s became dead.
- During this time, 220 kV Baddi-Upper Nangal(HP) Ckt, 220 kV Baddi-Madhala(HP) Ckt and 220 kV Baddi-Wardthman(HP) Ckt also tripped due to over-loading and 220kV Bus-1 at Baddi(HP) became dead.
- As per SCADA SOE, 220/66kV 31.5MVA ICT-1 at Jeori(HP) tripped during the same time. (Exact reason yet to be shared)
- As per PMU, **B-N phase to earth fault** is observed with fault clearing time of 80ms.
- As per SCADA, change in demand of approx. 525MW in HP control area is observed.

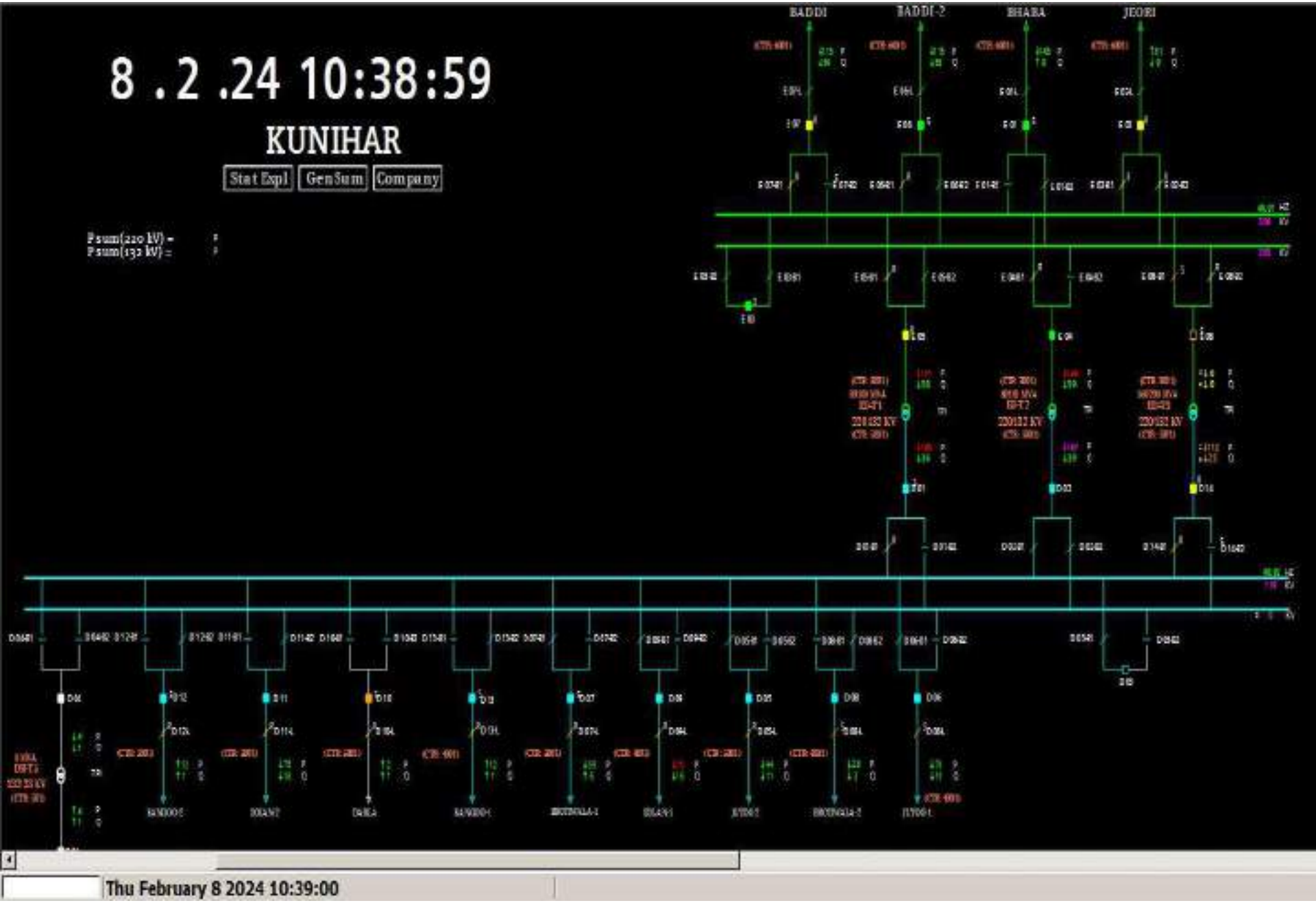
Elements tripped:

i. 220 kV Bhabha-Kunihar(HP) ckt
ii. 220 kV Jeori-Kunihar(HP) Ckt
iii. 220 kV Baddi-Kunihar(HP) Ckt-1
iv. 220 kV Baddi-Kunihar(HP) Ckt-2
v. 220 kV Baddi-Upper Nangal(HP) Ckt
vi. 220 kV Baddi-Madhala(HP) Ckt
vii. 220 kV Baddi-Wardthman(HP) Ckt

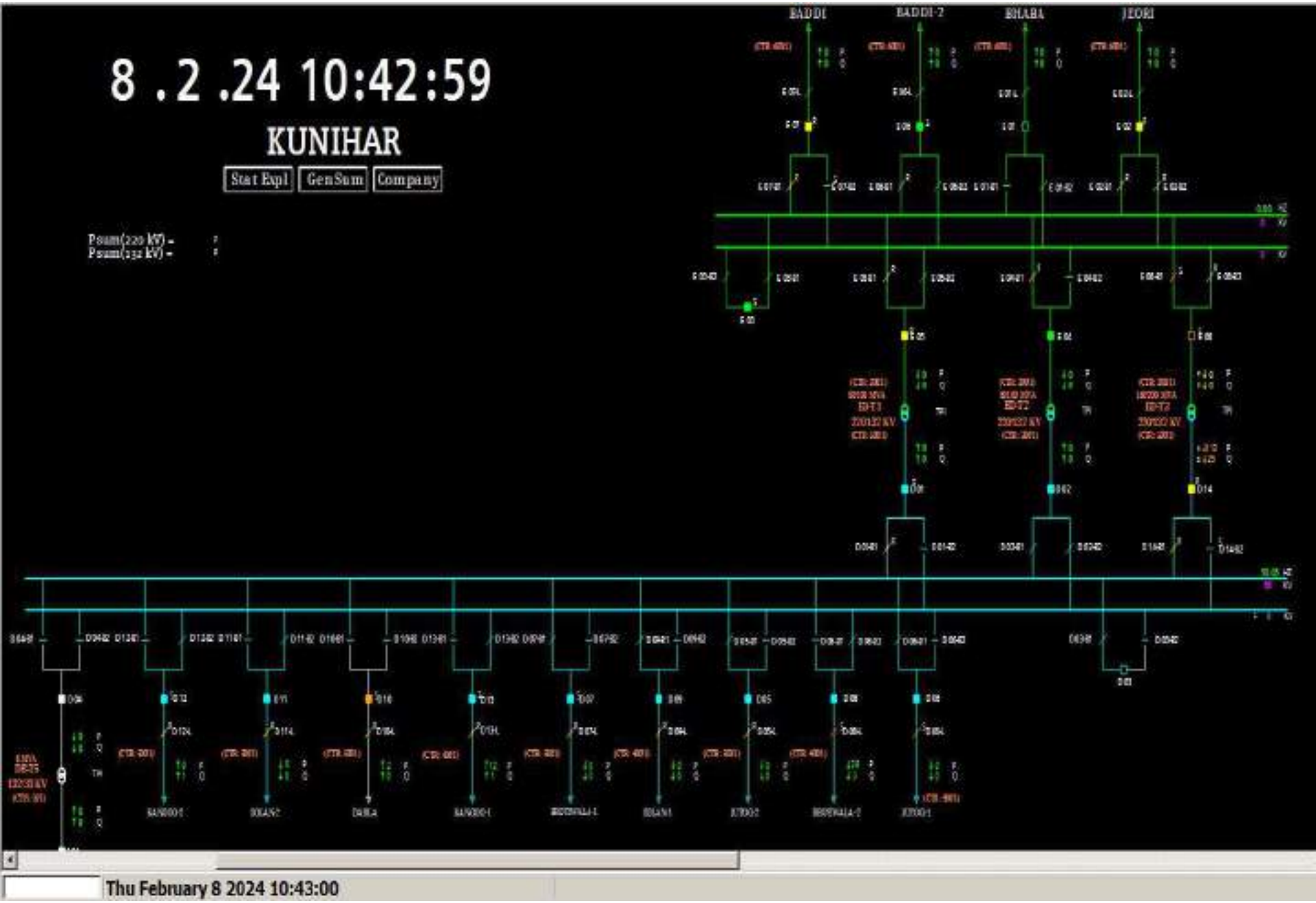
Network Diagram



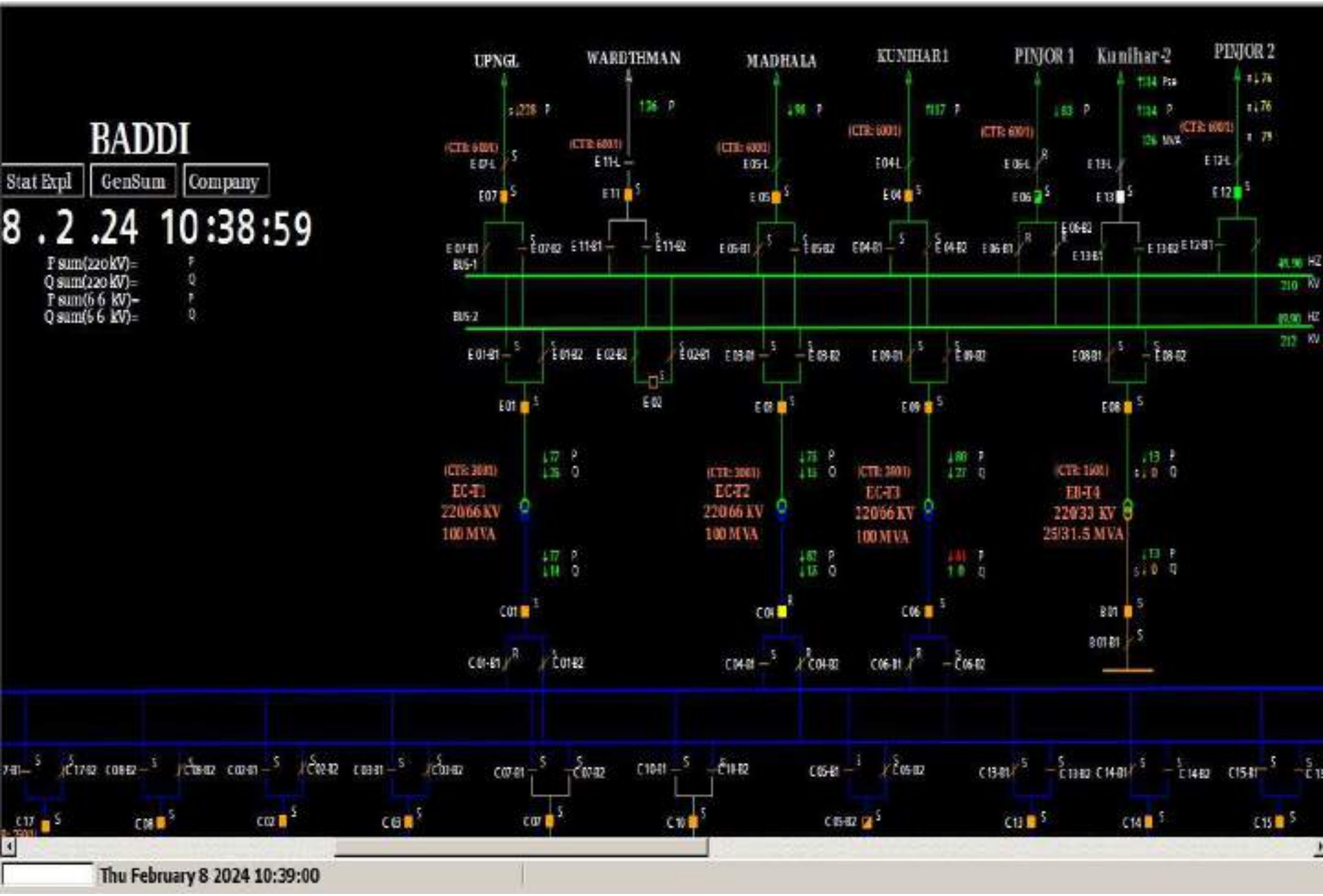
SLD of 220/132kV Kunihar(HP) before the event



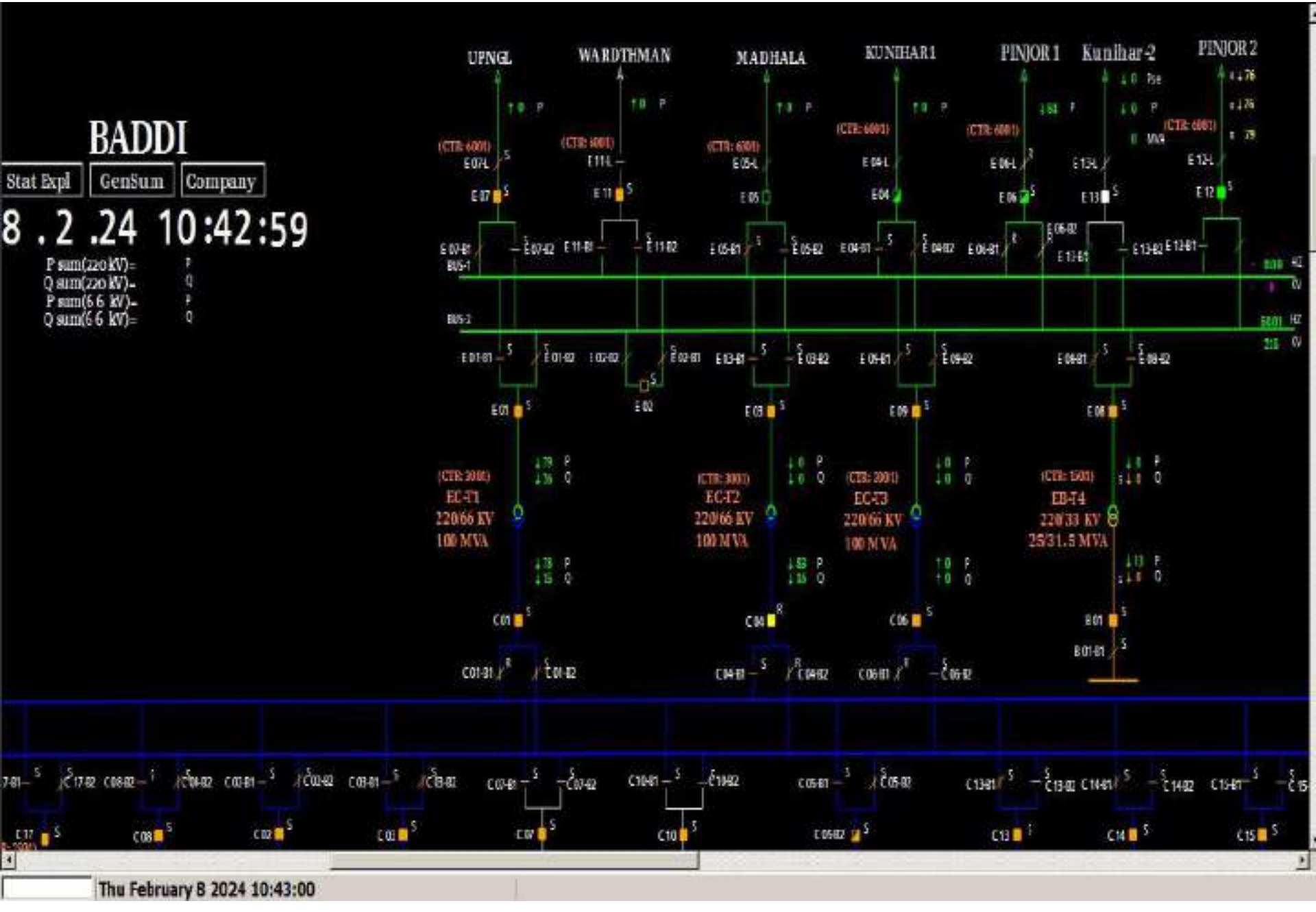
SLD of 220/132kV Kunihar(HP) after the event



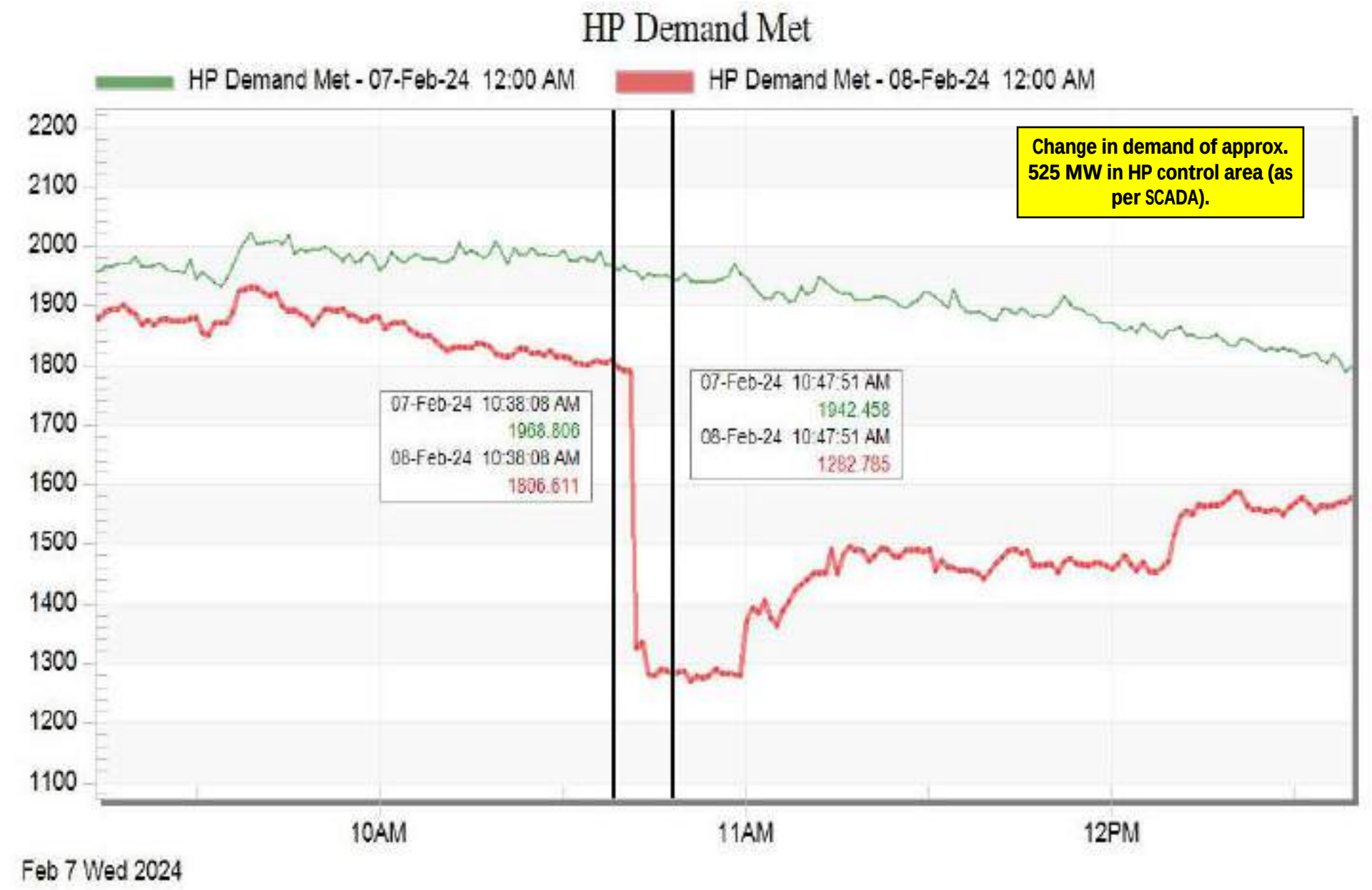
SLD of 220/66kV Baddi(HP) before the event



SLD of 220/66kV Baddi(HP) after the event



Himachal Pradesh demand during the event



PMU Plot of frequency at Panchkula(PG)

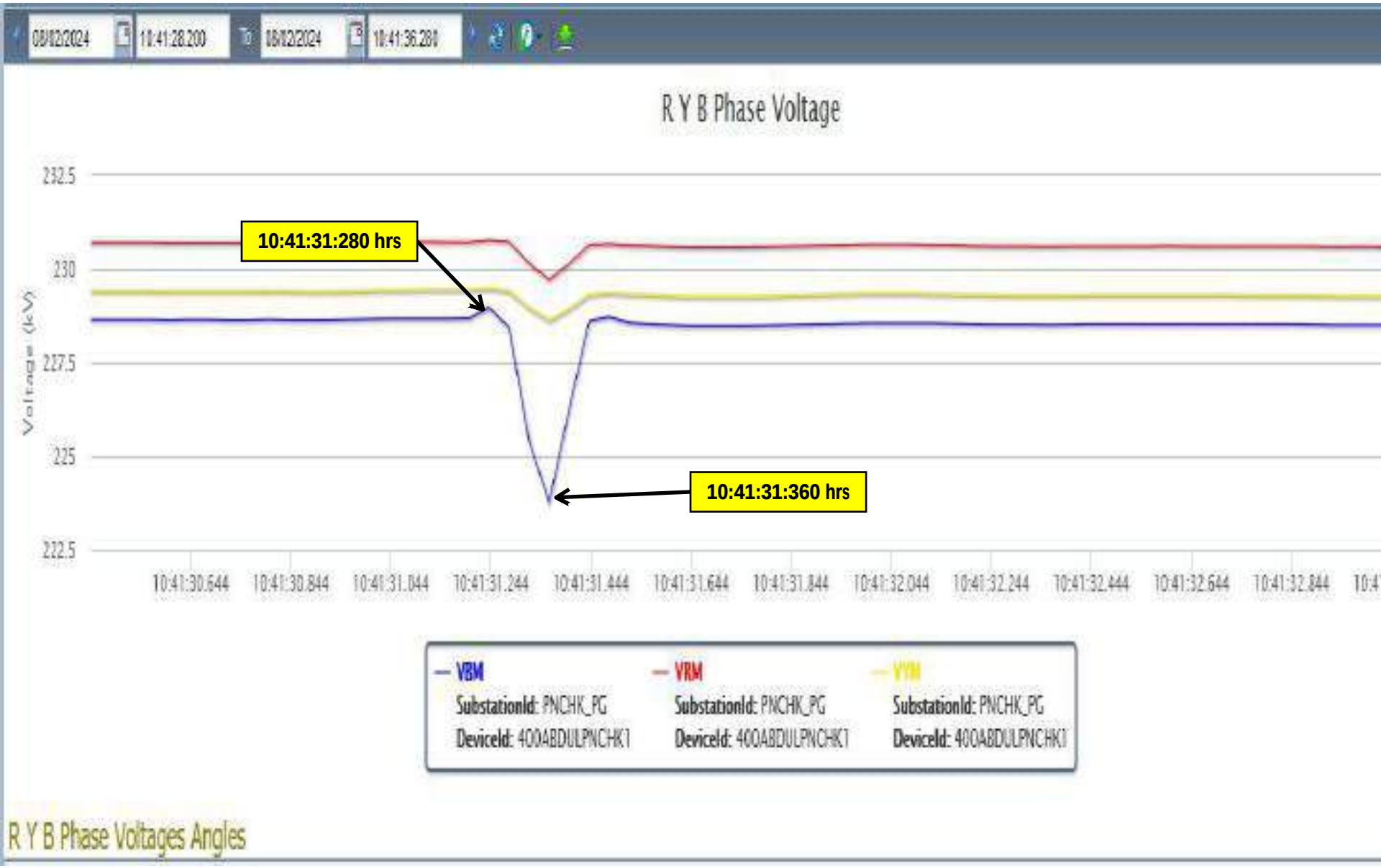
10:41 hrs/08-Feb-24

PMU Plot of phase voltage magnitude at Panchkula(PG)

10:41 hrs/08-Feb-24

PMU Plot of phase voltage magnitude at Panchkula(PG)

10:41 hrs/08-Feb-24



SCADA SOE

Time	Station Name	Voltage	Element Name	Element Type	Element Status	Remarks
10:41:31,478	JEORI_HP	220kV	02T1	Circuit Breaker	Open	CB at 220kV side of 220/66kV 31.5MVA ICT-1 at Jeori(HP) opened
10:41:31,510	WNGTU_HP	220kV	02KUNHR	Circuit Breaker	Open	Line CB at Wangtoo(HP) end of 220 kV Wangtoo –Bhabha-Kunihar(HP) ckt (Tconnection) opened
10:41:31,799	KUNIH_HP	220kV	01DUMMY	Circuit Breaker	Open	Line CB at Kunihar(HP) end of 220 kV Wangtoo –Bhabha-Kunihar(HP) ckt (Tconnection) opened
10:41:52,769	BADDI_HP	220kV	05MNDAL	Circuit Breaker	Open	Line CB at Baddi(HP) end of 220 kV Baddi-Madhala (HP) Ckt opened
10:42:05,150	PALAM_HP	33kV	01T1	Circuit Breaker	Open	CB at 33kV side of 132/33kV 16MVA ICT-1 at Palampur(HP) opened
10:42:19,482	PALAM_HP	132kV	02T1	Circuit Breaker	Open	CB at 132kV side of 132/33kV 16MVA ICT-1 at Palampur(HP) opened

Point of discussion

- Exact nature and location of fault?
- Sequence of event?
- Over-current protection settings of tripped elements?
- DR/EL of all the tripped elements?
- Tripping status of all the tripped elements are not coming in SCADA SOE.
- Detailed report along with remedial action taken details not received.
- In view of frequent tripping in this region wherein cascade tripping occurred due to overloading, suitable SPS may be planned by HP in this complex.

Multiple elements tripping at 220/132kV Kunihar(HP) 16th February 2024

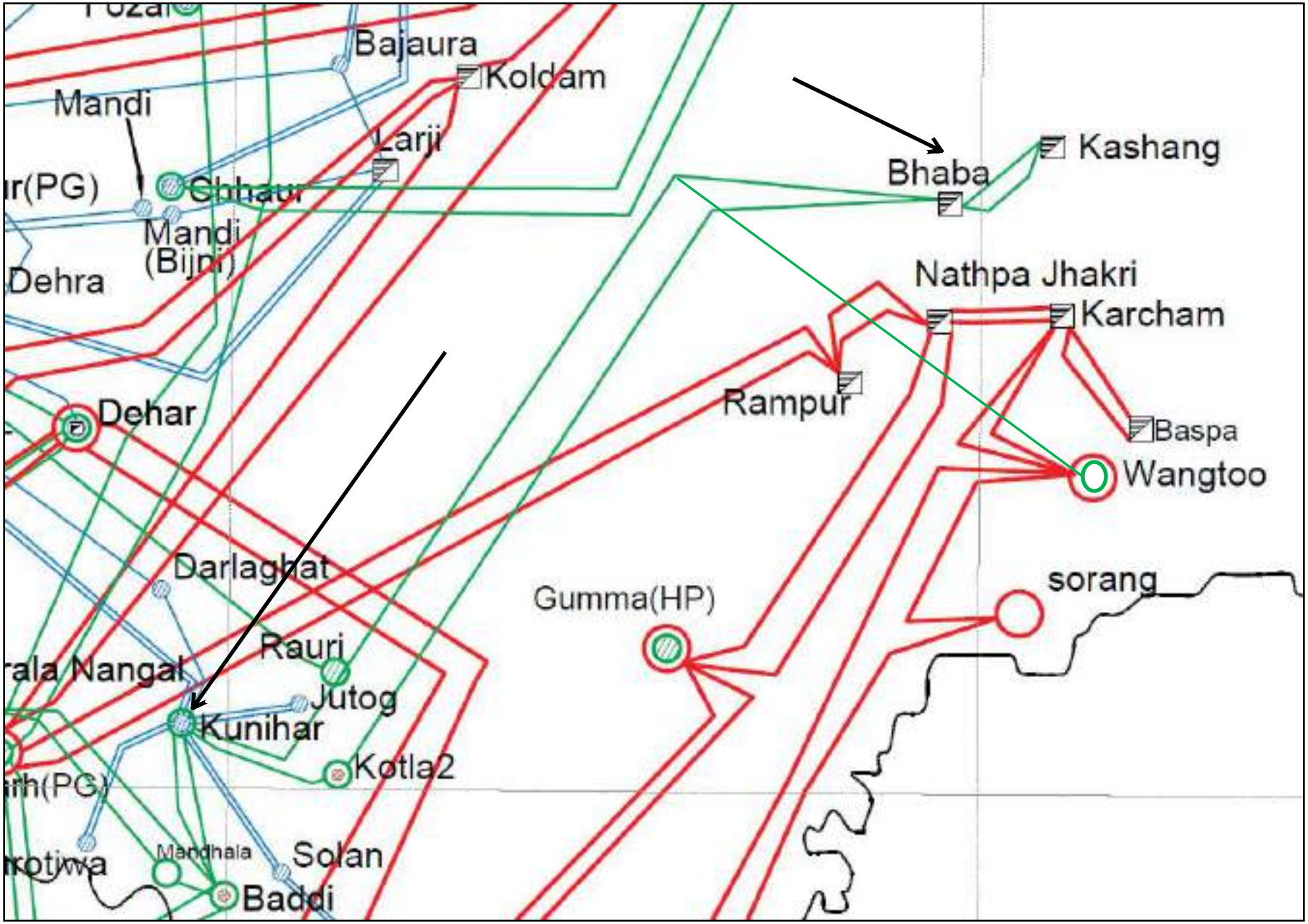
Brief of event:

- During antecedent condition, as per SCADA, power was flowing towards Kunihar through 220kV Jeori-Kunihar(HP) Ckt, 220 kV Wangtoo-Bhabha-Kunihar(HP) ckt (T-connection) and 220 kV Baddi-Kunihar(HP) Ckt-1 & 2 carrying approx. 91MW, 99MW, 57MW and 58MW. 220/132kV 80/100MVA ICT-1 & 2 at Kunihar(HP) were carrying approx. 150MW each. Bus coupler was in off position at 220kV Baddi(HP).
- As reported, at 11:30 hrs, **220kV Jeori-Kunihar(HP) Ckt tripped from Jeori end on R-N phase to earth faul**t with fault current of 1.537kA and fault distance of 39.7km from Jeori end. (Exact reason of fault yet to be shared). At the same time, 220kV Jeori-Bhaba(HP) Ckt also tripped on the same fault resulting into blackout at 220/66kV Jeori(HP) S/s.
- On inspection it was found that a stone crusher office was laying internet cable near Bayal below tower no. 110 span, due to which 220kV Jeori-Kunihar(HP) Ckt came in induction zone of the line and the line tripped. It was also reported that a person got injured due to same and notice by concerened office was served to the defaulting party.
- As further reported, bus coupler was in on position at that time at Bhaba(HP). Hence fault was sensed by 220 kV Wangtoo-Bhabha-Kunihar(HP) ckt (T-connection) and line tripped from Wangtoo end.
- Due to tripping of these two lines, 220 kV Baddi-Kunihar(HP) Ckt-1 & 2 tripped due to over-loading and 220/66kV Kunihar(HP) S/s became dead.
- During this time, 220 kV Baddi-Upper Nangal(HP) Ckt, 220 kV Baddi-Madhala(HP) Ckt and 220 kV Baddi-Wardthman(HP) Ckt also tripped due to over-loading and 220kV Bus-1 at Baddi(HP) became dead.
- As per SCADA SOE, 220/66kV 31.5MVA ICT-1 at Jeori(HP) and 220/11kV 3X13MVA ICT-2 at Mori(HP) tripped during the same time. (Exact reason yet to be shared)
- As per PMU, R-N phase to earth fault is observed with delayed fault clearing time of 560ms.
- As per SCADA, change in demand of approx. 510MW and change in generation of approx. 50MW in HP control area is observed. But as reported by, SLDC-HP, load loss of ~400MW (320MW at Kunihar feeding load of Solan and Shimla) and generation loss of ~40MW (20MW in Bhaba and 20MW in Giri) occurred in HP control area.

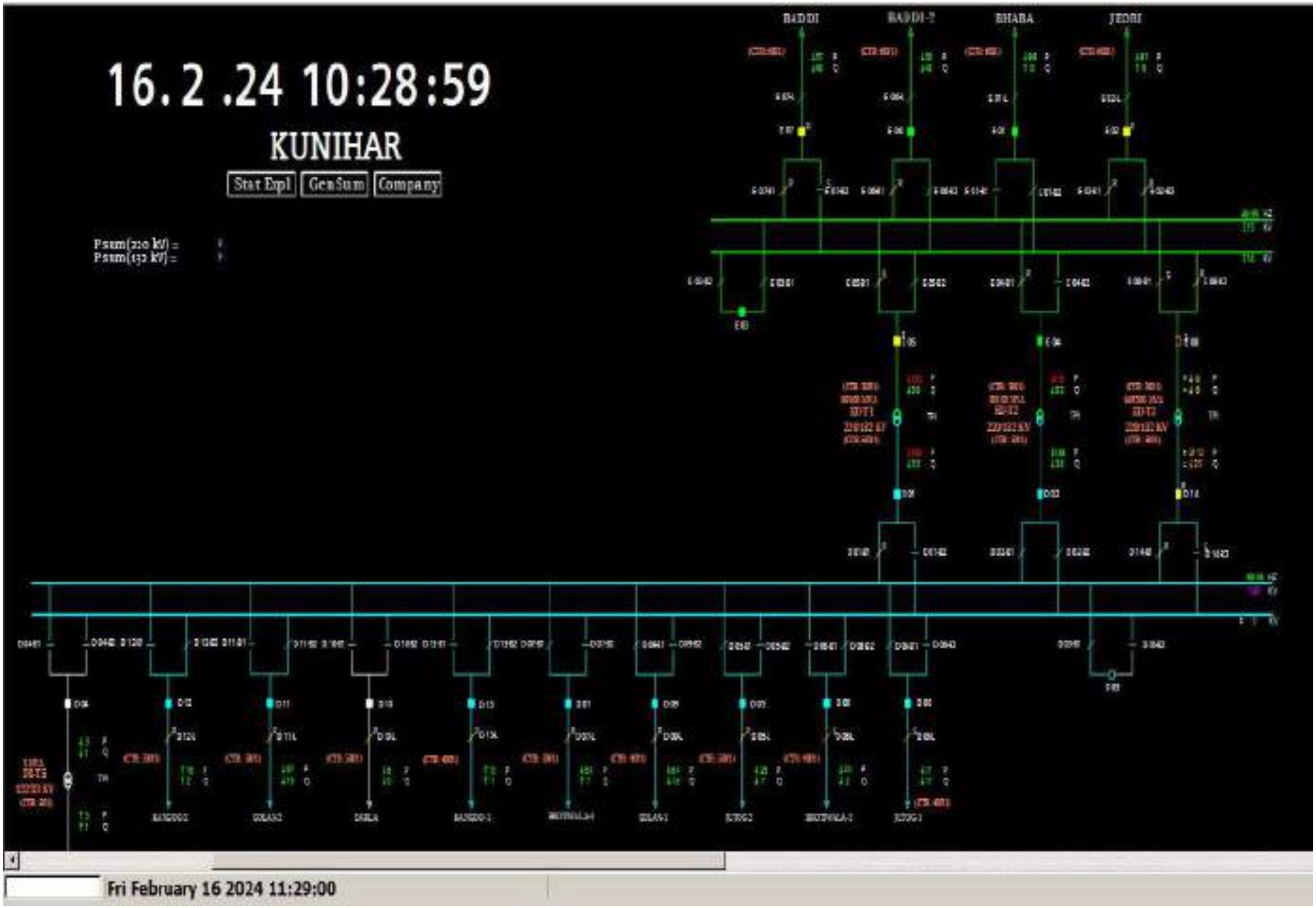
Elements tripped:

i. 220 kV Bhabha-Kunihar(HP) ckt
ii. 220 kV Jeori-Kunihar(HP) Ckt
iii. 220 kV Baddi-Kunihar(HP) Ckt-1
iv. 220 kV Baddi-Kunihar(HP) Ckt-2
v. 220 kV Baddi-Upper Nangal(HP) Ckt
vi. 220 kV Baddi-Madhala(HP) Ckt
vii. 220 kV Baddi-Wardthman(HP) Ckt
viii. 220 kV Jeori-Bhaba(HP) Ckt

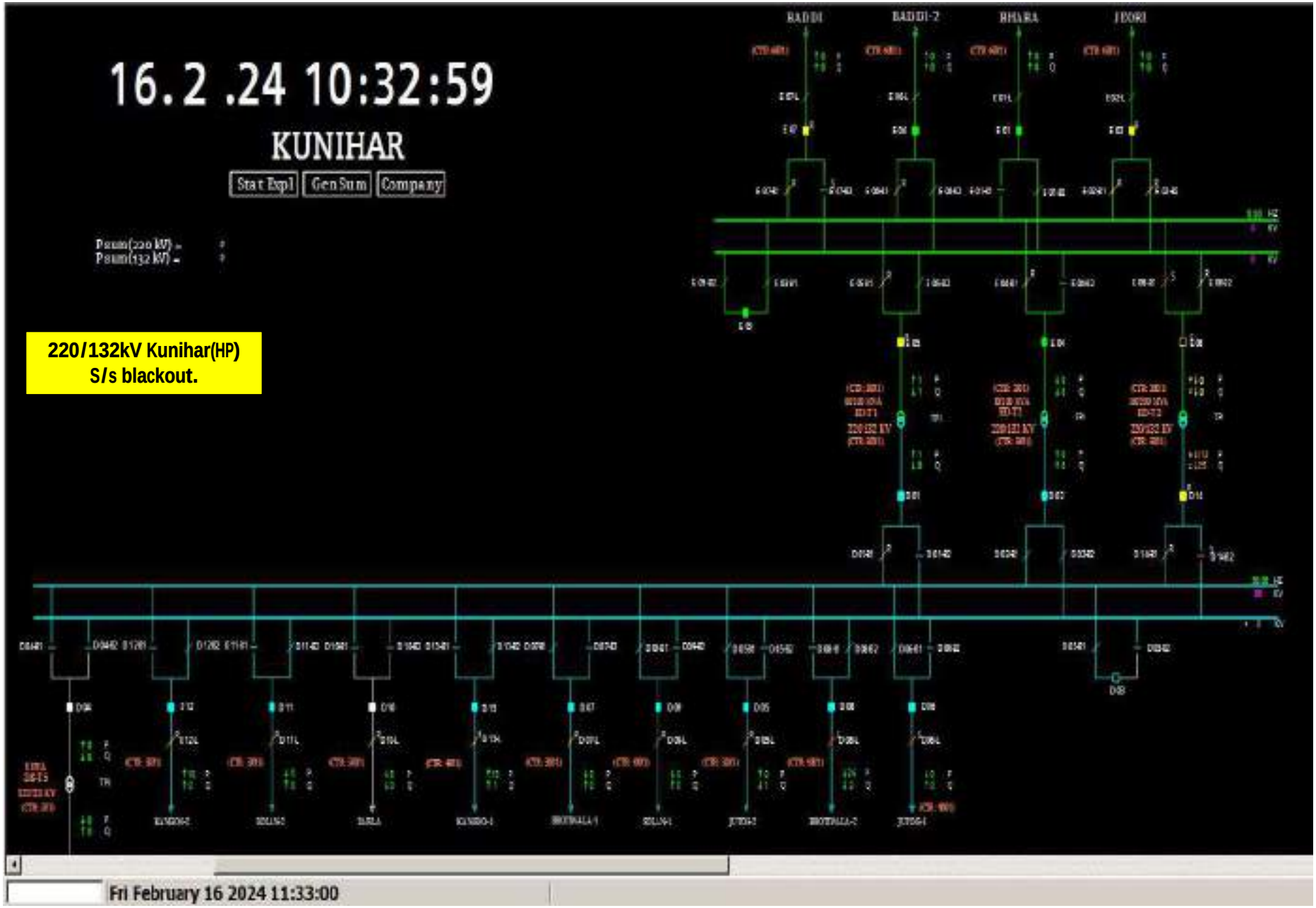
Network Diagram



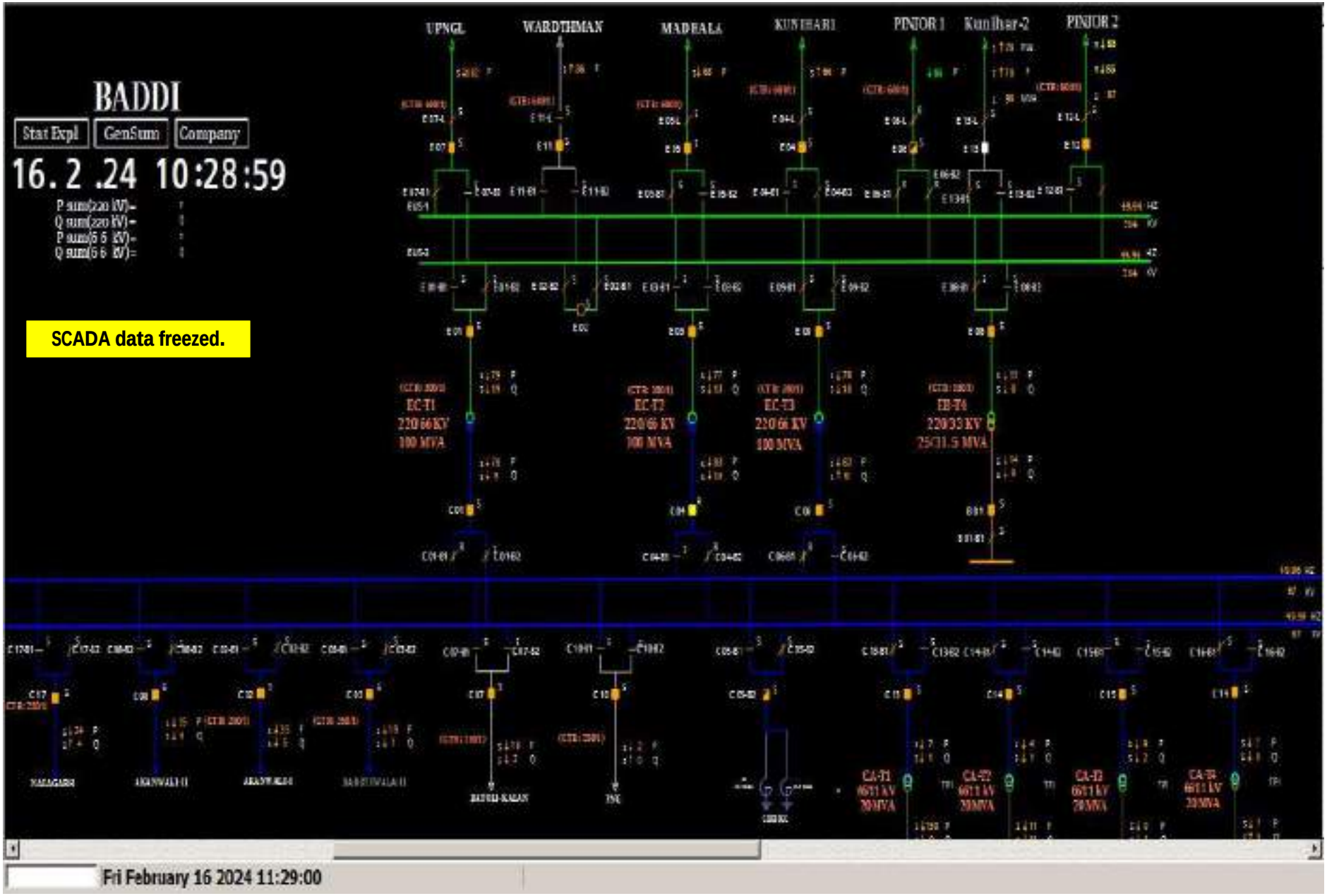
SLD of 220/132kV Kunihar(HP) before the event



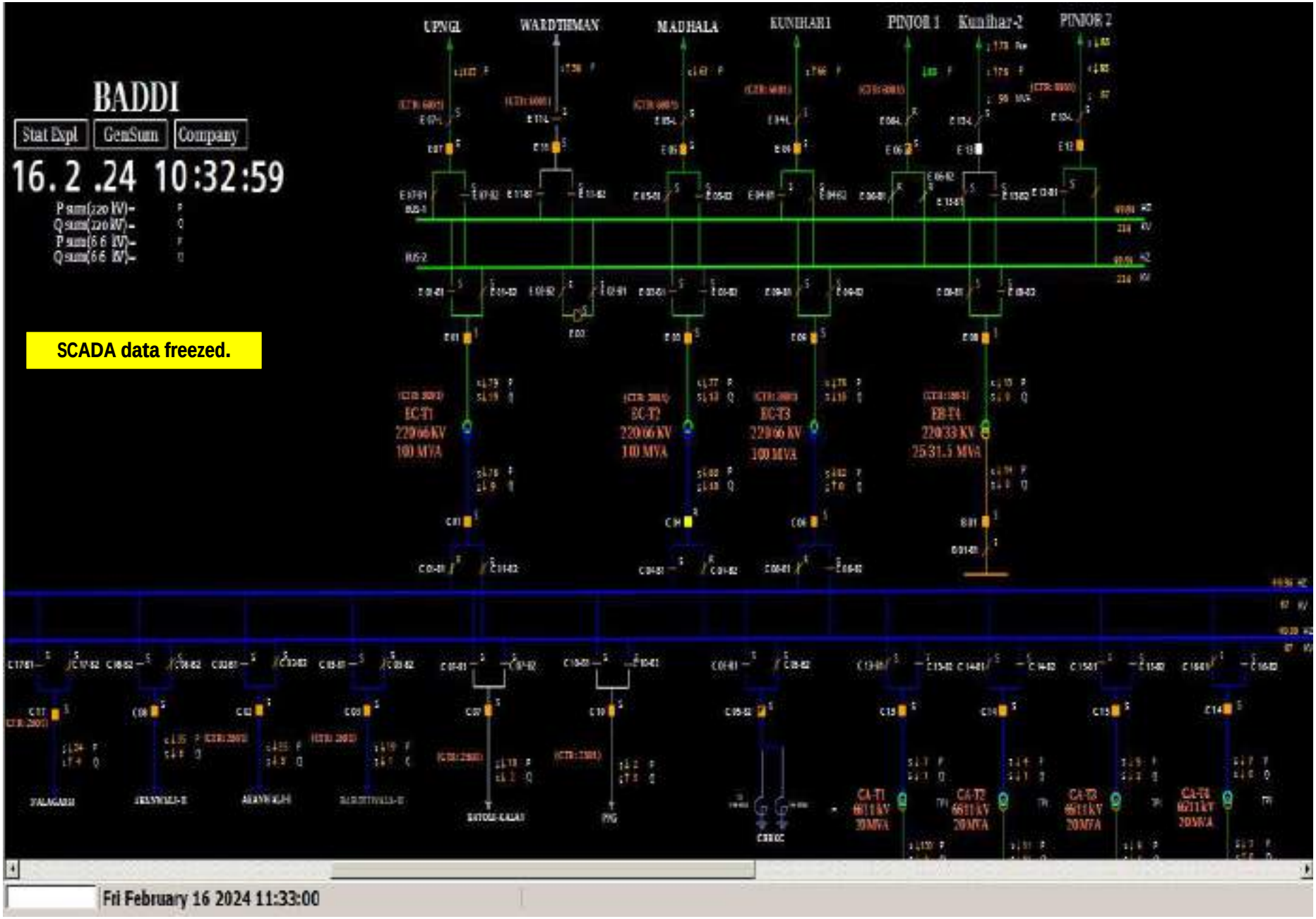
SLD of 220/132kV Kunihar(HP) after the event



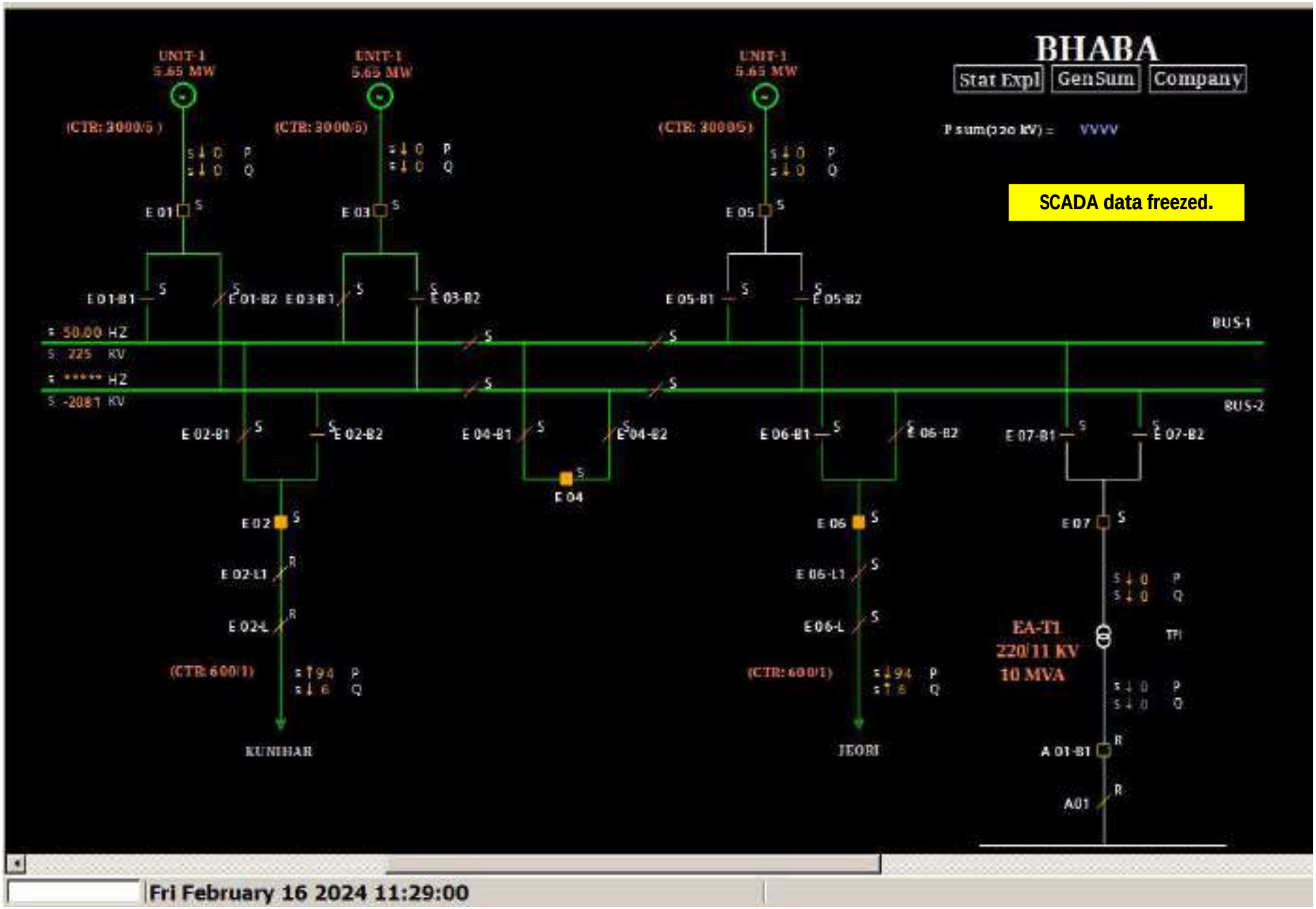
SLD of 220/66kV Baddi(HP) before the event



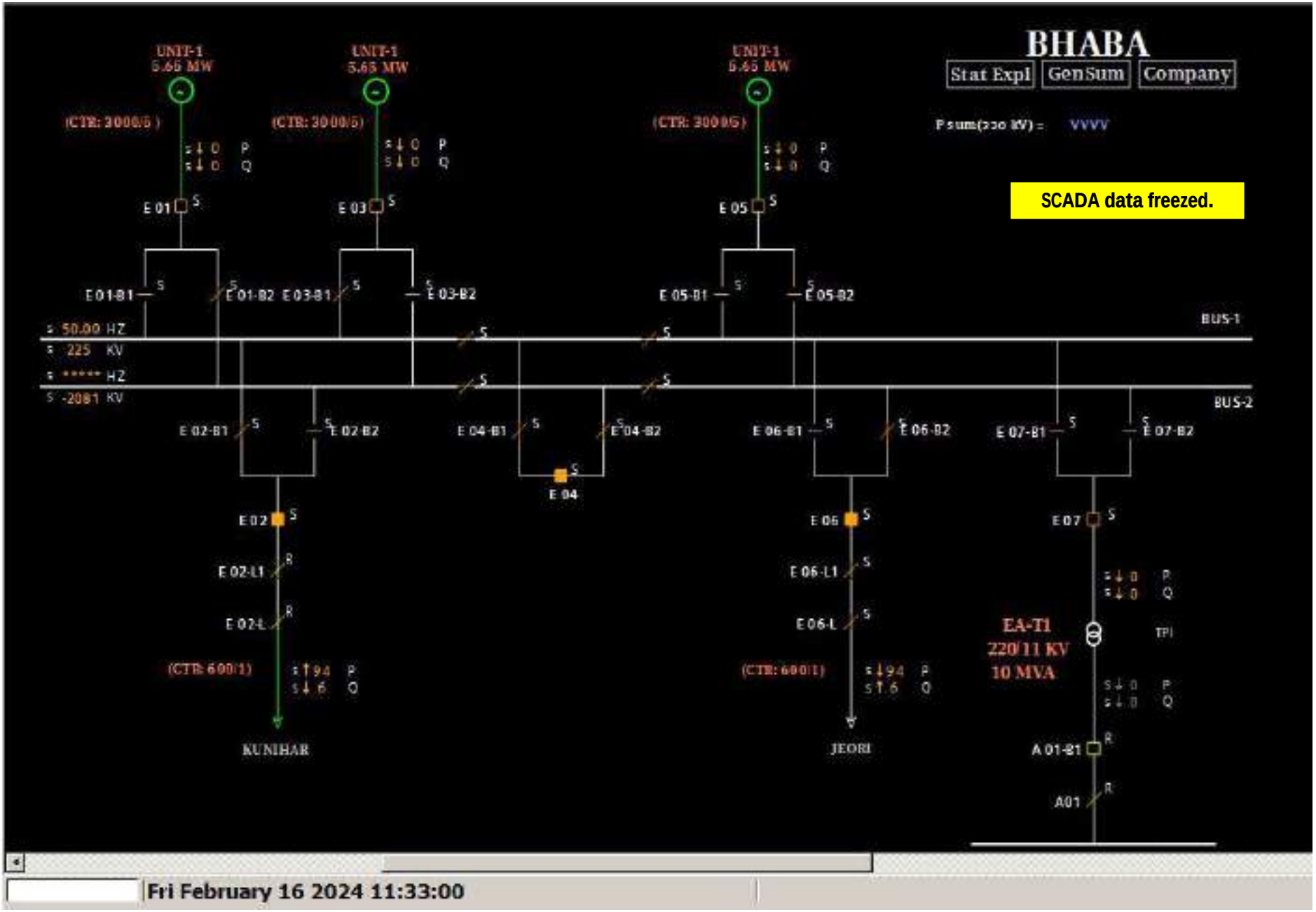
SLD of 220/66kV Baddi(HP) after the event



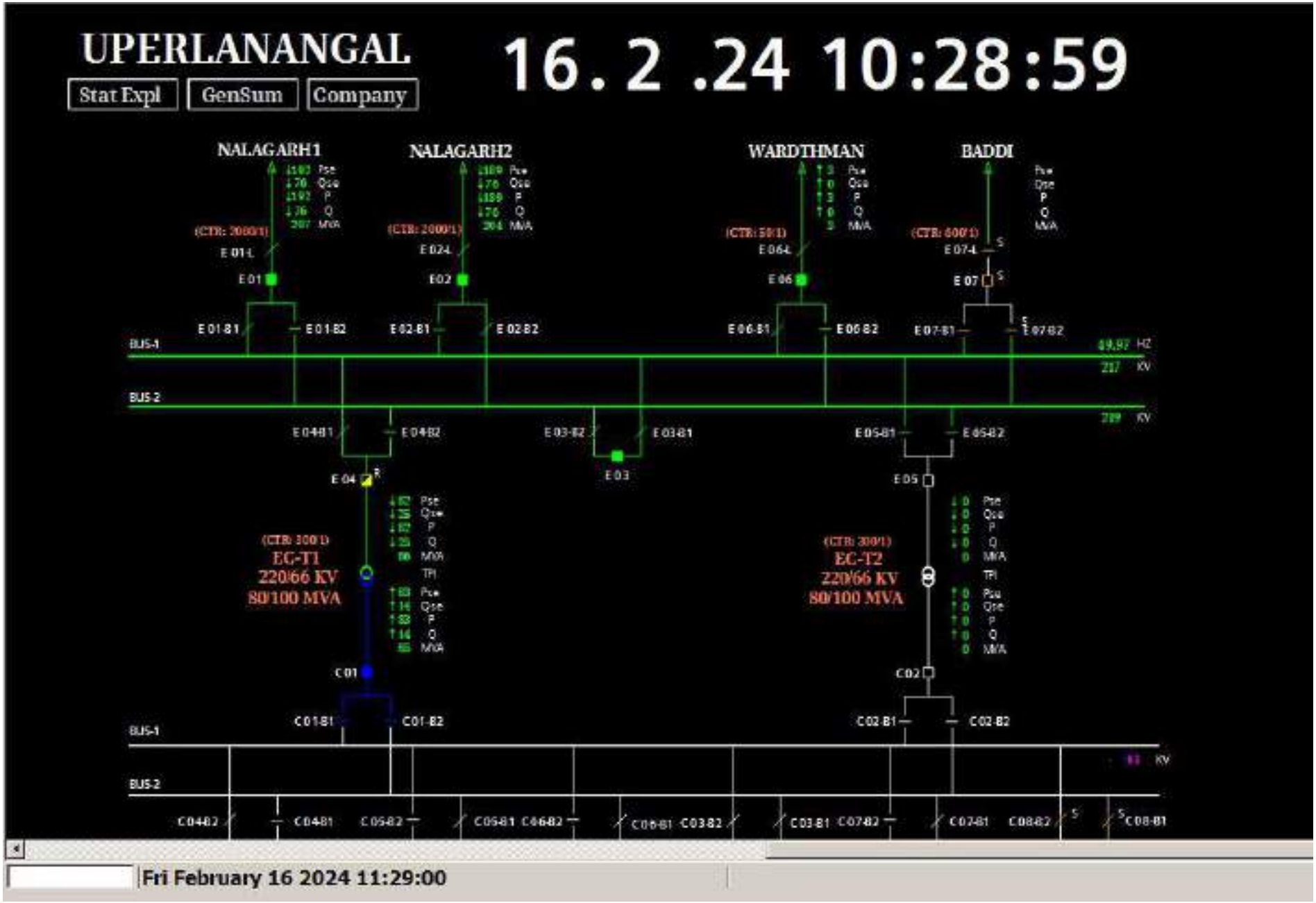
SLD of 220kV Bhaba(HP) before the event



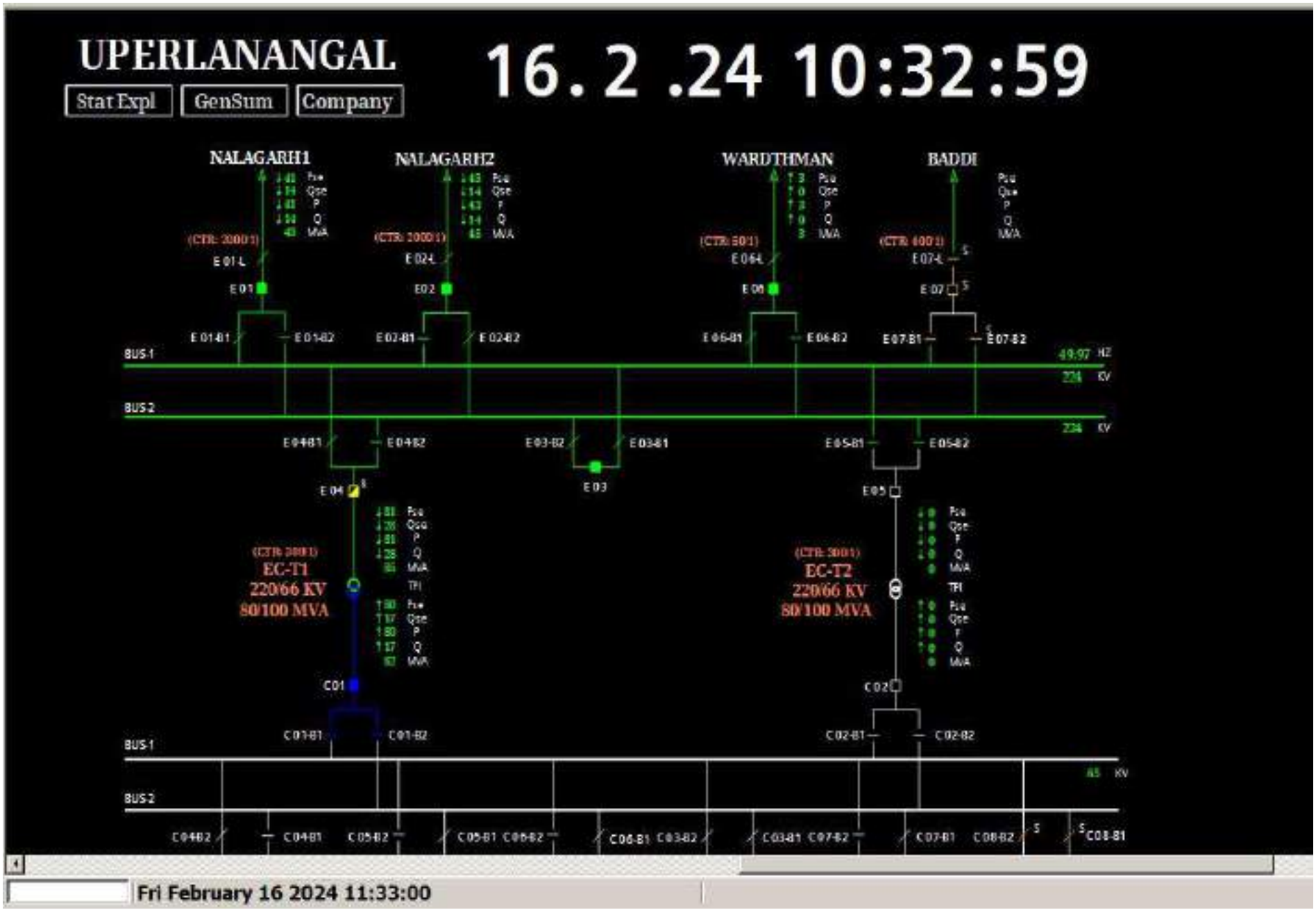
SLD of 220kV Bhaba(HP) after the event



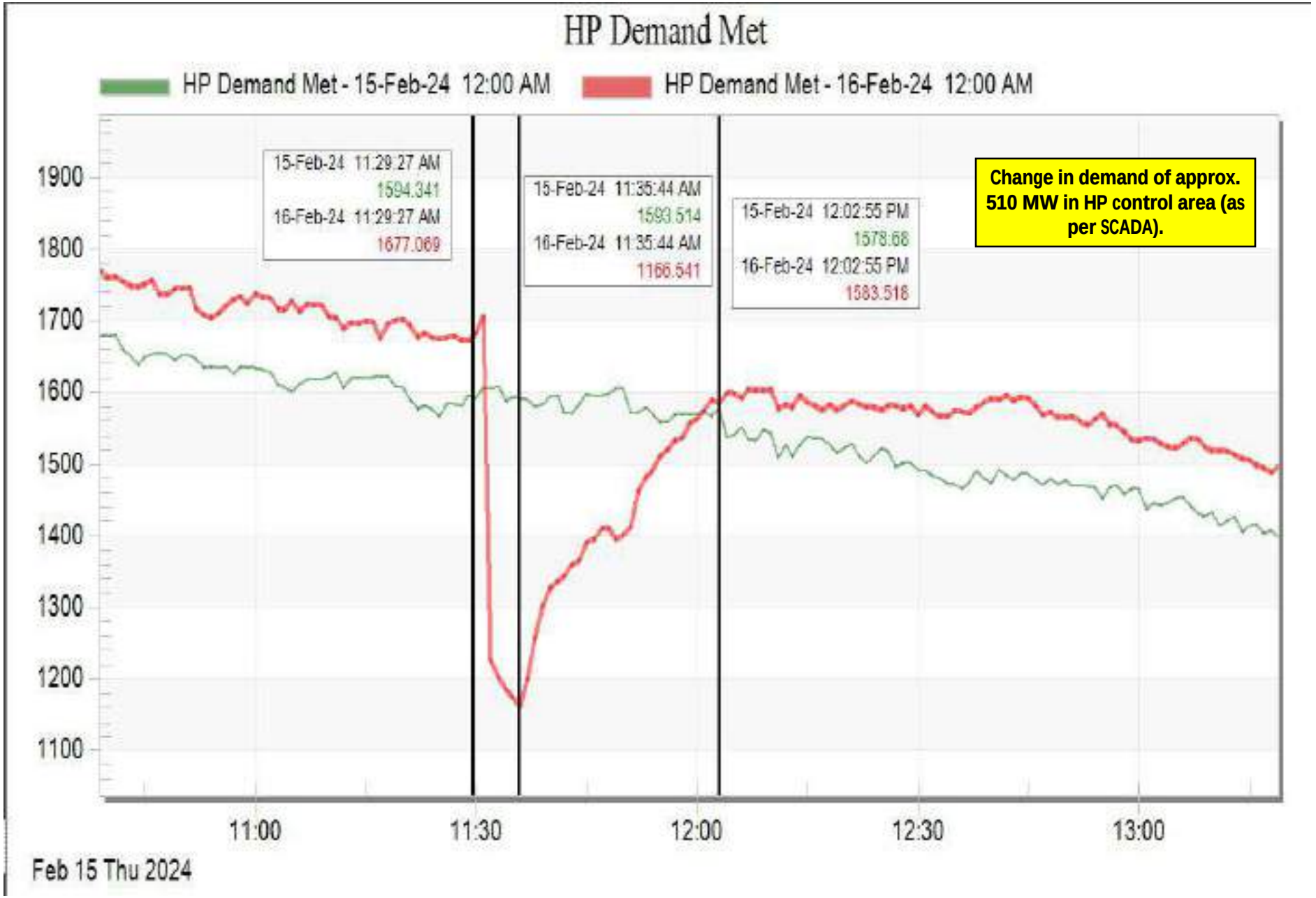
SLD of 220/66kV Uperla Nangal(HP) before the event



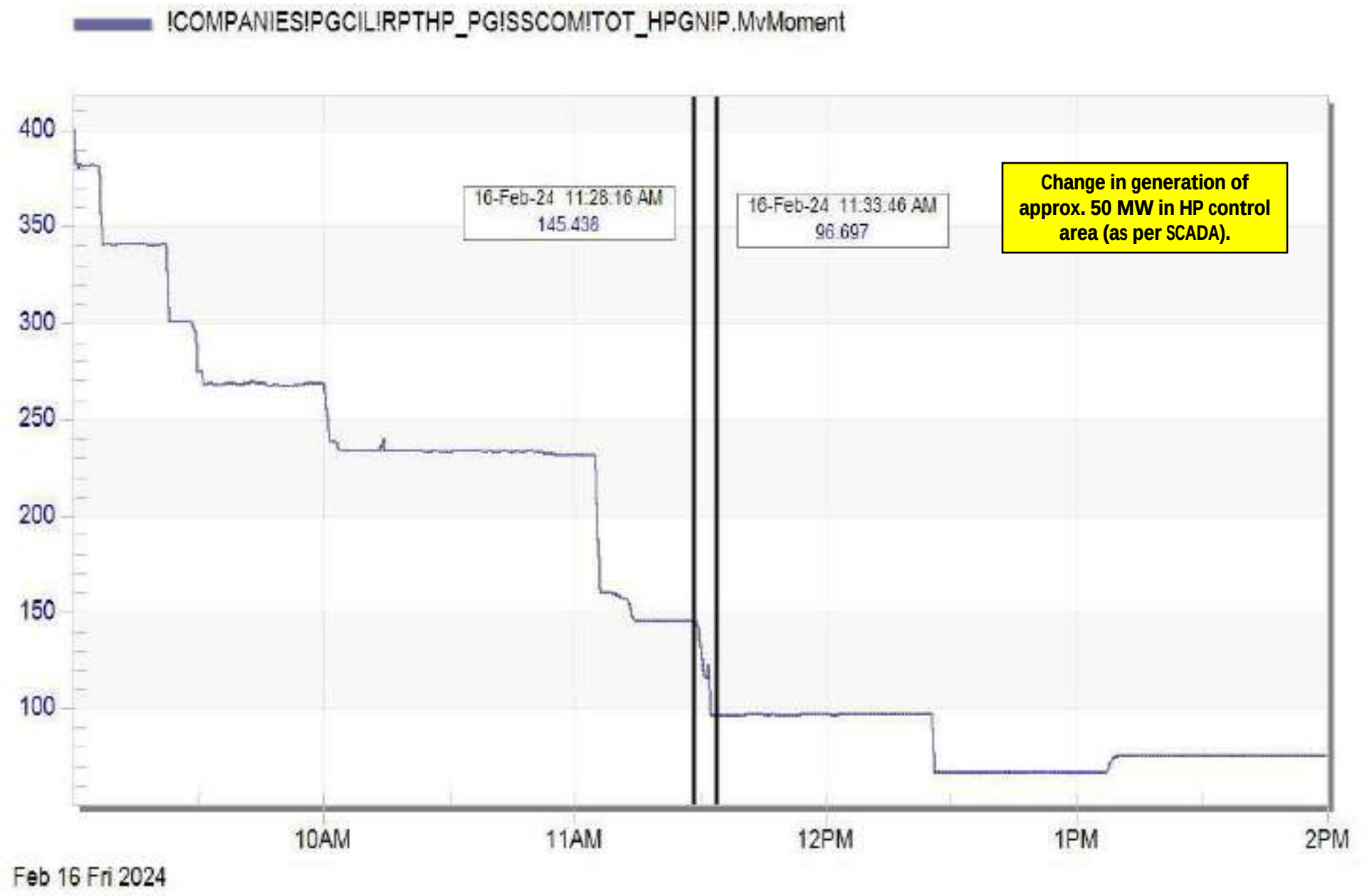
SLD of 220/66kV Uperla Nangal(HP) after the event



Himachal Pradesh demand during the event

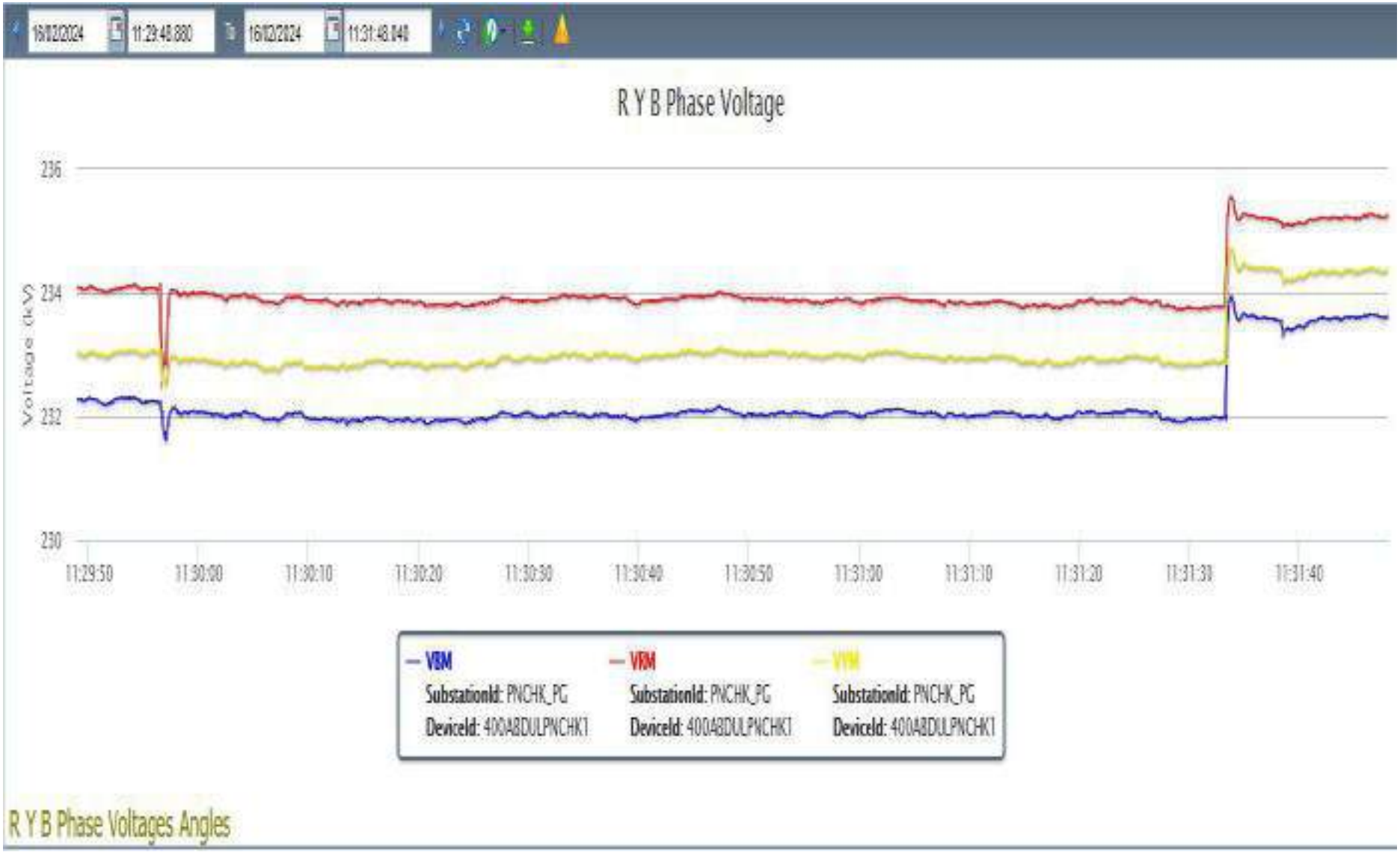


Himachal Pradesh generation during the event



PMU Plot of phase voltage magnitude of 400 KV Panchkula(PG)-Abdullapur(PG) ckt 1

11:31 hrs/16-Feb-24



PMU Plot of phase voltage magnitude at Panchkula(PG)

11:31 hrs/16-Feb-24

PMU Plot of frequency at Panchkula(PG)

11:31 hrs/16-Feb-24

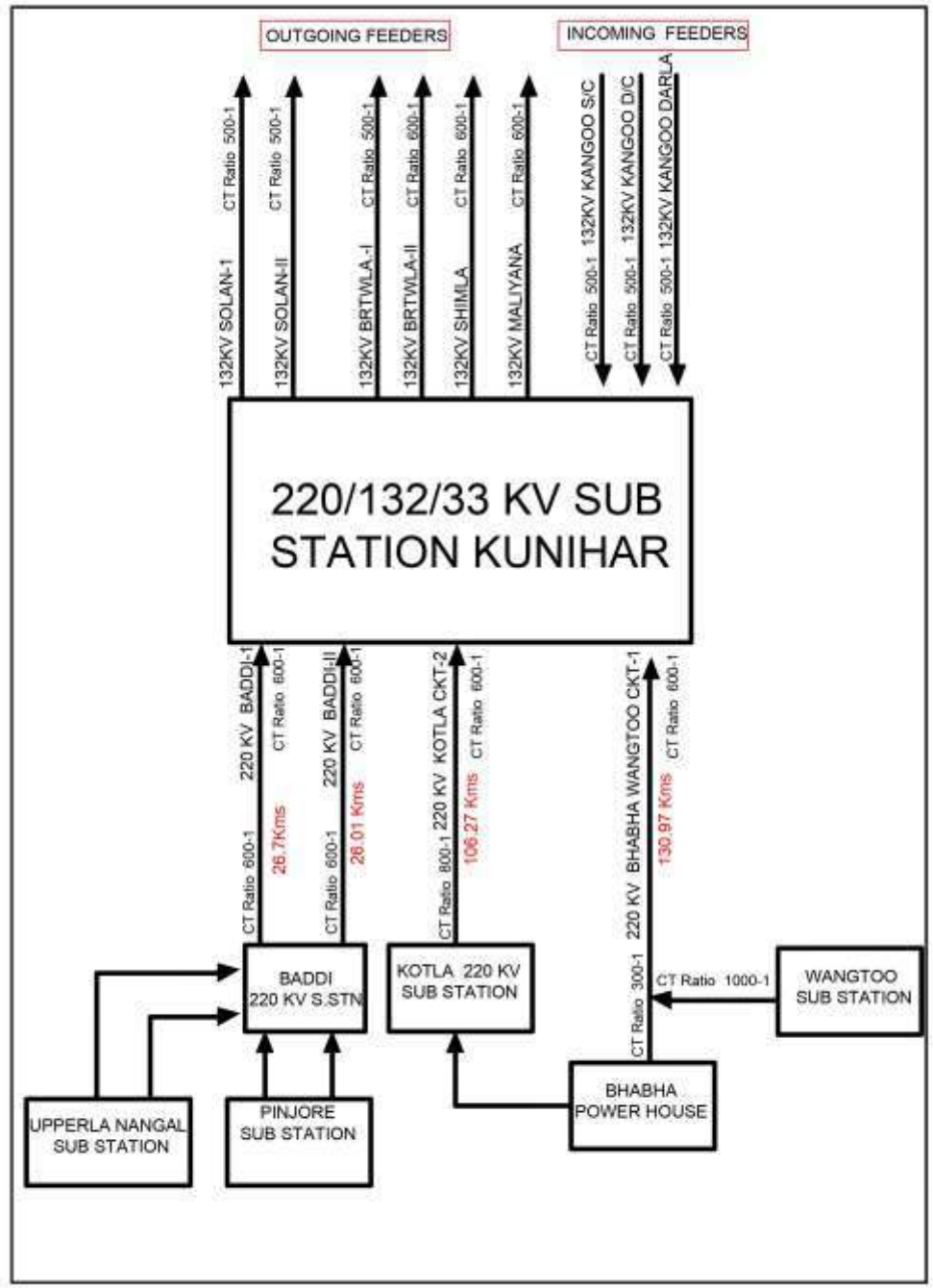
SCADA SOE

Time	Station Name	Voltage	Element Name	Element Type	Element Status	Remarks
11:29:56,705	JEORI_HP	220kV	02T1	Circuit Breaker	Open	CB at 220kV side of 220/66kV 31.5MVA ICT-1 at Jeori(HP) opened
11:29:56,708	JEORI_HP	220kV	03KUNIH	Circuit Breaker	Open	Line CB at Jeori(HP) end of 220 kV Jeori-Kunihar(HP) ckt opened
11:29:56,710	JEORI_HP	220kV	01BHABA	Circuit Breaker	Open	Line CB at Jeori(HP) end of 220 kV Jeori-Bhaba(HP) ckt opened
11:29:56,774	WNGTU_HP	220kV	02KUNHR	Circuit Breaker	Open	Line CB at Wangtoo(HP) end of 220 kV Wangtoo –Bhabha-Kunihar(HP) ckt (T-connection) opened
11:30:19,250	MORI_HP	220kV	02T2	Circuit Breaker	Open	CB at 220kV side of 220/11kV 3X13MVA ICT-2 at Mori(HP) opened

Point of discussion

- Exact nature and location of fault?
- Sequence of event?
- Over-current protection settings of tripped elements?
- Exact reason of tripping of 220/66kV 31.5MVA ICT-1 at Jeori(HP) and 220/11kV 3X13MVA ICT-2 at Mori(HP) need to be shared.
- SCADA data freezed at 220kV Bhaba(HP) and 220/66kV Baddi(HP) during the event. Availability and healthiness of SCADA data need to be ensured
- DR/EL of all the tripped elements?
- Tripping status of all the tripped elements are not coming in SCADA SOE.
- Detailed report along with remedial action taken details not received.
- In view of frequent tripping in this region wherein cascade tripping occurred due to overloading, suitable SPS may be planned by HP in this complex.

Report Analysis for tripping at 220/132/33kV Sub Station HPSEBL Kunihar.


OUTGOING FEEDERS
INCOMING FEEDERS
132KV SOLAN-1
CT Ratio 500-1
132KV SOLAN-II
CT Ratio 500-1
132KV BRTWLA.-I
CT Ratio 500-1
132KV BRTWLA-II
CT Ratio 600-1
132KV SHIMLA
CT Ratio 600-1
132KV MALIYANA
CT Ratio 600-1
132KV KANGOO S/C
CT Ratio 500-1
132KV KANGOO D/C
CT Ratio 500-1
132KV KANGOO DARLA
CT Ratio 500-1
220/132/33 KV SUB STATION KUNIHAR
220 KV BADDI-I
CT Ratio 600-1
26.7Kms
CT Ratio 600-1
220 KV BADDI-II
CT Ratio 600-1
26.01 Kms
CT Ratio 600-1
220 KV KOTLA CKT-2
CT Ratio 800-1
106.27 Kms
CT Ratio 600-1
220 KV BHABHA WANGTOO CKT-1
CT Ratio 300-1
130.97 Kms
CT Ratio 600-1
CT Ratio 1000-1
BADDI 220 KV S.STN
KOTLA 220 KV SUB STATION
WANGTOO SUB STATION
UPPERLA NANGAL SUB STATION
PINJORE SUB STATION
BHABHA POWER HOUSE

Event of Element tripping in respect of 220 kV ES Division HPSEBL kunihar

On Dated 2ND February 2024

- At 15:28 hours main supply fail from Baddi i.e. Baddi Baddi I &II and same time 220 kv kunihar bhawa Wangtoo circuit number -I tripped from wangtoo on O/C on two phase as reported by Wangtoo substation.
- At Kunihar Sub Station Zone-III Start towards Baddi in 220 KV Baddi- I & II feeders and no other element tripped at 220 KV Sub Station Kunihar.
- Due to failure of 220 KV source from baddi and Wangtoo, the outgoing feeders in kunihar substation get affected.
- At 16: 08 hours 220 KV Baddi CKT no.- II restored.
- At 16: 13 hours 220 KV Baddi CKT no.- I restored.
- At 16:21 hours all supply normalized.

Reason of Tripping.

220 KV Pinjore 1, 220 KV Kunihar -1 Tripped while shifting 100 MVA Power Transformer no.. 03 shifted from 220 KV Bus B to Bus A as per direction from ALDC during shifting process isolator B phase stuck due to which heavy sparking occurred and following events occured as reported by 220 kv Sub Station Baddi and due to which main supply of baddi sub station failed from Baddi sub station.

Disturbance Short Report

Disturbance Recordings Information

Device Information

Recorder ID	1
IED type	REL670
IED version	2.1.0
Station name	HPSEB
Object name	LINE - 1
IED name	REL670_M1

Fault Information

Trig date and time	02/02/2024 3:27:50.590 PM
Trigger signal name	ZMC3-START
Recording number	303
Total recording time	3599 ms
Pre-trig recording time	500 ms
Post trig recording time	3000 ms
Max. recording time	4000 ms

General Recordings Information

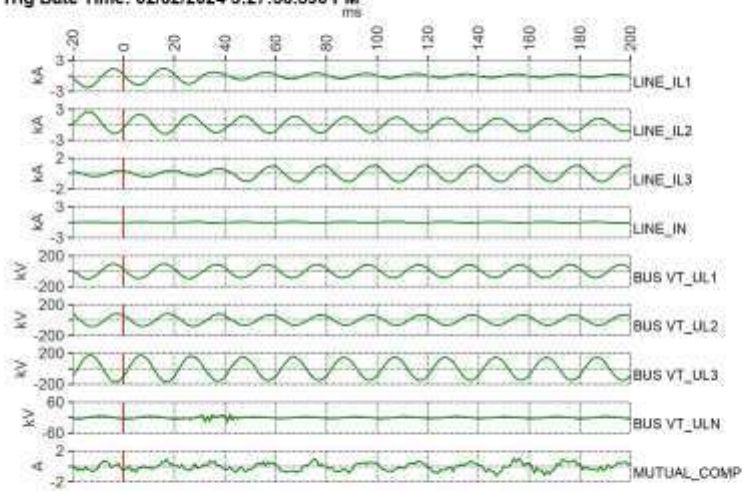
Disturbance recorder	Installed
Event recorder	Installed
System frequency	50 Hz
Sampling frequency	1 kHz
Active setting group during recording	1

Fault Location Information

Fault loop type	L1-L2
Fault location	26.0 km (100.0 %)
Status of fault calculation	Ok
Fault direction	Forward

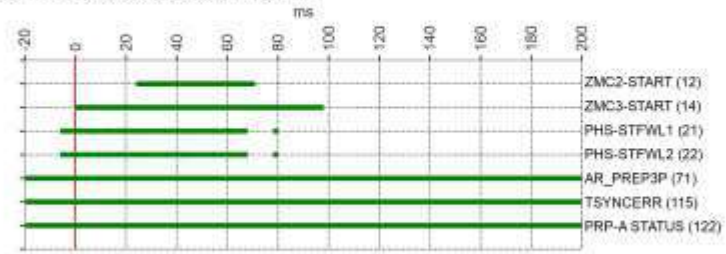
Analog Time Diagram

Trig Date Time: 02/02/2024 3:27:50.590 PM



Binary Time Diagram

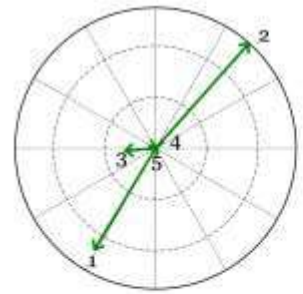
Trig Date Time: 02/02/2024 3:27:50.590 PM



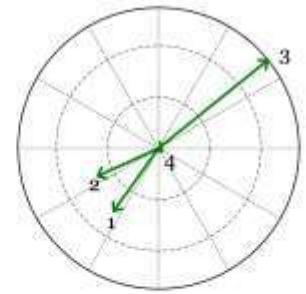
Vector Diagrams

Calculation Time Period : -6 ms to 13 ms

Currents



Voltages



No.	Name	RMS	Angle	No.	Name	RMS	Angle
1	LINE_IL1	1125.338(A)	238.8°	1	BUS VT_UL1	68016.0(V)	234.4°
2	LINE_IL2	1336.843(A)	48.3°	2	BUS VT_UL2	58954.27(V)	204.5°
3	LINE_IL3	288.406(A)	184.6°	3	BUS VT_UL3	123613.25(V)	38.9°
4	LINE_IN	28.146(A)	38.7°	4	BUS VT_ULN	3790.839(V)	324.8°
5	MUTUAL_COMP	0.317(A)	259.3°				

Events List

Channel Number	Name	Status	Time
21	PHS-STFWL1	On	02/02/2024 3:27:50.584 PM
22	PHS-STFWL2	On	02/02/2024 3:27:50.584 PM
14	ZMC3-START	On	02/02/2024 3:27:50.590 PM
12	ZMC2-START	On	02/02/2024 3:27:50.614 PM
21	PHS-STFWL1	Off	02/02/2024 3:27:50.659 PM
22	PHS-STFWL2	Off	02/02/2024 3:27:50.659 PM
12	ZMC2-START	Off	02/02/2024 3:27:50.662 PM
21	PHS-STFWL1	On	02/02/2024 3:27:50.668 PM
22	PHS-STFWL2	On	02/02/2024 3:27:50.668 PM
21	PHS-STFWL1	Off	02/02/2024 3:27:50.671 PM
22	PHS-STFWL2	Off	02/02/2024 3:27:50.671 PM
14	ZMC3-START	Off	02/02/2024 3:27:50.689 PM
21	PHS-STFWL1	On	02/02/2024 3:27:51.037 PM
22	PHS-STFWL2	On	02/02/2024 3:27:51.037 PM
14	ZMC3-START	On	02/02/2024 3:27:51.049 PM
21	PHS-STFWL1	Off	02/02/2024 3:27:51.307 PM

22	PHS-STFWL2	Off	02/02/2024 3:27:51.307 PM
14	ZMC3-START	Off	02/02/2024 3:27:51.316 PM

Disturbance Short Report

Disturbance Recordings Information

Device Information

Recorder ID	1
IED type	REC670
IED version	2.1.0
Station name	HPSEB
Object name	LINE
IED name	REC670

Fault Information

Trig date and time	02-Feb-24 3:27:02.839 PM
Trigger signal name	86B_OPTD
Recording number	48
Total recording time	4000 ms
Pre-trig recording time	1000 ms
Post trig recording time	0 ms
Max. recording time	3000 ms

General Recordings Information

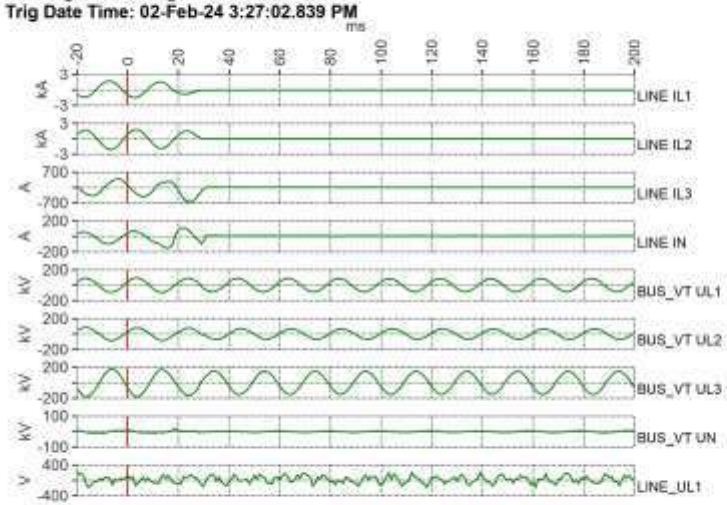
Disturbance recorder	Installed
Event recorder	Installed
System frequency	50 Hz
Sampling frequency	1 kHz
Active setting group during recording	1

Fault Location Information

Fault loop type	Not applicable
Fault location	Not applicable
Status of fault calculation	Not applicable
Fault direction	Not applicable

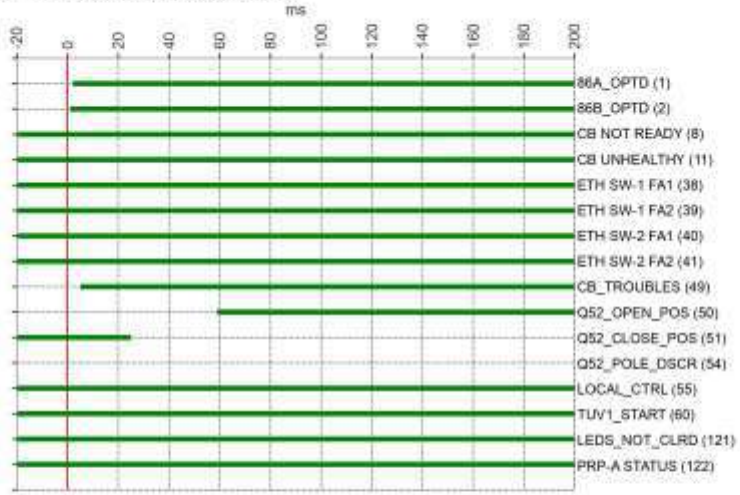
Analog Time Diagram

Trig Date Time: 02-Feb-24 3:27:02.839 PM



Binary Time Diagram

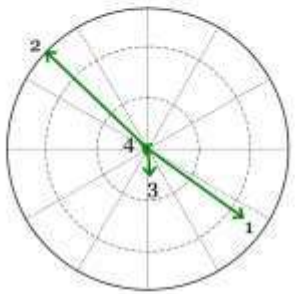
Trig Date Time: 02-Feb-24 3:27:02.839 PM



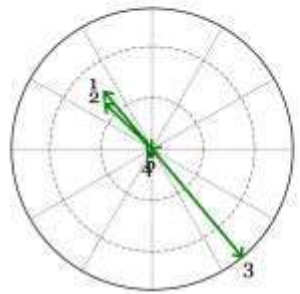
Vector Diagrams

Calculation Time Period : -24 ms to -5 ms

Currents



Voltages



No.	Name	RMS	Angle	No.	Name	RMS	Angle
1	LINE IL1	1148.818(A)	324.3°	1	BUS_VT UL1	67366.617(V)	130.0°
2	LINE IL2	1379.277(A)	136.3°	2	BUS_VT UL2	58752.496(V)	136.1°
3	LINE IL3	256.323(A)	274.5°	3	BUS_VT UL3	126785.148 (V)	309.8°
4	LINE IN	58.559(A)	150.5°	4	BUS_VT UN	6995.001(V)	236.3°
				5	LINE_UL1	112.928(V)	233.0°

Events List

Channel Number	Name	Status	Time
60	TUV1_START	On	02-Feb-24 3:27:02.814 PM
2	86B_OPTD	On	02-Feb-24 3:27:02.839 PM
1	86A_OPTD	On	02-Feb-24 3:27:02.840 PM

49	CB_TROUBLES	On	02-Feb-24 3:27:02.843 PM
51	Q52_CLOSE_POS	Off	02-Feb-24 3:27:02.864 PM
50	Q52_OPEN_POS	On	02-Feb-24 3:27:02.897 PM
54	Q52_POLE_DSCR	On	02-Feb-24 3:27:04.977 PM

Event of Element tripping in respect of 220 kV ES Division HPSEBL kunihar

On Dated 8 TH February 2024

- At 10:42 hours 220 Kv Bhabha- Wangtoo CKT No.1 tripped at kunihar shows B-Phase, O/C & E/F **900 Amp,** 123 km distance and at the same time Baddi CKT No.1& 2 tripped from Baddi end due to overloading.
- Affected area 132 KV Solan 1 and 2 , 132 KV Shimla 1 and 2 and 132 KB Brotiwala 1 & 16 MVA Transformer 132 /33 KV
- At 11:01 hour supply restored from Baddi substation
- At 12: 07 hours kunihar Bhabha Breaker closed

Reason of Tripping.

- Heavy thunder storm and bad weather, Snow fall condition near Kotla Region were reported on that day results the land slide and falling of tree which come under the minimum clearance of line and cause the tripping of the line.
- ES Division Kolta petrolled the line and looping of tree branch has been done by the team.

