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

No. उ.क्षे.वि.स./प्रचालन/107/01/2023/2098-2136 दिनांक:27.02.2023

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

विषय: संरक्षण उप-समिति की 46 वीं बैठक के कार्यवृत्त ।
Subject: Minutes of 46th Protection Sub-Committee Meeting.

संरक्षण उप-समिति की 46वीं बैठक दिनांक 22.12.2022 को 11:00 बजे से वीडियो कॉन्फ्रेंसिंग के माध्यम से आयोजित की गई थी । उक्त बैठक का सार पत्र दिनांक 09.01.2023 के द्वारा जारी किया गया था । उक्त बैठक का कार्यवृत्त संलग्न है एवं यह उत्तर क्षेत्रीय विद्युत समिति की वेबसाइट (http://164.100.60.165/) पर उपलब्ध है ।

The 46th meeting of Protection Sub-Committee was held on 22.12.2022 at 11:00 hrs through Video Conferencing. Gist of the same was issued vide letter dtd. 09.01.2023. The minutes of the aforesaid meeting is attached and the same are also available on NRPC website i.e. http://164.100.60.165/

Santosh
27/02/23
(संतोष कुमार)
अधीक्षण अभियंता

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List of Members of Potection Sub-Committee of NRPC

S.No.	Designation	Organization	Fax No.
1	Director (P&C)	BBMB	0172-2652054
2	General Manager (SLDC)	DTL	011-23236462
3	GM (O&M)	DTL	011-23236462
4	GM (T)	IPGCL	23370247
5	Chief Engineer (TS)	HVPNL	0172-2591244
6	SE (M&P)	HVPNL	0172-2540014
7	SE (SO & SLDC)	HVPNL	0172-2560622
8	SE (SLDC)	PTCUL	0135-2763570/2451160
9	SE(T&C)	PTCUL	0135-2451826
10	Chief Engineer (SLDC)	UPPTCL	0522-2287880/2288736
11	SE(Tech)	HPGCL	0172-5022436
12	SE(O&M-VI)	HPGCL	0180-2566768
13	Chief Engineer (Transmission)	HPSEB	01972-223435
14	SE (PR& ALDC)	HPSEB	0177-2837143
15	DGM(Protection)	HPPTCL	0177-2832384
16	Chief Engineer (Trading)	JKPTCL	0191-2474233
17	Chief Engineer (SLDC)	PSTCL	0175-2365340
18	Chief Engineer (P&M)	PSTCL	0161-2741280/2451491
19	CE (M&P)	RRVPNL	0141-2291891
20	SE (Electrical)	RRVUNL	01509-245299
21	Chief Engineer (LD)	RRVPNL	0141-2740920
22	Superintending Engineer (T&C)	UPPTCL	0121-2666062
23	Chief Engineer, (L-2)	UPRVUNL	0522-2287822/2287880
24	DGM (T&C)	PTCUL	0135-2760331
25	Chief Engineer (O&M)	NHPC	0129-2272413
26	GM (O&M) NR – I	PGCIL	011-26601079
27	GM (O&M), NR-II	PGCIL	01951-237186
28	GM (O&M), NR-III	PGCIL	
29	Chief Manager (TS)	N.R.L.D.C	011-26852747
30	GM(OS-NR)	NTPC	0522-2305848
31	GM (OS)	NTPC Ltd	0120-2410082/2410068
32	DGM (Maintenance)	SJVNL	0177-2673283
33	DGM (O&M)	THDC India Ltd	01376-236305
34	Director (GM & NPC division)	CEA	011-26109750
35	General Manager	APCPL	01251-266326
36	Director	JPPVL	0120-4516201/4609464/4609496
37	Addl. CE(M&P-IT)	JVVNL	-
38	GM (Production)	Jhajjar Power Ltd	01251-270155
39	GM(P&M)	APL	7925557176
40	Sh. Tarun Tanwar, Sr. Engineer	JSW	022- 42863000
41	President (Power Systems)	LPGCL	+91-22- 22048681
42	NPCIL		
	1.Maintenance Superintendent	NAPS	05734-222167
	2.Maintenance Superintendent	RAPS	01475-242060

Minutes of 46th Meeting of Protection Sub-committee

Time of meeting : 11.00 Hrs.

Date of meeting : 22.12.2022

A.1. Confirmation of minutes of 45th meeting of Protection sub-committee

Forum was apprised that gist of decisions of 45th meeting of Protection Sub-committee (held on 24.06.2022) were issued vide letter dated 11.07.2022. Minutes of the meeting were issued vide letter dtd. 13.09.2022. No comment has been received.

Sub-Committee confirmed the Minutes.

A.2. Implementation of Recommendations of Task Force

As a follow up of one of the recommendations of Enquiry Committee headed by the Chairperson, CEA on grid disturbances that took place on 30th and 31st July 2012, Ministry of Power had constituted a 'Task Force on Power System Analysis under Contingencies' in December 2012. The Task Force had submitted its report in August 2013. In a meeting taken by Union Power Secretary on 11.03.2014, it was decided that the report may be given wide circulation and its recommendations may be implemented in a time bound manner. Issue arising out of the recommendations of the Task Force is as under:

A.2.1. Database of protection settings

2.1 EE, NRPC apprised members that in 45th Protection sub-committee meeting held on 24.06.2022 it was decided that a meeting with NIC may be scheduled for exploring the possibility and cost estimate for hosting of portal considering quantum of data and Budgetary quotation/EOI may be requested from suitable vendors.

2.2 He highlighted that as per protection code in draft CERC (Indian Electricity Grid Code) Regulations, 2022 issued by CERC on 07.06.2022, additional responsibilities have been added for RPCs regarding protection setting approval and its database. The same are:

Quote

14. PROTECTION SETTINGS

(1) RPCs shall undertake review of the protection settings, assess the requirement of revisions in protection settings and revise protection settings in consultation with the stakeholders of the respective region, from time to time and at least once in a year. The necessary studies in this regard shall be carried out by the respective RPC.

(2) All users connected to the grid shall:

(a) furnish the protection settings implemented for each element to respective RPC in a format as prescribed by the concerned RPC;

(b) obtain approval of the concerned RPC for (i) any revision in settings, and (ii) implementation of new protection system;

(c) intimate to the concerned RPC about the changes implemented in protection system or protection settings within a fortnight of such changes;

(d) ensure correct and appropriate settings of protection as specified by the concerned RPC.

(e) ensure proper coordinated protection settings.

(3) RPCs shall:

(a) maintain a centralized database in respect of their respective region containing details of relay settings for grid elements connected to 220 kV and above (132 Kv and above in NER).

(b) carry out detailed system studies, twice a year, for protection settings and advise modifications / changes, if any, to the CTU and to all users and STUs of their respective regions.

(c) provide the database access to CTU and NLDC and to all users, RLDC, SLDCs, and STUs of the respective regions. The database shall have different access rights for different users.

Unquote

2.3 Hence, it was stated that database work may be taken up further only after notification of final IEGC by Hon'ble CERC as scope of tender may vary as per requirement.

2.4 POWERGRID stated that they have submitted comments regarding provisions in draft CERC (Indian Electricity Grid Code) Regulations, 2022 and it may be better to wait until final notification of IEGC.

2.5 MS, NRPC suggested that till the time new IEGC is notified, we may decide on funding mode for the project. He stated that POWERGRID may implement the project as they have expertise in various website development. However, the amount of project may be transferred to POWERGRID from NRPC Fund after approval in board meeting.

2.6 It was decided that implementing agency and funding mode may be discussed in upcoming NRPC meetings.

A.3. Protection Philosophy of NR

3.1 EE, NRPC apprised that in 42nd PSC meeting, it was decided to constitute expert group, comprising members from NRPC Sectt, NRLDC, POWERGRID, STUs, APL, NTPC, NHPC, RE Generator and other experts such as CBIP, expert from other RPCs, that may study various

recommendations related to Protection setting as well as adopted philosophy in other regions/utilities and may further propose an updated protection philosophy in time bound manner.

3.2 He stated that as per decision in 45th PSC meeting (held on 24.06.2022), Adani and NTPC were requested for nominating experts related to protection in renewable generation. Nomination from ADANI has been received. However, NTPC has not submitted nomination even after various follow-up vide letters dtd. 14.07.2022, 07.09.2022, & 01.11.2022.

3.3 He informed members that a committee has been constituted vide letter dated 08.12.2022 on the basis of nomination received. First meeting of the committee will be tentatively held in the 1st week of January and expert group is to submit recommendations within 03 months which will be deliberated in Protection sub-committee meeting.

A.4. Non-functional carrier Inter-trip feature (Agenda by BBMB)

4.1 BBMB stated that Carrier aided protection on Jalandhar-Dasuya ckt-4 is defective since June, 2012 and new PLC Terminals along with Protection couplers have been installed on 220 kV Barnala-Lehra Mohabbat Ckt. by BBMB at both ends on 24.11.2020. However, Inter-connection wiring between Protection Coupler to Distance Protection relays has not been completed at Lehra Mohabbat end by PSTCL in spite of repeated requests. Hence, carrier inter-trip feature (Carrier aided protection of transmission line) is non-functional on 220 kV Barnala-Lehra Mohabbat Line.

4.2 The issue couldn't be deliberated due to unavailability of representative from PSTCL.

A.5. Proposal to implement additional protection in 220KV lines at NAPS (Agenda by NAPS)

5.1 NAPS briefed about the issue and stated that in 45th Protection sub-committee meeting, it was decided that a committee may be constituted comprising members from NAPS, NRLDC, NRPC Sectt., POWERGRID and UPSLDC to look into the issue and submit its recommendation at the earliest.

5.2 MS, NRPC highlighted that issue may be deliberated in this meeting itself as event has taken place in August, 2021 and a lot of time has already been wasted.

5.3 NRLDC stated that over current settings proposed by NAPS may be accepted however, proposed voltage settings may not be useful. He stated that it involves major change in protection philosophy and this may be allowed as special case for NAPS without considering this as precedence for other utilities. Further, implemented scheme may be observed for six

months and NAPS may intimate observation thereon which can be deliberated further.

5.4 Accordingly, it was decided that over current settings may be allowed for implementation, however over voltage settings may be deliberated in a separate meeting before implementation.

A.6. Tripping in 400kV Uri – Amargarh line of NRSS XXIX (Agenda by Indigrid)

6.1 Indigrid briefed about the tripping in 400 kV Uri – Amargarh lines of NRSS XXIX in the month of April and June, 2021 as well as April, 2022. He highlighted that issue may be due to grounding of outer sheath of power cable at NHPC end.

6.2 NHPC highlighted that there were issues in cable (oil filled) of both circuits at their end. At instances of sheath overcurrent in oil filled cables, A/R was getting blocked as per design protocol. The issue has been taken up and cable of circuit no. 2 has already been replaced. Cable of circuit no. 1 will get replaced in one year. Therefore, A/R operation does not happen successfully in circuit no.1.