Disturbance Short Report

Disturbance Recordings Information

Device Information

Recorder ID	1
IED type	REC670
IED version	2.1.0
Station name	HPSEB
Object name	LINE
IED name	REC670

Fault Information

Trig date and time	08-Feb-24 10:41:31.363 AM
Trigger signal name	86B_OPTD
Recording number	49
Total recording time	4000 ms
Pre-trig recording time	1000 ms
Post trig recording time	0 ms
Max. recording time	3000 ms

General Recordings Information

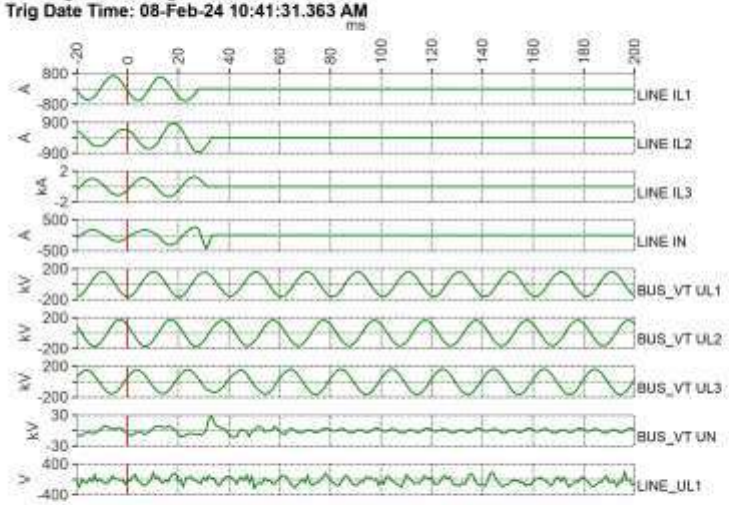
Disturbance recorder	Installed
Event recorder	Installed
System frequency	50 Hz
Sampling frequency	1 kHz
Active setting group during recording	1

Fault Location Information

Fault loop type	Not applicable
Fault location	Not applicable
Status of fault calculation	Not applicable
Fault direction	Not applicable

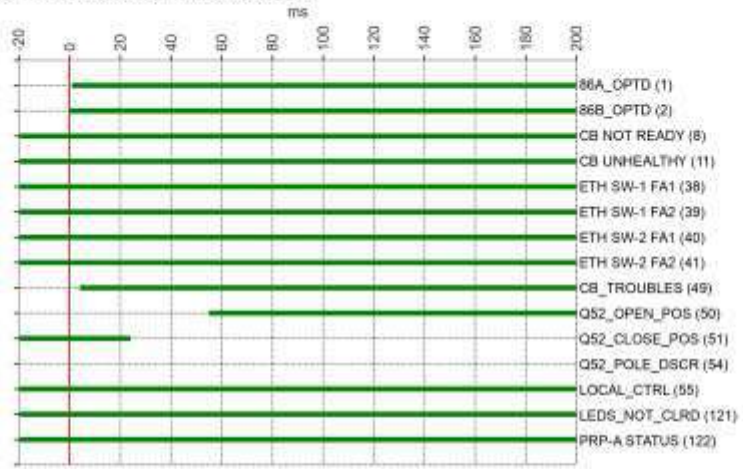
Analog Time Diagram

Trig Date Time: 08-Feb-24 10:41:31.363 AM



Binary Time Diagram

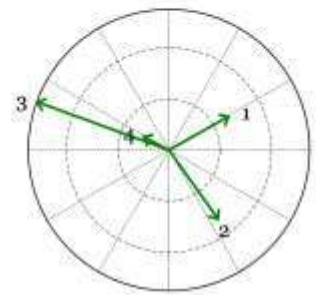
Trig Date Time: 08-Feb-24 10:41:31.363 AM



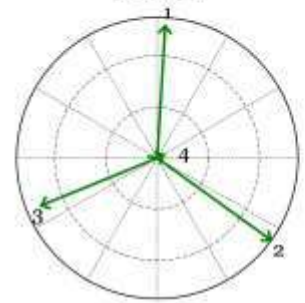
Vector Diagrams

Calculation Time Period : 0 ms to 19 ms

Currents



Voltages



No.	Name	RMS	Angle	No.	Name	RMS	Angle
1	LINE IL1	419.788(A)	29.4°	1	BUS_VT UL1	114907.703 (V)	86.5°
2	LINE IL2	520.353(A)	305.5°	2	BUS_VT UL2	121620.141 (V)	324.2°
3	LINE IL3	861.983(A)	160.0°	3	BUS_VT UL3	108689.43(V)	202.3°
4	LINE IN	175.528(A)	152.5°	4	BUS_VT UN	6304.046(V)	25.1°
				5	LINE_UL1	94.703(V)	310.6°

Events List

Channel Number	Name	Status	Time
2	86B_OPTD	On	08-Feb-24 10:41:31.363 AM
1	86A_OPTD	On	08-Feb-24 10:41:31.364 AM
49	CB_TROUBLES	On	08-Feb-24 10:41:31.366 AM

51	Q52_CLOSE_POS	Off	08-Feb-24 10:41:31.387 AM
50	Q52_OPEN_POS	On	08-Feb-24 10:41:31.418 AM
54	Q52_POLE_DSCR	On	08-Feb-24 10:41:33.432 AM

Disturbance Short Report

Disturbance Recordings Information

Device Information

Recorder ID	1
IED type	REL670
IED version	2.1.0
Station name	HPSEB KUNIHAR
Object name	WANGTU LINE
IED name	REL670_M1

Fault Information

Trig date and time	08/02/2024 10:42:45.754 AM
Trigger signal name	ZMC3-START
Recording number	357
Total recording time	3593 ms
Pre-trig recording time	500 ms
Post trig recording time	3000 ms
Max. recording time	4000 ms

General Recordings Information

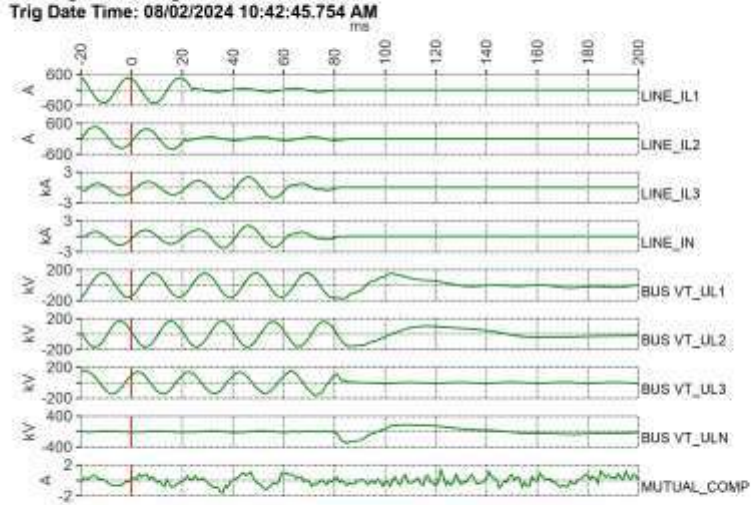
Disturbance recorder	Installed
Event recorder	Installed
System frequency	50 Hz
Sampling frequency	1 kHz
Active setting group during recording	1

Fault Location Information

Fault loop type	L3-N
Fault location	123.5 km (90.8 %)
Status of fault calculation	Ok
Fault direction	Forward

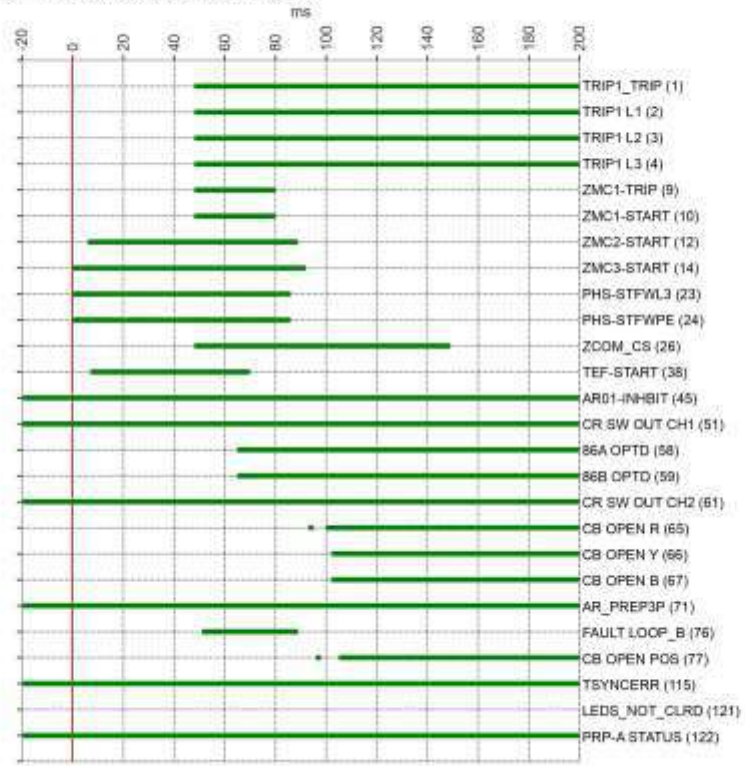
Analog Time Diagram

Trig Date Time: 08/02/2024 10:42:45.754 AM



Binary Time Diagram

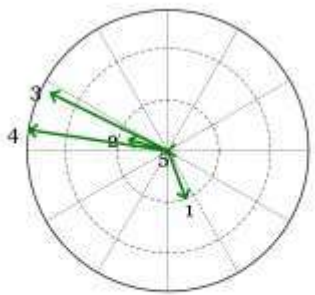
Trig Date Time: 08/02/2024 10:42:45.754 AM



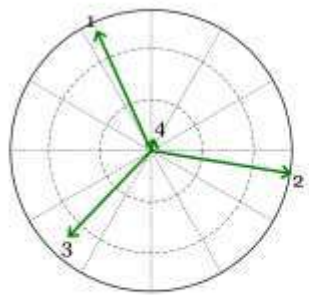
Vector Diagrams

Calculation Time Period : 0 ms to 19 ms

Currents



Voltages



No.	Name	RMS	Angle	No.	Name	RMS	Angle
1	LINE_IL1	352.243(A)	290.6°	1	BUS VT_UL1	110854.695 (V)	114.4°
2	LINE_IL2	280.694(A)	164.1°	2	BUS VT_UL2	119045.953 (V)	350.8°
3	LINE_IL3	905.562(A)	153.9°	3	BUS VT_UL3	100644.305 (V)	226.2°
4	LINE_IN	974.363(A)	171.5°	4	BUS VT_ULN	9495.481(V)	77.8°
5	MUTUAL_COMP	0.52(A)	182.9°				

Events List

Channel Number	Name	Status	Time
14	ZMC3-START	On	08/02/2024 10:42:45.754 AM
23	PHS-STFWL3	On	08/02/2024 10:42:45.754 AM
24	PHS-STFWPE	On	08/02/2024 10:42:45.754 AM
12	ZMC2-START	On	08/02/2024 10:42:45.760 AM
38	TEF-START	On	08/02/2024 10:42:45.761 AM
1	TRIP1_TRIP	On	08/02/2024 10:42:45.802 AM
2	TRIP1 L1	On	08/02/2024 10:42:45.802 AM
3	TRIP1 L2	On	08/02/2024 10:42:45.802 AM
4	TRIP1 L3	On	08/02/2024 10:42:45.802 AM
9	ZMC1-TRIP	On	08/02/2024 10:42:45.802 AM
10	ZMC1-START	On	08/02/2024 10:42:45.802 AM
26	ZCOM_CS	On	08/02/2024 10:42:45.802 AM
76	FAULT LOOP_B	On	08/02/2024 10:42:45.805 AM
58	86A OPTD	On	08/02/2024 10:42:45.819 AM
59	86B OPTD	On	08/02/2024 10:42:45.819 AM
38	TEF-START	Off	08/02/2024 10:42:45.825 AM
9	ZMC1-TRIP	Off	08/02/2024 10:42:45.835 AM
10	ZMC1-START	Off	08/02/2024 10:42:45.835 AM
23	PHS-STFWL3	Off	08/02/2024 10:42:45.841 AM
24	PHS-STFWPE	Off	08/02/2024 10:42:45.841 AM
12	ZMC2-START	Off	08/02/2024 10:42:45.844 AM
76	FAULT LOOP_B	Off	08/02/2024 10:42:45.844 AM
65	CB OPEN R	On	08/02/2024 10:42:45.847 AM
14	ZMC3-START	Off	08/02/2024 10:42:45.847 AM
65	CB OPEN R	Off	08/02/2024 10:42:45.850 AM
77	CB OPEN POS	On	08/02/2024 10:42:45.850 AM
77	CB OPEN POS	Off	08/02/2024 10:42:45.853 AM
65	CB OPEN R	On	08/02/2024 10:42:45.854 AM
66	CB OPEN Y	On	08/02/2024 10:42:45.856 AM
67	CB OPEN B	On	08/02/2024 10:42:45.856 AM
77	CB OPEN POS	On	08/02/2024 10:42:45.859 AM
26	ZCOM_CS	Off	08/02/2024 10:42:45.904 AM
1	TRIP1_TRIP	Off	08/02/2024 10:42:45.955 AM
2	TRIP1 L1	Off	08/02/2024 10:42:45.955 AM
3	TRIP1 L2	Off	08/02/2024 10:42:45.955 AM
4	TRIP1 L3	Off	08/02/2024 10:42:45.955 AM
121	LEDS_NOT_CLRD	On	08/02/2024 10:42:46.009 AM

Event of Element tripping in respect of 220 kV ES Division HPSEBL kunihar

On Dated 16 TH February 2024

- At 11:23 hours 220 KV kunihar Baba Wangtoo CKT No.-1 tripped from wangtoo end at R-Phase E/F as reported by wangtoo substation.
- At 11:30 hours 220 Kv kunihar Kotla CKT No.-II Tripped from kunihar end at R-Phase E/F **1150 Amp**, distance 91.20 km.
- At same time 220 KV kunihar Baddi CKT No.-1 and 2 fail from Baddi Sub Station as reported by Baddi substation.
- At 11:36 hours 220 Kv Baddi supply restored.
- At 11:48 hours 220 KV Bhava Wangtoo breaker closed at Wangtoo end.
- At 11:51 hours total supply narmalized.

Reason of Tripping.

- While investigeting the reason of tripping it has been found that a stone crusher company was trying to install the internet cable for their office which comes under the induction zone of 220 KV kunihar Kolta D/C line and cause the tripping. The above firm were already warned by this office for such act of negligence.

Disturbance Short Report

Disturbance Recordings Information

Device Information

Recorder ID	1
IED type	REC670
IED version	2.1.0
Station name	HPSEB
Object name	LINE
IED name	REC670

Fault Information

Trig date and time	16/02/2024 11:27:39.122 AM
Trigger signal name	86B_OPTD
Recording number	111
Total recording time	4000 ms
Pre-trig recording time	1000 ms
Post trig recording time	0 ms
Max. recording time	3000 ms

General Recordings Information

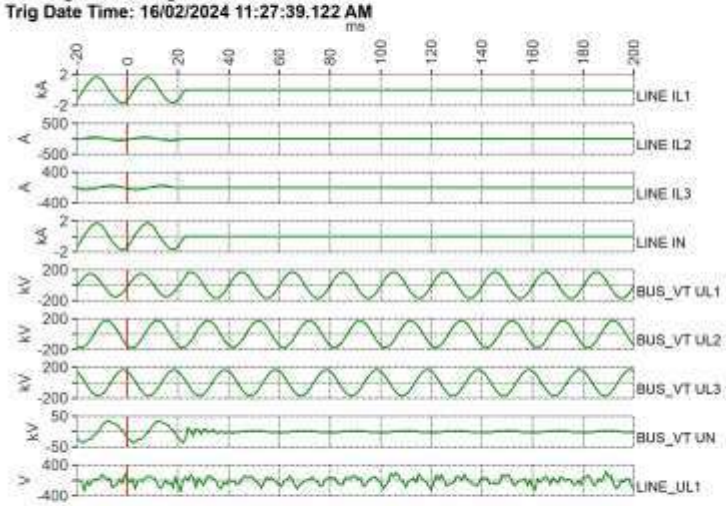
Disturbance recorder	Installed
Event recorder	Installed
System frequency	50 Hz
Sampling frequency	1 kHz
Active setting group during recording	1

Fault Location Information

Fault loop type	Not applicable
Fault location	Not applicable
Status of fault calculation	Not applicable
Fault direction	Not applicable

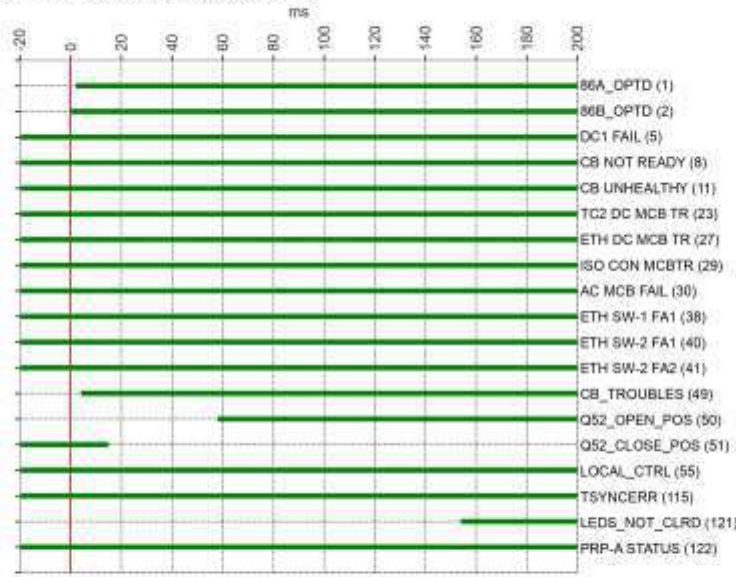
Analog Time Diagram

Trig Date Time: 16/02/2024 11:27:39.122 AM



Binary Time Diagram

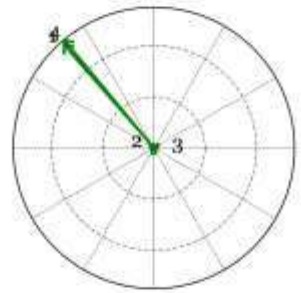
Trig Date Time: 16/02/2024 11:27:39.122 AM



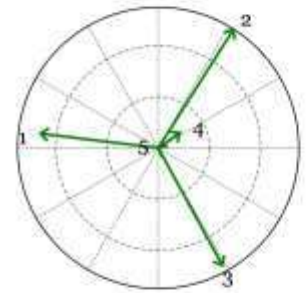
Vector Diagrams

Calculation Time Period : 0 ms to 19 ms

Currents



Voltages



No.	Name	RMS	Angle	No.	Name	RMS	Angle
1	LINE IL1	1169.105(A)	131.1°	1	BUS_VT UL1	105414.141 (V)	173.1°
2	LINE IL2	37.473(A)	145.6°	2	BUS_VT UL2	124573.039 (V)	57.6°
3	LINE IL3	38.079(A)	26.5°	3	BUS_VT UL3	118932.102 (V)	298.6°
4	LINE IN	1196.091(A)	129.8°	4	BUS_VT UN	23558.029(V)	35.1°
				5	LINE_UL1	102.494(V)	152.0°

Events List

Channel Number	Name	Status	Time
2	86B_OPTD	On	16/02/2024 11:27:39.122 AM
1	86A_OPTD	On	16/02/2024 11:27:39.124 AM
49	CB_TROUBLES	On	16/02/2024 11:27:39.126 AM
51	Q52_CLOSE_POS	Off	16/02/2024 11:27:39.138 AM
50	Q52_OPEN_POS	On	16/02/2024 11:27:39.180 AM
121	LEDS_NOT_CLRD	On	16/02/2024 11:27:39.276 AM

Multiple elements tripping at 765 kV Anpara_D (UP) 27th February 2024

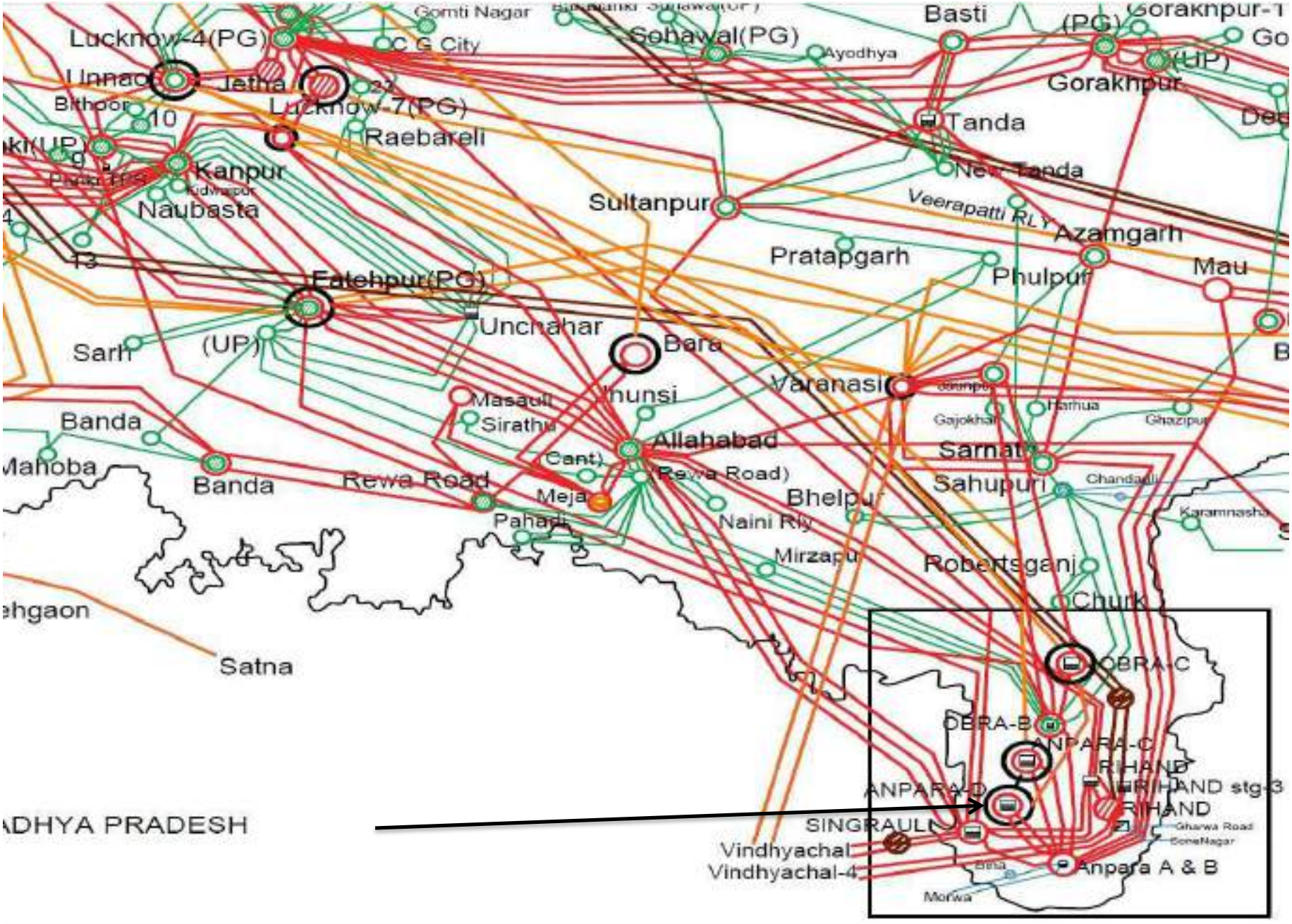
Brief of event:

- During antecedent condition, 500MW Anpara-D TPS Unit-1&2 were generating approx. 285MW & 295MW respectively and evacuating from 765kV Anpara_D-Obra_C ckt carrying approx 582MW.
- As reported, at 13:57hrs, R-N phase to earth fault occurred on 765kV Anpara_D-Obra_C ckt. Fault distance was ~8.5km from Obra_C end, Z-1 from Obra_C end and Z-2 from Anpara_D end. On this fault, 765kV Anpara_D-Obra_C ckt tripped from both ends however, delayed clearance occurred at Anpara_D end.
- At the same time, 765 KV Anpara_C(LAN)-Anpara_D(UP) (UP) Ckt-1 tripped from Anpara_C end and 400 KV Anpara-Anpara_D (UP) Ckt-1&2 tripped from Anpara end on O/C E/F protection operation. Protection setting of O/C E/F protection in these lines need to be reviewed.
- With the tripping of aforementioned lines, 500MW Unit-1&2 at Anpara_D TPS tripped due to loss of evacuation path.
- As per PMU at Anpara TPS, **R-N phase to earth fault** with **delayed clearance of 480ms** is observed.
- As per SCADA, loss of generation of approx. 580MW is observed at Anpara_D TPS in UP control area.

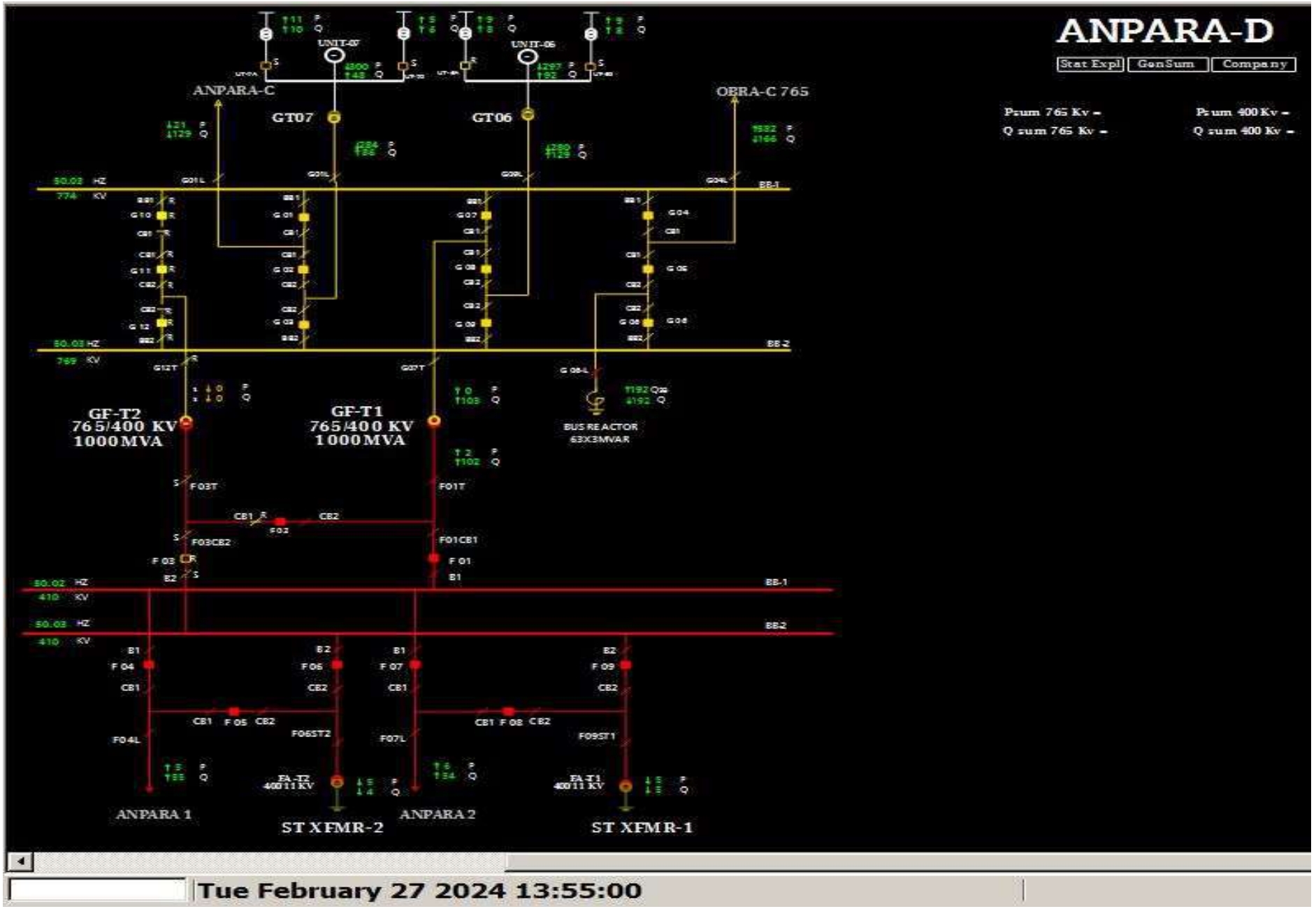
Elements tripped:

i. 765 KV Anpara_D(UP) - Bus 1
ii. 765 KV Anpara_D(UP) - Bus 2
iii. 765/400 kV 1000 MVA ICT 1 at Anpara_D(UP)
iv. 765 KV Obra_C_TPS-Anpara_D (UP) ckt
v. 765 KV Anpara_C(LAN)-Anpara_D(UP) (UP) Ckt-1
vi. 500 MW Anpara-D TPS - UNIT 1
vii. 500 MW Anpara-D TPS - UNIT 2
viii. 400 KV Anpara-Anpara_D (UP) Ckt-1
ix. 400 KV Anpara-Anpara_D (UP) Ckt-2

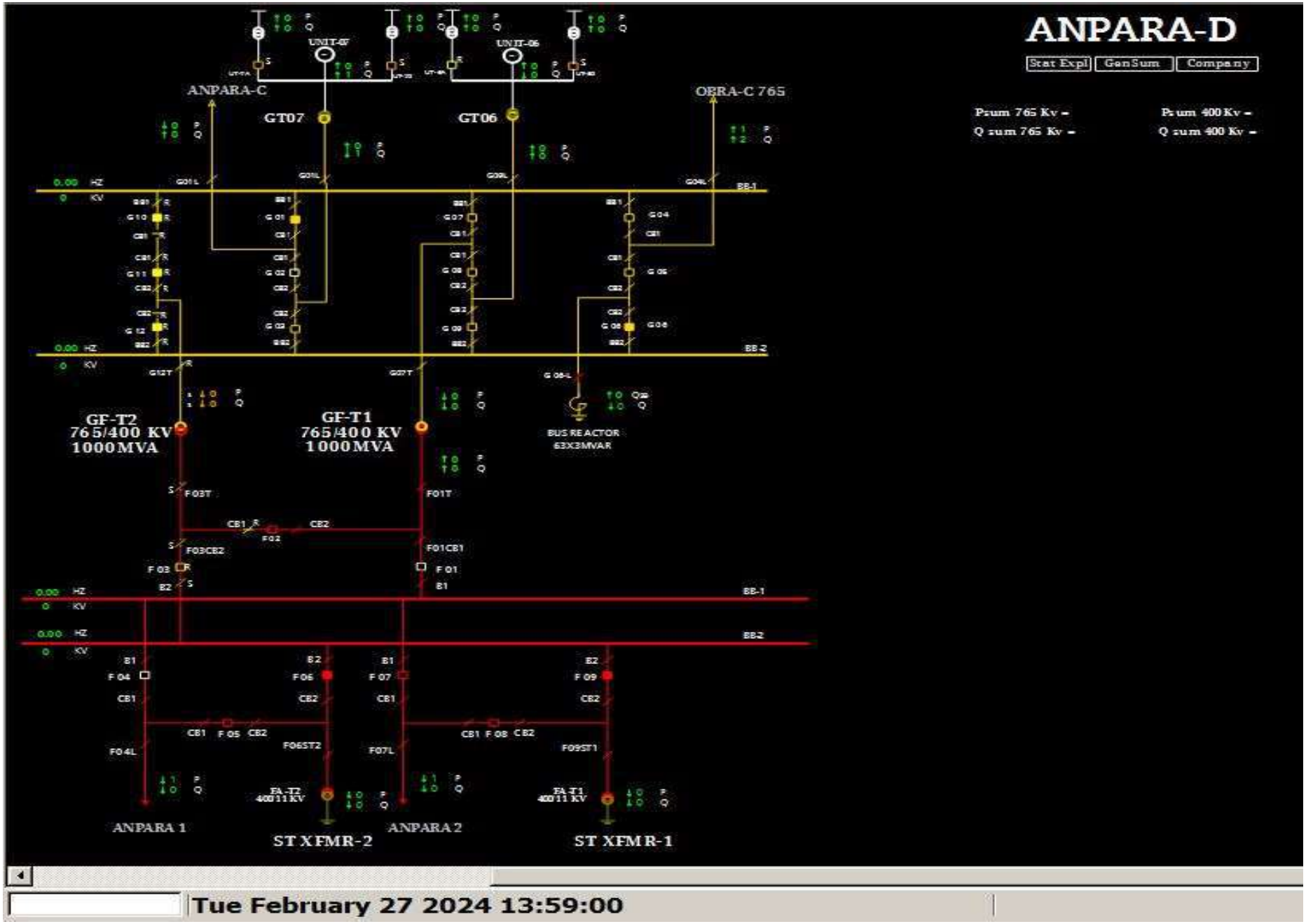
Network Diagram



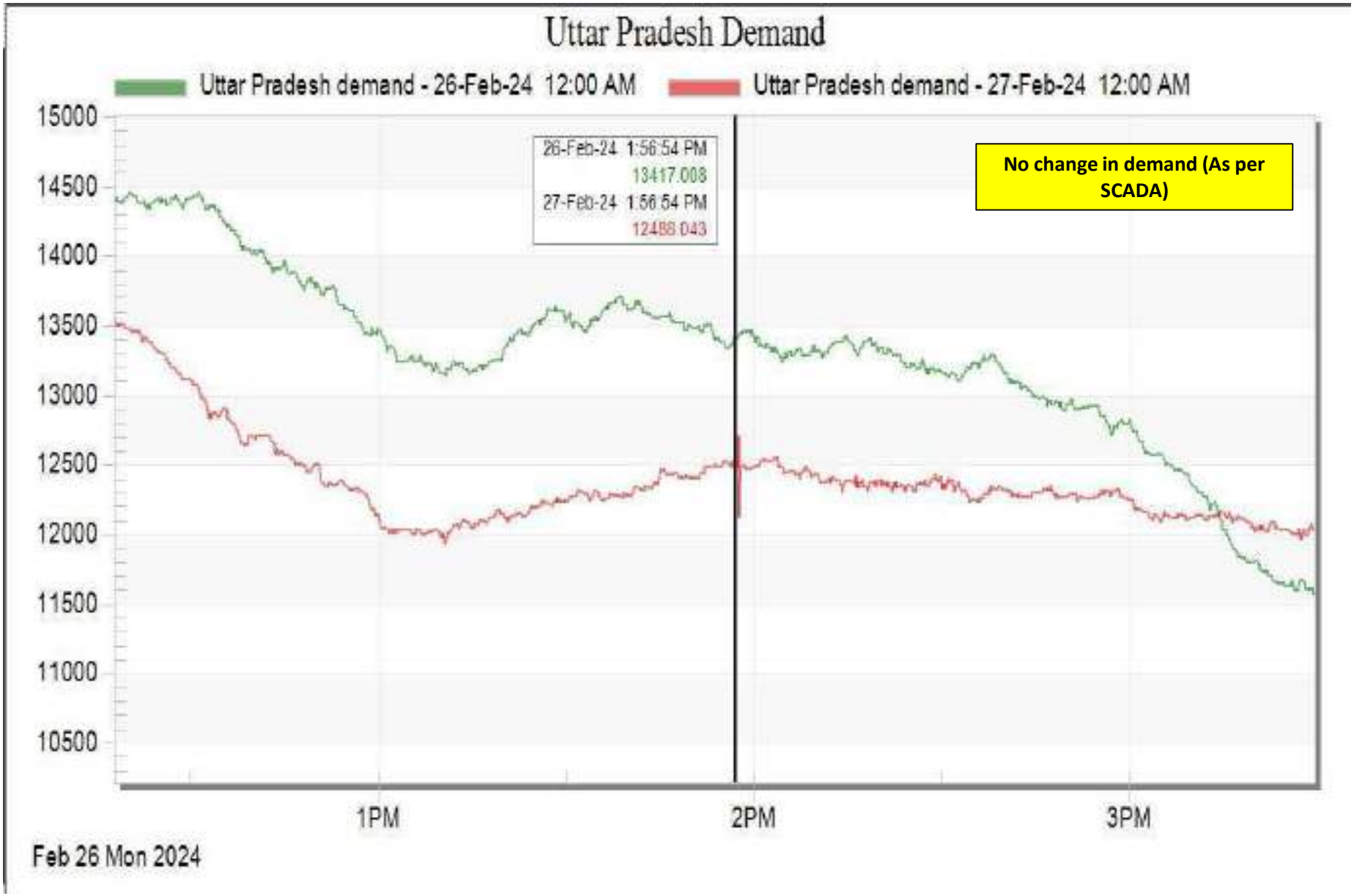
SLD of 765/400KV Anpara-D(UP) before the event



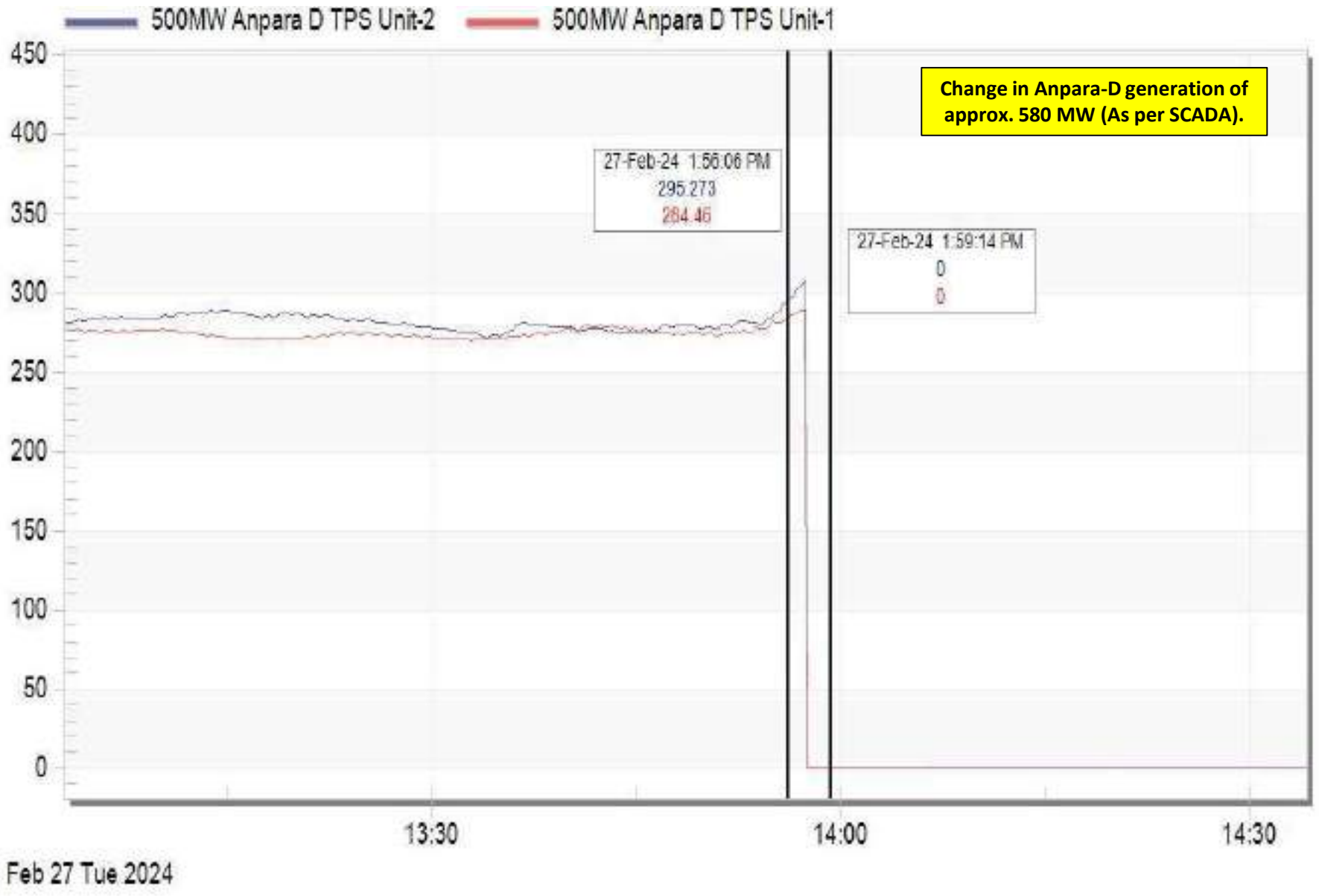
SLD of 765/400KV Anpara-D(UP) after the event



Uttar Pradesh Demand during the event



Anpara-D TPS Generation during the event

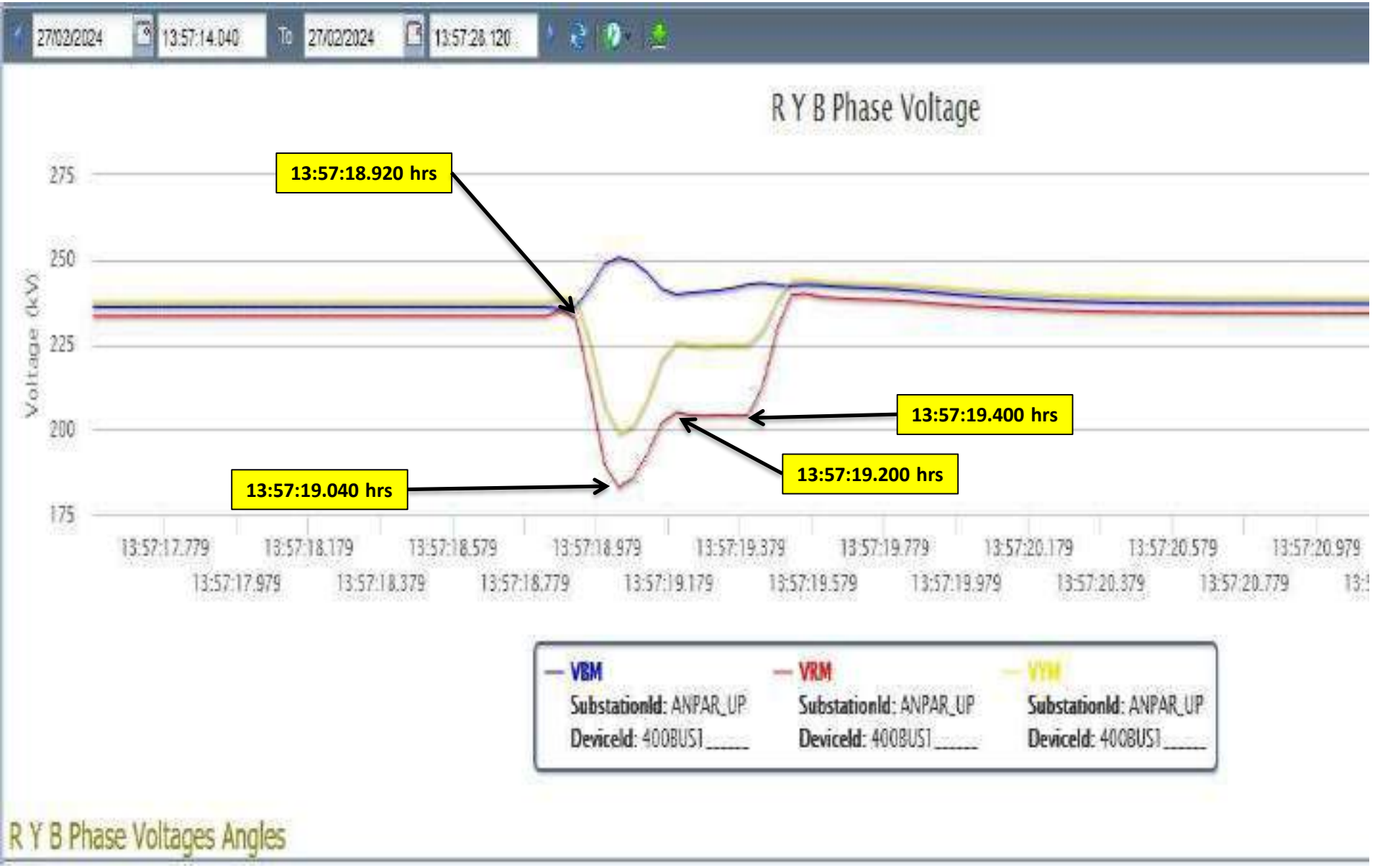


PMU Plot of frequency at Anpara TPS(UP)

13:57 hrs/27-Feb-24

PMU Plot of phase voltage magnitude at Bikaner(PG)

12:55 hrs/25-Feb-24

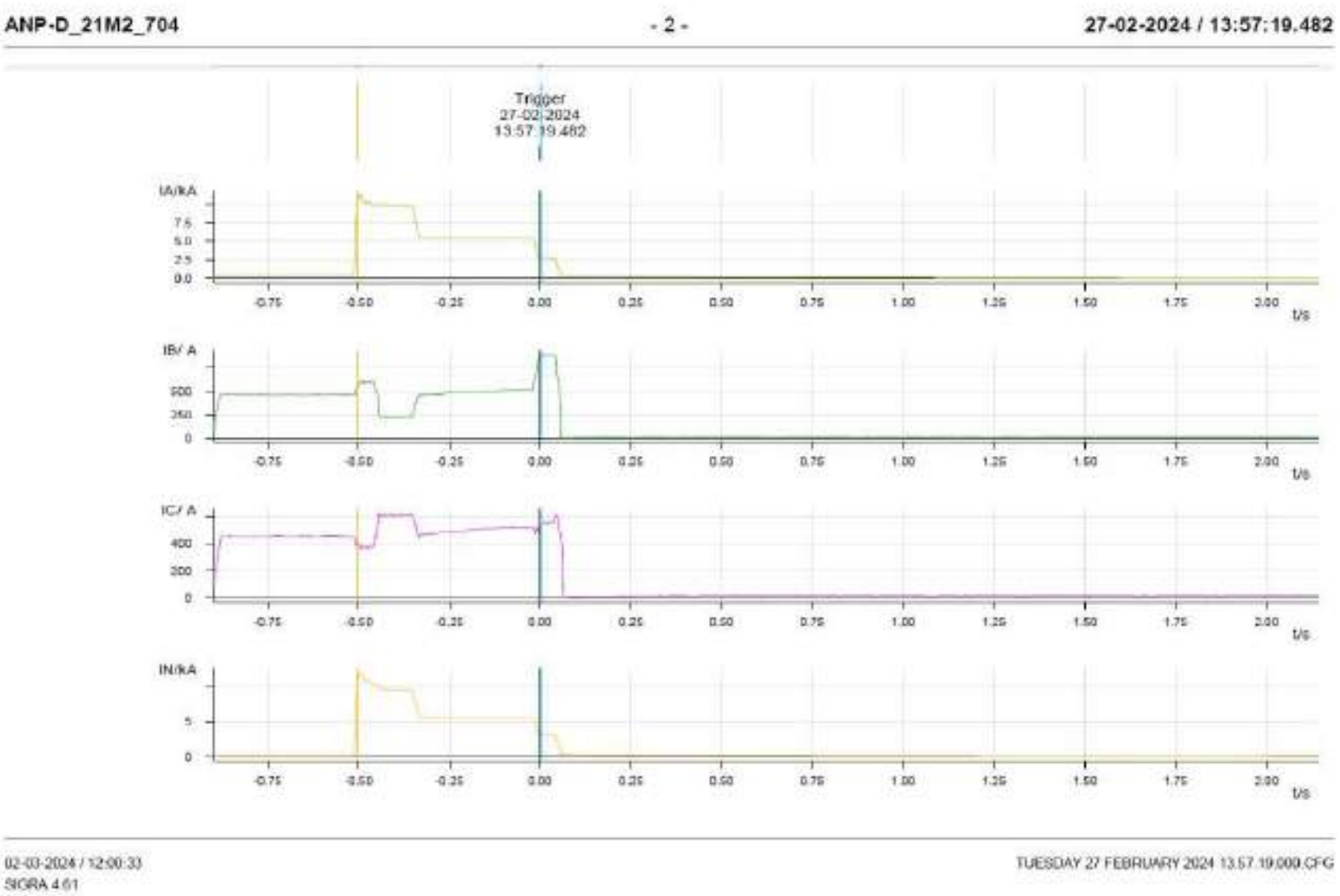


DR of Anpara_D-Obra_C(end) ckt

```
* File Information::
* ------------------
            Station: OBRA-C_21M1 707
             Device: 1
          File Name: C:\USERS\GE\DOCUMENTS\GE S1 AGILE\KKH2_OBRA_AGSYS\OBRA\765KV\B707\P444\1\DR\Tuesday 27 February 2024 18.26.28.000.DAT
          File Size: 616897 Bytes
      Prefault Time: 27/02/2024 18:26:27.188000
        Fault Time: 27/02/2024 18:26:28.174000
        Save Time: 02-27-2024 19:12:48
     Process Time: 02-28-2024 12:05:24
 Start Date && Time: 27/02/2024 18:26:27.188000
   End Date && Time: 27/02/2024 18:26:30.249614
      File Duration: 3  Sec(s) - 61 Mils(s) - 614 Mics(s)
 Sampling Frequency: 1139.040767, 834.000  Microsecond Rate
     Line Frequency: 50.000000

* Maximum/Minimum Analog Summary:
* --------------------------------
>  Max-Inst     Min-Inst      Max-RMS     Min-RMS    One-Bit   Inst-Diff    RMS-Diff   pUnits    Description
 688921.040  -642480.800   641692.500   2346.158   60.6400   46450.240   639346.342     V          1-VA
 648908.640  -643090.560   501578.313   4345.876   60.6400     181.920   497232.437     V          2-VB
 642784.000  -642541.440   552856.625   1976.602   60.6400     242.560   551080.022     V          3-VC
 624652.640  -339826.560   347788.219   4727.895   60.6400  284826.080   343060.324     V          4-VN
    154.700      -154.700      108.970      3.566    5.5250       0.000      105.404     A          5-IA
    165.750      -171.275      147.770      2.255    5.5250       5.525      145.515     A          6-IB
    160.225      -160.225      104.975      2.985    5.5250       0.000      101.990     A          7-IC
     93.925       -27.625       37.659      4.220    5.5250      66.300       33.439     A          8-IN

* Events/Sensors Activity Summary:
* ----------------------------------
>Pst  Lst  Pst-Change        Lst-Change       Changes    Description
  N    N   18:26:28.198808  18:26:28.208816   002          1-Any Start
  N    N   18:26:28.243844  xx:xx:xx.xxxxxx   001          3-M_CB_R-PH_OPEN
  N    N   18:26:28.243844  xx:xx:xx.xxxxxx   001          4-M_CB_Y-PH_OPEN
  N    N   18:26:28.243844  xx:xx:xx.xxxxxx   001          5-M_CB_B-PH_OPEN
  N    N   18:26:28.243844  xx:xx:xx.xxxxxx   001          6-T_CB_R-PH_OPEN
  N    N   18:26:28.243844  xx:xx:xx.xxxxxx   001          7-T_CB_Y-PH_OPEN
  N    N   18:26:28.243844  xx:xx:xx.xxxxxx   001          8-T_CB_B-PH_OPEN
  N    N   18:26:28.173788  xx:xx:xx.xxxxxx   001         30-86A_OPTD
  N    N   18:26:28.173799  xx:xx:xx.xxxxxx   001         31-86B_OPTD

* Events/Sensors Activity Log:
* -----------------------------
> State   Trigger-Time                 Description
    A     27/02/2024 18:26:28.173788   30-86A_OPTD
    A     27/02/2024 18:26:28.173788   31-86B_OPTD
    A     27/02/2024 18:26:28.198808    1-Any Start
N         27/02/2024 18:26:28.208816    1-Any Start
    A     27/02/2024 18:26:28.243844    3-M_CB_R-PH_OPEN
    A     27/02/2024 18:26:28.243844    4-M_CB_Y-PH_OPEN
    A     27/02/2024 18:26:28.243844    5-M_CB_B-PH_OPEN
    A     27/02/2024 18:26:28.243844    6-T_CB_R-PH_OPEN
    A     27/02/2024 18:26:28.243844    7-T_CB_Y-PH_OPEN
    A     27/02/2024 18:26:28.243844    8-T_CB_B-PH_OPEN
```

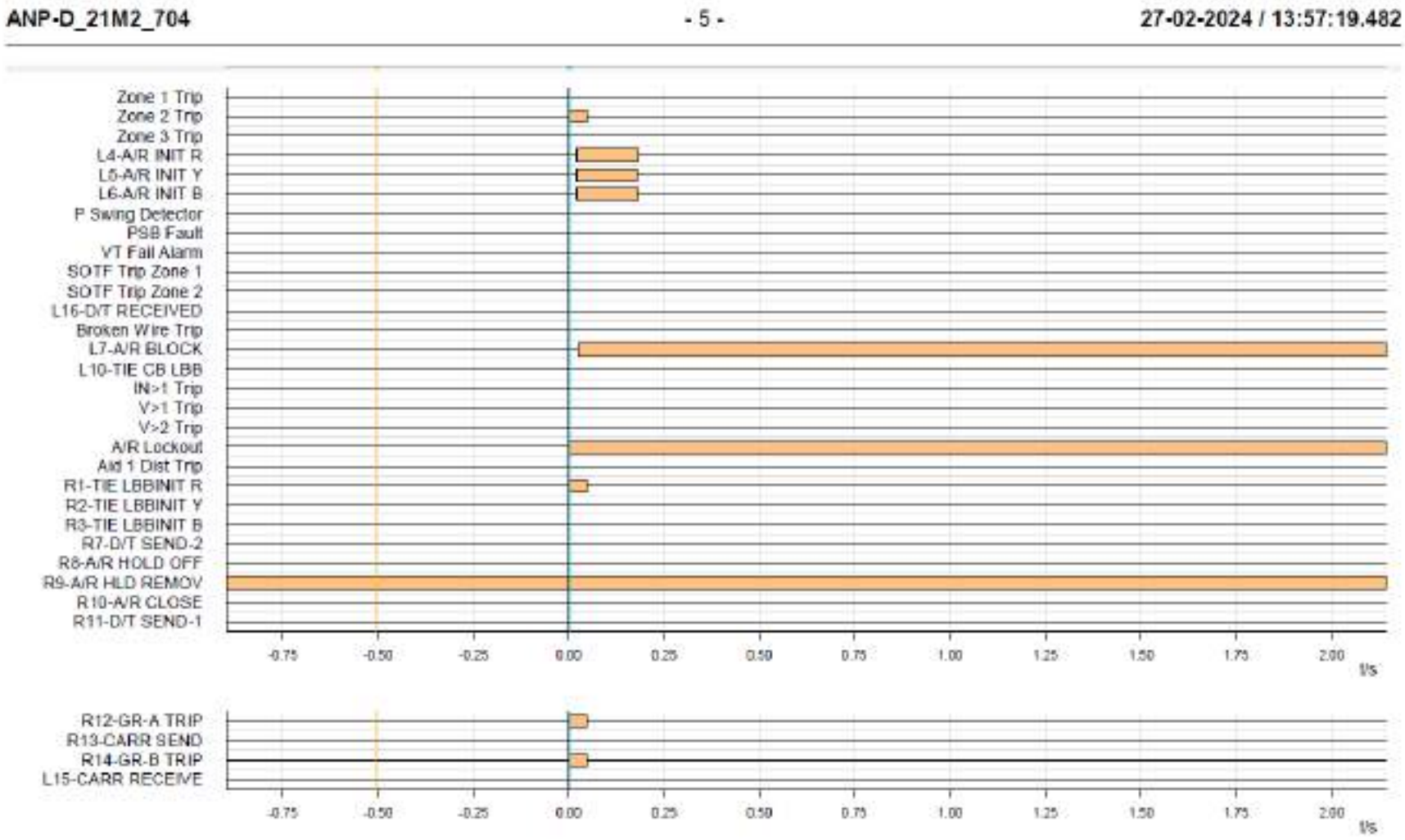
Time not synced; No protection operation flags recorded

DR of 765kV Anpara_D-Obra_C ckt at Anpara_D end



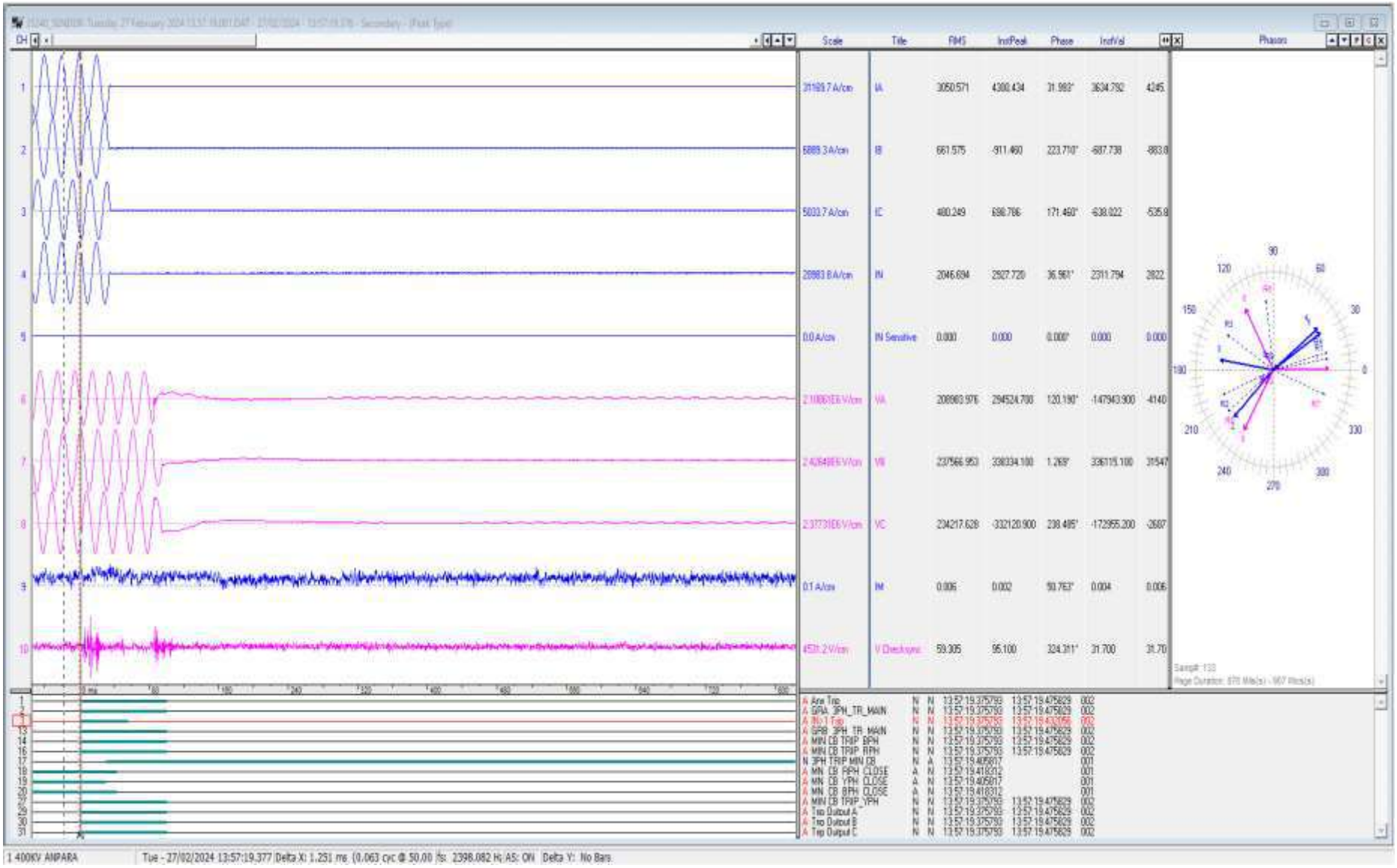
Delayed clearance from Anpara_D end is observed (~550msec), fault current was approx. ~7.5kA.

DR of 765kV Anpara_D-Obra_C ckt at Anpara_D end



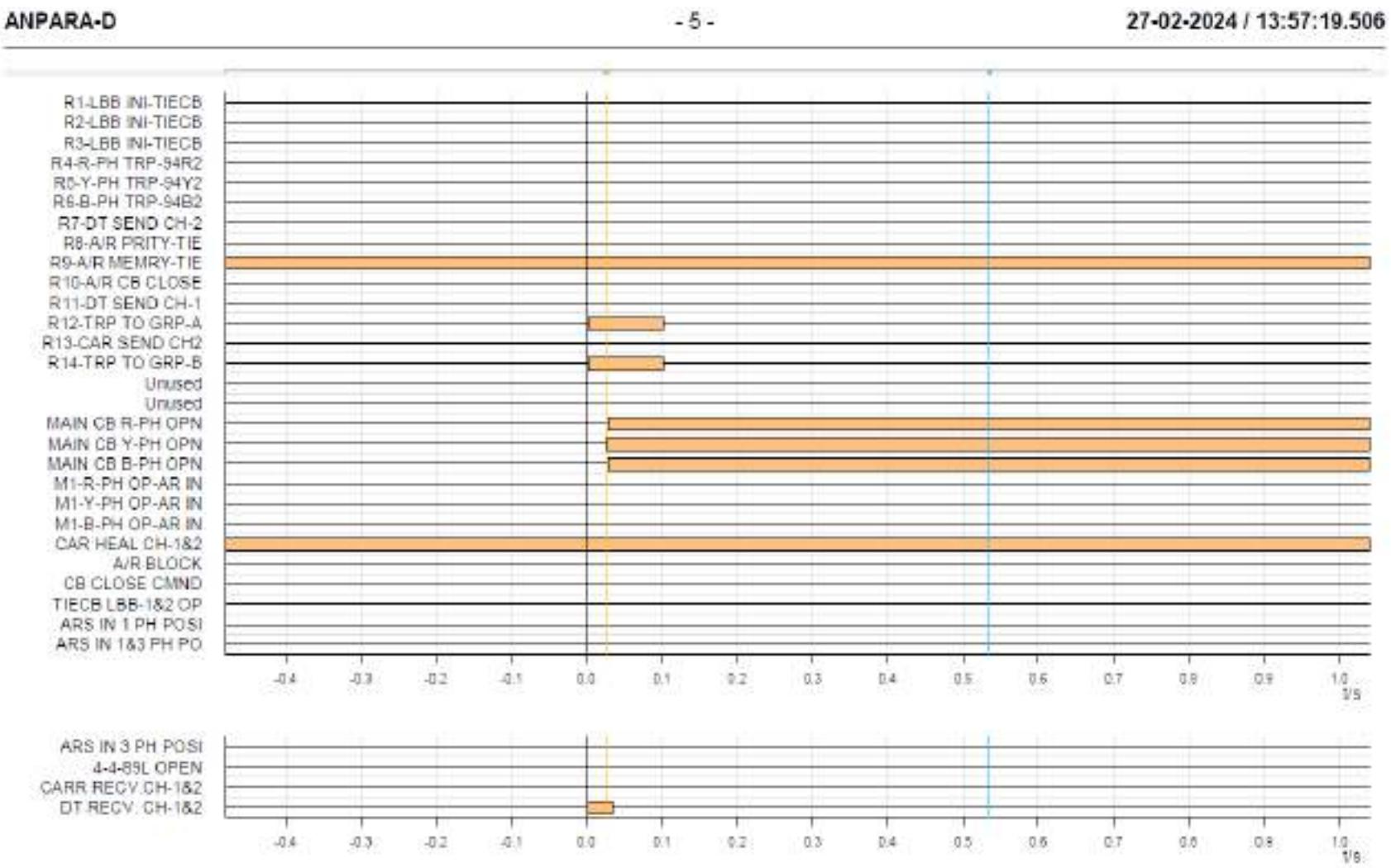
Fault was sensed in Z-2 at Anpara_D end.

DR of 400kV Anpara(end)-Anpara_D ckt-1



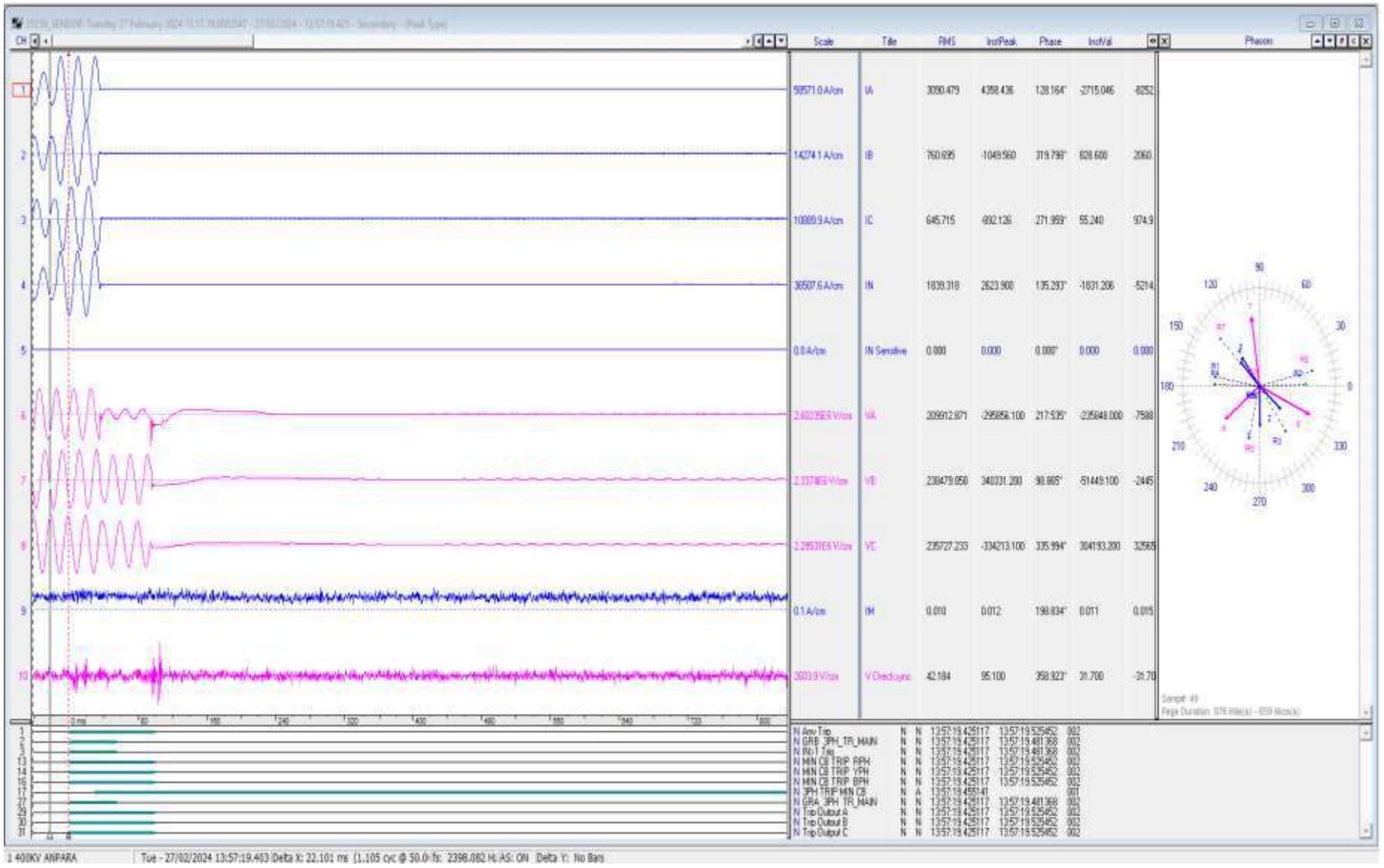
O/C E/F protection operated; Protection setting and coordination need to be reviewed.

DR of 400kV Anpara-Anpara_D(end) ckt-1



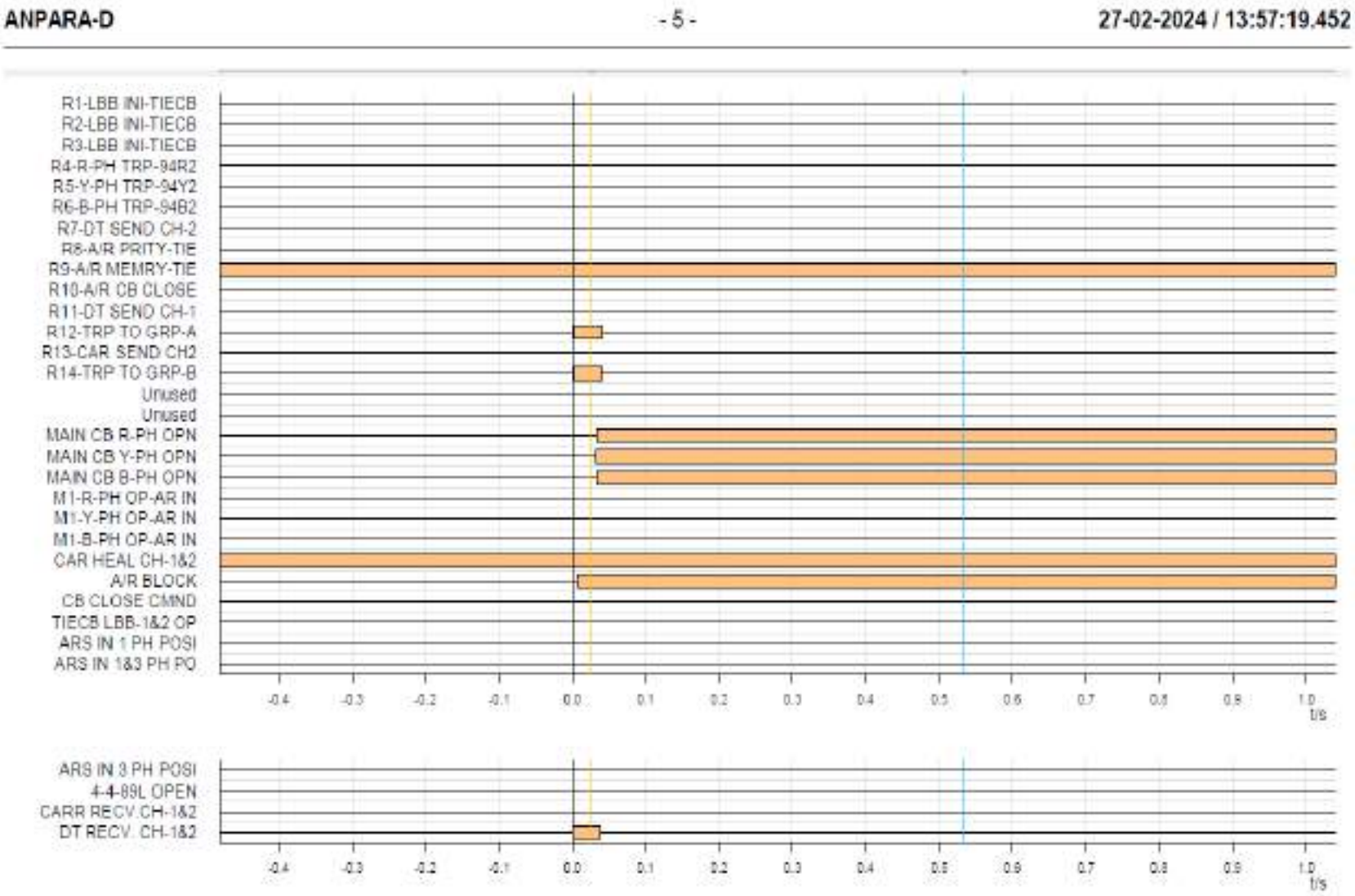
DT received at Anpara_D end

DR of 400kV Anpara(end)-Anpara_D ckt-2



O/C E/F protection operated; Protection setting and coordination need to be reviewed.

DR of 400kV Anpara-Anpara_D(end) ckt-2



DT received at Anpara_D end

SCADA SOE

Time	Station Name	Voltage	Element Name	Element Type	Element Status	Remarks
13:57:19,021	OBRAC_U	765kV	08APDT2	Circuit Breaker	disturbe	
13:57:19,022	OBRAC_U	765kV	07ANPAD	Circuit Breaker	disturbe	
13:57:19,131	ANPAC_UP	765kV	04ANPAD	Circuit Breaker	Open	Main & Tie CB at Anpara_C end of 765kV Anpara_C-Anpara_D ckt opened
13:57:19,132	ANPAC_UP	765kV	05ANPAD	Circuit Breaker	Open	
13:57:19,472	ANPAD_UP	400kV	07ANPAR2	Circuit Breaker	Open	Main & Tie CB at Anpara_D end of 400kV Anpara_D-Anpara ckt-2 opened
13:57:19,472	ANPAD_UP	400kV	08ANP2ST	Circuit Breaker	Open	
13:57:19,518	ANPAD_UP	765kV	04OBRAC	Circuit Breaker	Open	Main & Tie CB at Anpara_D end of 765kV Anpara_D-Obra_C ckt opened
13:57:19,519	ANPAD_UP	765kV	05UNGBR	Circuit Breaker	Open	
13:57:19,521	ANPAD_UP	400kV	04ANPAR1	Circuit Breaker	Open	Main & Tie CB at Anpara_D end of 400kV Anpara_D-Anpara ckt-1 opened
13:57:19,521	ANPAD_UP	400kV	05ANP1ST	Circuit Breaker	Open	
13:57:19,562	ANPAD_UP	400kV	01T1	Circuit Breaker	Open	Main & Tie CB of 765/400kV ICT-1 at Anpara_D opened from 400kV side
13:57:19,563	ANPAD_UP	400kV	02T1T2	Circuit Breaker	Open	
13:57:19,565	ANPAD_UP	765kV	08U06T1	Circuit Breaker	Open	Tie CB between 765/400kV ICT-1 and unit 6 opened at Anpara_D
13:57:19,567	ANPAD_UP	765kV	07T1	Circuit Breaker	Open	Main CB of 765/400kV ICT-1 at Anpara_D opened from 765kV side
13:57:19,885	ANPAR_UP	400kV	25ANPAD1	Circuit Breaker	Open	Main CB at Anpara end of 400kV Anpara-Anpara_D ckt-1 opened
13:57:20,043	OBRAC_U	765kV	07ANPAD	Circuit Breaker	Close	Main CB at Obra_C end of 765kV Obra_C-Anpara_D ckt closed
13:57:20,254	OBRAC_U	765kV	08APDT2	Circuit Breaker	Open	Tie CB between 765/400kV ICT-2 and Anpara_D line opened at Obra_C
13:57:20,874	OBRAC_U	765kV	08APDT2	Circuit Breaker	Close	Tie CB between 765/400kV ICT-2 and Anpara_D line closed at Obra_C
13:57:22,614	ANPAD_UP	765kV	09U06	Circuit Breaker	Open	Main CB at Anpara_D of unit-6 opened
13:57:23,962	ANPAD_UP	765kV	03U07	Circuit Breaker	Open	Main CB at Anpara_D of unit-7 opened
13:57:23,965	ANPAD_UP	765kV	02ANPU07	Circuit Breaker	Open	Tie CB between Unit-7 and Anpara_C line opened at Anpara_D

Point of discussion

- Exact location and nature of fault?
- Reason of delayed clearance of fault from Anpara_D end?
- Details of A/R operation in line on R-N fault?
- 765kV Anpara_D-Anpara_C ckt and 400kV Anpara_D-Anpara D/C tripped from remote end on O/C E/F protection within before tripping of main faulted line from Anpara_D end. Anpara_D end CB opened within ~550msec. Proper coordination of main and backup protection need to be ensured to avoid undesired tripping of lines.
- DR(.dat/.cfg) file of all the tripped elements not received.
- Detailed report along with remedial action taken details not received.
- Standardization (nomenclature, time sync etc) of recording instrument (DR/EL) need to be ensured.

765/400kV DTPS, ANPARA, UPRVUNL

27.02.2024, 13:57:19

TRIPPING OF 500MW UNIT-6 & 7 ALONG WITH 765kV OBRA-C, 765kV LANCO & 400kV ANPARA-B LINE-I&II DUE TO FAULT ON 765kV OBRA-C LINE

TRIPPING OF 500MW UNIT-6 & 7 ALONG WITH 765kV OBRA-C, 765kV LANCO & 400kV ANPARA-B LINE-I&II TO FAULT ON 765kV OBRA-C LINE

- **Date & Time of event**: 27.02.2024 at 13:57:19 Hrs
- **Sub-Station affected**: 765/400kV DTPS, Anpara
- **Date & Time of restoration**:

SEQUENCE OF TRIPPING WITH TIME & BOTH END FLAGS				
NAME OF ELEMENT	RESTORATION DATE	RESTORATION TIME	FLAGS END 1 (INCLUDING A/R)	FLAGS END 2 (INCLUDING A/R)
400kV Anpara D-Anpara B line-I	27.02.2024	14:44	1. DT Received 2. 86A, 86B Trip	1. R Phase D/R OC/EF Trip 2. 86T A & 86T B Trip
400kV Anpara D-Anpara B line-II	27.02.2024	18:28	1. DT Received 2. 86A, 86B Trip	1. R Phase D/R OC/EF Trip 2. 86T A & 86T B Trip
765kV Anpara D-Lanco line	27.02.2024	17:36	Not Tripped/Dead	1. R Phase OC Trip 2. 86T A & 86T B Trip
765kV Anpara D-Obra C line	28.02.2024	14:11	1. R Phase Zone-II Trip 2. AR Operated 3. 86A & 86B Trip	1. R Phase Zone-1 Trip 2. AR Operated
1000MVA 765/400kV ICT	28.02.2024	17:13	Dead	Dead
765kV Bus Reactor	28.02.2024	14:17	Not Trip/Dead	--
80MVA 400kV Station-I	27.02.2024	15:12	Not Trip/Dead	--
80MVA 400kV Station-II	27.02.2024	14:56	Not Trip/Dead	--

Antecedent condition

ANTECEDENT CONDITIONS	
FREQUENCY	50.06 Hz
BUS VOLTAGE **(AFFECTED S/S)**	400kV Bus-I : 410kV 400kV Bus-II : 409kV 765kV Bus-I : 775kV 765kV Bus-II : 776kV
WEATHER CONDITION	Stormy

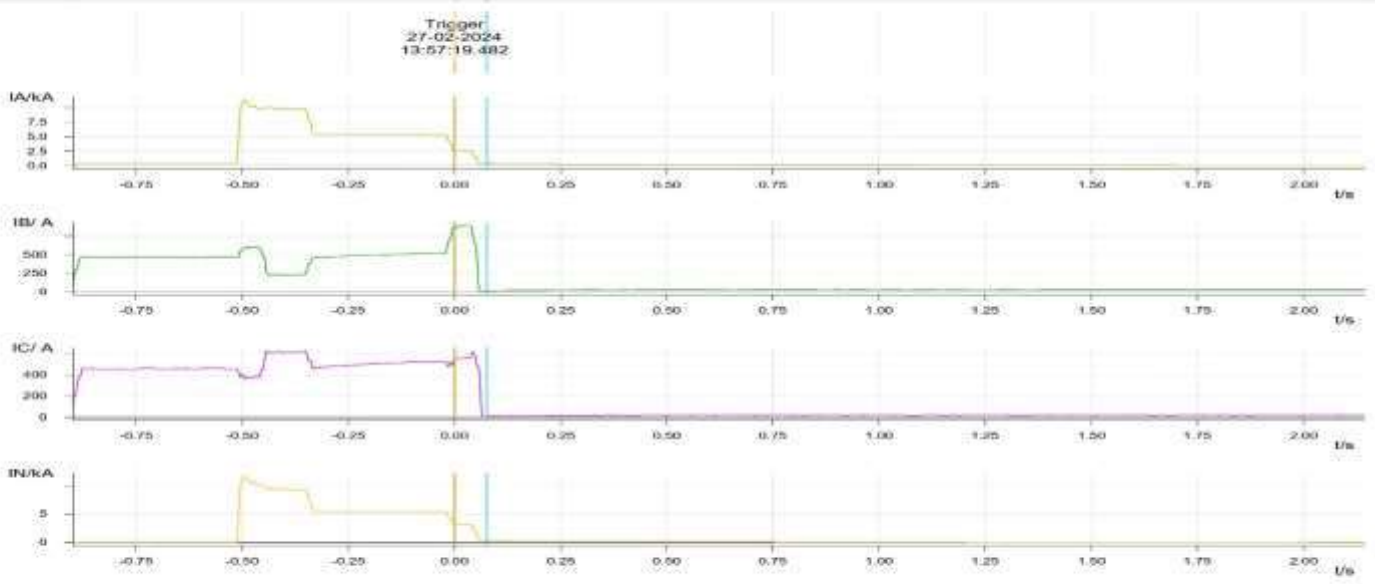
Report

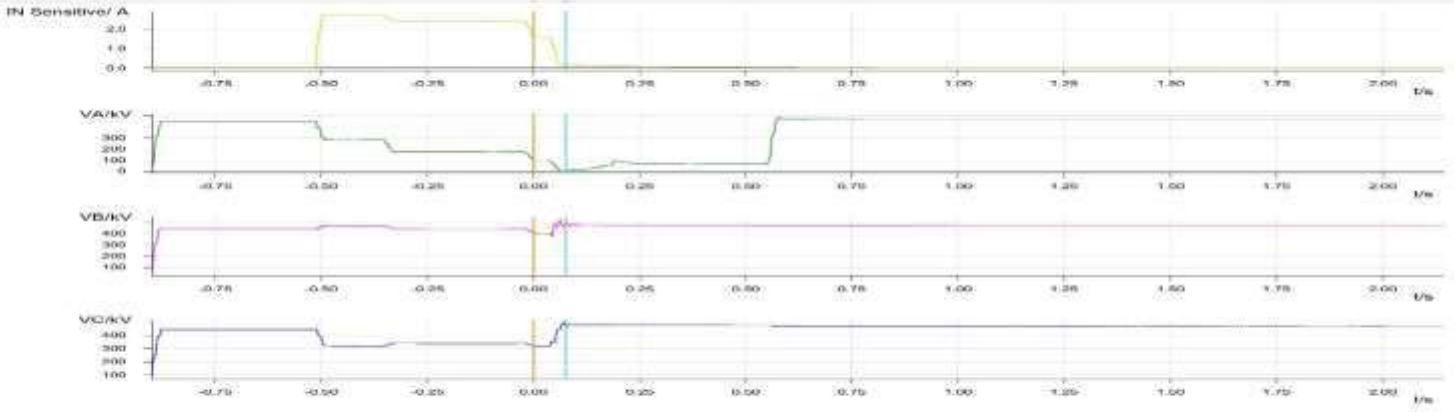
DISCRIPTION AND CAUSE OF EVENT	Transient fault started in 765kV Anpara D- Obra C line and line tripped on R Phase Zone-II fault from Anpara D end. Simultaneously 765kV Anpara D-Lanco line tripped from Lanco end only on R Phase OC fault along with tripping of both the 400kV Anpara D-Anpara B line- I &II from Anpara B end on R Phase Directional EF fault and sent Direct Trip (DT) to Anpara D end, resulted tripping of both the line from Anpara D end also. Due to tripping of all 765/400kV lines, 765/400kV substation Bus-I&II become dead, resulted No/Zero station supply for both 80MVA, 400kV Station transformer-I&II. Both 500MW Unit-6 & 7 tripped due to unavailability of station supply and power evacuation route.

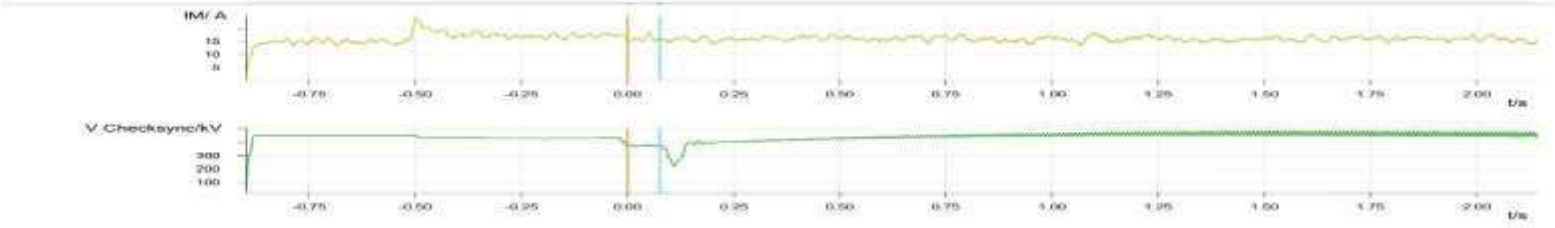
765kV ANPARA D-OBRA C LINE

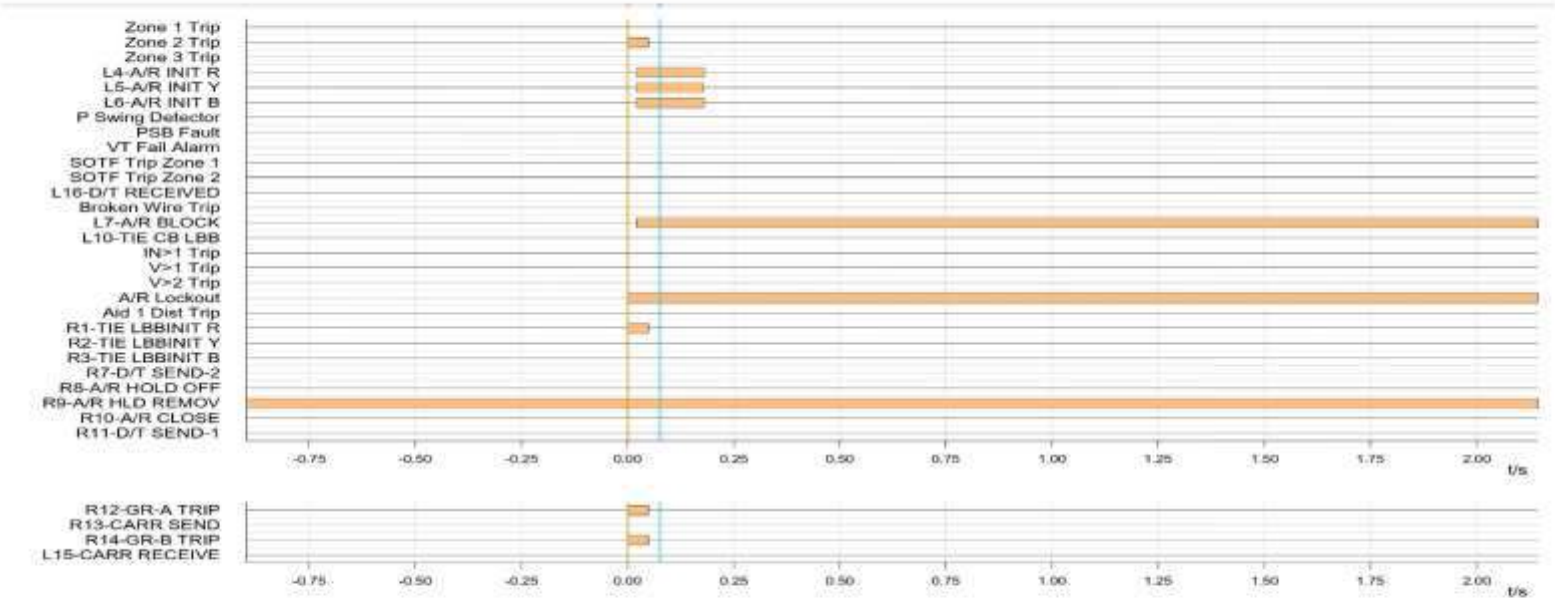
- **Event:** Transient fault started in 765kV Anpara D- Obra C line (8km from Obra C end) and line tripped on R Phase Zone-II fault from Anpara D end only however auto reclose successful from Obra C end.
- **Reason of Delayed Tripping**: Carrier signal was initiated from Obra C end relay but not received at Anpara D end relay caused tripping of line in Zone-II and along with unsuccessful operation of auto reclose.
- Anpara D end DR is enclosed.

3.1 DR 765kV Anpara D-Obra C Line (DTPS End Relay).pdf


Trigger
27-02-2024
13:57:19.482
IA/kA
IB/ A
IC/ A
IN/kA
t/s


IN Sensitive/ A
VA/kV
VB/kV
VC/kV
t/s


IM/ A
15
10
5
-0.75
-0.50
-0.25
0.00
0.25
0.50
0.75
1.00
1.25
1.50
1.75
2.00
t/s
V Checksync/kV
300
200
100
-0.75
-0.50
-0.25
0.00
0.25
0.50
0.75
1.00
1.25
1.50
1.75
2.00
t/s

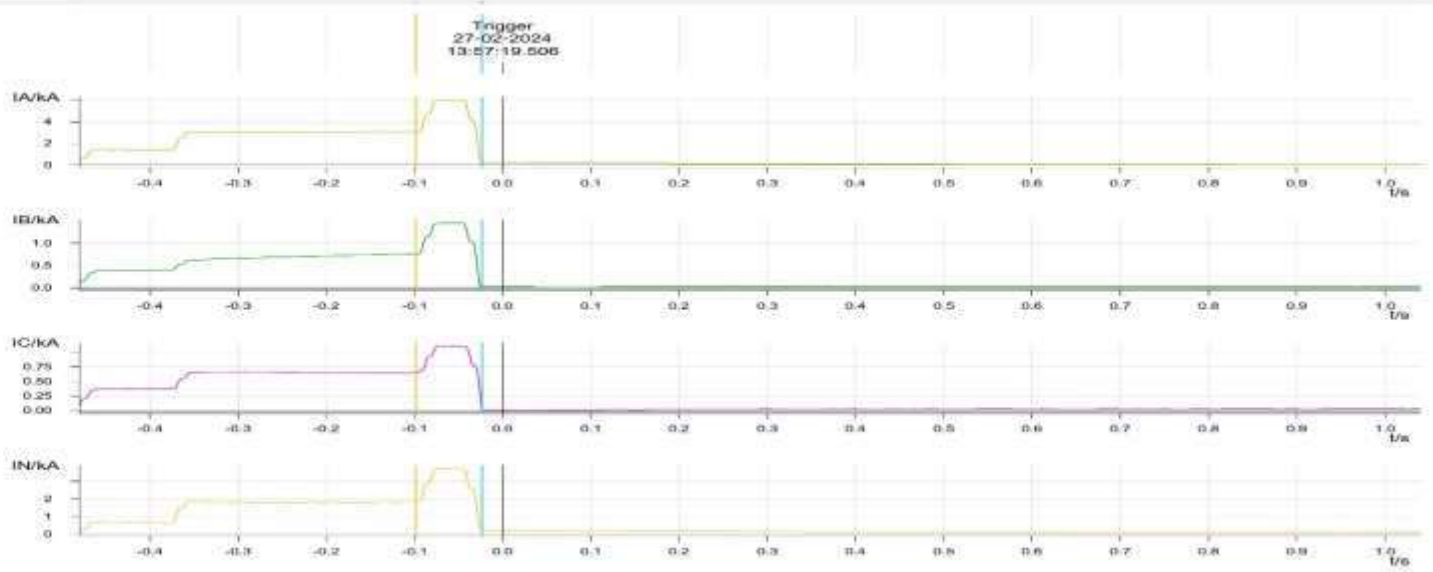

Zone 1 Trip
Zone 2 Trip
Zone 3 Trip
L4-A/R INIT R
L5-A/R INIT Y
L6-A/R INIT B
P Swing Detector
PSB Fault
VT Fail Alarm
SOTF Trip Zone 1
SOTF Trip Zone 2
L16-D/T RECEIVED
Broken Wire Trip
L7-A/R BLOCK
L10-TIE CB LBB
IN>1 Trip
V>1 Trip
V>2 Trip
A/R Lockout
Aid 1 Dist Trip
R1-TIE LBBINIT R
R2-TIE LBBINIT Y
R3-TIE LBBINIT B
R7-D/T SEND-2
R8-A/R HOLD OFF
R9-A/R HLD REMOV
R10-A/R CLOSE
R11-D/T SEND-1
-0.75
-0.50
-0.25
0.00
0.25
0.50
0.75
1.00
1.25
1.50
1.75
2.00
t/s
R12-GR-A TRIP
R13-CARR SEND
R14-GR-B TRIP
L15-CARR RECEIVE
-0.75
-0.50
-0.25
0.00
0.25
0.50
0.75
1.00
1.25
1.50
1.75
2.00
t/s

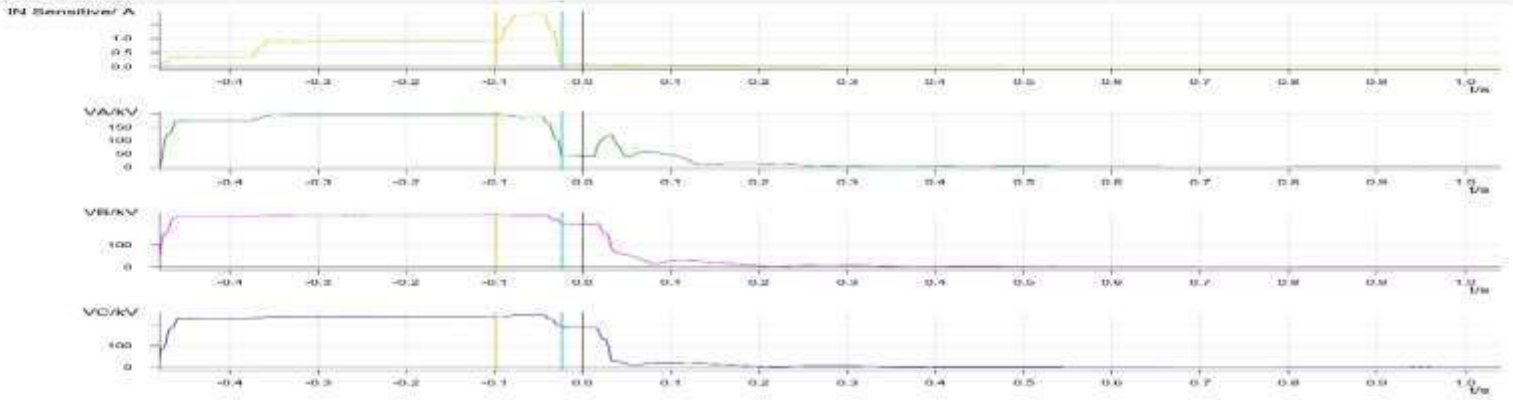
765kV ANPARA D- LANCO LINE

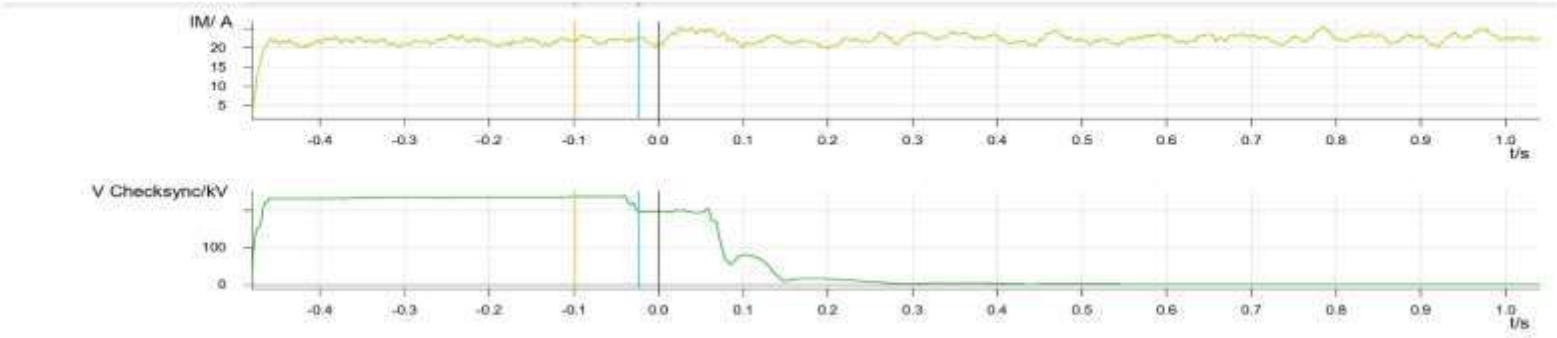
- **Event**: 765kV Anpara D- LANCO line tripped on R Phase OC protection from LANCO end Only.
- **Reason of Wrong Tripping**: Unwanted tripping was occurred due to Over current protection operation at LANCO end, causes complete power evacuation issues for 2X500MW Generators of DTPS Anpara.

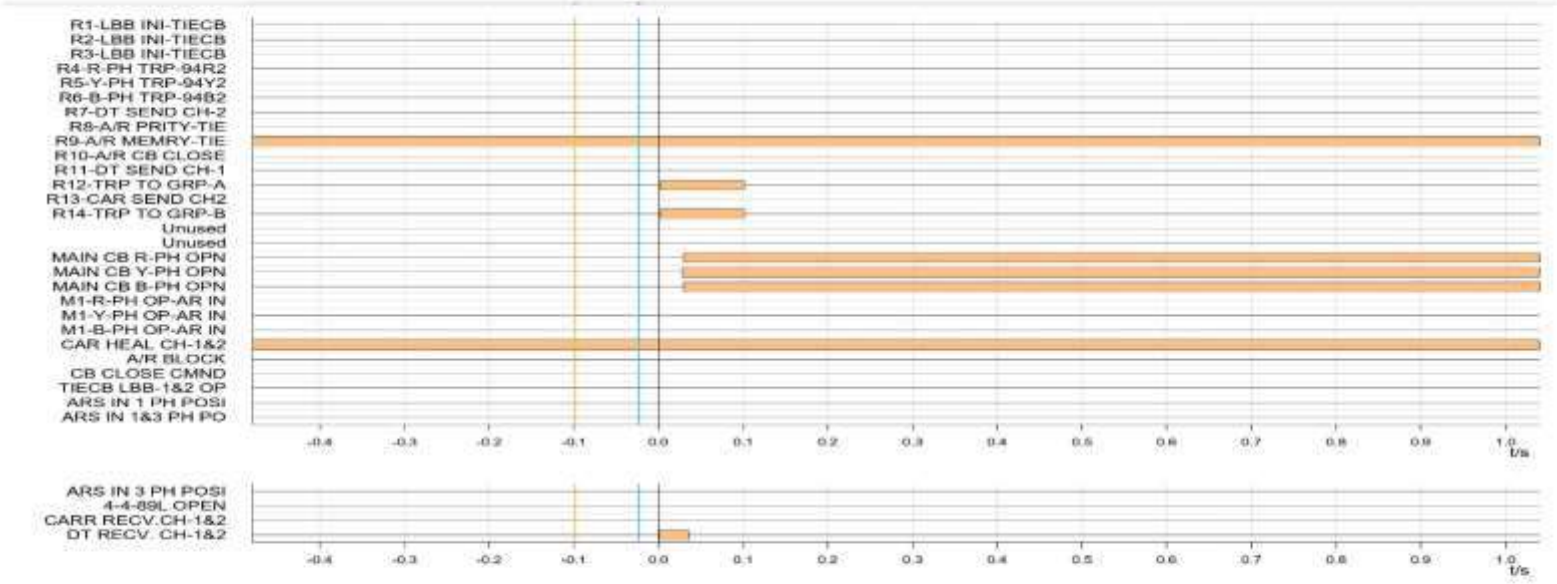
400kV ANPARA D-ANPARA B LINES

- **Event**: Both the 400kV Anpara D-Anpara B lines tripped from Anpara B end on R Phase Directional EF (Backup) Protection and sent Direct Trip (DT) to Anpara D end causes tripping line from both end.
- **Reason of Wrong Tripping**: Backup Protection Setting at Anpara B end for both the line was not properly coordinated with the Zone-II/III time of the line.
- Anpara D end DRs are enclosed.


Trigger
27-02-2024
13:57:19.506
IA/kA
IB/kA
IC/kA
IN/kA
t/s


IN Sensitive/ A
VA/kV
VB/kV
VC/kV
t/s


IM/ A
20
15
10
5
-0.4 -0.3 -0.2 -0.1 0.0 0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9 1.0
t/s
V Checksync/kV
100
0
-0.4 -0.3 -0.2 -0.1 0.0 0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9 1.0
t/s


R1-LBB INI-TIECB
R2-LBB INI-TIECB
R3-LBB INI-TIECB
R4-R-PH TRP-94R2
R5-Y-PH TRP-94Y2
R6-B-PH TRP-94B2
R7-DT SEND CH-2
R8-A/R PRITY-TIE
R9-A/R MEMRY-TIE
R10-A/R CB CLOSE
R11-DT SEND CH-1
R12-TRP TO GRP-A
R13-CAR SEND CH2
R14-TRP TO GRP-B
Unused
Unused
MAIN CB R-PH OPN
MAIN CB Y-PH OPN
MAIN CB B-PH OPN
M1-R-PH OP-AR IN
M1-Y-PH OP-AR IN
M1-B-PH OP-AR IN
CAR HEAL CH-1&2
A/R BLOCK
CB CLOSE CMND
TIECB LBB-1&2 OP
ARS IN 1 PH POSI
ARS IN 1&3 PH PO
-0.4 -0.3 -0.2 -0.1 0.0 0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9 1.0
t/s
ARS IN 3 PH POSI
4-4-89L OPEN
CARR RECV.CH-1&2
DT RECV. CH-1&2
-0.4 -0.3 -0.2 -0.1 0.0 0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9 1.0
t/s

Remedial Measures Taken

- **765kV Anpara D-Obra C line (Anpara D end)**: Shutdown has been approved in OCC meeting. Shutdown of line will be taken on 01.05.24 for testing of carrier receive and send in between Anpara D and Obra C. However, timing of the Zone-II has already been revised in both the Distance Relays to 350ms.
- **765kV Anpara D-LANCO Line (LANCO end):** As per the e-mail received from Lanco end, Overcurrent Protection has been made disable by LANCO TPS.
- **400kV Anpara D-Anpara B Line-I & II (Anpara B end):** Directional EF Protection setting has been revised according to the Zone-III timing of the lines.

THANK YOU.

Multiple elements tripping at 400/220kV Akal(RS) 02nd January 2024

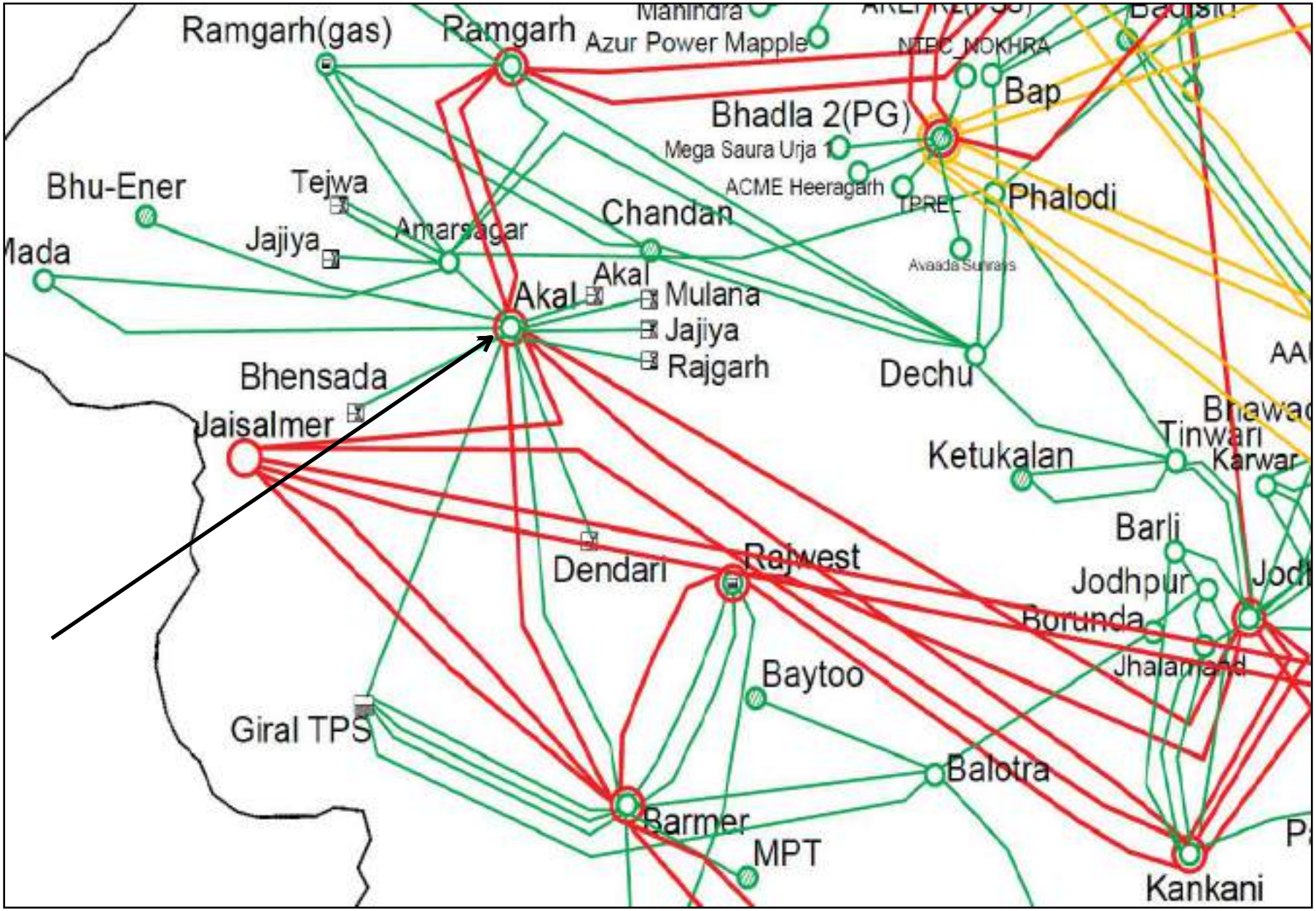
Brief of event:

- 400/220kV Akal(RS) has one and half breaker scheme at 400kV level and double main transfer bus scheme at 220kV level.
- As reported, at 07:28hrs, 220 KV Akal(RS)-Bhu(RS) Ckt-1 tripped on B-N phase to earth fault due to heavy fog.
- At the same time, 400/220 kV 500 MVA ICT-1, 2 & 4 and 315MVA ICT-3 at Akal(RS) also tripped. (Exact reason yet to be shared, but it is suspected that there is delay in CB opening due to which ICTs also got tripped. Also O/C protection settings of ICTs need to be shared.)
- As per SCADA SOE, 220kV Akal(RS)-Barmer(RS) Ckt also tripped during the same time. (Exact reason yet to be shared)
- As per PMU at Jodhpur(RS), two consecutive **B-N phase to earth faults** are observed with **delayed fault clearance time of 320ms and 1400ms respectively**.
- As per SCADA, change in demand of approx. 160MW is observed in Rajasthan control area.
- As per SCADA, change in Rajasthan wind generation of approx. 690MW is observed.

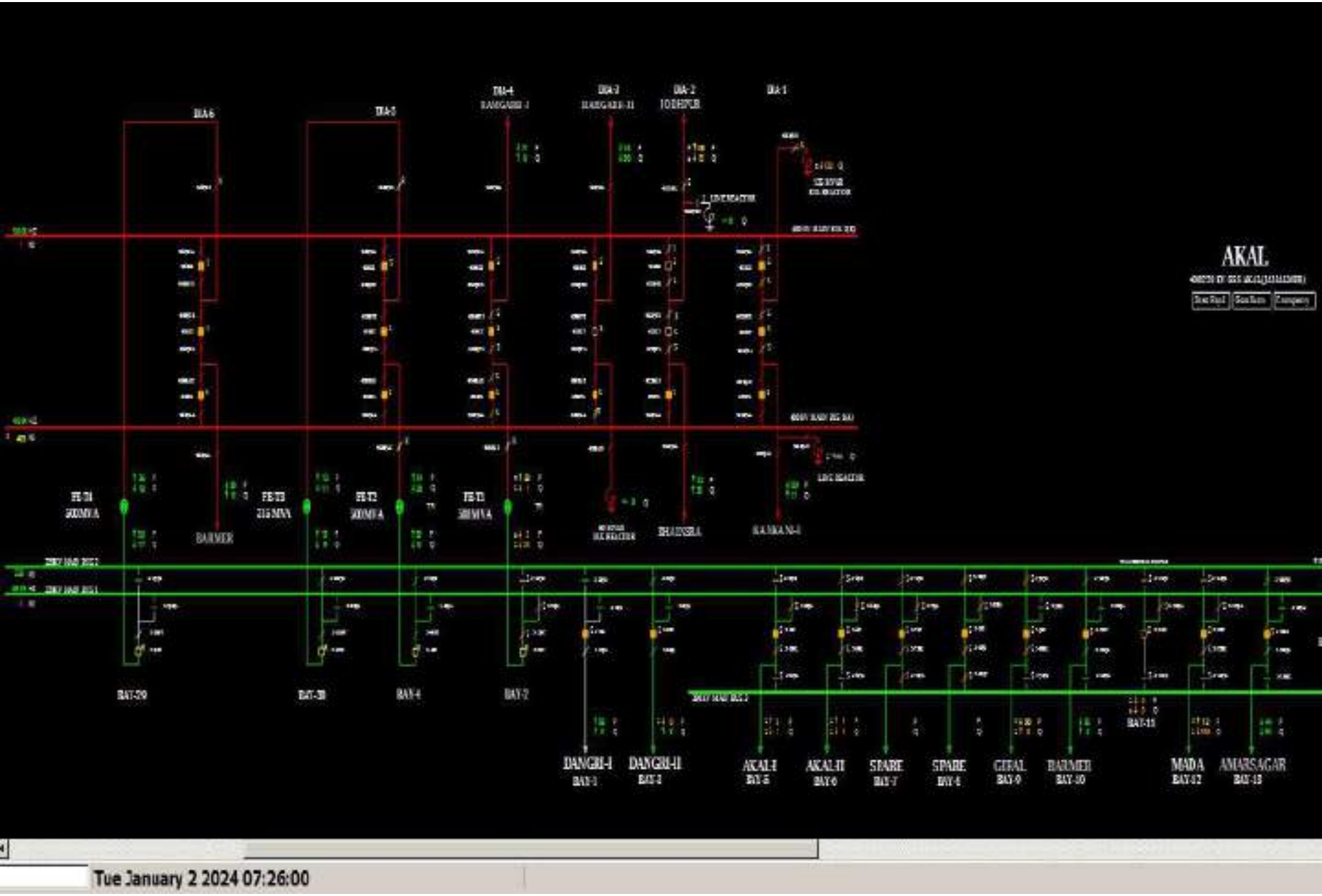
Elements tripped:

i. 400/220 kV 500 MVA ICT 1 at Akal(RS)
ii. 400/220 kV 500 MVA ICT 2 at Akal(RS)
iii. 400/220 kV 315 MVA ICT 3 at Akal(RS)
iv. 400/220 kV 500 MVA ICT 4 at Akal(RS)
v. 220kV Akal-Barmer ckt (as per SOE)

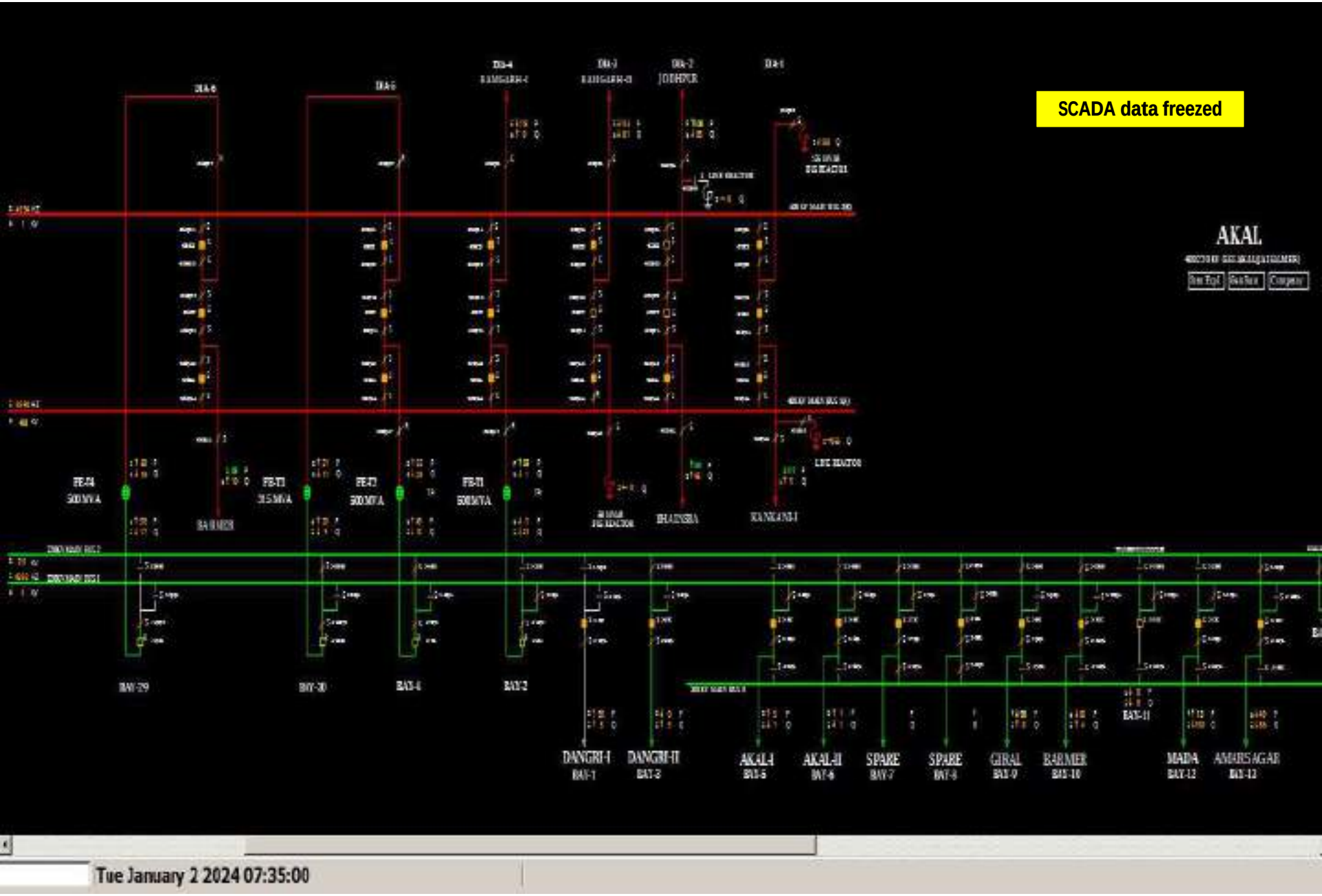
Network Diagram



SLD of 400/220kV Akal(RS) before the event

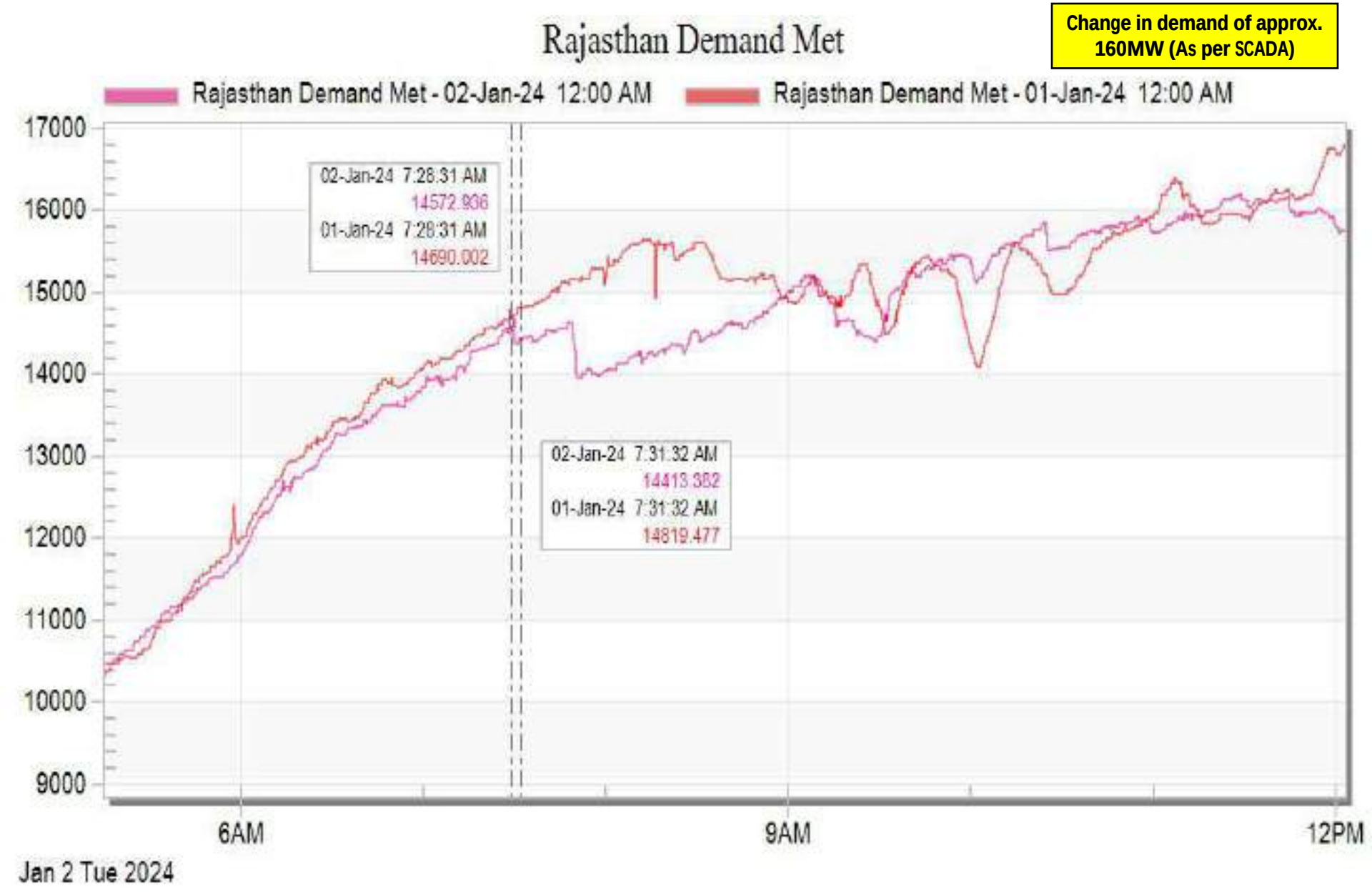


SLD of 400/220kV Akal(RS) after the event



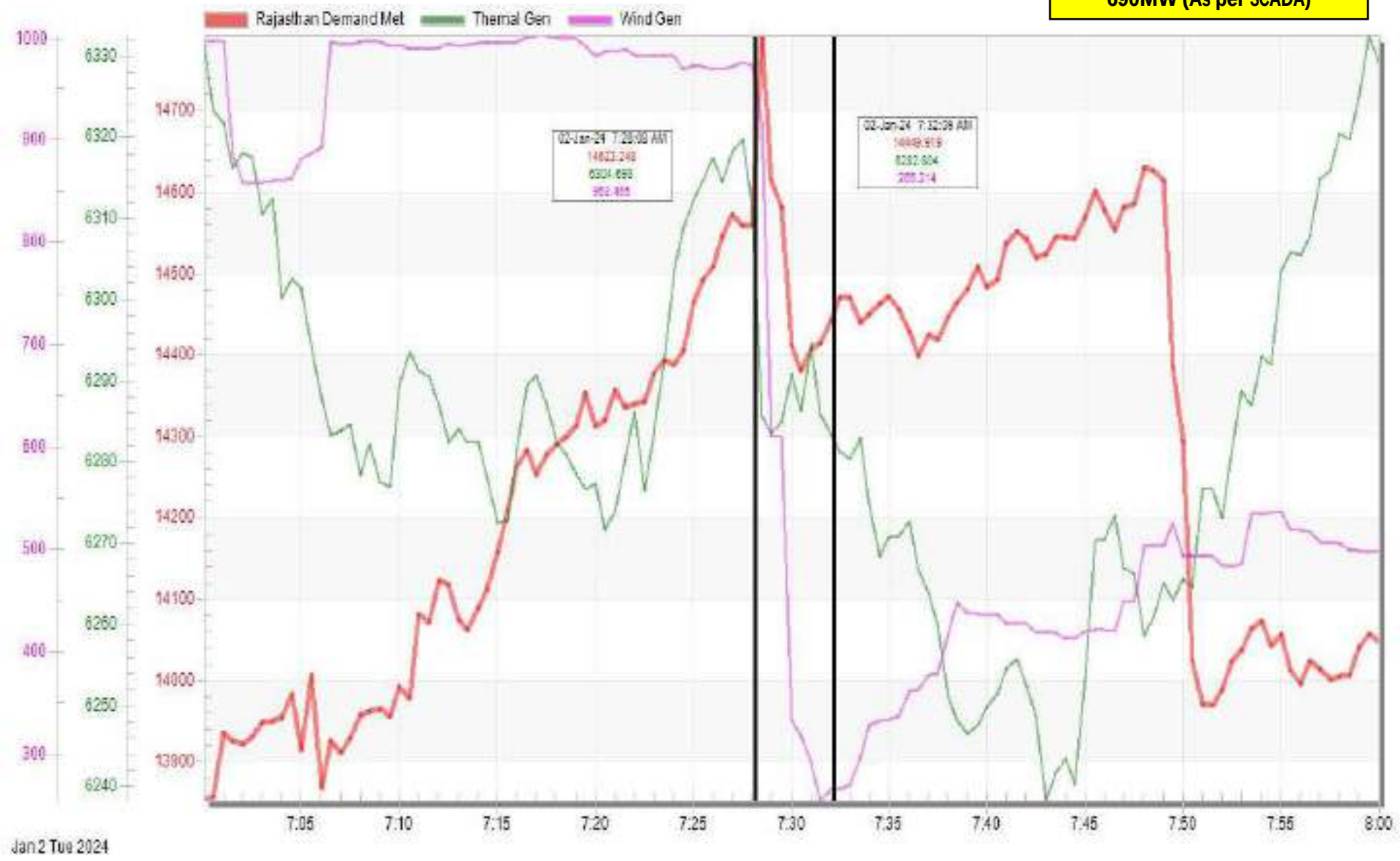
Rajasthan Demand during the event

Change in demand of approx. 160MW (As per SCADA)



Rajasthan Wind Generation during the event

Wind generation loss of approx. 690MW (As per SCADA)



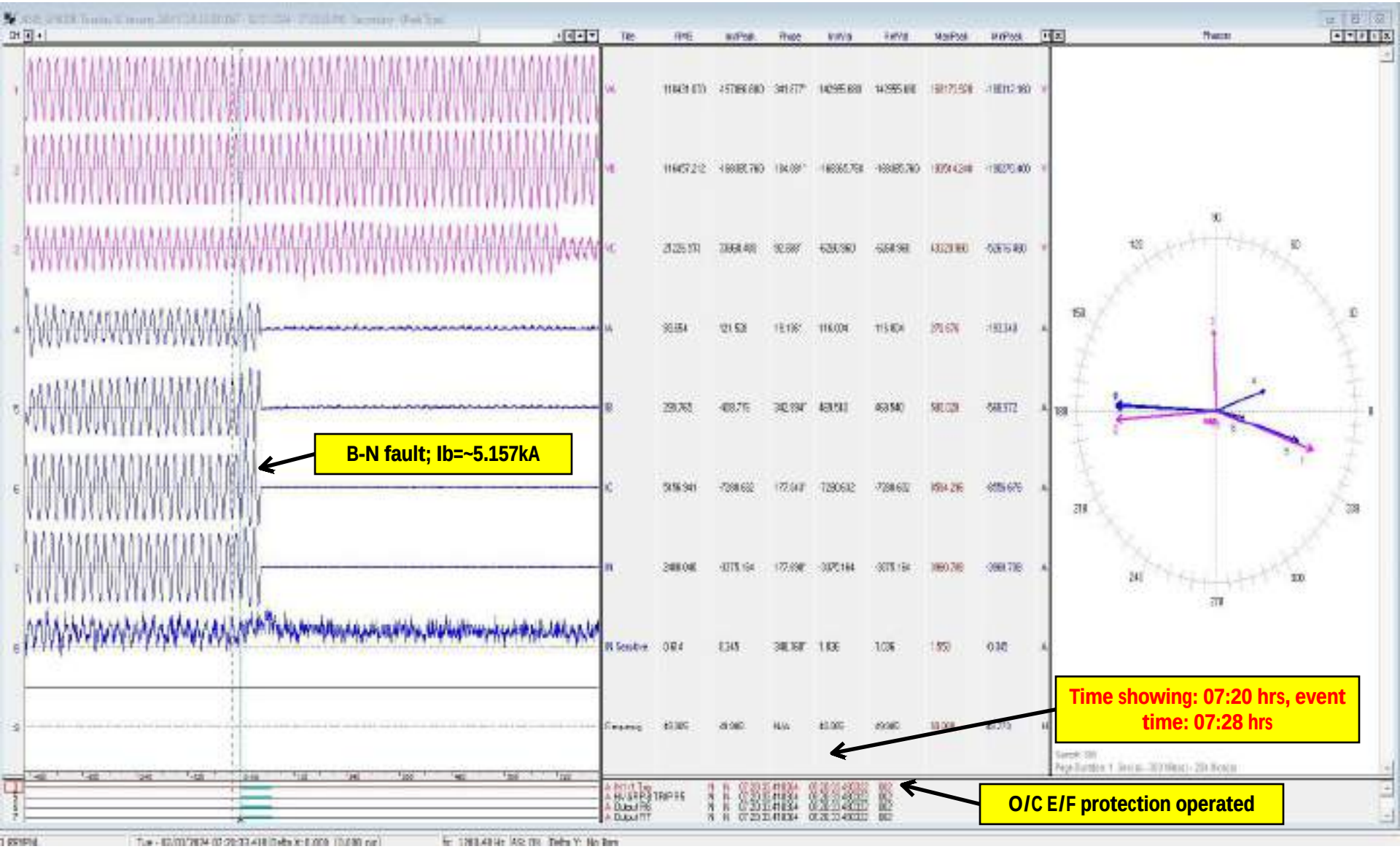
PMU Plot of frequency at Jodhpur(RS)

07:28 hrs/02-Jan-24

PMU Plot of phase voltage magnitude Jodhpur(RS)

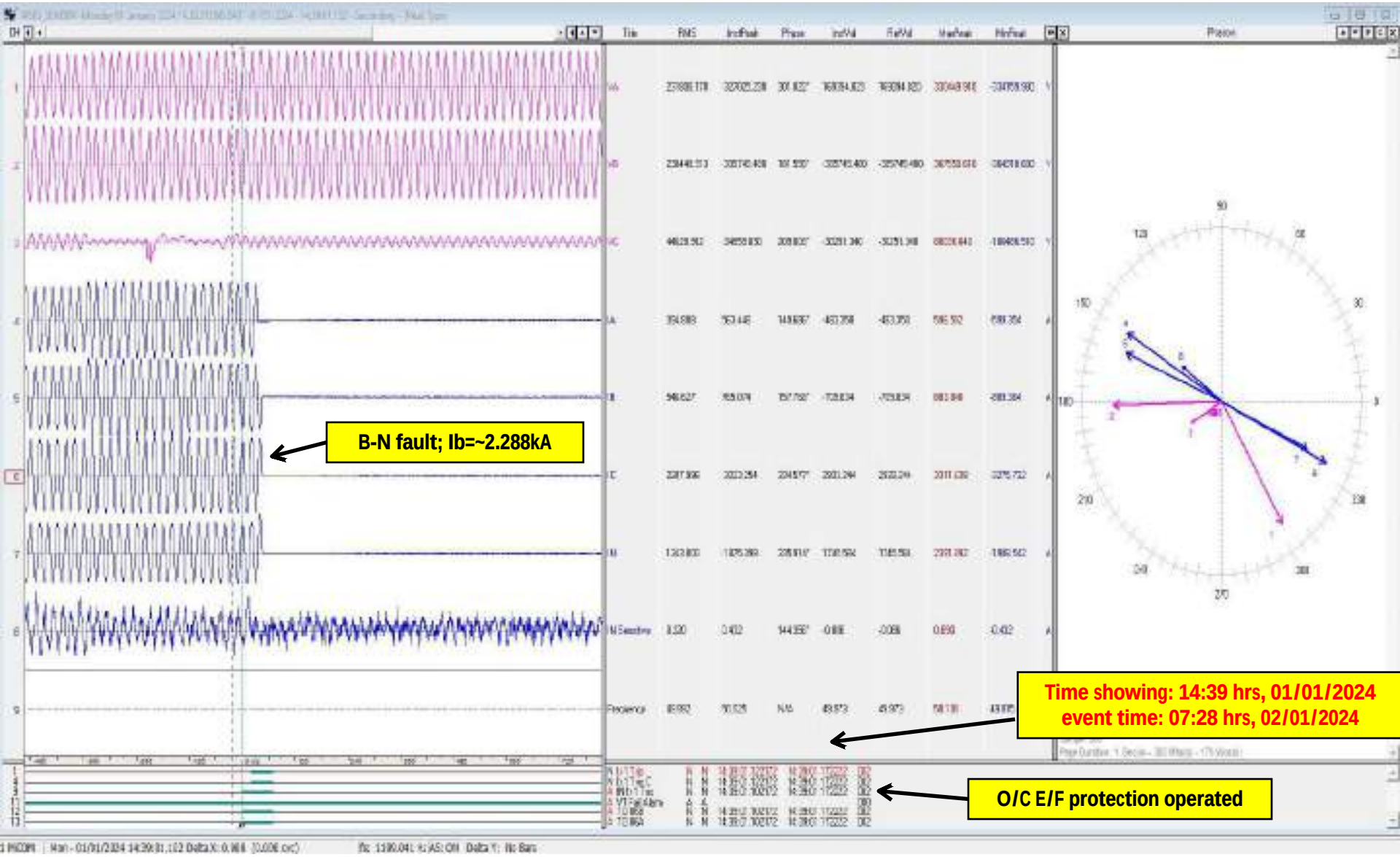
07:28 hrs/02-Jan-24

DR of 400/220 kV 500 MVA ICT 2 at Akal(RS)



As per DR, O/C E/F protection operated and fault current was Ib=~5.157kA. Time not sync and DR nomenclature is also not correct.

DR of 400/220 kV 315 MVA ICT 3 at Akal(RS)



As per DR, O/C E/F protection operated and fault current was Ib=~2.288kA. Time not sync and DR nomenclature is also not correct.

SCADA SOE

Time	Station Name	Voltage	Element Name	Element Type	Element Status	Remarks
07:28:12,493	BARMR_RS	220kV	06AKAL	Circuit Breaker	Open	Line CB at Barmer(RS) end of 220kV Akal(RS)-Barmer(RS) Ckt opened
07:29:11,824	BARMR_RS	400kV	05BRBHN1	Circuit Breaker	Open	Tie CB of 125MVAR Bus reactor connected at 400kV Barmer(RS) opened
07:29:32,174	BARMR_RS	400kV	06BR2	Circuit Breaker	Open	Main CB of 125MVAR Bus reactor connected at 400kV Barmer(RS) opened

Point of discussion

- As reported, Main bus jumper of 220 KV Akal(RS)-Bhu(RS) Ckt-1 snapped at Akal end. Location and nature of fault? Whether main protection operated or not?
- Reason of delayed clearance of fault?
- Exact reason of tripping of 220kV Akal(RS)-Barmer(RS) Ckt need to be shared. (tripped as per SCADA SOE). Details of relay flags, DR etc?
- As per SOE, 125MVAr bus reactor also tripped. Reason of the same need to be shared.
- Status of bus bar protection at 220kV Akal(RS)?
- SCADA data freezed during the event. Availability and healthiness of SCADA data need to be ensured.
- Tripping status of all the tripped elements are not coming in SCADA SOE.
- DR file of following elements not received:
  - ✓ 400/220kV 500MVA ICT-1 & 4
  - ✓ 220kV Akal-Barmer ckt
  - ✓ 220kV Akal-Bhu ckt
  - ✓ Other elements if tripped
- Detailed report along with remedial action taken details not received.
- Standardization (nomenclature, time sync etc) of recording instrument (DR/EL) need to be ensured.

Multiple elements tripping at 220/132/33kV Hissar(BB) 23rd March 2024

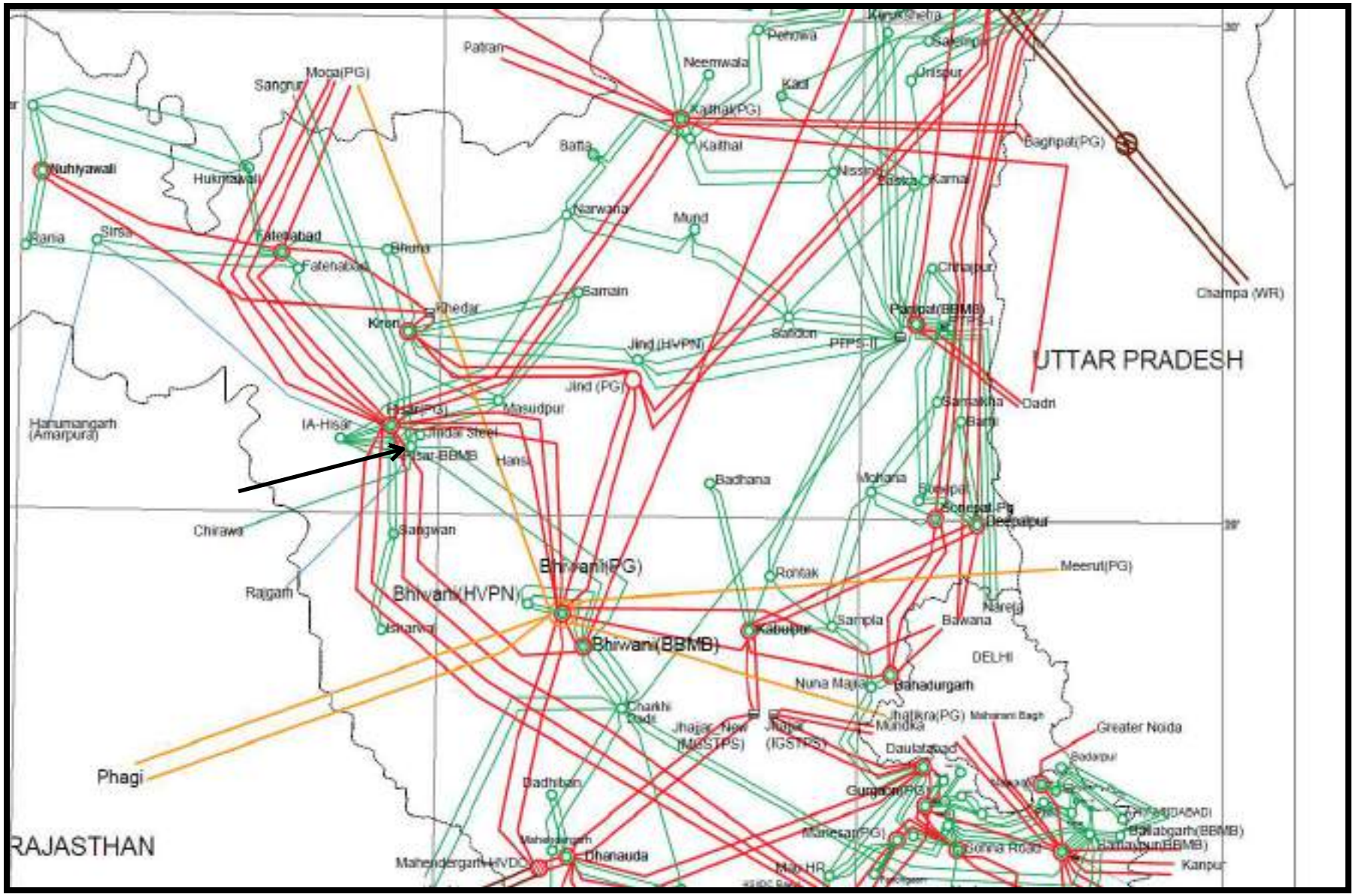
Brief of event:

- 220/132/33kV Hissar(BB) S/s has double main bus scheme at 220kV level.
- As reported, at 00:58hrs, bursting of B-ph CT of 220/132kV 100MVA ICT-2 at Hissar(BB) occurred.
- During the same time, all the lines and 220/132kV ICTs connected at 220kV Hissar(BB) also tripped (Exact reason, nature and location of fault yet to be shared).
- Due to tripping of all the elements connected to both the buses, both 220kV Bus-1 & 2 at Hissar(BB) and eventually the complete 220/132/33kV Hissar(BB) S/s became dead.
- As per PMU at Hissar(PG), two consecutive B-N phase to earth faults with fault clearing time of 80ms and 360ms (delayed) are observed.
- As per SCADA, change in demand of approx. 170MW is observed in Haryana control area.

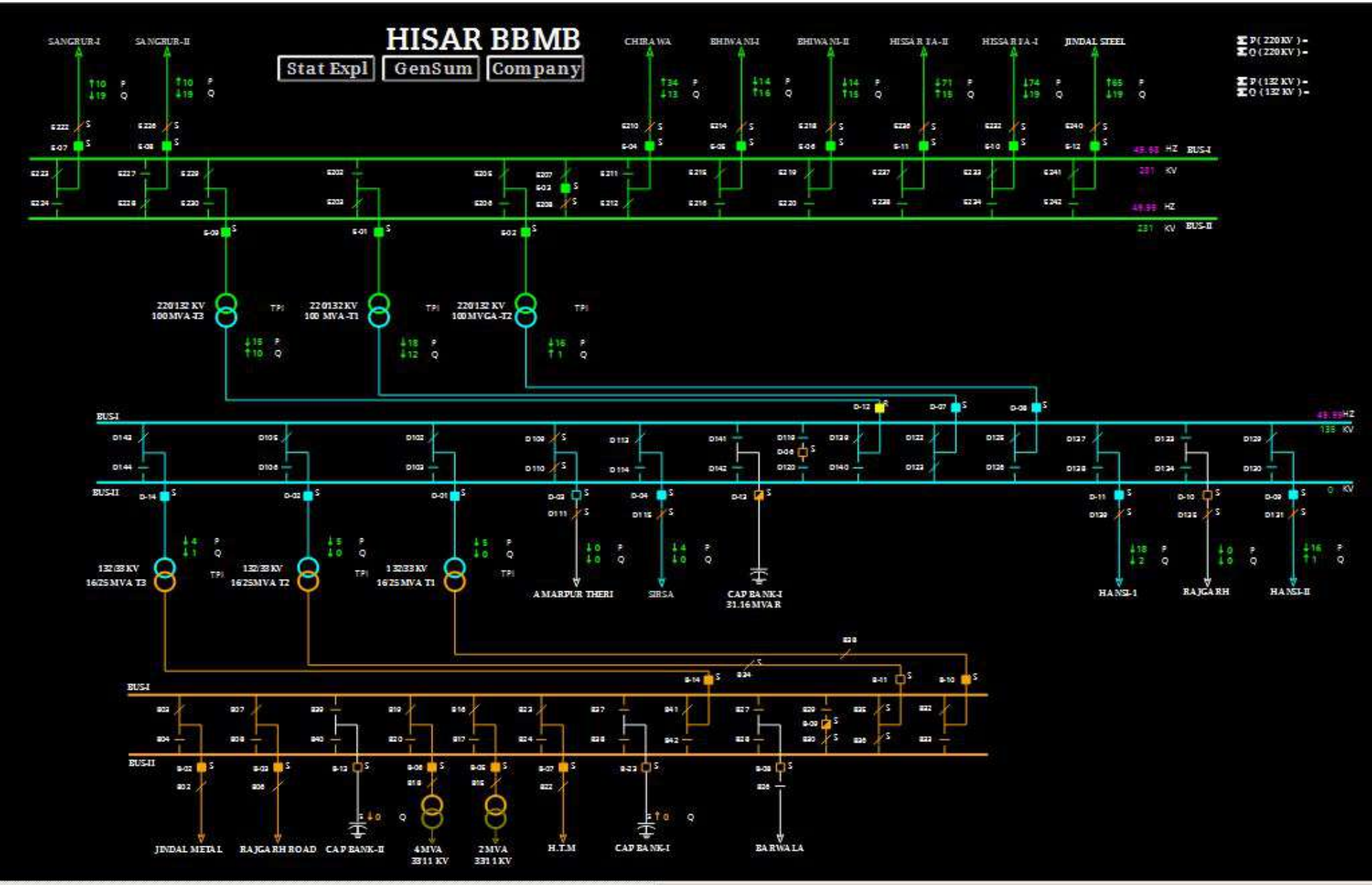
Elements tripped:

i. 220 KV Hissar(BB)-Hissar IA(HV) (HVPNL) Ckt-1
ii. 220 KV Hissar(BB)-Hissar IA(HV) (HVPNL) Ckt-2
iii. 220 KV Bhiwani-Hissar (BB) Ckt-1
iv. 220 KV Bhiwani-Hissar (BB) Ckt-2
v. 220 KV Hissar-Sangrur (BB) Ckt-1
vi. 220 KV Hissar-Sangrur (BB) Ckt-2
vii. 220 KV Hissar(BB)-Jindal Steel(HR) (HVPNL) Ckt
viii. 220 KV Hissar(BB)-Chirawa(RS) (BB) Ckt
ix. 220 KV Barnala-Sangrur(BB) Ckt
x. 220/132kV 100MVA ICT-1 at Hissar(BB)
xi. 220/132kV 100MVA ICT-2 at Hissar(BB)
xii. 220/132kV 100MVA ICT-3 at Hissar(BB)

Network diagram

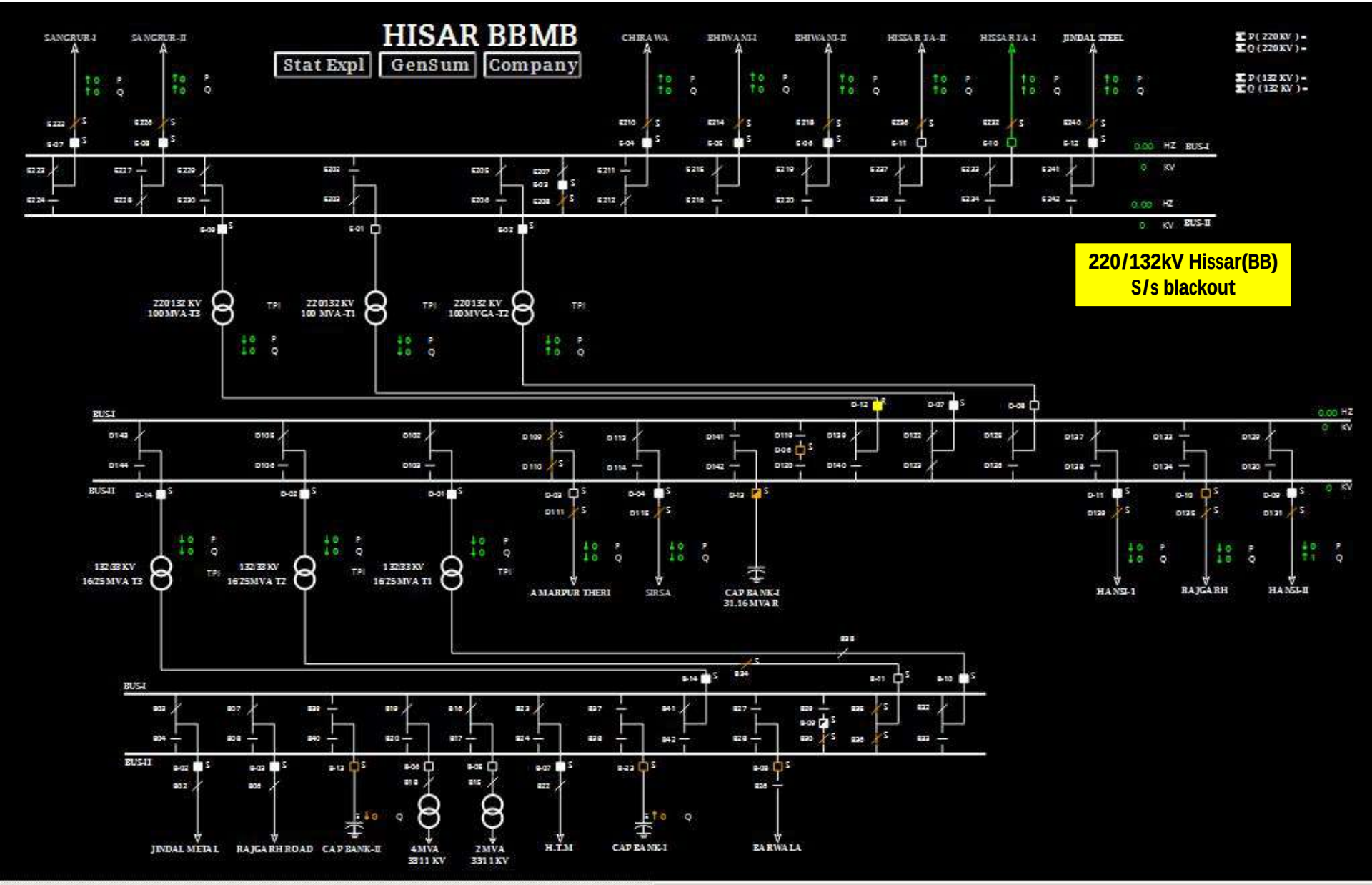


SLD of 220/132kV Hissar(BB) before the event

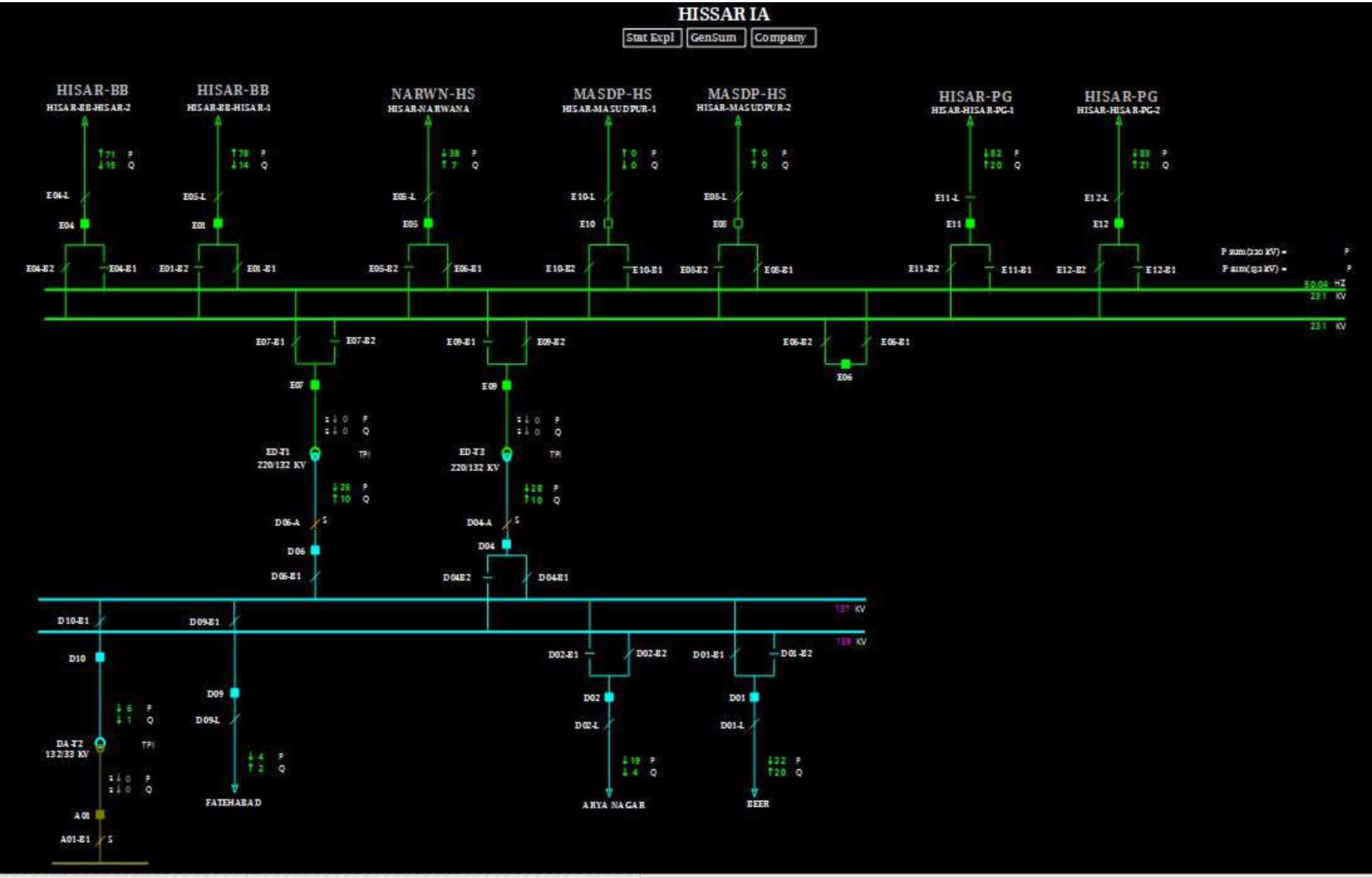


Sat March 23 2024 00:55:00

SLD of 220/132kV Hissar(BB) after the event

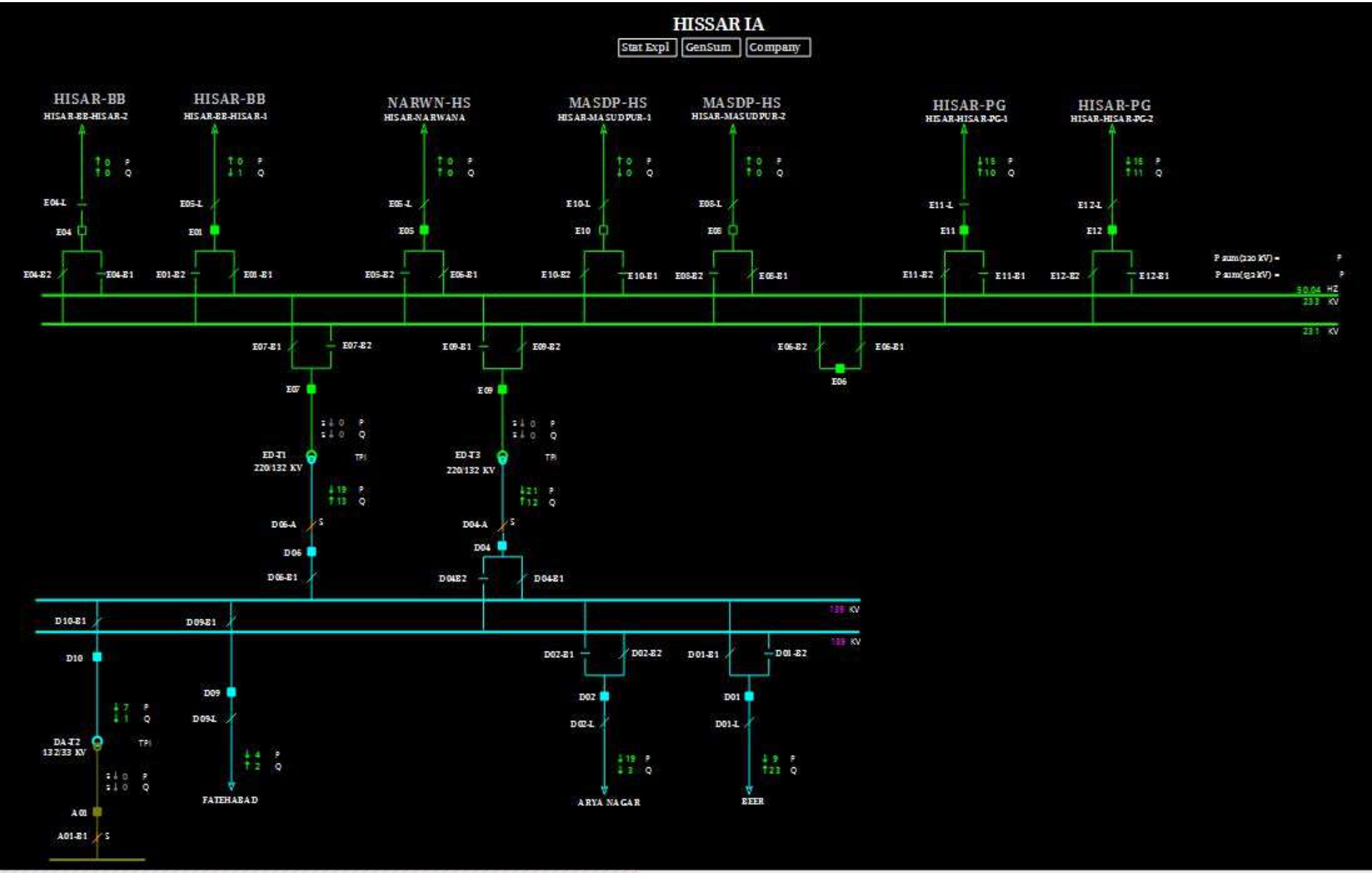


SLD of 220/132kV Hissar_IA(HR) before the event

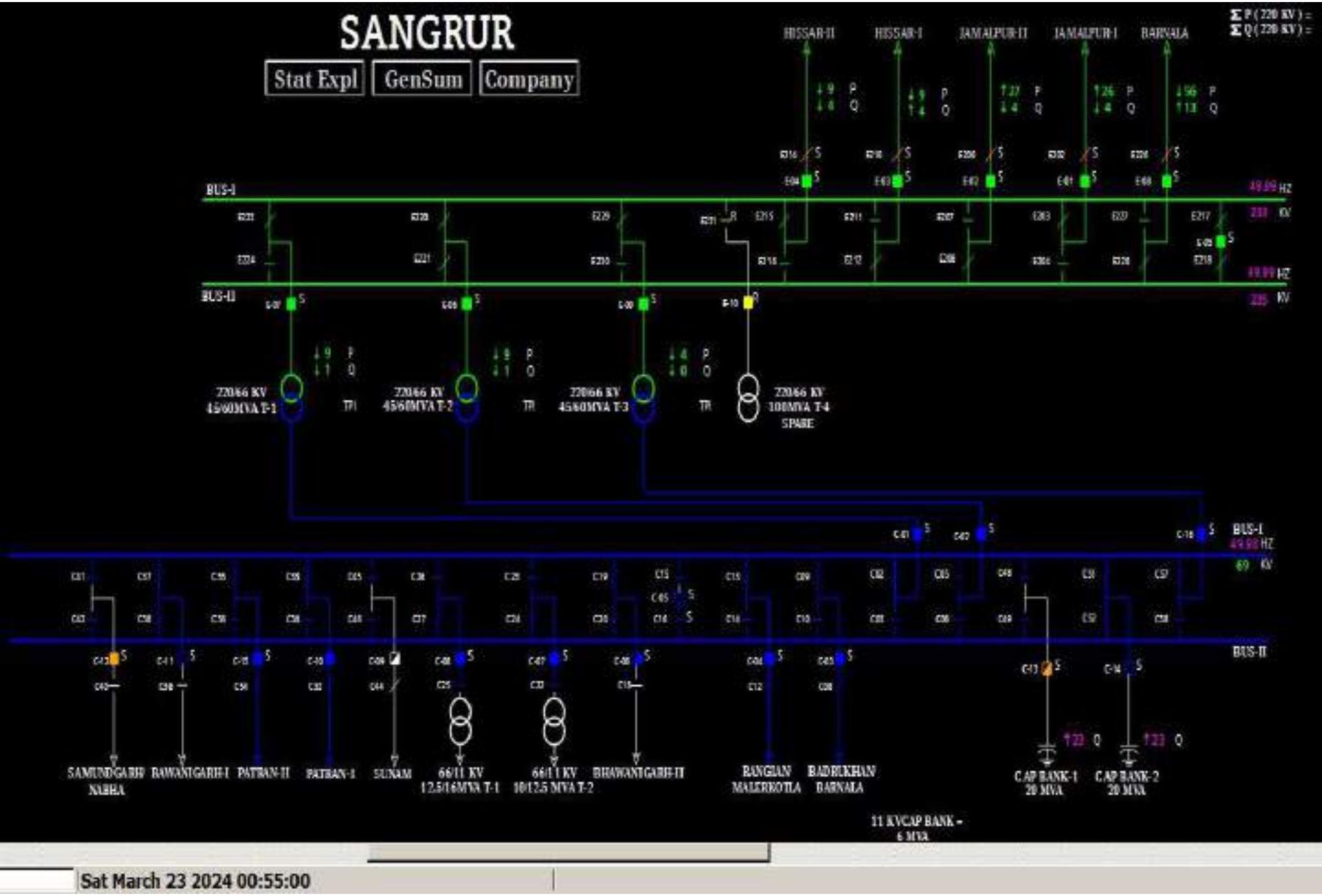


Sat March 23 2024 00:55:00

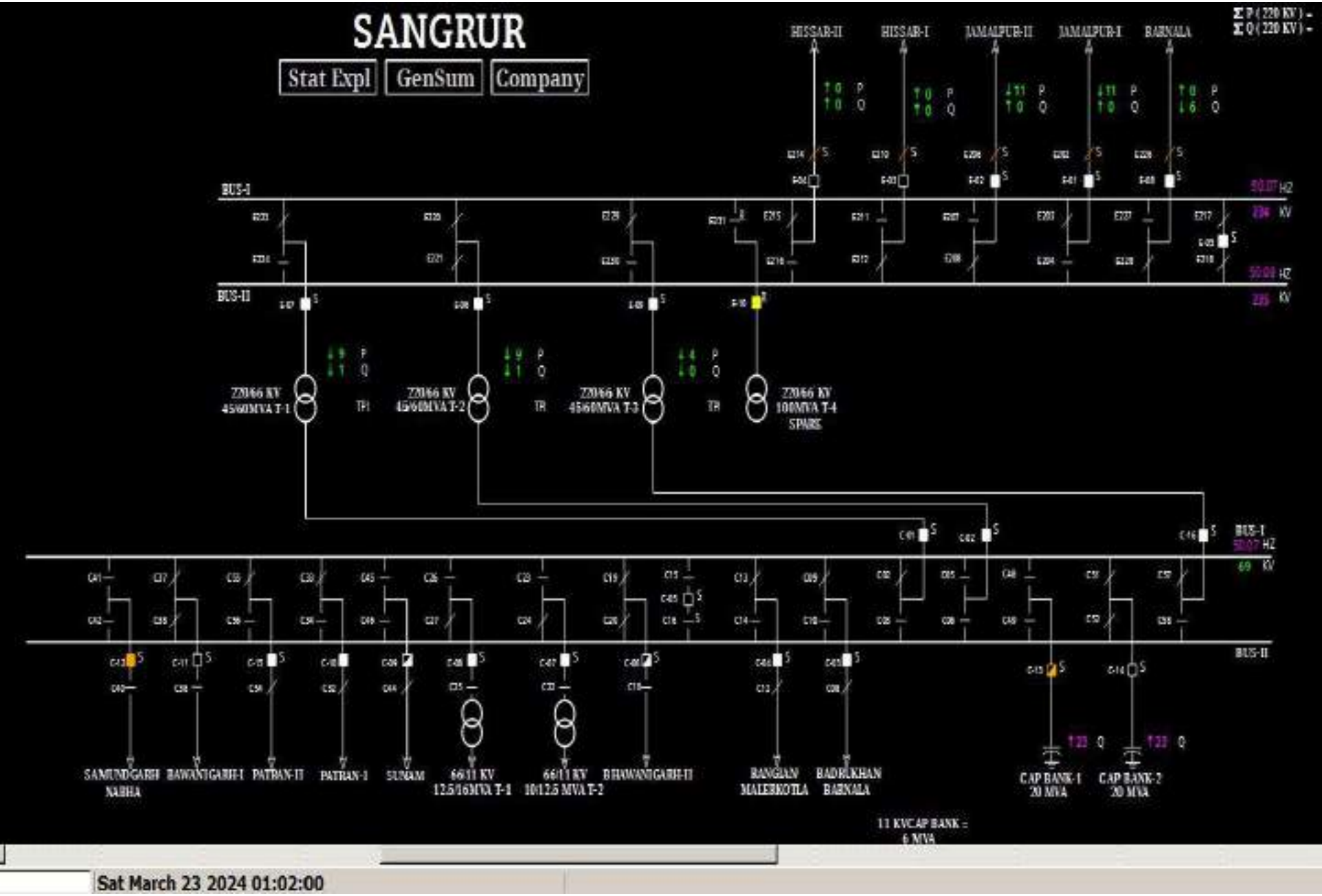
SLD of 220/132kV Hissar_IA(HR) after the event



SLD of 220/66kV Sangrur(BB) before the event

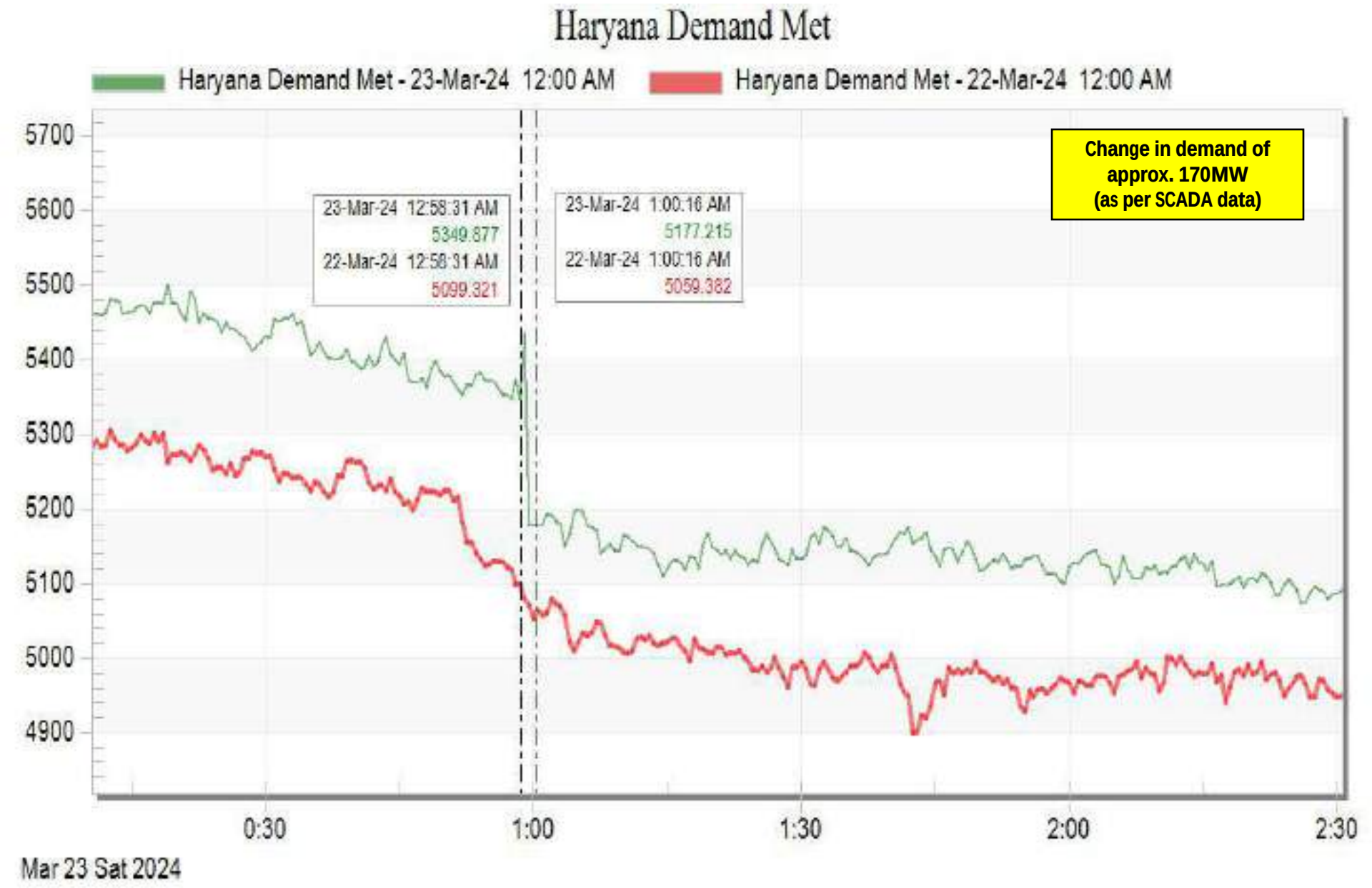


SLD of 220/66kV Sangrur(BB) after the event



Sat March 23 2024 01:02:00

Haryana demand during the event



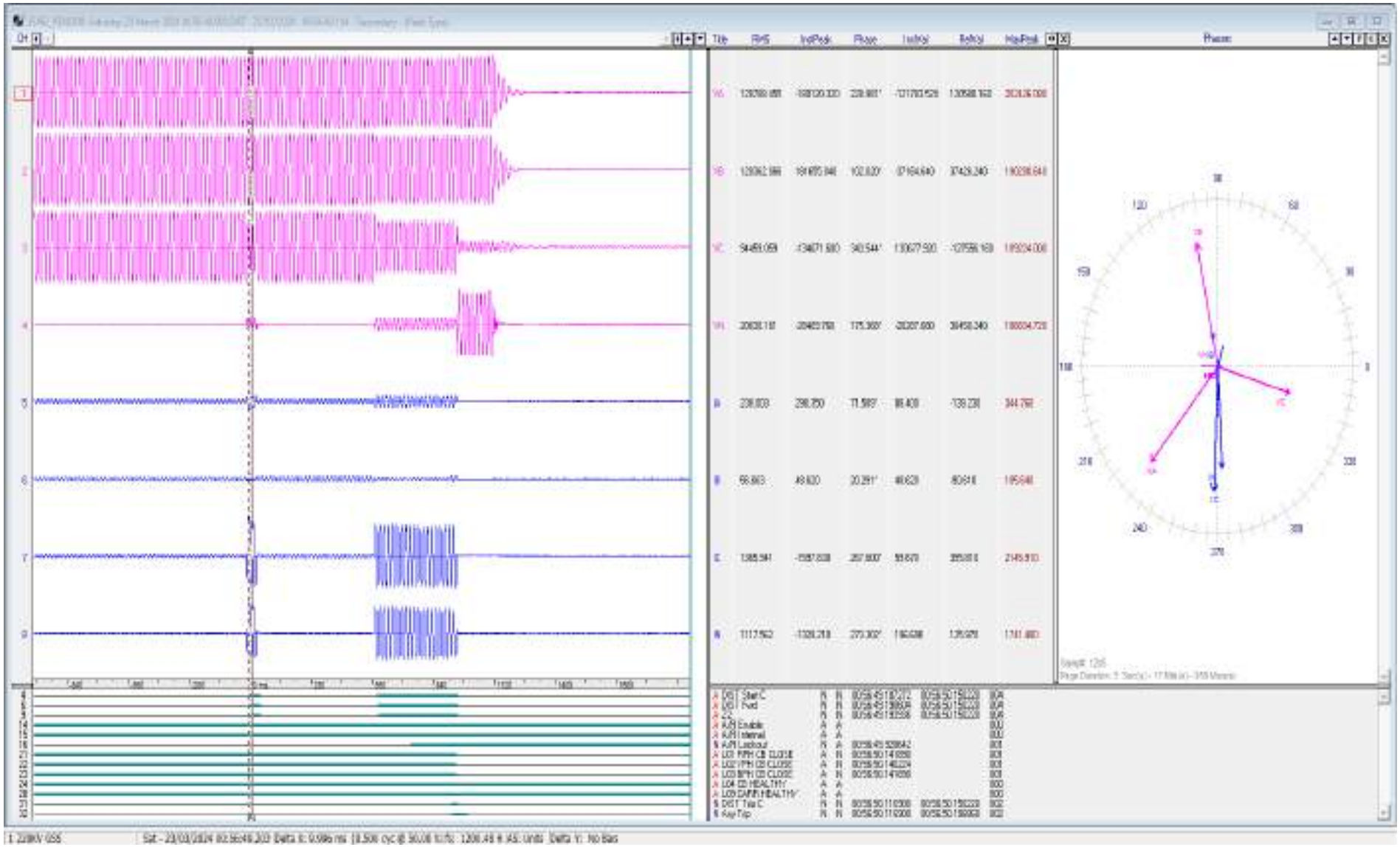
PMU Plot of frequency at Hissar(PG)

00:58hrs/23-Mar-24

PMU Plot of phase voltage magnitude at Hissar(PG)

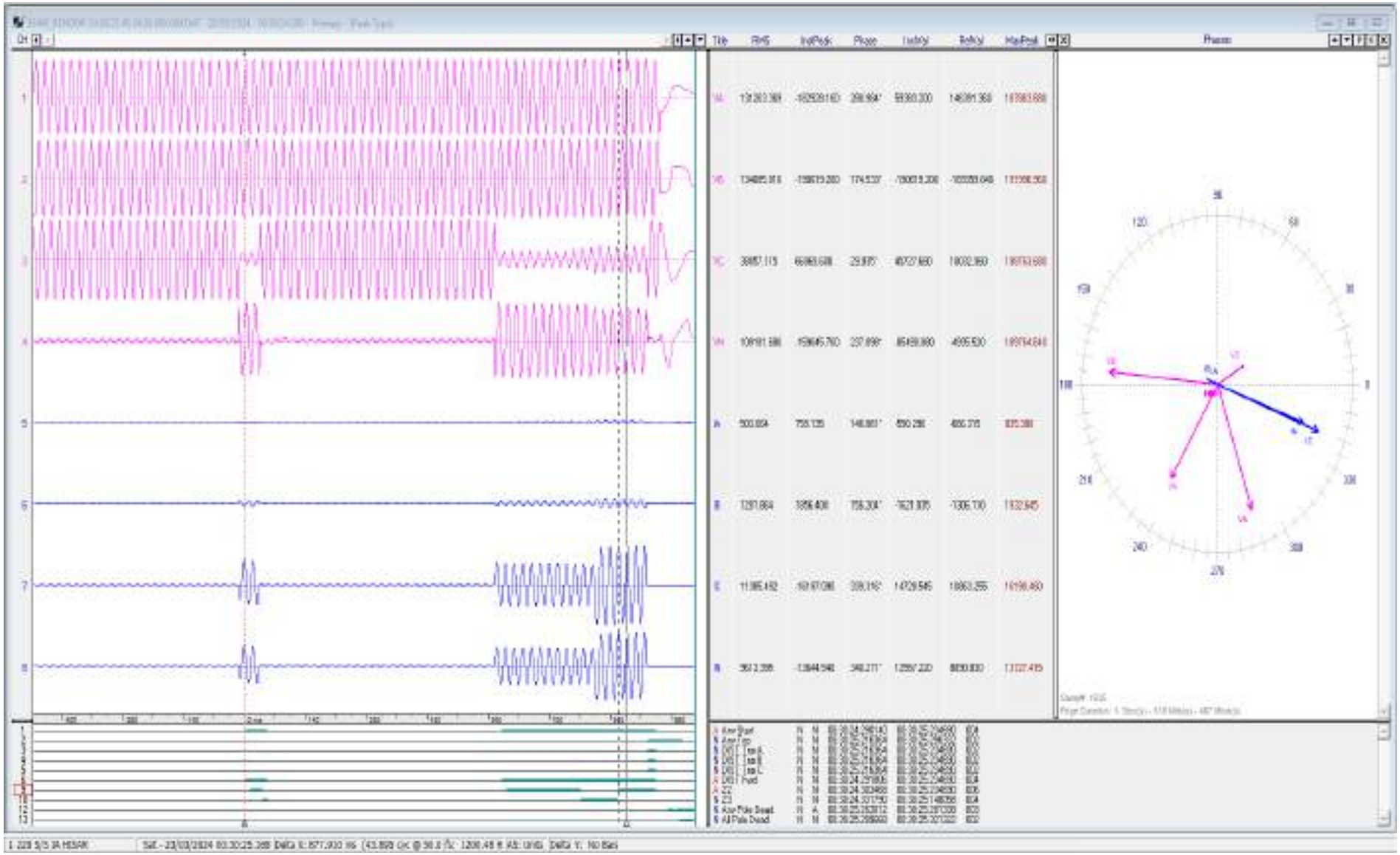
00:58hrs/23-Mar-24

DR of 220 KV Hissar(BB)-Chirawa(RS)(end) (BB) Ckt-1



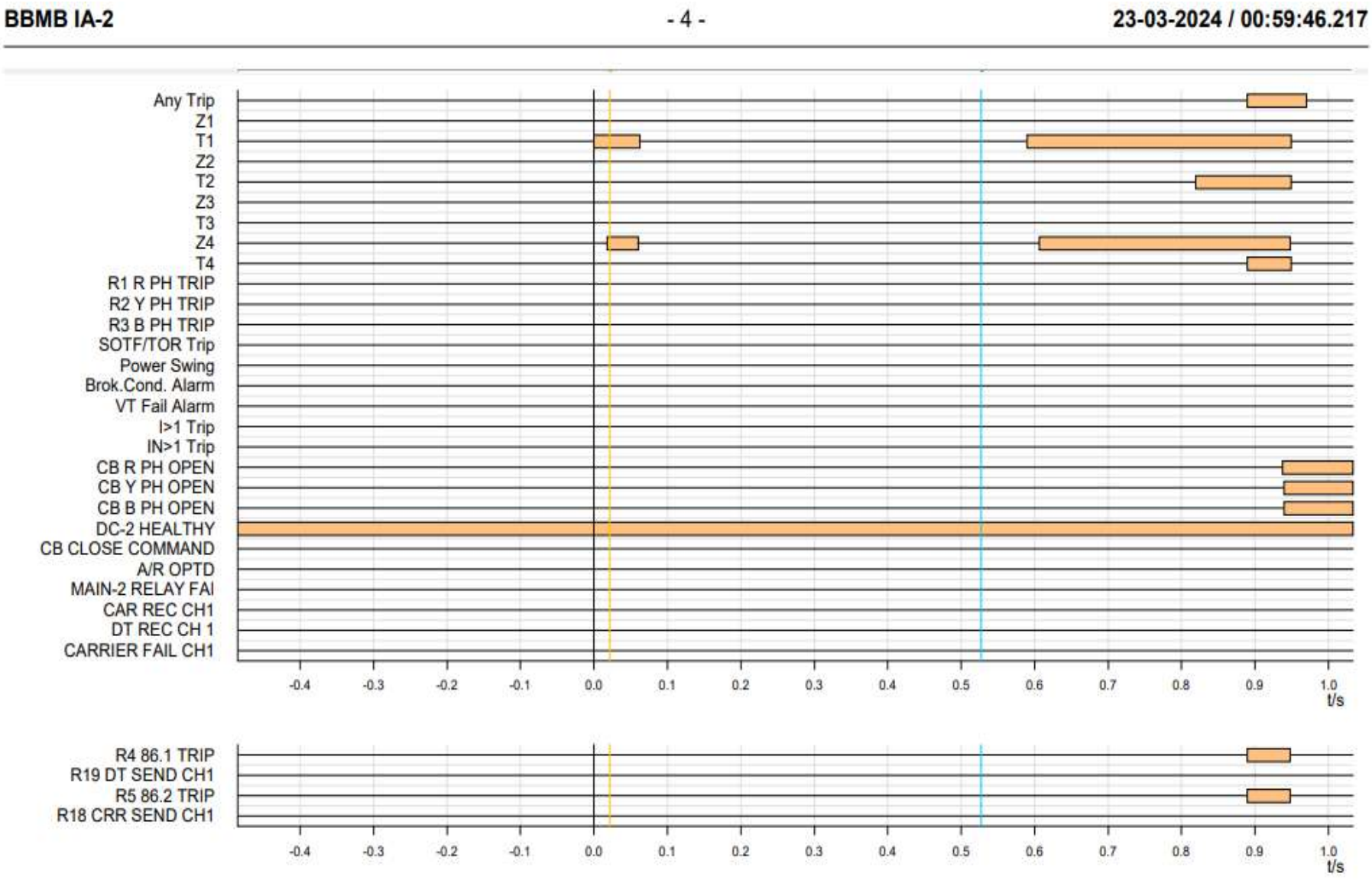
- ✓ *B-N phase to earth fault.*
- ✓ *Fault sensed and operated in Zone-2.*
- ✓ *Fault current: Ib= 1.2kA. Fault clearing time= 380ms.*
- ✓ *Time not Synced and DR nomenclature is also not correct.*

DR of 220 KV Hissar(BB)-Hissar IA(HV)(end) (BBMB) Ckt-2



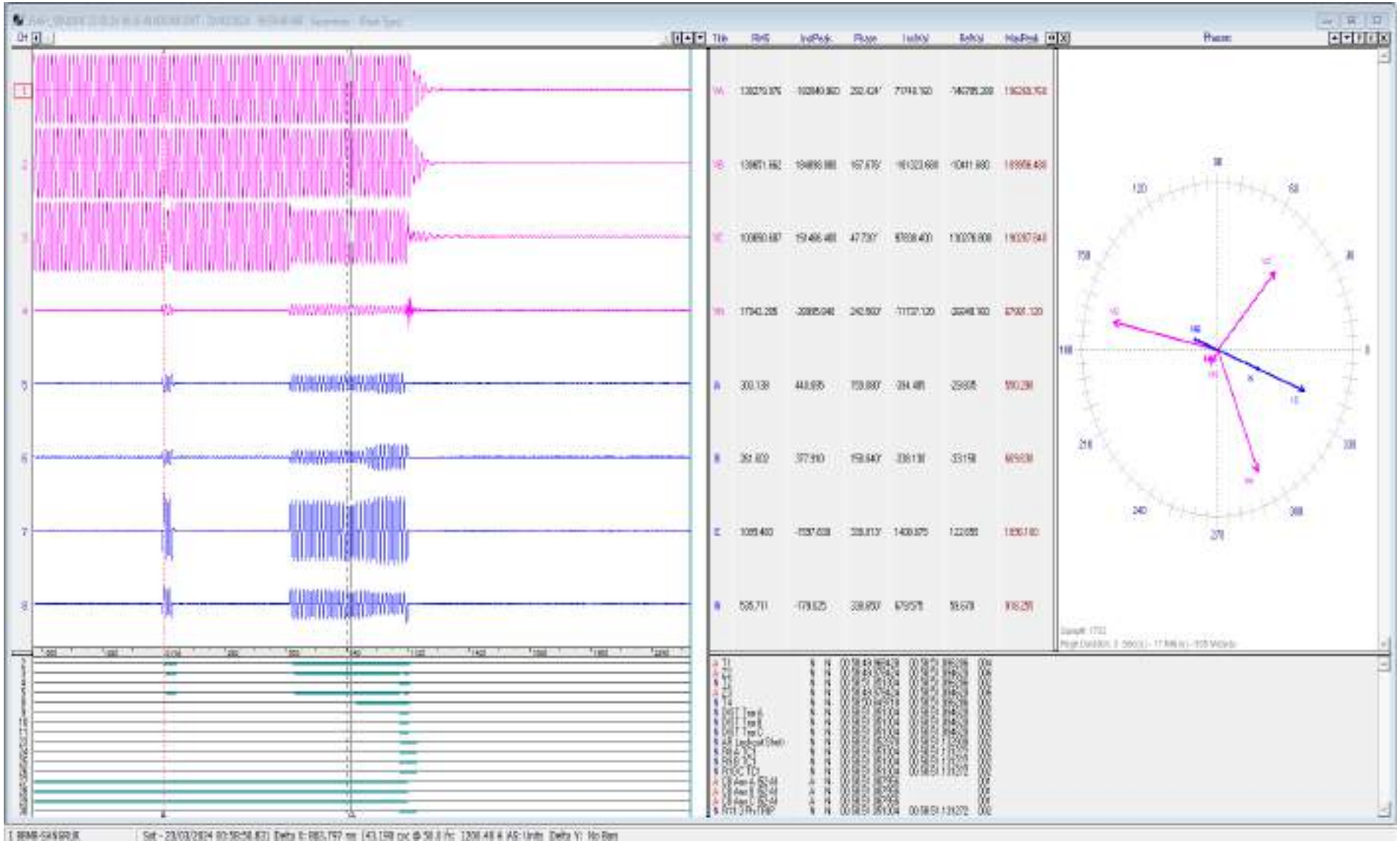
- ✓ *B-N phase to earth fault.*
- ✓ *Fault sensed and operated in Zone-2.*
- ✓ *Fault current: Ib= 11.4kA. Fault clearing time= 350ms.*
- ✓ *Time not Synced*

DR of 220 KV Hissar(BB)(end)-Hissar IA(HV) (BBMB) Ckt-2



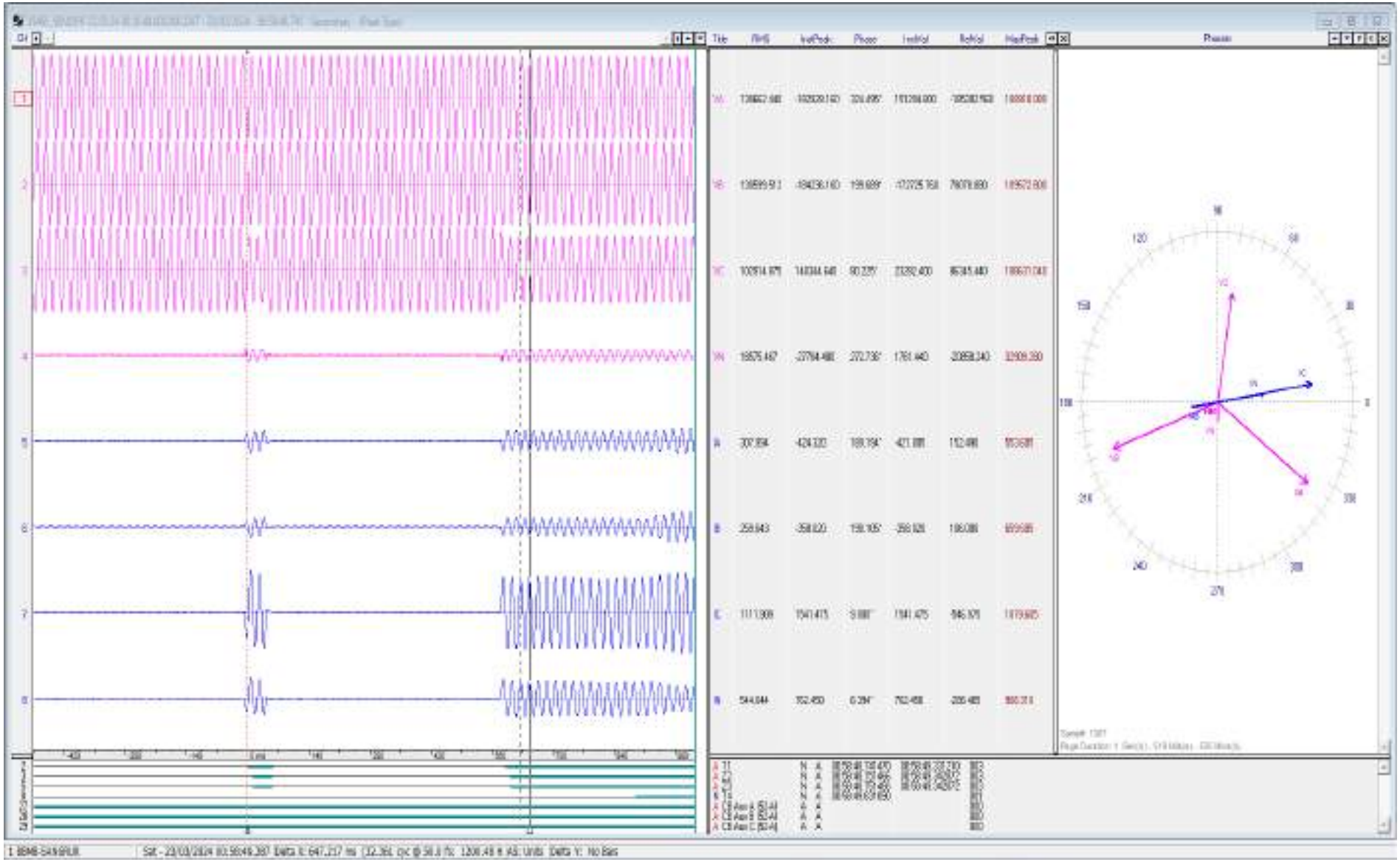
- ✓ *B-N phase to earth fault.*
- ✓ *Fault sensed and operated in Zone-4.*
- ✓ *Fault clearing time= 380ms.*

DR of 220 KV Hissar(end)-Sangrur (BB) Ckt-2



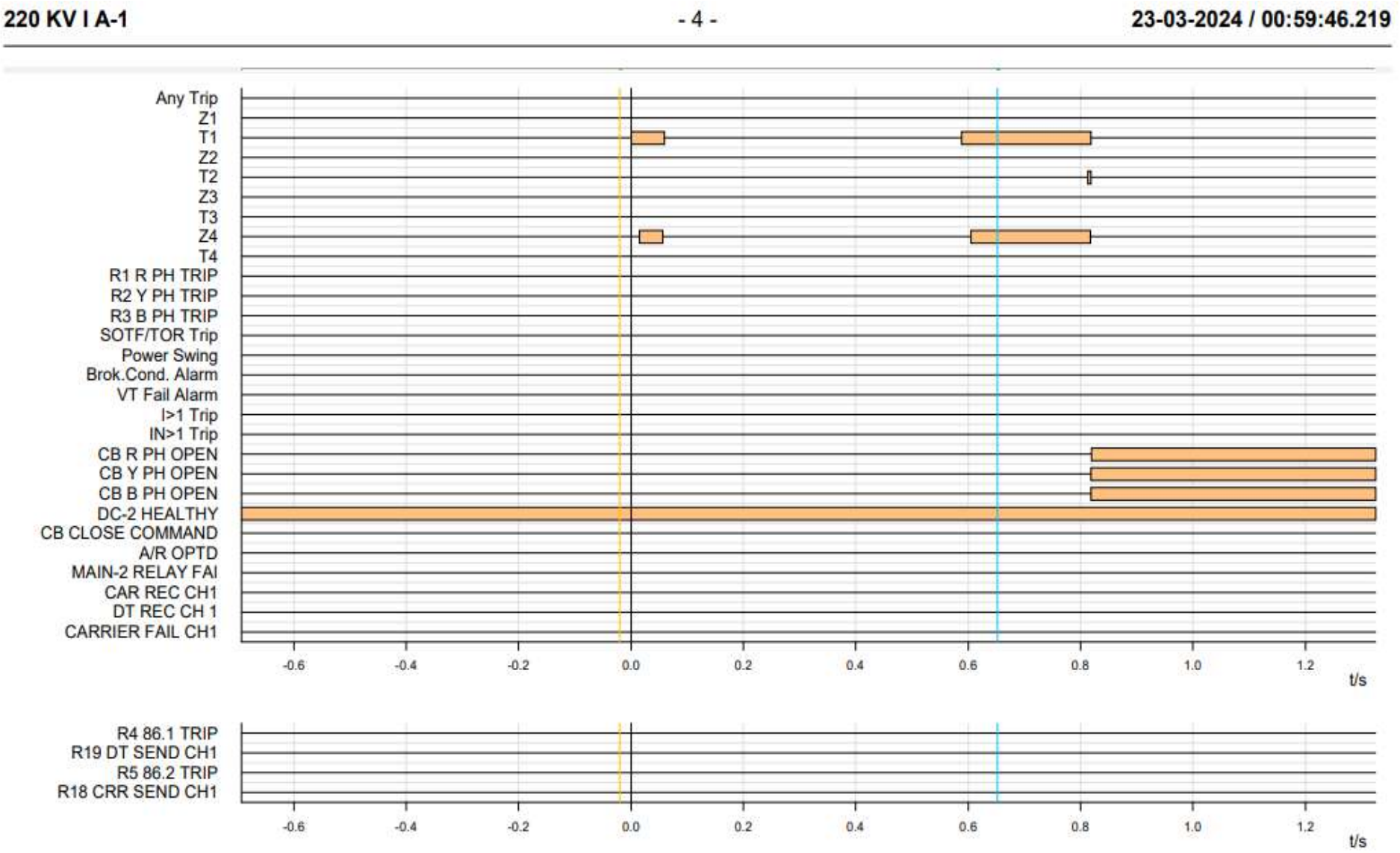
- ✓ *B-N phase to earth fault.*
- ✓ *Fault sensed and operated in Zone-2(distance protection).*
- ✓ *Fault current: Ib= 1.1kA. Fault clearing time= 540ms.*
- ✓ *DR nomenclature is not correct.*

DR of 220 KV Hissar(end)-Sangrur (BB) Ckt-1



- ✓ *B-N phase to earth fault.*
- ✓ *Fault sensed and in Zone-2.*
- ✓ *Fault current: Ib= 1.1kA.*
- ✓ *DR nomenclature is not correct.*

DR of 220 KV Hissar(BB)(end)-Hissar IA(HV) (HVPNL) Ckt-1



- ✓ *B-N phase to earth fault.*
- ✓ *Fault sensed and operated in Zone-4.*
- ✓ *Fault clearing time= 22ms.*

SCADA SOE

Time	Station Name	Voltage	Element Name	Element Type	Element Status	Remarks
00:58:52,294	HISAR_BB	220kV	01T1	Circuit Breaker	Open	CB at 220kV side of 220/132kV 100MVA ICT-1 at Hissar(BB) opened
00:58:52,310	HISAR_BB	132kV	08T2	Circuit Breaker	Open	CB at 132kV side of 220/132kV 100MVA ICT-1 at Hissar(BB) opened
00:58:53,000	HISAR_HS	220kV	04HISBB2	Circuit Breaker	Open	Line CB at Hissar IA(HV) end of 220 KV Hissar(BB)-Hissar IA(HV) (BBMB) Ckt-2 opened
00:58:53,066	HISAR_BB	220kV	10HISAR1	Circuit Breaker	Open	Line CB at Hissar(BB) end of 220 KV Hissar(BB)-Hissar IA(HV) (BBMB) Ckt-1 opened
00:58:53,189	HISAR_BB	220kV	11HISAR2	Circuit Breaker	Open	Line CB at Hissar(BB) end of 220 KV Hissar(BB)-Hissar IA(HV) (BBMB) Ckt-2 opened
00:58:53,380	SNGRU_BB	220kV	03HISAR1	Circuit Breaker	Open	Line CB at Sangrur(BB) end of 220 KV Hissar-Sangrur (BB) Ckt-1 opened
00:58:53,418	SNGRU_BB	220kV	04HISAR2	Circuit Breaker	Open	Line CB at Sangrur(BB) end of 220 KV Hissar-Sangrur (BB) Ckt-2 opened
00:58:53,471	BRNLA_BB	220kV	01SNGRR	Circuit Breaker	Open	Line CB at Barnala(BB) end of 220 KV Barnala-Sangrur (BB) Ckt opened

Point of discussion

- Exact reason, nature and location of fault ?
- Reason of delayed clearance of fault?
- Status of bus bar protection at Hissar(BB)?
- Why did Hissar end distance protection sense fault in Z-2 in Sangrur feeders if fault was at Hissar(BB) end?
- Detailed report along with remedial action taken details not received.
- Standardization (nomenclature, time sync etc) of recording instrument (DR/EL) need to be ensured.