6.3 IndiGrid highlighted that their equipment are at risk due to high voltage.

6.4 POWERGRID stated that the line has non-switchable reactor of 50 MVAr at Uri end, hence line seems to be overcompensated.

6.5 NRLDC highlighted that A/R status needs to same at both ends of circuit. Therefore, if A/R operation at one end is not possible, then A/R may be kept off at other end also. He highlighted that tripping may be due to LC oscillations as reactors are kept in circuit.

6.6 POWERGRID opined that A/R may be kept off, however cable replacement may be taken on priority.

6.7 IndiGrid requested that a study may be done for analysis of such trippings so that tripping may be avoided.

6.8 SE, NRPC opined that study may be carried out regarding overcompensation of line by Indigrid.

6.9 Accordingly, following was decided:

i. Due to issue at NHPC end of A/R in Uri- Amargarh line ckt-1, A/R at Amargarh end may be kept off till the replacement of cable is completed by NHPC.

ii. NHPC may replace the cable on priority.

iii. It may be ensured that A/R is healthy and operative on circuit 2.

iv. If trippings happen in future, IndiGrid may model the network and undertake study of the event. The same may be put up before this committee for analysis.

A.7. Third Party Protection audit of PTCUL and UJVN stations (Agenda by NRPC Sectt.)

7.1 EE (P&SS), NRPC informed that as per decisions of 199th OCC meeting (held on 16.09.2022), 2 group of officers were formed for protection audit of PTCUL sub-station and audit was conducted by one group during 12-13 October 2022 at 220 kV s/s of PTCUL. However, two officers (THDC and NRLDC) of 2nd group denied for audit as per schedule intimated to them and they requested for re-scheduling the dates. He highlighted that organizations are not comfortable in engaging officers for the said audit.

7.2 PTCUL stated that audit team is also required to sign on BoQ document.

7.3 Forum decided that PTCUL/UJVN may approach CPRI for the said audit. They may also explore with other constituents/utilities, if they can spare some officers for said audit.

A.8. Installation of PLCC in transmission lines and protection audit of substations in J&K(UT) control area (Agenda by NRLDC)

8.1 NRLDC representative highlighted that Frequent events of multiple elements tripping leading to load loss has been observed in J&K (UT) control area. Majorly affected substation are 220kV Ziankote, Udhampur, Barn, Hiranagar, Alusteng, Jammu(Gladini) & Pampore. Details of tripping events occurred at aforementioned sub stations during period of May'22-Dec'22 were enclosed in Annexure-1 of agenda. Such frequent grid events are very detrimental to the safety and security of the state grid as well as to that of regional and national grid.

8.2 He stated that issues which need to be addressed for remedial actions to minimize the frequency of tripping and its extent are as followed:

- PLCC with carrier aided protection in most of the 220kV lines owned by PDD are not functional due to which A/R does not operate during single phase to earth fault. Besides, carrier aided accelerated clearance of fault is also not possible.
- Protection system are also not well coordinated with remote substations. During most of the tripping event, delayed clearance of fault also observed. Hence, reviewing of protection settings of transmission elements at J&K(UT) substations and ensuring its optimal coordination with the nearby substation is need to be ensured.

8.3 It was informed that most of the J&K (UT) 220kV substations are connected to ISTS network via POWERGRID (NR-2) substations. Hence, POWERGRID may assist PDD J&K in resolving above mentioned protection system related issue. Protection audit of 220/132kV substations in J&K(UT) control area may also be conducted. An early action for

resolving the above mentioned issues is earnestly solicited from PDD J&K, for reliable operation of J&K power system.

8.4 J&K representative informed that in next financial year, work of installation of OPGW in all the transmission lines will be started and follow-up actions are being done regarding the same. He stated that OPGW work will be followed by installation of PLCC. He will also take follow-up action to conduct protection audit of J&K S/s with the help of POWERGRID. He assured to check & correct the protection settings at frequently affected S/s.

A.9. Tripping Events (Agenda by NRLDC)

Detailed presentation of NRLDC and presentation submitted by different entities is attached at **Annexure-1.**

The discussion and recommendations of PSC are as follows:

A. Multiple elements tripping at 400/220kV Muzaffarnagar(UP) Station at 05th May 2022, 00:35 hrs

1. Discussion during the meeting:

a. **NRLDC representative raised following points during the meeting:**

- As per SOE, CB of 220kV Muzaffarnagar-Charla ckt opened within time. Exact location and nature of fault?
- As per PMU, fault cleared after approx 5sec. Such high delayed clearance of fault affects reliability and security of grid. Reason of delayed clearance of fault needs to be investigated and to be shared.
- If CB of 220kV Muzaffarnagar-Charla ckt got stuck, then why did LBB didn't operate?
- Whether distance protection (Z-2 or Z-3) initiated from remote end of 220kV lines? If not operated, then same needs to be analysed and corrective action to be taken wherever necessary.
- SCADA data of 400/220kV was suspected during the event. MW flow of 400/220kV ICTs and 220kV lines for around 10min duration during the event may be shared for analysis.
- On which protection 400/220 kV 315 MVA ICT 3 at Muzaffarnagar(UP) had tripped? And why was delay of around 2sec between tripping of ICT 3 with ICT 1 & ICT 2?
- 132kV lines to Purquazi, jolly Road1 and Jenseth also tripped during the event. Reason of tripping of these lines to be shared.
- Remedial action taken report to be shared.

b. **UPPTCL representative and others informed the following:**

- B ph pole of CB of 220 kV MZN -CHARLA line damaged at 400 kV MZN end during the fault.
- Later fault cleared with the tripping of ICTs on back up O/C E/F.
- Due to overloading on ICTs (ICT1, ICT2, ICT3), 132 kV Purkaji, 132 kV Bhopa road, 132 kV jolly road1 ,220 kV lines Janshat and Shamli line tripped on SPS operation.

- LBB protection also didn't operate. After checking logic and settings of 220 kV Bus Bar & according to relay engineer, breaker status was disserted (open) So LBB didn't operate. Scheme and logics of Bus bar relay need to be checked by Engineer (SEL BUS BAR relay Engineer)
- 220 kV MZN-NARA and 220 kV MZN-Modipuram line were opened manually from MZN end.
- 220 kV MZN-Badhaikalan, 220 kV MZN-Modipuram lines were tripped from remote end also.

2. *PSC Recommendations:*
   a. *Scheme and logic of the bus bar relay needs to be corrected as soon as possible. UP assured that this point would be attended up to Jan-2023.*
   b. *The problem of faulty time sync in protection relays of UP control area is coming up frequently during tripping analysis. UP assured to take some concrete action in this regard and will intimate the same to NRLDC and NRPC.*
   c. *UP was requested to report SPS operations in its control area promptly to NRLDC for onward analysis at NRLDC end. UP assured for the same in future.*

B. Multiple element tripping at 220kV Hissar (BBMB) & 220kV Hissar IA(HV) at 10-May-2022 16:09 hrs

1. Discussion during the meeting:
   a. NRLDC representative raised following points during the meeting:

- As per PMU, Y-ph fault which later converted into three phase fault and same was cleared with delay of 840ms. Exact location and nature of fault to be shared and reason of delayed clearance of fault also to be shared.
- Why did 220kV Hissar IA-Masudpur ckt-1 & 2 and 220kV Hissar IA-Narwana ckt-1 not trip from Hissar IA end?
- Why did bus bar protection operate at Hissar(BBMB) end operate as fault was at 220kV Hissar IA(Har) substation?
- CB status of tripped elements from Hissar(BBMB) is not available with NRLDC. Availability of same needs to be ensured.
- Remedial action taken report to be shared.
- DR not received from BBMB end.
- Time sync issue at Hissar_IA end.

   b. BBMB representative and others informed the following:
   As reported at 16:09 Hrs, Bus fault occurred due to bursting of Y-Ph CT of 220 KV Hissar(BB)-Hissar IA(HV) (HVPNL) Ckt-1 at Hissar IA end. During same time, bus bar protection at Hissar_BB operated which resulted into tripping of all 220kV lines i.e, 220 KV Hissar(BB)-Chirawa(RS) (BB) Ckt-1, 220 KV Hissar(BB)-Jindal Steel(HR)

(HVPNL) Ckt-1, 220 KV Hissar-Sangrur (BB) Ckt-1 & Ckt-2, 220 KV Bhiwani-Hissar (BB) Ckt-2, 220 KV Hissar(BB)-Hissar IA(HV) (HVPNL) Ckt-1 & Ckt-2. At the same time, 220 KV Hissar(PG)-Hissar IA(HV) (PG) Ckt-1 & Ckt-2 also tripped from Hissar IA end and 220kV Hissa IA-Masudpur ckt-1 & Ckt-2, 220kV Hissa IANarwana ckt-1 tripped from remote end only.

2. *PSC Recommendations:*
   a. *BBMB and Haryana were requested to coordinate and replace distance protection on line Hissar (BB)-Hissar IA (HV) with Differential protection.*
   b. *BBMB was requested to send DR and event logger along with tripping report promptly for every tripping to NRLDC within time stipulated as per IEGC.*

C. Multiple elements tripping at 400/220kV Greater Noida(UP) at 20th May 2022, 22:46 hrs

1. Discussion during the meeting:

a. NRLDC representative raised following points during the meeting:

- Reason of delayed clearance of fault in 220kV Gr. Noida- RC green ckt ?
- DR of 220kV Gr. Noida- RC green ckt need to be shared.
- Proper operation of A/R need to be ensured.
- As per concerned field officer 220kV Noida 129-Noida 148 line tripped at the same time which needs to be analysed. DR of the same need to be shared.
- Remedial action taken report to be shared.

b. UPPTCL representative and others informed the following:

As per information received from Executive Engineer (T&C) Gr. Noida, R-N fault occurred on 220kV Gr. Noida-RC Green ckt.-I. Auto Recloser attempt was taken by circuit breaker and got unsuccessful due to persistent fault. After this, relay did not issue 3 phase tripping command. Due to this all ICTs at 400kV Gr. Noida tripped on E/F protection. As per PMU, R-B double phase to earth fault with delayed clearance in 1280ms is observed. As per SCADA, change in load of approx. 750MW observed in UP control area.

2. PSC Recommendations:

a. Distance protection relay (CSC make) of 220kV Gr. Noida-RC Green ckt. -I am susceptible to faulty operation and needs to be changed. UP assured, that correspondence for the same has already been done with transmission wing and it will be replaced shortly.

b. Follow-up actions for the same may be intimated by UP.

D. Multiple element tripping at 220kV Simbholi (UP) at 20th Oct 2022, 10:17 hrs

1. Discussion during the meeting:

NRLDC representative raised following points during the meeting:

- LBB initiation wiring of two Nos of 220 kV feeders at Simbholi S/s (220 kV Simbholi - Hapur ckt & 220 KV Simbholi -765 kV Hapur ckt-I) was found defective.
- LBB operation testing is also required on other 220 feeders for ens uring smooth functioning of protection system, same will be done b y availing shutdown of remaining feeders one by one.
- Healthiness of protection system needs to be ensured. Routine tes ting of protecton system need to be done.