MULTIPLE TRIPPING ANALYSIS REPORT

ANALYSIS REPORT OF MULTIPLE TRIPPING AT BBMB HISAR SUB- STATION ON DATED 23/03/2024

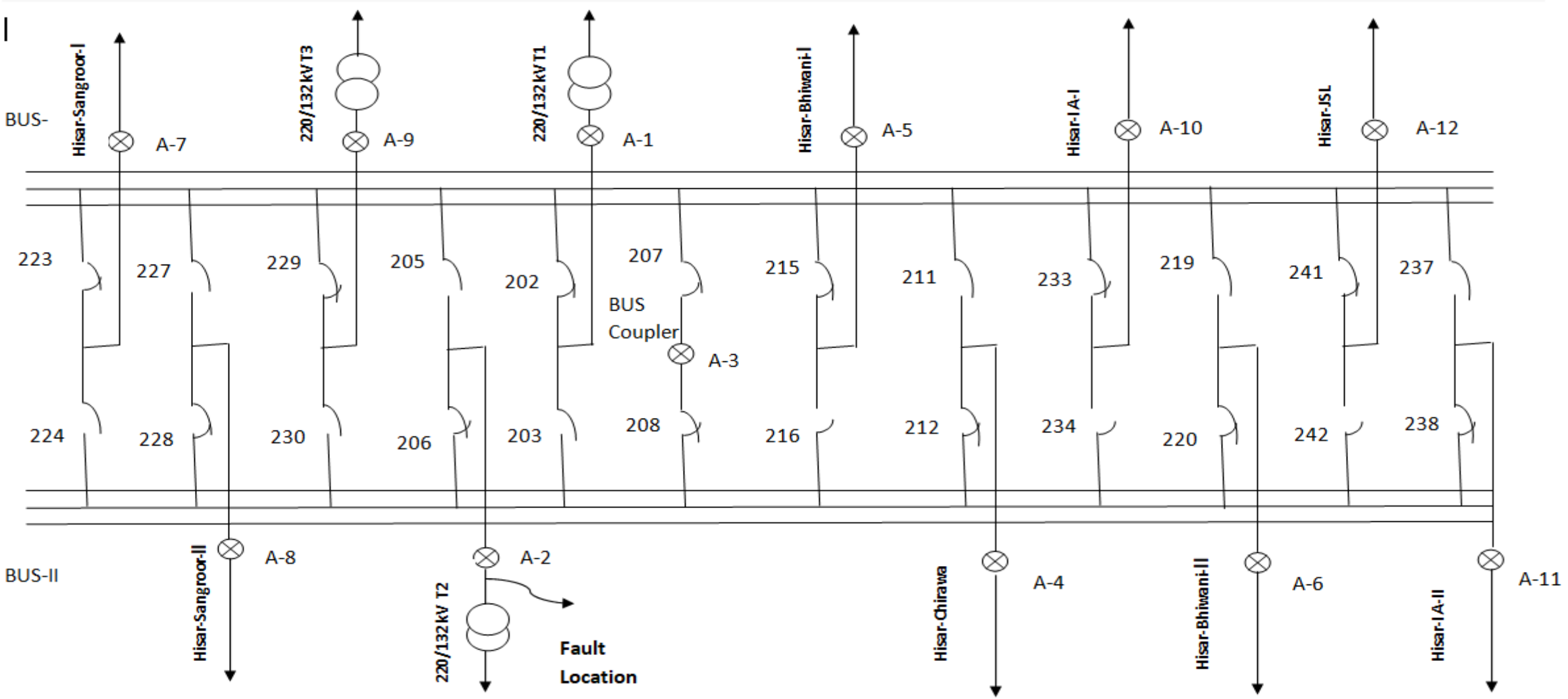
BRIEF INTRODUCTION

- At 00:59 hrs. of dated 23/03/2024, 08 nos. 220kV feeders i.e. 220 KV Hisar IA Ckt. 1&2, 220kV Hisar-Bhiwani Ckt. 1&2, 220kV Hisar-Sangrur Ckt. 1&2, 220KV Hisar- Chirawa S/C and 220/132kV 100MVA T/F T-2 tripped due to bursting of 220 kV Blue phase CT of 220 /132 kV, 100 MVA T/F T-2. Fault intimation report of the said event is attached as Annexure-A.

Tripped Grid Element

Sr. No.	Tripped Grid Element	Date / Time of Tripping (As per Event report)
1.	220kV HISAR- IA Ckt-1 & 2	23/03/2024 / 00.59 hrs.
2.	220kV HISAR- Bhiwani Ckt- 1& 2	23/03/2024 / 00.59 hrs.
3.	220kV HISAR-SANGRUR CKT-1 & 2	23/03/2024 / 00.59 hrs.
4.	220kV HISAR-CHIRAWA S/C	23/03/2024 / 00.59 hrs.
5.	220/132kV, 100 MVA Transformer T-2	23/03/2024 / 00.59 hrs.
6.	220kV HISAR- IA Ckt-1 & 2	23/03/2024 / 00.59 hrs.

SINGLE LINE DIAGRAM



Location and type of fault

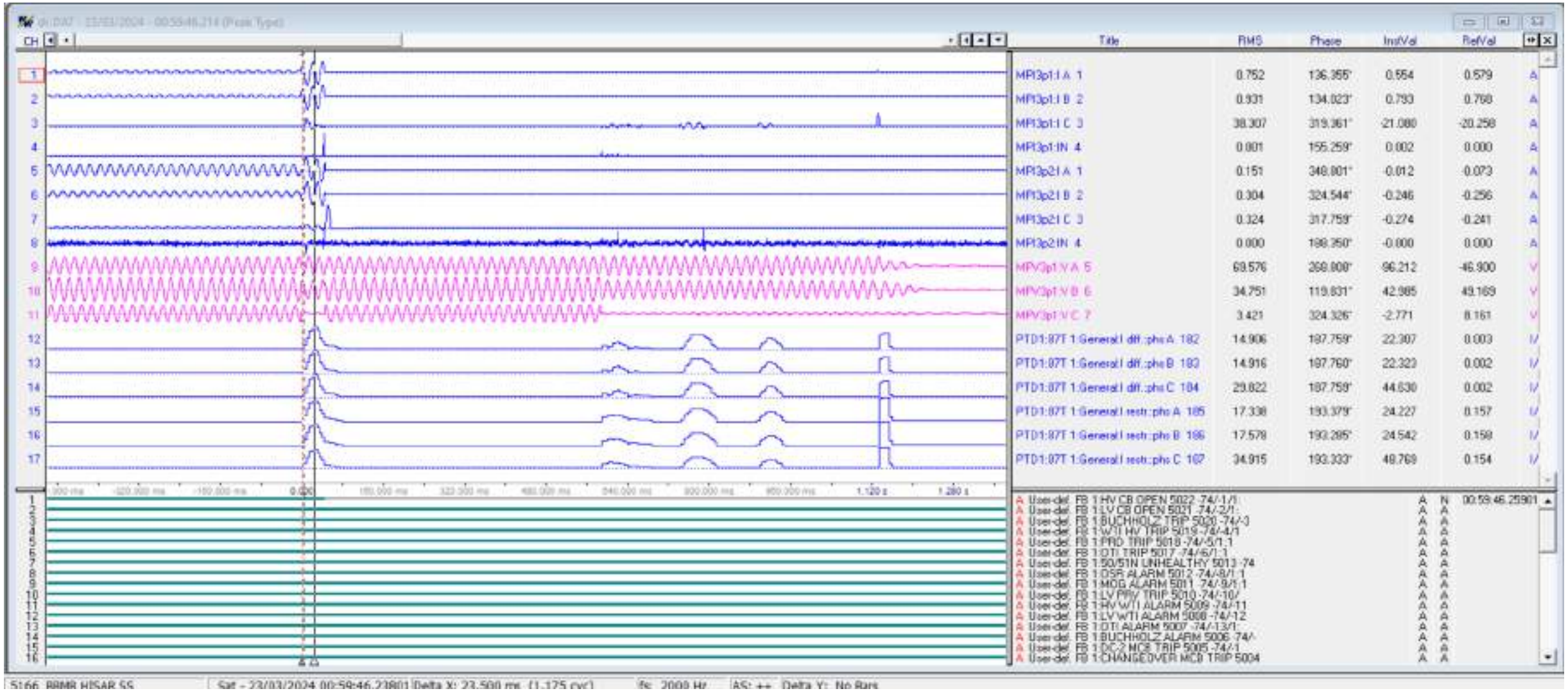
- Tripping occurred due to bursting of Blue Phase 220 kV CT of 220 /132 kV, 100 MVA Transformer T-2.

Detailed Analysis

- On dated 23/03/2024 at 00:59 hrs., there was bursting of 220 kV Blue Phase CT of 220/132 kV, 100 MVA Transformer T-2. The DR and events were extracted from Siprotec 7UT85 Differential relay of 220/132 kV, 100 MVA T/F T-2. From DR, it has been observed that Differential relay (Highset stage) was operated immediately on bursting of above said CT at 00:59:46:214 Hrs. Accordingly T/F T-2 was tripped from both sides within 45 ms at 00:59:46:259 Hrs.

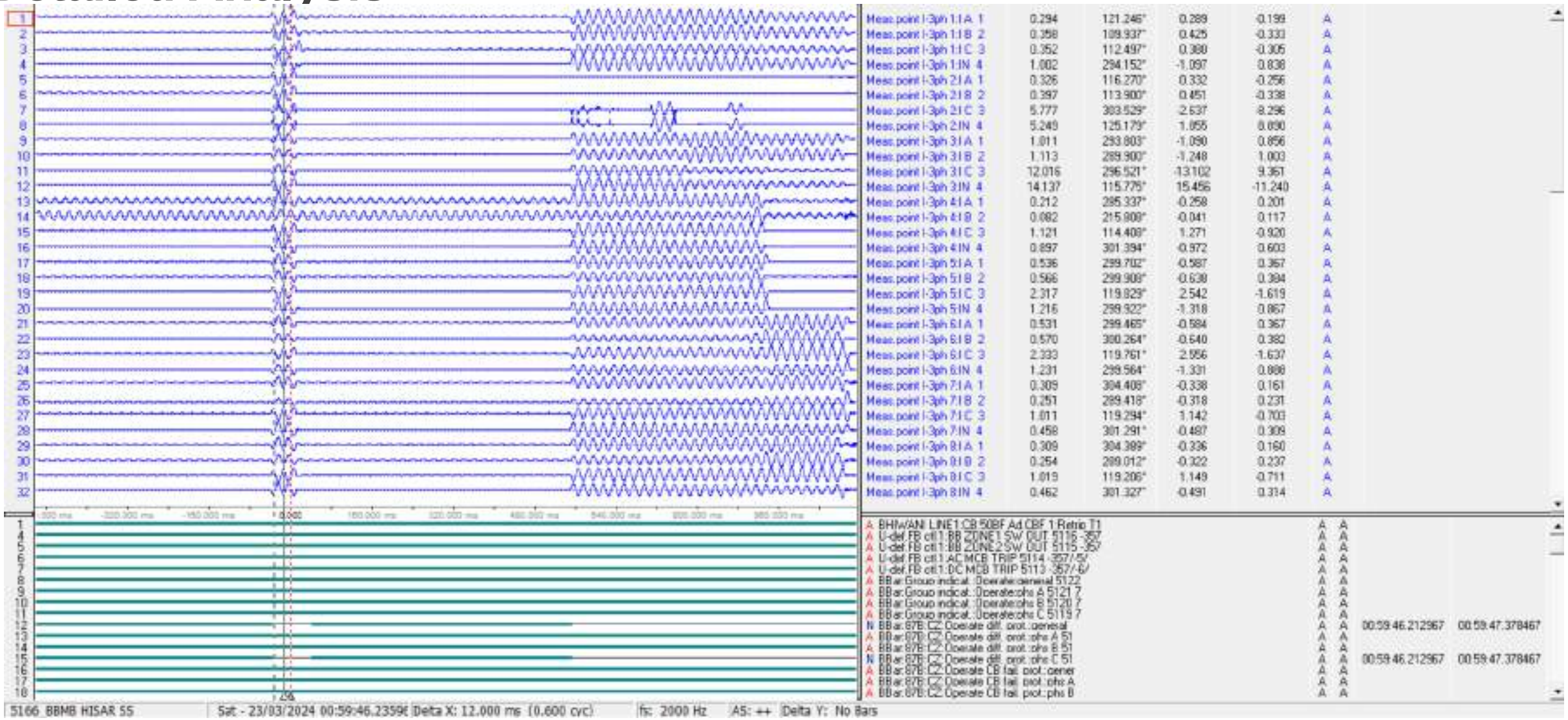
DR T-2 DIFF.

Detailed Analysis



DR T-2 DIFF.

Detailed Analysis



Bus bar DR

- However due to bursting of CT, there was continuous fire in CT which resulted into ionization in surrounding air probably more towards 220/132 kV, 100 MVA T/F T-2 side. As per DR, Fault current was again fed through flame (after approx. 540 msec from tripping of 100 MVA T/F T-2) from blue phase jack bus just above the said CT. However no fault current came through the transformer as LV side breaker had already opened.

BUS BAR RELAT DRTRIPPING DUE TO CT BLAST 23.03.2024\Bus bar\BUS BAR dr.CFG

- The fault was cleared when 220kV Bus-1 & Bus-2 were dead by tripping of Hisar- IA Ckt-1 & 2 from this end due to operation of DP relay in Z-4 and other 220 KV ckts. from other end in Z-2. 220 kV Hisar- IA Ckt-1 & 2 tripped from this end in Z-4 because Z-4 time is 300 ms and Z-2 time at IA Sub-station end is 350 ms.

- As per the DR extracted from Bus-Bar relay, max. differential current measured by Check Zone, Main Zone-1 & Main Zone-2 was 29.636, 0.167 and 29.281 respectively. Max. restraining current measured by Check Zone, Main Zone-1 & Main Zone-2 was 3.947, 20.627 and 26.286 respectively. Check Zone was operated instantly. However, Bus-Bar Main zone was not operated. Bus Bar protection will be checked in consultation with M/s Siemens being in warranty period.

Summary

- 220/132 kV, 100 MVA T/F T-2 and all other bay equipment of the abovementioned bay have been tested and all results are found within permissible limits. After replacing the damaged blue phase 220 kV CT with new one, 220/132 kV, 100 MVA T/F T-2 was charged on dated 24.03.2024 at 13:09 Hrs.
- M/s Siemens has been requested to check Bus Bar protection relay as it is in warranty period.”

Remedial Measure: -

- Specification of New CTs being procured has been changed and there is a provision of Oil testing of CT after commissioning also.

PREPARED & PESENTED BY :

DEPUTY DIRECTOR P&T CELL BBMB BHIWANI

Multiple elements tripping at 400/220kV Ratangarh(RS) 28th January 2024

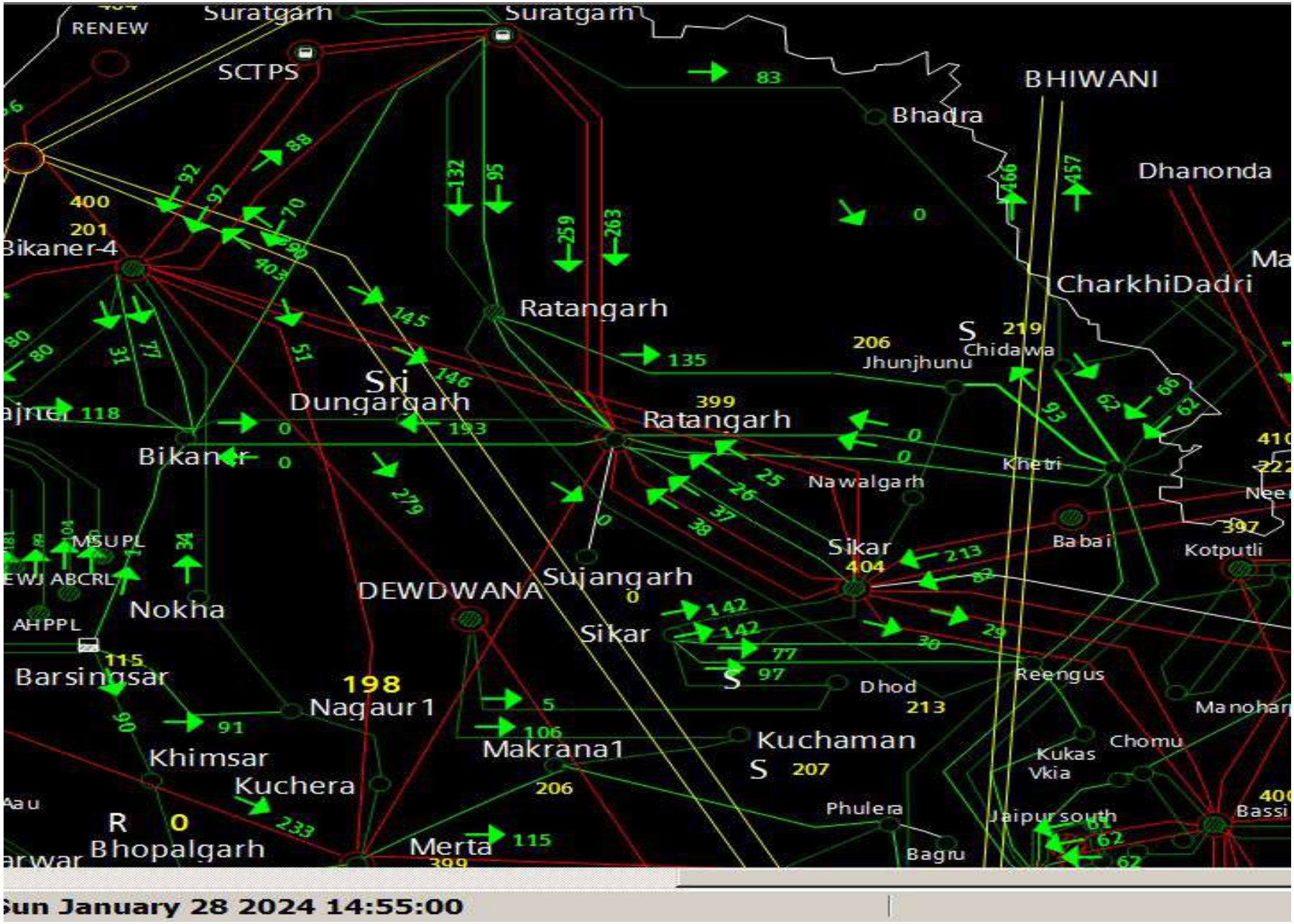
Brief of event:

- As reported, at 14:58hrs, 220kV Isolator (489B) B-phase jumper of 220kV Bus Coupler-1 broke and the fault reflected on the 220kV bus bar at Ratangarh(RS).
- Due to this fault, 400/220 kV 315 MVA ICT 1 at Ratangarh(RS), 220 KV Ratangarh(RS)-Sikar(PG) (PG) Ckt-1, 220 KV Ratangarh(RS)-Sri Dungargarh (RS) Ckt, 220kV Ratangarh-Ratangarh220 (RS) Ckt-1 & 2 tripped (Bus-wise arrangement of elements yet to be shared).
- As per SCADA SOE, 220kV Ratangarh220-Jhunjhunu (RS) Ckt also tripped during the same time. (Exact reason yet to beshared)
- As per PMU at Sikar(PG), **Y-N phase to earth fault** is observed with **delayed fault clearance time of 280 ms** (Phase sequence issue is observed).
- As per SCADA, load loss of approx. 540MW is observed in Rajasthan control area.
- Further as reported, broken 220kV Isolator (489B) B-phase jumper of 220kV Bus Coupler-1 was already replaced.

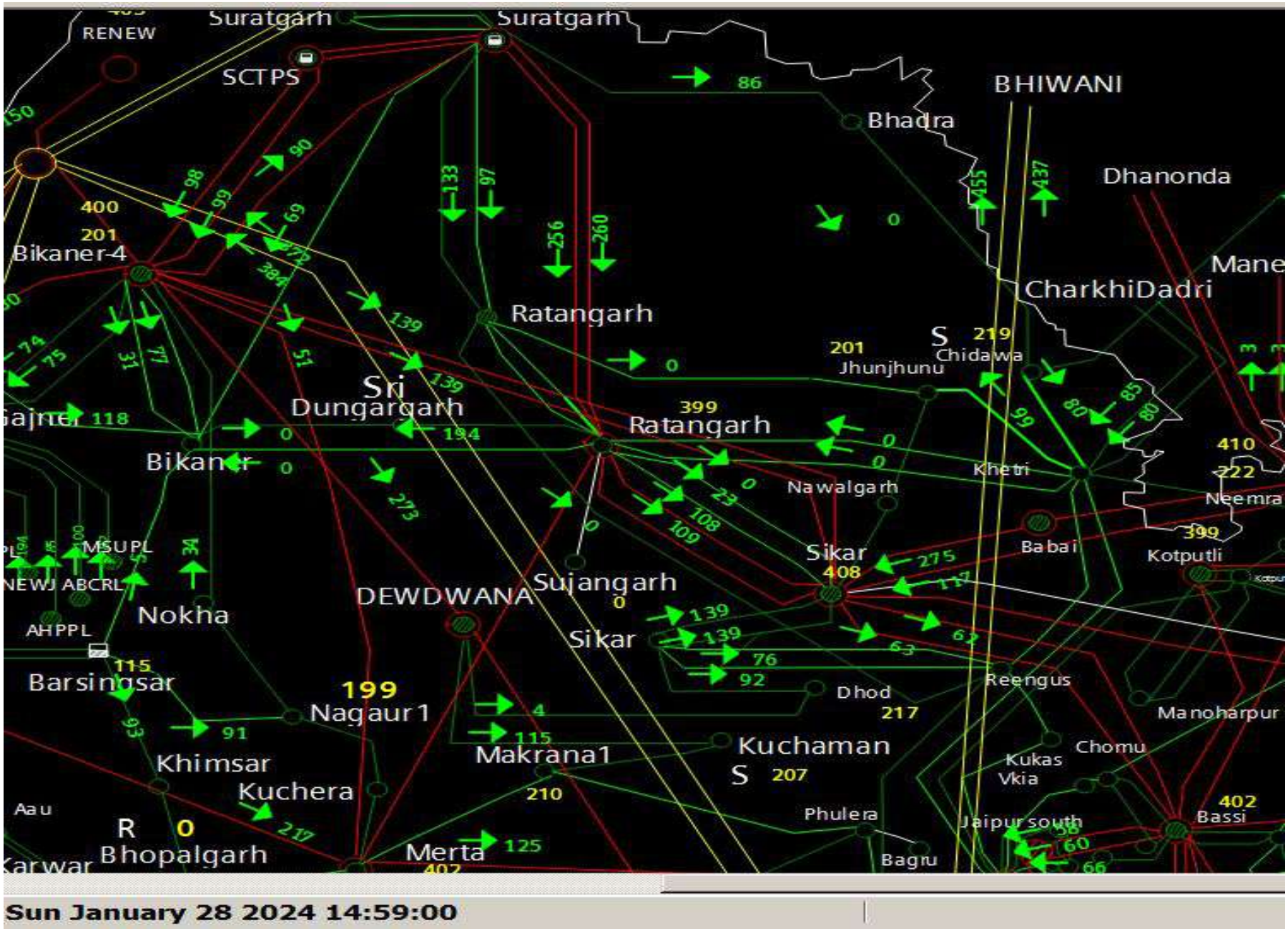
Elements tripped:

i. 400/220 kV 315 MVA ICT 1 at Ratangarh(RS)
ii. 220 KV Ratangarh(RS)-Sikar(PG) (PG) Ckt-1
iii. 220 KV Ratangarh(RS)-Sri Dungargarh (RS) Ckt
iv. 220kV Ratangarh-Ratangarh220 (RS) Ckt-1
v. 220kV Ratangarh-Ratangarh220 (RS) Ckt-2

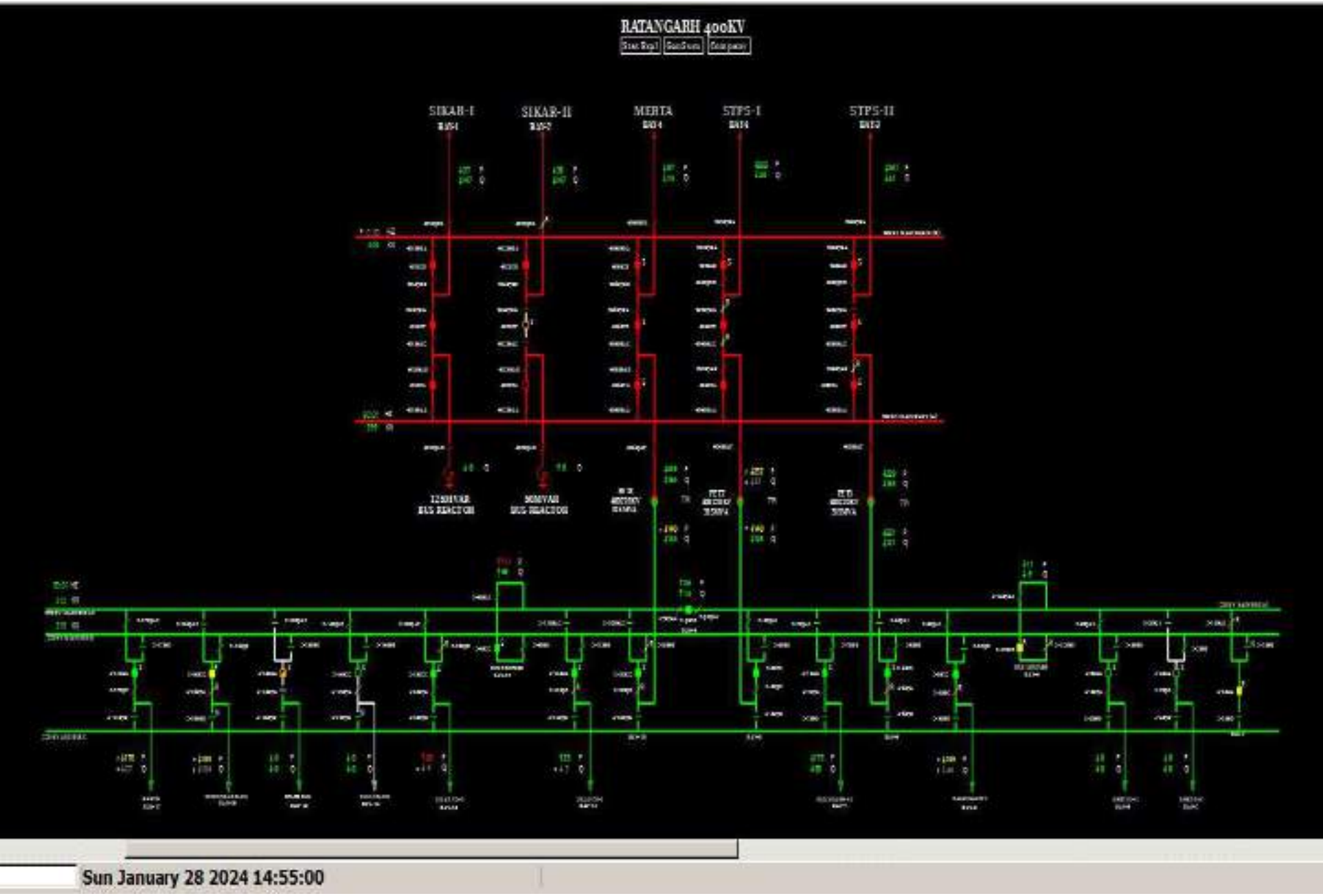
Network Diagram before the event



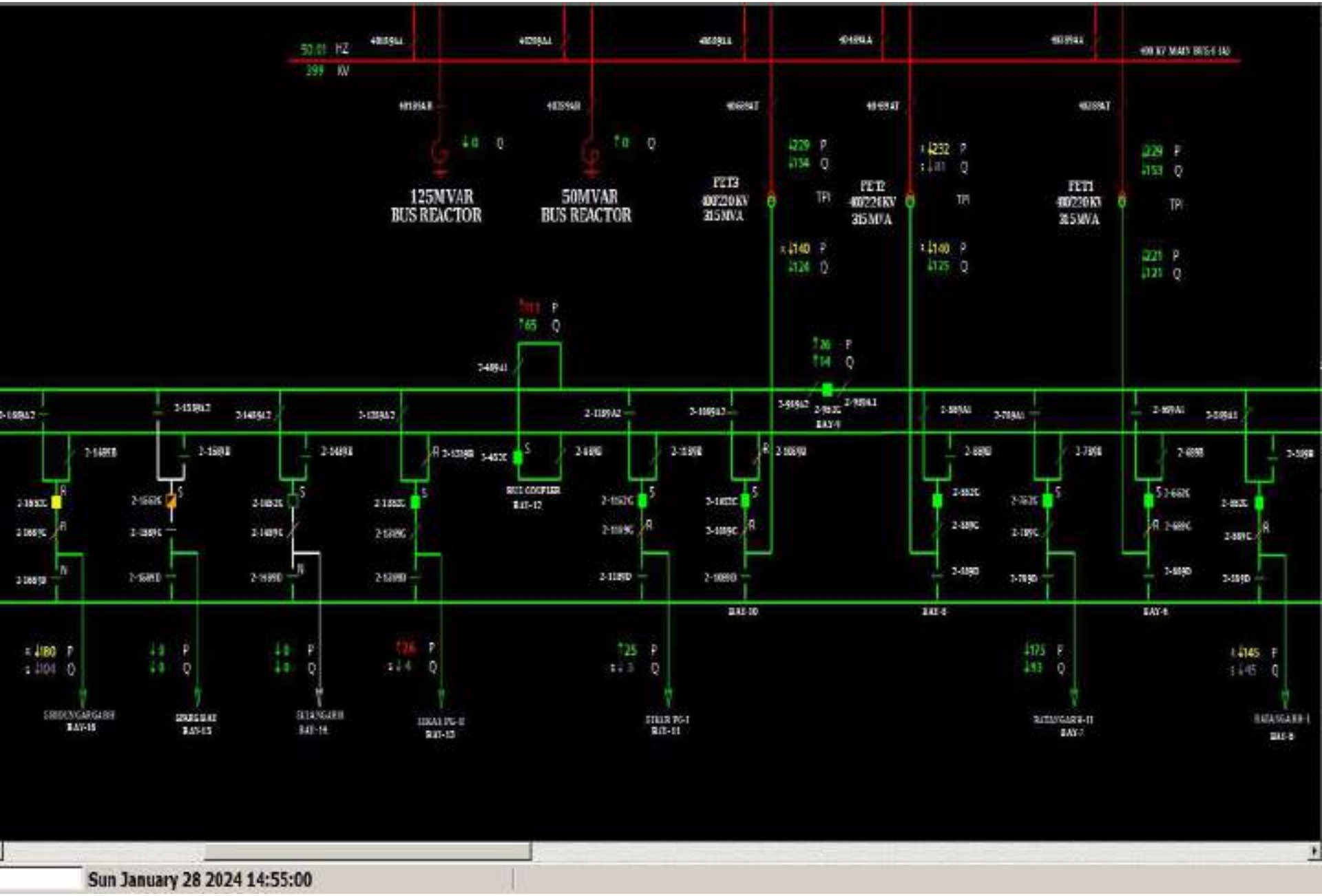
Network Diagram after the event



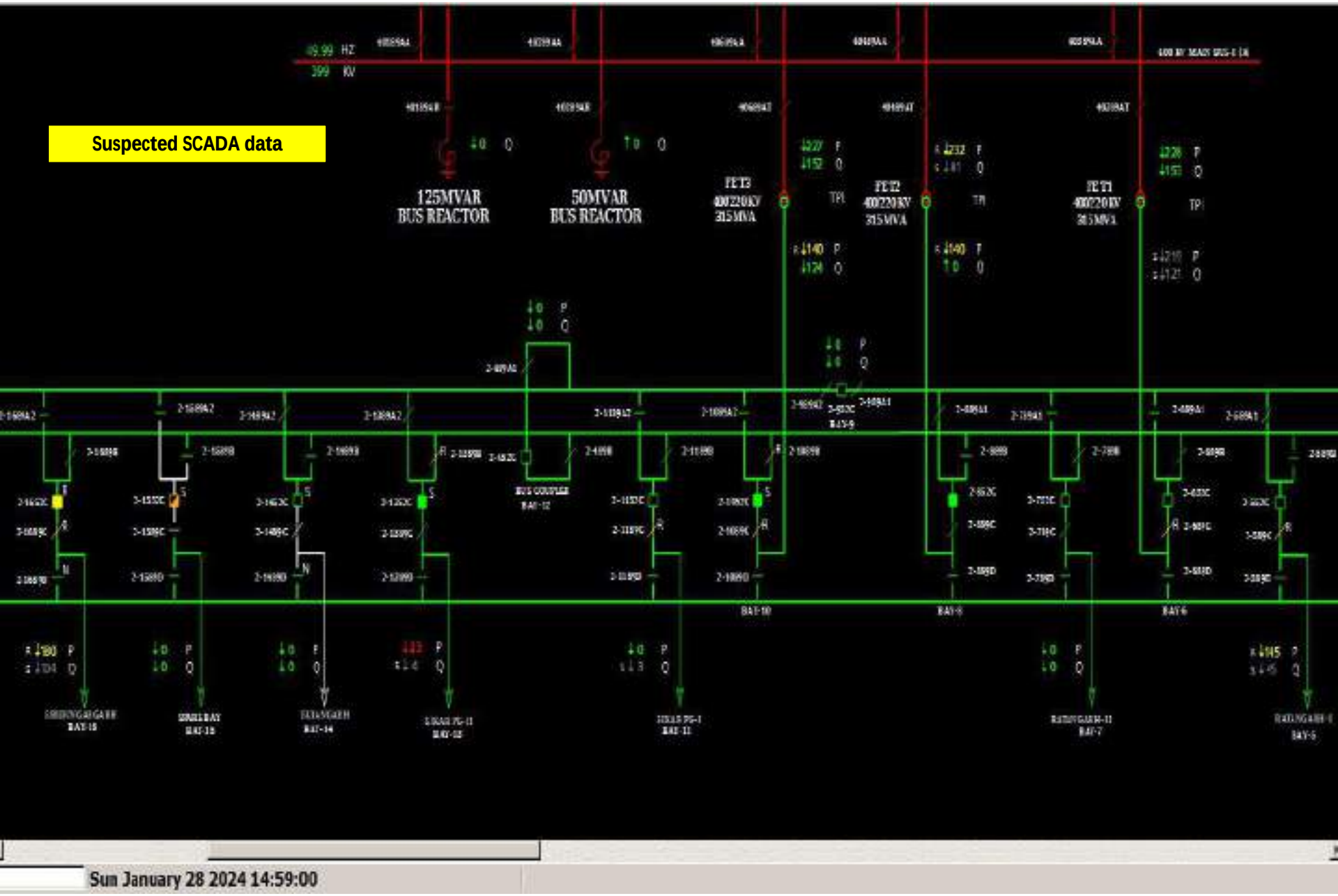
SLD of 400/220kV Ratangarh(RS) before the event



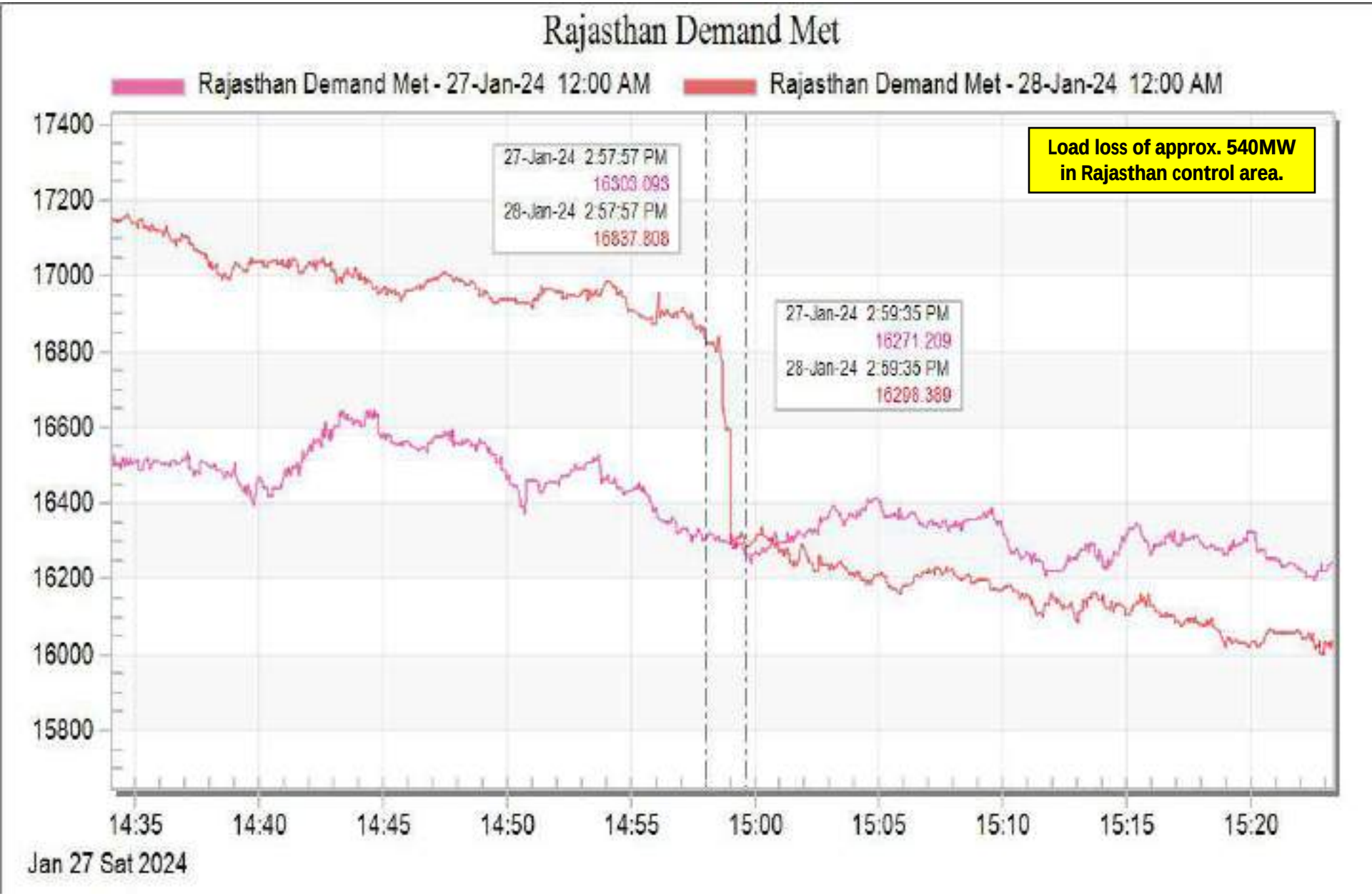
SLD of 400/220kV Ratangarh(RS) (zoomed) before the event



SLD of 400/220kV Ratangarh(RS) (zoomed) after the event

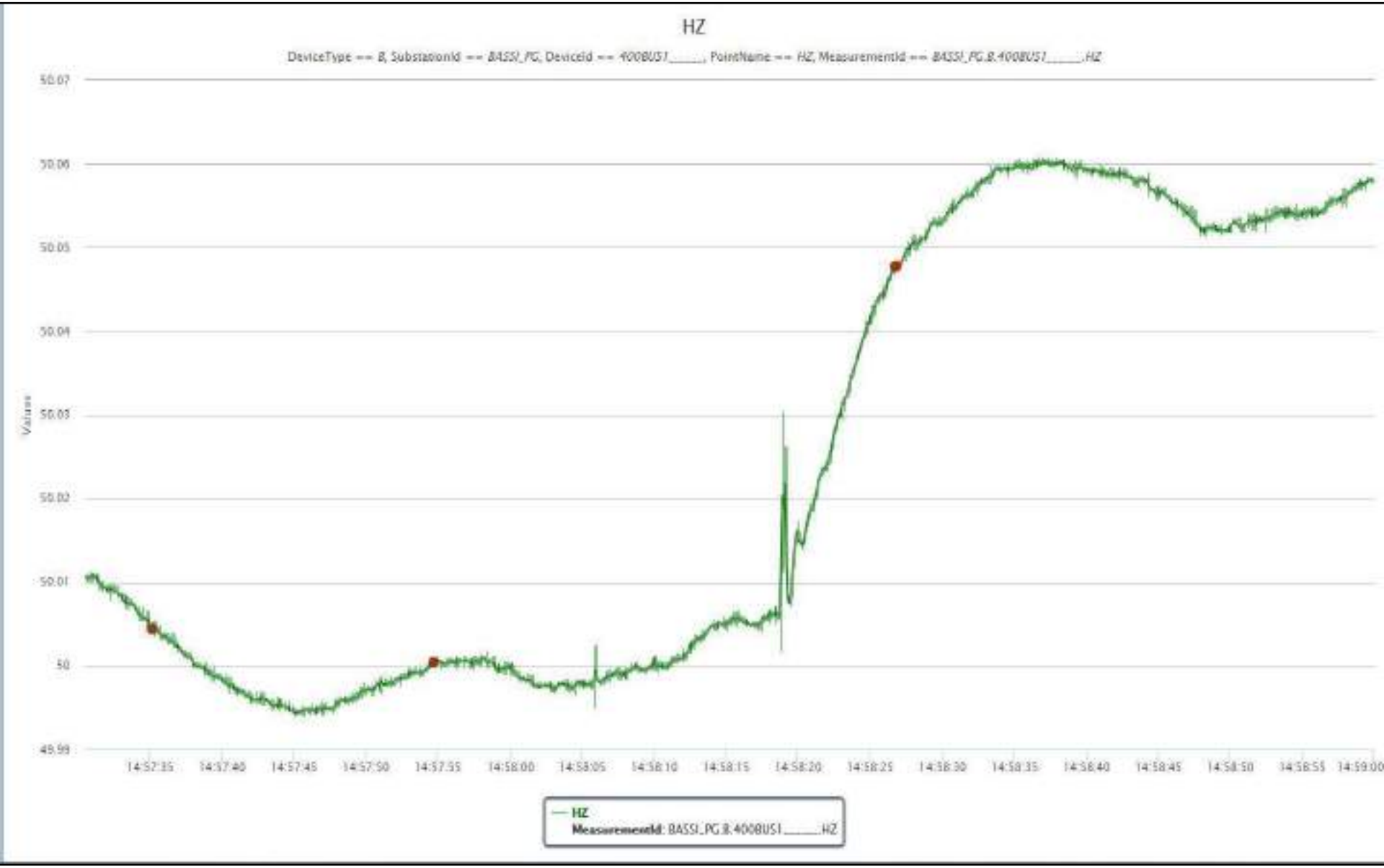


Rajasthan Demand during the event



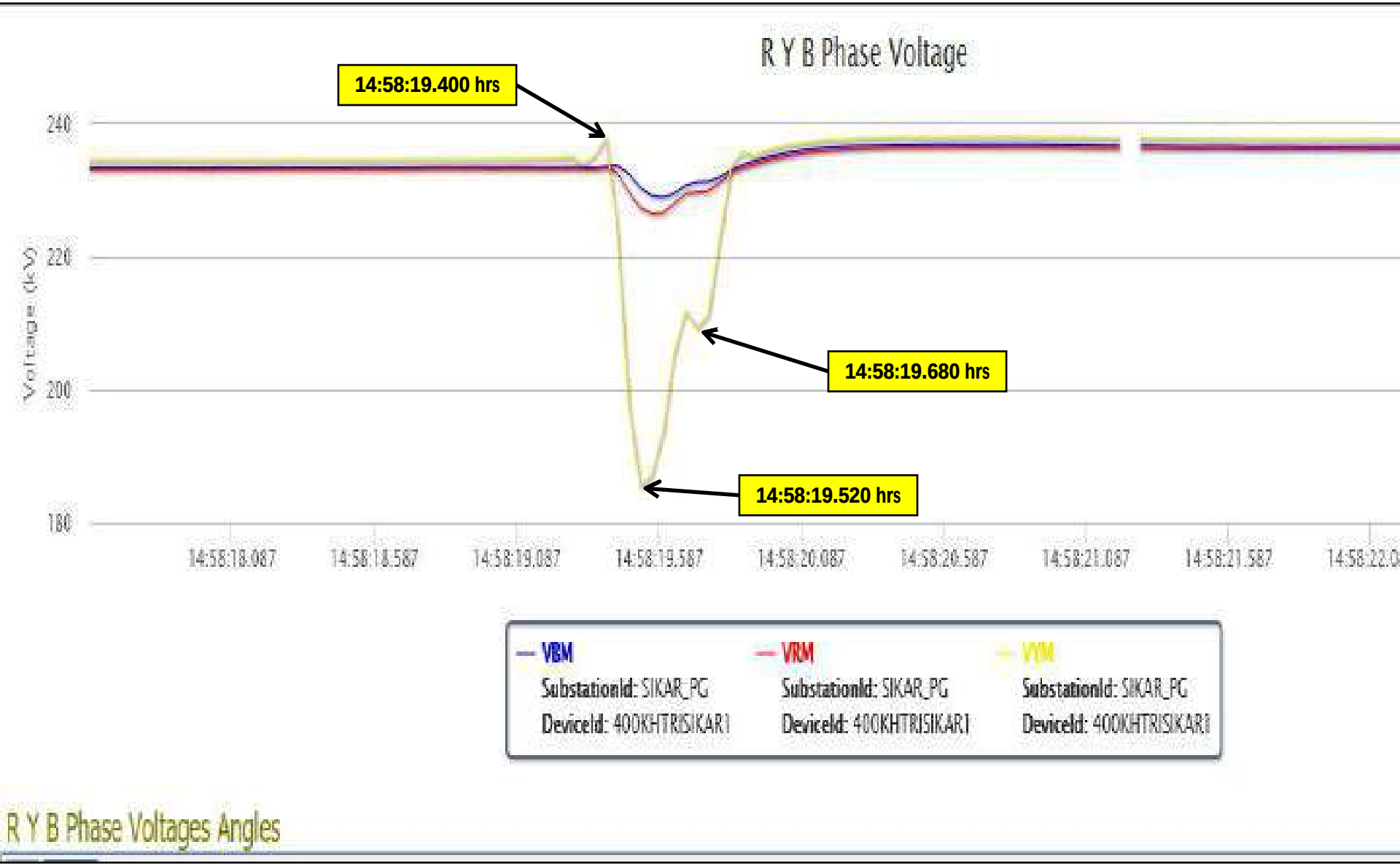
PMU Plot of frequency at Bassi(PG)

14:58 hrs/28-Jan-24

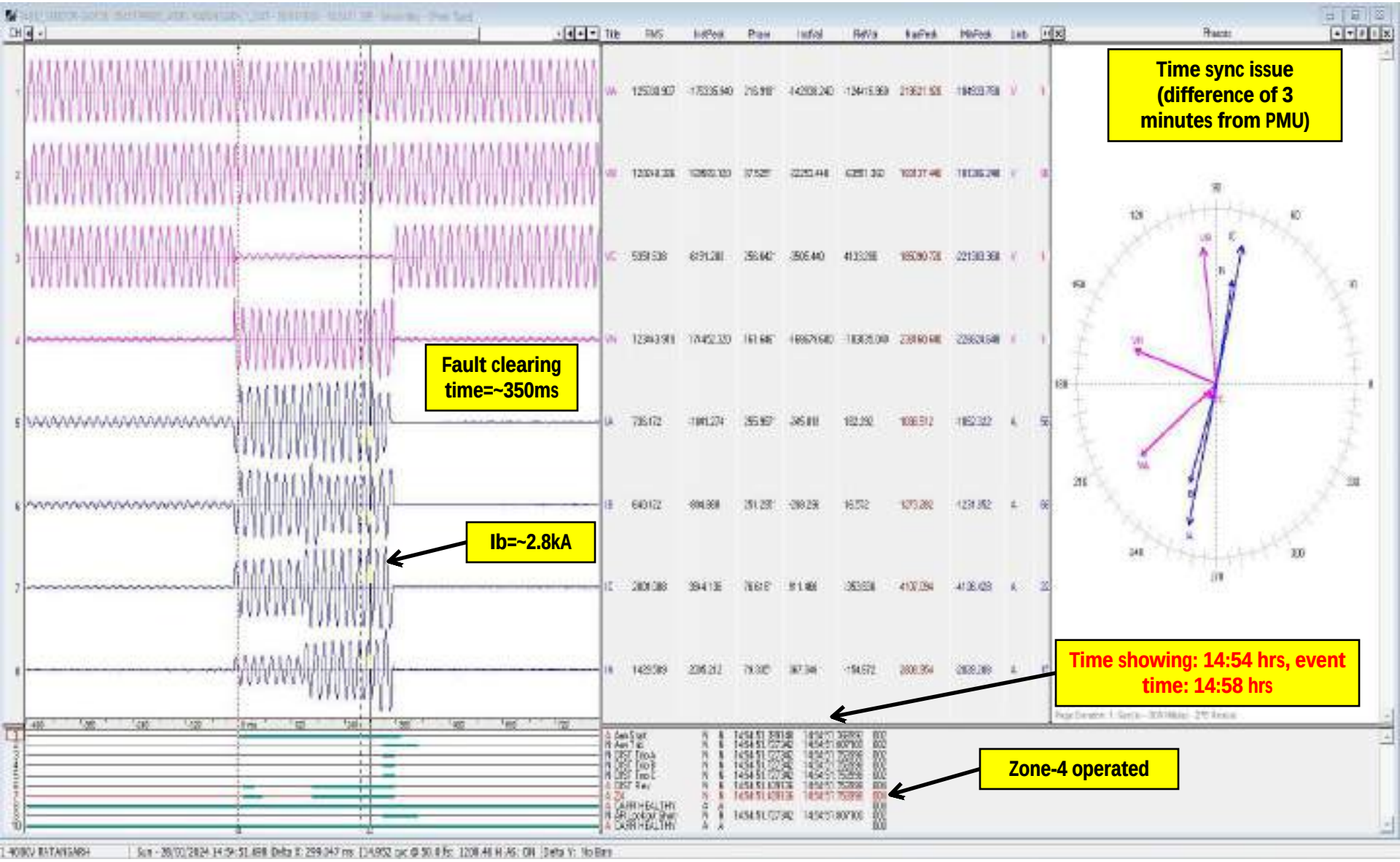


PMU Plot of phase voltage magnitude at Sikar(PG)

14:58 hrs/28-Jan-24



DR of 220 KV Ratangarh(RS) (end)-Sikar(PG) (PG) Ckt-1



As per DR, fault sensed in zone-4 and fault current was Ib=~2.8kA. Z-4 reset and again picked up and line tripped further after ***approx. 160msec Time not sync*** *and* ***DR nomenclature is also not correct.***

SCADA SOE

Time	Station Name	Voltage	Element Name	Element Type	Element Status	Remarks
14:56:49,647	RATN4_RS	220kV	05RATAN1	Circuit Breaker	Open	Line CB at Ratangarh(RS) end of 220kV Ratangarh-Ratangarh220 (RS) Ckt-1 opened
14:56:50,239	RATN4_RS	220kV	04MBC	Circuit Breaker	Open	Main Bus Coupler CB at 220kV Ratangarh(RS) opened
14:58:18,892	RATN4_RS	220kV	09BS	Circuit Breaker	Open	Bus Sectionaliser CB at 220kV Ratangarh(RS) opened
14:58:18,904	RATN4_RS	220kV	07RATAN2	Circuit Breaker	Open	Line CB at Ratangarh(RS) end of 220kV Ratangarh-Ratangarh220 (RS) Ckt-2 opened
14:58:18,987	RATAN_RS	220kV	08JHUNJ1	Circuit Breaker	Open	Line CB at Ratangarh220(RS) end of 220kV Ratangarh220-Jhunjhunu (RS) Ckt opened
14:58:19,041	RATN4_RS	400kV	11T1SU2	Circuit Breaker	Open	Tie CB at 400kV side of 400/220kV 315 MVA ICT-1 Ratangarh(RS) opened
14:58:19,043	RATN4_RS	220kV	06T1	Circuit Breaker	Open	CB at 220kV side of 400/220kV 315 MVA ICT-1 Ratangarh(RS) opened
14:58:19,043	RATN4_RS	400kV	12T1	Circuit Breaker	Open	Main CB at 400kV side of 400/220kV 315 MVA ICT-1 Ratangarh(RS) opened
14:58:19,069	RATN4_RS	220kV	11SIKAR1	Circuit Breaker	Open	Line CB at Ratangarh(RS) end of 220kV Ratangarh(RS)-Sikar(PG) Ckt-1 opened

Point of discussion

- Exact location and nature of fault?
- Bus-wise arrangements of elements at 220kV Ratangarh?
- Reason of delayed clearance of fault need to be shared.
- Phase sequence issue is observed. As per PMU, Y-N fault however, as per DR pf Ratangarh end B-N fault.
- Details of all tripped elements at 220kV level?
- Exact reason of tripping of 220kV Ratangarh220-Jhunjhunu (RS) Ckt need to be shared. Relay flag, DR etc.?
- DR/EL of following elements not received?
  - ✓ 400/220kV 315MVA ICT-1
  - ✓ 220kV Ratangarh-Ratangarh ckt -1&2
  - ✓ Other elements if tripped
- Detailed report along with remedial action taken details not received.

Multiple elements tripping at 400/220kV Bhadla(RS) 25th February 2024

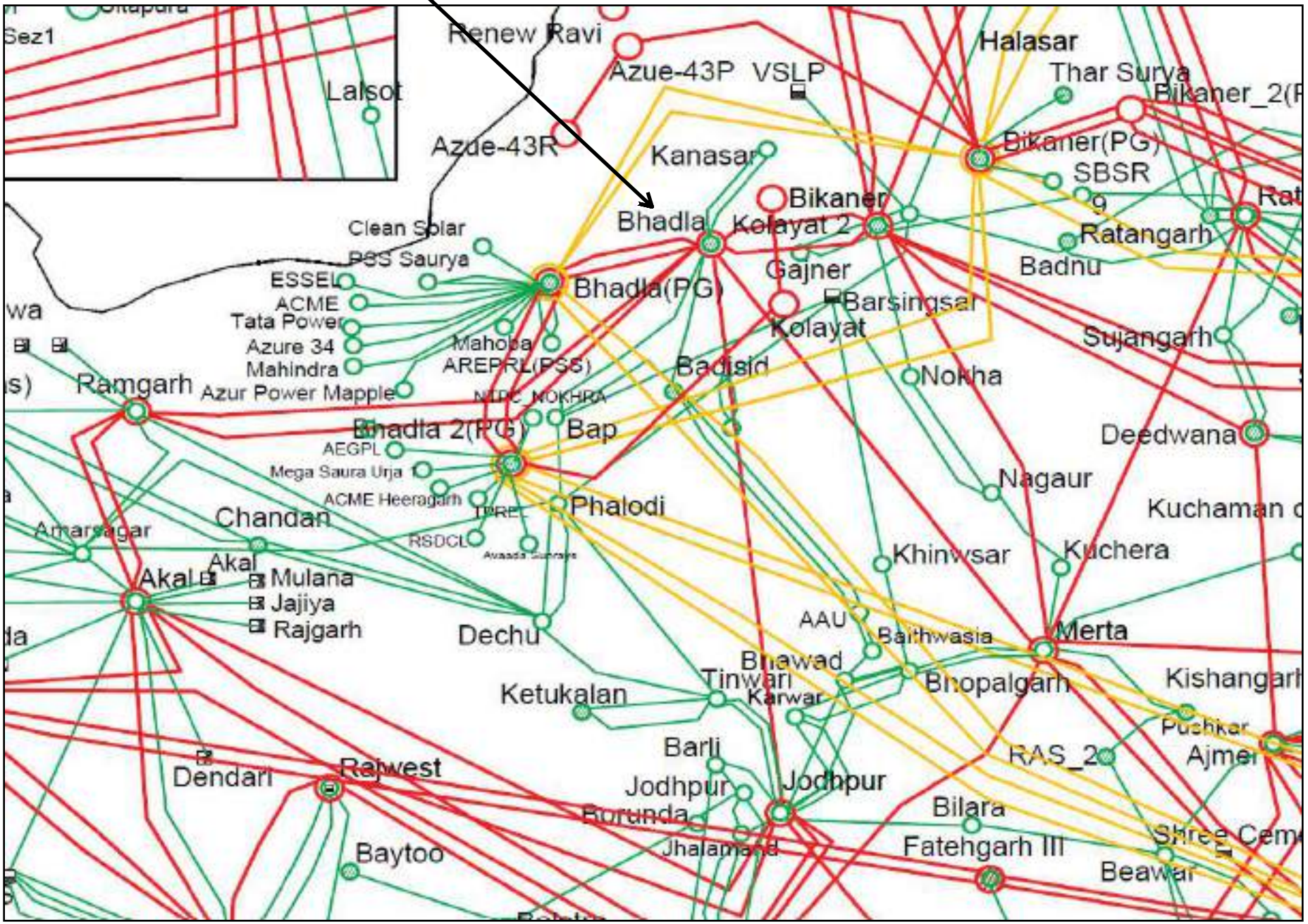
Brief of event:

- During antecedent condition, MVA power flows of 400/220 kV 500 MVA ICT 1, 2 & 3 at Bhadla(RS) were 417MVA, 452MVA and 454MVA respectively as per SCADA.
- As reported, at 12:55hrs, 400/220 kV 500 MVA ICT 1 at Bhadla(RS) tripped. 220 KV side R-Phase Bus isolator of 500 MVA 400/220/33 kV Transformer (ICT-I) found burnt.
- Due to this tripping, 400/220 kV 500 MVA ICT 2 and 3 at Bhadla(RS) also tripped on overcurrent protection operation.
- As per PMU at Bikaner(PG), R-Y phase to phase fault converted to 3-phase fault is observed with delayed fault clearance time of 880 ms.
- As per SCADA, change in demand of approx. 545MW is observed in Rajasthan control area.
- As per SCADA, change in NR total solar generation of approx. 1890MW is observed.

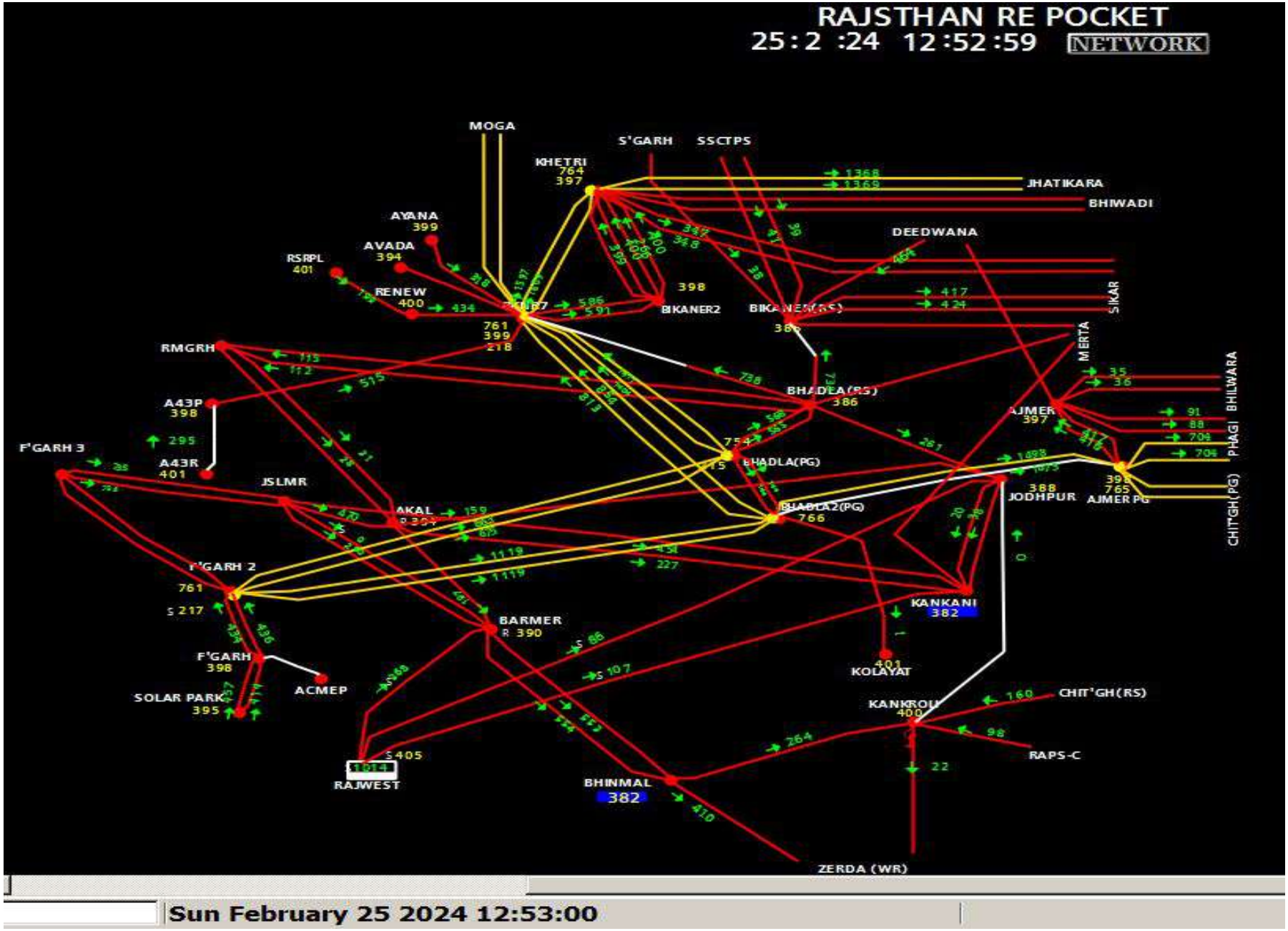
Elements tripped:

i. 400/220 kV 500 MVA ICT 1 at Bhadla(RS)
ii. 400/220 kV 500 MVA ICT 2 at Bhadla(RS)
iii. 400/220 kV 500 MVA ICT 3 at Bhadla(RS)

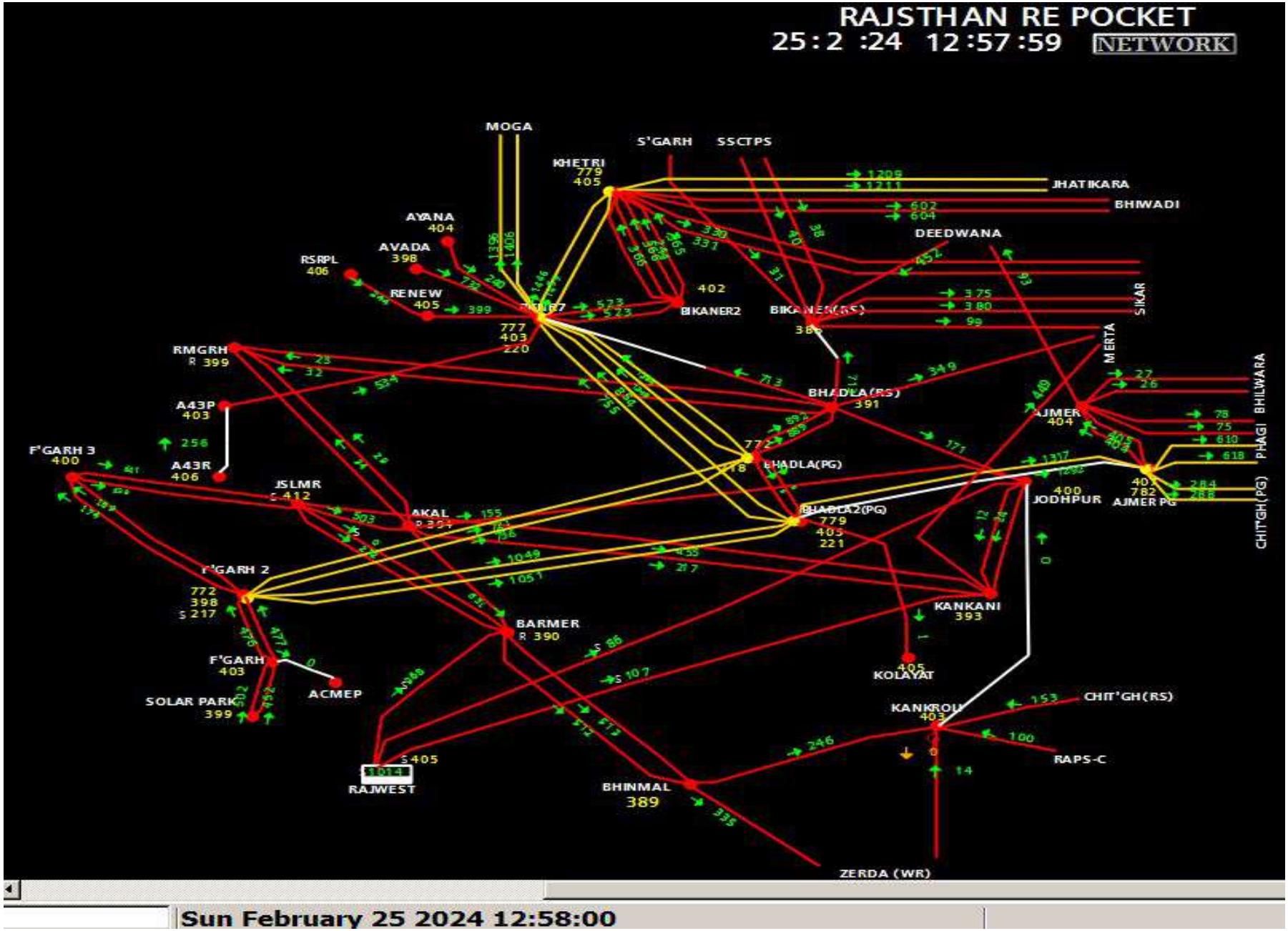
Network Diagram



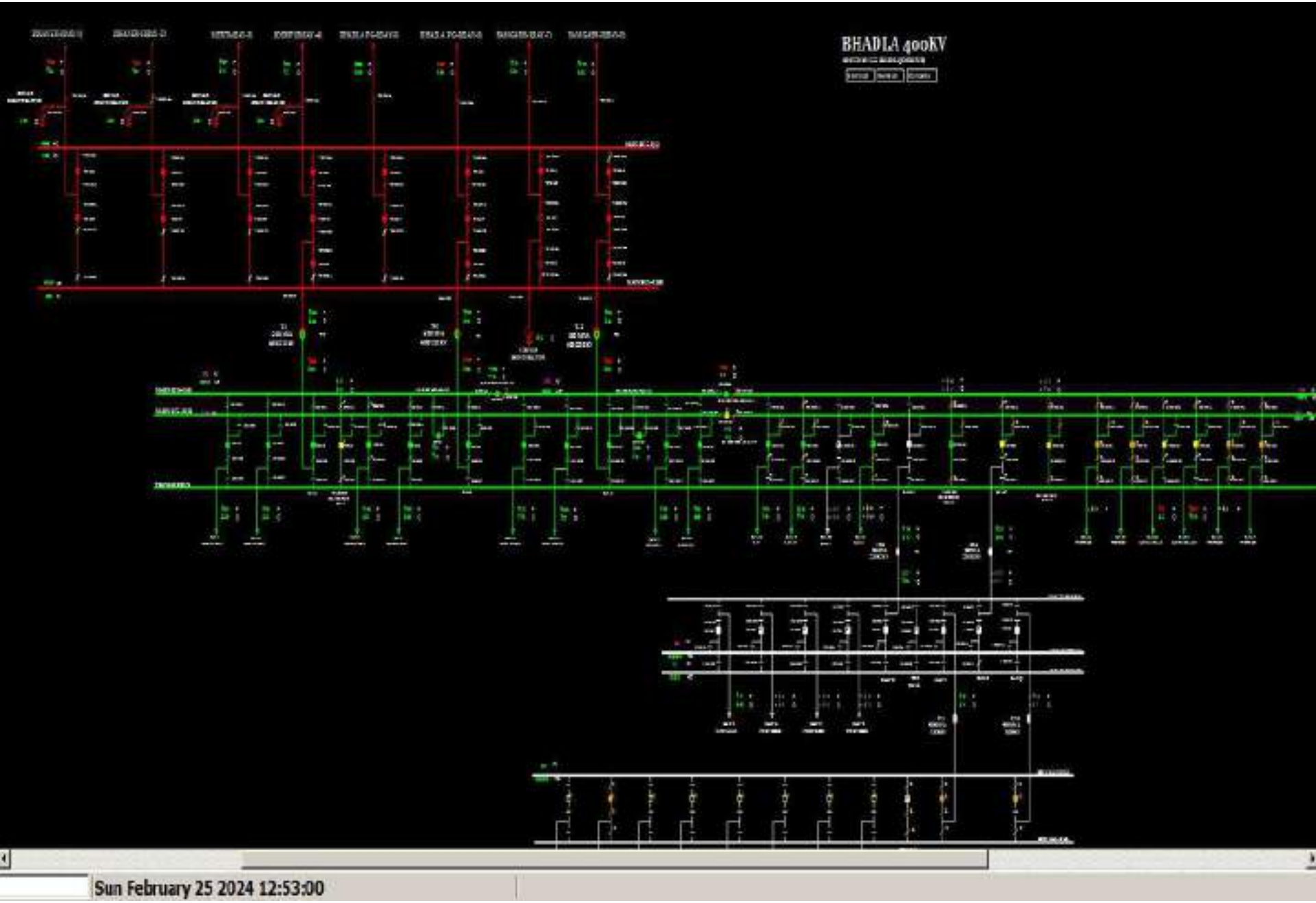
Network Diagram before the event



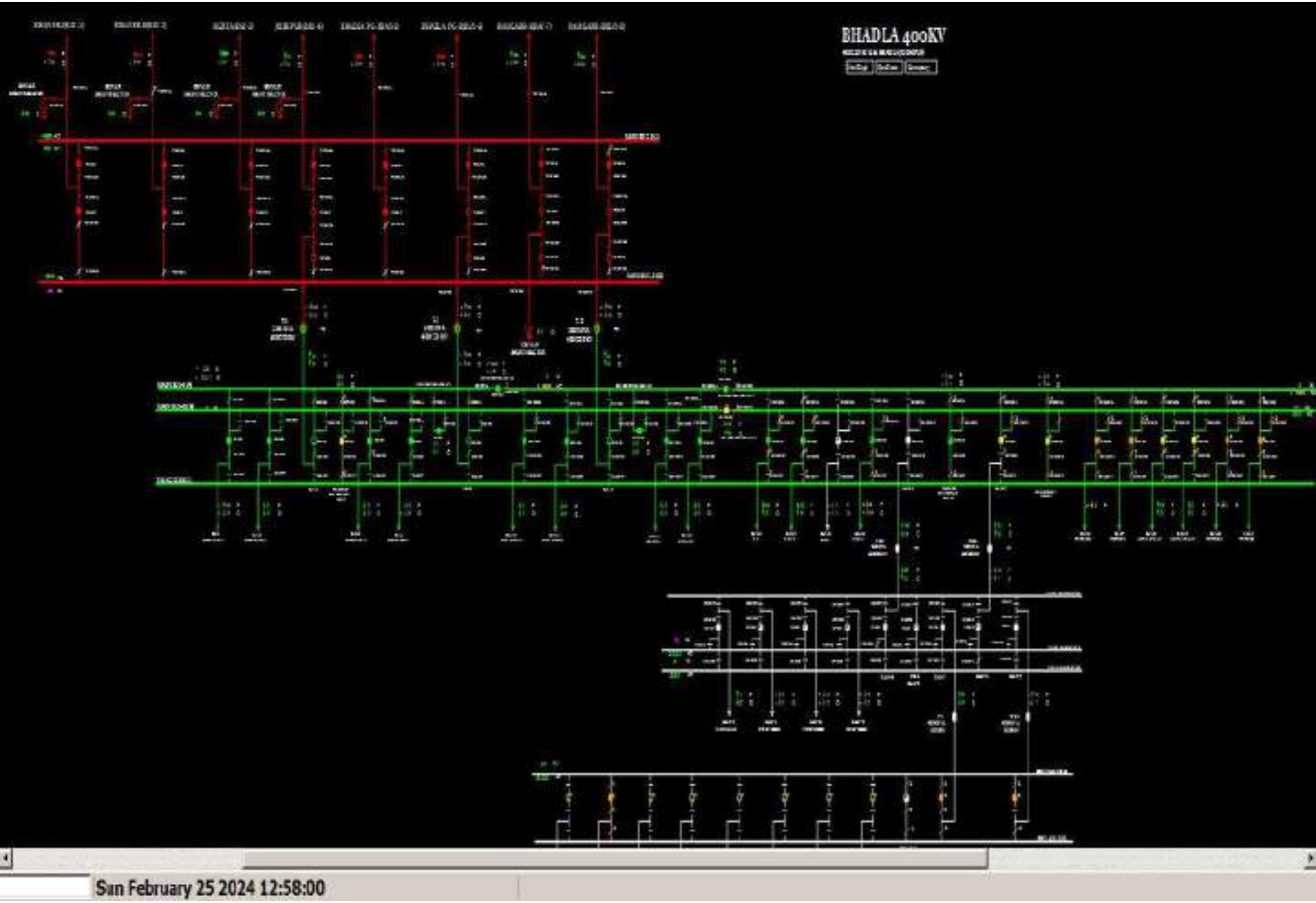
Network Diagram after the event



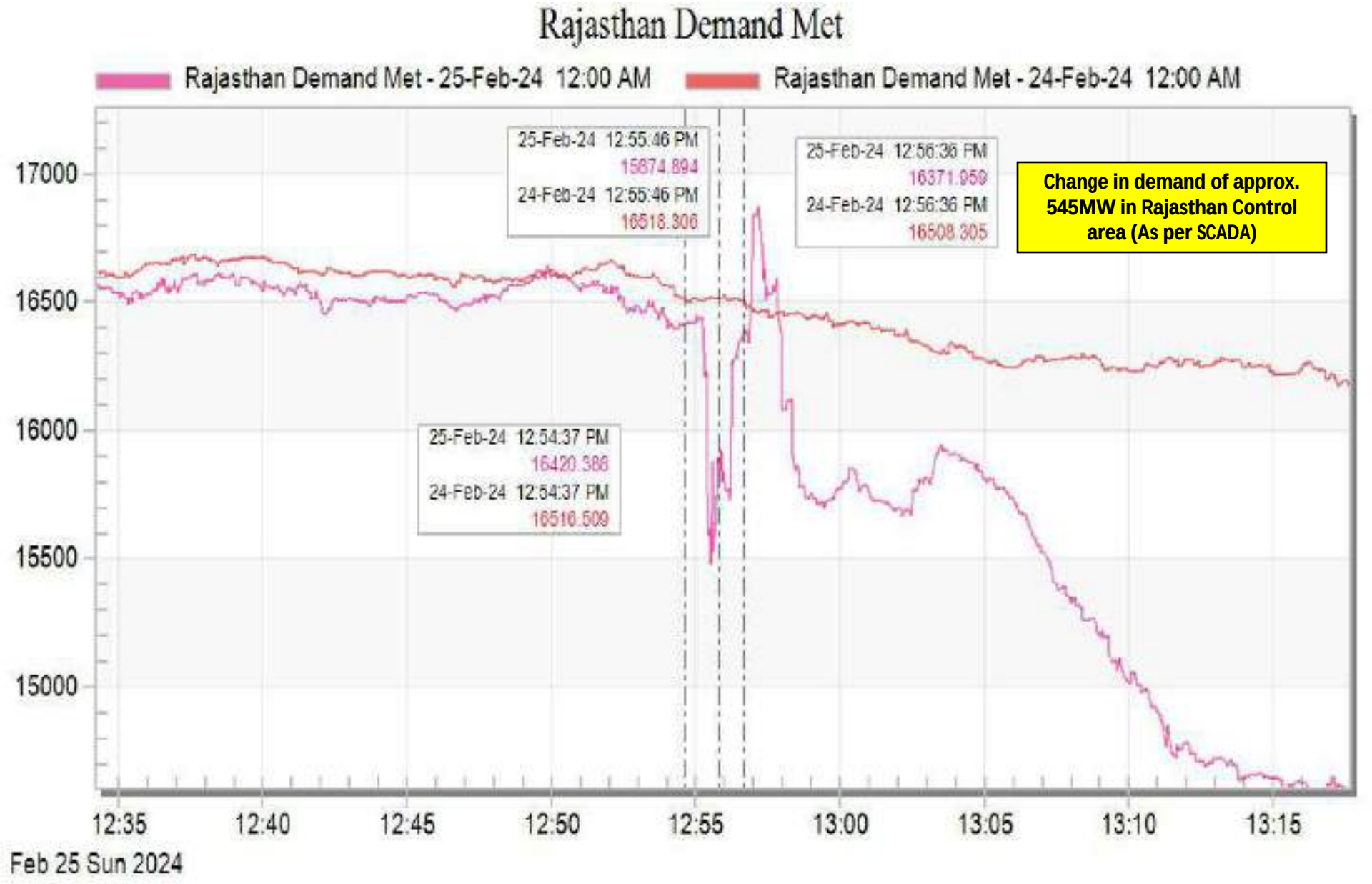
SLD of 400 KV Bhadla(RS) before the event



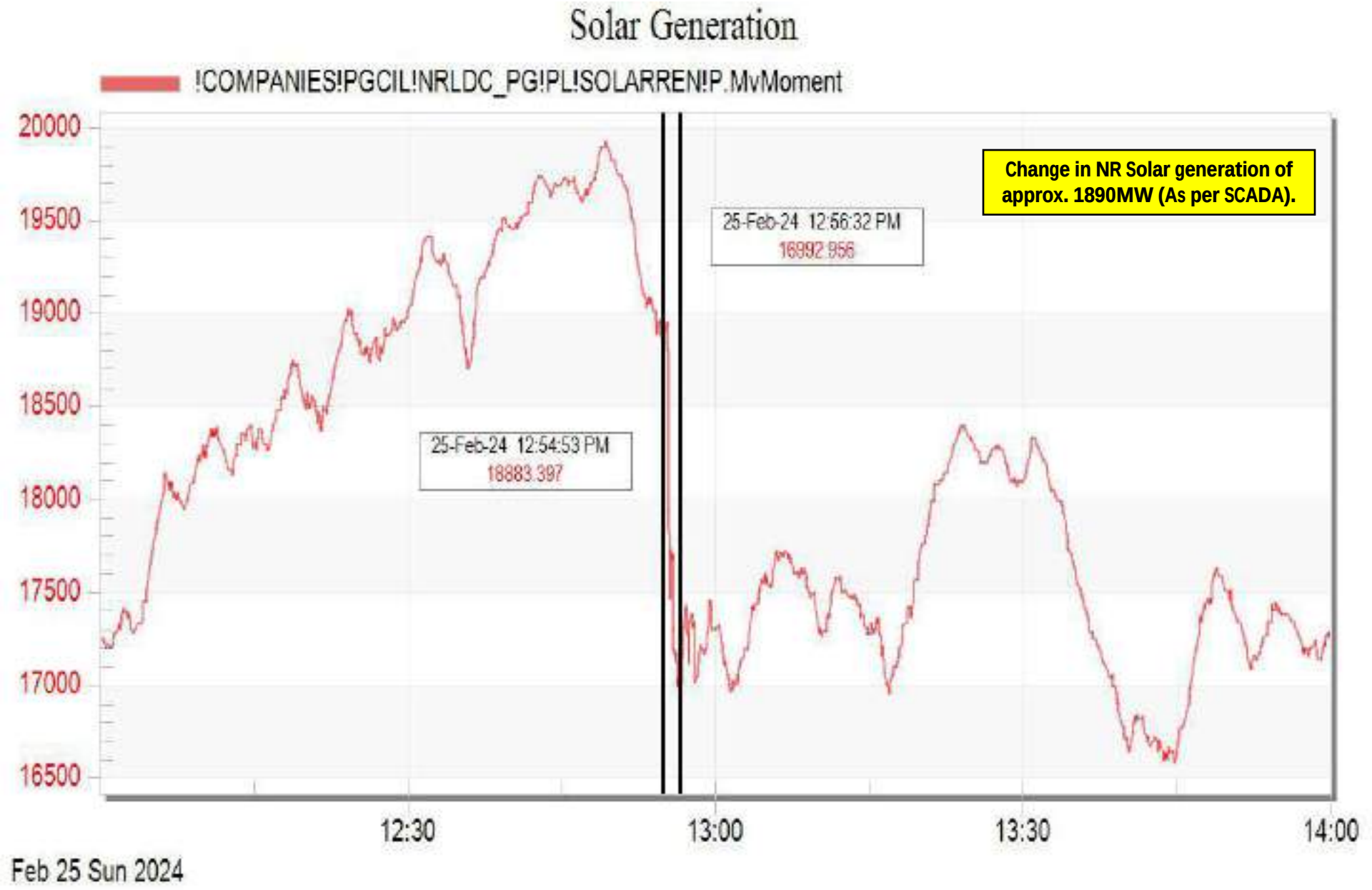
SLD of 400 KV Bhadla(RS) before the event



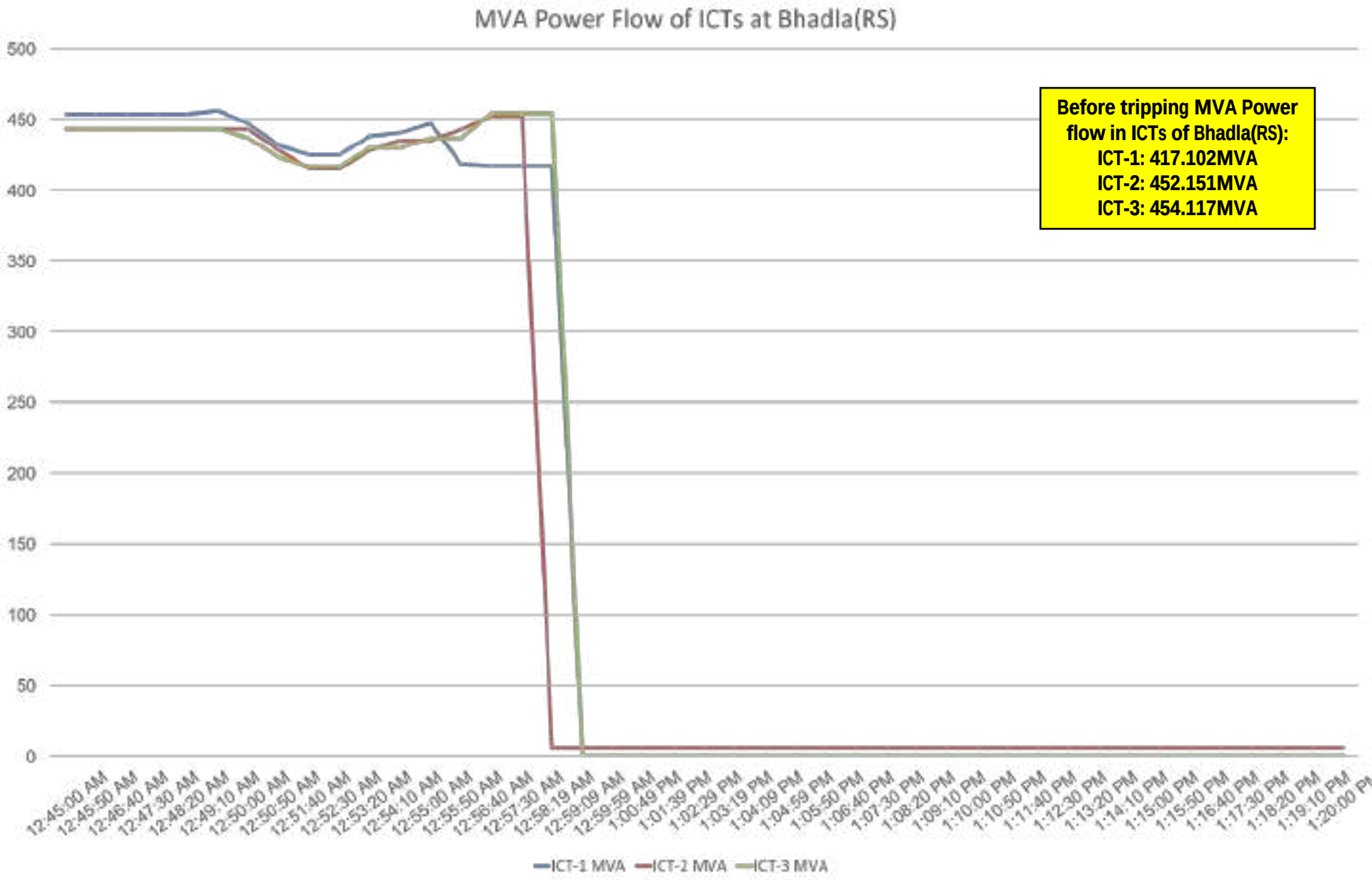
Rajasthan Demand during the event



NR Solar Generation during the event



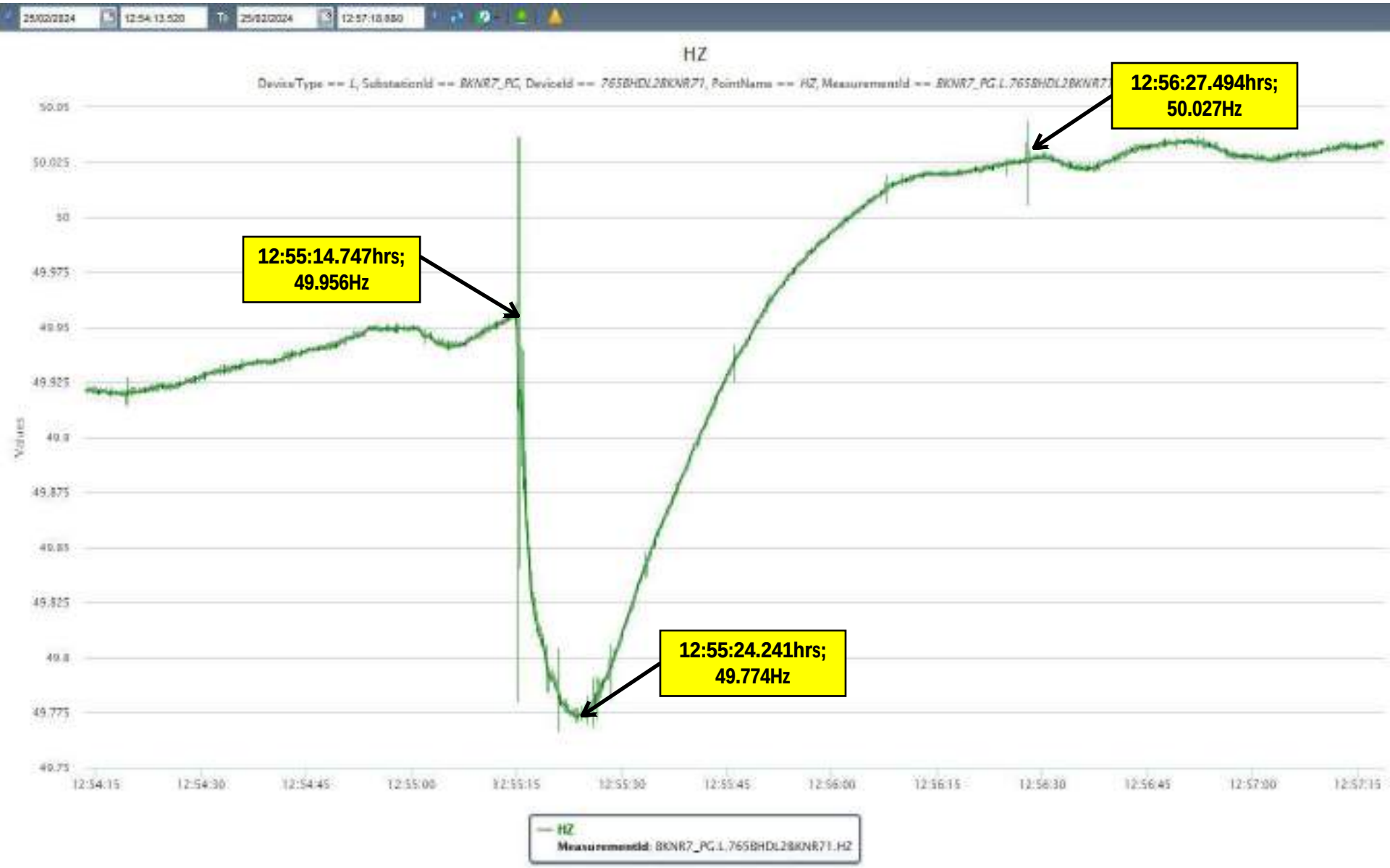
MVA Power Flow of ICTs at Bhadla(RS)



Before tripping MVA Power flow in ICTs of Bhadla(RS):
ICT-1: 417.102MVA
ICT-2: 452.151MVA
ICT-3: 454.117MVA

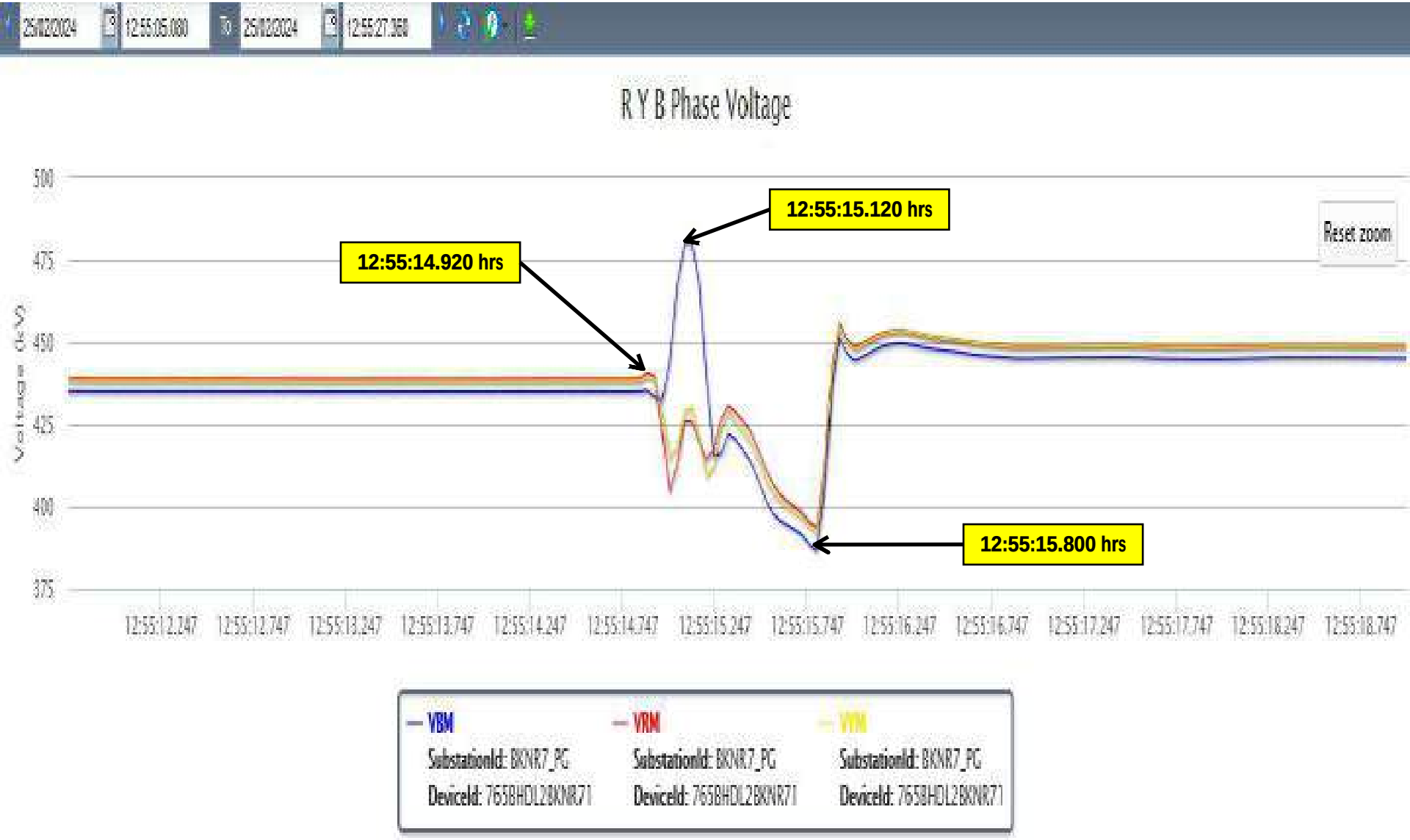
PMU Plot of frequency at Bikaner(PG)

12:55 hrs/25-Feb-24



PMU Plot of phase voltage magnitude at Bikaner(PG)

12:55 hrs/25-Feb-24



SCADA SOE

Time	Station Name	Voltage	Element Name	Element Type	Element Status	Remarks
12:55:15,268	BHDLA_RS	400kV	11JODHP2	Circuit Breaker	Open	Tie CB at 400kV side of 400/220kV 500MVA ICT-1 at Bhadla(RS) opened
12:55:15,268	BHDLA_RS	400kV	12T1	Circuit Breaker	Open	Main CB at 400kV side of 400/220kV 500MVA ICT-1 at Bhadla(RS) opened
12:55:15,268	BHDLA_RS	220kV	03T1	Circuit Breaker	Open	CB at 220kV side of 400/220kV 500MVA ICT-1 at Bhadla(RS) opened
12:55:15,859	BHDLA_RS	400kV	23RMGRH2	Circuit Breaker	Open	Tie CB at 400kV side of 400/220kV 500MVA ICT-3 at Bhadla(RS) opened
12:55:15,861	BHDLA_RS	400kV	18T2	Circuit Breaker	Open	Main CB at 400kV side of 400/220kV 500MVA ICT-2 at Bhadla(RS) opened
12:55:15,861	BHDLA_RS	400kV	24T3	Circuit Breaker	Open	Main CB at 400kV side of 400/220kV 500MVA ICT-3 at Bhadla(RS) opened
12:55:15,862	BHDLA_RS	220kV	08T2	Circuit Breaker	Open	CB at 220kV side of 400/220kV 500MVA ICT-2 at Bhadla(RS) opened
12:55:15,863	BHDLA_RS	400kV	17PGT2	Circuit Breaker	Open	Tie CB at 400kV side of 400/220kV 500MVA ICT-2 at Bhadla(RS) opened
12:55:15,863	BHDLA_RS	220kV	12T3	Circuit Breaker	Open	CB at 220kV side of 400/220kV 500MVA ICT-3 at Bhadla(RS) opened

Point of discussion

- Exact reason, nature and location of fault?
- As per SCADA SOE, ICT-1 tripped within ~200msec of fault. Fault would have cleared with tripping of this ICT, Then, why did delayed clearance of fault is observed.
- DR/EL of all three ICTs didn't receive yet.
- Detailed report along with remedial action taken details not received.

Multiple elements tripping at 400/220/132kV Merta(RS) 14th March 2024

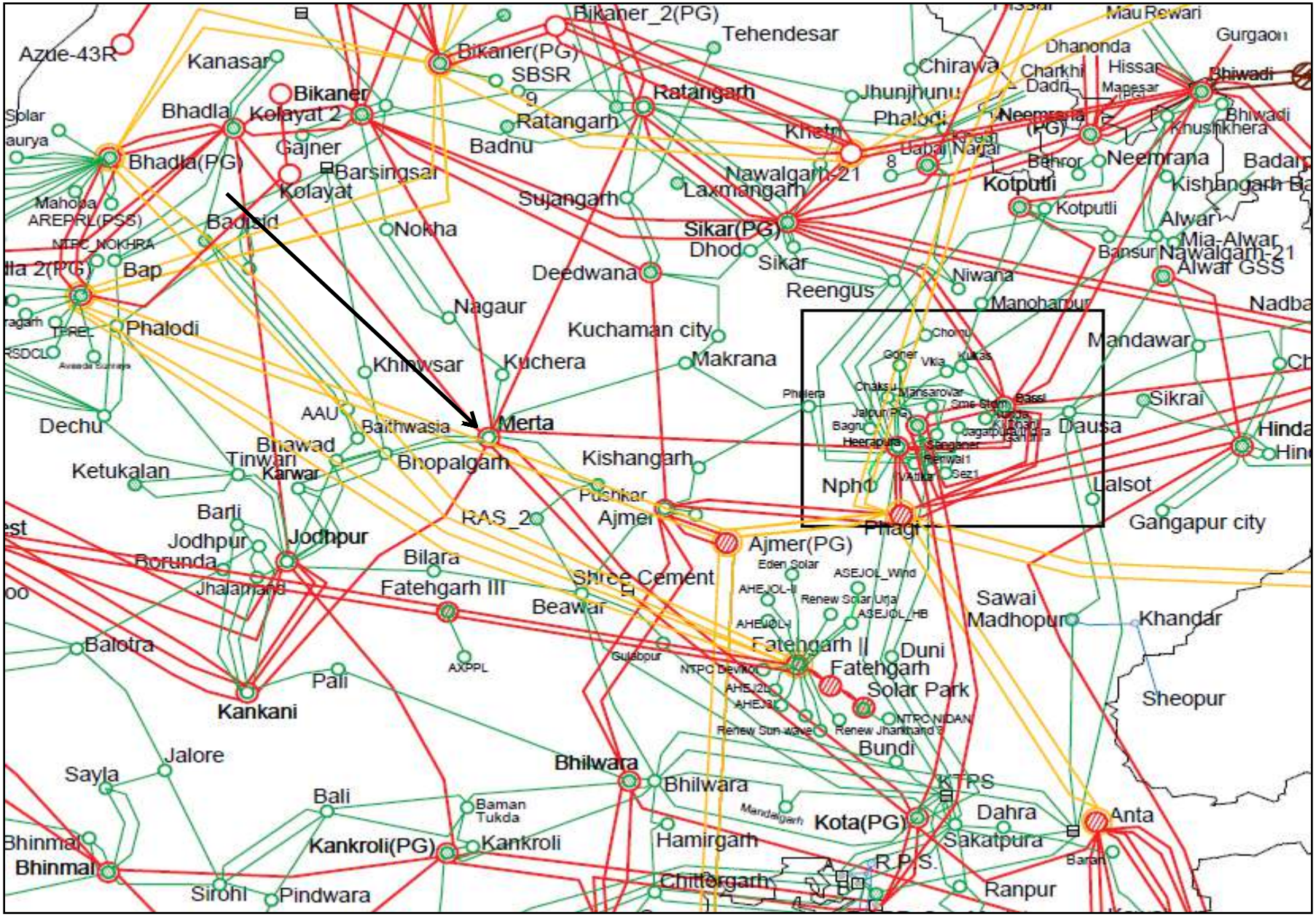
Brief of event:

- During antecedent condition, MVA power flows of 400/220 kV 315 MVA ICT 1 & 2 and 220/132kV 100MVA ICT-1, 2 & 3 at Merta(RS) were 275MVA, 261MVA, 60MVA, 55MVA and 54MVA respectively as per SCADA. 220kV Merta(RS)-Makrana(RS) Ckt was not in service.
- As reported, **at 12:55hrs, R-phase jumper of 220kV Merta(RS)-Bhopalgarh(RS) Ckt snapped** and this **broken jumper fell on conductor of ICT 1.** As per DR, **400/220 kV 315 MVA ICT 1 at Merta(RS) tripped on O/C E/F protection operation** with Ir=~5.2kA.
- Due to tripping of ICT-1, 400/220 kV 315 MVA ICT 2 at Merta(RS) got over-loaded. As per DR, 400/220 kV 315 MVA ICT 2 at Merta(RS) tripped on phase directional O/C protection operation with Ir=~5.83kA.
- During the same time, **LBB of 220kV Merta(RS)-Bhopalgarh(RS) Ckt operated** (exact reason for line CB at Merta(RS) end unable to clear the fault yet to be shared).
- Due to LBB operation, all the elements connected to 220kV Bus-1 & 2 at Merta(RS) tripped and both the buses became dead.
- As per PMU at Merta(RS), R-N phase to earth fault is observed with delayed fault clearance time of 880 ms.
- As per SCADA, change in demand of approx. 335MW is observed in Rajasthan control area.