UPPTCL representative and others informed the following:

As reported at 10:17 hrs, BN phase to earth fault occurred on 220kV Ha purSimbholi (UP) ckt due to damage of polymer insulator of line, fault di stance was 54.19km & ~5km and fault current was 2.4kA & 9.8kA from Simbholi & Hapur end respectively.

On this fault, distance protection operated at both ends. Line tripped fro m Hapur end but due to failure of mechanical mechanism of breaker at Simbholi end, Bph pole of breaker got stuck and hence line didn't trip fr om Simbholi end. As breaker of 220kV HapurSimbholi (UP) ckt at Si mbholi end didn't open, LBB of this CB operated. However, due to defective wiring between busbar protection & LBB line protection ,the CBF (Circuit Breaker Failure) initiation wasn't detected by bus bar protection and busbar could not operate. Hence, all 220 kV lines emanating from Simbholi S/s tripped from remote end in zone 2. As per PMU, BN phase to earth fault with delayed clearance in 640msec is obs erved.

As per SCADA, change in demand of approx. 50MW is Observed in UP control area.

2. PSC Recommendations:
   a. *UP intimated that protection audit of 220 kV Simbholi substation was carried out in 2020 and no audit has been there since then. MS, NRPC stressed on the point that protection audit of each substation is very important and should be conducted regularly without any fail.*
   b. *On issue of carrier fail alarm coming in 220 kV NAPP – Simbholi line. UP expressed that testing has been done and LMU has been found to be faulty. New LMU has been received at site and will be replaced up to 31.12.2022.*

E. Multiple elements tripping at 220kV Dhauliganga at 15th Jun 2022, 10:19 hrs

1. Discussion during the meeting:

NRLDC representative raised following points during the meeting:

- What is the over current protection setting of 132kV Pithoragarh-Almora ckt?
- Dhauliganga (NHPC) may share the event logger details of SPS operation.
- Remedial action taken report to be shared.

NHPC representative and others informed the following:

In antecedent condition, 70MW Dhauliganga Unit-3 & 4, 220kV Dhauliganga-CB Ganj ckt (carrying 110MW) were connected to 220kV Bus-1 at Dhauliganga HEP and 70MW Dhauliganga Unit-1 & 2, 220kV Dhauliganga – Pithoragarh ckt (carrying 167MW) were connected to 220kV Bus-2 at Dhauliganga HEP. 220kV Pithoragarh- Almora ckt was carrying 67MW during antecedent condition. At 10:18:52:990 (as per SOE), 220kV Pithoragarh-CB Ganj ckt was opened to avail shutdown. At the same time, oscillations also observed (as per PMU plot of frequency and voltage at Pithoragarh). With the opening of 220kV Pithoragarh-CB Ganj ckt, MW loading of 220kV Dhauliganga-CB Ganj ckt & 220kV Pithoragarh- Almora ckt rose to 145MW & 137MW respectively (as per SCADA). Further after approx. 16secs, at 10:19:09:161(as per SOE,), 132kV Pithoragarh- Almora ckt tripped on over current protection. (approx. loading during antecedent condition was 137MW (~600A) as per SCADA. With the tripping of 132kV Pithoragarh- Almora ckt, path of evacuation of Dhauliganga generation from Pithoragarh side lost. Further after approx. 4secs at 10:19:13 (as per SOE), bus coupler breaker at Dhauliganga opened (on SPS operation) and 70MW Dhauliganga Unit-1 & 2 tripped on loss of evacuation path.

2. PSC Recommendations:

   a. *NRLDC representative pointed out that the network has changed now and SPS can be disabled now.*

F. Multiple Element tripping at 220 kV Hiranagar at 18:00 hrs of 29th Aug 2022

1. Discussion during the meeting:

NRLDC representative raised following points during the meeting:

- Why did R-N fault in 220kV Hiranagar-Ghatti ckt not clear in time? Reason of delayed clearance of fault?
- Which protection cleared the fault after ~760ms.
- Remedial action taken report to be shared.

NHPC and J&K representative along with others informed the following:

In antecedent condition, 220kV Sambha-Hirangar ckt-1 & Ckt-2 was carrying 79MW & 75MW respectively and 40MW Unit-1, 2 & 3 at Sewa-2 HEP were carrying 30 MW, 21MW & 30MW respectively.

As reported at 18:00hrs, R-N phase to earth fault occurred in 220kV Hiranagar-Ghatti ckt, fault distance was ~8.45km & fault current was 7.38kA from Hiranagar end. As per PMU at Sambha(PG), R-N phase to earth fault with delayed clearance in 760ms is observed.

CB of 220kV Hiranagar-Ghatti ckt didn't open on this fault and after approx. 750ms other 220kV feeders at Hiranagar tripped and 220kV side of Hiranagar S/s became dead. 220kV Sambha-Hirangar ckt-1 tripped from both end & DT received at Sambha(PG) end and 220kV Sambha-Hirangar ckt-2 tripped from Hiranagar end only.

As 220kV side of Hiranagar S/s became dead, island formed with Sewa-2 HEP generation & load at 132kv side of 220/132 Hiranagar(J&K). However, further after approx. 2secs, all three (03) 40MW units of Sewa-2(NHPC) tripped on over current protection operation and 132kV side of Hiranagar S/s also became dead due to loss of power supply.

As per SCADA, load loss of approx. 250MW observed in J&K control area & generation loss of approx. 80MW is observed at Sewa-2(NHPC) HEP.

2. PSC Recommendations:

   a. *J&K representative informed that bus-bar protection would be made operational at all the substations of JKPTCL by March-2023. NRLDC asked for detailed plan may please be shared.*
   b. *J&K was requested to carryout protection audit as soon as possible as protection system in J&K jurisdiction is having a number of serious issues and needs immediate audit and rectification. MS, NRPC also stressed for the immediate protection audit and instructed all to take promising steps for same.*

G. Multiple elements tripping at 400kV Alaknanda(UP) and 220 kV Singoli Bhatwari at 01:12 hrs of 23/08/2022

1. Discussion during the meeting:

NRLDC representative raised following points during the meeting:

- As all the Main CB & Tie CB tripped at Alaknanda end and as per LBB protection only Main CBs connected at 400kV Bus-2 should have tripped, what is the tripping logic implemented at 400kV Alaknanda on LBB protection? Tripping logic of LBB protection at 400kV Alaknanda needs to be reviewed.
- As per DR of 400 KV Alaknanda GVK(UPC)-Muzaffarnagar (UP) Ckt, line tripped after ~500ms of tripping command. Channel of LBB protection is also not available in DR. As time delay of LBB protection is 200ms, tripping of line after ~500ms need to be reviewed.
- As per SCADA SOE, 220 KV Singoli Bhatwari(Singoli(LTUHP))-Srinagar(UK) (PTCUL) Ckt-1 & Ckt-2 tripped within 2.5secs of tripping of 400 KV Alaknanda GVK(UPC)-Muzaffarnagar (UP) Ckt. In addition,

as per protection philosophy, minimum time delay for OV stage-1 protection is 5secs. Hence, OV stage-1 protection setting of aforementioned tripped lines on over protection need to be reviewed.

- DR, EL & tripping report of all the tripped elements need to be shared.
- Remedial action taken report to be shared.

Alaknanda representative and others informed the following:

400kV Alaknanda (UP) have one and half breaker bus scheme. During antecedent condition, 400 KV Alaknanda GVK(UPC)-Muzaffarnagar (UP) Ckt & 400 KV Alaknanda GVK(UPC)-Vishnuprayag(JP) (UP) Ckt were carrying 457MW & -85MW respectively. As reported, at 01:12hrs, R-N phase to earth fault occurred on 400 KV Alaknanda GVK(UPC)-Muzaffarnagar (UP) Ckt, fault distance was 20.3km & fault current was ~10.5kA from Muzaffarnagar end. As per PMU at Muzaffarnagar(UP), R-N phase to earth fault with delayed clearance in 680ms is observed. As per DR received of 400 KV Alaknanda GVK(UPC)-Muzaffarnagar (UP) Ckt, A/R operation started at Muzaffarnagar end but after approx. 500ms Y & B phase also tripped and at Alaknanda end, R-ph didn't open even after trip command was sent by relay, later three phase tripped after approx. 500ms. As informed by Alaknanda HEP, R-ph Main CB didn't open on tripping command by relay as it was stuck and later line tripped on LBB protection operation. At the same time, 400 KV Alaknanda GVK(UPC)-Vishnuprayag(JP) (UP) Ckt & 400kV Alaknanda-Sringar ckt-1 & Ckt-2 also tripped on LBB protection operation at Alaknanda end. Due to tripping of both the lines, all four (04) of 82.5MW units at Alaknanda HEP also tripped on loss of evacuation path.

At the same time, 220 KV Singoli Bhatwari(Singoli(HP))-Srinagar(UK) (PTCUL) Ckt-1 & Ckt-2 also tripped on over voltage stage-1 protection operation at Srinagar end followed by tripping of 33 MW Singoli Bhatwari HEP -UNIT 2 & 3 on loss of evacuation path. As per SCADA, change in load of approx. 25MW in Uttarakhand control area, loss in generation of ~342MW at Alaknanda HEP & ~72MW at Singoli Bhaywari HEP occurred.

2. <u>PSC Recommendations:</u>

   a. *GVK representative explained that they have different scheme in with main and tie circuit breakers open simultaneously in case of a fault. UPSLDC and NRLDC representative expressed that this scheme in itself defeats the purpose of having one and a half breaker scheme.*
   b. *GVK expressed that they have planned for third party protection audit through PRDC after which they will go for scheme modification. NRLDC requested for the detailed action plan along with progress report. GVK assured to share the same.*

c. *GVK was intimated that they are deviating from the already in place approved NR protection philosophy. MS, NRPC and NRLDC representative expressed that the required modifications can be done without going for any third party protection audit as the same can be carried out taking basis of the already approved protection philosophy in place. GVK agreed for the same and assured to go ahead with the modification without waiting for the third party protection audit from PRDC side.*

H. Multiple elements tripping at 400/220 kV Muradnagar_2(UP) on 07th Sep 2022 at 21:25 hrs

1. Discussion during the meeting:

NRLDC representative raised following points during the meeting:

- Mechanical healthiness of CBs need to be ensured.
- As fault was in 400 KV Muradnagar_2-Mathura (UP) Ckt, why did bus bar protection of bus -2 operate?
- DR submitted of Muradnagar_2 end are not time sync. Time sync of DR needs to be ensured.
- Remedial action taken report to be shared.