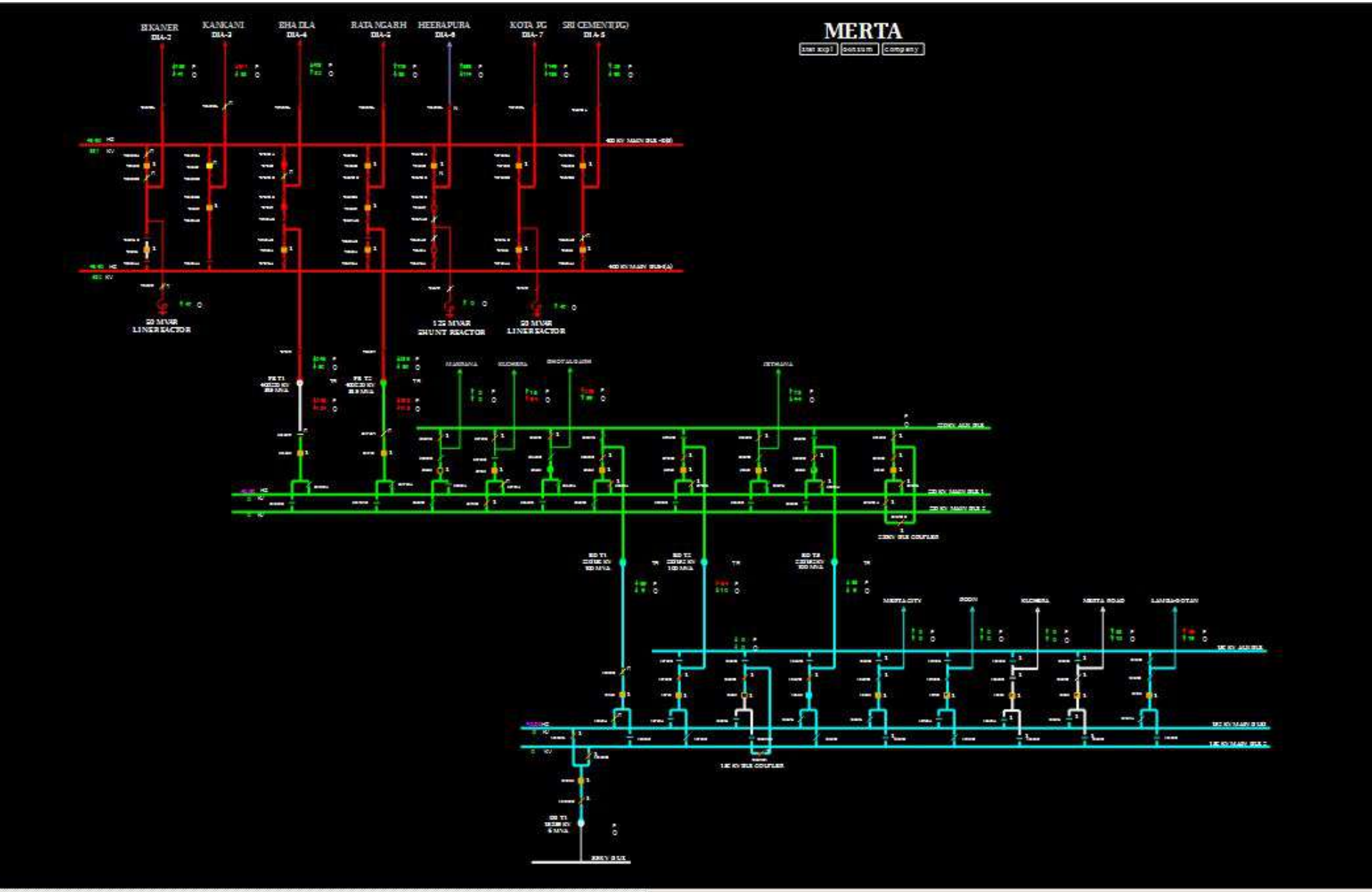
Elements tripped:

i. 400/220 kV 315 MVA ICT 1 at Merta(RS)
ii. 400/220 kV 315 MVA ICT 2 at Merta(RS)
iii. 220kV Merta(RS)-Bhopalgarh(RS) Ckt
iv. 220kV Merta(RS)-Kuchera(RS) Ckt
v. 220kV Merta(RS)-Jethana(RS) Ckt
vi. 220/132kV 100MVA ICT-1 at Merta(RS)
vii. 220/132kV 100MVA ICT-2 at Merta(RS)
viii. 220/132kV 100MVA ICT-3 at Merta(RS)

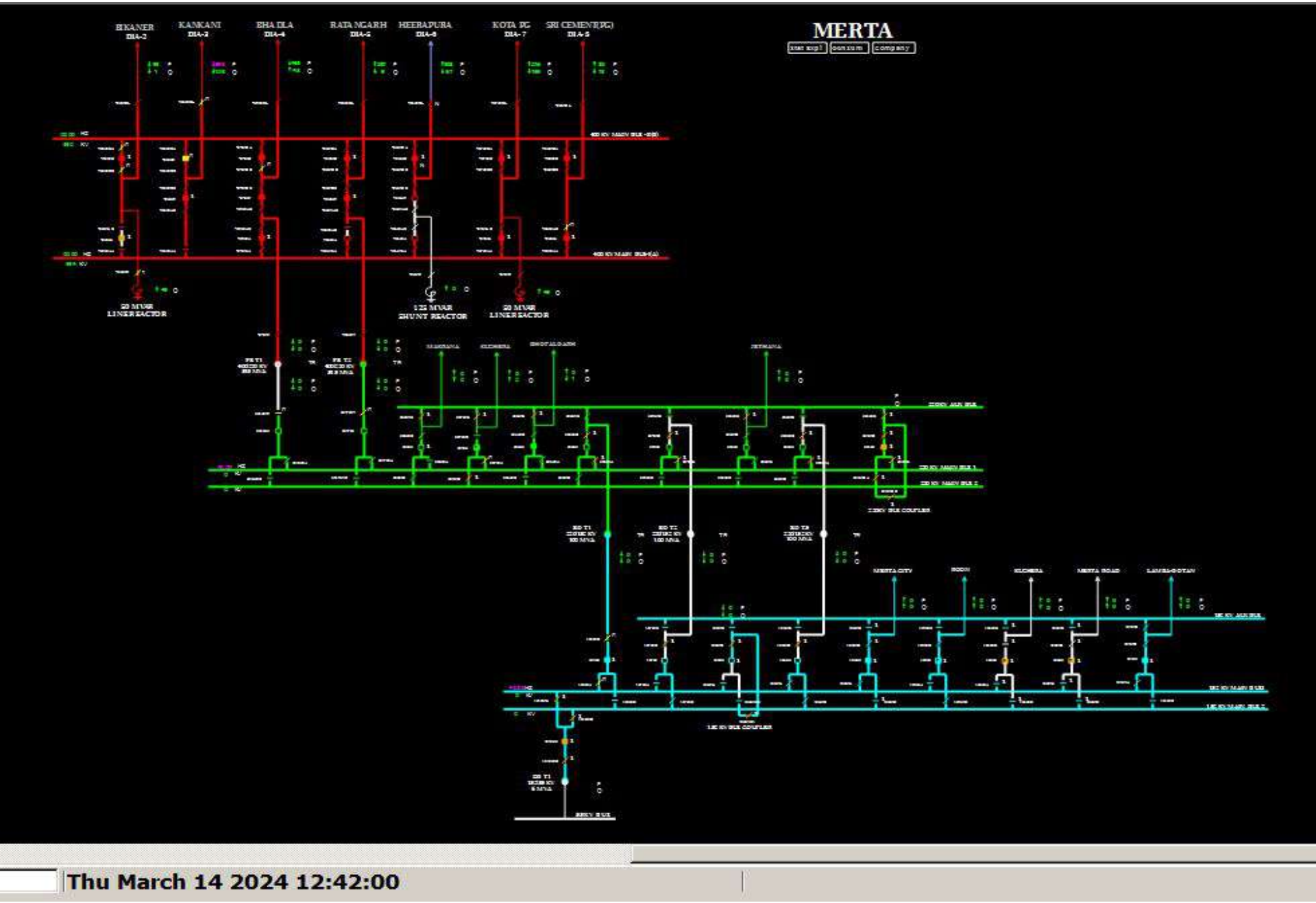
Network Diagram



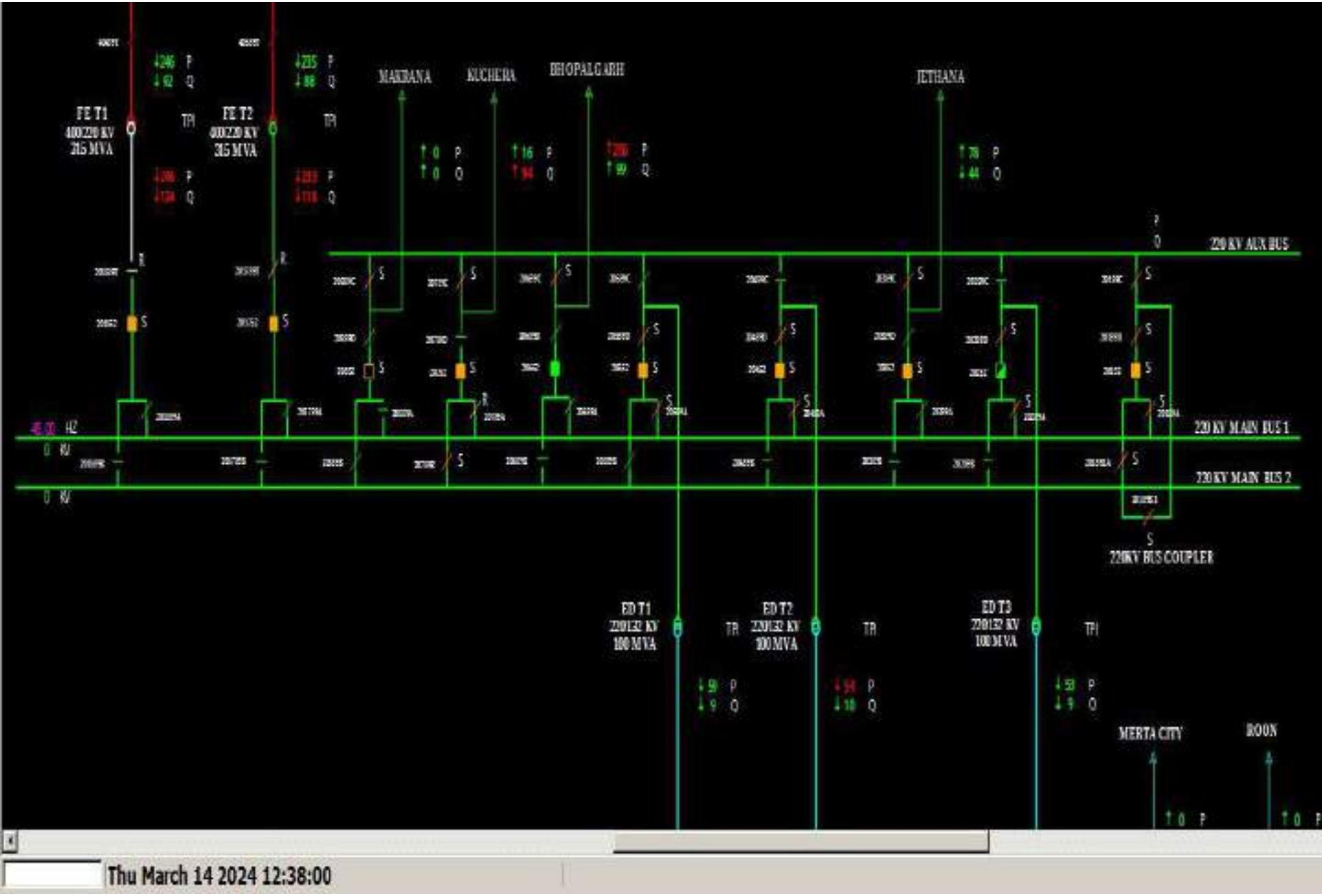
SLD of 400/220/132kV Merta(RS) before the event



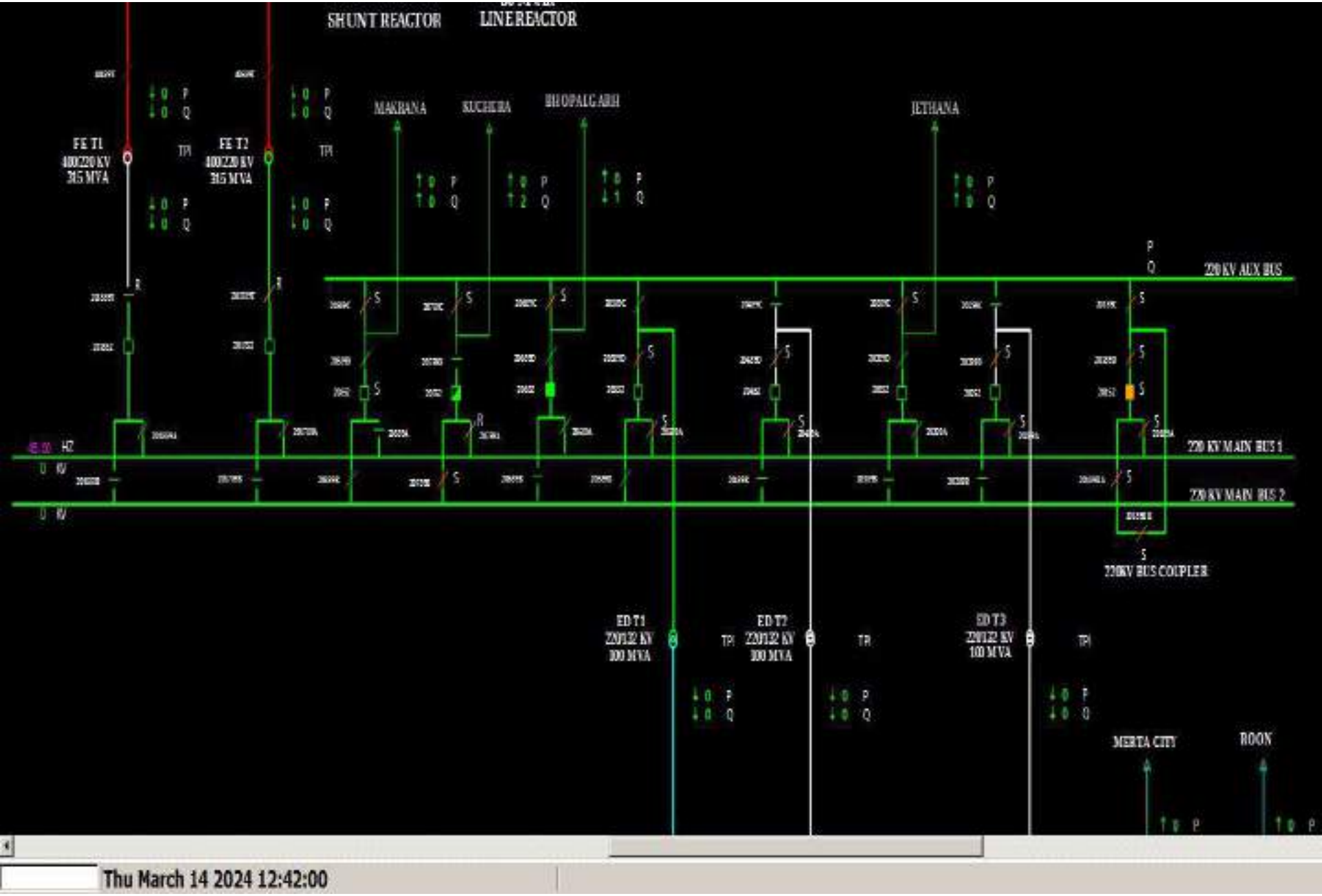
SLD of 400/220/132kV Merta(RS) after the event



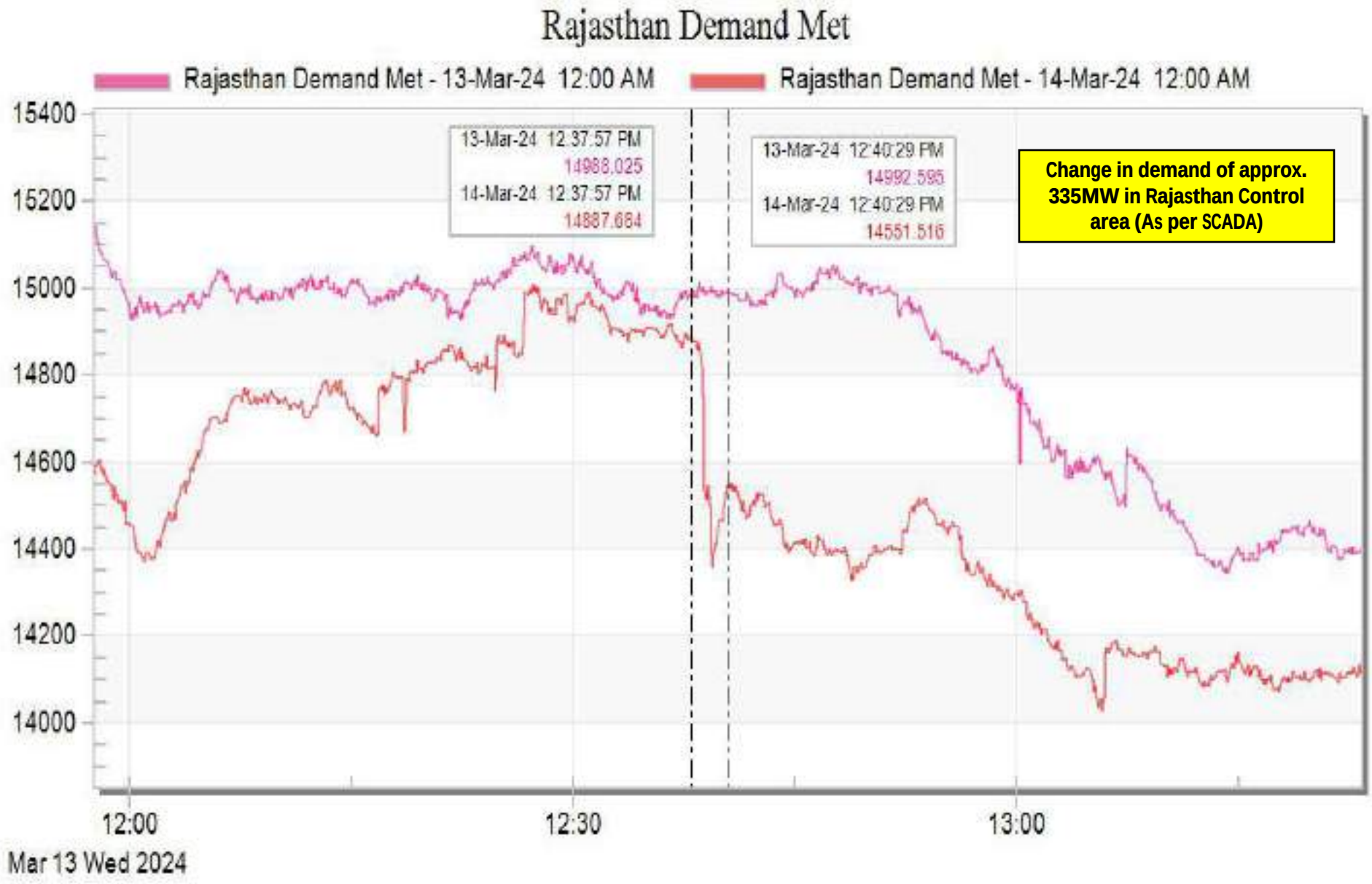
SLD of 400/220/132kV Merta(RS) (zoomed) before the event



SLD of 400/220/132kV Merta(RS) (zoomed) after the event

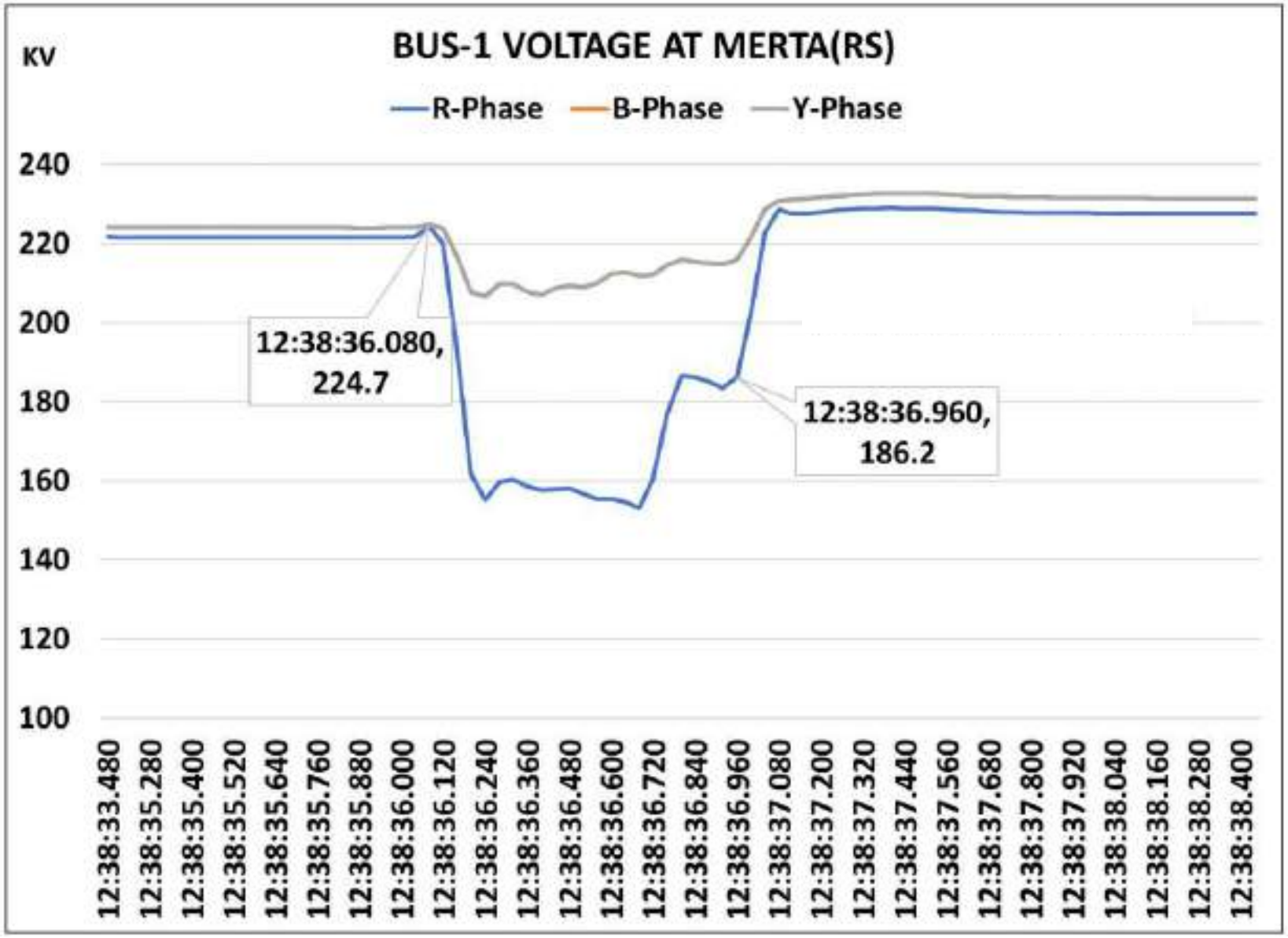


Rajasthan Demand during the event



PMU Plot of phase voltage magnitude at Merta(RS)

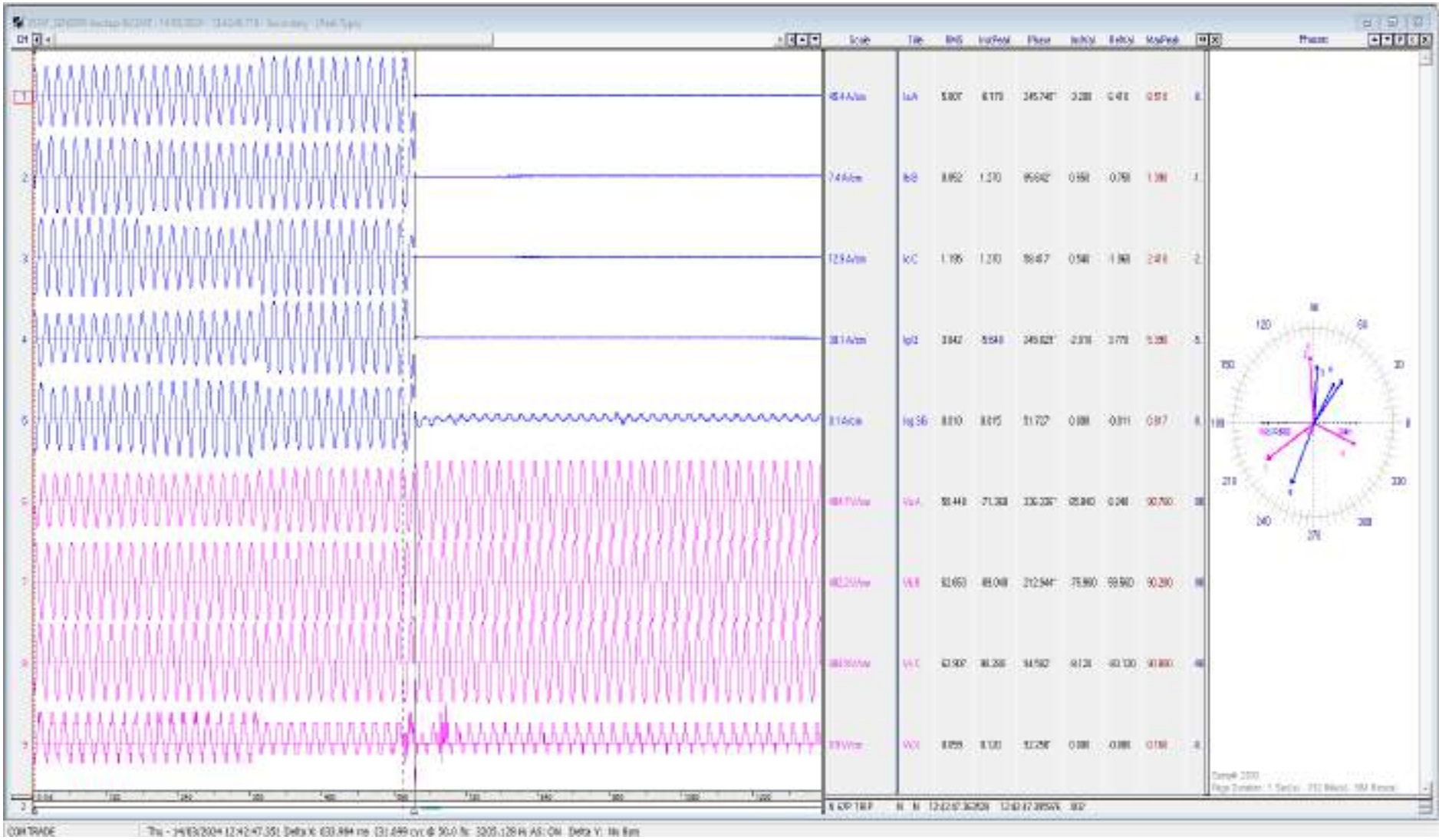
12:38 hrs/14-Mar-24



DR of 400/220 kV 315 MVA ICT 1 at Merta(RS)

- ✓ ICT-1 tripped on O/C E/F protection; Ir=~5.2kA, ICT-1 tripped with the delay of ~580msec of occurrence of fault.
- ✓ Time sync issue observed

DR of 400/220 kV 315 MVA ICT 2 at Merta(RS)



- ✓ ICT-2 tripped on phase directional O/C protection; Ir=~5.83kA
- ✓ Time sync issue observed

SCADA SOE

Time	Station Name	Voltage	Element Name	Element Type	Element Status	Remarks
12:40:29,003	MERTA_RS	220kV	01JETHN	Circuit Breaker	Open	Line CB at Merta(RS) end of 220kV Merta(RS)-Jethana(RS) Ckt opened
12:40:29,003	MERTA_RS	220kV	07BPGRH1	Circuit Breaker	Open	Line CB at Merta(RS) end of 220kV Merta(RS)-Bhopalgarh(RS) Ckt opened
12:40:29,003	MERTA_RS	220kV	08T3	Circuit Breaker	Open	CB at 220kV side of 220/132kV 100MVA ICT-3 at Merta(RS) opened
12:40:29,003	MERTA_RS	132kV	11T3	Circuit Breaker	Open	CB at 132kV side of 220/132kV 100MVA ICT-3 at Merta(RS) opened
12:40:29,003	MERTA_RS	220kV	06T2	Circuit Breaker	Open	CB at 220kV side of 220/132kV 100MVA ICT-2 at Merta(RS) opened
12:40:29,003	MERTA_RS	220kV	05T1	Circuit Breaker	Open	CB at 220kV side of 220/132kV 100MVA ICT-1 at Merta(RS) opened
12:40:29,003	MERTA_RS	220kV	04T2	Circuit Breaker	Open	CB at 220kV side of 400/220kV 315MVA ICT-2 at Merta(RS) opened
12:40:29,003	MERTA_RS	132kV	06T2	Circuit Breaker	Open	CB at 132kV side of 220/132kV 100MVA ICT-2 at Merta(RS) opened
12:40:29,003	MERTA_RS	220kV	02T1	Circuit Breaker	Open	CB at 220kV side of 400/220kV 315MVA ICT-1 at Merta(RS) opened
12:40:29,003	MERTA_RS	400kV	4T2	Circuit Breaker	Open	CB at 400kV side of 400/220kV 315MVA ICT-2 at Merta(RS) opened
12:47:21,320	KUCHR_RS	220kV	03MERTA	Circuit Breaker	Open	Line CB at Kuchera(RS) end of 220kV Merta(RS)-Kuchera(RS) Ckt opened

Point of discussion

- Exact location and nature of fault?
- DR of 220kV Merta-Bhopalgarh ckt? Relay flags and detail of protection operation/non-operation?
- Sequence of event?
- Exact reason of LBB operation? DR of LBB relay?
- Why did 220kV elements connected at both the 220kV bus trip?
- DR of ICTs are not time sync.
- DR time sync issue is observed in DR of 400/220 kV 315 MVA ICT 1 & 2 at Merta(RS). Issue need to be resolved at the earliest.
- DR/EL of all the tripped elements along with tripping report of the event need to be shared.
- Tripping status of all the tripped elements are not coming in SCADA SOE.
- Detailed report along with remedial action taken details not received.
- Standardization (nomenclature, time sync etc) of recording instrument (DR/EL) need to be ensured.

Multiple elements tripping at 220/132kV Bhiwadi(RS) 29th March 2024

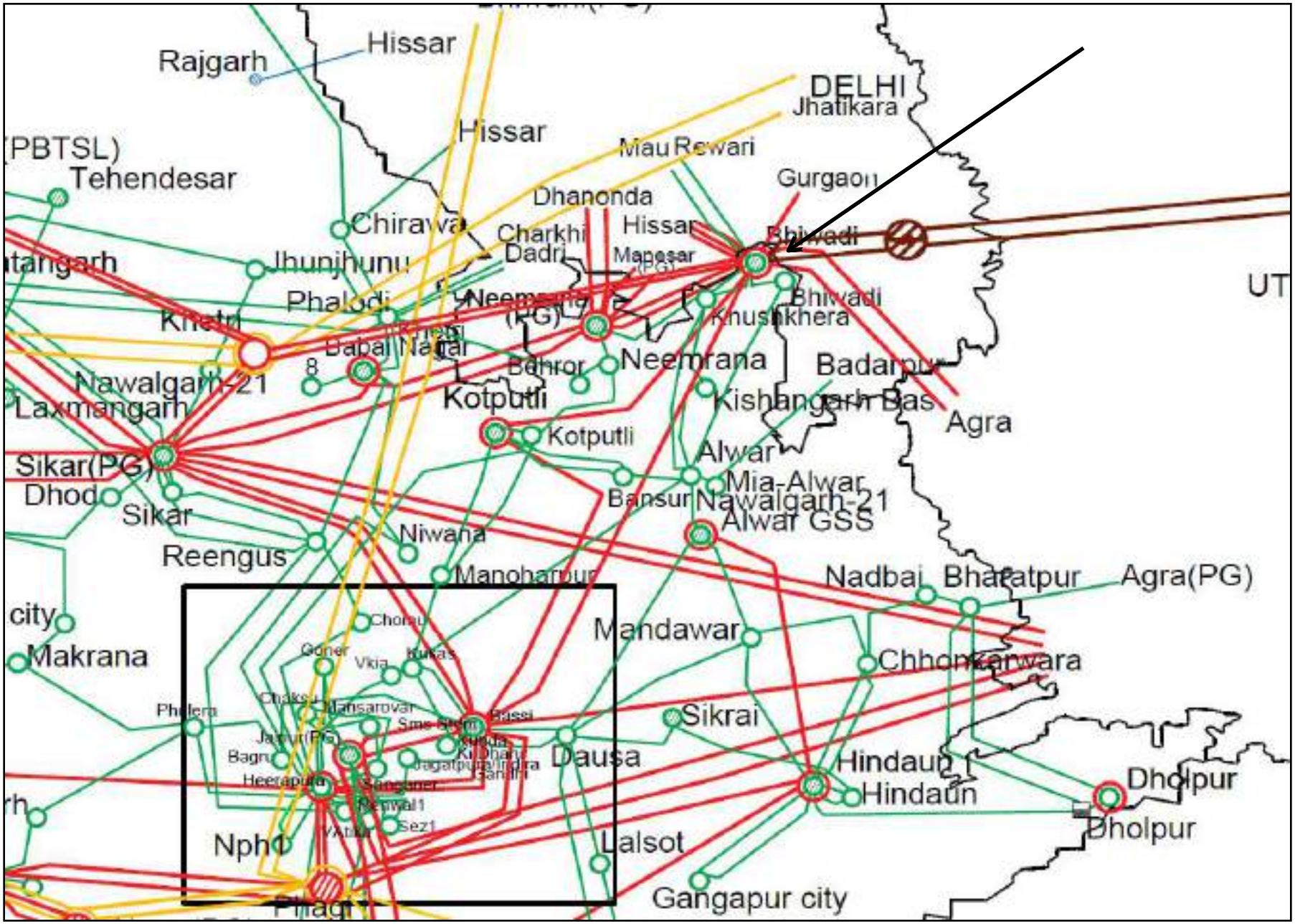
Brief of event:

- 220/132kV Bhiwadi(RS) has double main bus scheme at 220kV side.
- As reported, **at 17:10hrs, 400 kV Khetri (PKTSL)-Bhiwadi(PG) (PBTSL) Ckt-2 tripped on Y-N phase to earth fault** during heavy wing storm with fault distance of 123.3km from Khetri and fault current of 2.34kA from Khetri and 39.7kA from Bhiwadi.
- As per PMU at Bhiwadi(PG), **at 17:10 hrs, Y-N phase to earth fault with unsuccessful A/R followed by R-N fault is observed** with fault clearing time of 80ms and 80ms respectively.
- As per SCADA SOE, 132 KV Bhiwadi(RS)-Bhiwadi132(RS) (RS) Ckt-2 tripped at 17:17hrs (exact reason, nature and location of fault yet to be shared). As per PMU, Y-N phase to earth fault with fault clearing time of 80ms is observed during the same time.
- Further, **at 17:22hrs, bus bar protection operated at 220kV Bhiwadi(RS) due to failure of B-phase CVT of 220kV Main Bus -II**. Due to this, both **220 KV Bhiwadi(PG)-Bhiwadi(RS) (RS) Ckt-1 & 2 tripped from Bhiwadi(RS) end only.**
- **220/132kV 160MVA ICT-1 & 2 and 100MVA ICT-3 at Bhiwadi(RS) also tripped** and supply to 132kV feeders connected to Bhiwadi(RS) lost. Complete blackout occurred at 220/132kV Bhiwadi(RS) S/s.
- As per PMU at Bhiwadi(PG**), at 17:22hrs, B-N phase to earth fault is observed with fault clearing time of 120ms**.
- Again, at 17:26 hrs, 220 KV Bhiwadi(PG)-Kushkhera(RS) (RS) Ckt tripped on R-N phase to earth fault with fault distance of 0.865km from Bhiwadi(PG) end.
- As per DR at Bhiwadi(PG) end of 220 KV Bhiwadi(PG)-Kushkhera(RS) (RS) Ckt, fault current was 24.41kA from Bhiwadi(PG), fault was sensed in zone-1, line was successfully auto-reclosed from Bhiwadi(PG) end and tripped only from Kushkhera end.
- As per PMU at Bhiwadi(PG), at 17:26 hrs, R-N fault followed by R-N fault with unsuccessful A/R is observed with fault clearing time of 120ms and 80ms respectively.
- As per SCADA, change in demand of approx. 120MW in Rajasthan control area is observed.

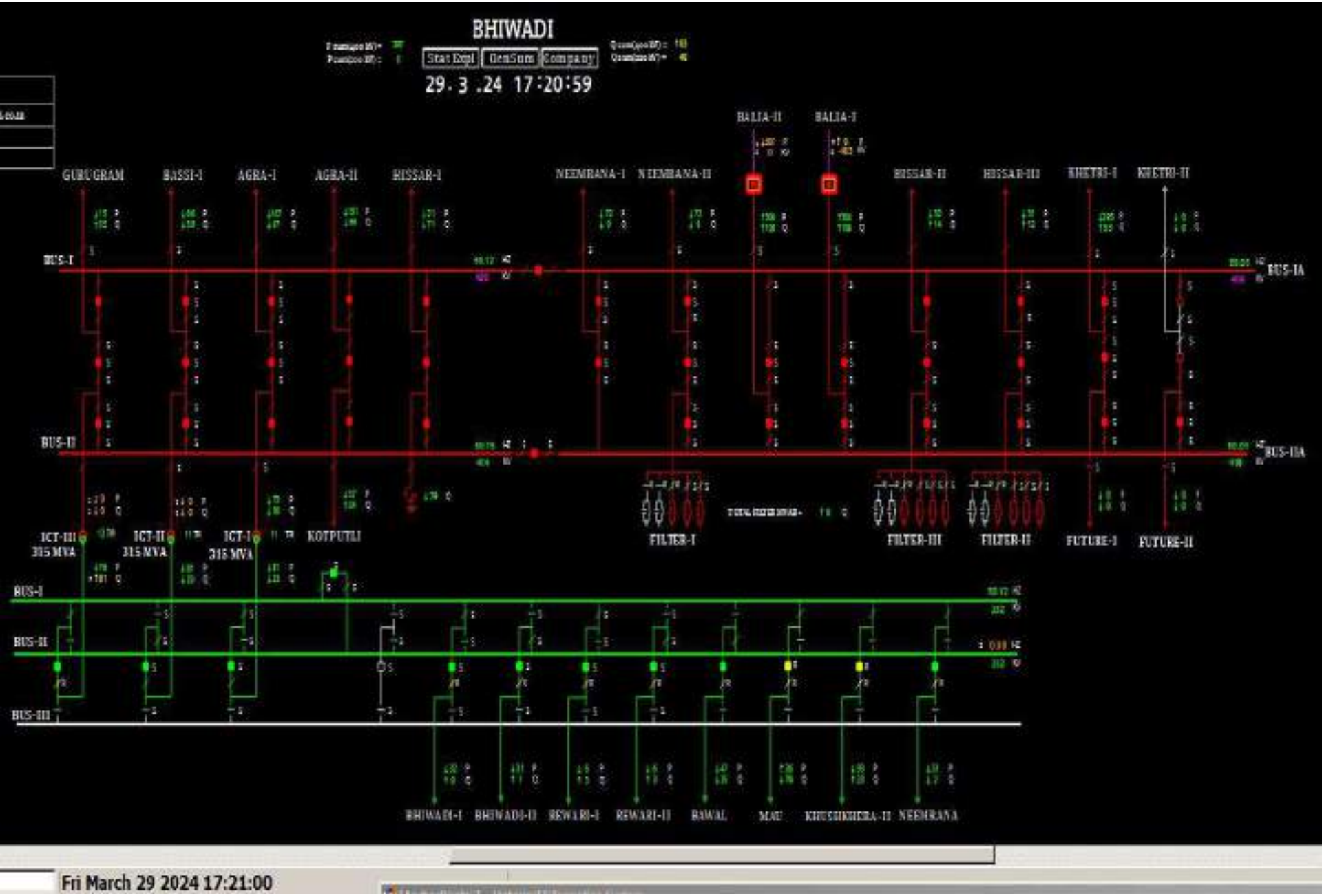
Elements tripped:

i. 400 KV Khetri (PKTSL)-Bhiwadi(PG) (PBTSL) Ckt-2
ii. 220 KV Bhiwadi(PG)-Bhiwadi(RS) (RS) Ckt-1
iii. 220 KV Bhiwadi(PG)-Bhiwadi(RS) (RS) Ckt-2
iv. 220/132kV 160MVA ICT-1 at Bhiwadi(RS)
v. 220/132kV 160MVA ICT-2 at Bhiwadi(RS)
vi. 220/132kV 100MVA ICT-3 at Bhiwadi(RS)
vii. 220 KV Bhiwadi(PG)-Kushkhera(RS) (RS) Ckt

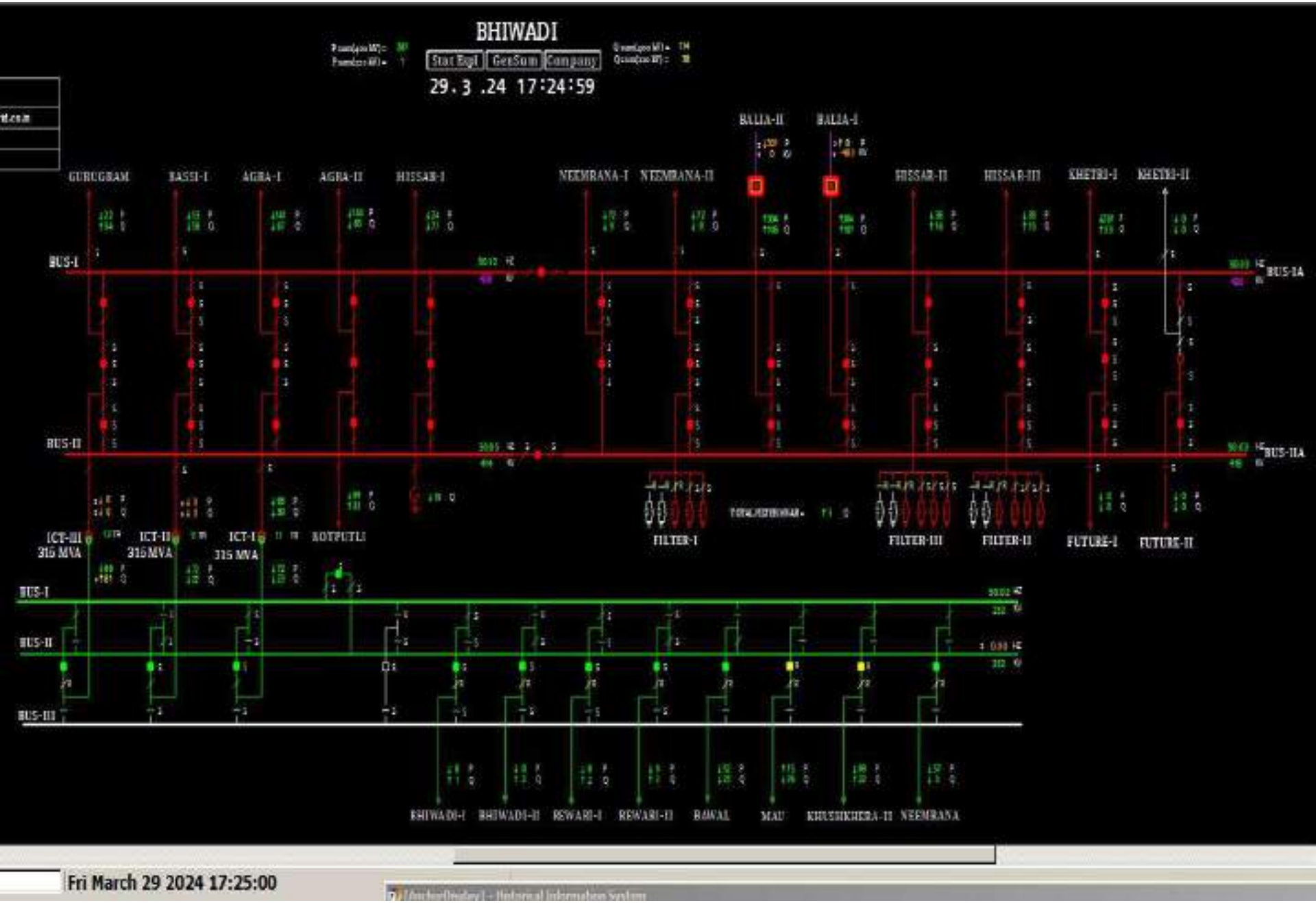
Network Diagram before the event



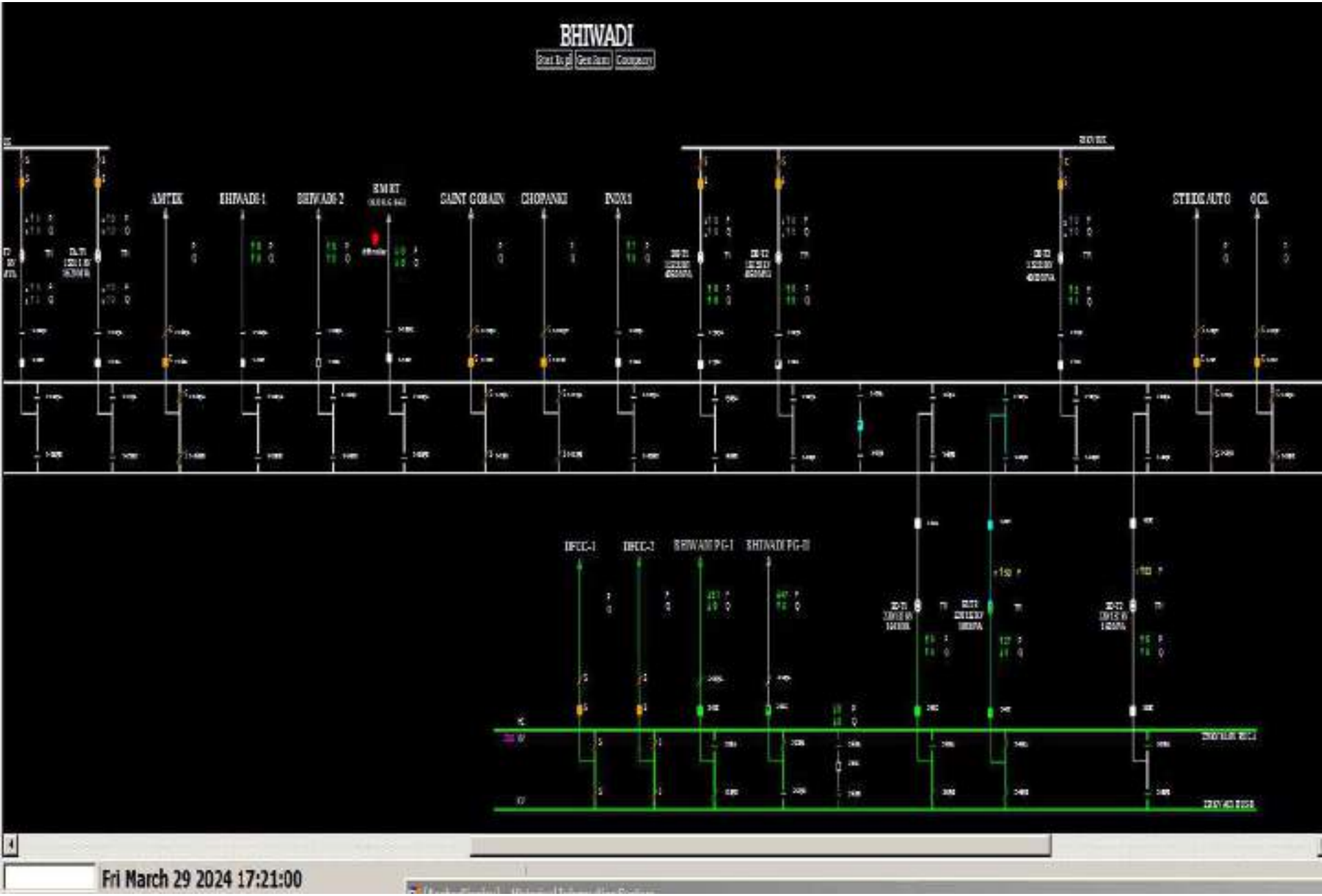
SLD of 400/220kV Bhiwadi(PG) before the event



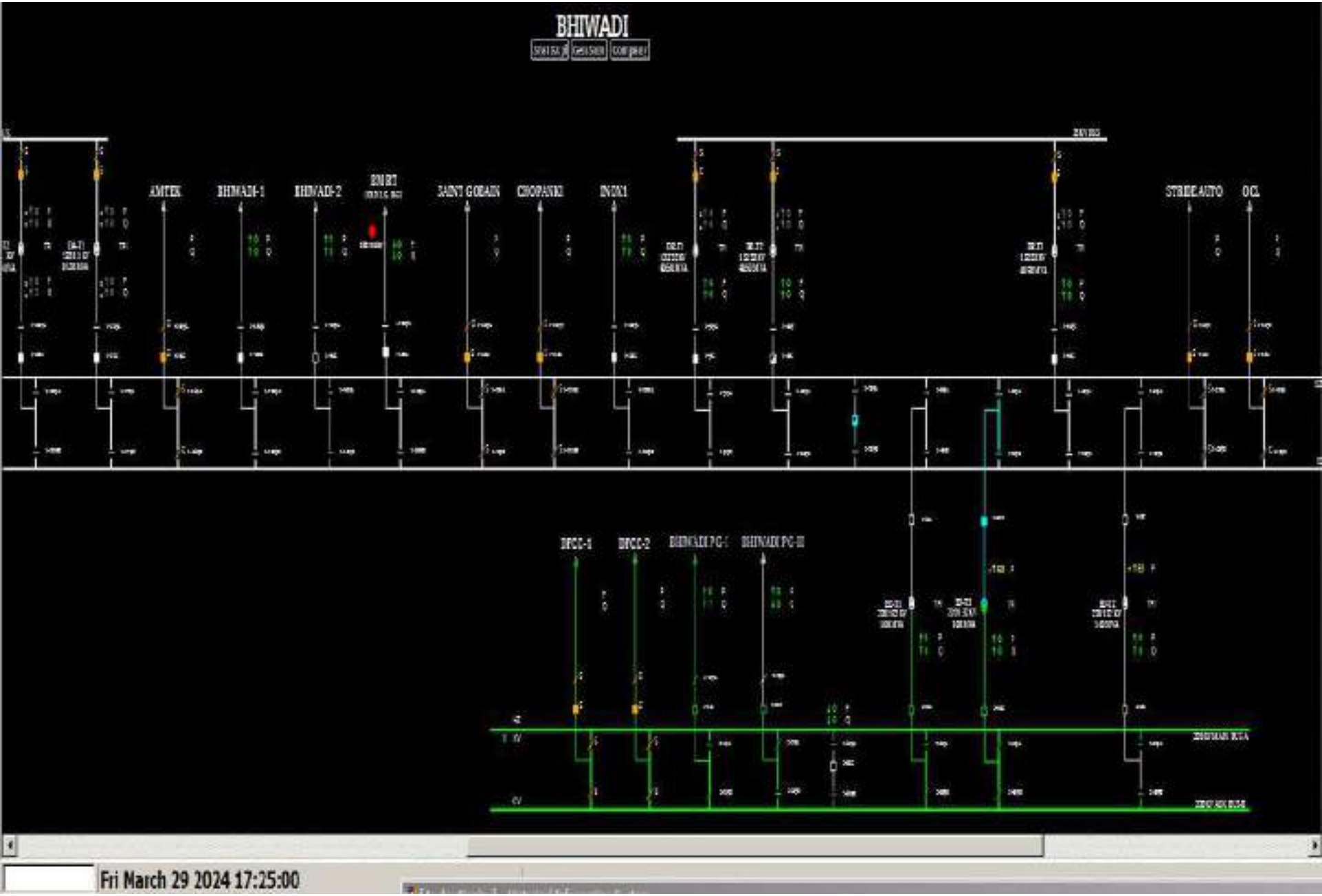
SLD of 400/220kV Bhiwadi(PG) after the event



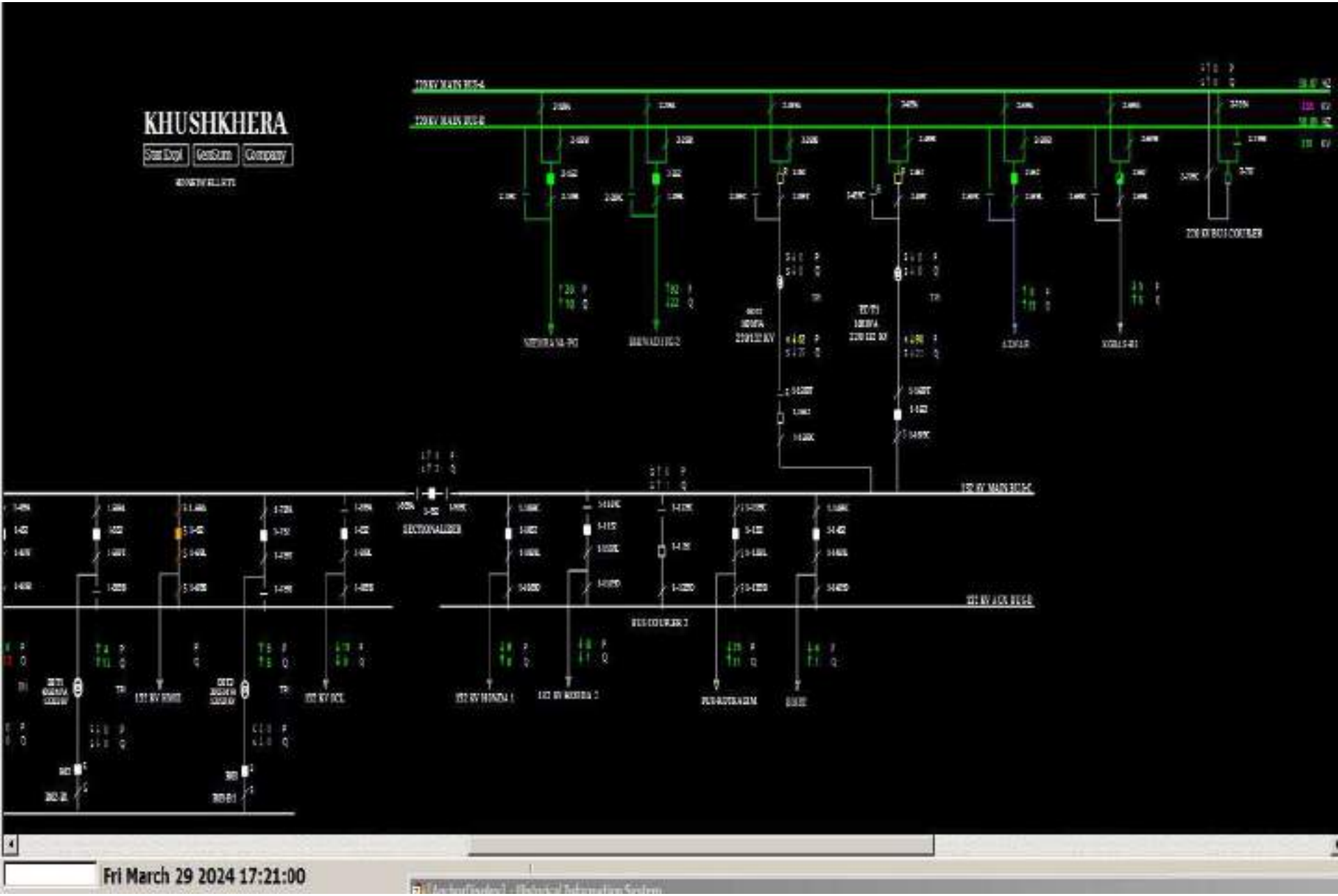
SLD of 220/132kV Bhiwadi(RS) before the event



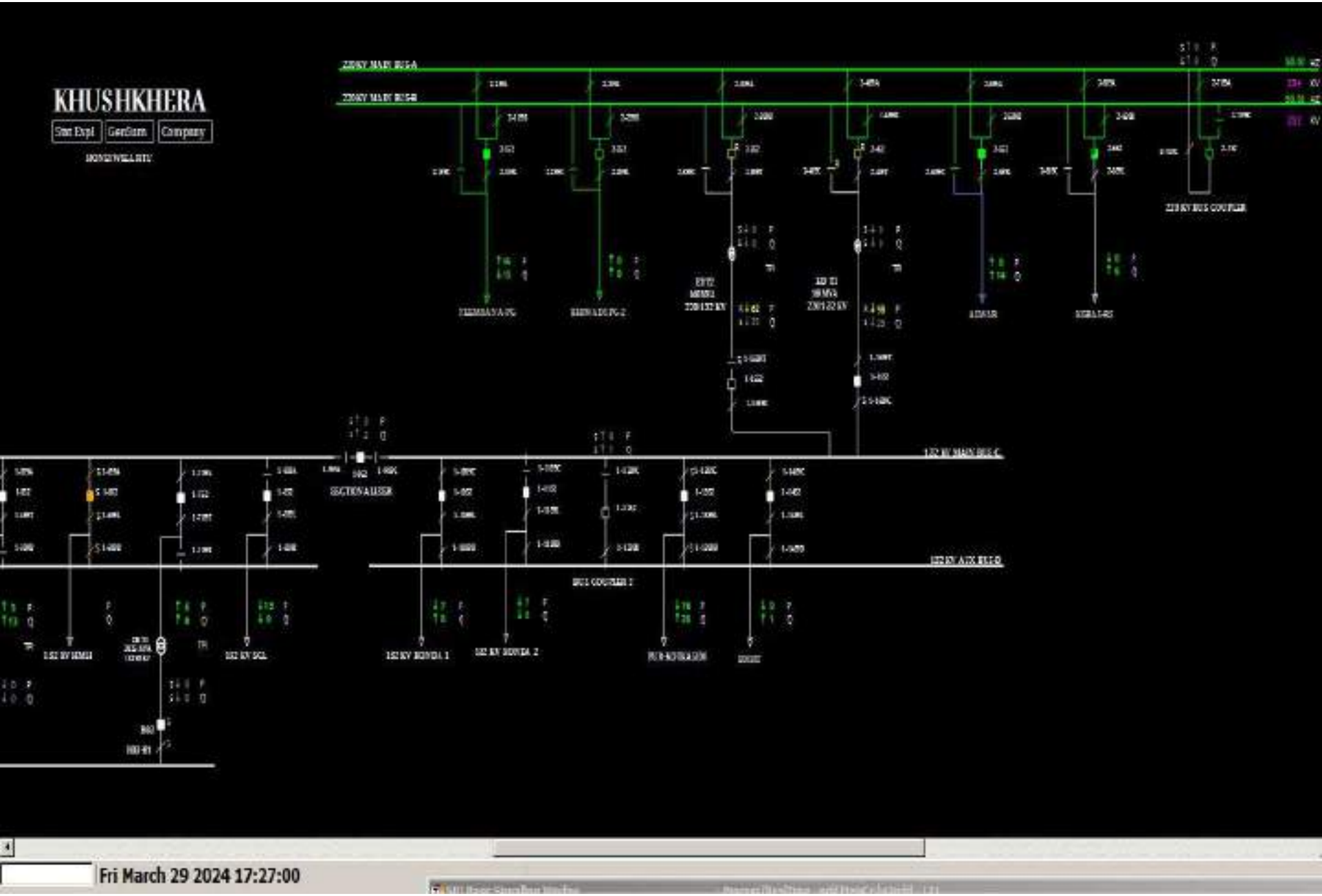
SLD of 220/132kV Bhiwadi(RS) after the event



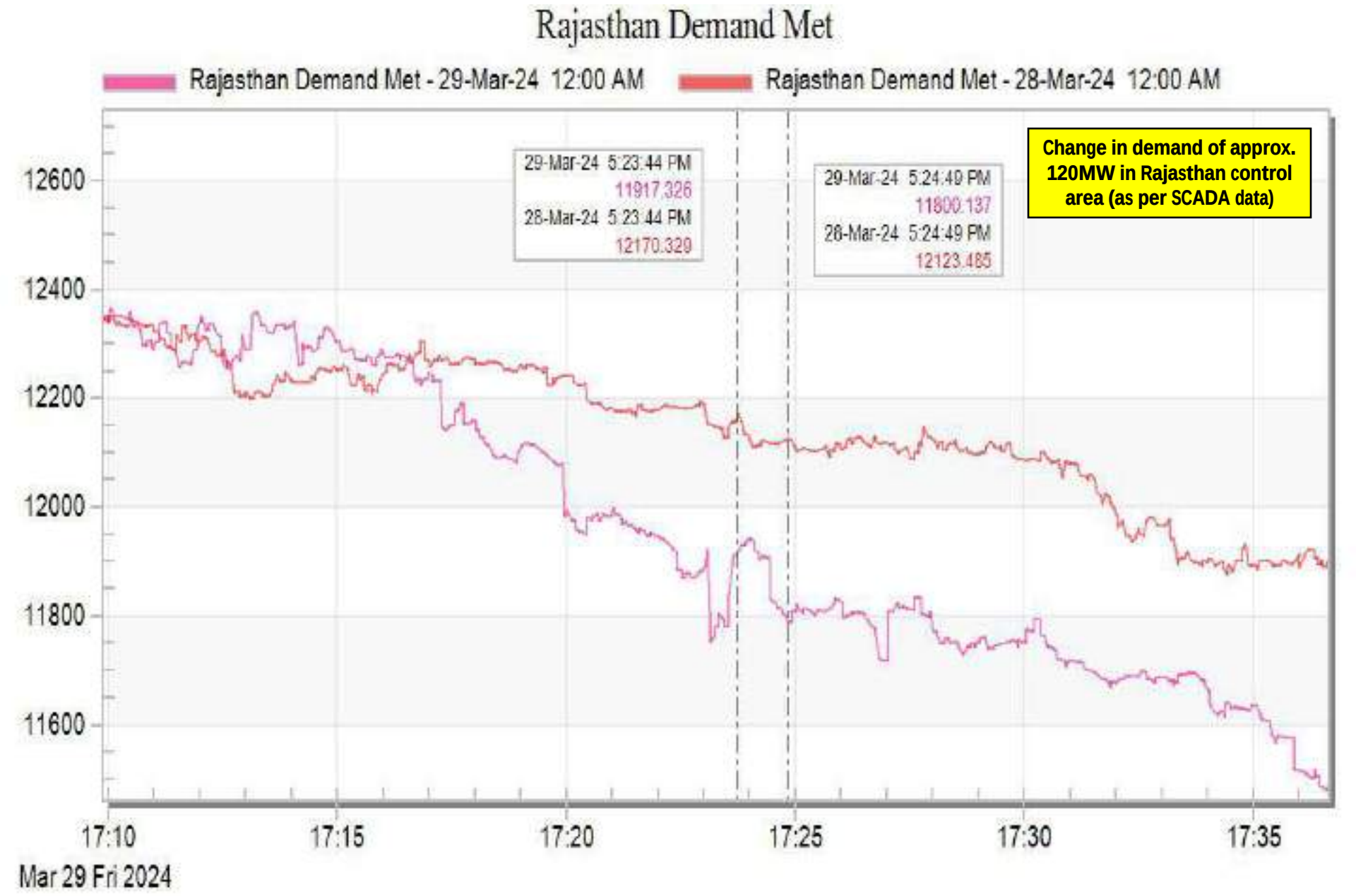
SLD of 220/132kV Kushkhera(RS) before the event



SLD of 220/132kV Kushkhera(RS) after the event

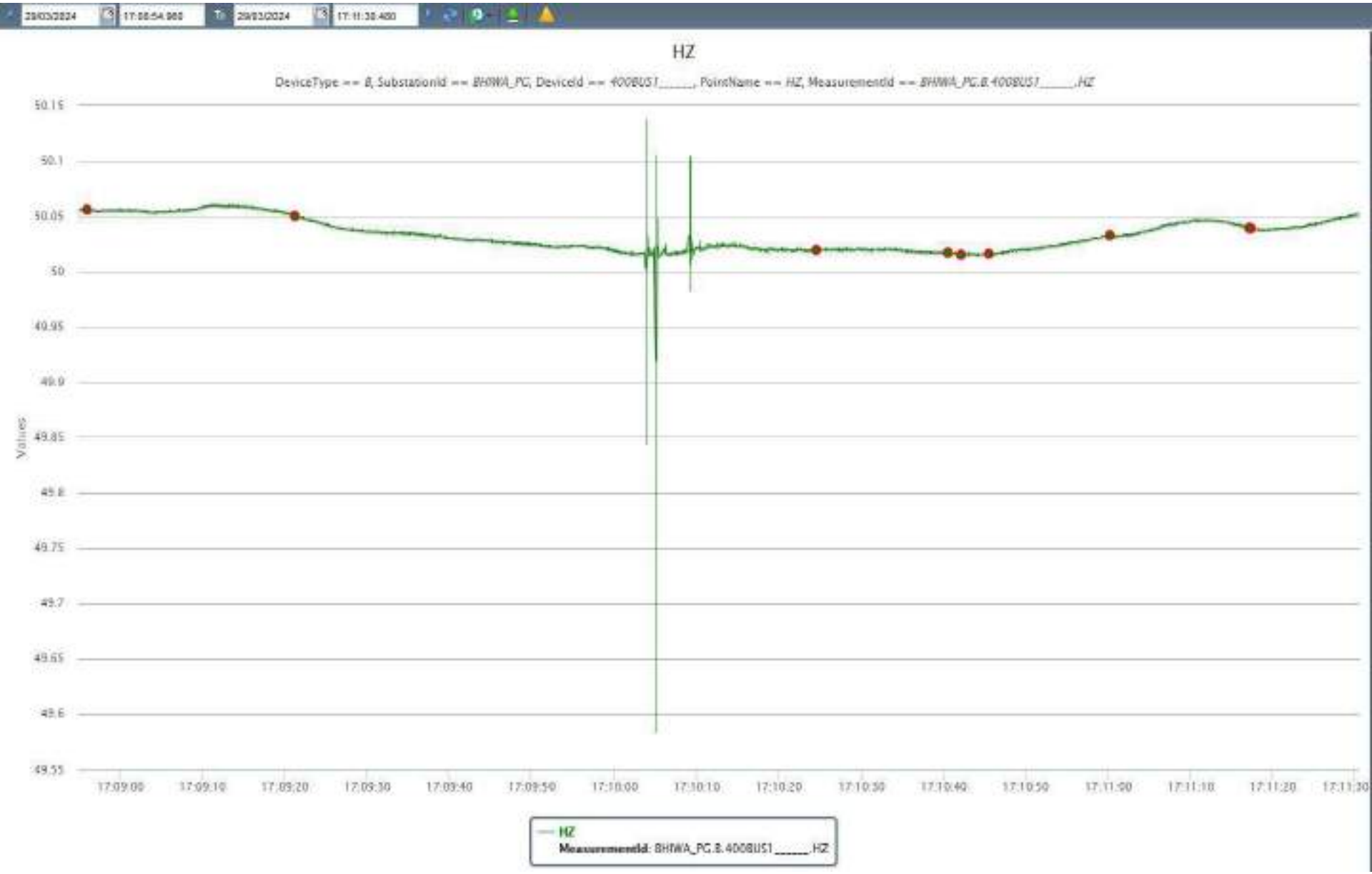


Rajasthan demand during the event



PMU Plot of frequency at Bhiwadi(PG)

17:10hrs/29-Mar-24

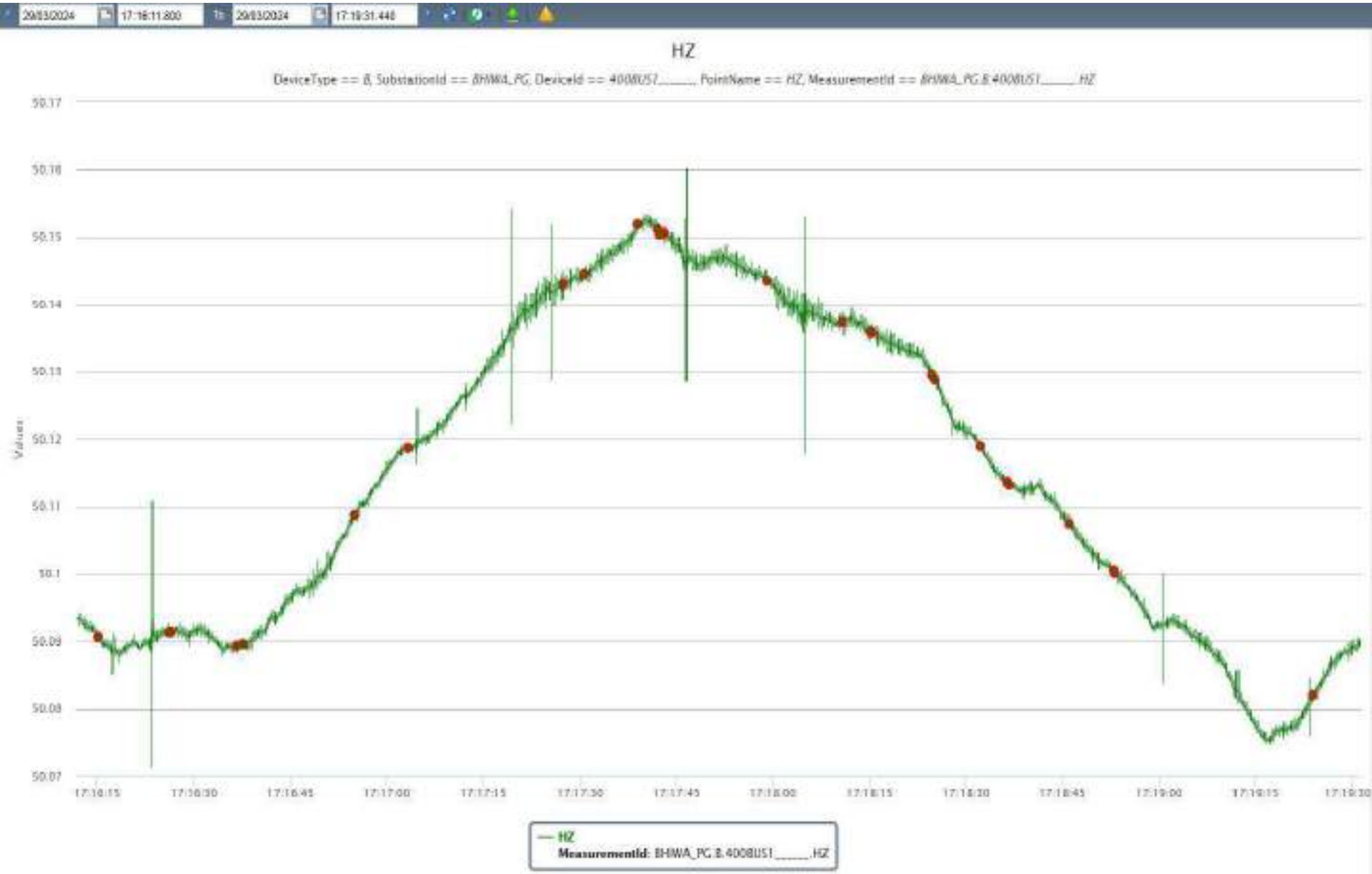


PMU Plot of phase voltage magnitude at Bhiwadi(PG)

17:10hrs/29-Mar-24

PMU Plot of frequency at Bhiwadi(PG)

17:17hrs/29-Mar-24



PMU Plot of phase voltage magnitude at Bhiwadi(PG)

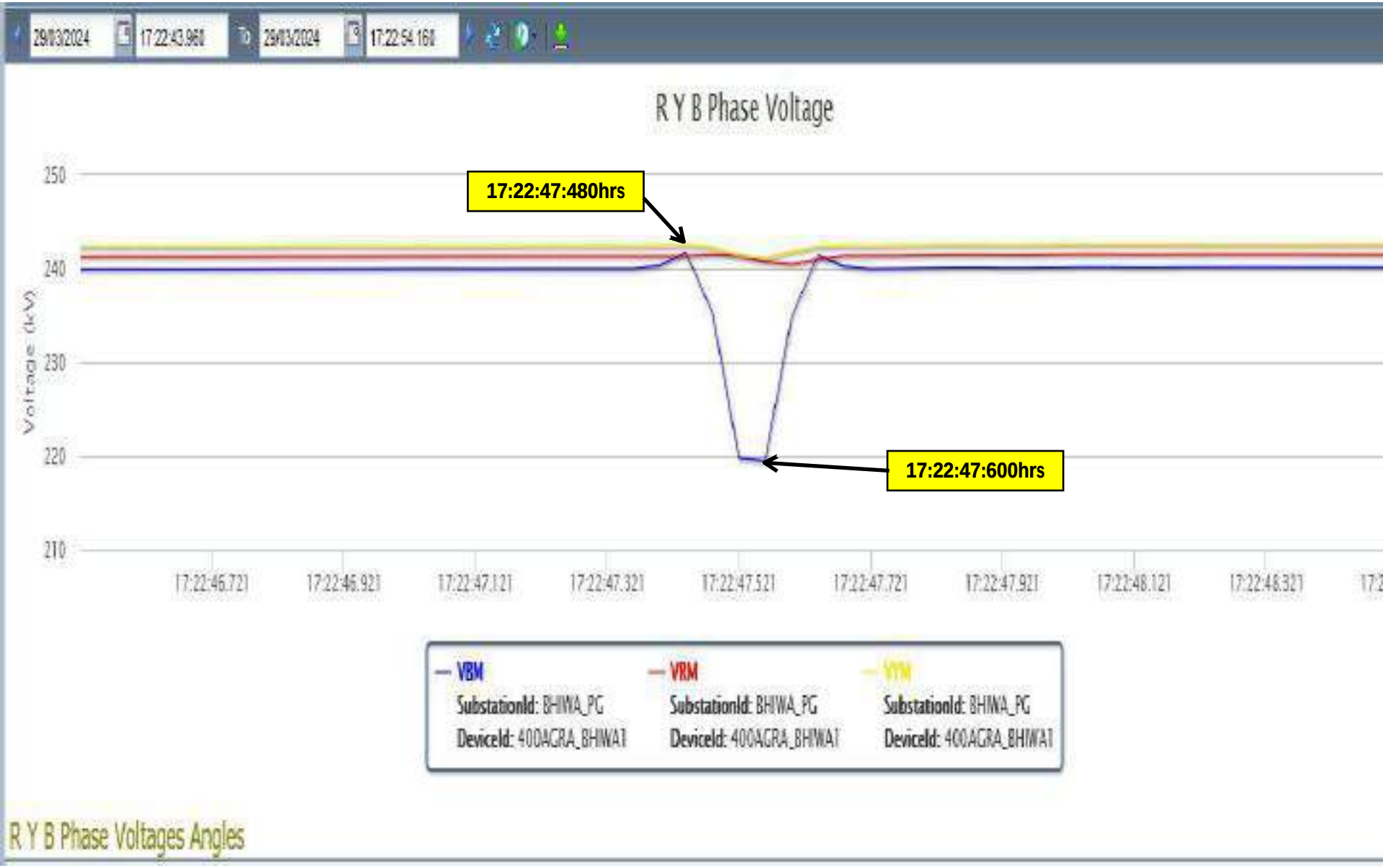
17:17hrs/29-Mar-24

PMU Plot of frequency at Bhiwadi(PG)

17:22hrs/29-Mar-24

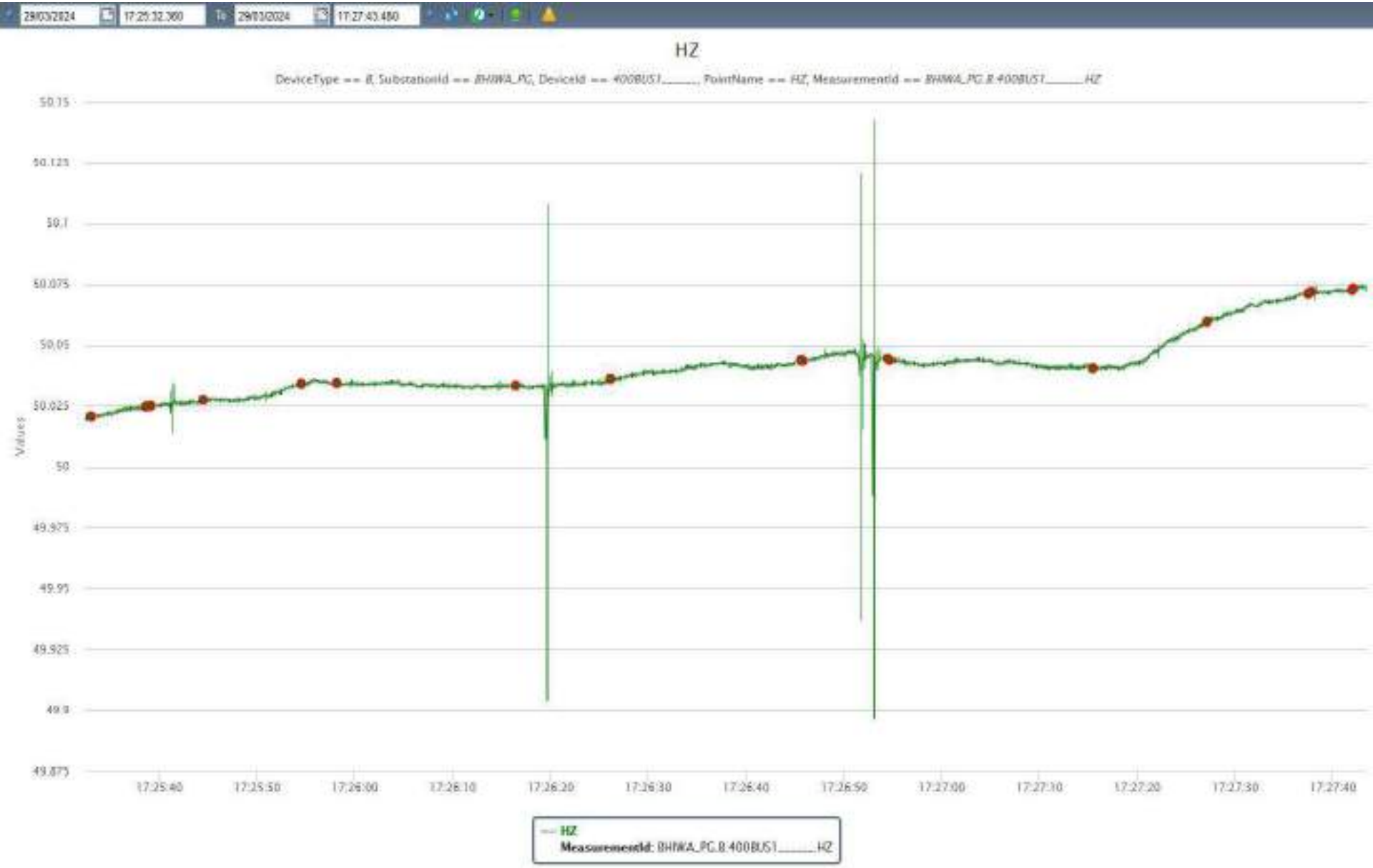
PMU Plot of phase voltage magnitude at Bhiwadi(PG)

17:22hrs/29-Mar-24



PMU Plot of frequency at Bhiwadi(PG)

17:26hrs/29-Mar-24

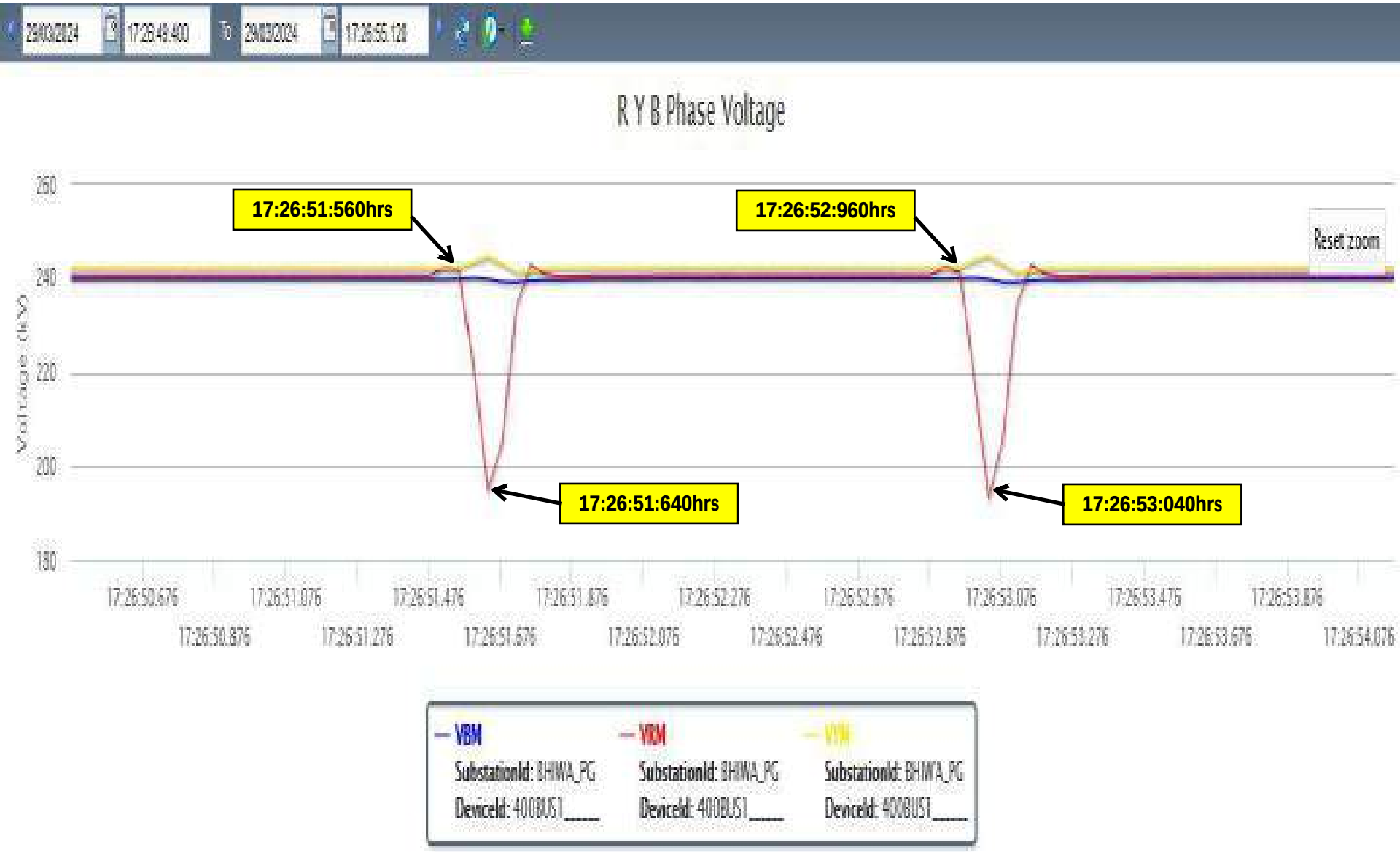


PMU Plot of phase voltage magnitude at Bhiwadi(PG)

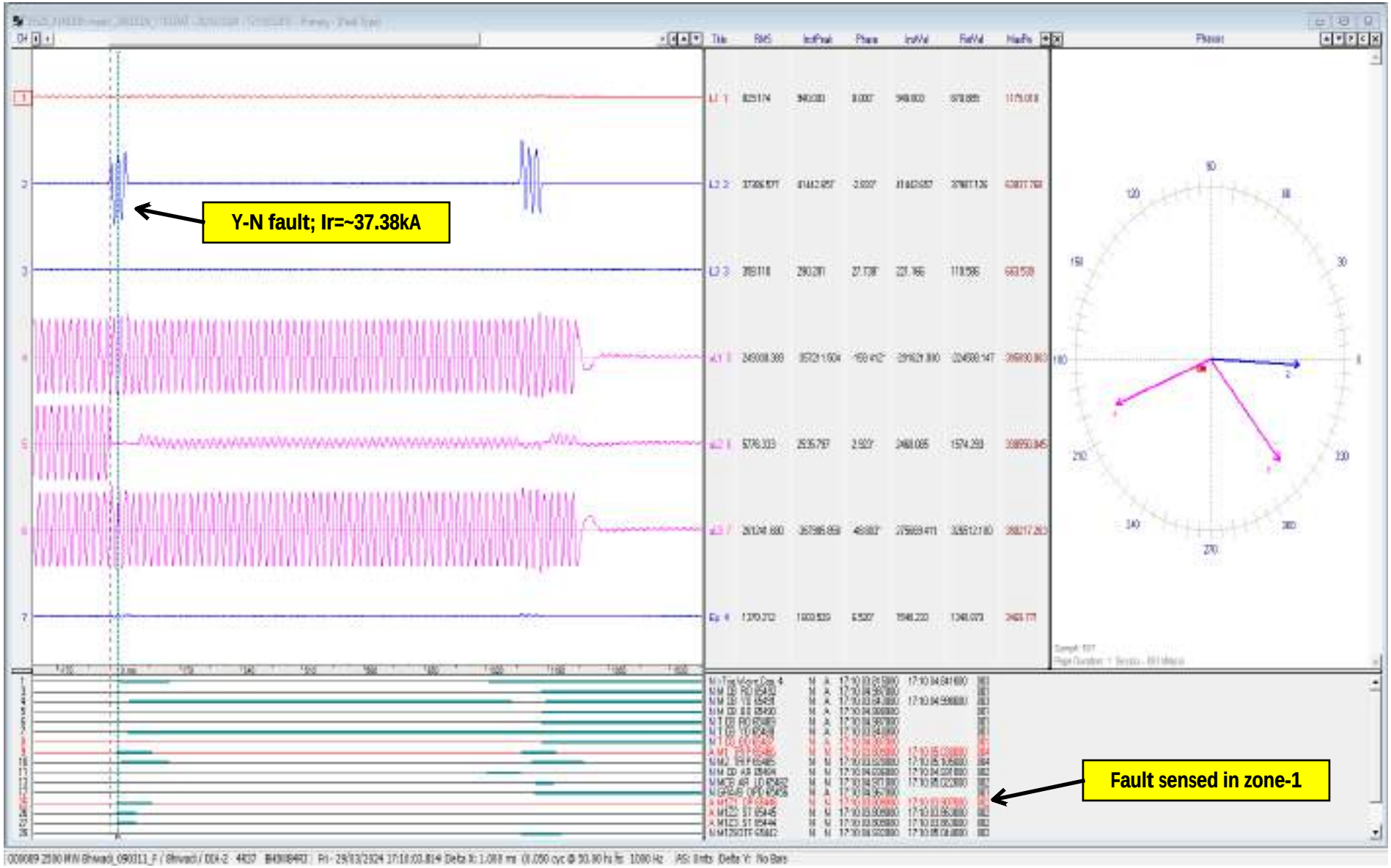
17:26hrs/29-Mar-24

PMU Plot of phase voltage magnitude at Bhiwadi(PG)

17:26hrs/29-Mar-24

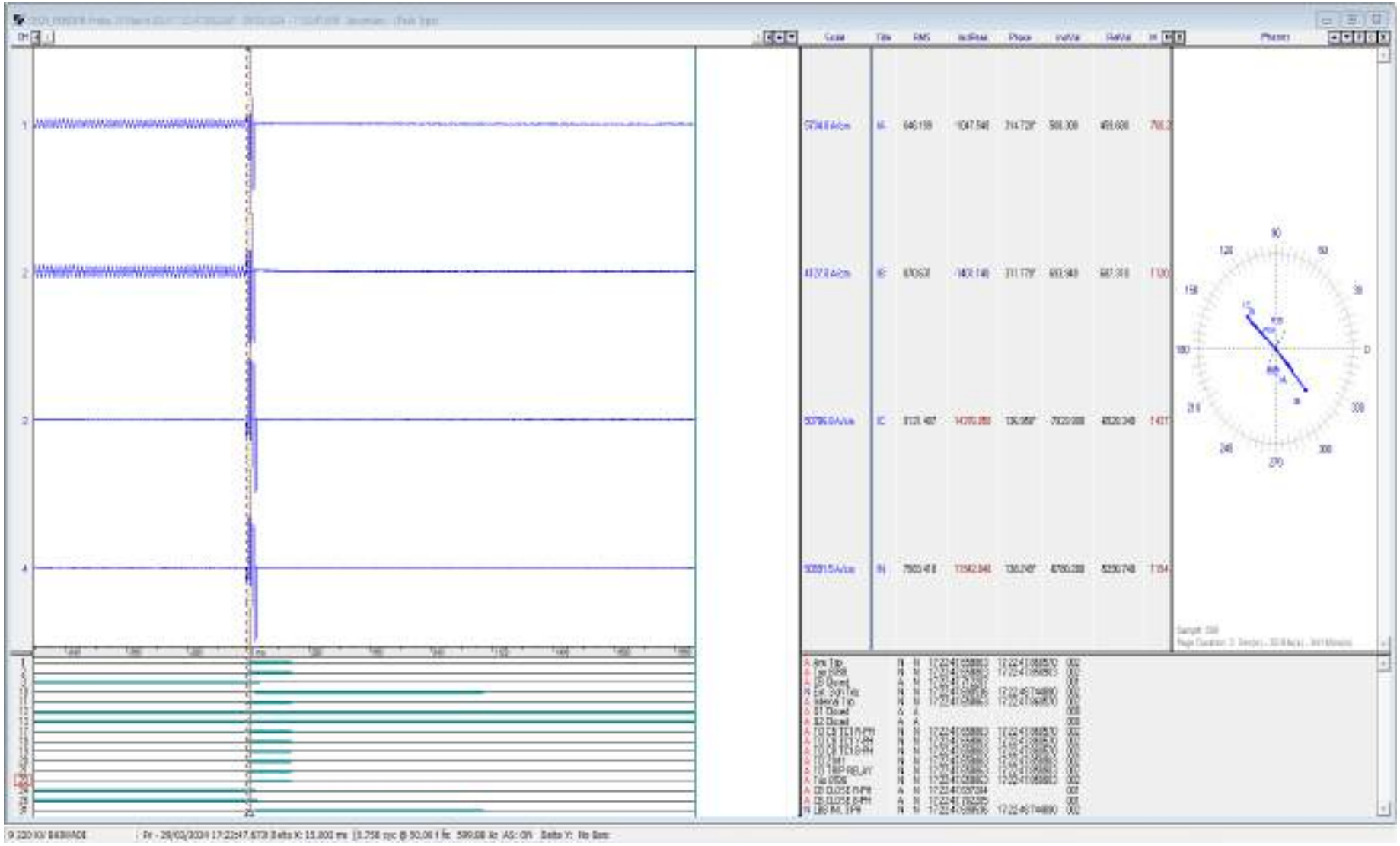


DR of 400 KV Khetri (PKTSL)-Bhiwadi(PG)(end) (PBTSL) Ckt-2



- ✓ Unsuccessful auto-recloser operation observed at Bhiwadi(PG) end.

DR of Bhiwadi(RS) end showing bus bar protection operation

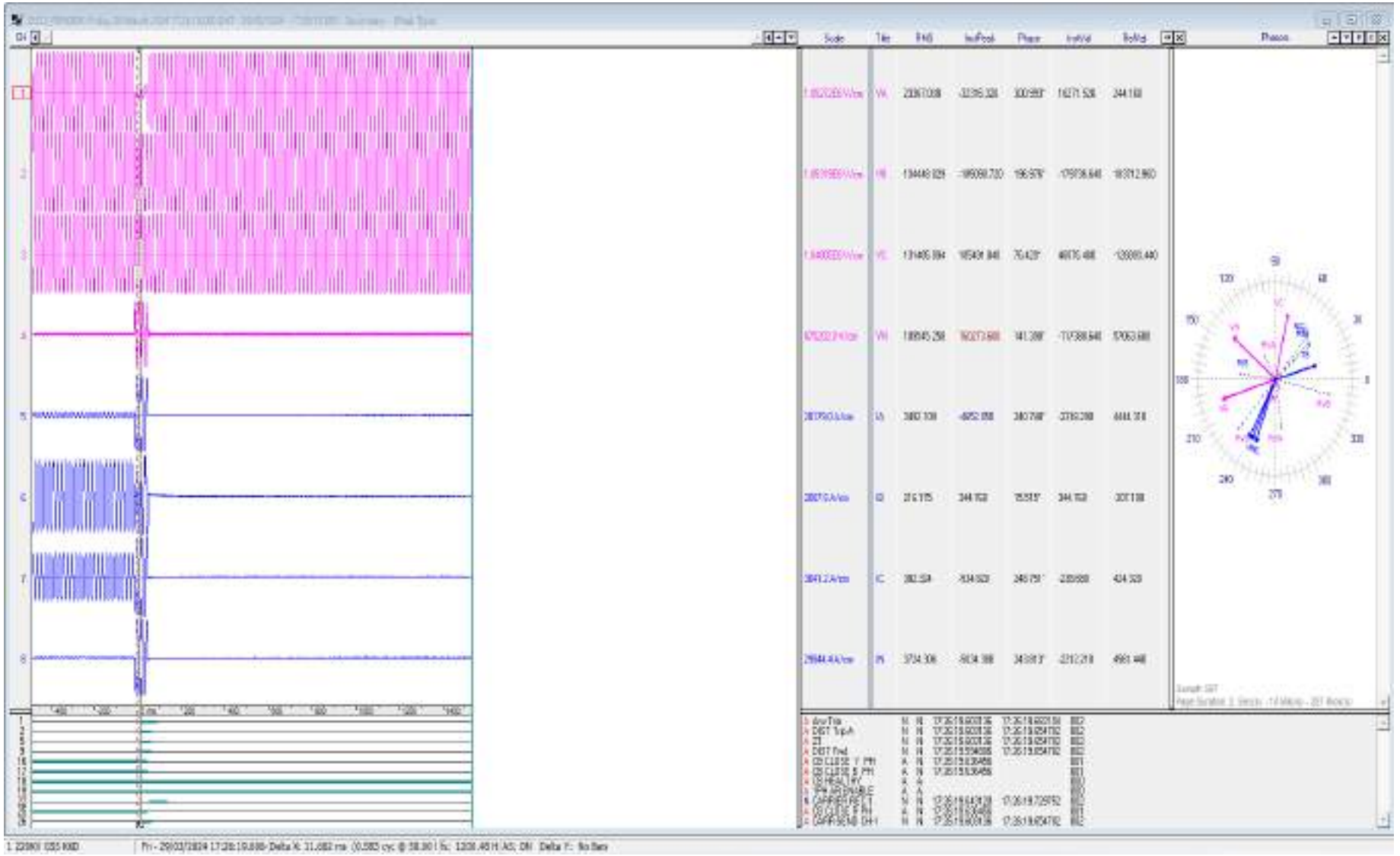


- ✓ B-N fault, Ib=9.1kA, instantaneous tripping initiated

DR of 220 KV Bhiwadi(PG) (end)- Kushkhera(RS) (RS) Ckt

- ✓ Line successfully auto-reclosed from Bhiwadi(PG) end
- ✓ Line tripped only from Kushkhera(RS) end

DR of 220 KV Bhiwadi(PG)- Kushkhera(RS)(end) (RS) Ckt



- ✓ Line successfully auto-reclosed from Bhiwadi(PG) end
- ✓ Line tripped only from Kushkhera(RS) end, no A/R operation

SCADA SOE

Time	Station Name	Voltage	Element Name	Element Type	Element Status	Remarks
17:10:04,986	BHWHV_PG	400kV	38TIE	Circuit Breaker	Open	Tie CB at Bhiwadi(PG) end of 400 KV Khetri (PKTSL)-Bhiwadi(PG) (PBTSL) Ckt-2 opened
17:10:04,996	BHWHV_PG	400kV	37KHTRI2	Circuit Breaker	Open	Main CB at Bhiwadi(PG) end of 400 KV Khetri (PKTSL)-Bhiwadi(PG) (PBTSL) Ckt-2 opened
17:10:05,093	KHTRI_PG	400kV	24BHIWD2	Circuit Breaker	Open	Main CB at Khetri(PG) end of 400 KV Khetri (PKTSL)-Bhiwadi(PG) (PBTSL) Ckt-2 opened
17:10:05,100	KHTRI_PG	400kV	23TIE	Circuit Breaker	Open	Tie CB at Khetri(PG) end of 400 KV Khetri (PKTSL)-Bhiwadi(PG) (PBTSL) Ckt-2 opened
17:17:23,774	BHIWR_RS	132kV	N3RS_RS2	Circuit Breaker	Open	Line CB at Bhiwadi(RS) end of 132 KV Bhiwadi(RS)-Bhiwadi132(RS) (RS) Ckt-2 opened
17:22:48,630	BHIWR_RS	220kV	02BHIWA2	Circuit Breaker	Open	Line CB at Bhiwadi(RS) end of 220 KV Bhiwadi(PG)-Bhiwadi(RS) (RS) Ckt-2 opened
17:22:51,790	BHIWR_RS	220kV	01BHIWA1	Circuit Breaker	Open	Line CB at Bhiwadi(RS) end of 220 KV Bhiwadi(PG)-Bhiwadi(RS) (RS) Ckt-1 opened
17:22:51,790	BHIWR_RS	132kV	08T2	Circuit Breaker	Open	CB at 132kV side of 220/132kV 160MVA ICT-2 at Bhiwadi(RS) opened
17:22:51,790	BHIWR_RS	132kV	06T1	Circuit Breaker	Open	CB at 132kV side of 220/132kV 160MVA ICT-1 at Bhiwadi(RS) opened
17:22:51,790	BHIWR_RS	220kV	07T3	Circuit Breaker	Open	CB at 220kV side of 220/132kV 100MVA ICT-3 at Bhiwadi(RS) opened
17:22:51,790	BHIWR_RS	220kV	05T2	Circuit Breaker	Open	CB at 220kV side of 220/132kV 160MVA ICT-2 at Bhiwadi(RS) opened
17:22:51,790	BHIWR_RS	220kV	04T1	Circuit Breaker	Open	CB at 220kV side of 220/132kV 160MVA ICT-1 at Bhiwadi(RS) opened
17:26:19,594	KHUSH_RS	220kV	02BHIWA2	Circuit Breaker	Open	Line CB at Kushkhera(RS) end of 220 KV Bhiwadi(PG)-Kushkhera(RS) (RS) Ckt opened

Point of discussion

- Nature of fault at 17:22hrs?
- Why did elements connected at both the 220kV Bus at Bhiwadi(RS) trip on bus bar protection operation?
- A/R didn’t operate at Kushkhera end on R-N fault.
- DR/EL along with tripping report for each element need to be shared
- Detailed report along with remedial action taken details not received.

Multiple elements tripping at 400/220kV Unnao(UP) 20th February 2024

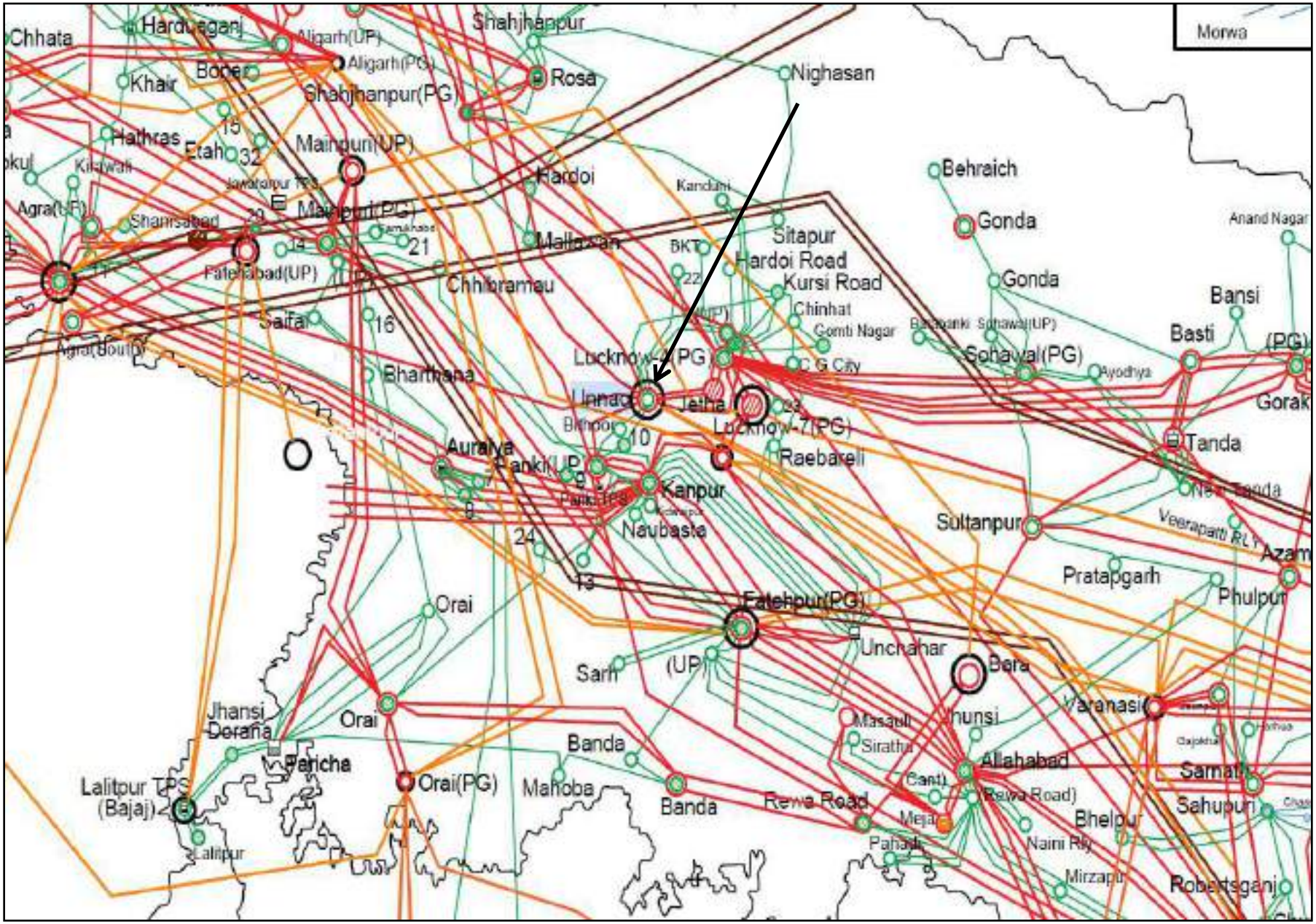
Brief of event:

- 765/400/220kV Unnao(UP) has double main and transfer bus scheme at 400kV level.
- During antecedent condition, 400 KV Agra-Unnao (UP) Ckt, 400 KV Unnao-Lucknow (UP) Ckt, 400 KV Bareilly-Unnao (UP) Ckt-2, 400 KV Unnao(UP)-Jehta_Hardoi Road (UP) (PG) Ckt-2, 400/220 kV 315 MVA ICT 1 at Unnao(UP), 765/400 kV 1000 MVA ICT 2 and 3 at Unnao(UP) were connected to 400KV Bus 1 at Unnao(UP) and rest of the elements were connected to 400KV Bus 2 at Unnao(UP).
- As per SCADA, 400/220 kV 315 MVA ICT 1 at Unnao(UP), 765/400 kV 1000 MVA ICT 2 and 3 at Unnao(UP) were carrying approx. 151MW, 518MW and 535MW respectively.
- As reported, at 21:47 hrs, **LBB operated due to fault at Main CB of 400 KV Bareilly-Unnao (UP) Ckt-2.** Hence all the elements connected to 400KV Bus 1 at Unnao(UP) tripped and 400KV Bus 1 at Unnao(UP) became dead.
- As per DR of 400 KV Bareilly-Unnao (UP) Ckt-2, R-N phase to earth fault is observed with fault current of 6.135kA from Unnao(UP) and 2.197kA from Bareilly(UP). Fault was sensed in zone-1 at Unnao(UP) end. **Fault was cleared within 280ms from Unnao(UP) end and 130ms from Bareilly(UP) end.**
- As per PMU at Unnao(UP), R-N phase to earth fault is observed with fault clearing time of 280ms.
- As per SCADA, no change in demand is observed in UP control area.

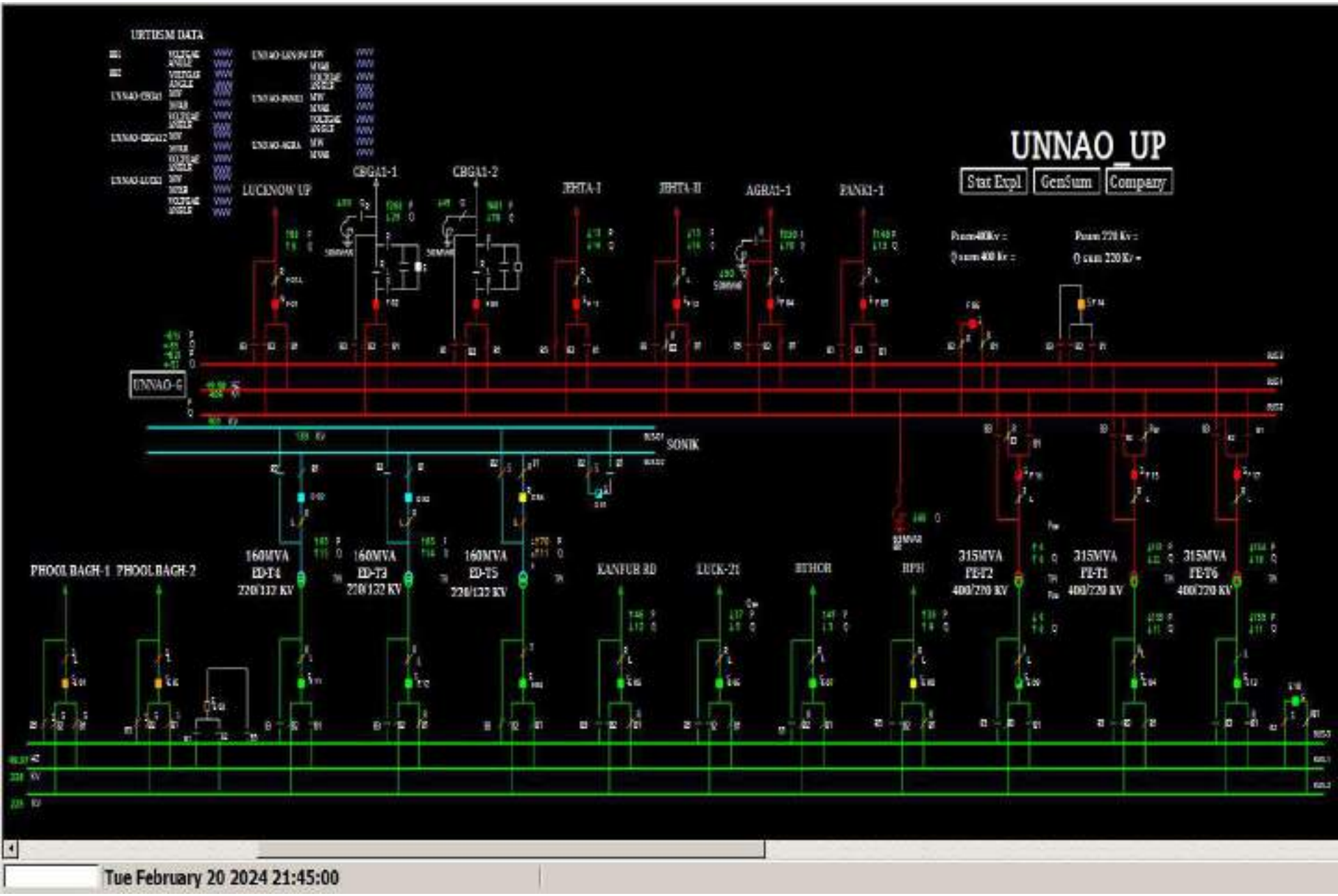
Elements tripped:

i. 400 KV Agra-Unnao (UP) Ckt
ii. 400 KV Unnao-Lucknow (UP) Ckt
iii. 400 KV Bareilly-Unnao (UP) Ckt-2
iv. 400 KV Unnao(UP)-Jehta_Hardoi Road (UP) (PG) Ckt-2
v. 400/220 kV 315 MVA ICT 1 at Unnao(UP)
vi. 765/400 kV 1000 MVA ICT 2 at Unnao(UP)
vii. 765/400 kV 1000 MVA ICT 3 at Unnao(UP)
viii. 400KV Bus 1 at Unnao(UP)

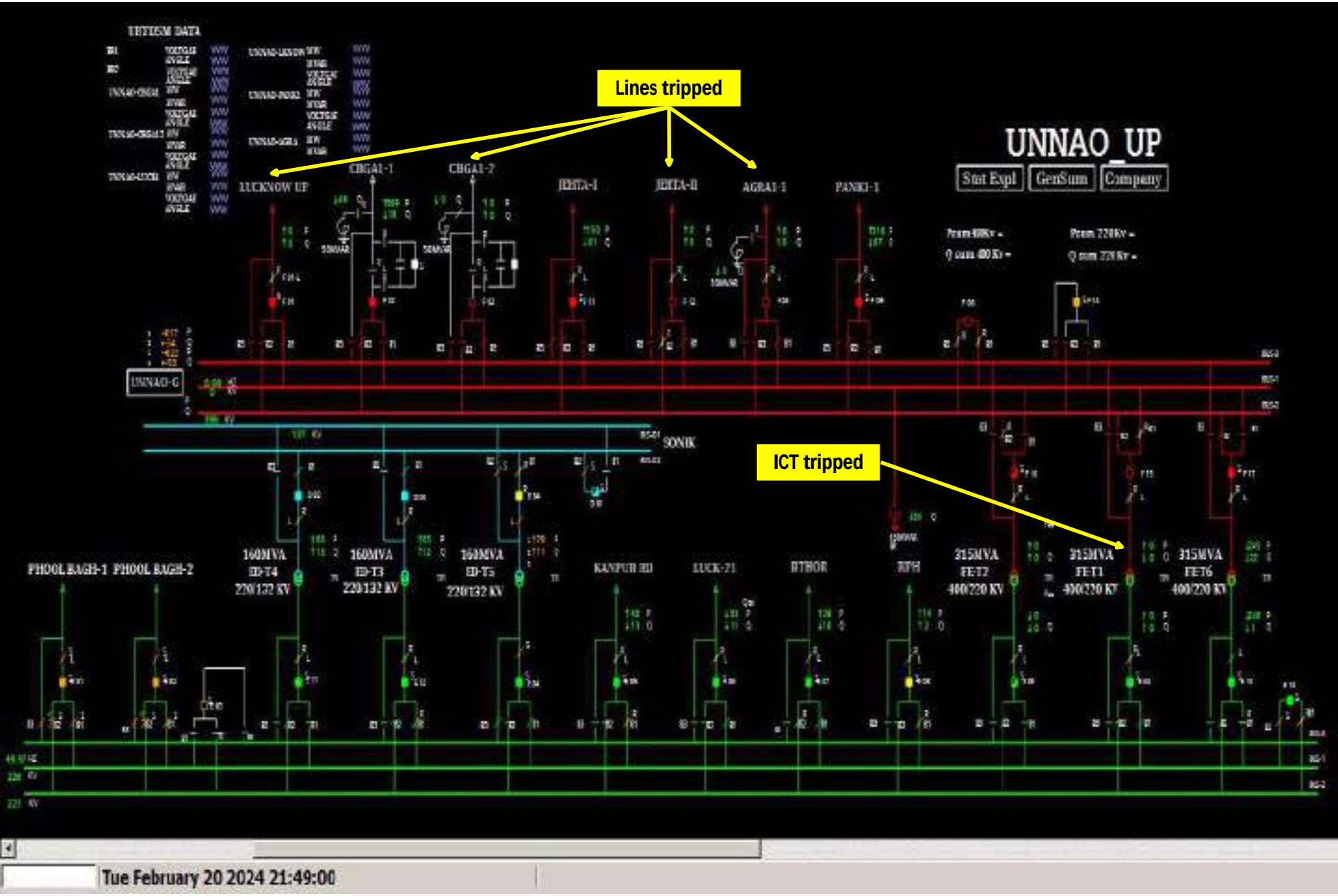
Network Diagram



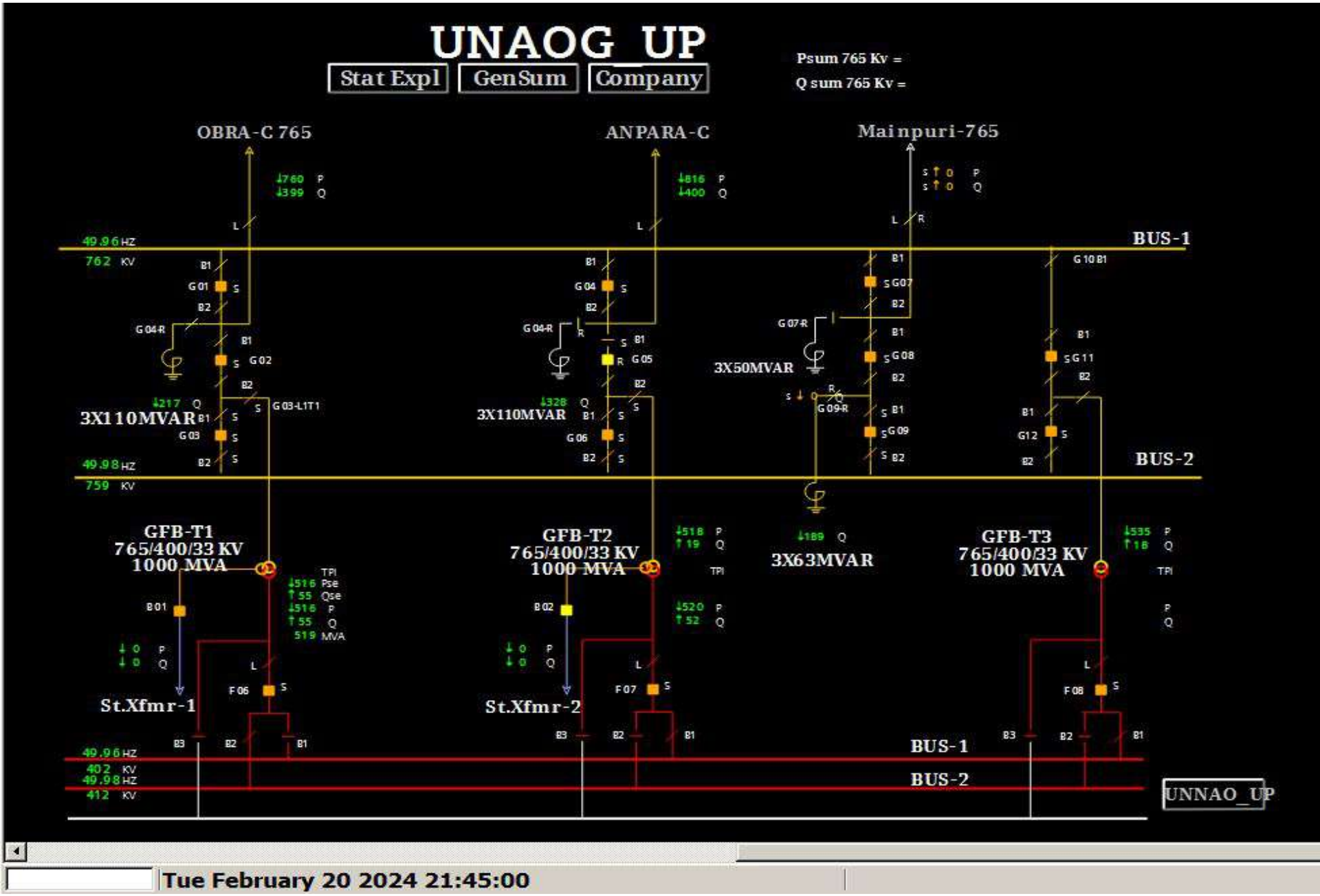
SLD of 400/220kV Unnao (UP) before the event



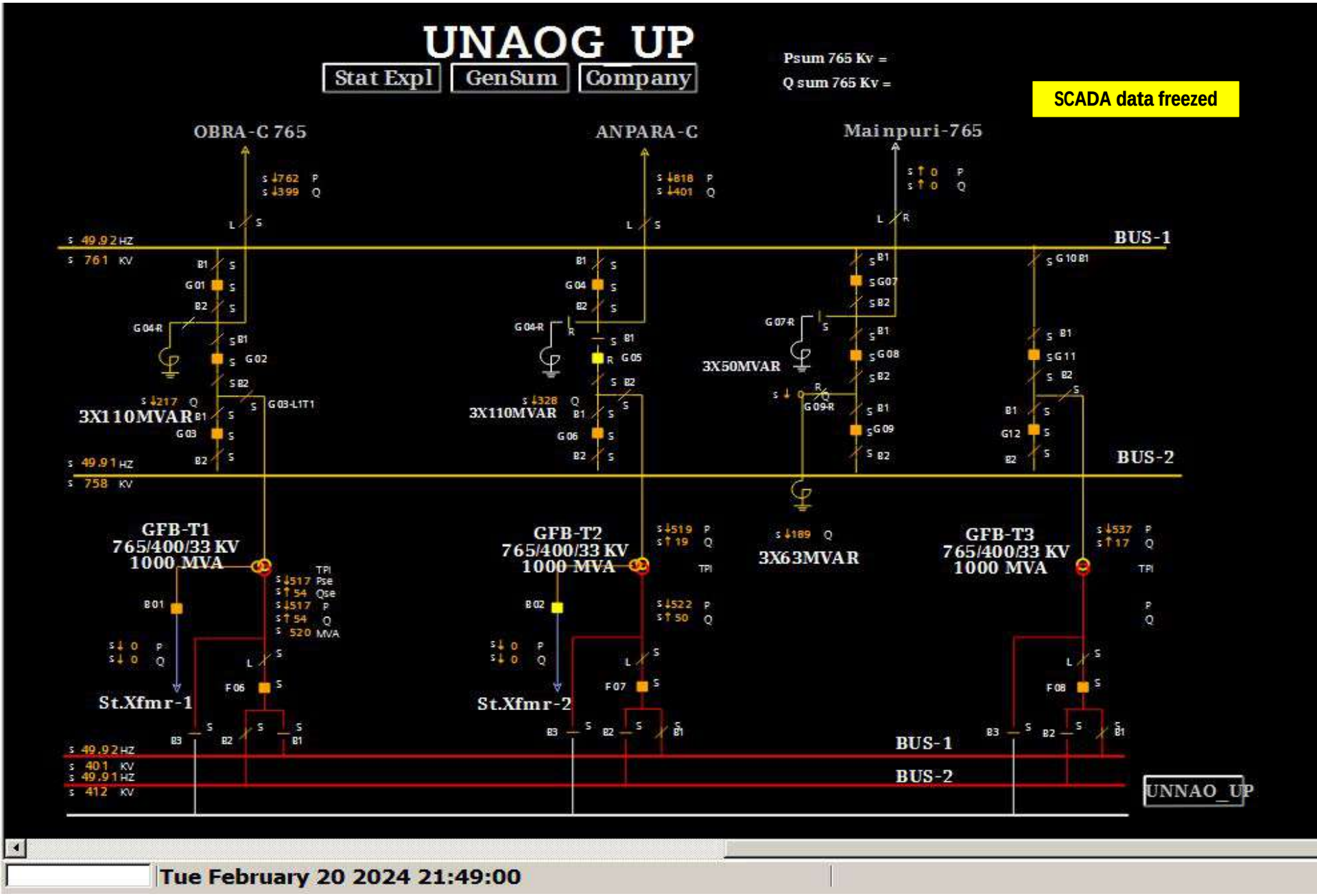
SLD of 400/220kV Unnao (UP) after the event



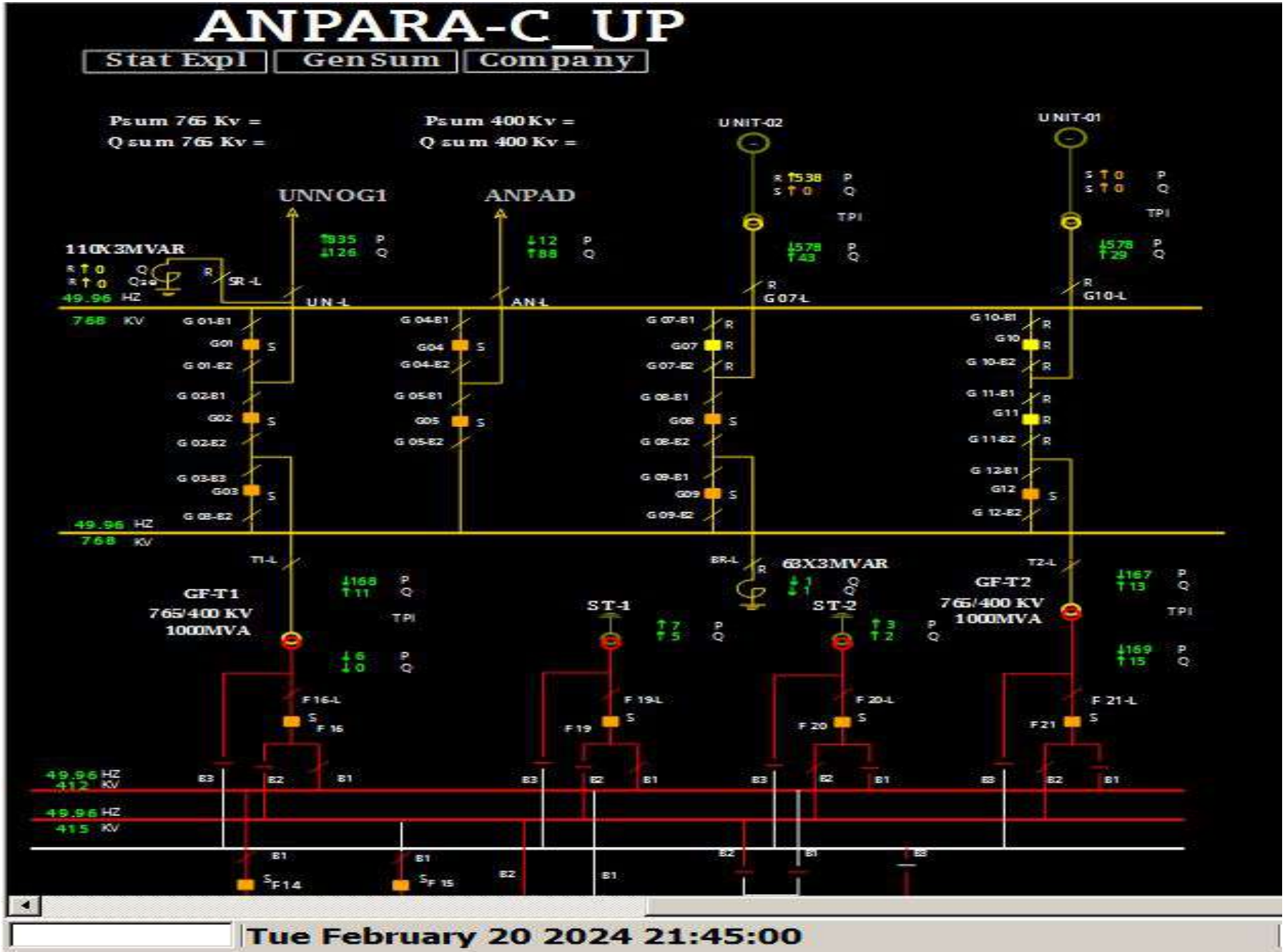
SLD of 765/400kV Unnao (UP) before the event



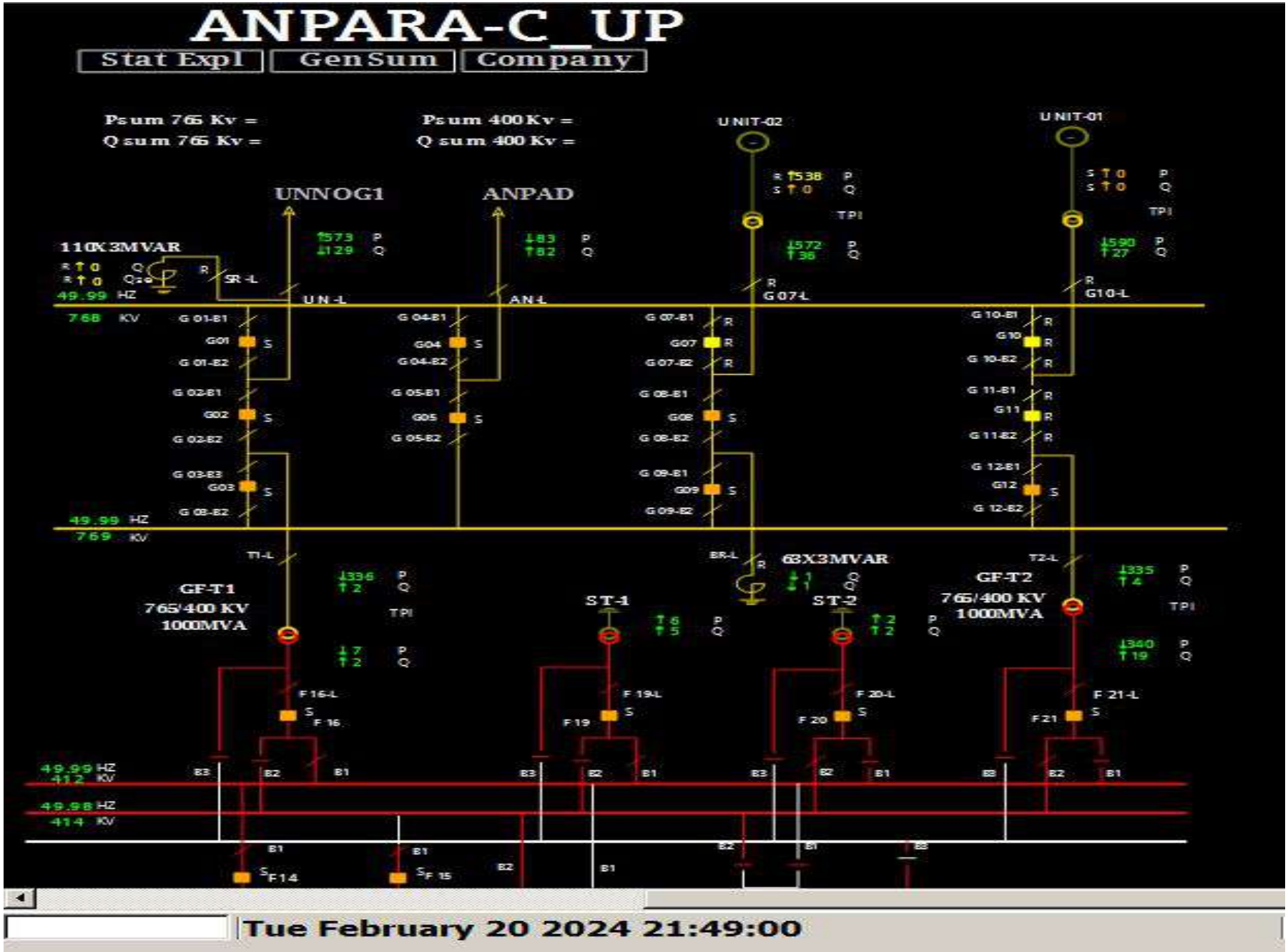
SLD of 765/400kV Unnao (UP) after the event



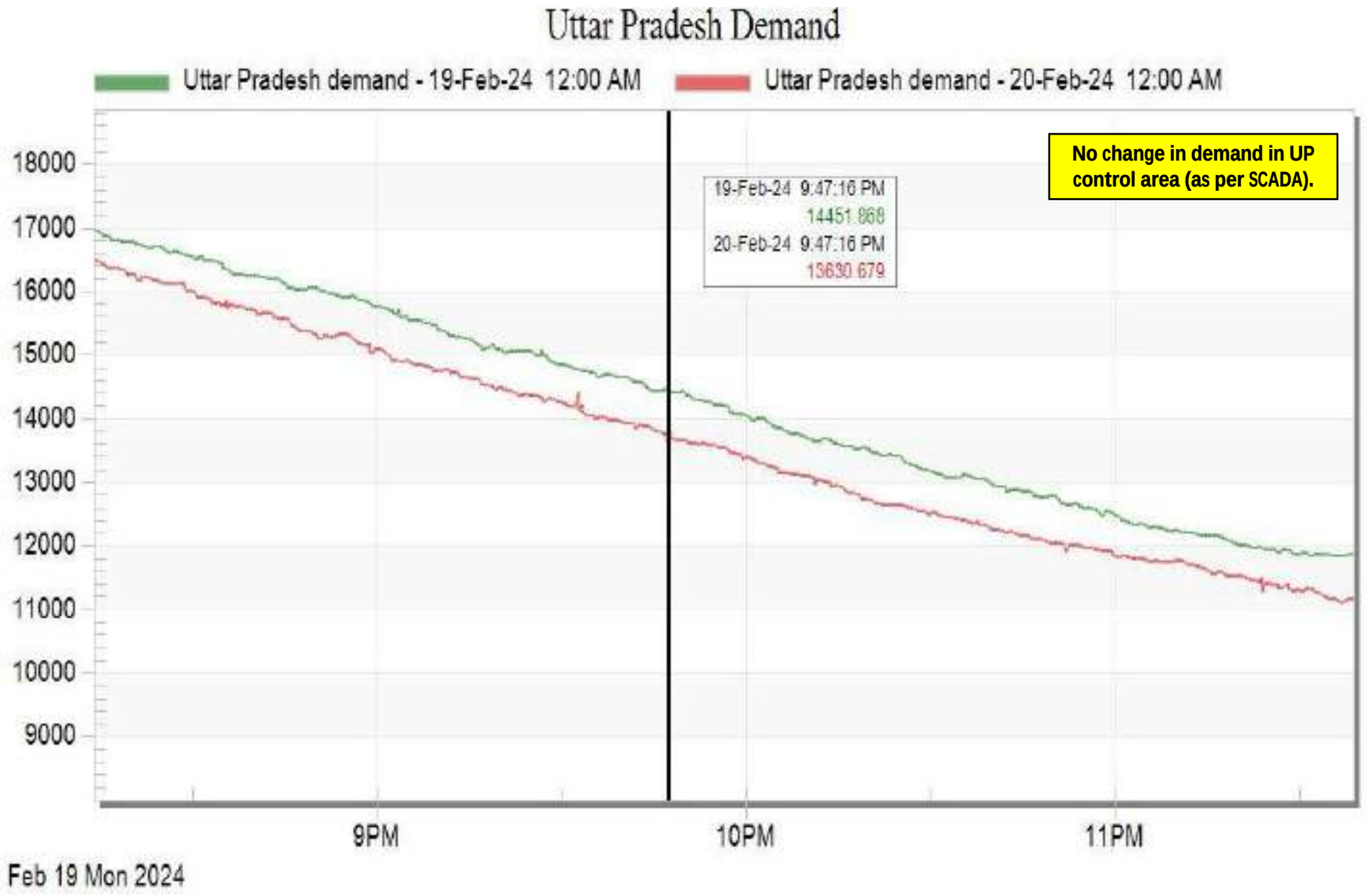
SLD of 765/400kV Anpara-C(UP) before the event



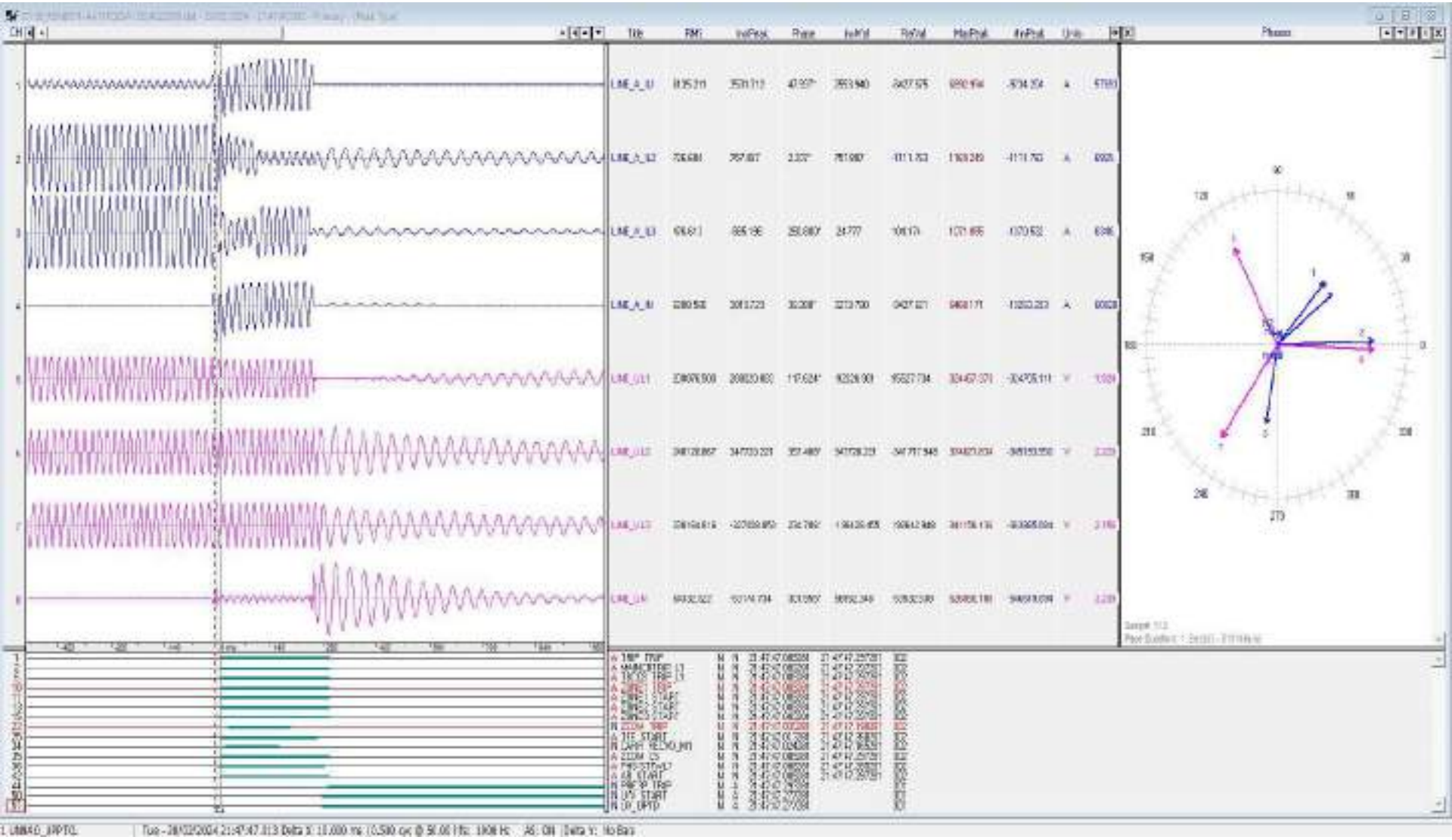
SLD of 765/400kV Anpara-C(UP) after the event



Uttar Pradesh demand during the event

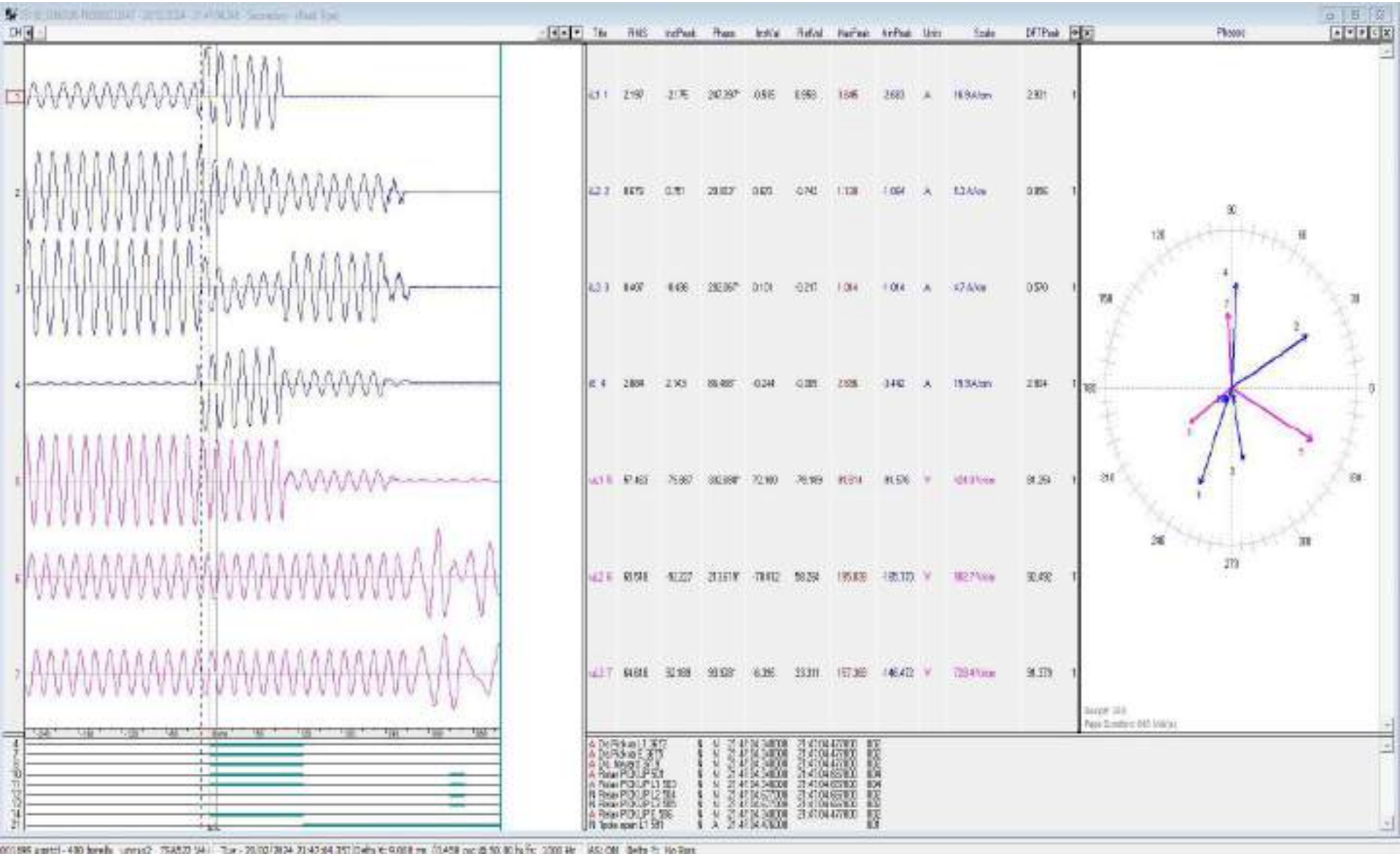


DR of 400 KV Bareilly-Unnao(end) (UP) Ckt-2



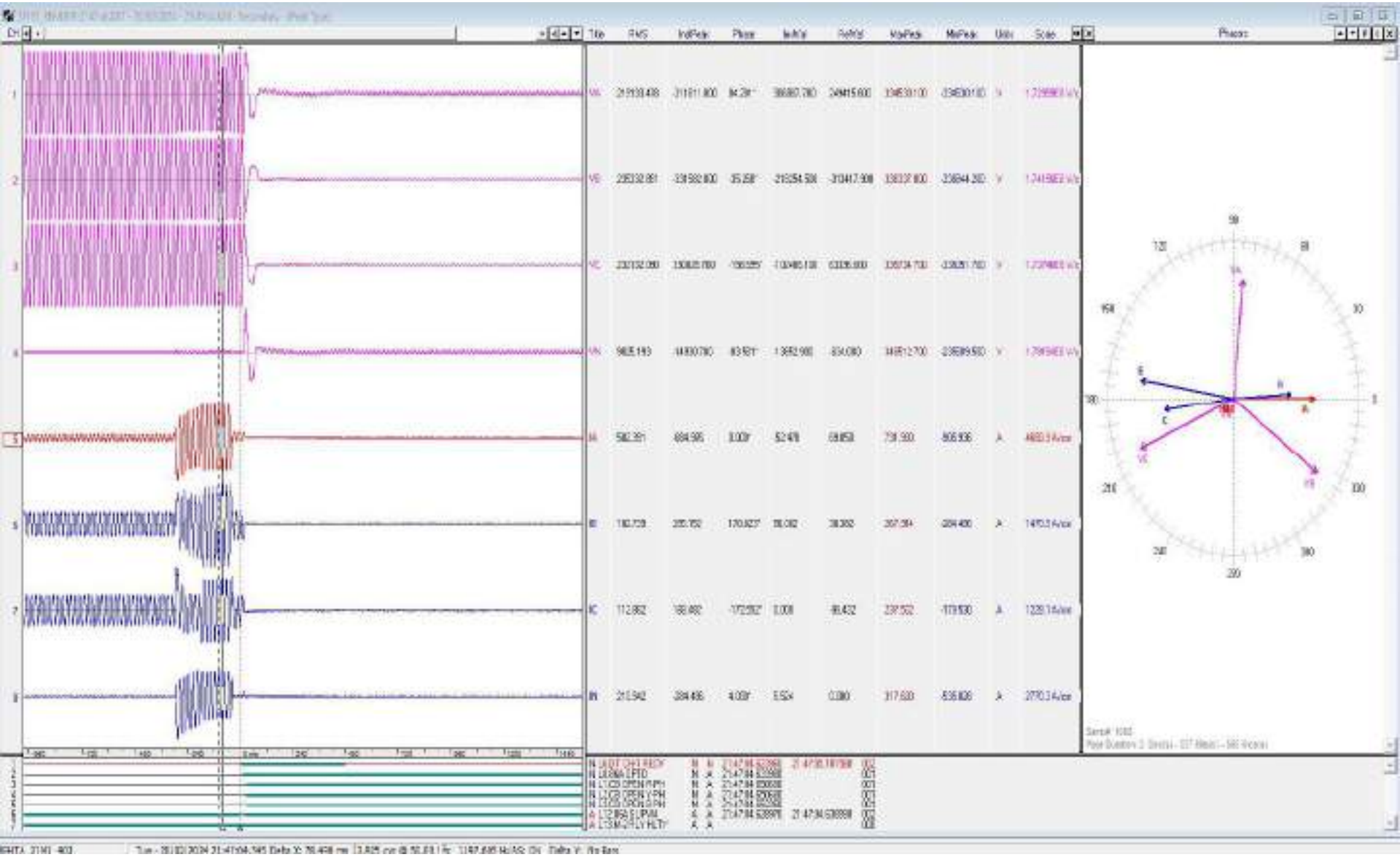
- ✓ R-N phase to earth fault; Ir=~6.135kA
- ✓ Fault clearing time=~280ms
- ✓ Zone-1 trip, breaker didn’t open

DR of 400 KV Bareilly (end)-Unnao (UP) Ckt-2



- ✓ R-N phase to earth fault; Ir=~2.197kA
- ✓ Fault clearing time=~130ms

DR of 400 KV Unnao(UP)-Jehta_Hardoi Road (UP) (end) (PG) Ckt-2



- ✓ R-N phase to earth fault; Ir=~502.39A
- ✓ DT received at Jehta end

Event logger details

- ✓ 400 KV Bareilly (end)-Unnao (UP) Ckt-2 LBB operated

PMU Plot of frequency at Unnao(UP)

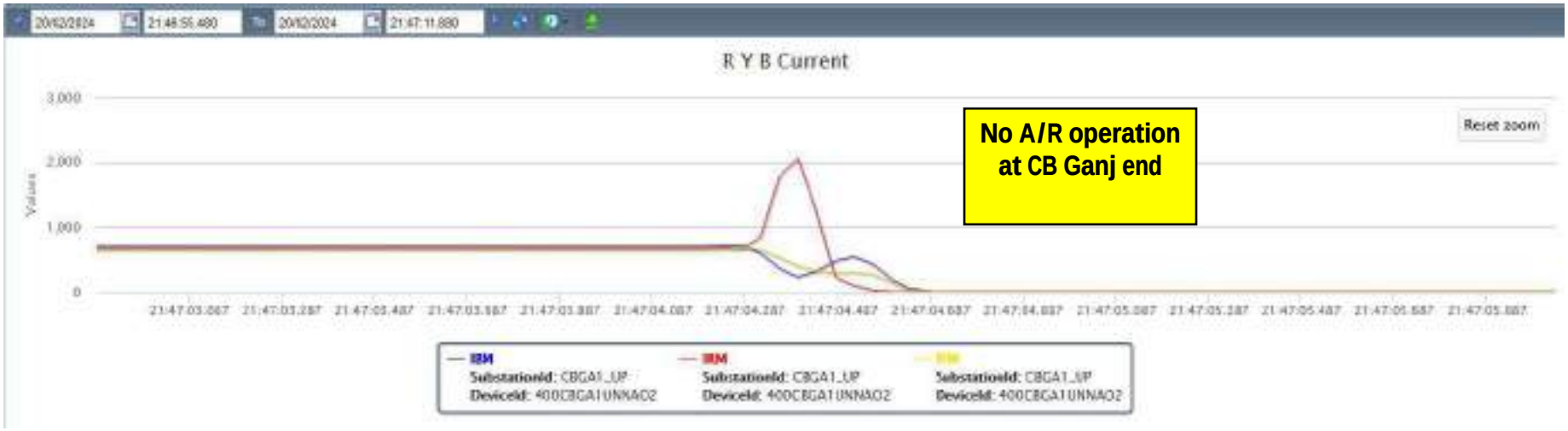
21:47 hrs/20-Feb-24

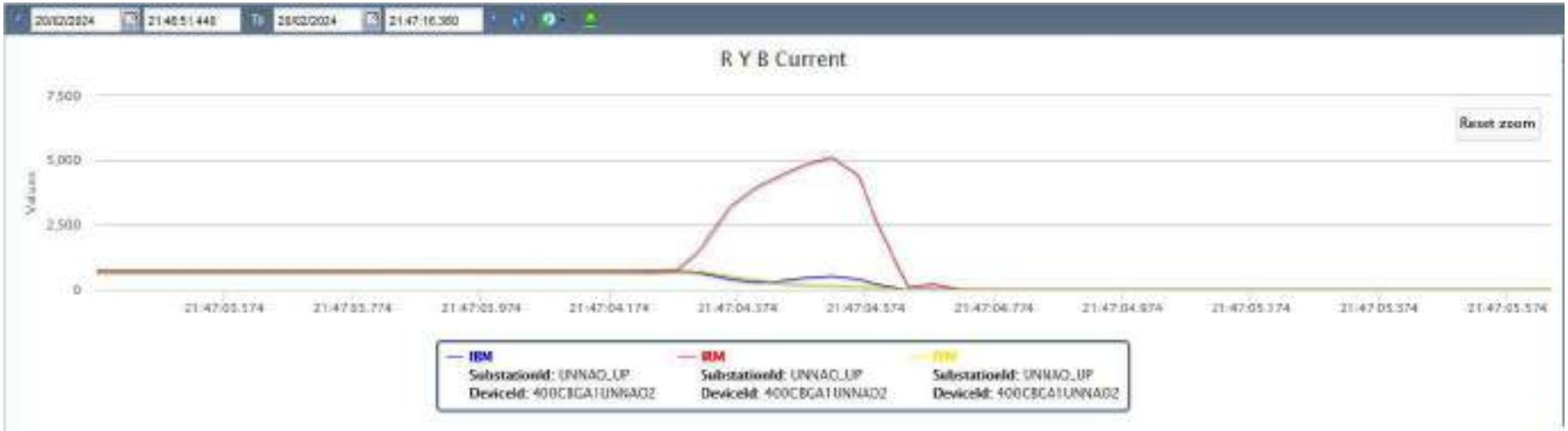
PMU Plot of phase voltage magnitude at Bareilly(PG)

21:47 hrs/20-Feb-24

PMU Plot of phase current magnitude at CB Ganj and Unnao(UP)

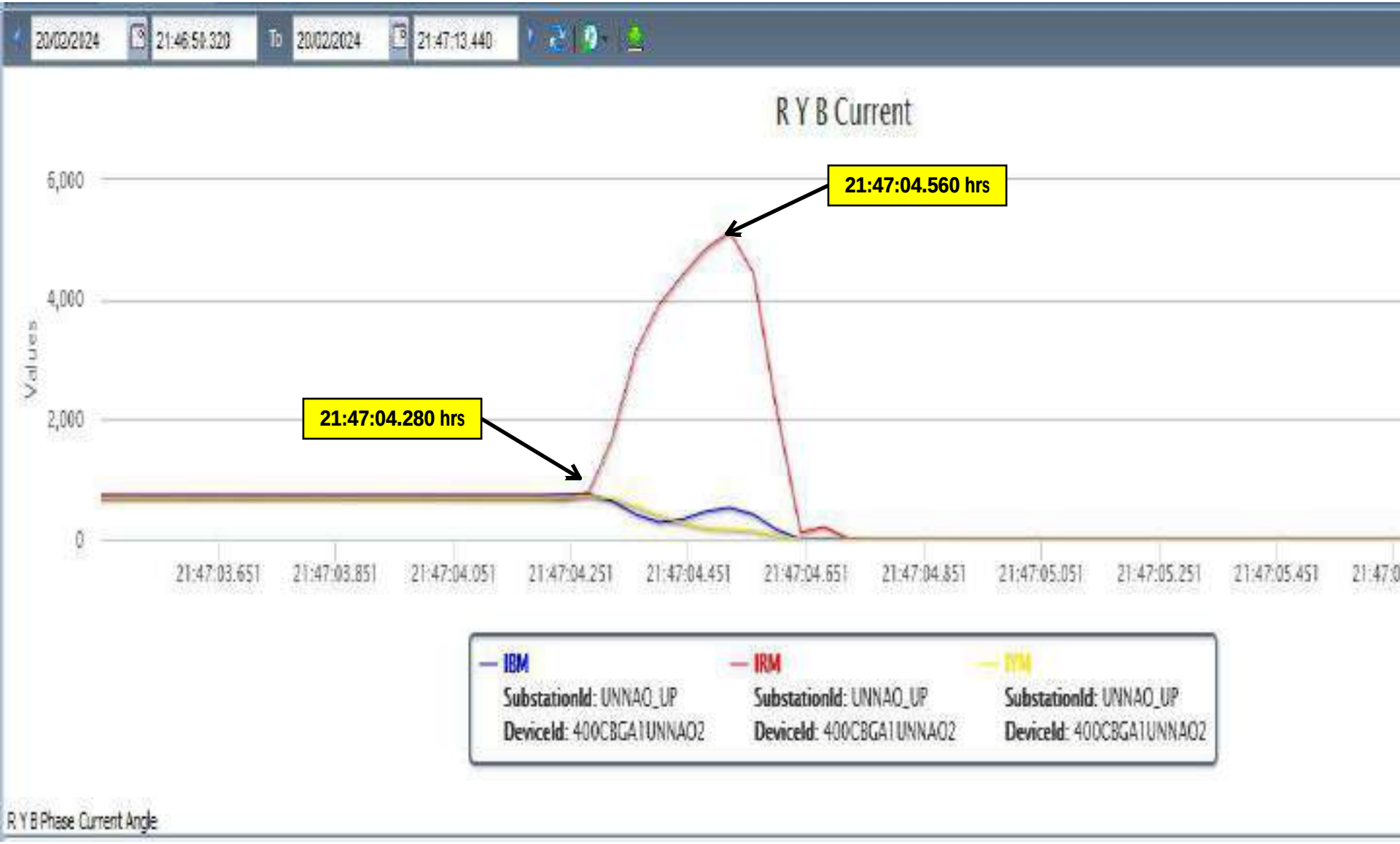
21:47 hrs/20-Feb-24





PMU Plot of phase current magnitude of 400 KV Bareilly-Unnao(UP) Ckt-2 at Unnao(UP)

21:47 hrs/20-Feb-24



SCADA SOE

Time	Station Name	Voltage	Element Name	Element Type	Element Status	Remarks
21:47:04,551	UNNAO_UP	400kV	04AGRA11	Circuit Breaker	Open	Line CB at Unnao(UP) end of 400 KV Agra-Unnao (UP) Ckt opened
21:47:04,556	UNNAO_UP	400kV	06MBC	Circuit Breaker	Open	Main bus coupler CB at 400kV Unnao(UP) opened
21:47:04,557	UNNAO_UP	400kV	15T1	Circuit Breaker	Open	CB at 400kV side of 400/220 kV 315 MVA ICT 1 at Unnao(UP) opened
21:47:04,575	UNNAO_UP	400kV	12LKNOW2	Circuit Breaker	Open	Line CB at Unnao(UP) end of 400 KV Unnao-Lucknow (UP) Ckt opened
21:47:04,578	CBGA1_UP	400kV	11UNNAO2	Circuit Breaker	Open	Line CB at Bareilly(UP) end of 400 KV Bareilly-Unnao (UP) Ckt-2 opened
21:47:04,647	ZEHTA_UP	400kV	03UNNAO2	Circuit Breaker	Open	Line CB at Jehta_Hardoi Road (UP) end of 400 KV Unnao(UP)-Jehta_Hardoi Road (UP) (PG) Ckt-2 opened
21:47:10,759	UNNAO_UP	400kV	03CBGA12	Circuit Breaker	Open	Line CB at Unnao(UP) end of 400 KV Bareilly-Unnao (UP) Ckt-2 opened

Point of discussion

- Exact reason of fault at Main CB of 400 KV Bareilly-Unnao (UP) Ckt-2 ?
- Why did CB didn't open on tripping command?
- Status of A/R operation at CB Ganj end?
- Frequent cases of non-opening of CB have been observed in UP control area. Necessary operation and maintenance actions may be initiated to avoid such events in future.
- SCADA data at 765/400kV Unnao(UP) was freezed during the event. Availability and healthiness of SCADA data need to be ensured.
- DR w.r.t. all other tripped elements on LBB not received. Comment received is '' No DR is available as ABB RADSS scheme is in place''. Implementation of numerical relay may be expedited.
- Tripping status of all the tripped elements are not coming in SCADA SOE.
- Detailed report along with remedial action taken details not received.
- Standardization (nomenclature, time sync etc) of recording instrument (DR/EL) need to be ensured.

400kV Unnao Sub-Station, UPPTCL

On 20.02.2024 at 21:47 hrs following elements trip at 400kV Unnao S/s

NAME OF ELEMENT	RESTORATION DATE	RESTORATION TIME	FLAGS END 1 (INCLUDING A/R)	FLAGS END 2 (INCLUDING A/R)
400kV Bareilly-II	21.02.2024	01:21	Unnao End- RP:-Main-1:-Gen trip,R-ph,Earth,Zone-1, CS, CR, RXMH2, Start AR, 86A. Main-2:-Gen trip,R-ph, Start AR, CS, CR, 86A.	Bareilly End- CP- CH1 DTR, Main1/2 CS, CH-2 DTR, Gr A Trip relay optd, Gr Btrip relay operated. Aux main2-Carrier send, Carrier receive. Gr A trip relay-RXME-18 R, Gr a & B 3 phase trip unit operated
1000MVA ICT-II	20.02.2024	02:51	No flag, tripped form 400kV side only	
1000MVA ICT-III	20.02.2024	05:35	No flag, tripped form 400kV side only	
400kV Main Bus A	20.02.2024	03:09	No flag, tripped form 400kV side only	
400kV Unnao-Jehta line-II	20.02.2024	23:31	LBB operated	
400kV Unnao-Agra	20.02.2024	23:24	No flag	
400kV Unnao-Lucknow	20.02.2024	23:27	No flag	
315MVA ICT-I	20.02.2024	23:21	No flag	

Antecedents condition

- During antecedent condition, 400kV Agra-Unnao, 400kV Unnao-Lucknow, 400kV Bareilly-Unnao ckt-2, 400kV Unnao-Jehta Ckt-2, 400/220kV 315MVA ICT 1 at Unnao, 765/400kV 1000MVA ICT 2 and 3 at Unnao were connected to 400KV Bus 1 at Unnao and rest of the elements were connected to 400KV Bus 2 at Unnao.

- As per SCADA, 400/220kV 315MVA ICT 1 was carrying 151MW and 765/400kV 1000MVA ICT 2 & 3 were carrying 518MW and 535MW respectively.

Events Description

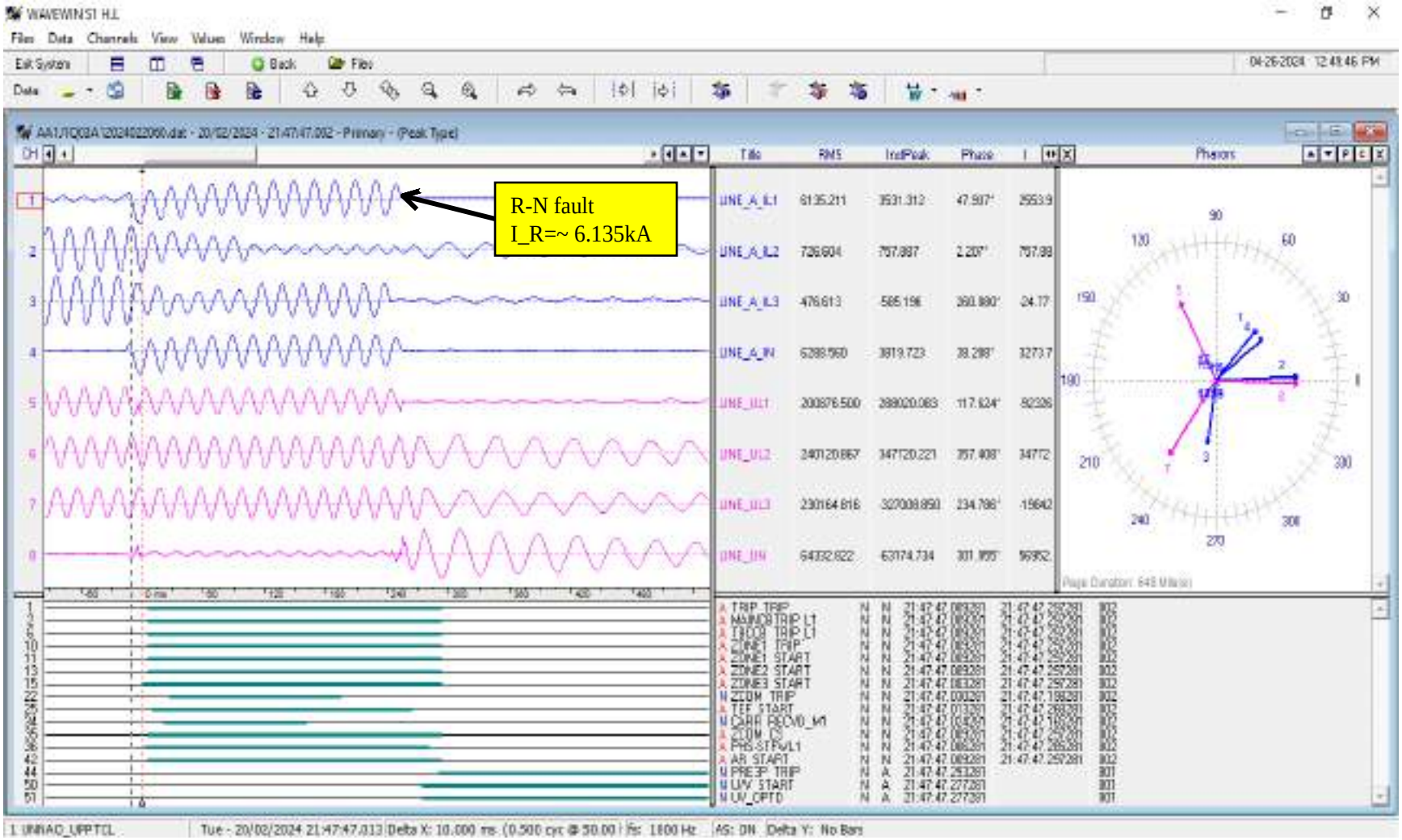
- On 20.02.2024 at 21:47 hrs, R-N phase to earth fault occurred at 400 kV Bareilly-Unnao(UP) Ckt-2 with fault location of 82 km from Unnao(UP) end. But line CB at Unnao(UP) end of 400 kV Bareilly-Unnao (UP) Ckt-2 failed to clear R-N phase to earth the fault till 200ms which should have been cleared within 100ms, hence LBB protection operated.

- As per DR of 400kV Bareilly-Unnao (UP) Ckt-2, zone-1 distance protection operated at Unnao end and fault was sensed in zone-1 (carrier-aided trip) at Bareilly end. Fault was cleared within 255ms at Unnao end. R-N phase to earth fault was observed with fault current of 6.329kA at Unnao end and 2.197kA at Bareilly end.

- Due to LBB operation, 400 KV Unnao-Lucknow(UP), 400 KV Agra-Unnao (UP) Ckt, 400 KV Unnao(UP)- Jehta_Hardoi Road (UP) (PG) Ckt-2, 400/220 kV 315 MVA ICT 1 at Unnao(UP), 765/400 kV 1000 MVA ICT 2 & 3 at Unnao(UP) also tripped and 400kV Bus 1 at Unnao(UP) became dead.

- As per SCADA, no load loss of is observed in UP control area.

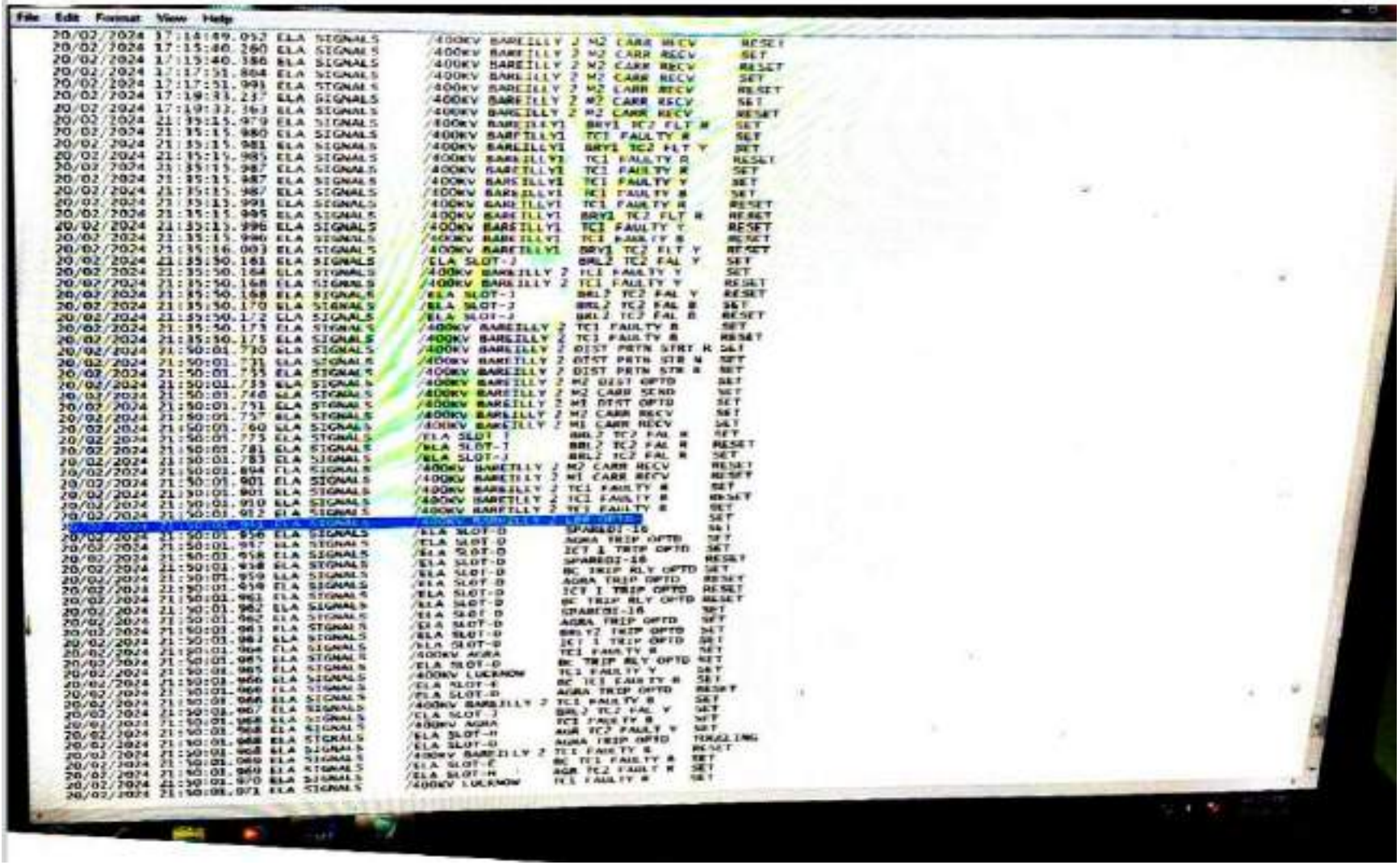
DR of 400kV Bareilly-Unnao(end) ckt 2



Zone-1 distance protection operated at Unnao end

Fault clearing time =~ 255ms

Event logger status



Exact location and Nature of fault:- R-N phase to earth fault occurred at 400 kV Bareilly-Unnao(UP) Ckt-2 with fault location of 82 km from Unnao(UP) end.

Reason for delayed clearance of fault :- R-N phase to earth fault in zone-1 should have been cleared within <=100ms by CB of 400 kV Bareilly-Unnao (UP) Ckt-2 at Unnao end but due to prolonged operation and line CB failed to clear the fault within 200ms, LBB protection operated.

SCADA data at 765/400kV Unnao(UP) freeze during the event :- Replacement work of Defective Battery sets of UPS for SCADA System was under progress at 765kV S/S Unnao by maintenance team and in that period auxiliary supply of gateways taken from 400kV S/s Unnao, supply of Gateways were also affected hence data of 765kV S/S Unnao was freeze for some time.

Remedial Actions

- Complete overhaul of Line CB of 400kV Unnao-Bareilly ckt 2 line is under process by O&M team and is expected to be completed by 20 May 2024.

- At 765kV Unnao, both defective Battery sets of UPS for SCADA System including UPS Inverter for supply of SCADA System has been replaced by maintenance team and now power supply of SCADA system are healthy and working properly.

THANK YOU.

Multiple elements tripping at 400/220kV Unnao(UP) 11th March 2024

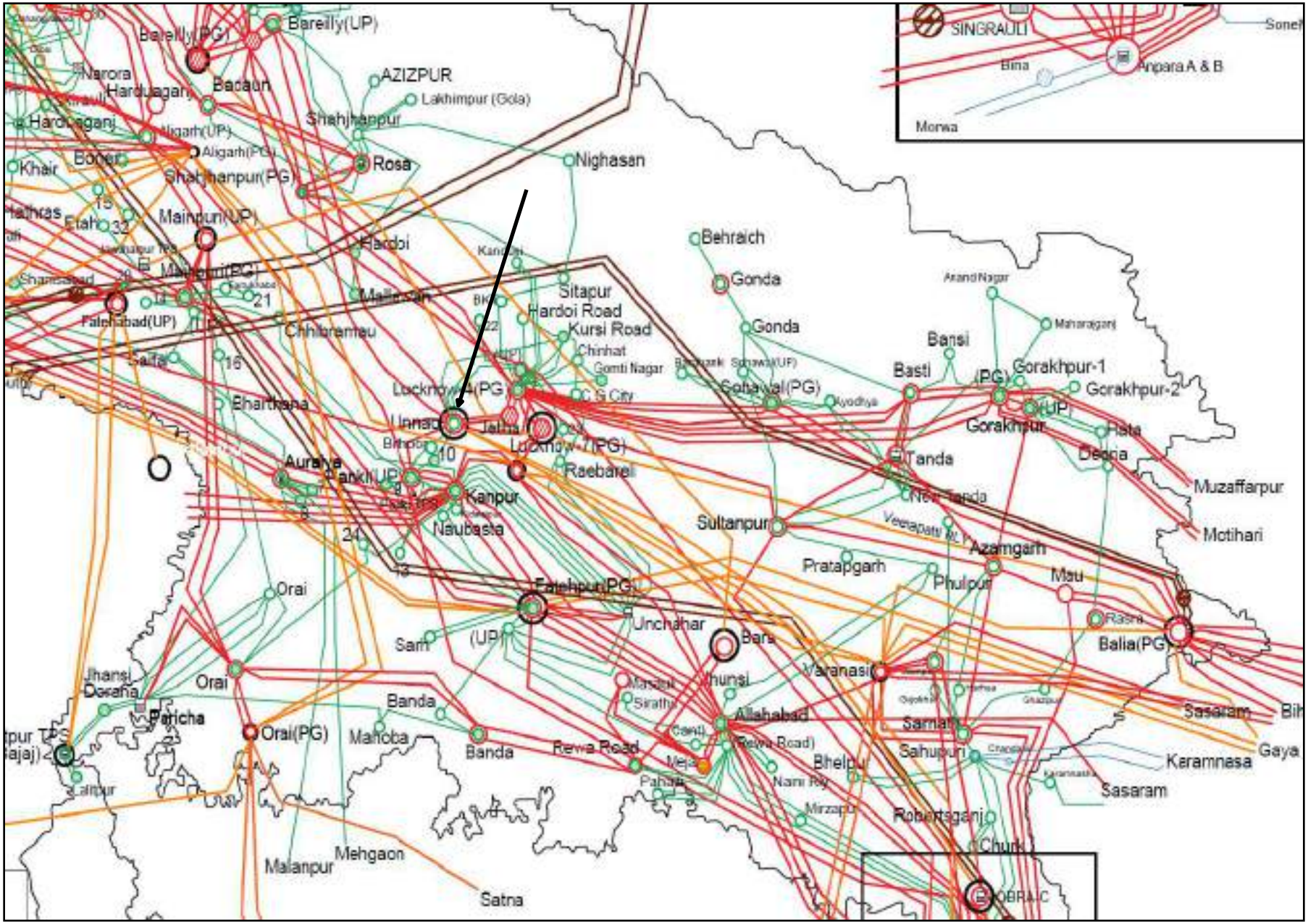
Brief of event:

- During antecedent condition, 400/220 kV 315 MVA ICT 1 & 6 and 765/400kV 1000 MVA ICT 1, 2 & 3 at Unnao(UP) were carrying 138MW, 140MW, 549MW, 551MW and 570MW respectively. 400/220 kV 315 MVA ICT 2 at Unnao(UP) was not in service.
- As reported, at 01:56 hrs, **R-N phase to earth fault occurred at 400 kV Bareilly-Unnao (UP) Ckt-2** with fault location of 85 km from Unnao(UP) end. But line CB at Unnao(UP) end of 400 kV Bareilly-Unnao (UP) Ckt-2 failed to clear the fault, hence LBB operated.
- Due to LBB operation, 400 KV Agra-Unnao (UP) Ckt, 400 KV Unnao(UP)-Jehta_Hardoi Road (UP) (PG) Ckt-2, 400/220 kV 315 MVA ICT 1 at Unnao(UP), 765/400 kV 1000 MVA ICT 2 & 3 at Unnao(UP) also tripped and 400kV Bus 1 at Unnao(UP) became dead.
- As per DR of 400 KV Bareilly-Unnao (UP) Ckt-2, zone-1 distance protection operated at Unnao end and fault was sensed in zone-1 (carrier-aided trip) at Bareilly end. Fault was cleared within 245ms at Unnao end and 170ms at Bareilly end. R-N phase to earth fault was observed with fault current of 6.329kA from Unnao end and 2.122kA from Bareilly end.
- As per DR of 400 KV Unnao(UP)-Jehta_Hardoi Road (UP) (PG) Ckt-2, DT received at Jehta_Hardoi Road end.
- As per SCADA SOE, CB of FSC at Unnao(UP) end connected to 400kV Bareilly-Unnao (UP) Ckt-2 closed during the same time. (It is suspected that fault may have initiated due to this. Exact reason of fault need to be shared).
- As per PMU at Agra(PG), **R-N phase to earth fault** is observed with **delayed fault clearing time of 280ms**.
- As per SCADA, no load loss of is observed in UP control area.

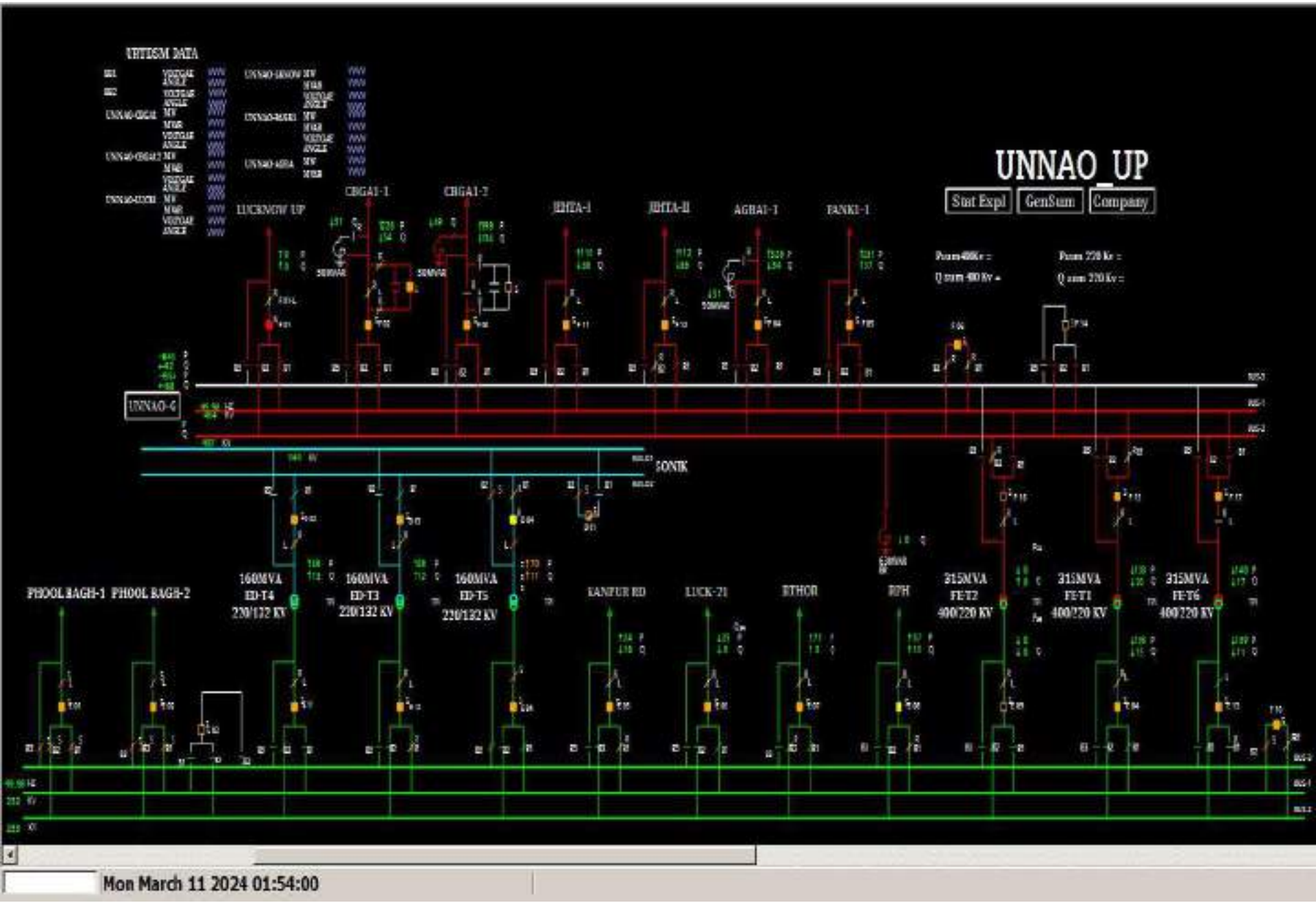
Elements tripped:

i. 400 KV Bareilly-Unnao (UP) Ckt-2
ii. 400 KV Agra-Unnao (UP) Ckt
iii. 400 KV Unnao(UP)-Jehta_Hardoi Road (UP) (PG) Ckt-2
iv. 400/220 kV 315 MVA ICT 1 at Unnao(UP)
v. 765/400 kV 1000 MVA ICT 2 at Unnao(UP)
vi. 765/400 kV 1000 MVA ICT 3 at Unnao(UP)
vii. 400kV Bus 1 at Unnao(UP)

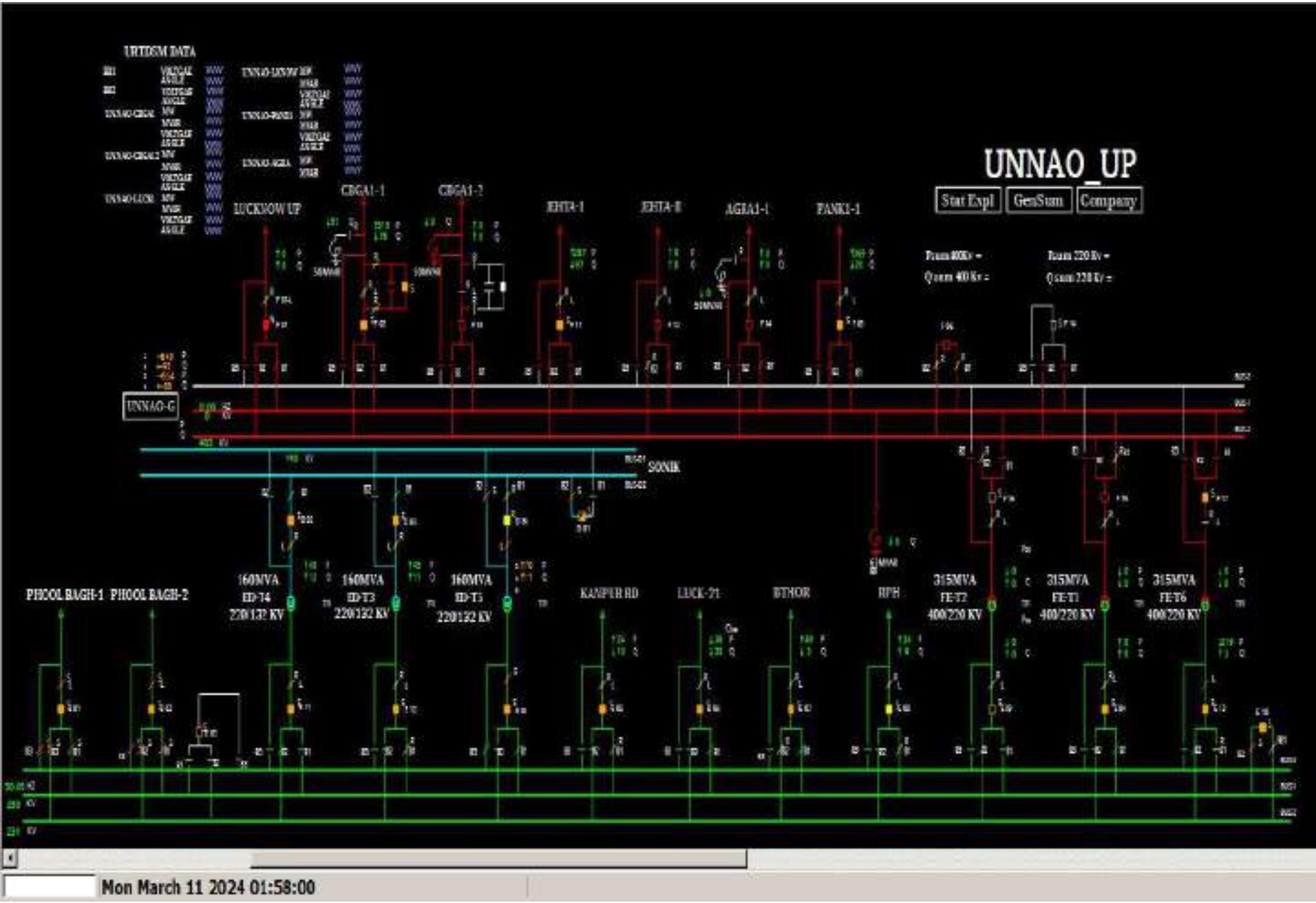
Network Diagram



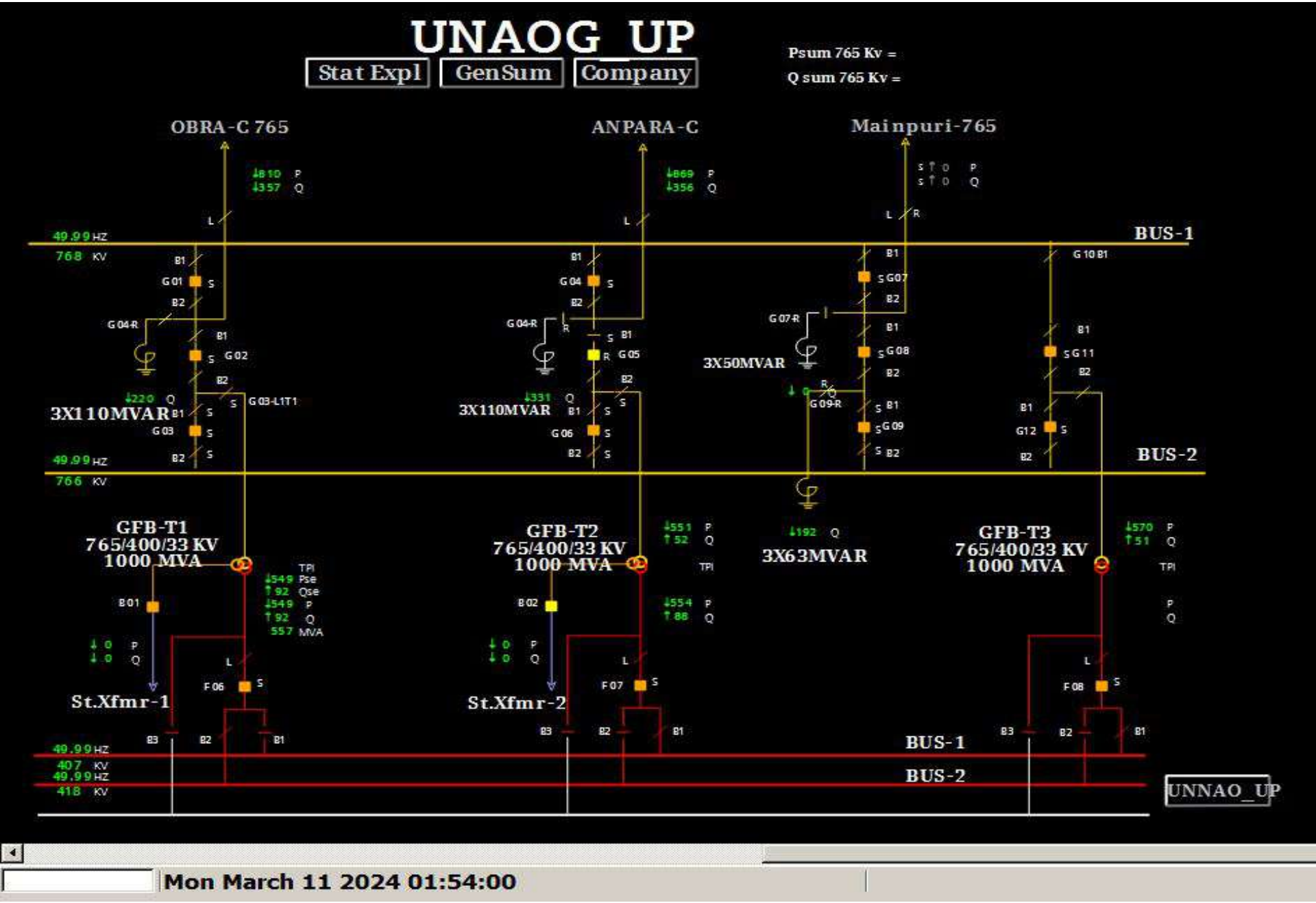
SLD of 400/220/132kV Unnao(UP) before the event



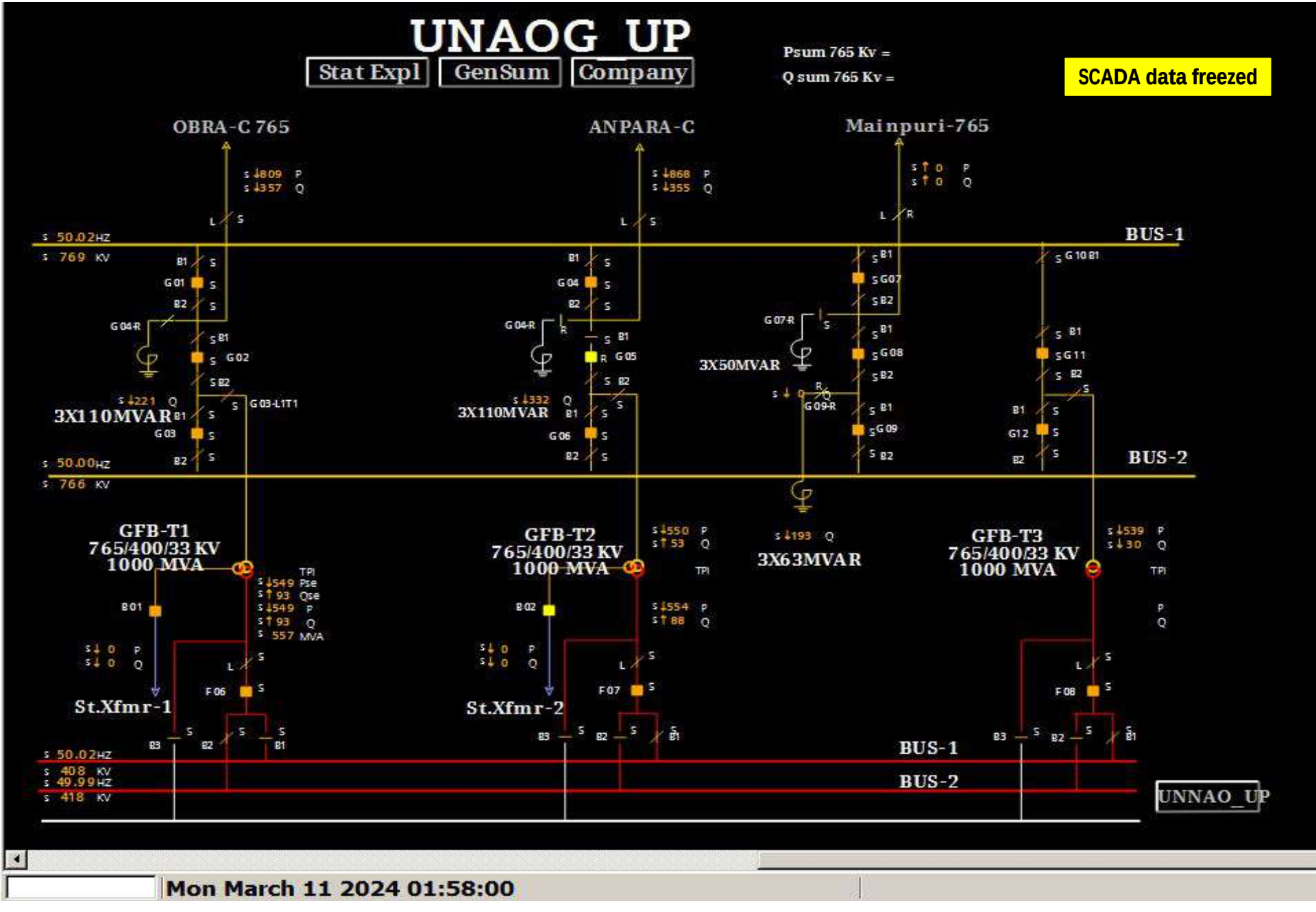
SLD of 400/220/132kV Unnao(UP) after the event