UP representative and others informed the following:

400/220kV Muradnagar_2(UP) have one & half breaker bus scheme at 400kV side. During antecedent condition, 400kV line to Mathura & Dadri(NTPC) were connected to 400kV Bus-1 and 400/220kV 240MVA ICT-1 & 3, 400/220kV 315MVA ICT-2 and 63MVAr bus reactor were connected at 400kV bus-2.

At 21:25:51hrs, B-N phase to earth fault occurred on 400 KV Muradnagar_2-Mathura (UP) Ckt, fault distance & fault current was ~60km & ~3.9kA from Muradnagar_2(UP) end and ~79km & ~3.2kA from Mathura end. As per PMU at Dadri Thermal(NTPC), B-N phase to earth fault with delayed clearance in 320ms is observed.

On this fault, line CB from Mathura end and Tie CB at Muradnagar_2 end opened but Main CB at Muradnagar_2 end didn't open. As Main CB at Muradnagar_2 end of 400 KV Muradnagar_2-Mathura (UP) Ckt didn't open, its LBB operated and all the Main CBs connected at 400kV Bus-1 opened. At the same time, Bus bar protection of 400kV Bus-2 at Muradnagar_2(UP) also operated. As reported, current in PU1 & PU2 of 400/220kV 240MVA ICT-3 increased which led to the operation of bus bar-2 protection. As both the 400kV Bus tripped, 400kV Muradnagar_2(UP) became dead. As per SCADA, no change in demand of UP is observed.

2. PSC Recommendations:

a. *Control room staff to be sensitized to intimate SLDC and maintenance staff if any critical alarms such as circuit breaker lockout, Busbar out of service etc. are observed.*
b. *UP representative assured that issues related to time sync at Muradnagar station have been taken up and will be solved.*
c. *NRLDC representative requested to send DRs in native .cfg and .dat format.*
d. *UP requested to remove compulsory upload of pdf format in tripping portal. NRLDC representative agreed for the same.*

I. Multiple elements Tripping Incident at 220kV Khodri (Utt) on 06.10.22 at 02:27 hrs

1. Discussion during the meeting:

NRLDC representative raised following points during the meeting:

- Exact location and nature of fault?
- Reason of delayed clearance of fault?
- Why did 220 kV Saharanpur(UP) -Khodri (UK) (UP) Ckt-1 trip from Saharanpur end?
- On which protection 60MW unit-1, 2 & 4 at Khodri HEP had tripped?
- DR, EL of tripped elements & tripping report of the event need to be shared.
- Remedial action taken report to be shared.

UP and Uttarakhand representative and others informed the following:

As reported, at 02:27 hrs, 220 KV Sarsawan (UP)Khodri (UK) (UP) Ckt-1 tripped from both ends on BN phase to earth fault. Fault distance was ~52km from Khodri end. At the same time, 220 KV Saharanpur (UP) Khodri (UK) (UP) Ckt1 tripped from Saharanpur end only followed by tr ipping of 60MW unit1, 2 & 4 at Khodri HEP carrying total ~60MW.

As per PMU at Roorkee (PG), BN phase to earth fault with delayed clea rance in 1160ms is observed. As per SCADA, change of approx. 60MW in Uttarakhand generation is observed. Thus it can be concluded that the fault on the 220 kV Sarsawa – Khodri line was not cleared at Khodri end, which led to the further tripping of the 220 kV Saharanpur-Khodri line on DEF (backup) and three machines at Khodri.

2. PSC Recommendations:

a. *220 KV Saharanpur (UP) -Khodri (UK) (UP) Ckt-1, sharanpur end disturbance record is not getting triggered on DEF protection. UP representative assured to rectify the same and map DEF for trigger of DR.*

J. Multiple elements Tripping Incident at 220/132 kV Sitarganj on 17.07.22 at 20:27 hrs

1. Discussion during the meeting:

NRLDC representative raised following points during the meeting:

- Reason of delayed clearance of fault?
- Whether bus bar protection operated at 132kV Sitarganj(PG)?
- DR, EL & tripping report needs to be shared.
- Remedial action taken report to be shared.

Powergrid representative and others informed the following:

220/132kV Sitarganj(PG) substation feeds load of Uttarakhand through 132kV feeders. It is having three 220/132kV 100MVA ICTs. As reported, at 20:27hrs, one snake climbed on R-phase main bus isolator of 132kV Kichha line at Sitarganj. It caused R-ph bus fault at 132kV Sitarganj. As per PMU at CB Ganj(UP), R-N phase to earth fault with delayed clearance in 1080ms is observed. On this bus fault, three 132kV feeders to Sitarganj(PTCUL), three 220/132kV 100MVA ICTs at Sitarganj(PG) tripped and 132kV Sitarganj(PG) became dead. At the same time, 220 KV Tanakpur(NH)-Sitarganj(PG) (PG) Ckt-1 tripped on Z-3 distance protection operation fron tanakpur end and remained intact from sitarganj end. As per SCADA, load loss of approx. 55MW occurred in Uttarakhand control area. Sitarganj ICTs fed fault for 1.4 secs. PTCUL has kept reduced time in reverse zone in all elements as bus bar protection is not available at 132 kV sitarganj(PTCUL).

2. <u>PSC Recommendations:</u>

   a. *PTCUL representative was requested to take the issue of bus bar protection at 132 kV level. PTCUL informed that it has been included in upcoming budget and will take some time.*
   b. *As an interim measure, PTCUL was requested to install O/C relay as backup protection to take care of Bus faults. PTCUL agreed for the same and assured that O/C relay will be installed within a months' time.*

K. Multiple elements Tripping Incident at 400 kV Koteshwar on 04.09.22 at 17:37 hrs

1. <u>Discussion during the meeting:</u>

NRLDC representative raised following points during the meeting:

- As line length are very low (~2km) and both Main-1 & 2 relay are distance protection relay which many times led to overreach of protection, possibility of implementing differential protection can be explored as Main 1 or Main 2.
- Why did R-pole of 400 KV Koteshwar(TH)-Koteshwar(PG) (PG) Ckt-1 opened at Koteshwar(THDC) end after successful A/R operation? Issue with the same needs to be checked and corrected.
- Details of tripped elements at Koteshwar(THDC) end are not recorded in SCADA SOE. Availability of the same need to be ensured.
- Remedial action taken report to be shared.

THDC and Powergrid representative and others informed the following:

400 kV Koteshwar(THDC) & 400kV Koteshwar(PG) have double main transfer bus scheme. 400 KV Koteshwar(TH)-Koteshwar(PG) (PG) Ckt-1 & Ckt-2 is on same tower and line length are ~2km. During antecedent condition, 400 KV Koteshwar(TH)-Koteshwar(PG) (PG) Ckt-2 was connected at 400kV Bus-2 and 400 KV Koteshwar(TH)-Koteshwar(PG) (PG) Ckt-1, 100 MW Koteshwar HPS - UNIT 4 & 125 MVAR Bus Reactor No 1 were connected at 400kV Bus-1. As reported at 17:37hrs, B-ph LA at Koteshwar(THDC) end of 400 KV Koteshwar(TH)-Koteshwar(PG) (PG) Ckt-2 burst and line tripped. As per PMU at Koteshwar(PG), line tripped from Koteshwar(THDC) end after unsuccessful A/R operation. However, B-ph tripped at Koteshwar(PG) end with 440ms delay after A/R operation. At the same time, 400 KV Koteshwar(TH)-Koteshwar(PG) (PG) Ckt-1 tripped on pole discrepancy relay operation at Koteshwar(THDC) end. As per PMU at Koteshwar(PG), line successfully autoreclosed from both end and then R-ph tripped from Koteshwar(THDC) end. Further after 2sec, pole descripency relay operated at Koteshwar(THDC) end and line tripped. Due to tripping of both the evacuating lines, 100 MW Koteshwar HPS - UNIT 4 also tripped. As per SCADA, change in generation of approx. 100MW at Koteshwar HEP is observed. Powergrid and THDC informed that proposal for replacing distance protection with differential protection in 400 Koteshwar(PG) – Koteshwar(THDC) line is already approved and the work will be completed soon.

2. PSC Recommendations:
    a. *The work of replacement of distance protection with differential protection may be taken up on fast pace.*

L. Multiple elements Tripping Incident at 765 kV Fatehgarh2 (PG) on 17.09.22 at 10:14 hrs

1. Discussion during the meeting:

NRLDC representative raised following points during the meeting:

- Why did 220 KV Fatehgarh_II (PG)-AHEJ3L PSS HB_FGRAH_PG (AHEJ3L) (AHEJ3L) Ckt-1 trip?
- DR, EL & tripping report need to be shared.
- Remedial action taken report to be shared.

POWERGRID representative and others informed the following:

At 10:14:29:840hrs, R-N phase to phase fault occurred on 220kV Fatehgarh2- AHEJ2L ckt due to blast of R-ph CT at Fatehgarh2 end. As per PMU, R-N phase to earth fault which cleared within 120ms is observed. On this fault, 220 KV Fatehgarh_II (PG)-AHEJ2L PSS HB_FGRAH_PG (AHEJ2L) (AHEJ2L) Ckt-1 tripped. At the same time,

220 KV Fatehgarh_II (PG)-AHEJ3L PSS HB_FGRAH_PG (AHEJ3L) (AHEJ3L) Ckt-1 tripped from AHEJ3L end only. Due to tripping of aforementioned lines, RE generation of AHEJ2L & AHEJ3L total 560MW lost. During the fault, phase voltage at other RE stations went below 0.85pu. As voltage dropped below 0.85pu, almost all the RE stations dropped their MW on LVRT operation. However, active power (MW) of few of the RE stations didn't recover after clearance of fault within defined time (as per LVRT). As per SCADA, total drop in solar generation of approx. 1566MW (including AHEJ2L & AHEJ3L generation) is observed during the event.

Due to significant drop in MW, rise in voltage is observed at ISTS RE pooling stations and further after 5sec, 765 KV Fatehgarh_II(PG)-Bhadla(PG) (FBTL) Ckt-1 tripped from Bhadla end on over voltage stage-1 protection.

2. PSC Recommendations:
    b. The protection system operated as desired and no anomalies were observed as such.

No representatives were present from Rajasthan, Haryana and Punjab state and Member secretary NRPC took serious concern of the same and expressed that due to their absence many events could not be discussed. He instructed to take up remaining trippings in upcoming OCC meeting.

MS, NRPC also stated that protection sub-committee is a very important forum wherein active participation from all members is necessary. This forum is an opportunity to get guidance and information sharing to adopt best practices across the utilities.

As approved in 39th PSC meeting, NRPC suggested all the utilities to prepare the presentation for all the tripping events for deliberation in PSC meeting. Representative from the utilities shall collect all the information for its control area and share the details. At least one representative from each SLDC shall also be present during the meeting.

NRLDC representative informed that Event closing information (Remedial measures taken and to be taken along with completion time) yet to be reported for most of the tripping discussed in PSC meetings. Utilities should submit the event closing information to the NRPC/ NRLDC in stipulated time frame approved in various PSC meeting.

MS, NRPC also expressed concern about non-submission of event closing information by the utilities despite of discussion in various PSC meeting and suggested to all the NR utilities for timely submission of the information.

It was decided that all the NR utilities shall share the Event closing information (Remedial measures taken and to be taken along with completion time) for last three PSC (44th PSC meeting onwards) meetings. Follow up will be taken

separately in next PSC meeting. The final report shall also be uploaded on the tripping portal by the constituents preferably within a fortnight.

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Multiple elements tripping at 400 KV Koteshwar (THDC)

04.09.2022 at 17:37 Hrs

Antecedent Condition and Tripped Elements

Antecedent Condition:-

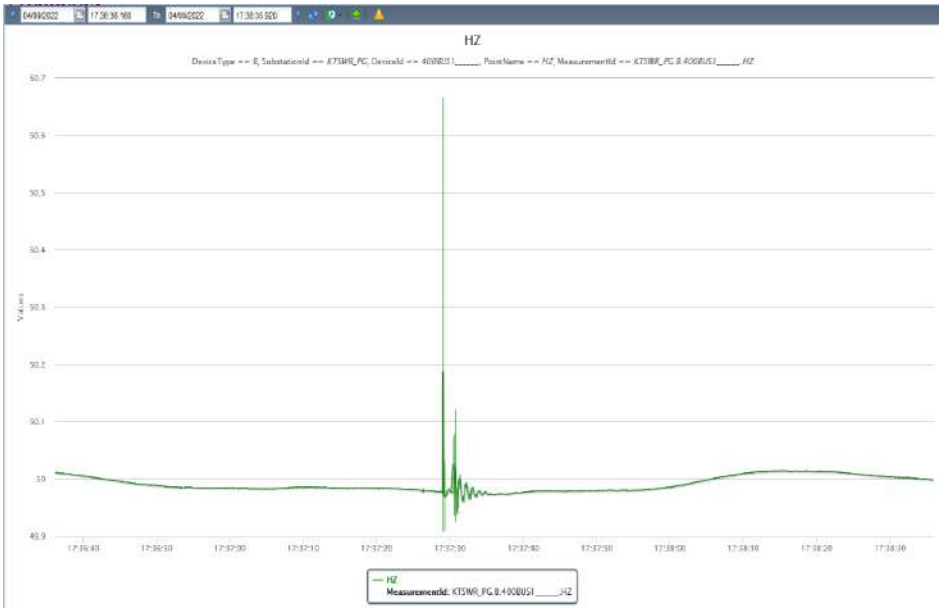
- NR Generation: 53078 MW
- NR Load: 68147 MW
- Frequency: 49.98 Hz
- Voltage (Koteshwar): 414KV
- weather: Normal condition
- Generation loss: 90 MW
- Duration of interruption: Approx. 200 minutes

Following elements tripped:-

1. 125 MVAR Bus Reactor No 1 at 400KV Koteswar(TH)
2. 400 KV Koteswar(TH)-Koteshwar(PG) (PG) Ckt-1
3. 400 KV Koteswar(TH)-Koteshwar(PG) (PG) Ckt-2
4. 100 MW Koteshwar HPS - UNIT 4

PMU Plot of frequency at Koteshwar(PG)

17:37hrs/04-Sept-22

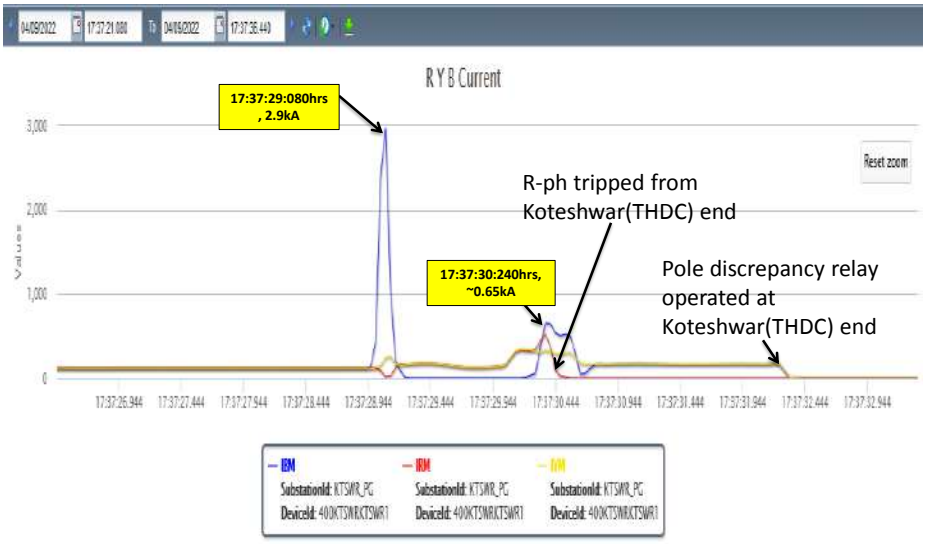


PMU Plot of phase voltage magnitude at Koteshwar(PG)

17:37hrs/04-Sept-22

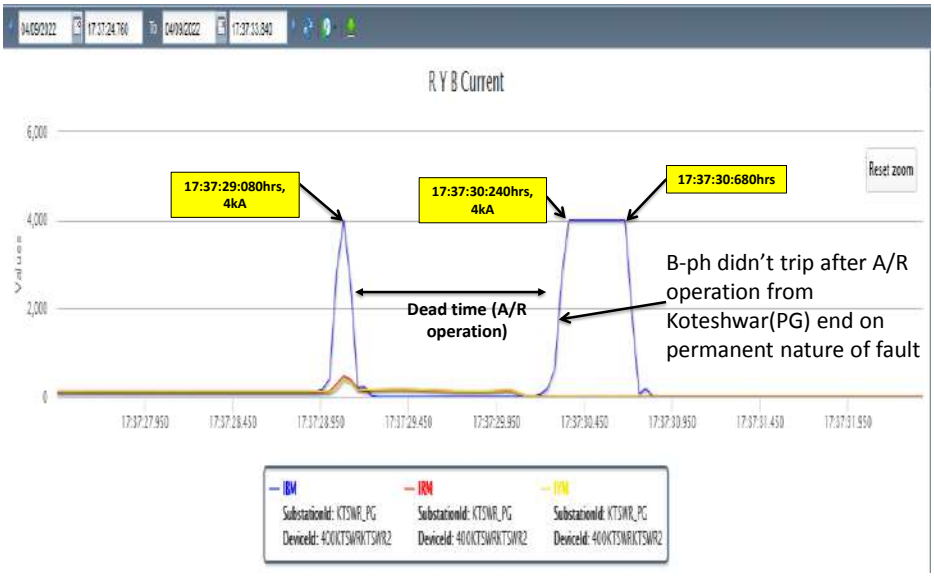
PMU Plot of phase current magnitude of 400kV Koteshwar(PG)(end)-Koteshwar (THDC) ckt-1

17:37hrs/04-Sept-22

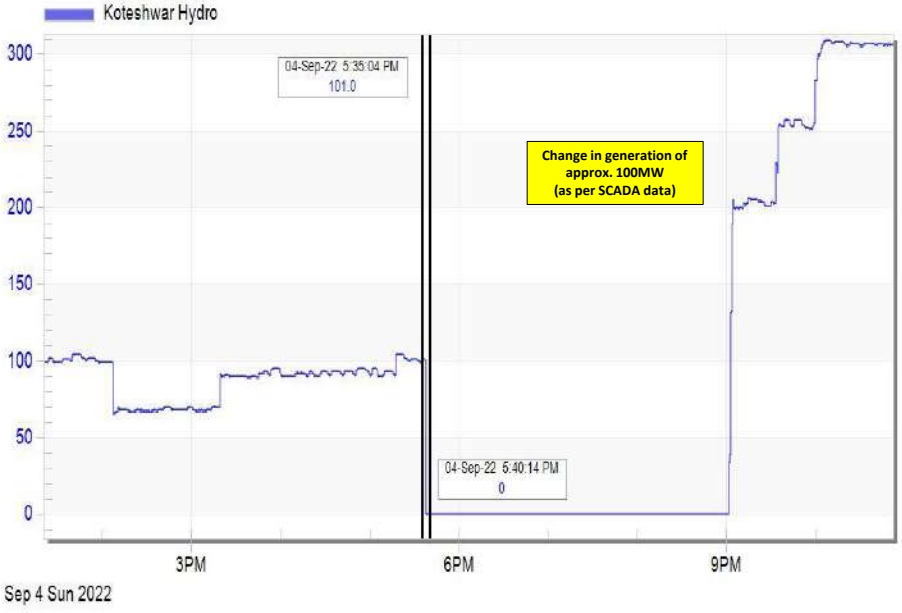


PMU Plot of phase current magnitude of 400kV Koteshwar(PG)(end)-Koteshwar (THDC) ckt-2