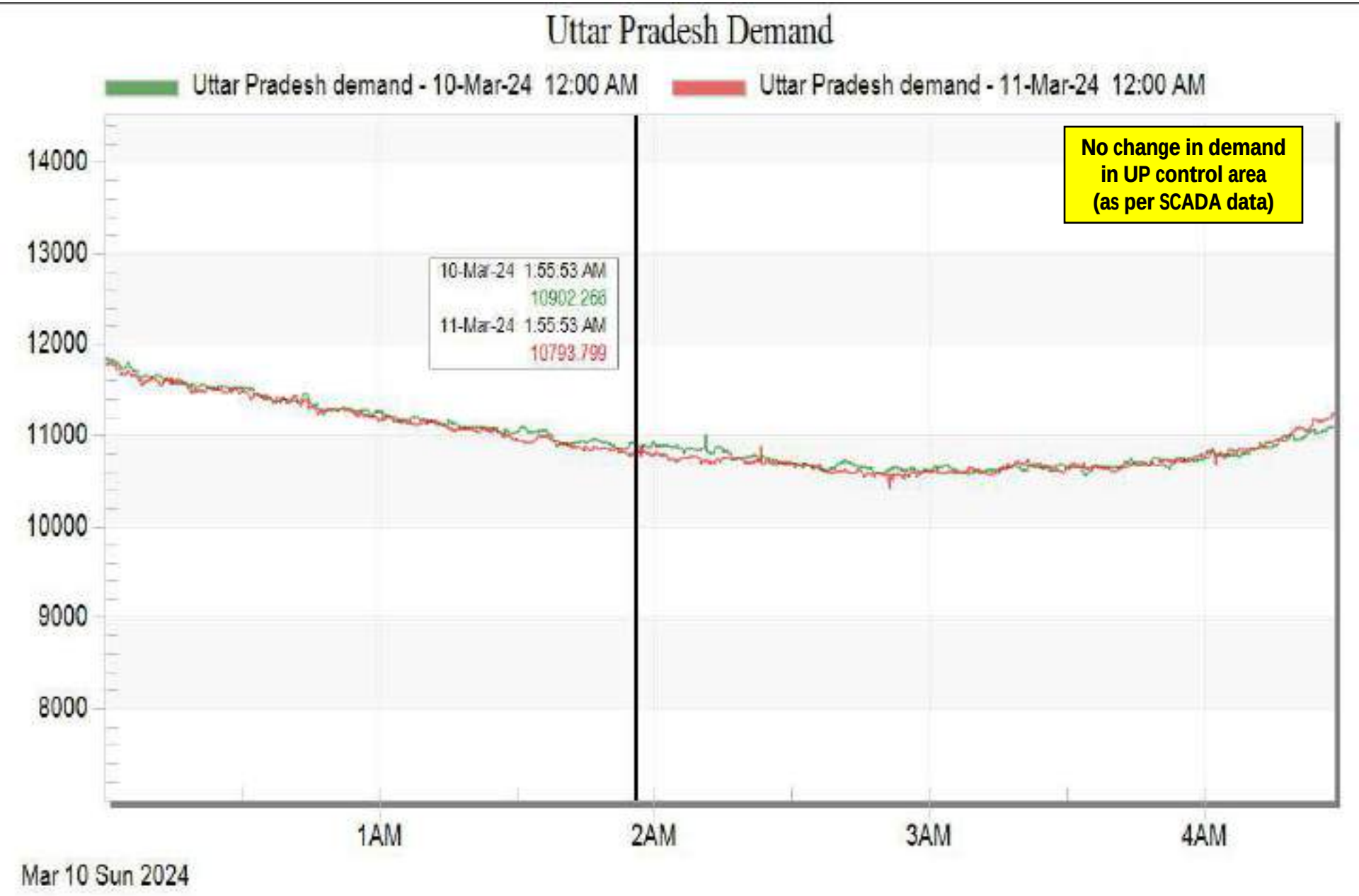
SLD of 765/400kV Unnao(UP) before the event



SLD of 765/400kV Unnao(UP) after the event



Uttar Pradesh demand during the event



PMU Plot of frequency at Agra(PG)

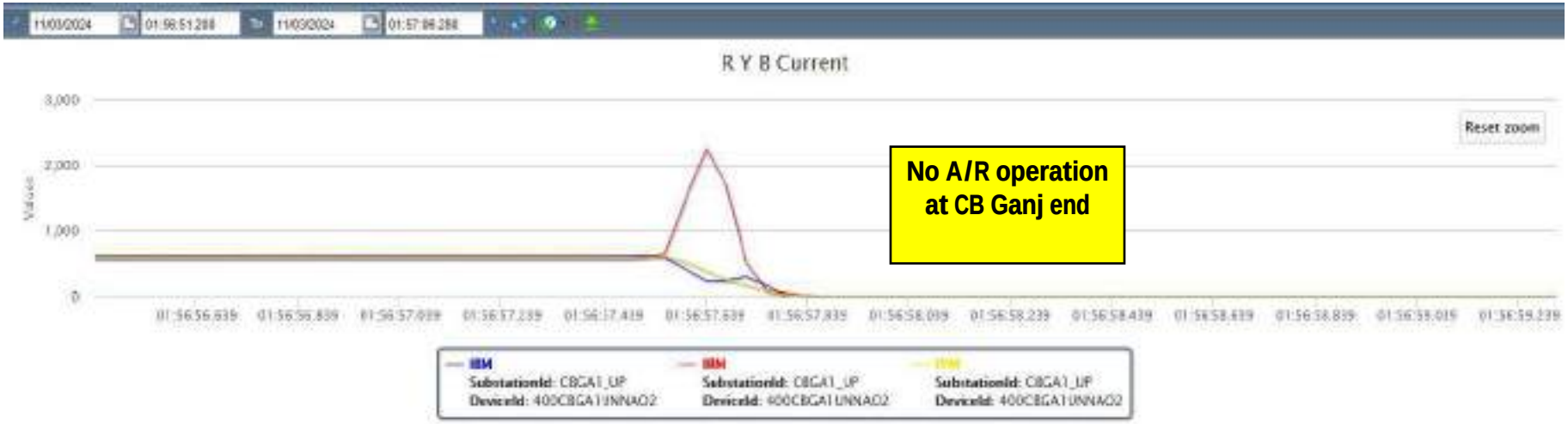
01:56 hrs/11-Mar-24

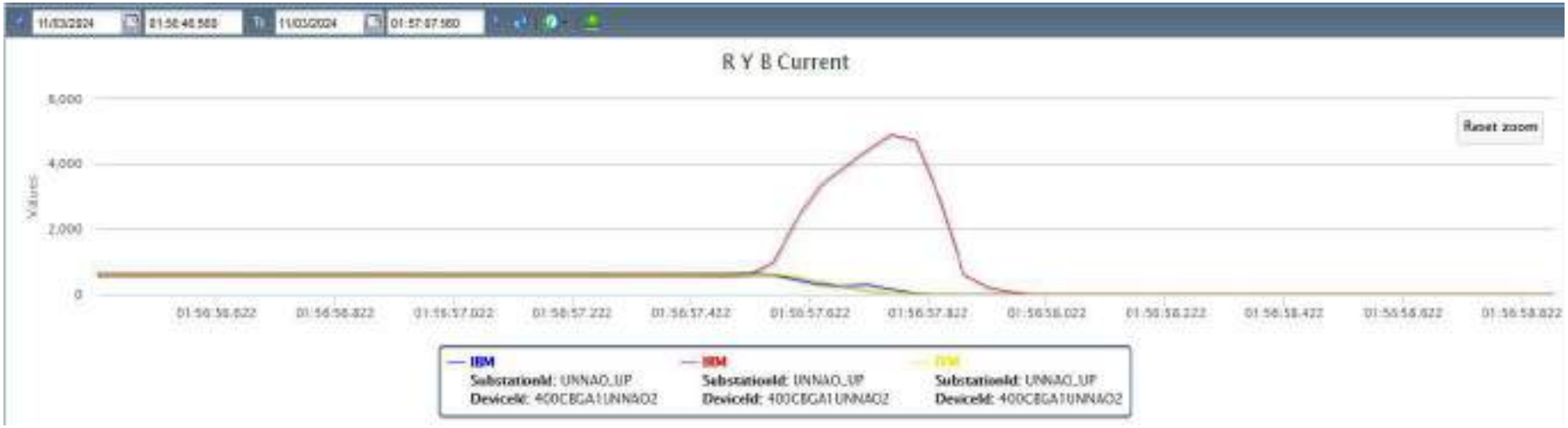
PMU Plot of phase voltage magnitude at Agra(PG)

01:56 hrs/11-Mar-24

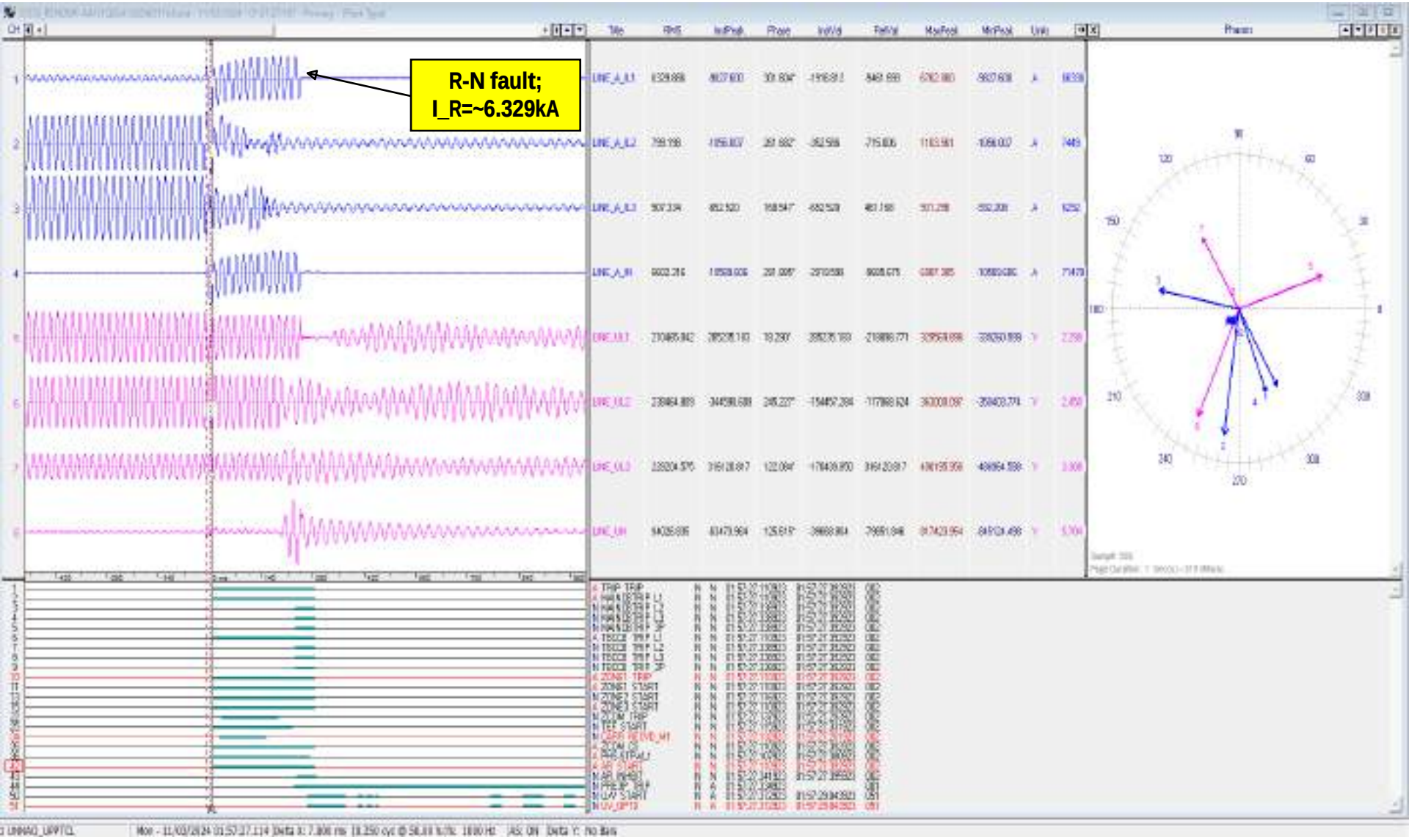
PMU Plot of phase current magnitude at CB Ganj and Unnao(UP)

01:56 hrs/11-Mar-24



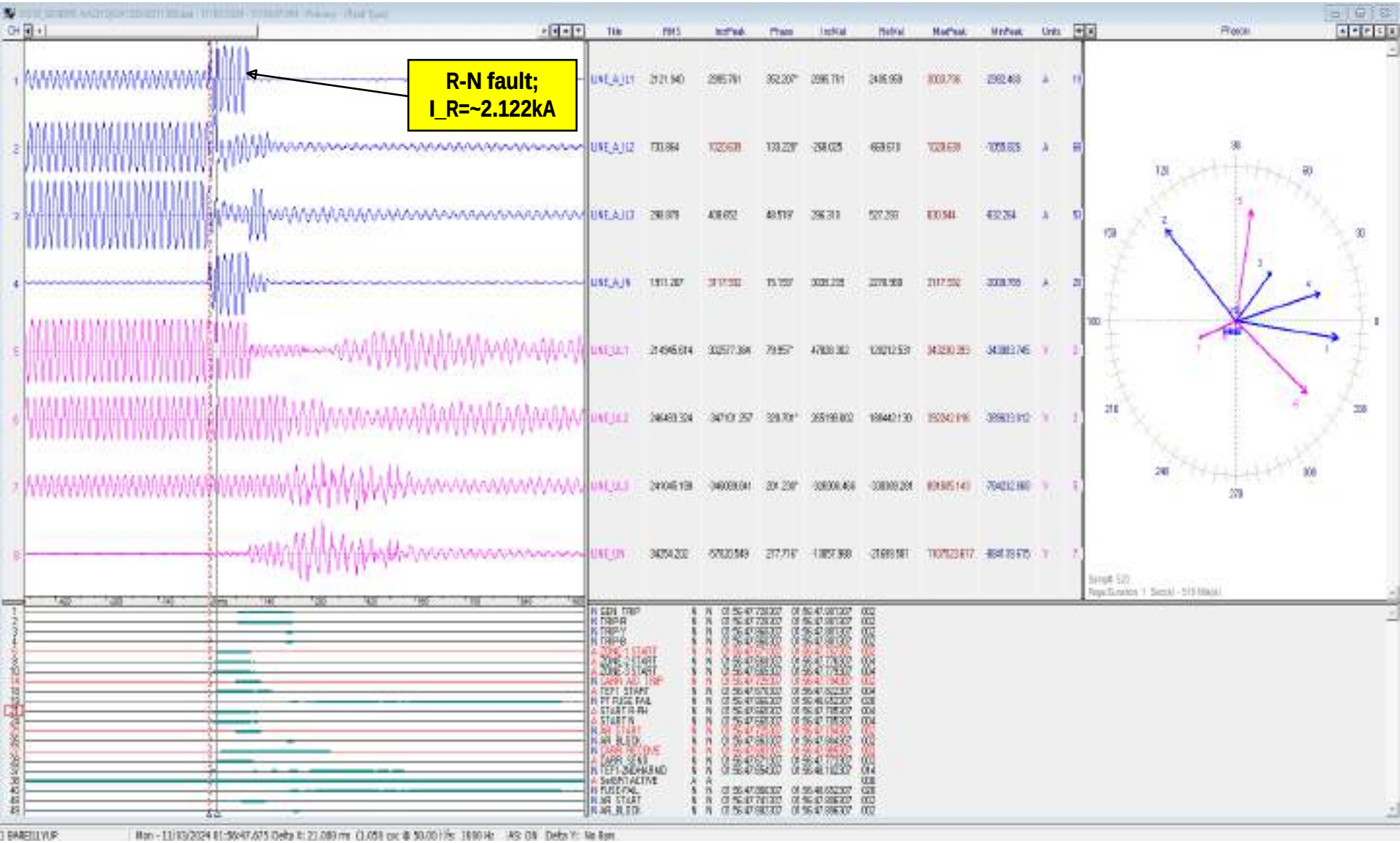


DR of 400 KV Bareilly-Unnao (end) (UP) Ckt-2



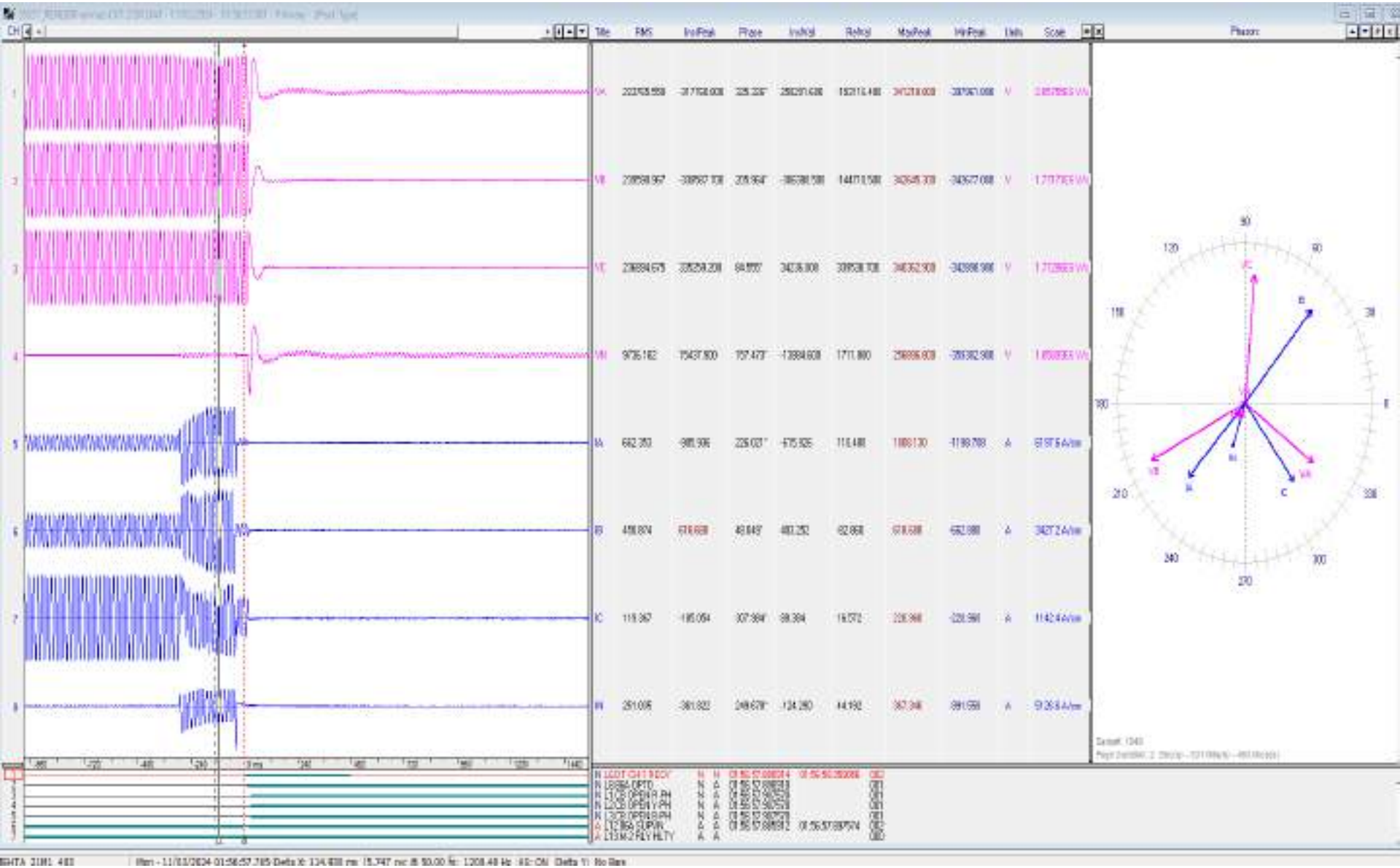
- ✓ Zone-1 distance protection operated at Unnao end
- ✓ Fault clearing time=~245ms

DR of 400 KV Bareilly (end)-Unnao (UP) Ckt-2



- ✓ Fault in Zone-1 at Bareilly end; Carrier-aided trip
- ✓ Fault clearing time=~170ms

DR of 400 KV Unnao(UP)-Jehta_Hardoi Road (UP) (end) (PG) Ckt-2



- ✓ DT received at Jehta_Hardoi Road end

SCADA SOE

Time	Station Name	Voltage	Element Name	Element Type	Element Status	Remarks
01:56:57,556	UNNAO_UP	400kV	FSC2	Circuit Breaker	Close	CB of FSC at Unnao(UP) end connected to 400kV Bareilly-Unnao (UP) Ckt-2 closed
01:56:57,717	CBGA1_UP	400kV	11UNNAO2	Circuit Breaker	Open	CB at Bareilly(UP) end of 400kV Bareilly-Unnao (UP) Ckt-2 opened
01:56:57,795	UNNAO_UP	400kV	04AGRA11	Circuit Breaker	Open	CB at Unnao(UP) end of 400kV Agra-Unnao (UP) Ckt-1 opened
01:56:57,798	UNNAO_UP	400kV	15T1	Circuit Breaker	Open	CB at 400kV end of 400/220kV 315MVA ICT-1 at Unnao(UP) opened
01:56:57,800	UNNAO_UP	400kV	06MBC	Circuit Breaker	Open	Main Bus Coupler CB at 400kV Unnao(UP) opened
01:56:57,819	UNNAO_UP	400kV	12LKNOW2	Circuit Breaker	Open	CB at Unnao(UP) end of 400kV Unnao(UP)-Jehta_Hardoi Road (UP) (PG) Ckt-2 opened
01:56:57,903	JEHTA_UP	400kV	03UNNAO2	Circuit Breaker	Open	CB at Jehta_Hardoi Road(UP) end of 400kV Unnao(UP)-Jehta_Hardoi Road (UP) (PG) Ckt-2 opened
01:56:59,641	UNNAO_UP	400kV	03CBGA12	Circuit Breaker	Open	CB at Unnao(UP) end of 400kV Bareilly-Unnao (UP) Ckt-2 opened

Point of discussion

- Exact reason of fault at Main CB of 400 KV Bareilly-Unnao (UP) Ckt-2 ?
- Why did CB didn't open on tripping command?
- Status of A/R operation at CB Ganj end?
- Frequent cases of non-opening of CB have been observed in UP control area. Necessary operation and maintenance actions may be initiated to avoid such events in future.
- SCADA data at 765/400kV Unnao(UP) was freezed during the event. Availability and healthiness of SCADA data need to be ensured.
- DR w.r.t. all other tripped elements on LBB not received. Comment received is '' No DR is available as ABB RADSS scheme is in place''. Implementation of numerical relay may be expedited.
- Tripping status of all the tripped elements are not coming in SCADA SOE.
- Detailed report along with remedial action taken details not received.
- Standardization (nomenclature, time sync etc) of recording instrument (DR/EL) need to be ensured.

400kV Unnao Sub-Station, UPPTCL

On 11.03.2024 at 01:56 hrs following elements trip at 400kV Unnao S/s

NAME OF ELEMENT	RESTORATION DATE	RESTORATION TIME	FLAGS END 1 (INCLUDING A/R)	FLAGS END 2 (INCLUDING A/R)
400kV Bareilly-II	11.03.2024	04:27	Unnao End- R-phase, EPU, Z-1, C/S, Distance 85km. start A/R main I pro. Block A/R from Main I . Main I pro C/R, 86 A , 86B, 86C, F/L 30%, LBB. Main-II GT, R-phase Added trip Z-1, U/V alarm start A/R, c/s 86 A start A/R from main II pro block A/R from main –II fpro, main II pro C/S & C/R	Bareilly End- Rphase, Y phase, B phase, Z-1, GT, ch-1 DTR, ch-II DTR dist. 180.7km., F/L-66.68%,
1000MVA ICT-II	11.03.2024	02:51	No flag, tripped form 400kV side only	
1000MVA ICT-III	11.03.2024	05:35	No flag, tripped form 400kV side only	
400kV Main Bus A	11.03.2024	03:09	No flag, tripped form 400kV side only	
400kV Unnao-Jehta line-II	11.03.2024	04:29	LBB operated	
400kV Unnao-Agra	11.03.2024	04:02	No flag	
315MVA ICT-I	11.03.2024	03:39	No flag	

Antecedents condition

- During antecedent condition, 400/220 kV 315 MVA ICT 1 and 3 were carrying 138MW and 140MW respectively.
- 400/220 kV 315 MVA ICT 2 at Unnao(UP) was not in service.
- 765/400kV 1000 MVA ICT 1, 2 & 3 at Unnao(UP) were carrying 549MW, 551MW and 570MW respectively.

Events Description

- On 11.03.2024 at 01:56 hrs, R-N phase to earth fault occurred at 400 kV Bareilly-Unnao(UP) Ckt-2 with fault location of 85 km from Unnao(UP) end. But line CB at Unnao(UP) end of 400 kV Bareilly-Unnao (UP) Ckt-2 failed to clear R-N phase to earth the fault till 200ms which should have been cleared within 100ms, hence LBB protection operated.

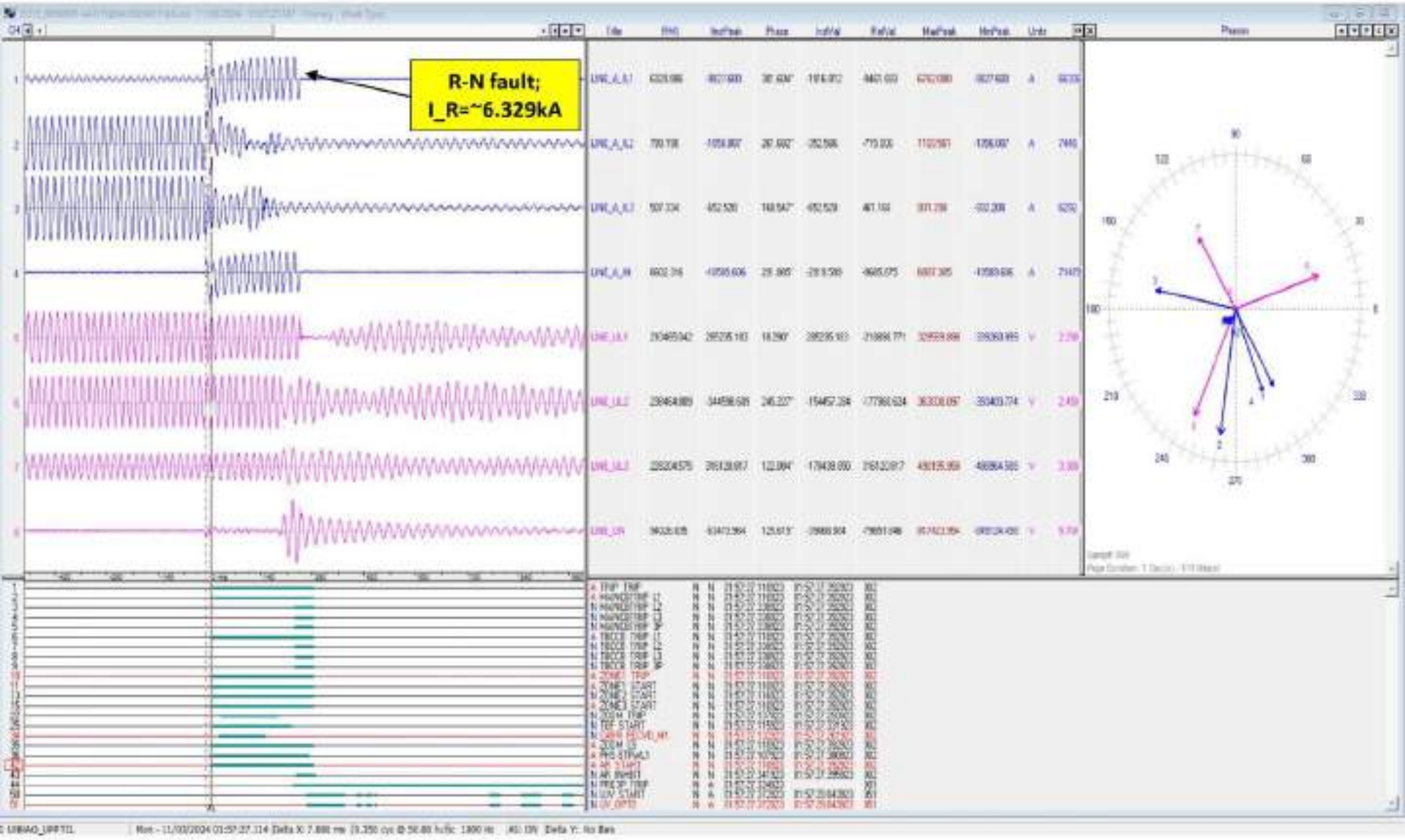
- As per DR of 400kV Bareilly-Unnao (UP) Ckt-2, zone-1 distance protection operated at Unnao end and fault was sensed in zone-1 (carrier-aided trip) at Bareilly end. Fault was cleared within 245ms at Unnao end and 170ms at Bareilly end. R-N phase to earth fault was observed with fault current of 6.329kA from Unnao end and 2.122kA from Bareilly end.

- Due to LBB operation, 400 KV Agra-Unnao (UP) Ckt, 400 KV Unnao(UP)- Jehta_Hardoi Road (UP) (PG) Ckt-2, 400/220 kV 315 MVA ICT 1 at Unnao(UP), 765/400 kV 1000 MVA ICT 2 & 3 at Unnao(UP) also tripped and 400kV Bus 1 at Unnao(UP) became dead.

- As per DR of 400 KV Unnao(UP)-Jehta_Hardoi Road (UP) (PG) Ckt-2, DT received at Jehta_Hardoi Road end.

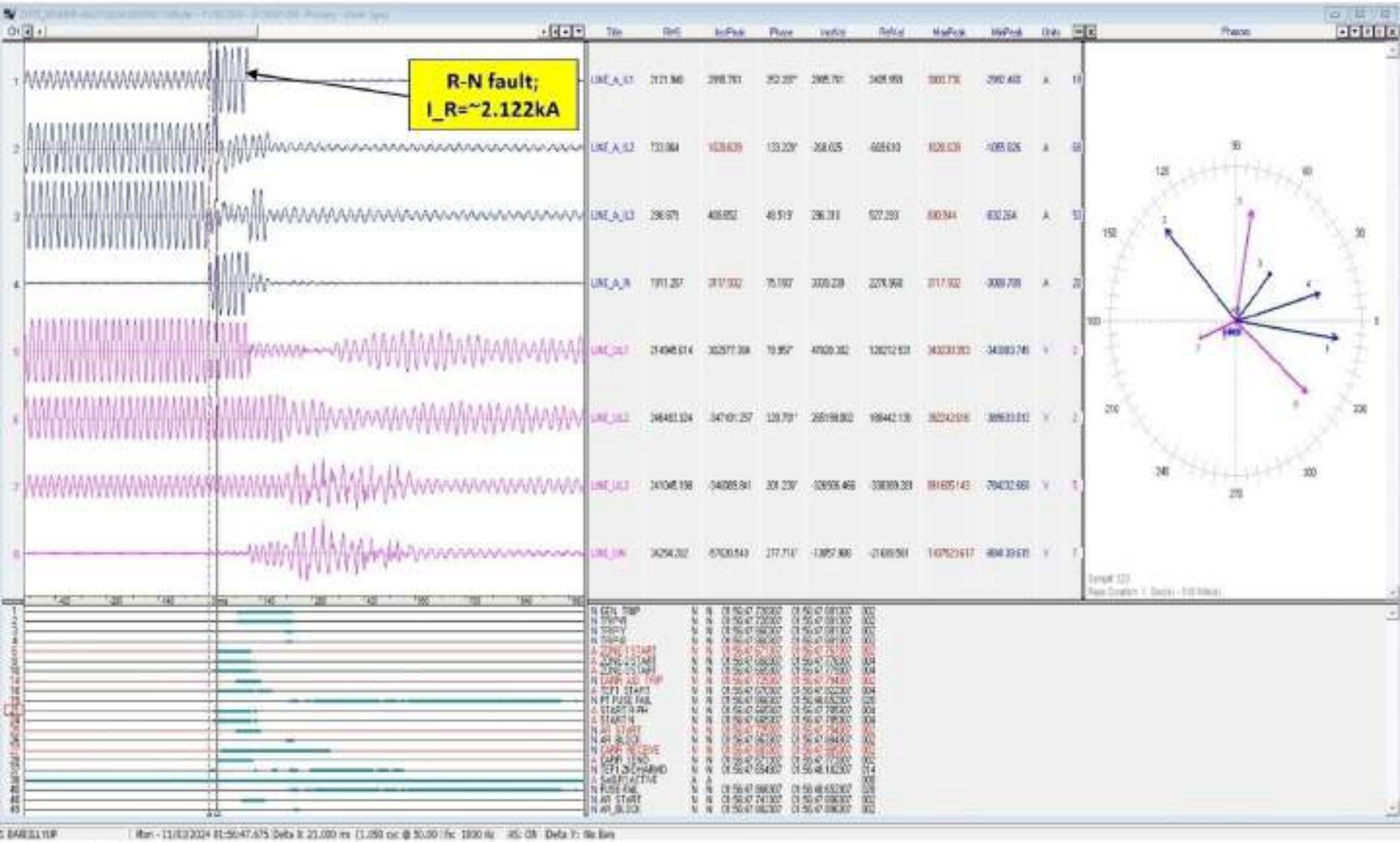
- As per SCADA, no load loss of is observed in UP control area.

DR of 400 KV Bareilly-Unnao (end) (UP) Ckt-2



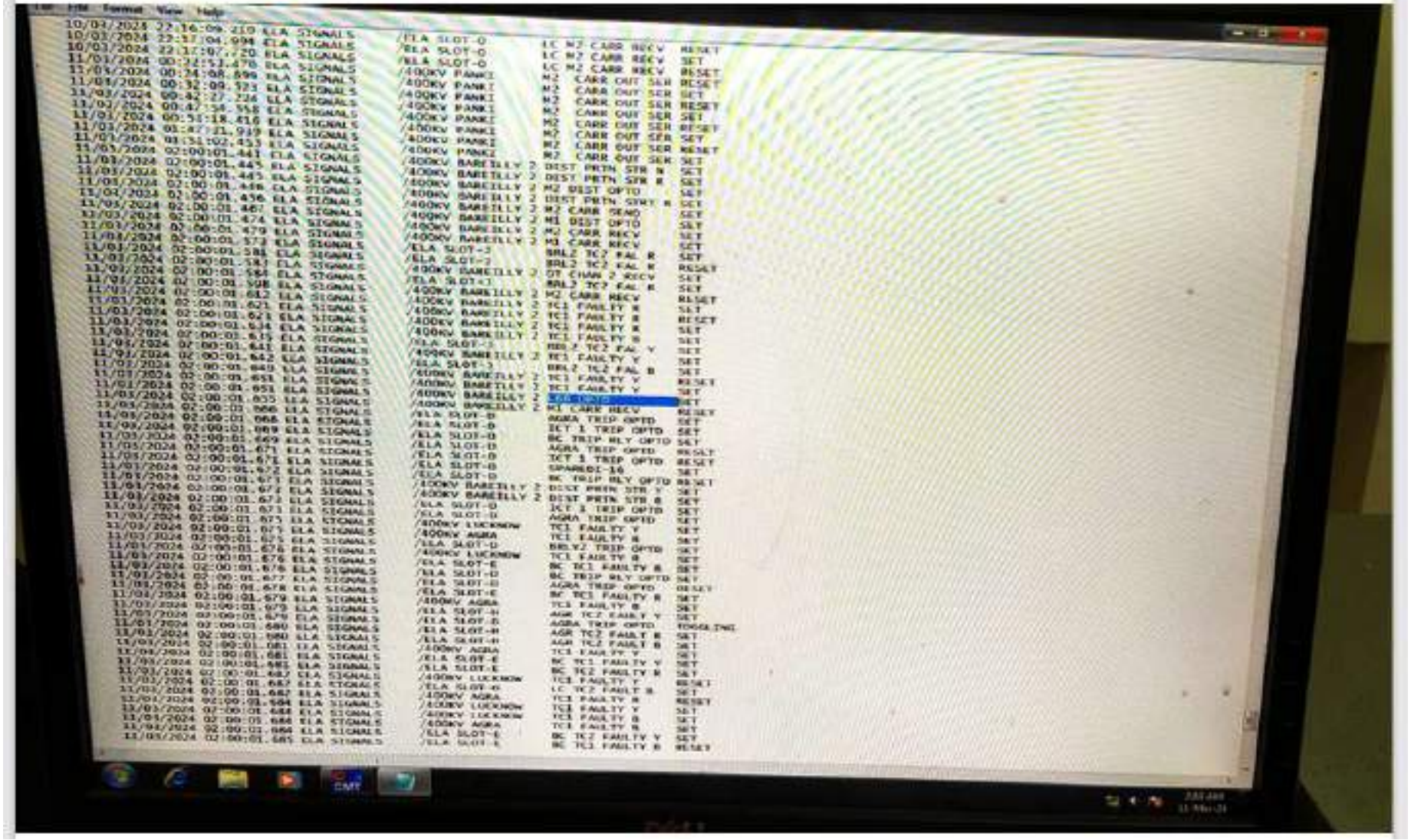
- ✓ Zone-1 distance protection operated at Unnao end
- ✓ Fault clearing time=~245ms

DR of 400 KV Bareilly (end)-Unnao (UP) Ckt-2



- ✓ Fault in Zone-1 at Bareilly end; Carrier-aided trip
- ✓ Fault clearing time=~170ms

Event logger status



Exact location and Nature of fault:- R-N phase to earth fault occurred at 400 kV Bareilly-Unnao(UP) Ckt-2 with fault location of 85 km from Unnao(UP) end.

Reason for delayed clearance of fault :- R-N phase to earth fault in zone-1 should have been cleared within <=100ms by CB of 400 kV Bareilly-Unnao (UP) Ckt-2 at Unnao end but due to prolonged operation and line CB failed to clear the fault within 200ms, LBB protection operated.

SCADA data at 765/400kV Unnao(UP) freeze during the event :- During operation of Bus Bar Protection at 400kV S/S Unnao on 11.03.2024 at 01:56Hrs, replacement work of Defective Battery sets of UPS for SCADA System was under progress at 765kV S/S Unnao by maintenance team and in that period auxiliary supply of gateways taken from 400kV S/s Unnao, supply of Gateways were also affected hence data of 765kV S/S Unnao was freeze for some time.

Remedial Actions

- Complete overhaul of Line CB of 400kV Unnao-Bareilly ckt 2 line is under process by O&M team and is expected to be completed by 20 May 2024.

- At 765kV Unnao, both defective Battery sets of UPS for SCADA System including UPS Inverter for supply of SCADA System has been replaced by maintenance team and now power supply of SCADA system are healthy and working properly.

THANK YOU.

Multiple elements tripping at 220kV BTPS (DTL) 31th January 2024

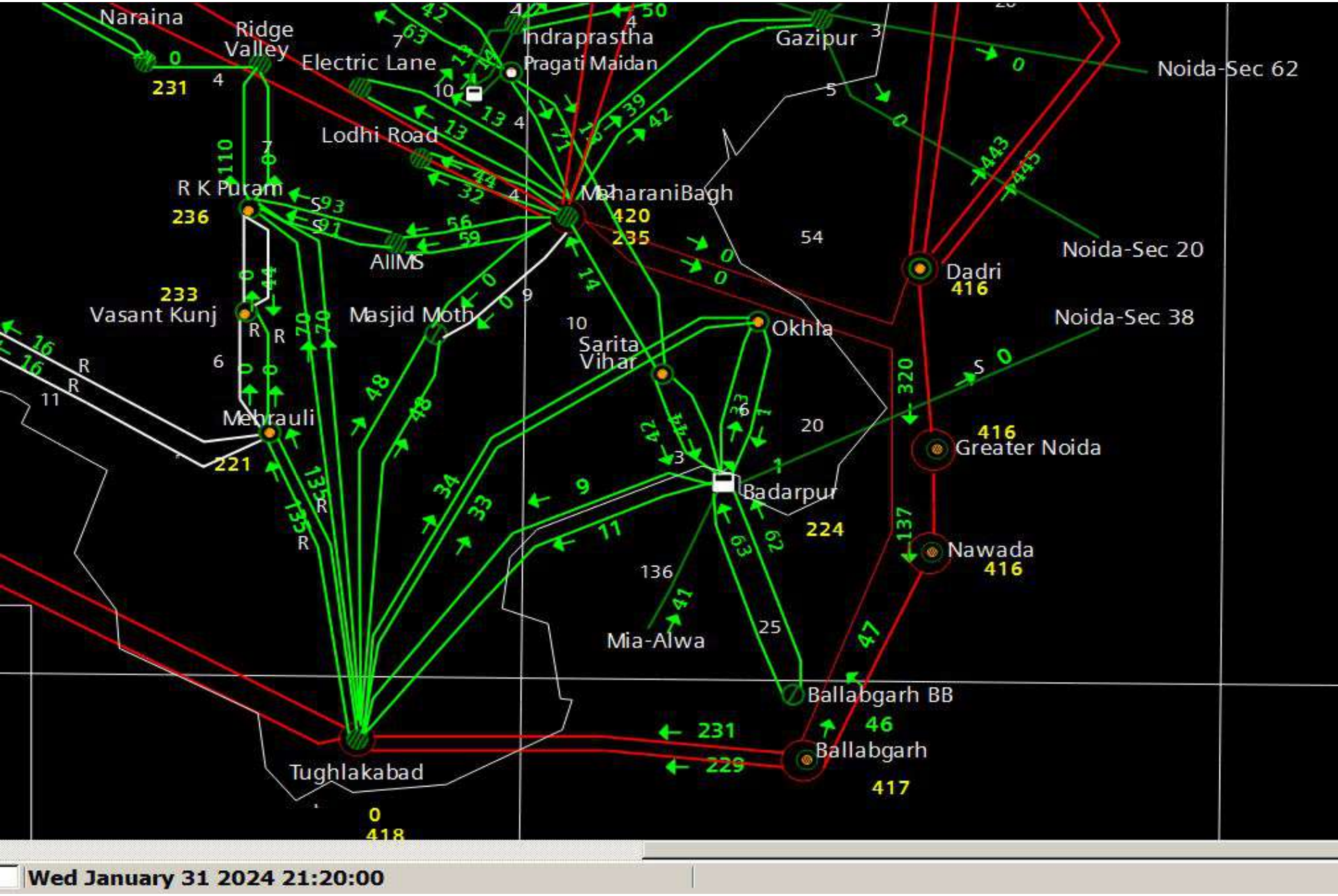
Brief of event:

- During antecedent condition, 220 KV Ballabhgarh(BB)-BTPS(DTL) (BB) Ckt-1 & 2 and 220 KV Tughlakabad(PG)-BTPS(DTL) Ckt-1 & 2 were catering the part load of 220kV Okhla and 220kV Sarita Vihar through 220 KV BTPS(DTL)-Okhla Ckt-1 & 2 and 220 KV BTPS(DTL)-Sarita Vihar Ckt-1 & 2. 220 KV BTPS(DTL)-Alwar Ckt and 220 KV BTPS(DTL)-Noida Sec 38 Ckt were on no-load. 220kV bus coupler at BTPS was in closed condition.
- As reported, **at 21:22 Hrs, 220 KV Ballabhgarh(BB)-BTPS(DTL) (BB) Ckt-1 tripped on Y-N phase to ground fault** with fault distance of 17.01 km and fault current of 4.2 kA from Ballabgarh end**; zone-1 distance protection operated at Ballabhgarh end and zone-4 distance protection operated at BTPS end.** On inspection, 220kV Bus-2 PT isolator Y-ph LA jumper was found broken at BTPS S/s.
- At the same time, all other 220kV ckts connected at BTPS(DTL) tripped on zone-4 distance protection operation at BTPS end (reason of non-operation of bus bar protection yet to be shared).
- Due to tripping of all 220kV ckts, both the 220kV buses became dead at BTPS(DTL) and blackout occurred at 220kV BTPS(DTL) S/s.
- As reported by SLDC-Delhi, the load of Okhla, Batra, Malviya Nagar, Shivalik, Sirifort, DC Saket, Select City mall, Sarita Vihar, Meethapur, Jamia, Sarai Julena, Jasola got affected.
- As per SCADA, change in demand of approx. 220MW is observed in Delhi control area out of which approx. 90MW is restored within 10 minutes. But as reported by SLDC Delhi, load loss of approx. 160MW is observed.
- As per PMU, **Y-N phase to ground fault** with **delayed fault clearing time of 160ms** is observed.
- Further as reported, at 21:29 hrs, load of Okhla was normalized through 220kV Tughlakabad-Okhla Ckt-1 & 2. At 21:45 hrs, load of 220kV Sarita Vihar was attempted to normalize through 220kV Maharanibagh-Sarita Vihar ckt at Sarita Vihar, but line could not hold and a blast occurred in 220kV Bus coupler CB at Sarita Vihar; R-ph pole was found damaged. Later at 23:20 hrs, load of 220kV Sarita Vihar was normalized through 220kV Maharanibagh-Sarita Vihar ckt.

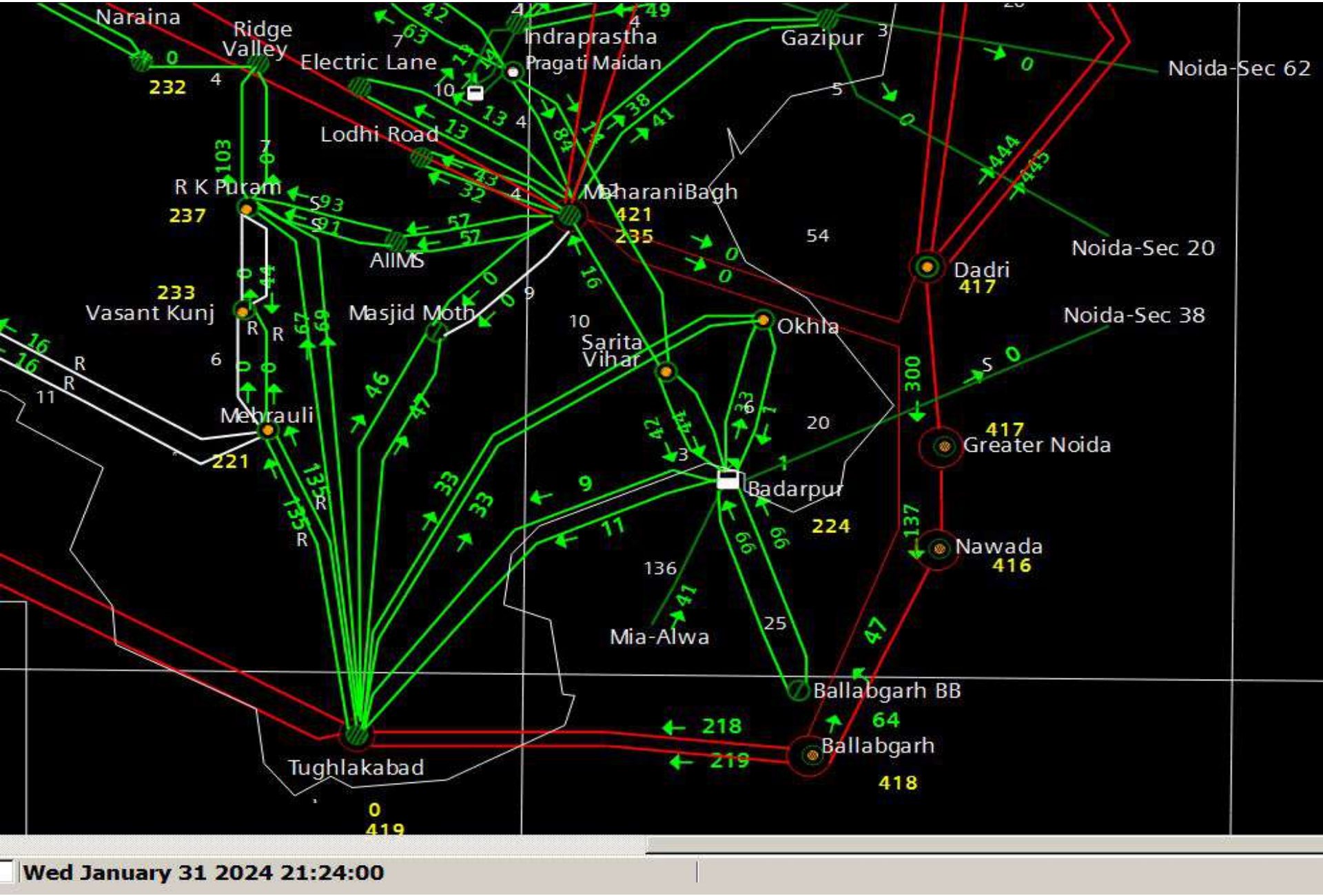
Elements tripped:

i. 220 KV Ballabhgarh(BB)-BTPS(DTL) (BB) Ckt-1
ii. 220 KV Ballabhgarh(BB)-BTPS(DTL) (BB) Ckt-2
iii. 220 KV Tughlakabad(PG)-BTPS(DTL) Ckt-1
iv. 220 KV Tughlakabad(PG)-BTPS(DTL) Ckt-2
v. 220 KV BTPS(DTL)-Okhla Ckt-1
vi. 220 KV BTPS(DTL)-Okhla Ckt-2
vii. 220 KV BTPS(DTL)-Sarita Vihar Ckt-1
viii. 220 KV BTPS(DTL)-Sarita Vihar Ckt-2
ix. 220 KV BTPS(DTL)-Alwar Ckt
x. 220 KV BTPS(DTL)-Noida Sec 38 Ckt

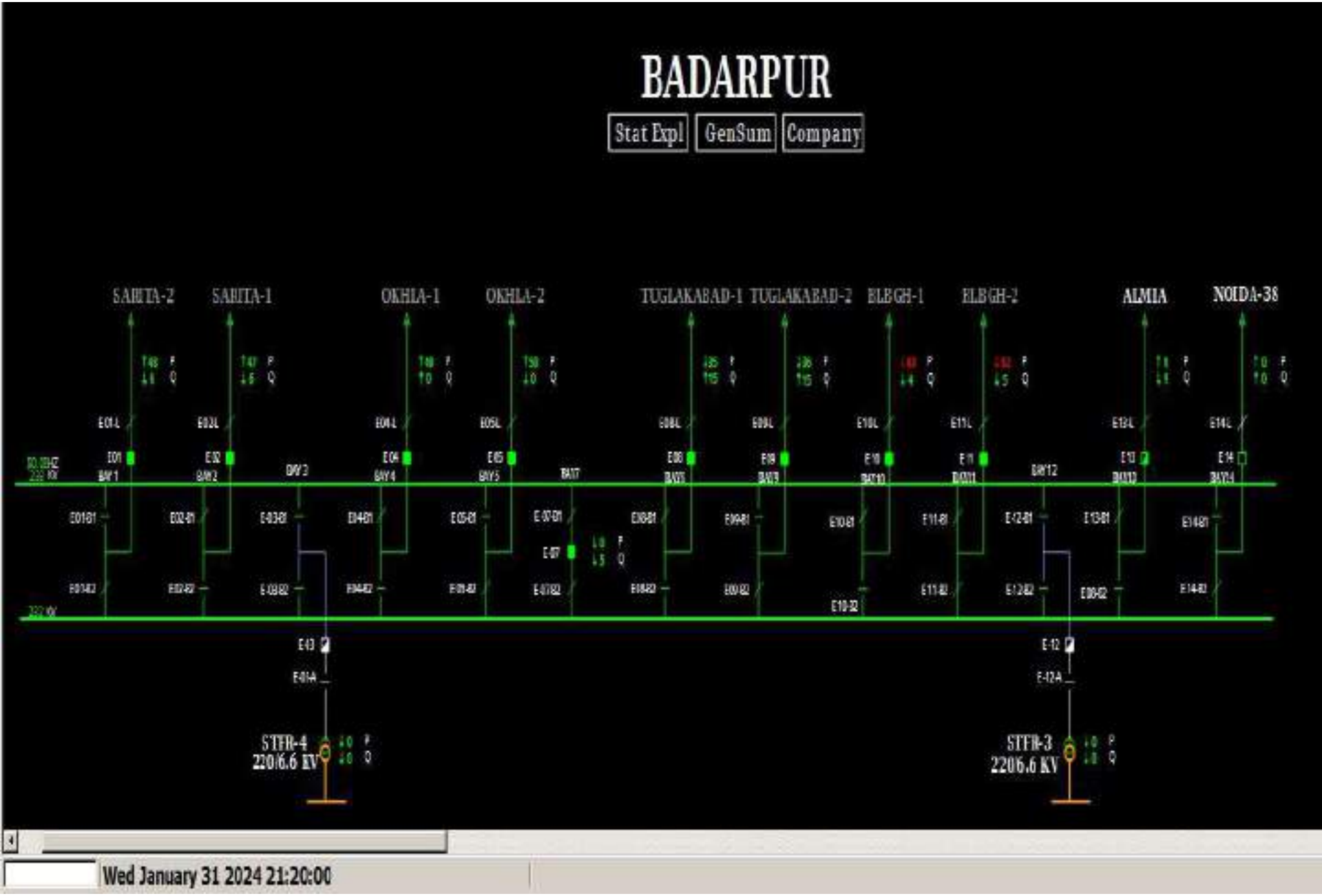
Network Diagram before the event



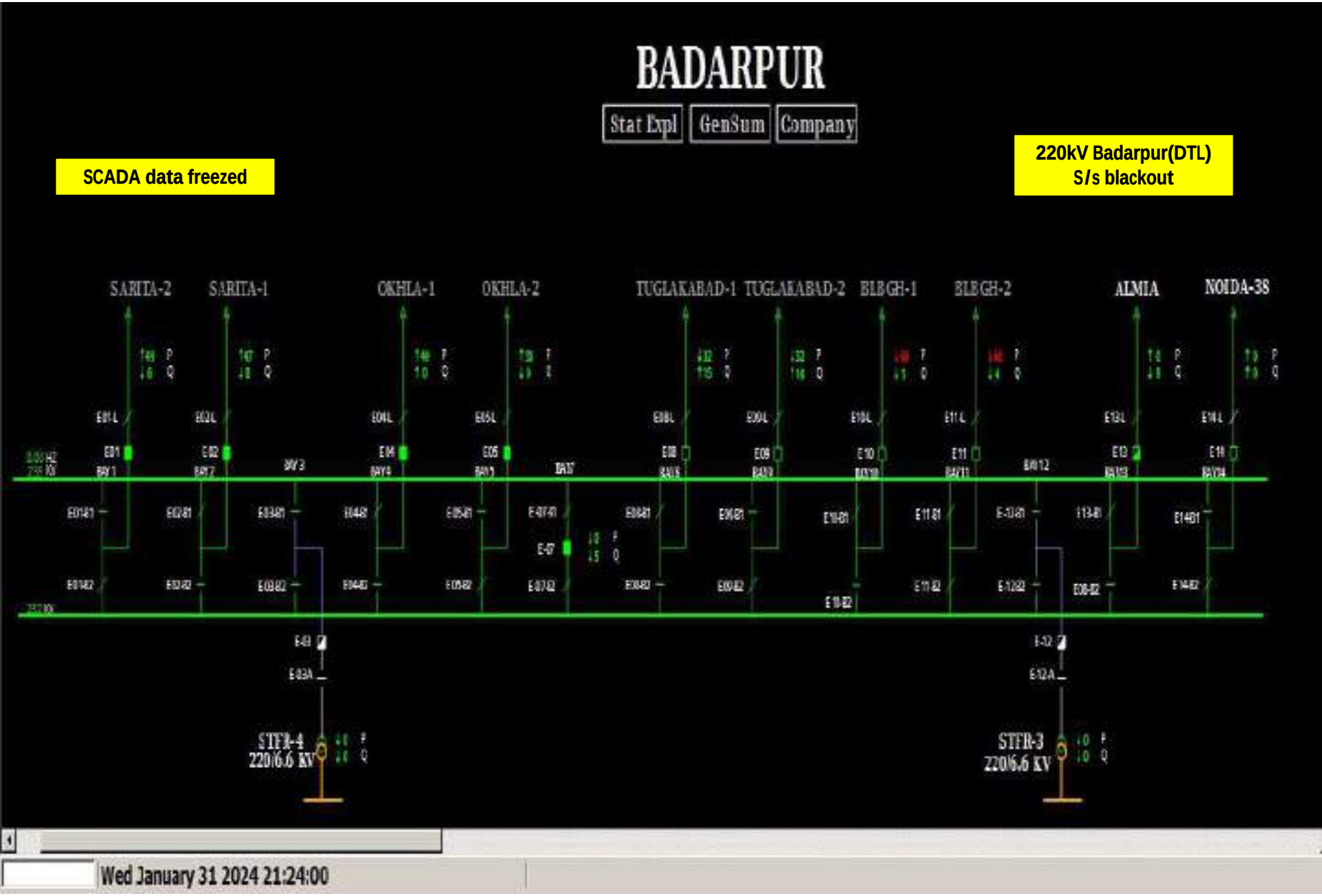
Network Diagram after the event



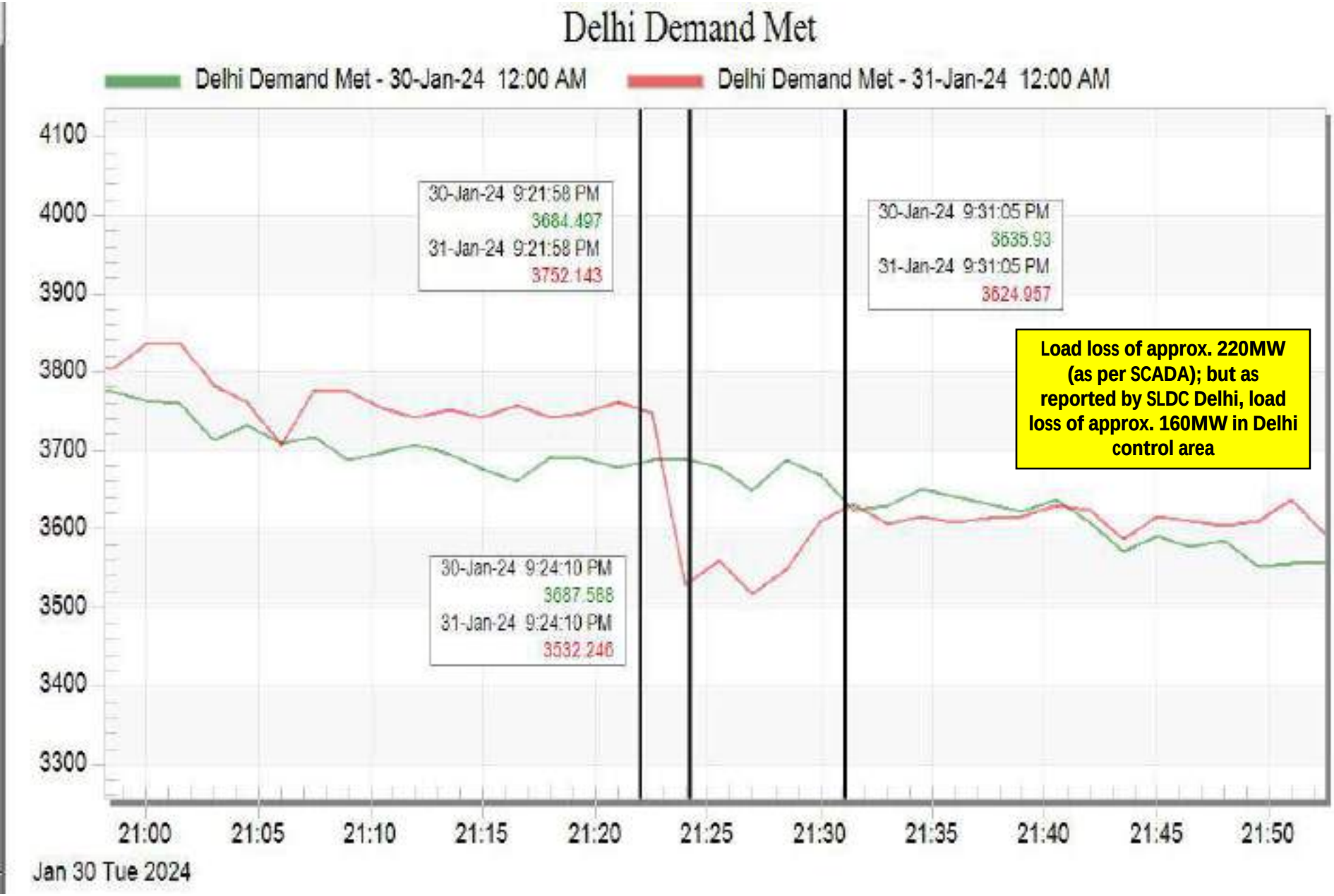
SLD of 220kV Badarpur(DTL) before the event



SLD of 220kV Badarpur(DTL) after the event



Delhi demand during the event



PMU Plot of frequency at Ballabgarh(PG)

21:22hrs/31-Jan-24

PMU Plot of phase voltage magnitude at Ballabgarh(PG)

21:22hrs/31-Jan-24

DR of 220 KV Ballabhgarh(BB) (end)-BTPS(DTL) (BB) Ckt-1

Disturbance Short Report

Disturbance Recordings Information

Device Information

Recorder ID	1
IED type	REL650 1.1.0.3
IED version	1.1.0
Station name	Station name
Object name	REL650-A01
IED name	Unit name

Fault Information

Trig date and time	31-01-2024 21:52:39.340
Trigger signal name	START_Z3
Recording number	399
Total recording time	2355 ms
Pre-trig recording time	300 ms
Post trig recording time	2000 ms
Max. recording time	5000 ms

General Recordings Information

Disturbance recorder	Installed
Event recorder	Installed
System frequency	50 Hz
Sampling frequency	1 kHz
Active setting group during recording	1

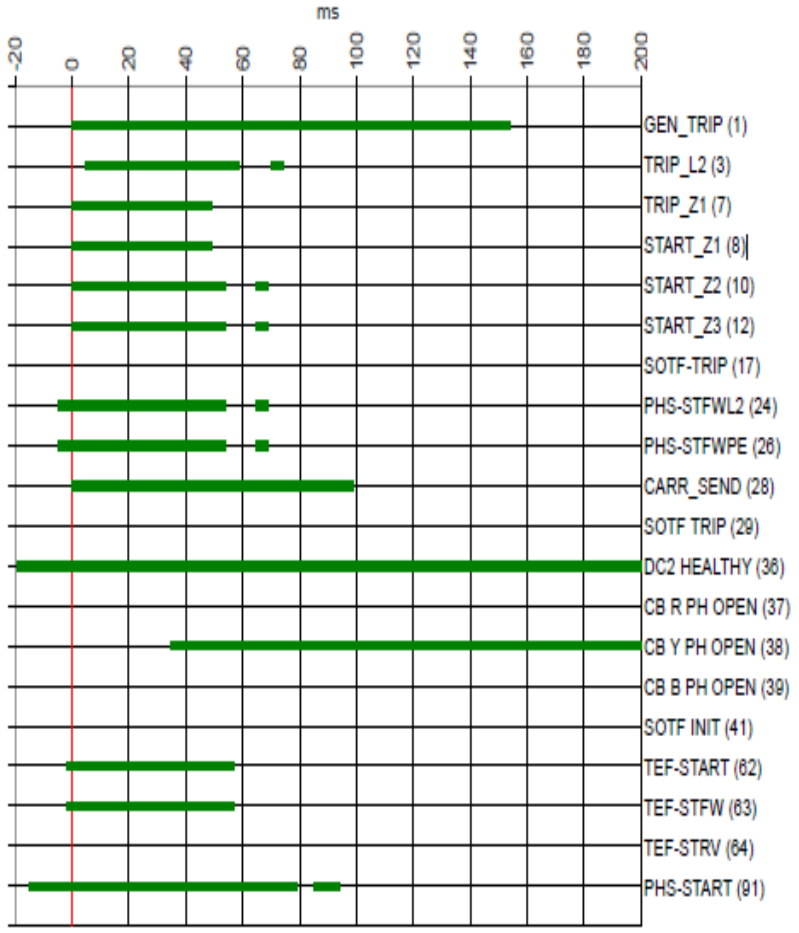
Fault Location Information

Fault loop type	L2-N
Fault location	16.8 (67.9 %)
Status of fault calculation	Ok
Fault direction	Forward

Pag

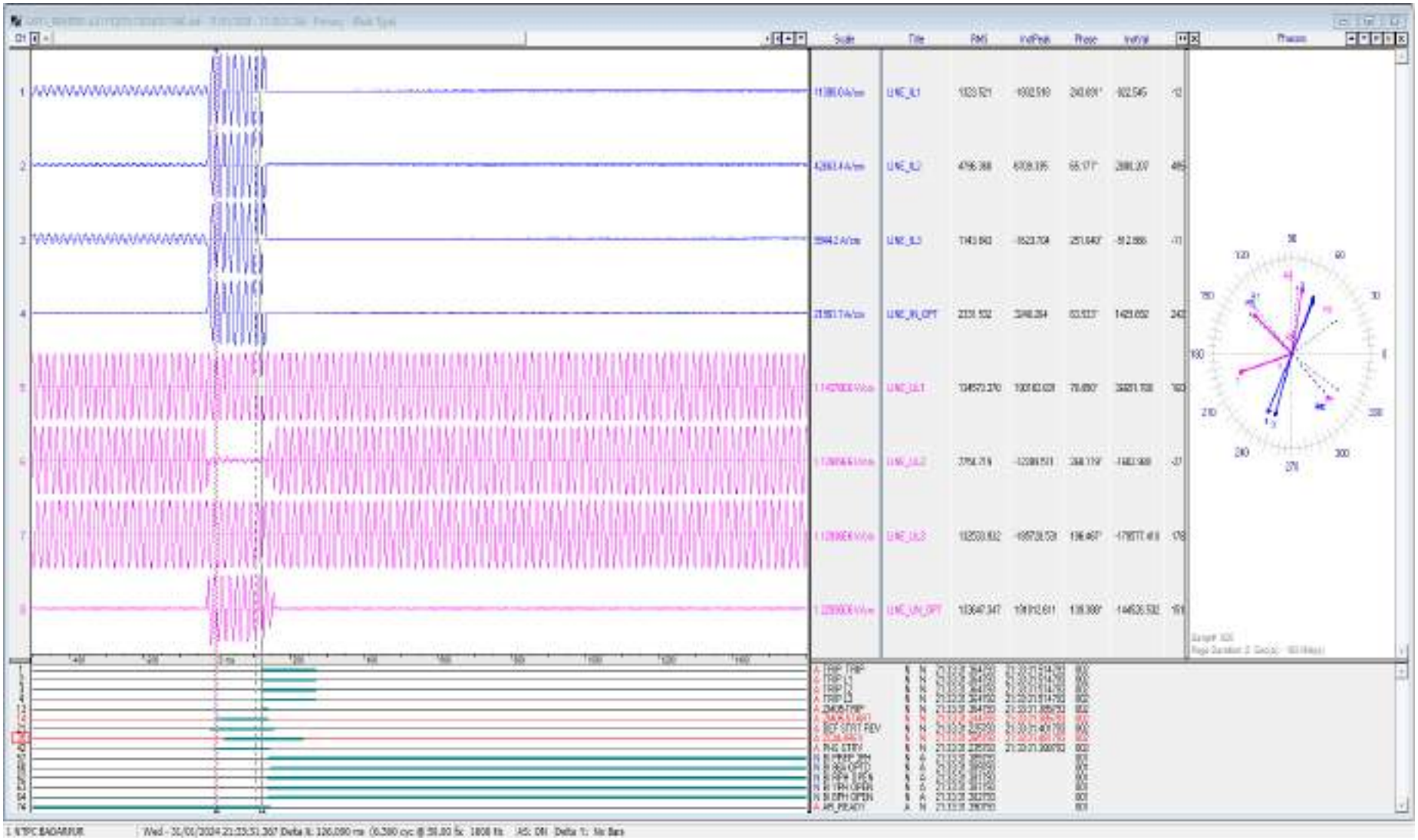
Binary Time Diagram

Trig Date Time: 31-01-2024 21:52:39.340



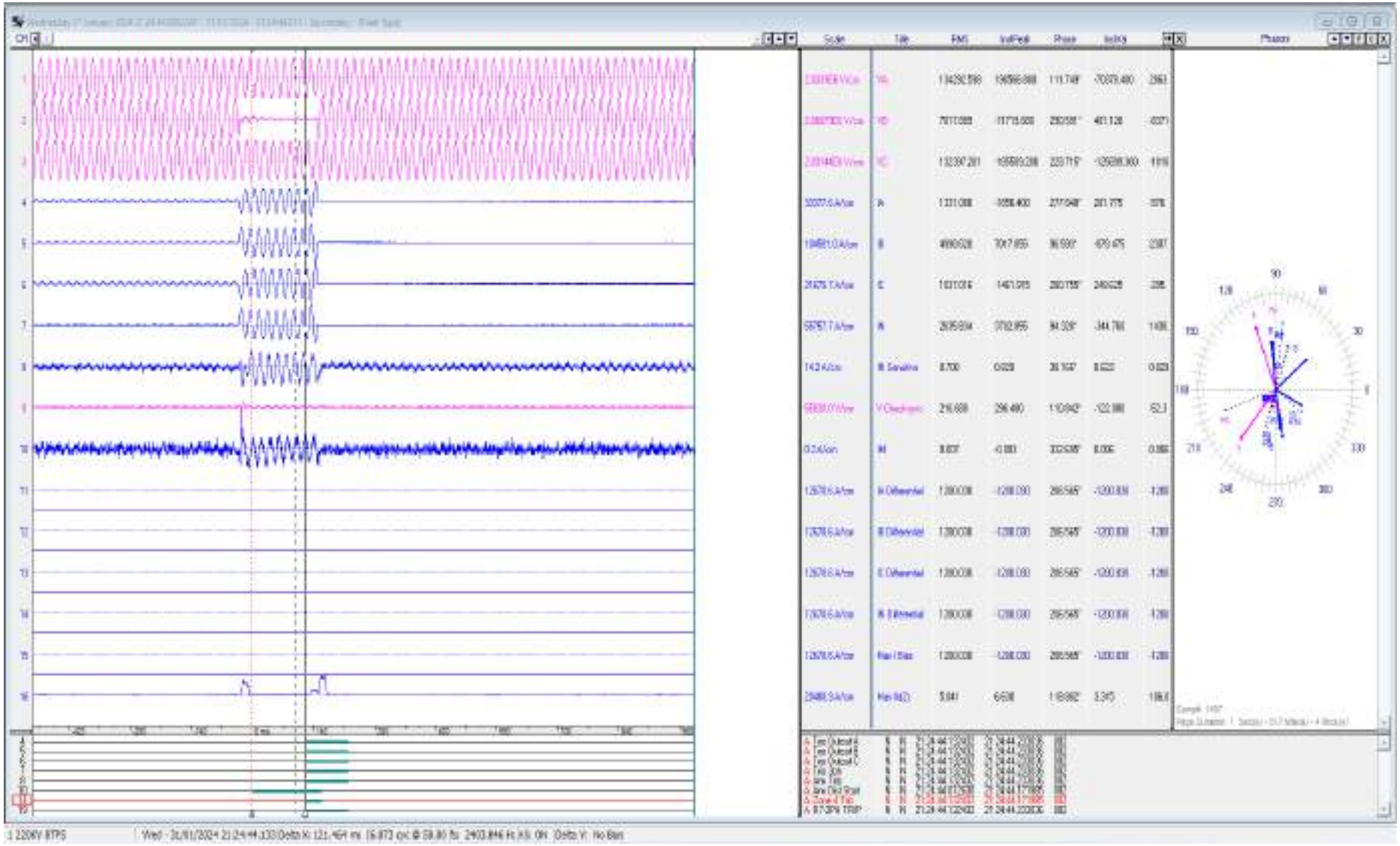
As per DR, Ballabhgarh end sensed Y-N fault in Z-1, distance ~17km (68%)

DR of 220 KV Ballabhgarh(BB)-BTPS(DTL) (end) (BB) Ckt-1



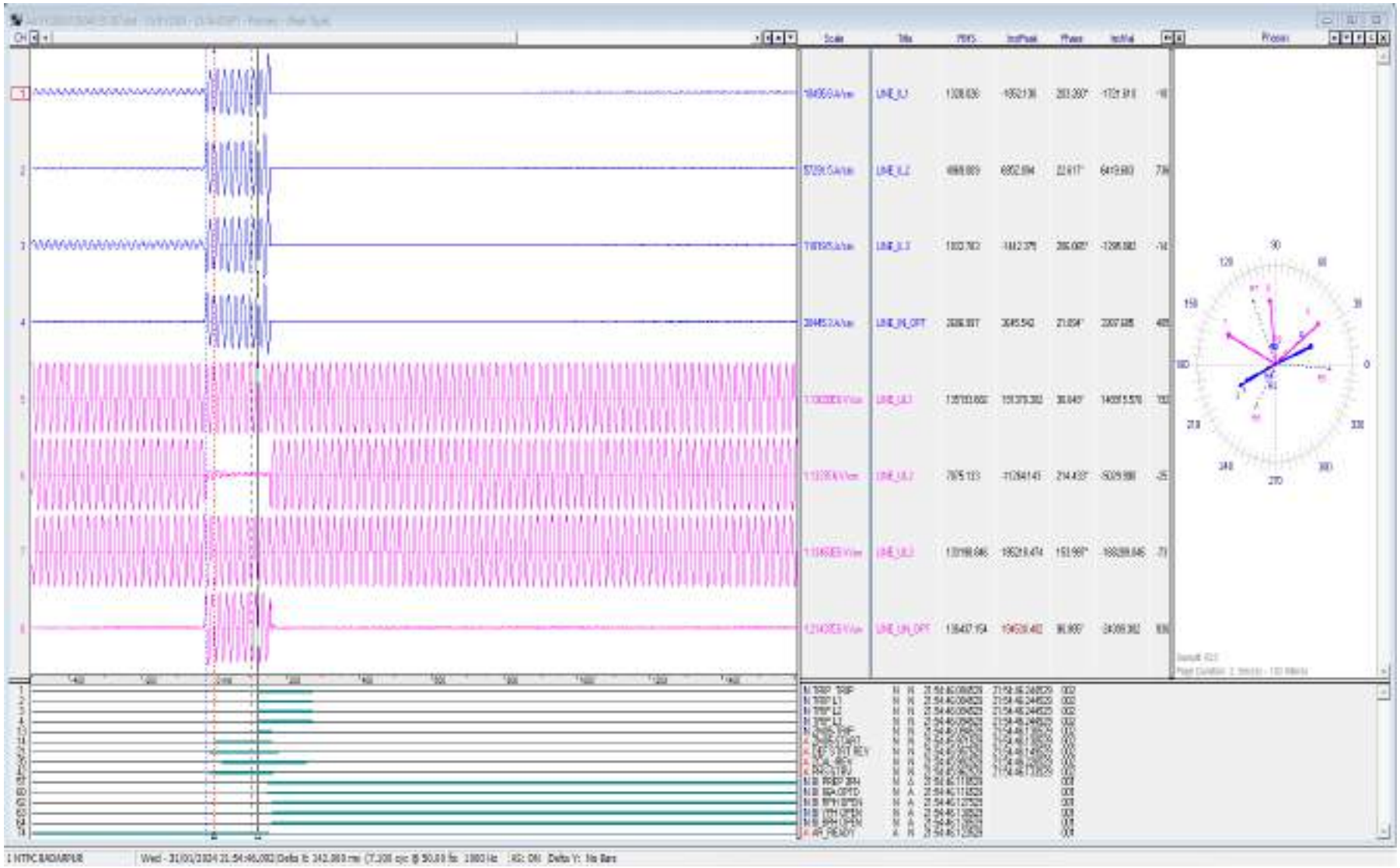
As per DR, Badarpur end sensed Y-N fault in Z-4, and initiated tripping in 125msec

DR of 220 KV Ballabhgarh(BB)-BTPS(DTL) (end) (BB) Ckt-2



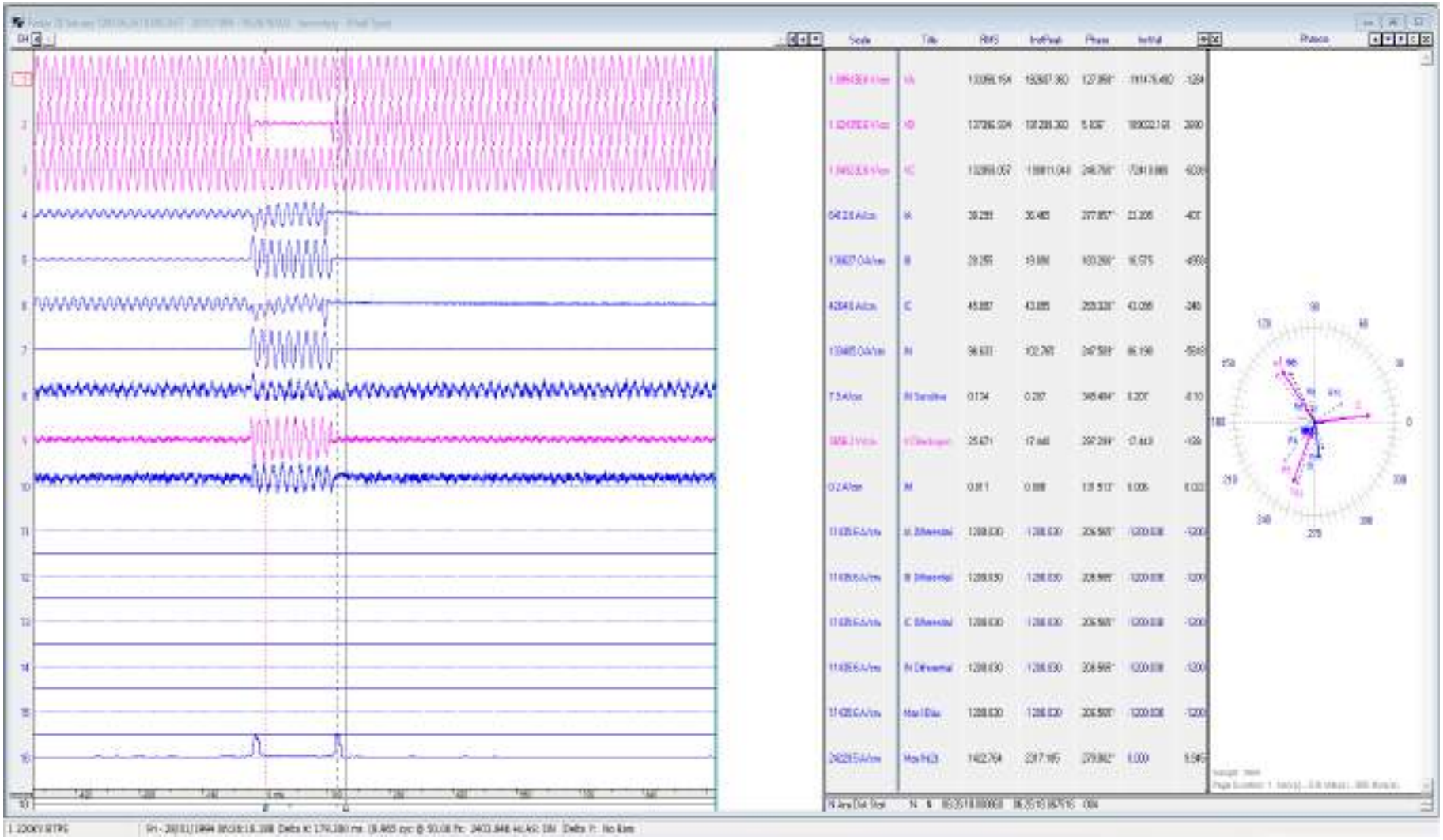
As per DR, Badarpur end sensed Y-N fault in Z-4, and initiated tripping in 120msec

DR of 220 KV Ballabhgarh(BB)-BTPS(DTL) (end) (BB) Ckt-2



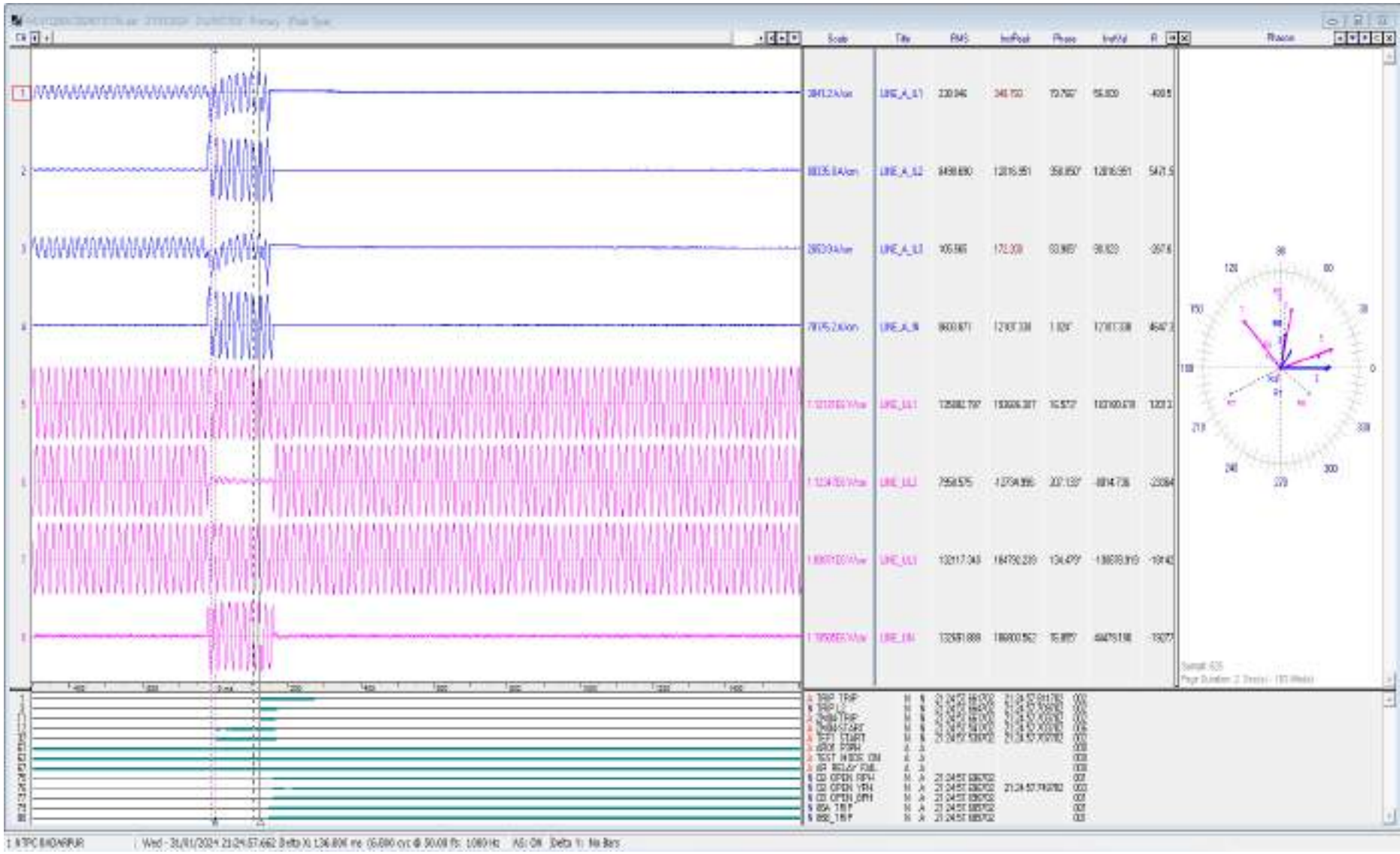
As per DR, Badarpur end sensed Y-N fault in Z-4, and initiated tripping in 140msec; Time not synced

DR of 220 KV BTPS(end)-Tughlakabad ckt-1



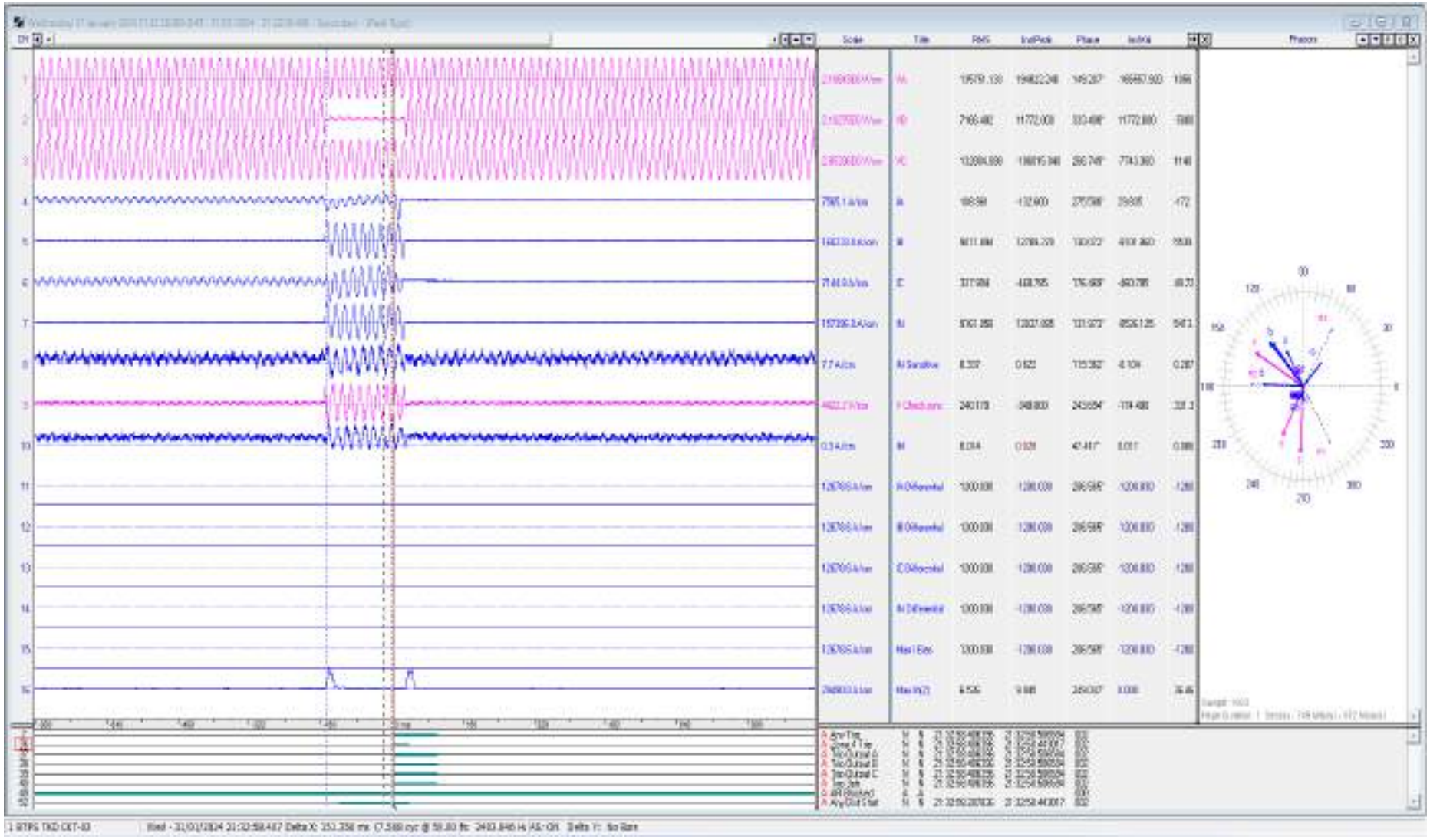
As per DR, Y-N fault, no flag observed. ***Time not synced***

DR of 220 KV BTPS(end)-Tughlakabad ckt-1



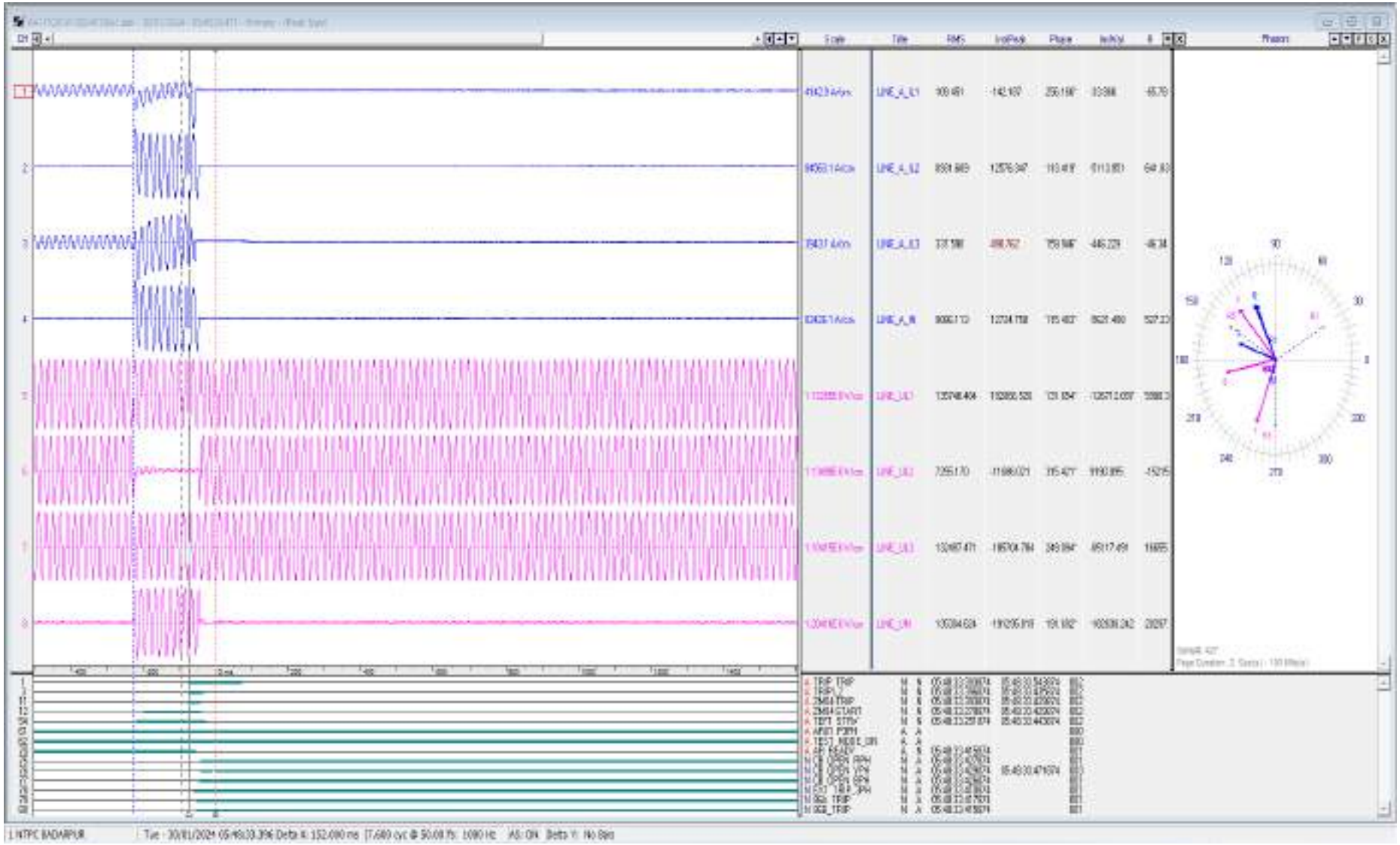
As per DR, Badarpur end sensed Y-N fault in Z-4, and initiated tripping in 135msec; Time not synced

DR of 220 KV BTPS(end)-Tughlakabad ckt-2



As per DR, Badarpur end sensed Y-N fault in Z-4, and initiated tripping in 150msec; Time not synced

DR of 220 KV BTPS(end)-Tughlakabad ckt-2



As per DR, Badarpur end sensed Y-N fault in Z-4, and initiated tripping in 150msec; Time not synced

SCADA SOE

Time	Station Name	Voltage	Element Name	Element Type	Element Status	Remarks
21:25:02,714	OKHLA_DV	220kV	10BADAR2	Circuit Breaker	Open	Line CB at Okhla end of 220 KV Okhla - Badarpur Ckt-1 opened
21:25:08,806	OKHLA_DV	220kV	09BADAR1	Circuit Breaker	Open	Line CB at Okhla end of 220 KV Okhla - Badarpur Ckt-2 opened
21:25:57,678	OKHLA_DV	66kV	01T1	Circuit Breaker	Open	CB at 66kV side of 220/66kV ICT-1 at Okhla opened
21:26:02,586	OKHLA_DV	66kV	02T2	Circuit Breaker	Open	CB at 66kV side of 220/66kV ICT-2 at Okhla opened

Point of discussion

- As reported, fault was of bus fault nature. Why did bus bar protection didn't operate?
- Z-4 time delay setting in lines at Badarpur end?
- Why did 220kv Ballabhgarh-Badarpur ckt-1 trip from Ballabhgarh end in Z-1? Z-1 overreached is suspected. Reason of the same and detail of remedial action taken is any?
- SCADA data of 220kV BTPS(DTL) was freezed during the event. Healthiness of the SCADA data need to be ensured.
- DR/EL of all the tripped elements along with tripping report of the event need to be shared.
- Tripping status of all the tripped elements are not coming in SCADA SOE.
- Detailed report along with remedial action taken details not received.
- Standardization (nomenclature, time sync etc) of recording instrument (DR/EL) need to be ensured.

Multiple elements tripping at 220kV DCRTPP Yamuna Nagar(HR) 8th February 2024

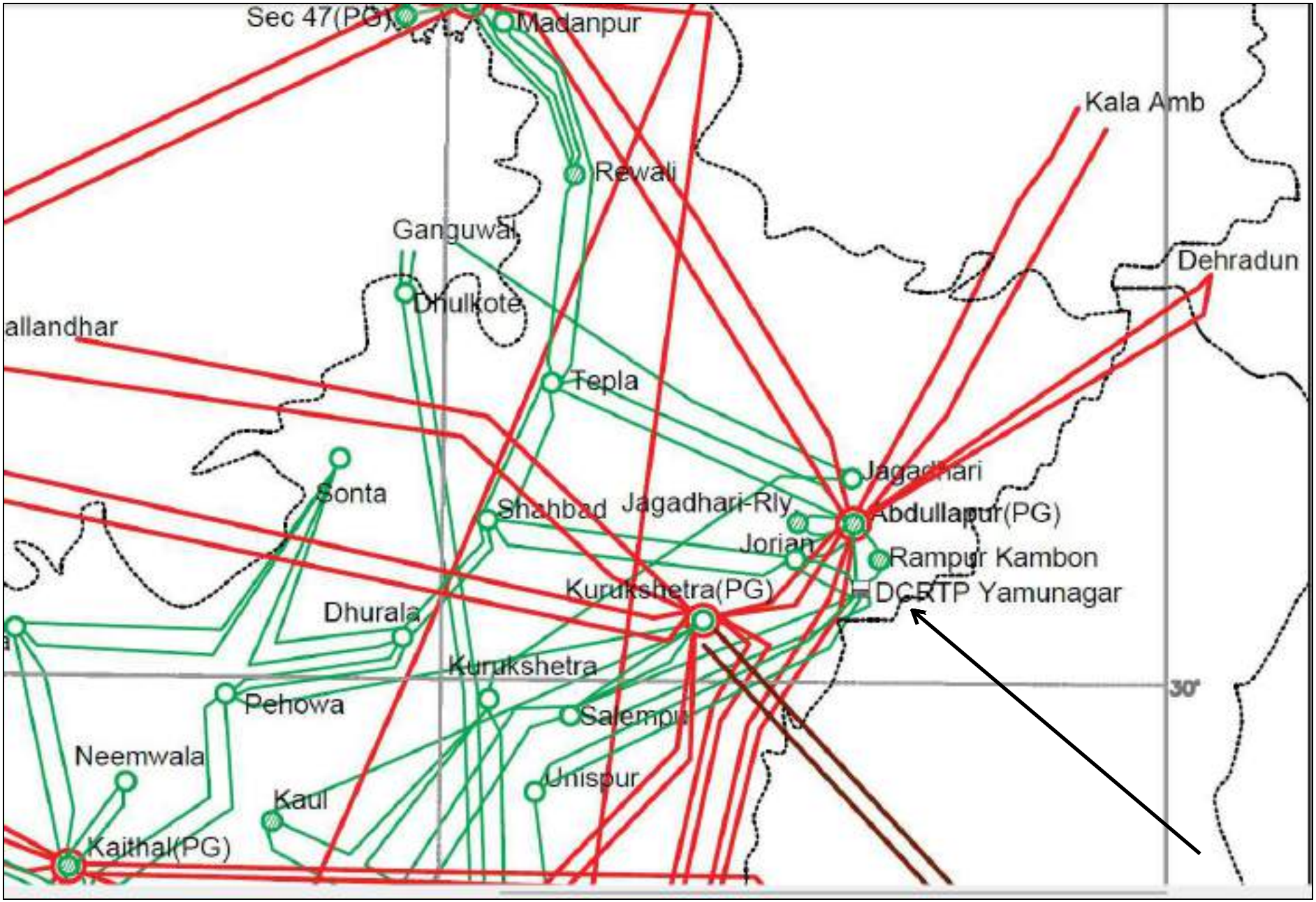
Brief of event:

- During antecedent condition, 220kV DCRTPP-Rampur Ckt-1 was under construction (LILO in place of DCRTPP-Abdullapur Ckt) and 220kV DCRTPP-Rampur Ckt-2 was under shutdown. 220kV DCRTPP(HR)-Joria(HR) ckt -1 & 2, 220kV DCRTPP(HR)-Bakana(HR) ckt -1 & 2 and 220kV DCRTPP(HR)-Unispur(HR) ckt -1 & 2 were carrying approx. 189MW, 183MW, 47MW, 56MW, 30MW and 31MW respectively.
- As reported, at **16:12hrs, 220kV DCRTPP(HR)-Joria(HR) ckt -2 tripped due to snapping of R-ph jumper at tower location no. 8. Simultaneously, 220kV DCRTPP(HR)-Joria(HR) ckt -1 tripped on over-loading.**
- After this, load shifted to remaining four ckts. 220kV DCRTPP(HR)-Bakana(HR) ckt -1 & 2 and 220kV DCRTPP(HR)-Unispur(HR) ckt -1 & 2 were carrying approx. 192MW, 202MW, 74MW and 74MW respectively. Power was flowing from 220kV DCRTPP(HR) to Bakana(HR) (through 220kV DCRTPP(HR)-Bakana(HR) D/C) to Salempur(HR) (through 220kV Bakana(HR)-Salempur(HR) D/C) and 220kV DCRTPP(HR) to Unispur(HR) (through 220kV DCRTPP(HR)-Unispur(HR) D/C) to Karnal(HR) (through 220kV Unispur(HR)-Karnal(HR) S/C).
- As further reported**, at 16:22hrs, 220kV Karnal(HR)-Unispur(HR) ckt (carrying ~123MW) tripped on transient fault (exact nature and location of fault yet to be shared).**
- After this, 220kV DCRTPP(HR)-Bakana(HR) ckt -1 & 2 and 220kV Bakana(HR)-Salempur(HR) ckt -1 & 2 were carrying approx. 253MW, 263MW, 239MW and 233MW respectively.
- During the same time, **220kV Salempur(HR)-Bakana(HR) ckt-2 also tripped due to breaking of Y-ph conductor at tower location no. 83.**
- Due to this tripping, **DCRTPP(HR)-Bakana(HR) ckt -1 & 2, 220kV Bakana(HR)-Salempur(HR) ckt -1 and 220kV DCRTPP(HR)-Unispur(HR) ckt -1 & 2 tripped on over-loading**. Complete blackout occurred at 220KV Bakana(HR) and Unispur(HR) S/s.
- Due to tripping of all the evacuating lines at DCRTPP, 300 MW DCRTPPP (Yamuna Nagar) - UNIT 1 & 2 also tripped and complete blackout occurred at 220KV DCRTPP(HR) S/s.
- As per PMU at Abdullapur(PG), **R-Y phase to phase fault** is observed with fault clearing time of 80ms.
- As per SCADA, load loss of approx. 160 MW in Haryana control area and generation loss of approx. 547 MW at 220KV DCRTPP Yamunanagar(HR) are observed.
- Supply at 220kV DCRTPP(HR) and Unispur(HR) was restored within 23 minutes and Supply at Bakana(HR) was restored within 30 minutes.

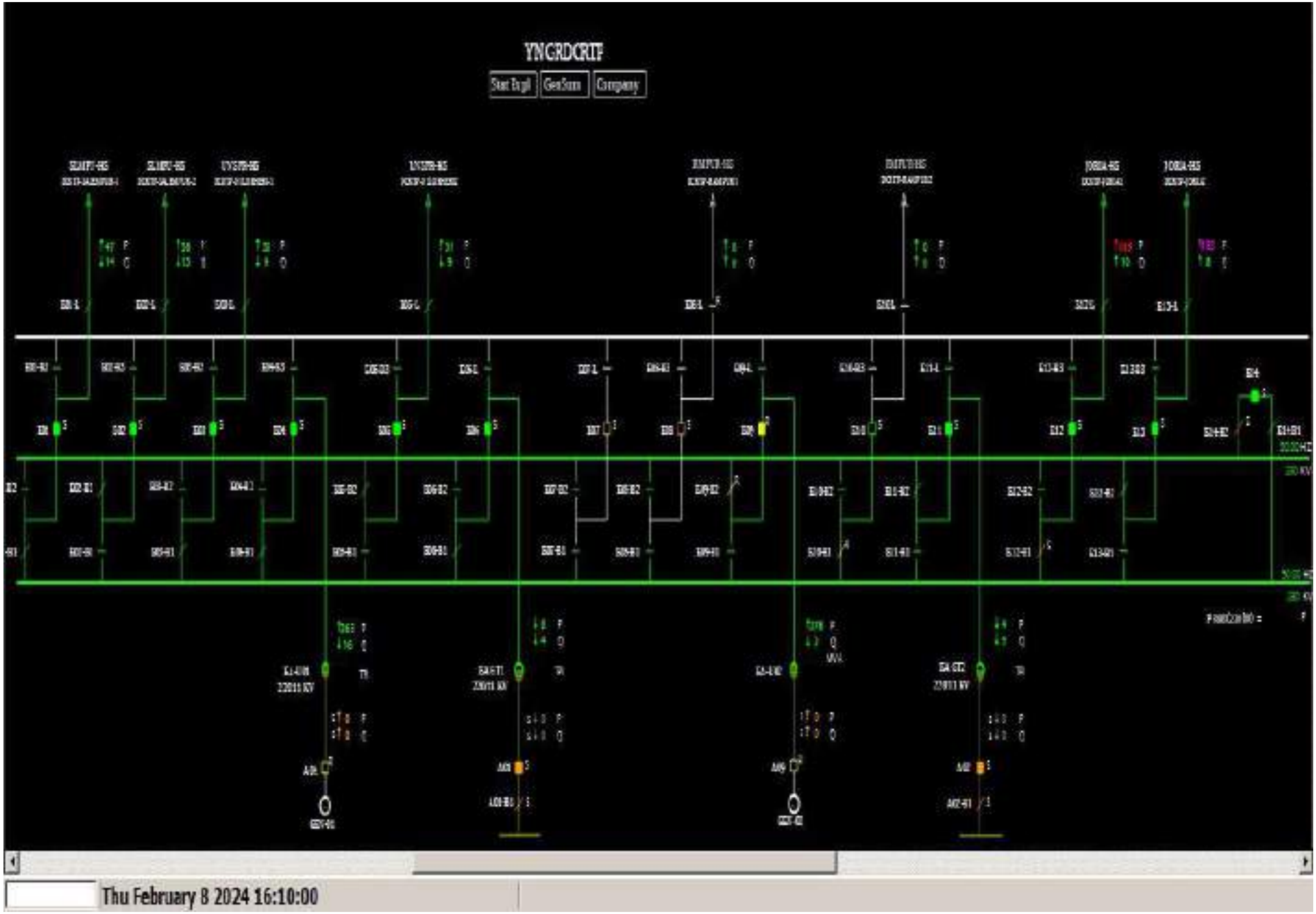
Elements tripped:

i. 220kV DCRTPP(HR)-Joria(HR) ckt -2
ii. 220kV DCRTPP(HR)-Joria(HR) ckt -1
iii. 220kV Karnal(HR)-Unispur(HR) ckt
iv. 220kV Salempur(HR)-Bakana(HR) ckt-2
v. 220kV DCRTPP(HR)-Unispur(HR) ckt -1
vi. 220kV DCRTPP(HR)-Unispur(HR) ckt -2
vii. 220kV Salempur(HR)- Bakana(HR) ckt-1
viii. 220kV DCRTPP(HR) – Bakana(HR) ckt -1
ix. 220kV DCRTPP(HR) – Bakana(HR) ckt-2
x. 300 MW DCRTPPP (Yamuna Nagar) - UNIT 1
xi. 300 MW DCRTPPP (Yamuna Nagar) - UNIT 2

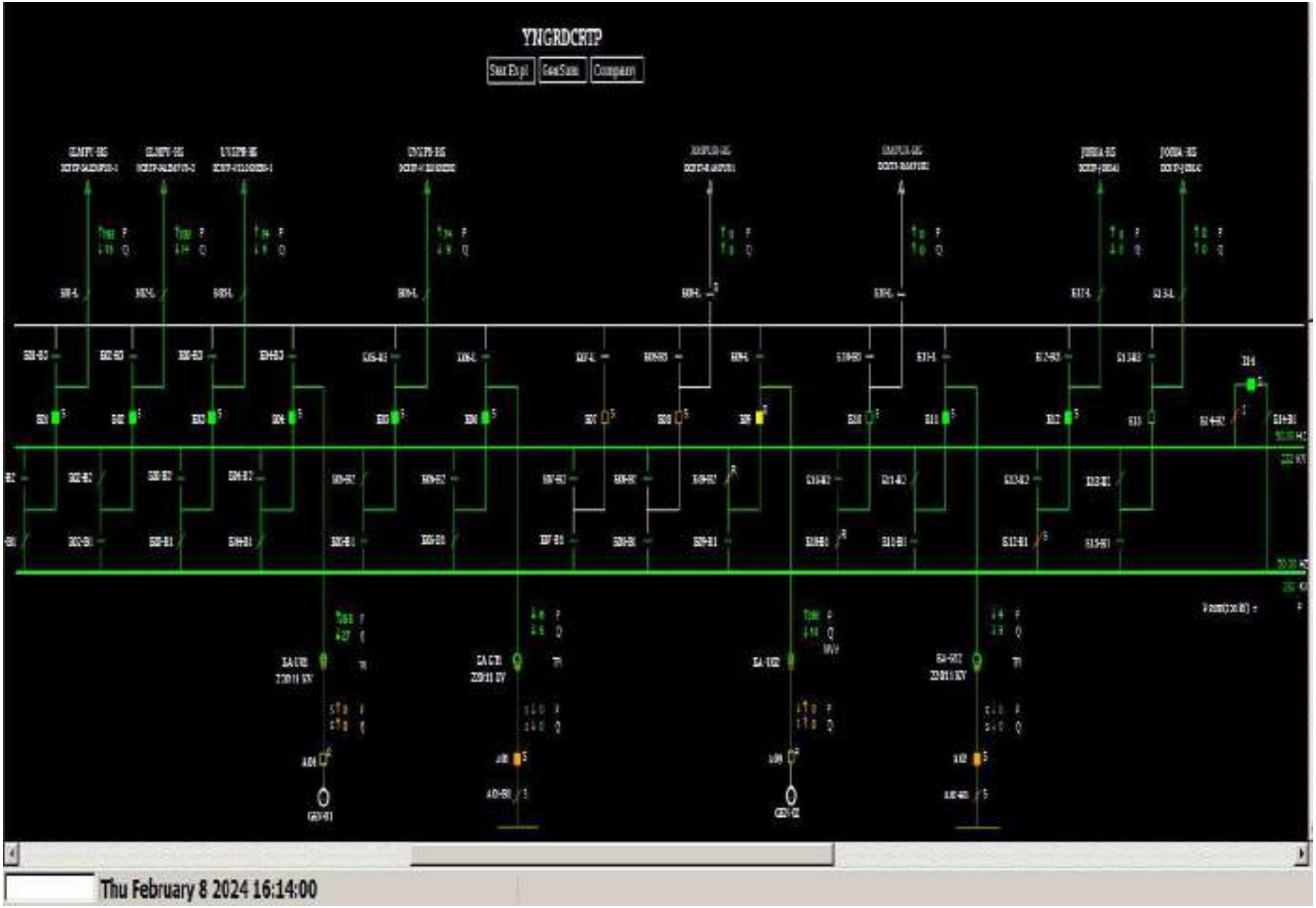
Network Diagram



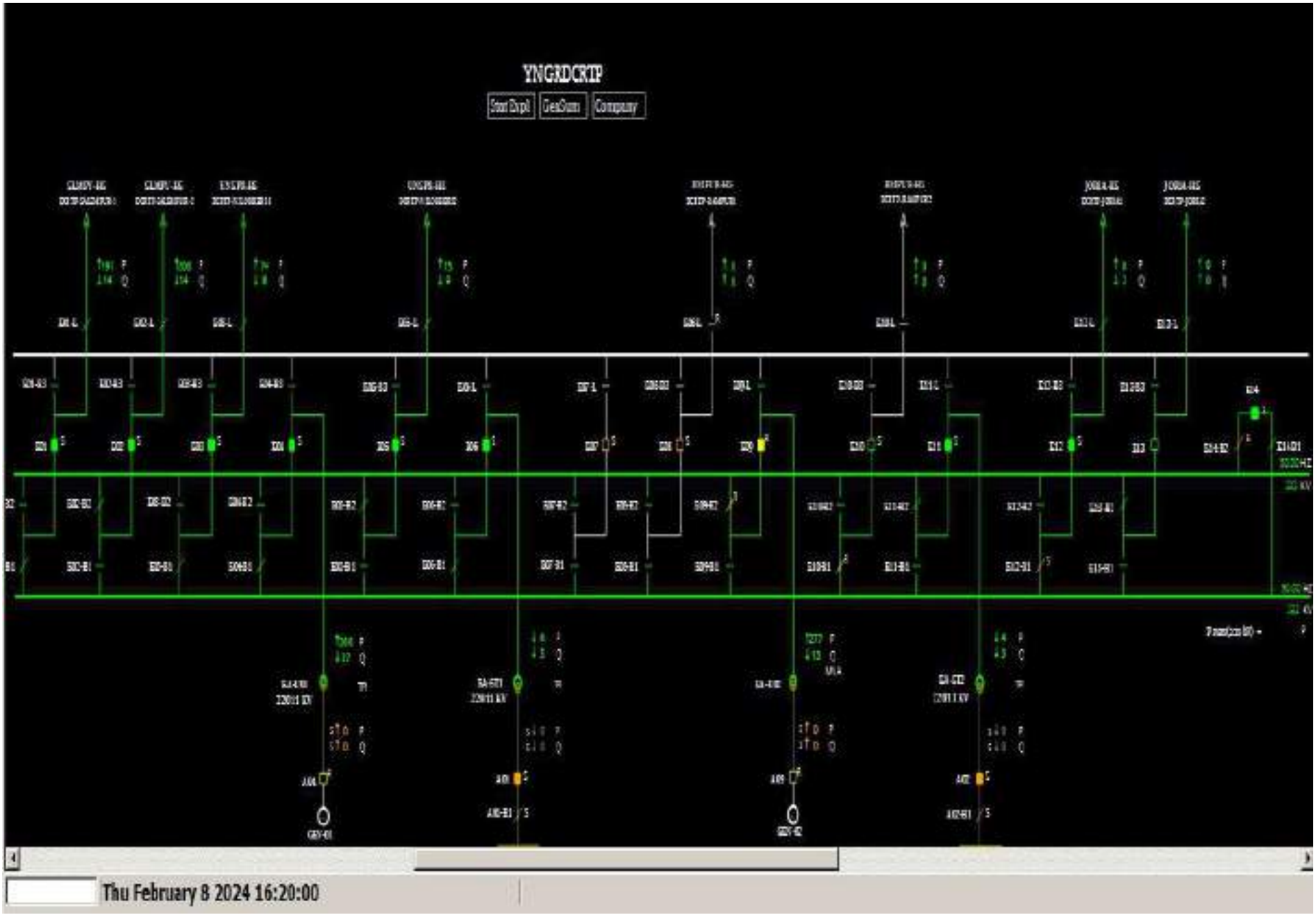
SLD of 220 kV DCRTP Yamuna Nagar(HR) @16:10hrs



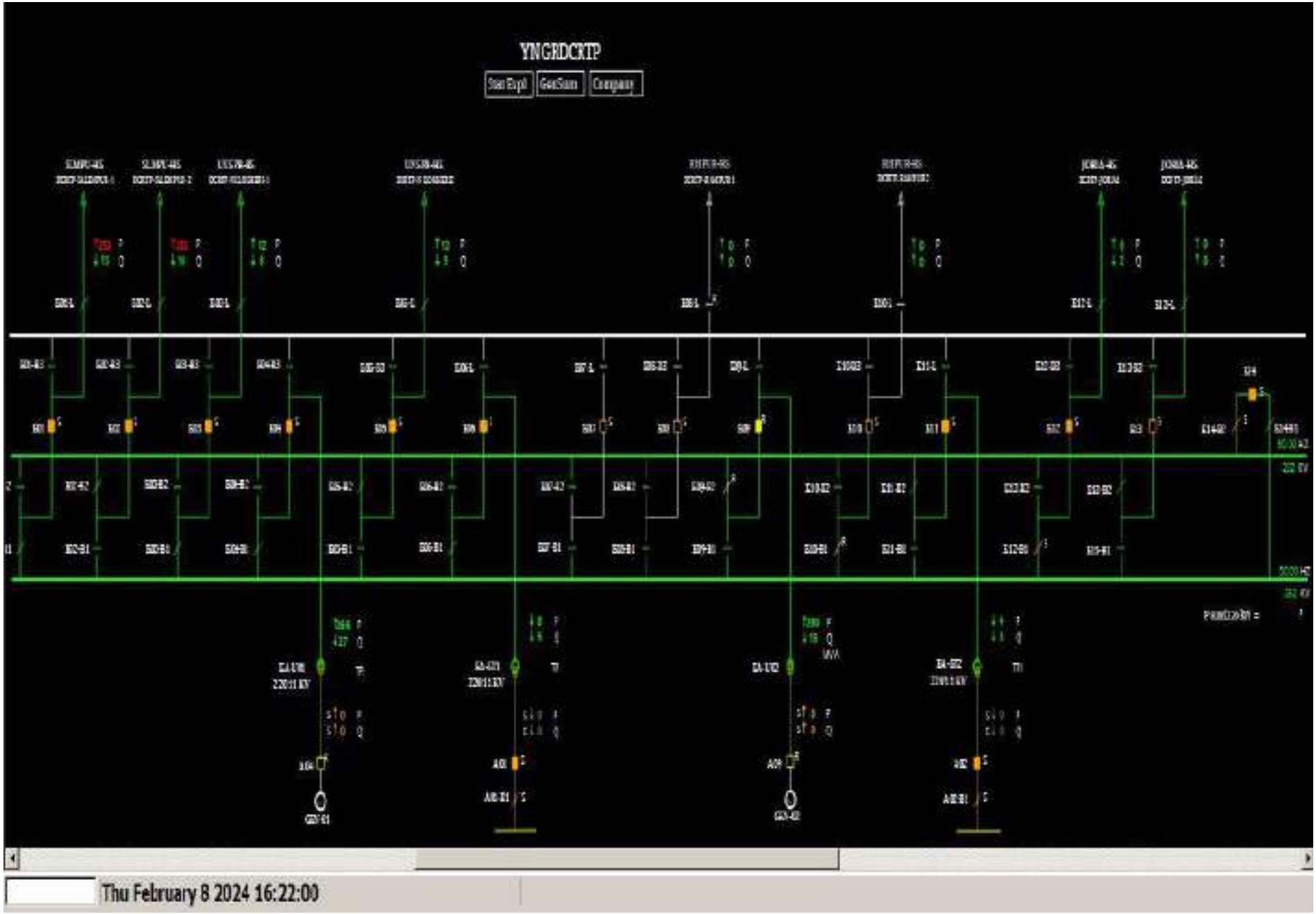
SLD of 220 kV DCRTP Yamuna Nagar(HR) @16:14hrs



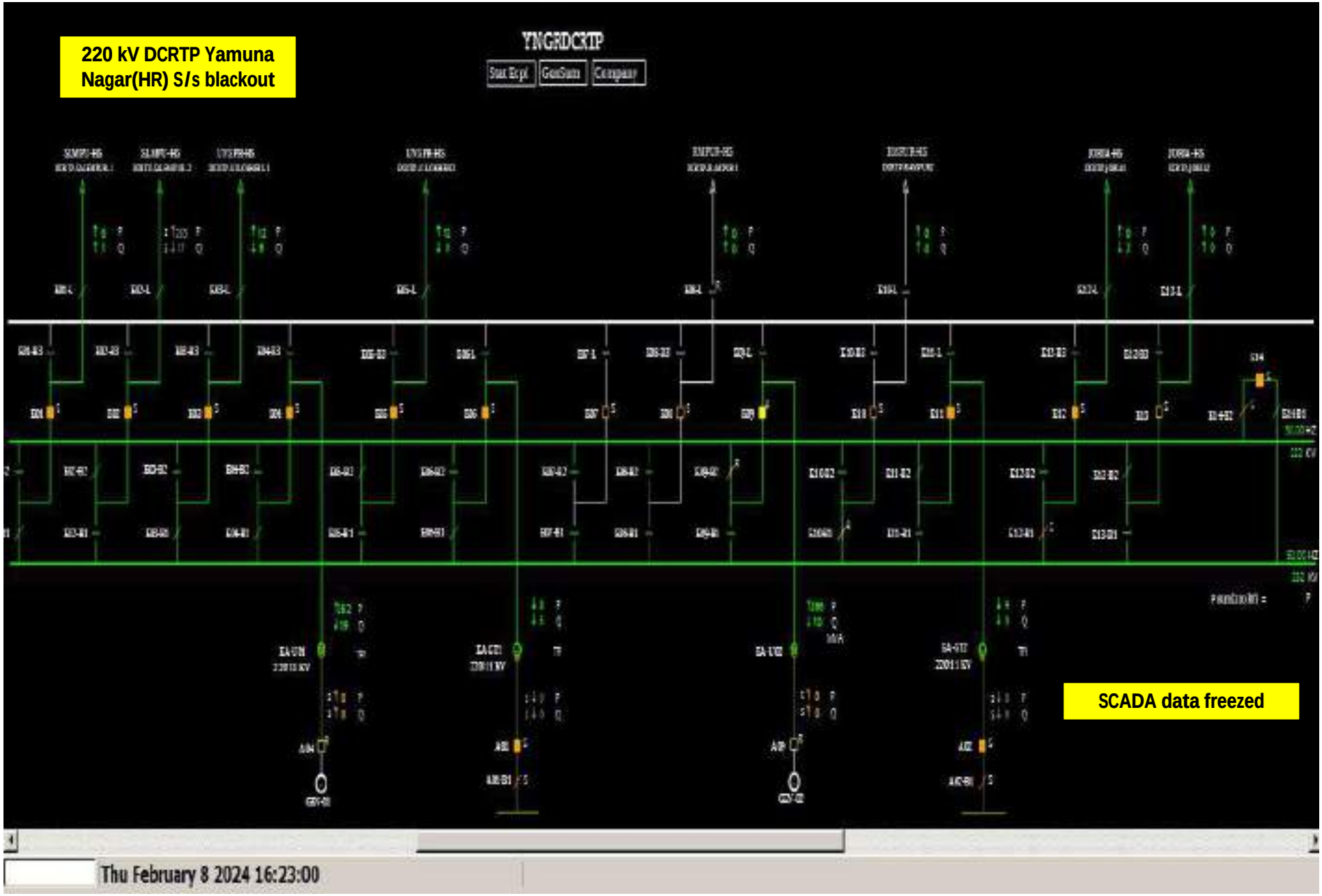
SLD of 220 kV DCRTP Yamuna Nagar(HR) @16:20hrs



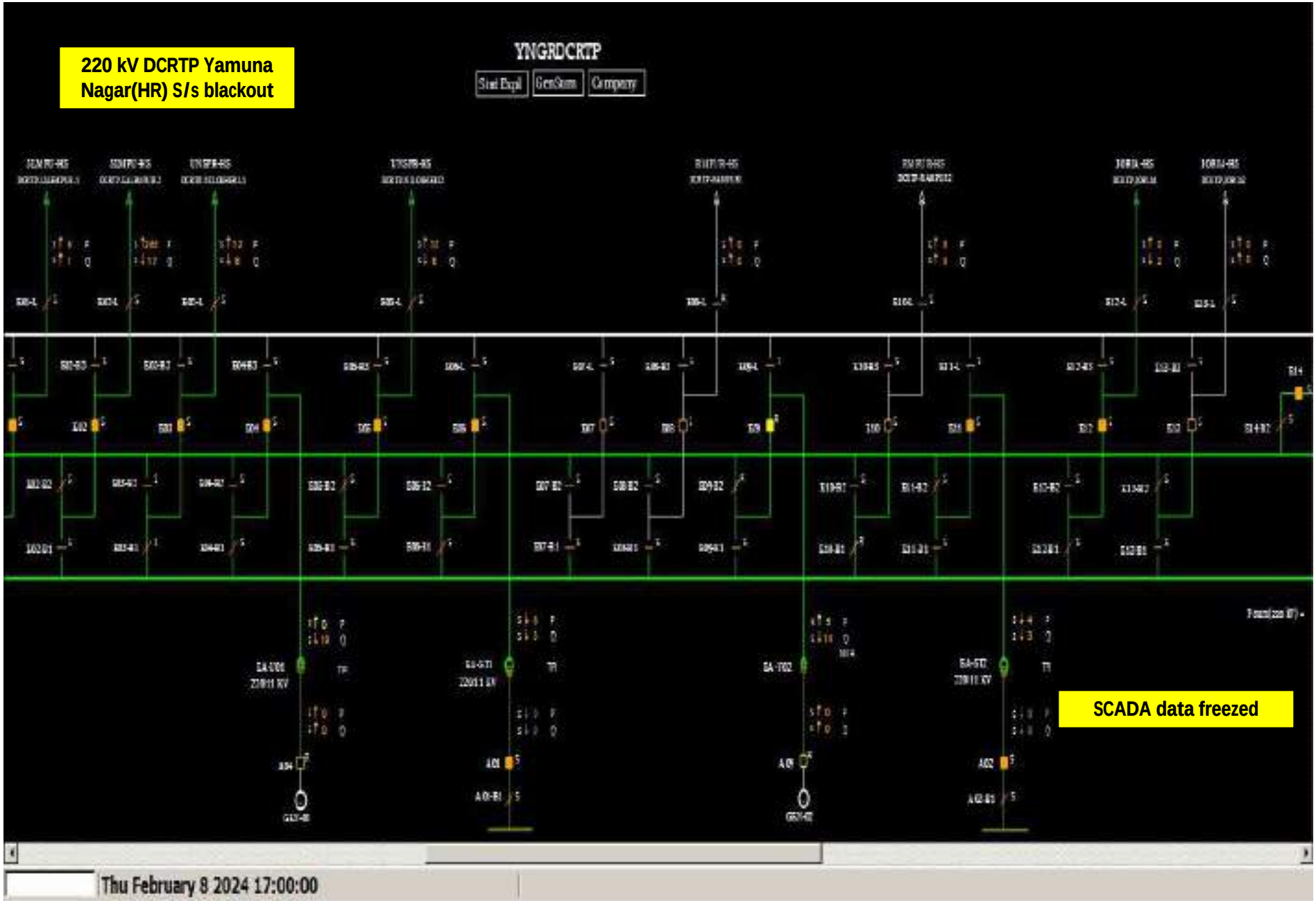
SLD of 220 kV DCRTP Yamuna Nagar(HR) @16:22hrs



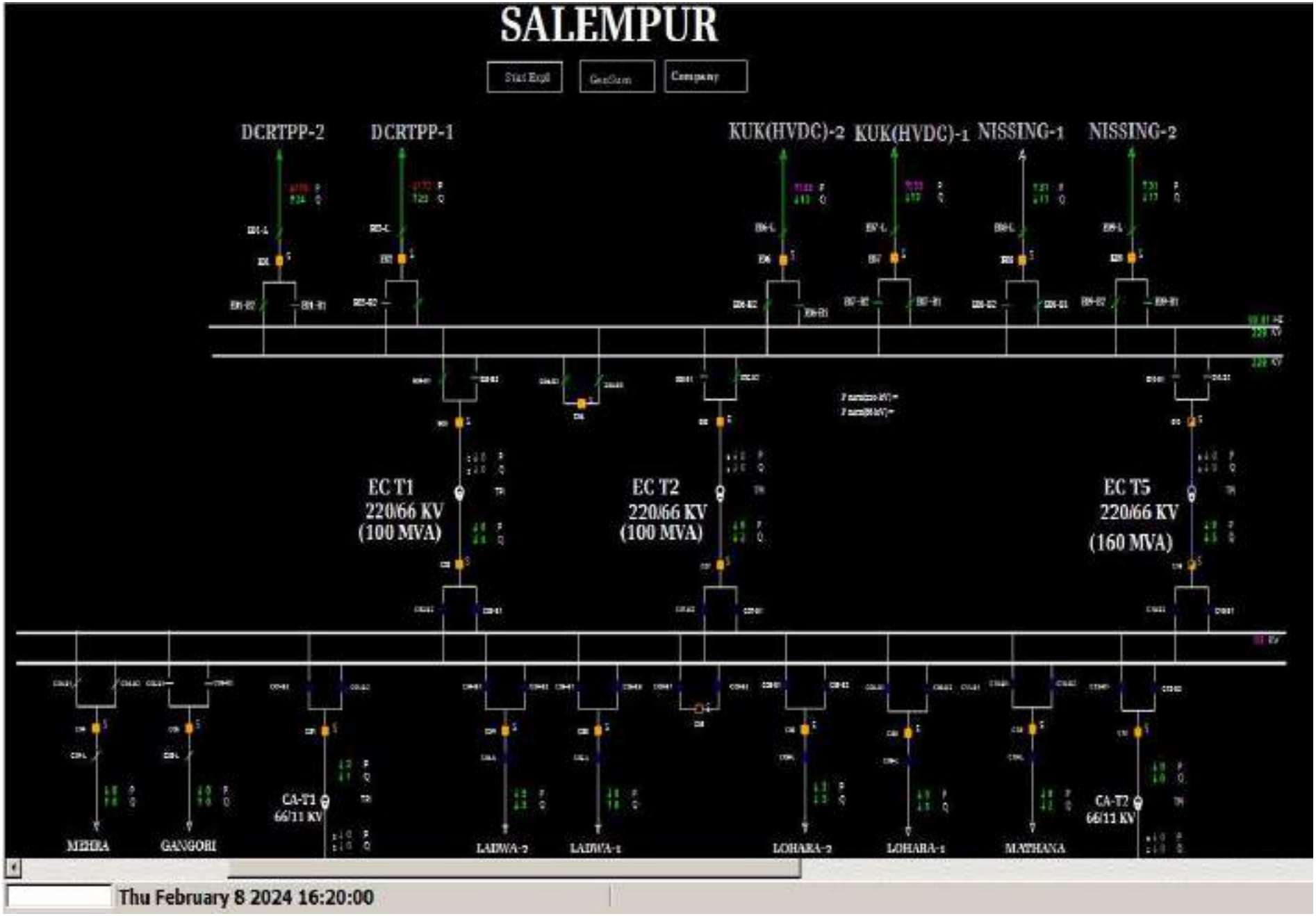
SLD of 220 kV DCRTP Yamuna Nagar(HR) @16:23hrs



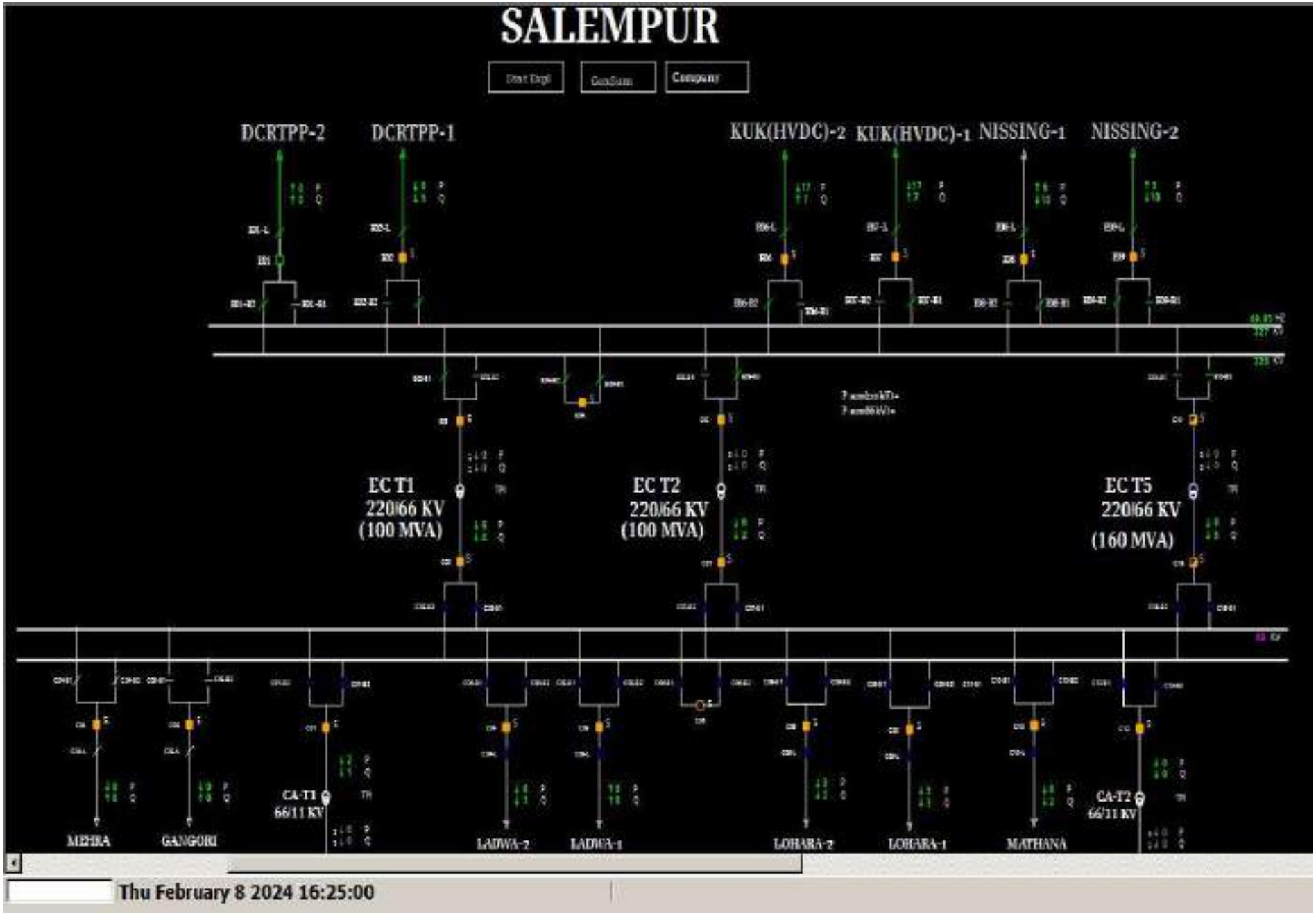
SLD of 220 kV DCRTP Yamuna Nagar(HR) @17:00hrs



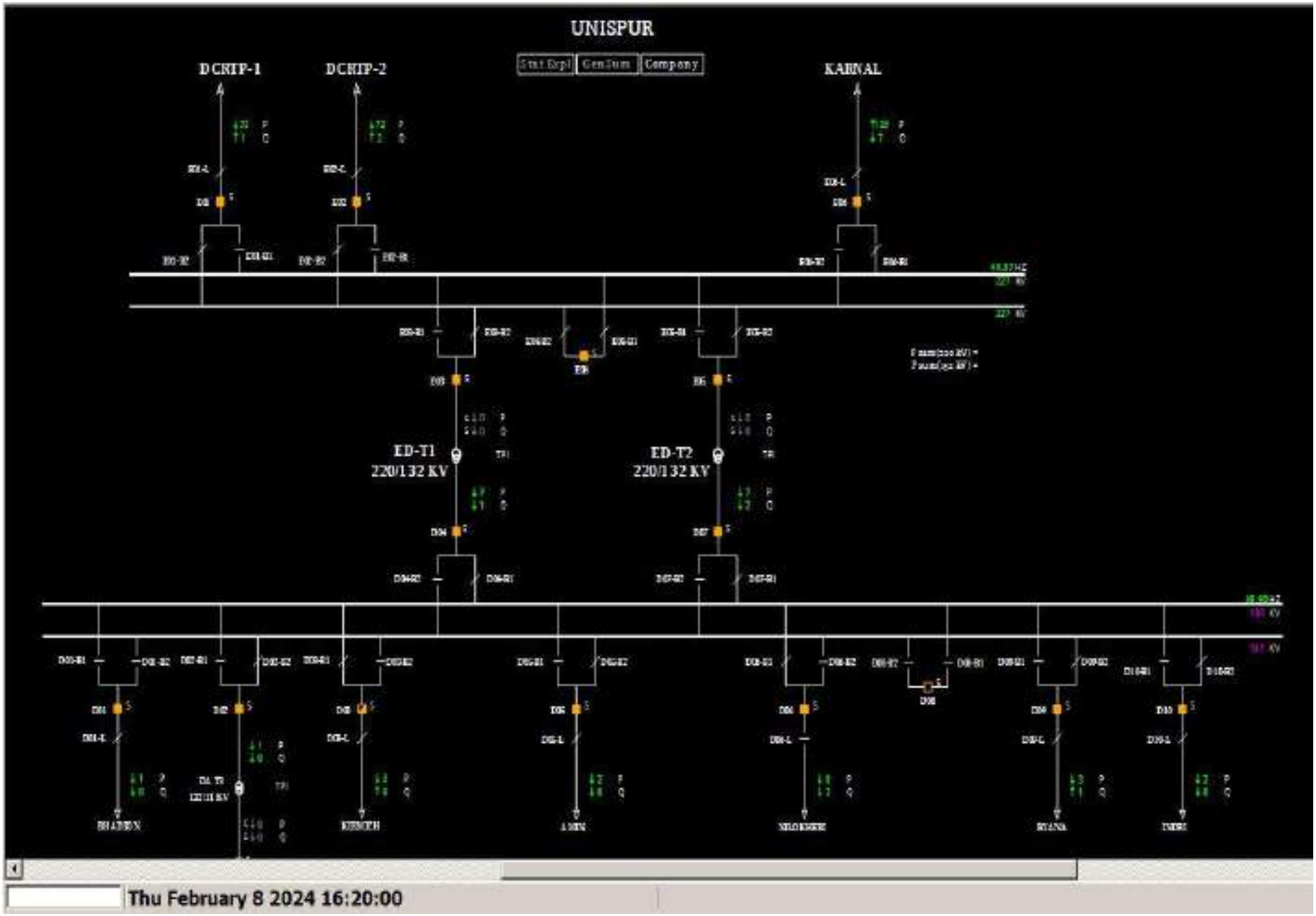
SLD of 220 kV Salempur(HR) @16:20hrs



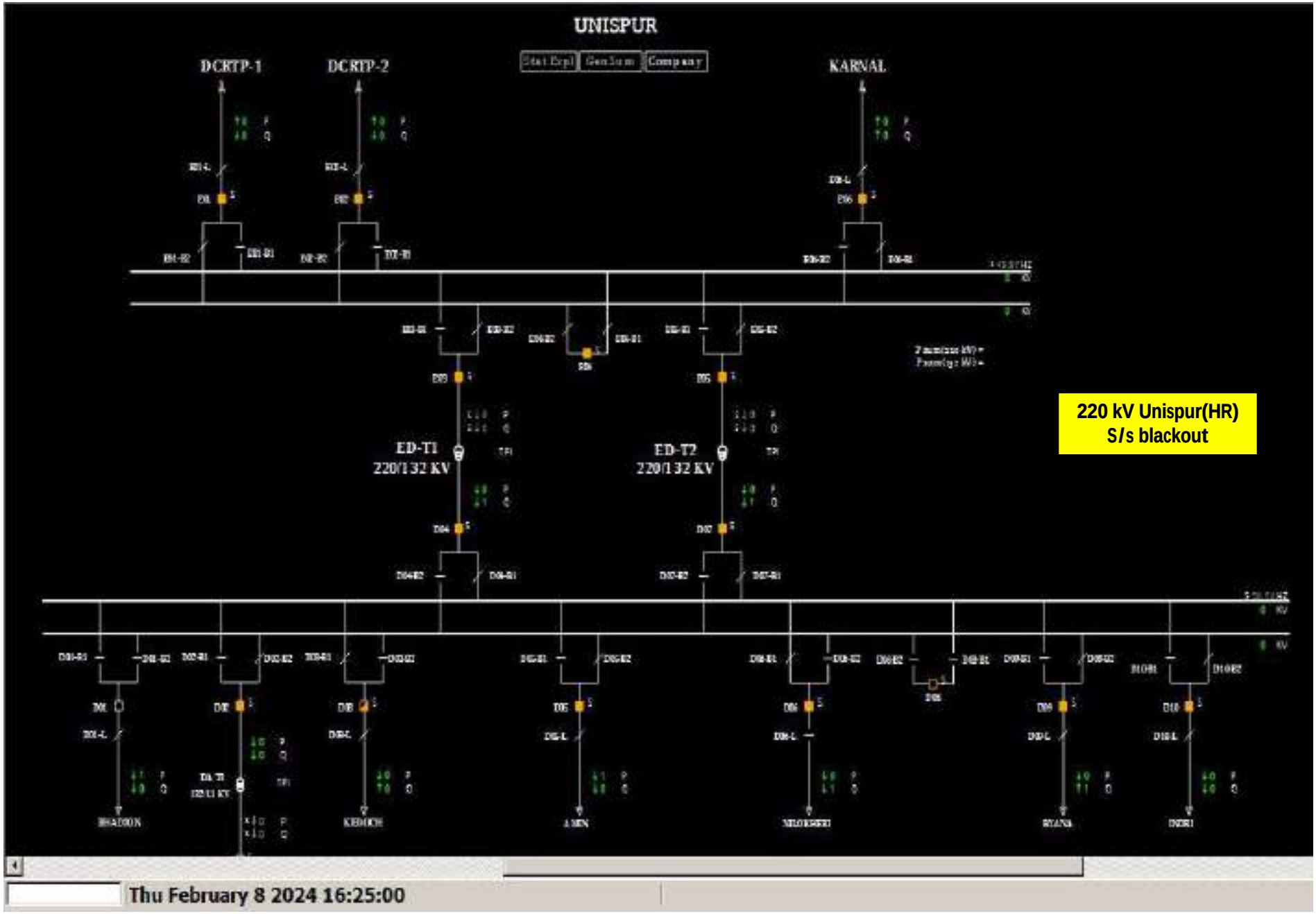
SLD of 220 kV Salempur(HR) @16:25hrs



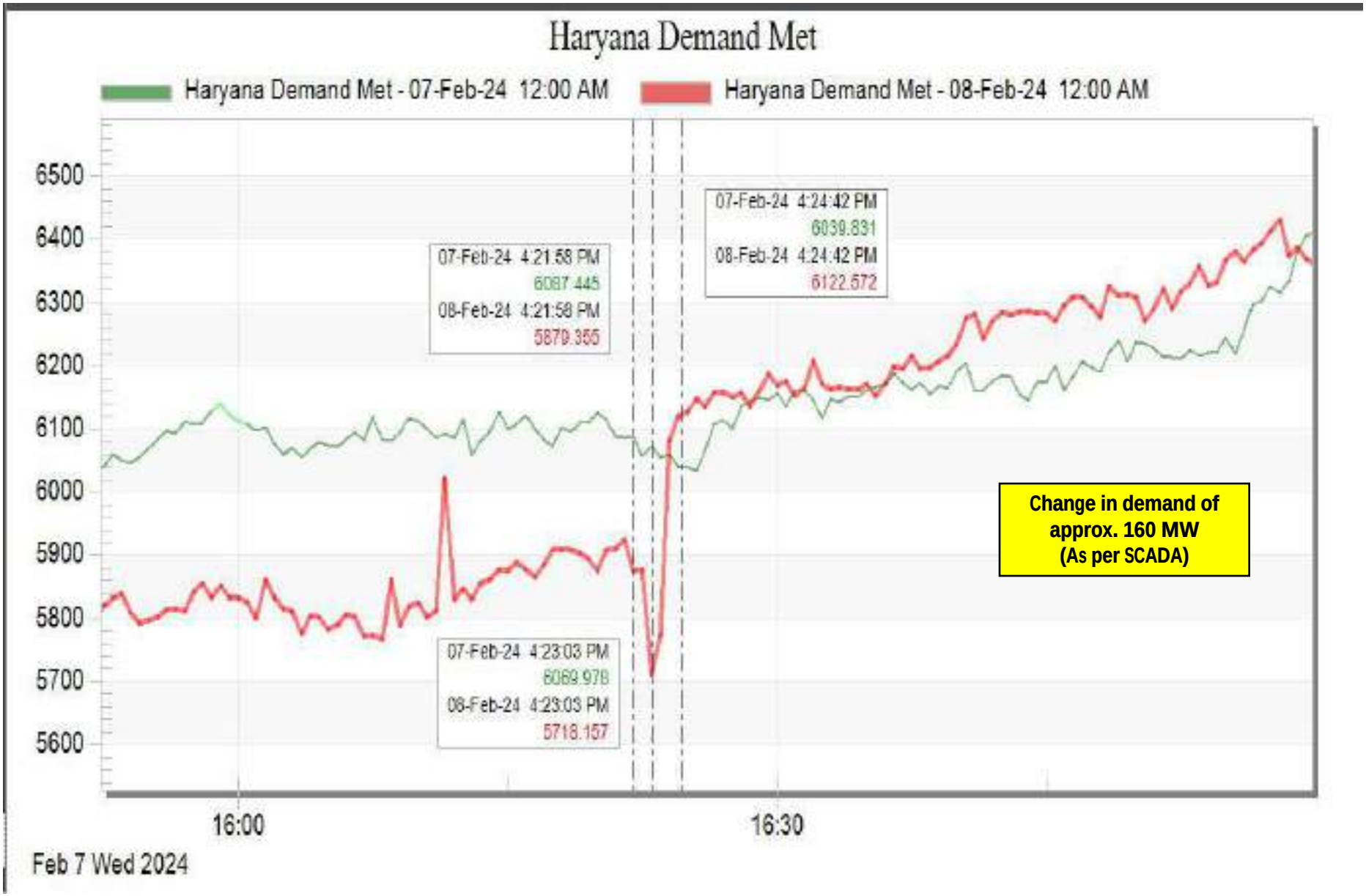
SLD of 220 kV Unispur(HR) @16:20hrs



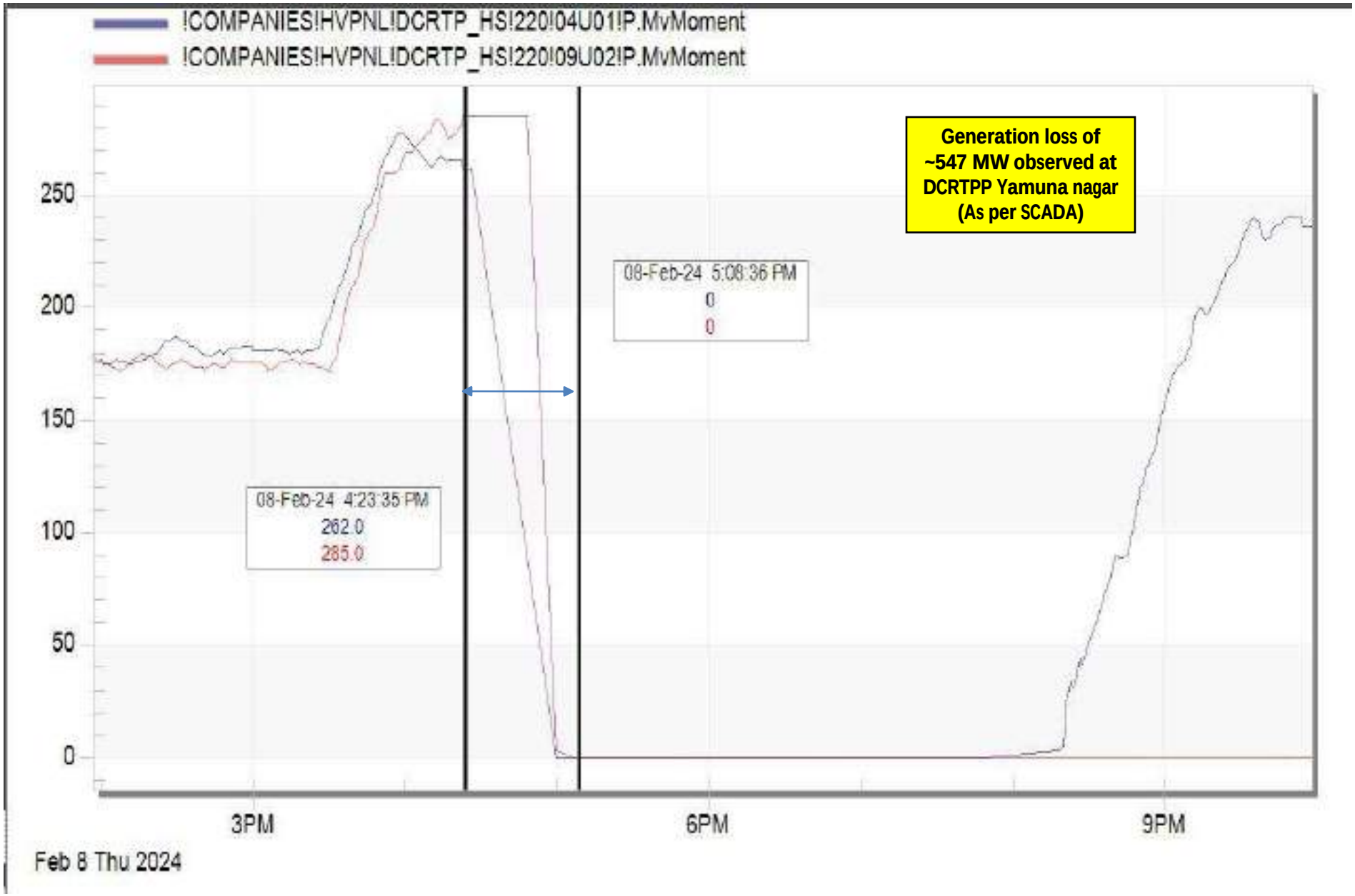
SLD of 220 kV Unispur(HR) @16:25hrs



Haryana Demand during the event



Unit-1 & Unit-2 generation during the event at 220KV DCRTPP Yamuna Nagar(HR)

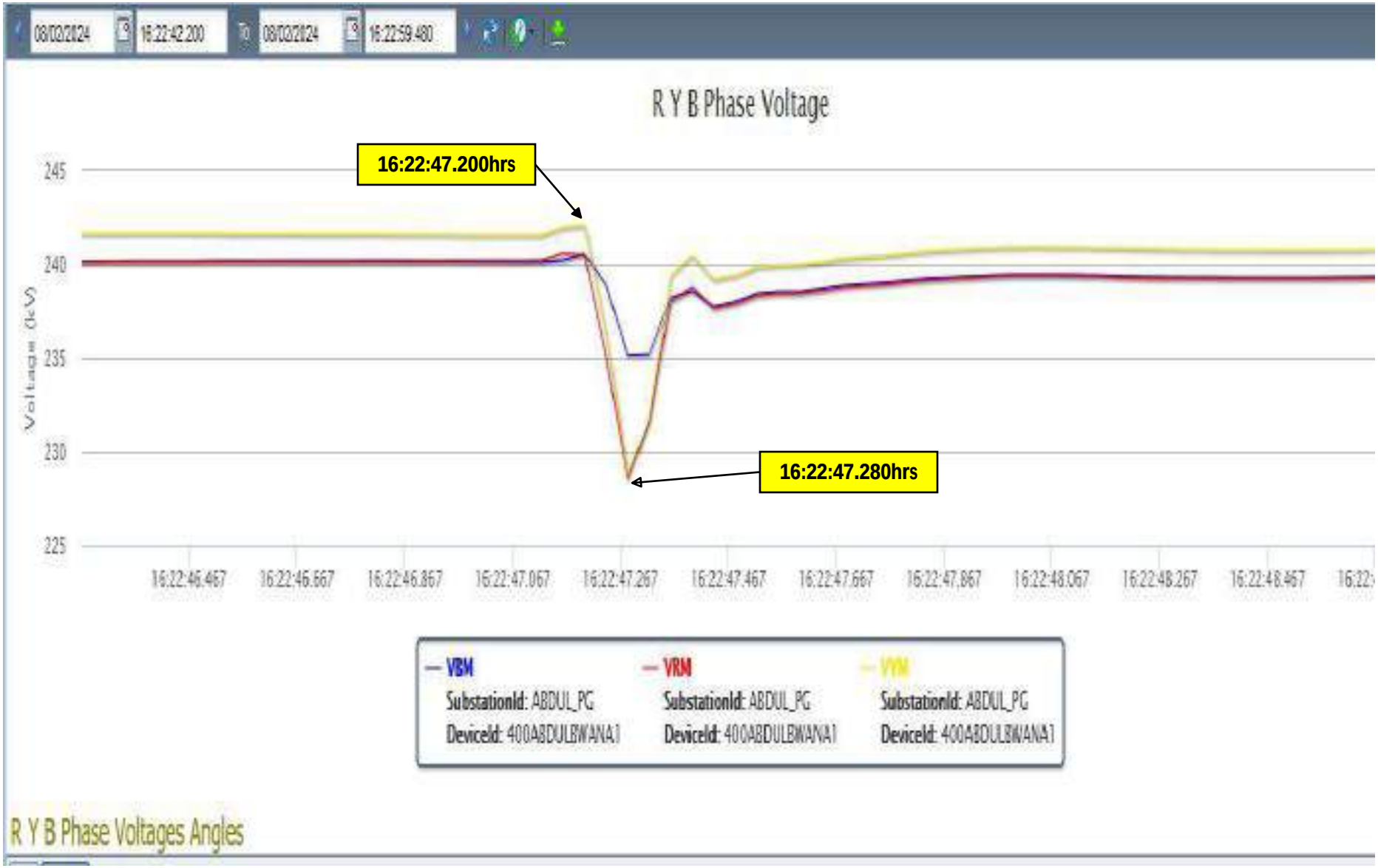


PMU Plot of frequency at Abdullapur(PG)

16:22 hrs/08-Feb-24

PMU Plot of phase voltage magnitude at Abdullapur(PG)

16:22 hrs/08-Feb-24



SCADA SOE

Time	Station Name	Voltage Level	Element Name	Element Type	Element Status	Remarks
16:22:47,325	SLMPU_HS	220KV	01DCRT2	Circuit Breaker	Open	Line CB at 220KV Salempur end of 220KV Salempur(HR)-Bakana(HR) Ckt-2 opened
16:23:02,182	UNSPR_HS	132KV	1BHADSON	Circuit Breaker	Open	Line CB at 220KV Unispur end of 132KV Unispur(HR)-Bhadson(HR) Ckt opened
16:24:01,672	DCRTP_HS	220kV	13JORIA2	Circuit Breaker	Open	Line CB at 220KV DCRTPP end of 220KV DCRTPP(HR)-Joria(HR) Ckt-2 opened

Point of discussion

- Exact reason, nature and location of fault ?
- Sequence of event?
- No tripping details have been received yet?
- SCADA data of 220kV Yamnunanagar S/s freezed during the event. Healthiness of the SCADA data need to be ensured.
- DR/EL of all the tripped elements along with tripping report of the event need to be shared.
- Tripping status of all the tripped elements are not coming in SCADA SOE.
- Detailed report along with remedial action taken details not received.

Report regarding Multiple tripping of HVPNL transmission lines on Dated 08.02.2023.

Brief History:

- The DCRTPP, Yamuna Nagar is connected with 8 no 220 KV line circuits from which the power is evacuated.
- On dated 06-02-2024 the shutdown was arranged on 2 no. 220 KV circuits i.e. 220 KV DCRTPP to PGCIL Abdullapur circuit & 220 KV DCRTPP to Rampur kamboyan circuit for making the LILO arrangement of 2nd circuit from DCRTPP to Abdullapur at 220 KV substation Rampurkamboyan which was approved from the SLDC, Haryana as well as from NRLDC.
- The power was evacuated from and injected to the grid on dated : 08.02.2024 through the following 6 no. 220 KV circuits:
    - 220 KV DCRTPP to Jorian Circuit I.
    - 220 KV DCRTPP to Jorian Circuit II
    - 220 KV DCRTPP to Bakana Circuit I
    - 220 KV DCRTPP to Bakana Circuit II
    - 220 KV DCRTPP to Unispur Circuit I
    - 220 KV DCRTPP to Unispur Circuit II
- The 220 KV DCRTPP to Jorian circuit I & II are the shortest circuits which are connected to the DCRTPP and are usually loaded. But after the shutdown on the circuits as mentioned above these 220 KV DCRTPP to Jorian Circuit I & II were running continuously highly loaded.

Antecedent Conditions:

- 220kV DCRTPP-Rampur Ckt-1 was under construction (LILO in place of DCRTPP-Abdullapur Ckt) and 220kV DCRTPP-Rampur Ckt-2 was under shutdown.
- 220 kV Bus-coupler at 220 KV Jorian was in ON position.

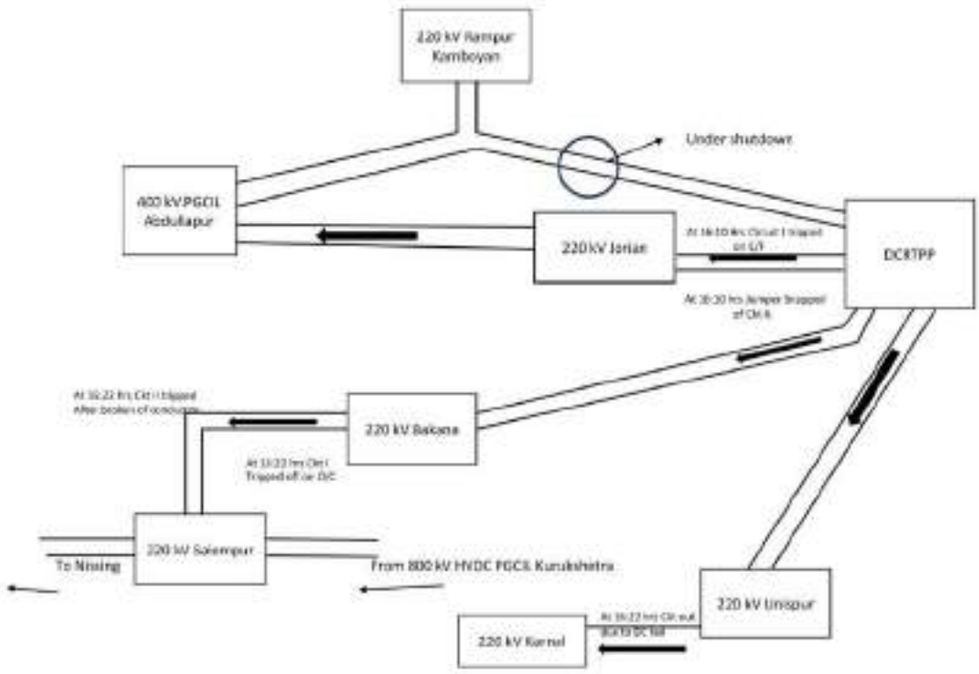
Detail of tripped elements:

On dated 08-02-2023, onward 16:10 hrs. multiple trippings occurred of 220KV lines and thereafter both the unit no. 1 & 2 of DCRTPP, Yamuna Nagar tripped off due to choking of power evacuation on the transmission lines simultaneously. The detail of trippings/SOE is as under:-

Sr no.	Date	Time	Name of circuit	Length of line in KM	Approx. Load in Amp. at 16.00 Hrs	Fault at one end	Fault at Other end	Fault Found
1	08/02/24	16:10 Hrs	220 KV Jorian to DCRTPP ckt II	10.9	396	Breaker remained in ON position at Jorian End	DCRTPP Breaker tripped off on operation of E/F relay Fault Duration- 1995 msec	R Phase Jumper snapped at TL No. 8 from Jorian end to DCRTPP end

2	08/02/24	16:10 hrs	220 KV Jorian to DCRTPP ckt I	10.9	396	Jorian End Breaker tripped off on operation of E/F Start IN 1 Fault Duration- 1992 msec Relay Trip Time- 80.07ms	Breaker remained in ON position at DCRTPP end	No Fault found
3	08/02/24	16:22 Hrs	220 KV Karnal to Unispur line			Breaker tripped off on operation of CTD at 220 KV Karnal End	Breaker at Unispur End remained in ON position.	DC Supply failed of breaker at Karnal end.
4	08/02/24	16:22 hrs	220 KV Salempur to Bakana Ckt I	32.083	145	Breaker remained in ON position at Salempur end	At Bakana End breaker tripped off on operation of B - Phase O/C relay only.	No Fault found
5	08/02/24	16:22 hrs	220 KV Salempur to Bakana Ckt II	32.083	160	At Salempur End, breaker tripped off on operation of Main I & II Auto Recloser lockout Zone 1, Distance 24.861KM Fault on phase :- A& B IA :- 8.	At Bakana End, breaker tripped off on operation of Main I Auto Recloser lockout Zone 1, Distance 8KM Fault on phase :- A & B IA :- 5.104 A IB :- 4.096 A IC :- 877mA IN :- 513 mA	Y phase conductor broke at TL no. 83 alongwith damage of crossarm
6	08/02/24	16:22 hrs	220 KV DCRTPP to Bakana Ckt I	22.031	192	Breaker remained in ON position at Bakana End	Breaker remained in ON position at DCRTPP end	Supply failed from DCRTPP end
7	08/02/24	16:22 Hrs	220 KV DCRTPP to Bakana Ckt II	22.031	202	Breaker remained in ON position at Bakana End	Breaker remained in ON position at DCRTPP end	Supply failed from DCRTPP end
8	08/02/24	16:22 hrs	220 KV DCRTPP to Unispur Ckt I		74	Breaker remained in ON position at Unispur End	Breaker remained in ON position at DCRTPP end	Supply failed from DCRTPP end
9	08/02/24	16:22 Hrs	220 KV DCRTPP to Unispur Ckt II		74	Breaker remained in ON position at Unispur End	Breaker remained in ON position at DCRTPP end	Supply failed from DCRTPP end

Single line Diagram (Attached



Analysis :-

- At 16:10 hrs. on dated 08-02-2024, jumper of Red phase (Bottom Cross Arm) of 220 KV Jorian to DCRTPP Circuit II snapped from tower location no. 8. The jumper snapped from Jorian end and hangs towards DCRTPP side and the jumper didn't touch any part of tower/earth. The broken conductor alarm appeared, the breaker remained in ON position from the 220 KV Jorian end and the breaker tripped off from the DCRTPP end on E/F.
- At the same time, 220 KV Jorian - DCRTPP circuit- I tripped off on operation of E/F at 220 KV Jorian end but breaker at DCRTPP end remained in ON position. The broken conductor alarm appeared at Jorian end. As it did not touch the tower/earth, DPR didn't operated but due to persisted unbalance loading & maloperation of Voltage Selection Relay, E/F relay of 220 KV Jorian – DCRTPP Ckt-I (1992 msec. fault duration) operated at 220 KV S/Stn. Jorian and almost in same time (1995 msec. fault duration) at DCRTPP end of Ckt-II. The fault got cleared by the breaker of 220 KV DCRTPP- Jorian Ckt-I at Jorian end as well as by the breaker of 220 KV DCRTPP- Jorian Ckt-II at DCRTPP end.
- Now the main power flow interrupted on these two circuits and increased power flow started on the rest 4 no. 220 KV circuits. Till 16:22 hrs. power flow through other circuits were running normally and without any constraint.

- At 16:22 hrs. 220 KV Unispur – Karnal S/C line tripped off from 220 KV substation Karnal on operation of CTD due to DC supply fail of breaker. The 220 KV Unispur had no so much load to consume the power of the thermal thus chocking of power flow on 220 KV DCRTPP-Unispur Circuit I & II which resulted in diversion of power on other circuits.

- The maximum power of both units of DCRTPP start flowing towards 220 KV DCRTPP- Bakana Circuit I & II and 220 KV Bakana - Salempur Circuit I & II, the lines were running on overload.

- 220 KV Bakana-Salempur -Ckt I tripped on B phase O/C relay at Bakana end resulting total load on 2nd Ckt. 220 KV Bakana – Salempur circuit II also tripped off from both ends with operation of DPS relays due to conductor of yellow phase broke from TL no. 83 and then the power evacuation got chocked due to loss of transmission lines and then both the units of DCRTPP tripped off.

Corrective/Remedial action taken:-

1. It is apprehended that the PT voltage in the voltage selection relay at 220 KV Jorian end was not proper at the time of fault, now the function of voltage selection relays at 220 KV Jorian end has been ensured by the concerned wing.
2. The alarm feature in O/C current due to overloading on line at 220 KV Bakana end has been ensured instead of tripping as per NRPC protection philosophy.
3. The protection settings are required to be coordinated with DCRTPP as per latest guideline issued by NRPC so that tripping could be monitored in chronological order to safeguard the grid and generating stations.

Multiple elements tripping at 220/66kV Uperlanangal(HP) 19th March 2024

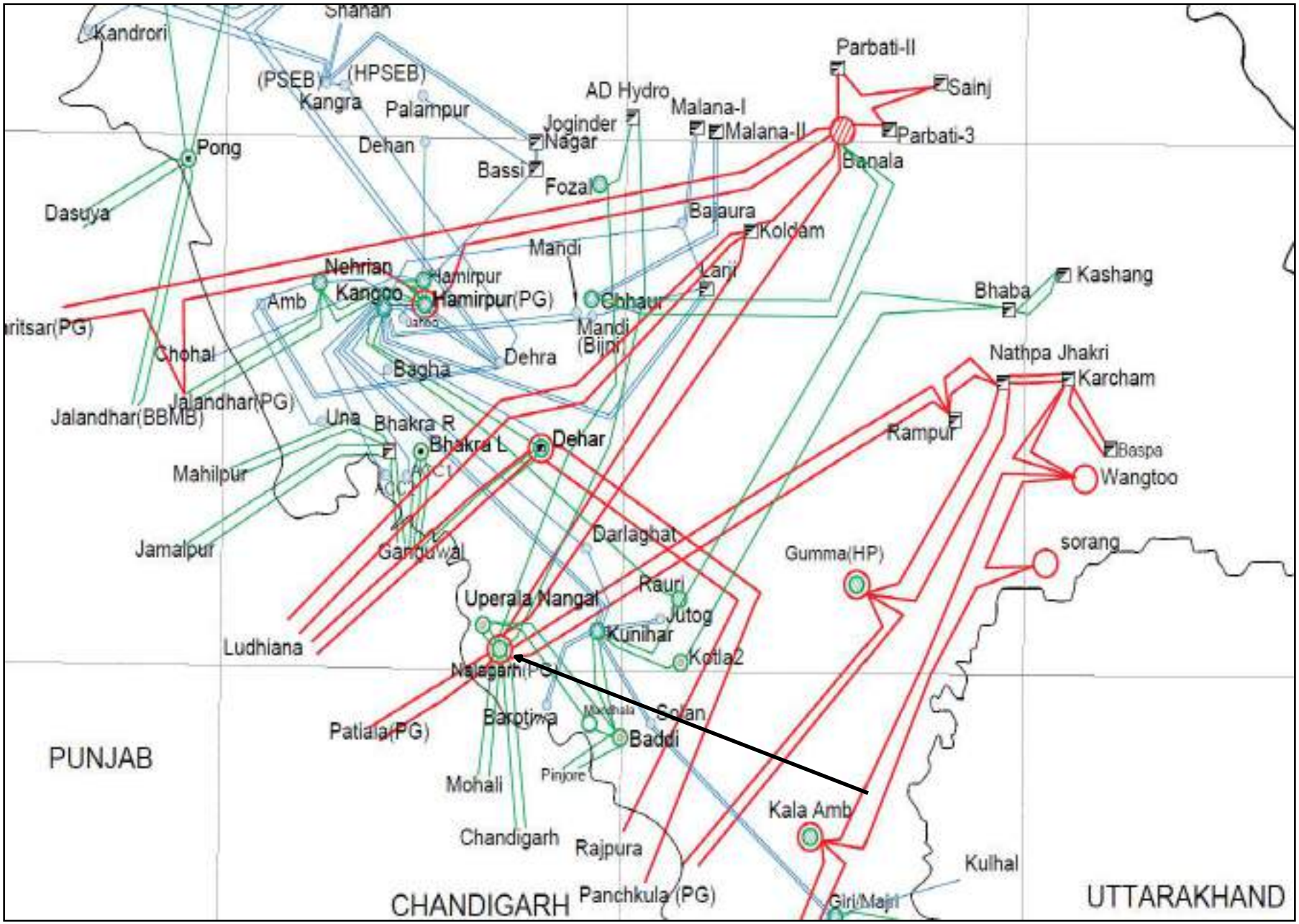
Brief of event:

- 220/66kV Uperlanangal(HP) S/s have double main bus scheme at 220kV level.
- During antecedent condition, 220 KV Nallagarh(PG)- Uperlanangal (HP) (HPSEB) Ckt-1 & 2 were carrying 260MW each. 220 KV Baddi- Uperlanangal (HP) Ckt was not in service (as per SCADA).
- As reported, **at 19:18 hrs, 220 KV Nallagarh(PG)- Uperlanangal (HP) (HPSEB) Ckt-1 & 2 tripped on R-N phase to earth fault.** (Exact reason, nature and location of fault yet to be shared)
- As further reported, 220 KV Uperlanangal(HP)-Wardthman (HPSEB) Ckt, 220/66kV 80/100MVA ICT-1 & 2 at Uperlanangal(HP) also tripped during the same time (Exact reason, nature and location of fault yet to be shared). Complete blackout occurred at 220/66kV Uperlanangal(HP) S/s.
- As per PMU at Nallagarh(PG), R-N phase to earth fault is observed with fault clearing time of 120ms.
- As per SCADA, change in demand of approx. 380MW is observed in HP control area.

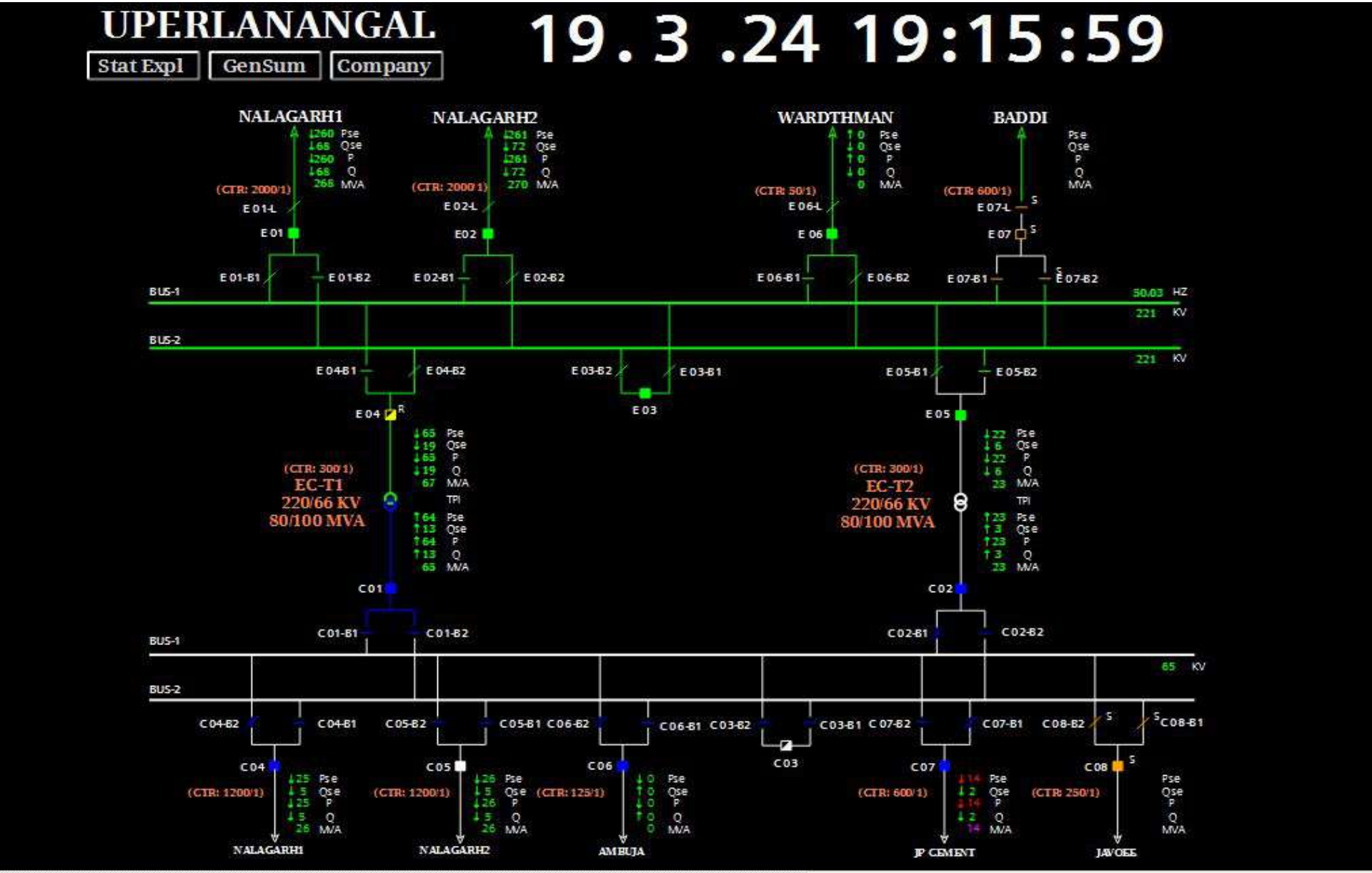
Elements tripped:

i. 220 KV Nallagarh(PG)- Uperlanangal (HP) (HPSEB) Ckt-1
ii. 220 KV Nallagarh(PG)-Uperlanangal(HP) (HPSEB) Ckt-2
iii. 220 KV Uperlanangal(HP)-Wardthman (HPSEB) Ckt
iv. 220/66kV 80/100MVA ICT-1 at Uperlanangal(HP)
v. 220/66kV 80/100MVA ICT-2 at Uperlanangal(HP)

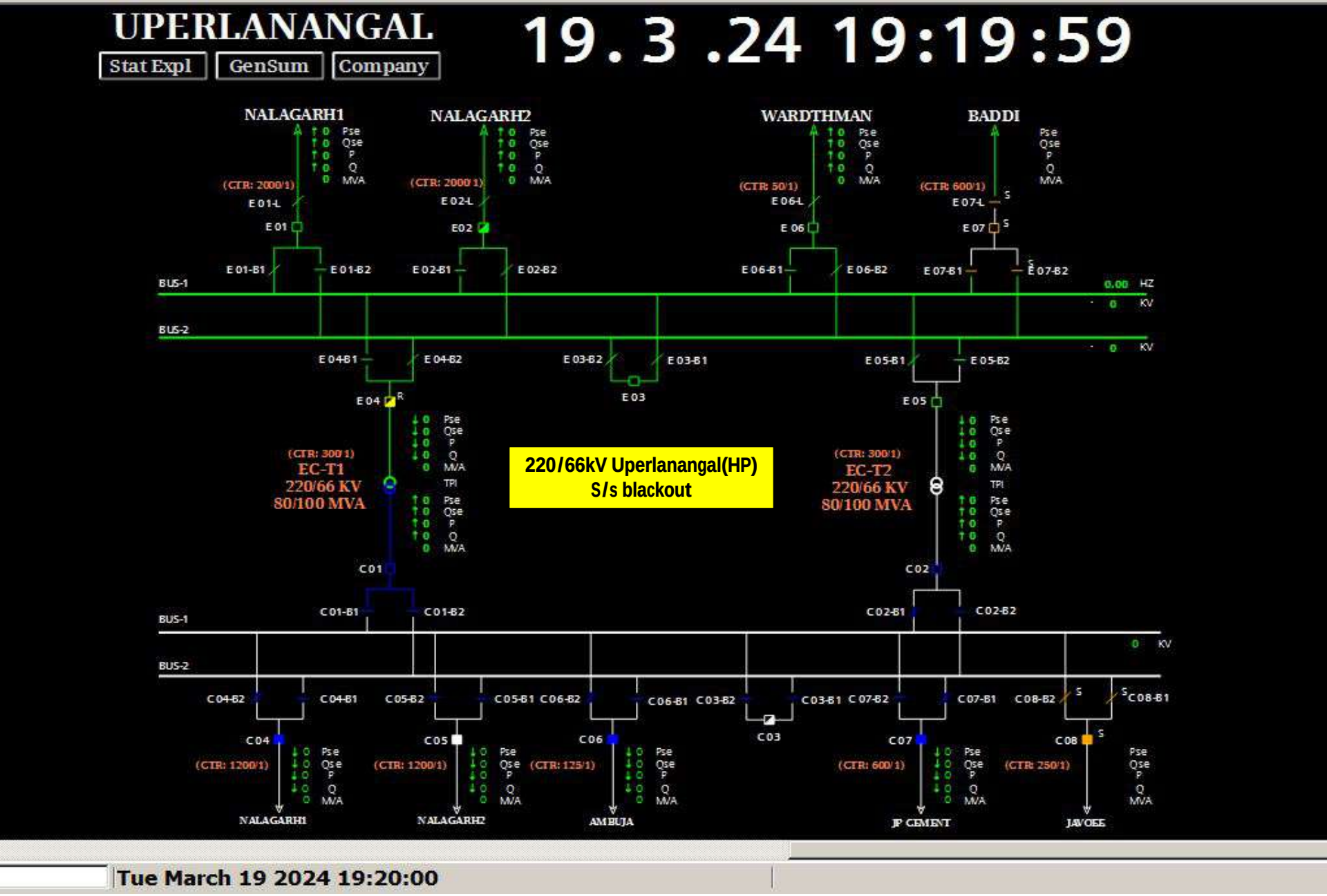
Network Diagram



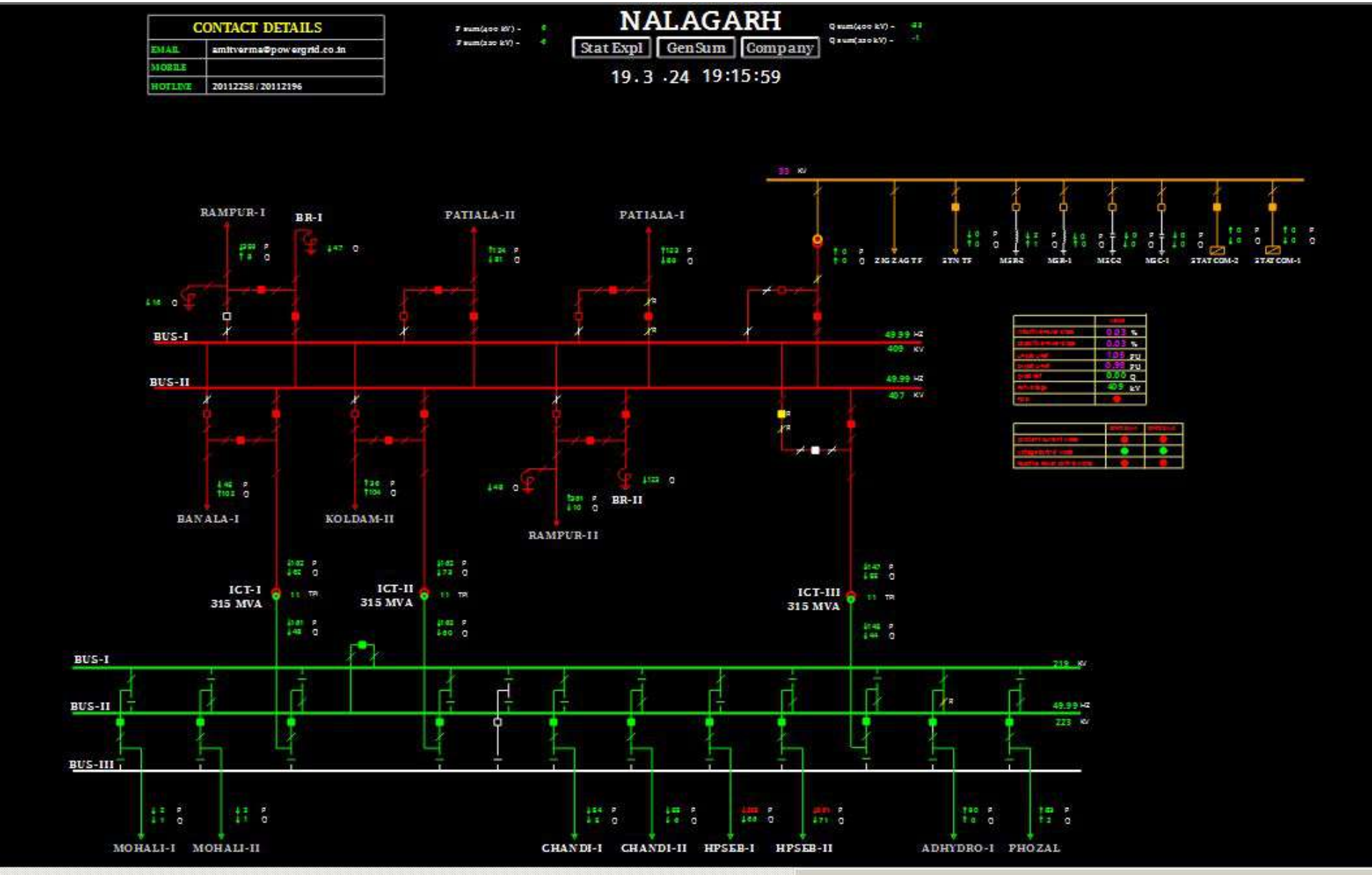
SLD of 220/66kV Uperlanangal(HP) before the event



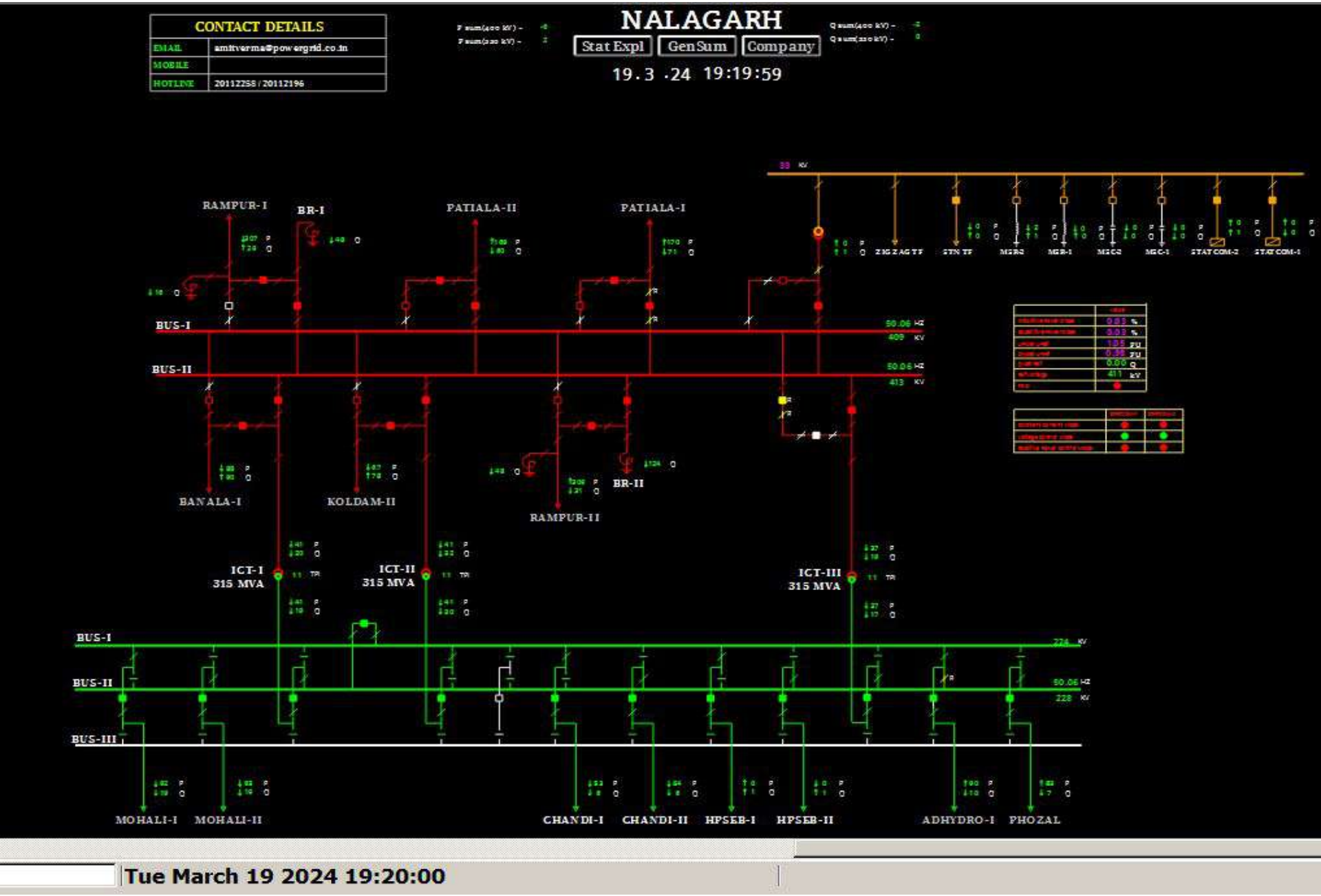
SLD of 220/66kV Uperlanangal(HP) after the event



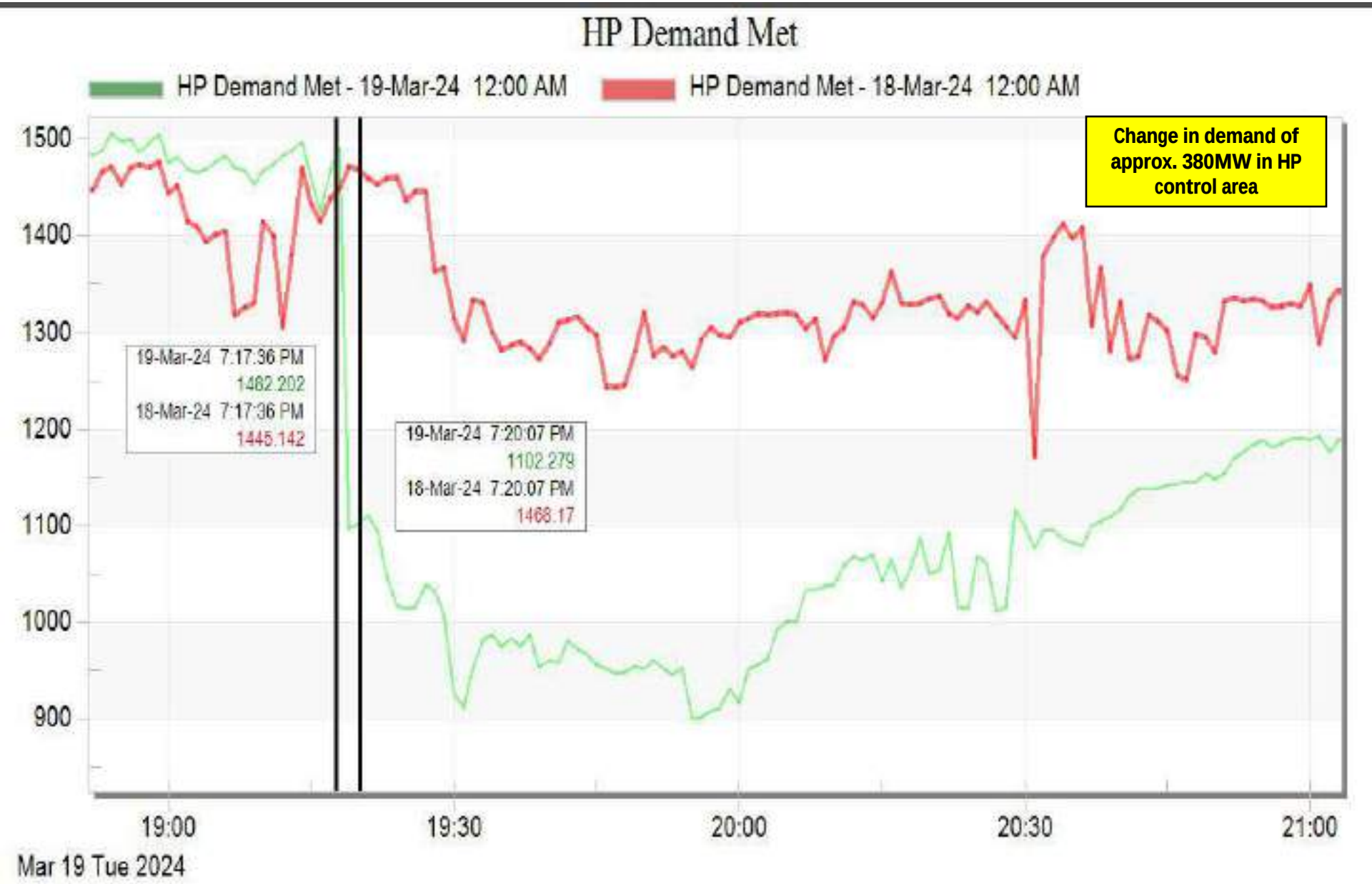
SLD of 400/220kV Nallagarh(PG) before the event



SLD of 400/220kV Nallagarh(PG) after the event



Himachal Pradesh demand during the event



PMU Plot of frequency at Nallagarh(PG)

19:18hrs/19-Mar-24

PMU Plot of phase voltage magnitude at Nallagarh(PG)

19:18hrs/19-Mar-24

SCADA SOE

Time	Station Name	Voltage	Element Name	Element Type	Element Status	Remarks
19:18:36,180	UPNGL_HP	220kV	02NALAG2	Circuit Breaker	disturbe	
19:18:36,227	UPNGL_HP	220kV	01NALAG1	Circuit Breaker	Open	Line CB at Uperlanangal(HP) of 220 KV Nallagarh(PG)-Uperlanangal(HP) (HPSEB) Ckt-1 opened
19:18:36,294	UPNGL_HP	220kV	06WRDHM	Circuit Breaker	Open	Line CB at Uperlanangal(HP) of 220 KV Uperlanangal(HP)-Wardthman (HPSEB) Ckt opened
19:18:36,297	UPNGL_HP	220kV	05T2	Circuit Breaker	Open	CB at 220kV side of 220/66kV 80/100MVA ICT-2 at Uperlanangal(HP) opened
19:18:36,311	UPNGL_HP	220kV	03MBC	Circuit Breaker	Open	Main Bus coupler CB at 220kV Uperlanangal(HP) opened
19:18:36,362	UPNGL_HP	66kV	02T2	Circuit Breaker	Open	CB at 66kV side of 220/66kV 80/100MVA ICT-2 at Uperlanangal(HP) opened
19:18:36,365	UPNGL_HP	66kV	01T1	Circuit Breaker	Open	CB at 66kV side of 220/66kV 80/100MVA ICT-1 at Uperlanangal(HP) opened

Point of discussion

- Exact nature and location of fault?
- Sequence of event?
- Details of protection operation at Uperlanangal end (relay flags, DR files etc.)
- No tripping details received yet.
- Tripping status of all the tripped elements are not coming in SCADA SOE.
- Detailed report along with remedial action taken details not received.

Annexure-XXX

Presentation at NRPC Meeting

Protection & Technical Audit of Sub station by CBIP

ABOUT CBIP:

- Central Board of Irrigation & Power (CBIP) is a Premier Institution, constituted by Government of India, serving the nation since 1927, in following areas:

  - Water Resources,
  - Power and Renewable Energy Sectors.

- Dissemination of knowledge in the above fields through:

  - Seminars,

ABOUT CBIP:

- Workshops
- Training program &
- Technical Manuals
- Third-party Technical Audit, Safety Audit & Inspection of following:
- EHV Sub Station – Protection, Technical & Safety Audit,
- Thermal Power Plants,
- Hydro Electric power plant &
- Solar plant

- Team of well experienced experts having rich knowledge of the subject.
- Capable of undertaking Protection & Technical Audit of Sub Stations.

Recently Completed Projects:

- 132 KV sub stations of DVC.
- 400 KV & 220 KV sub stations of OPTCL.
- 220 KV & 66 KV sub stations of Electricity Department of Daman.
- 220KV sub stations/ Switching Stations of Dadar & Nagar Haveli.
- 400KV & 220KV sub stations of PTCUL.

- **Projects undergoing:**

- 765 kV/ 400 kV sub stations of Adani infrastructure Management Services Ltd.

- 400 kV/ 220 kV GIS sub stations of Adani infrastructure Management Services Ltd.

- 400 kV Switching stations of Adani infrastructure Management Services Ltd.

OUR COMMITMENT:

- Audits are part of quality assurance & bench marking point of leading Power utilities.

- Audits leads to improved organizational productivity/ efficiency with same man power and equipment.

- The Protection/ Technical Audits covers reviewing protections, recommendation for improvement, implementation of operation policies, guidelines, specific quality plans, documentation, assessing the activities to obtain better technical data management, identifying the requirement of training to improve organizational efficiency.

- Implementation of Audit points improves performance of organization.

OUR WORK:

- During the Protection/ Technical Audit the team of experts visit, review the current practices being followed & suggest the improvements as detailed below:

  - Visits to substation & go through various relevant documents.
  - Review data as per protection subcommittee Check Lists.
  - Discussions/ Interactions with the concerned technical officials of organization
  - Review fault clearing system available at substations.
  - Review of the existing protection philosophy & relay settings adopted at substation.

- Review healthiness of the protection system & the test results available at site.
- Review of special protection schemes, implementation of logics & setting.
- Review of the disturbance records and fault analysis.
- Check the performance of Relay & Protection system along with CT/ PT, DC Supply & PLCC/ OPGW during faults in sub station.
- Check adequacy of short circuit rating of existing equipment/ switchgear .
- Check the healthiness of auxiliary AC/ DC system (220V DC, 110V DC, 48V DC etc.).
- Check availability & adequacy of PLCC, OPGW / Fiber Optic.

- Check availability/ adequacy of SAS, SCADA, GPS & time synchronization.

- Review relay setting coordination based on fault MVA, Network configuration, system requirement & Root cause analysis of unwanted tripping events, if any.

- Review the records & documentation of Protection Relay, transformers & substation switchgear/ breakers etc. testing & condition monitoring & Practices of condition monitoring of equipment at substation.

- Review Records of abnormal equipment and transmission line trippings.

- Review periodicity of relay testing.

- Review Adequacy of testing equipment's and condition monitoring equipment at substations.

- To Review station Earthing system.
- Prepare report with recommended protection philosophy & suitable solutions for rectification of identified problems.
- Presenting the finding of the Audit & conducting closure meeting along with recommendation/ suggestion with the concerned engineers at site & HO.
- Submission of Draft Report after completion of physical audit at the site.
- Submission of final Audit report.

TAKE AWAY:

- The practices being followed are evaluated by expert team with respect to the best practices prevailing in the industry. Based on the audit, our Audit Team suggest plan for improvement with available resources. The draft report is submitted for discussion & followed by submission of final report to the management.

- Third party Protection & Technical Audit is of immense help to the organization. This will reduce the likelihood of undesirable events, increase the system availability, ensures safety of work force and avoid failure of costly equipment.

Thank you