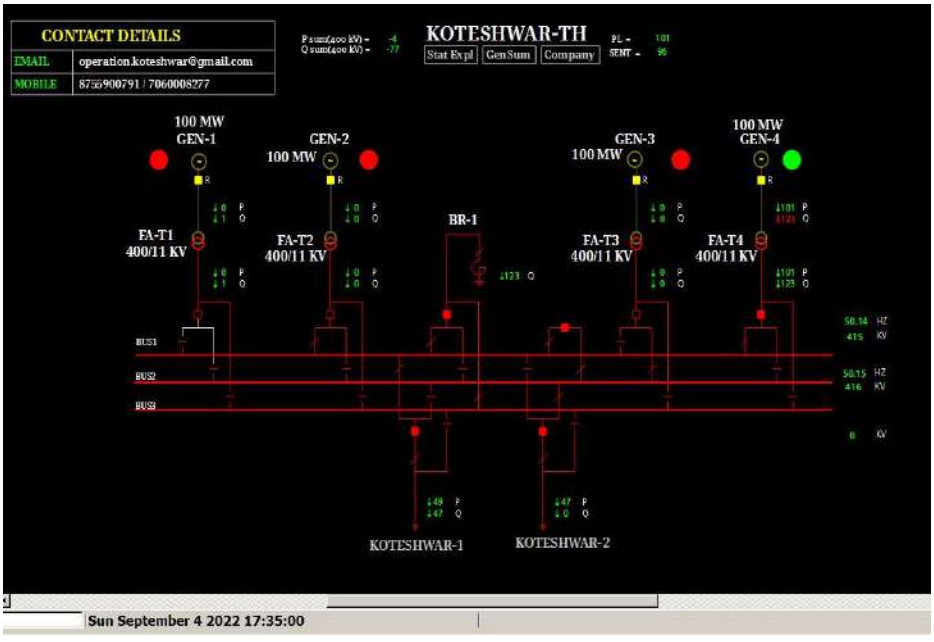
17:37hrs/04-Sept-22



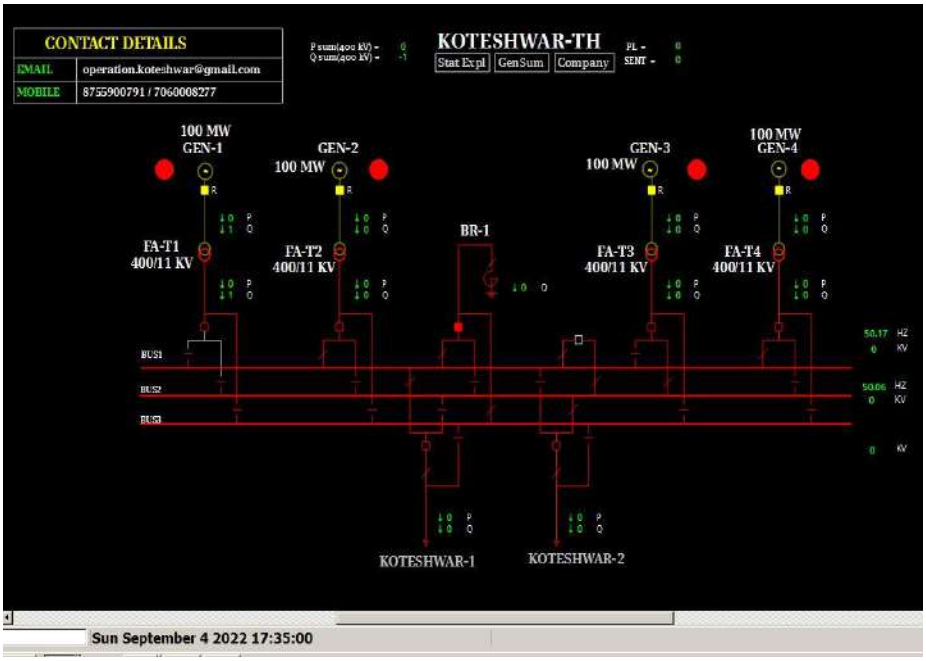
Koteshwar HEP generation during the event



SLD of 400kV Koteshwar(PG) before the event



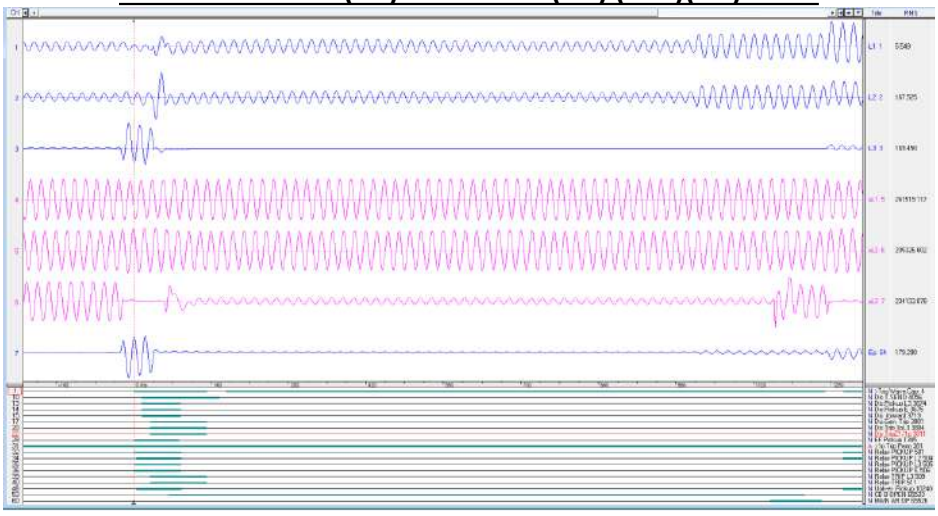
SLD of 400kV Koteshwar(PG) after the event



SCADA SOE

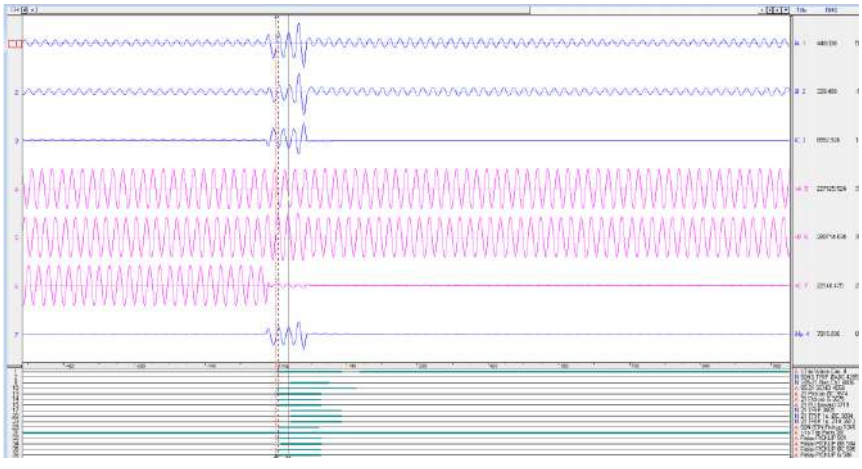
Time	Station Name	Voltage	Element Name	Element Type	Element Status	Remark
17:37:29,111	KOTESHWAR	400kV	08TH2	Circuit Breaker	disturbe	
17:37:29,114	KOTESHWAR	400kV	07TH1	Circuit Breaker	disturbe	
17:37:30,324	KOTESHWAR	400kV	08TH2	Circuit Breaker	Close	Line CB at Koteshwar(PG) end of 400 KV Koteswar(TH)-Koteshwar(PG) (PG) Ckt-2 closed (A/R operation)
17:37:30,327	KOTESHWAR	400kV	07TH1	Circuit Breaker	Close	Line CB at Koteshwar(PG) end of 400 KV Koteswar(TH)-Koteshwar(PG) (PG) Ckt-1 closed (A/R operation)
17:37:30,714	KOTESHWAR	400kV	08TH2	Circuit Breaker	Open	Line CB at Koteshwar(PG) end of 400 KV Koteswar(TH)-Koteshwar(PG) (PG) Ckt-2 opened

400 KV Koteswar(TH)-Koteshwar(PG) (End)(PG) Ckt-1



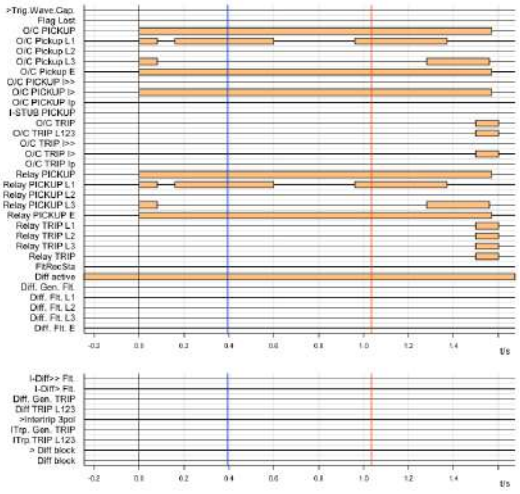
1. B-phase to earth fault in Zone-1 evident.
2. AR attempted and seems to be successfully completed from this end.
3. Current became zero in R-phase after AR.
4. Powergrid Analysis
5. Koteshwar HEP end DR

400 KV Koteswar(TH)-Koteshwar(PG) (End)(PG) Ckt-2



1. B-phase to earth fault in Zone-1 evident.
2. AR attempted.
3. Current again increasing to 13 kA in reclaim time.
4. Koteshwar HEP end DR.
5. Koteshwar HEP end SOE

Koteshwar HEP Unit-4 DR



1. Tripped on O/C
2. Unit – 4 SOE

Observations

Analysis of tripping (As reported):

- 400kV Koteshwar(THDC) & 400kV Koteshwar(PG) have double main transfer bus scheme. 400 KV Koteshwar(TH)-Koteshwar(PG) (PG) Ckt-1 & Ckt-2 are on same tower and line length are ~2km.
- During antecedent condition, 400 KV Koteshwar(TH)-Koteshwar(PG) (PG) Ckt-2 was connected at 400kV Bus-2 and 400 KV Koteshwar(TH)-Koteshwar(PG) (PG) Ckt-1, 100 MW Koteshwar HPS - UNIT 4 & 125 MVAR Bus Reactor No 1 were connected at 400kV Bus-1.
- As reported at 17:37hrs, B-ph LA at Koteshwar(THDC) end of 400 KV Koteshwar(TH)-Koteshwar(PG) (PG) Ckt-2 burst and line tripped. As per PMU at Koteshwar(PG), line tripped from Koteshwar(THDC) end after unsuccessful A/R operation. However, B-ph tripped at Koteshwar(PG) end with 440ms delay after A/R operation.
- At the same time, 400 KV Koteshwar(TH)-Koteshwar(PG) (PG) Ckt-1 tripped on pole discrepancy relay operation at Koteshwar(THDC) end. As per PMU at Koteshwar(PG), line successfully autoreclosed from both end and then R-ph tripped from Koteshwar(THDC) end. Further after 2sec, pole descripency relay operated at Koteshwar(THDC) end and line tripped.
- Due to tripping of both the evacuating lines, 100 MW Koteshwar HPS - UNIT 4 also tripped.
- As per SCADA, change in generation of approx. 100MW at Koteshwar HEP is observed.

Points of concern:

- As line length are very low (~2km) and both Main-1 & 2 relay are distance protection relay which many times led to overreach of protection, possibility of implementing differential protection can be explored as Main 1 or Main 2.
- Why did R-pole of 400 KV Koteshwar(TH)-Koteshwar(PG) (PG) Ckt-1 opened at Koteshwar(THDC) end after successful A/R operation? Issue with the same needs to be checked and corrected.
- Details of tripped elements at Koteshwar(THDC) end are not recorded in SCADA SOE. Availability of the same need to be ensured.
- Remedial action taken report to be shared.

Multiple elements tripping at 400/220kV Muradnagar_2(UP)

07-Sep-2022 21:25

Antecedent Condition and Tripped Elements

Antecedent Condition:-

- Grid Frequency (Hz) 49.97
- Total IR Import (MW) 18055
- Northern Region Demand (MW) 72226
- Type of fault - Line to ground
- Fault clearing time – 320 ms
- Faulted Phase - B-N

Following elements tripped:-

1. 400/220 kV 240 MVA ICT 3 atMuradnagar_2(UP)
2. 400 KV Muradnagar_2-Mathura (UP) Ckt-1
3. 400 KV Dadri(NT)-Muradnagar_2(UP) (PG) Ckt-1
4. 400KV Bus 2 at Muradnagar_2(UP)
5. 400/220 kV 240 MVA ICT 1 atMuradnagar_2(UP)
6. 400/220 kV 315 MVA ICT 2 atMuradnagar_2(UP)
7. 400KV Bus 1 at Muradnagar_2(UP)

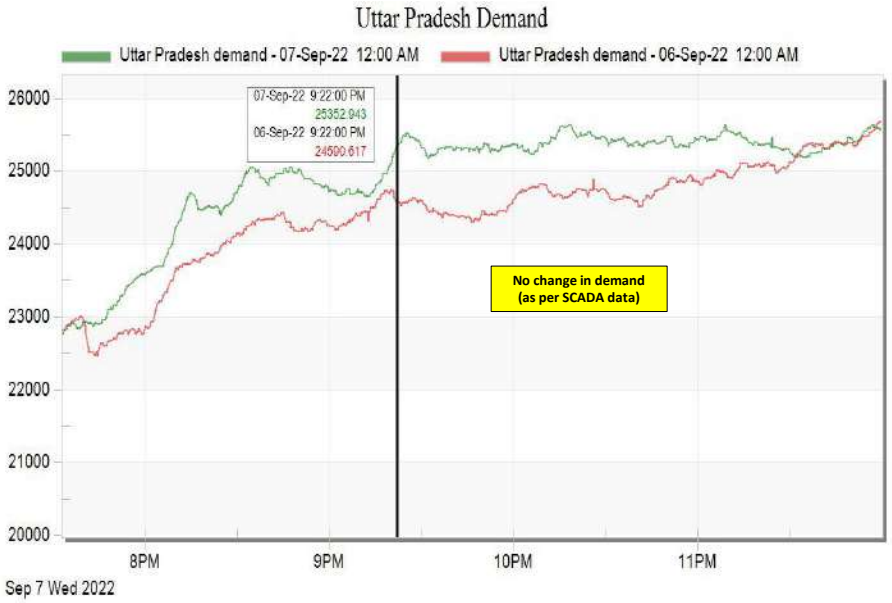
PMU Plot of frequency at Dadri Thermal(NTPC)

21:25hrs/07-Sept-22

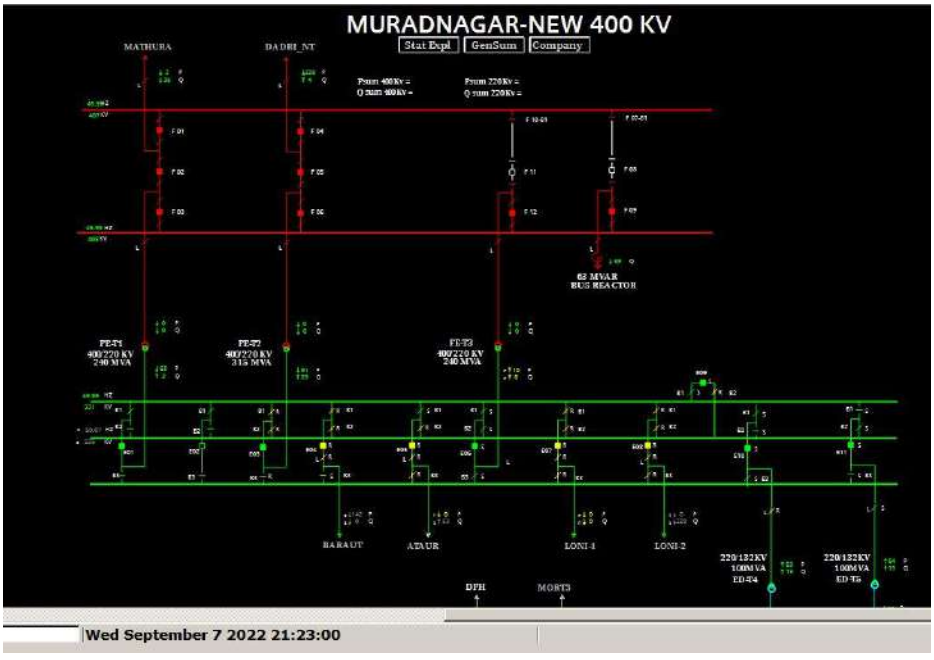
PMU Plot of phase voltage magnitude at Dadri Thermal(NTPC)

21:25hrs/07-Sept-22

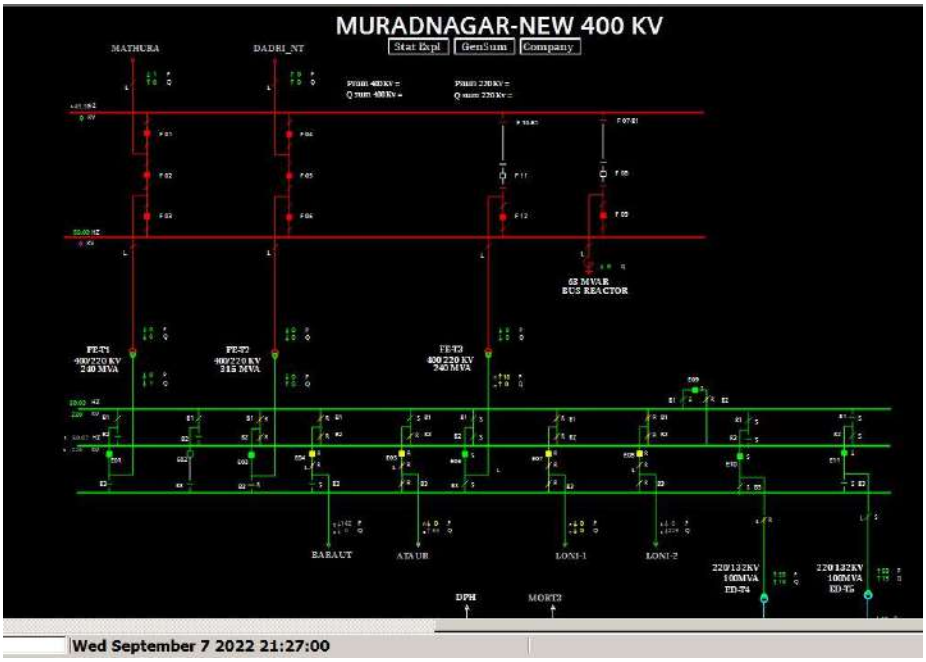
Uttar Pradesh demand during the event



SLD of 400/220kV Muradnagar_2(UP) before the tripping



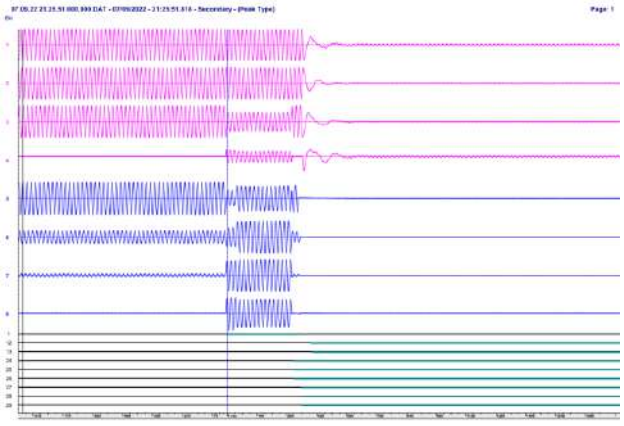
SLD of 400/220kV Muradnagar_2(UP) after the tripping



SCADA SOE

Time	Station Name	Voltage	Element Name	Element Type	Element Status	Remark
21:25:51,906	MTHRA_U	400KV	09MURN1	Circuit Breaker	Open	Line CB at Mathura end of 400 KV Muradnagar_2-Mathura (UP) Ckt opened
21:25:51,950	MURADNAGAR-1	400KV	02T1MTHR	Circuit Breaker	Open	Tie CB at Muradnagar-2 end of 400 KV Muradnagar_2-Mathura (UP) Ckt opened
21:25:52,149	MURADNAGAR-1	400KV	04DTHM	Circuit Breaker	Open	Main CB at Muradnagar-2 end of 400 KV Dadri(NT)-Muradnagar_2(UP) (PG) Ckt opened
21:25:52,153	MURADNAGAR-1	400KV	06T2	Circuit Breaker	Open	Main CB at 400kV side of 400/220 kV 315 MVA ICT 2 at Muradnagar_2(UP) opened
21:25:52,159	MURADNAGAR-1	400KV	12T3	Circuit Breaker	Open	Main CB at 400kV side of 400/220 kV 240 MVA ICT 3 at Muradnagar_2(UP) opened
21:25:52,160	MURADNAGAR-1	400KV	09BR	Circuit Breaker	Open	
21:25:52,166	MURADNAGAR-1	400KV	03T1	Circuit Breaker	Open	Main CB at 400kV side of 400/220 kV 240 MVA ICT 1 at Muradnagar_2(UP) opened
21:25:52,193	MURADNAGAR-1	220KV	01T1	Circuit Breaker	Open	CB at 220kV side of 400/220 kV 240 MVA ICT 1 at Muradnagar_2(UP) opened
21:25:52,194	DADRI (TH)	400kV	11MURPA1	Circuit Breaker	Open	Tie CB at Dadri Thermal end of 400 KV Dadri(NT)-Muradnagar_2(UP) (PG) Ckt opened
21:25:52,195	MURADNAGAR-1	400KV	05T2DTHM	Circuit Breaker	Open	Tie CB at Muradnagar-2 end of 400 KV Dadri(NT)-Muradnagar_2(UP) (PG) Ckt opened
21:25:52,196	DADRI (TH)	400kV	10MURN1	Circuit Breaker	Open	Main CB at Dadri Thermal end of 400 KV Dadri(NT)-Muradnagar_2(UP) (PG) Ckt opened
21:25:52,239	MURADNAGAR-1	220KV	03T2	Circuit Breaker	Open	CB at 220kV side of 400/220 kV 315 MVA ICT 2 at Muradnagar_2(UP) opened

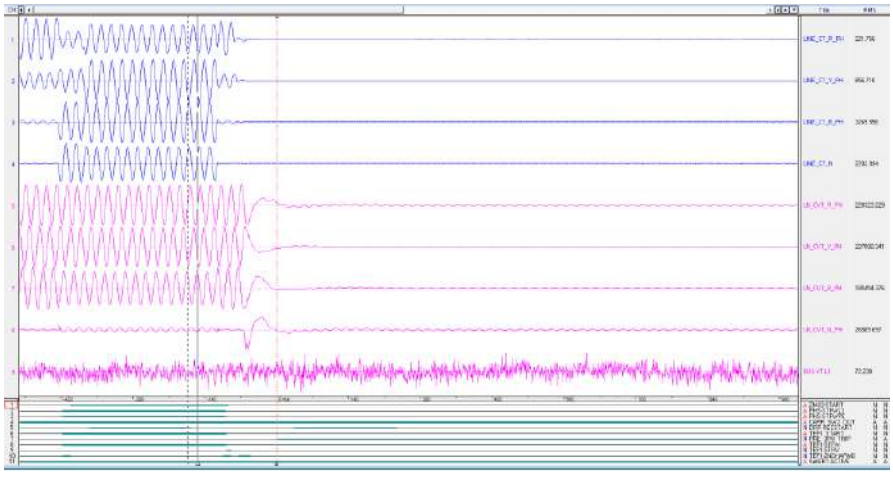
400 KV Dadri(NT)-Muradnagar_2(UP)(End) (PG) Ckt-1



1. Fault in B-phase evident.
2. Which protection operated not clear.

```
* Events/Sensors Activity Summary:
* -------------------------------
>Fst  Lst  Fst-Change          Lst-Change          Changes   Description
  N    N    21:25:51.817600   21:25:52.190833   004         1-Any Start
  N    N    21:25:52.209181   xx:xx:xx.xxxxxx   001        12-Any Pole Dead
  N    N    21:25:52.215853   xx:xx:xx.xxxxxx   001        13-All Pole Dead
  N    N    21:25:52.132482   xx:xx:xx.xxxxxx   001        24-L1 CB OPEN R PH
  N    N    21:25:52.132482   xx:xx:xx.xxxxxx   001        25-L2 CB OPEN Y PH
  N    N    21:25:52.130810   xx:xx:xx.xxxxxx   001        26-L3 CB OPEN B PH
  N    N    21:25:52.165813   xx:xx:xx.xxxxxx   001        27-L5 TIE CB OPEN R
  N    N    21:25:52.167481   xx:xx:xx.xxxxxx   001        28-L6 TIE CB OPEN Y
  N    N    21:25:52.167481   xx:xx:xx.xxxxxx   001        29-L7 TIE CB OPEN B
```

400 KV Dadri(NT)(End)-Muradnagar_2(UP) (PG) Ckt-1



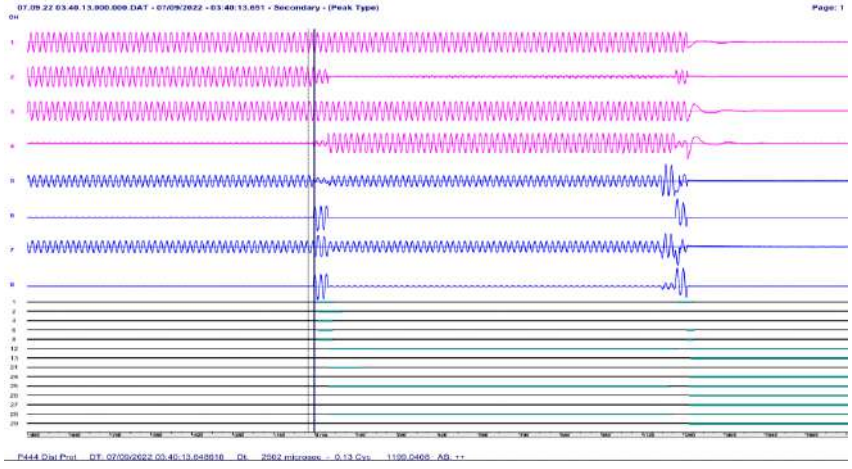
1. B-phase to earth fault.
2. Which protection operated not clear.

400 KV Muradnagar_2(End)-Mathura (UP) Ckt-1

AXIS	CURSOR 1	CURSOR 2	DELTA
F1-IA	-218.74A	-195.30A	23.44A
F2-IB	160.15A	-42.97A	-203.11A
F3-IC	78.12A	125.00A	46.88A
F4-IG	0.01A	0.01A	0.00A
F5-VA	-246314.89V	-244406.20V	1908.69V
F6-VB	320178.22V	-5593.03V	-325771.25V
OSC TRIGGER On	Low	High	-
GND DIST Z1 OP	Low	High	-
CAR SEND CH1 On	Low	High	-
AR START On	Low	High	-
TRIP 1-POLE	Low	High	-
TRIP PHASE B	Low	High	-

1. Z1 operation visible.
2. Time sync faulty.
3. Please send DR in .cfg format.

400 KV Muradnagar_2-Mathura (UP)(End) Ckt-1



1. Y-Phase to earth fault seen
2. AR attempted and failed due to persistent fault.
3. Kindly send DR in .cfg format.

Details received from UP

TRIPPING STATEMENT OF 400KV FOR THE MONTH OF SEP 2022 — 400KV S/S II MURADNAGAR -2

Sr. No	Tripping date/time	Closing date/time	Name of Substation	C.B.NO. with direction code	Type of relay	Flags and Indication observed	F/L (KM)	APPROX % DISTANCE	Analysis with discripency in flag if any
1	07.09.2022 21:25:51.828	07.09.2022 22:58	400KV Muradnagar -II	T-402 MATHURA	ZIV MICOM	**M1-C phase, ZONE 1, CS, CR, DT SEND, 86A** Ir=0.06A ,Iy= 0.088A ,Ib=3.93A,In=3.98A Vr= 64.16V, Vy=65.25V, Vb=37.44V,Vn=29.16V **M2-C phase,ZONE 1, CS, CR, DT SEND, 86B** **FAULT DURATION=321.7 msec** Ir=52.98A , Iy=51.19A , Ib=3.93KA Vr=232.8KV,Vy=236.7KV,Vb=136.2KV BCU=AR LOCKOUT	58.59 59.83	36%	DURING ANALYSIS IT HAS BEEN FOUND THAT- 1) LOW AIR PRESSURE LOCKOUT ALARM OBSERVED AT CB-401 20:51:01.990 & TRIP CIRCUIT FAULTY AT 20:51:02.140 HRS. 2) FAULT OCCUR IN 400 KV MURADNAGAR-2-MATHURA LINE IN ZONE 1 AT 21:25:51.835 HRS. AND RELAY ISSUED TRIP COMMAND TO MAIN CB-401 AND TIE CB-402, HENCE TIE CB-402 TRIPPED BUT MAIN CB-401 COULD NOT TRIP (DUE TO LOW AIR PRESSURE/TRIP CIRCUIT FAULT). 3) LBB INITIATION OCCUR AT 21:25:51.892 HRS AND FAULT PERSIST MORE THAN 200 msec & FAULT CURRENT FLOWS MORE THAN 200 AMP. 4) THEREFORE LBB PROTECTION OPERATED AND ALL BAYS CONNECTED TO BUS 1 TRIPPED EXCEPT CB-401 (CB-464, CB-408, CB-411). 5) 400KV MAIN BUS 2 TRIPPED ON DIFFERENTIAL PROTECTION DUE TO HEAVY CURRENT INCREASE IN PU1 AND PU2 OF BAY 412, 240 MVA ICT-III. THEREFORE ALL BAYS CONNECTED TO BUS 2 TRIPPED (CB-403,405, 406, 409, 412)
	07.09.2022 21:25:51.828	07.09.2022 22:58	MATHURA	400KV Muradnagar -II	GE MICOM	**M1-** B PHASE TRIP , ZONE 1 ,DT RECEIVE, IC=3.21KA **M2:** B PHASE TRIP, ZONE 1 ,DT RECEIVE, IC=3.26KA	78.75		
	07.09.2022 21:25:51.820	07.09.2022 23:14	400KV Muradnagar -II	T-404 DADRI	MICOM	**M2-C PHASE PICKUP, ANY START** Ir=242A , Iy=864A , Ib=3.28KA Vr=228KV,Vy=231KV,Vb=139KV			
	07.09.2022 21:25:52.168	07.09.2022 22:58	400 KV BUSBAR PROTECTION	400KV Muradnagar -II	ZIV	**BUSBAR PROTECTION MAIN UNIT 1** BUS 1 TRIP, BAY 1 BREAKER FAILURE, BAYS 404,408,411 TRIP PU 401 (MATHURA MAIN CB) LBB TRIP (BUT CB-401 FAILED TO TRIP DUE TO LOW AIR PRESSURE/TCF) PU 404 (DADRI MAIN CB) LBB TRIP PU 408 (REACTOR TIE CB) LBB TRIP , 86A, 86B PU 411 (ICT-III TIE CB) LBB TRIP , 86A, 86B **BUSBAR PROTECTION MAIN UNIT 2** BUS 2 TRIP, DIFF TRIP, BAYS 403, 406,409, 412 TRIP PU 403/201 (ICT-I MAIN CB) DIFF TRIP , 86A, 86B PU 405 (DADRI TIE CB), 86A, 86B PU 406/203 (ICT-II MAIN CB) DIFF TRIP , 86A, 86B PU 409 (REACTOR MAIN CB) DIFF TRIP , 86A, 86B PU 412/206 (ICT-III MAIN CB) DIFF TRIP , 86A, 86B			

Observations

Analysis of tripping (As reported):

- 400/220kV Muradnagar_2(UP) have one & half breaker bus scheme at 400kV side. During antecedent condition, 400kV line to Mathura & Dadri(NTPC) were connected to 400kV Bus-1 and 400/220kV 240MVA ICT-1 & 3, 400/220kV 315MVA ICT-2 and 63MVAr bus reactor were connected at 400kV bus-2.
- At 21:25:51hrs, B-N phase to earth fault occurred on 400 KV Muradnagar_2-Mathura (UP) Ckt, fault distance & fault current were ~60km & ~3.9kA from Muradnagar_2(UP) end and ~79km & ~3.2kA from Mathura end. As per PMU at Dadri Thermal(NTPC), B-N phase to earth fault with delayed clearance in 320ms is observed.
- On this fault, line CB from Mathura end and Tie CB at Muradnagar_2 end opened but Main CB at Muradnagar_2 end didn't open.
- As Main CB at Muradnagar_2 end of 400 KV Muradnagar_2-Mathura (UP) Ckt didn't open, its LBB operated and all the Main CBs connected at 400kV Bus-1 opened.
- At the same time, Bus bar protection of 400kV Bus-2 at Muradnagar_2(UP) also operated. As reported, current in PU1 & PU2 of 400/220kV 240MVA ICT-3 increased which led to the operation of bus bar-2 protection.
- As both the 400kV Bus tripped, 400kV Muradnagar_2(UP) became dead.
- As per SCADA, no change in demand of UP is observed.

Points of concern:

- Mechanical healthiness of CBs need to be ensured.
- As fault was in 400 KV Muradnagar_2-Mathura (UP) Ckt, why did bus bar protection of bus -2 operate?
- DR submitted of Muradnagar_2 end are not time sync. Time sync of DR needs to be ensured.
- Remedial action taken report to be shared.

Multiple elements tripping at Fatehgarh2(PG)

17-Sep-2022 10:14

Antecedent Condition and Tripped Elements

Antecedent Condition:-

- Grid Frequency (Hz) 50.01
- Total IR Import (MW) 4859
- Northern Region Demand (MW) 55069
- Type of fault Line to ground
- Fault clearing time (ms) 120
- Faulted Phase R-N

Following elements tripped:-

1. 765 KV Fatehgarh_II(PG)-Bhadla(PG) (FBTL) Ckt-1
2. 220 KV Fatehgarh_II(PG)-AHEJ2L PSS HB_FGRAH_PG (AHEJ2L) (AHEJ2L) Ckt-1
3. 220 KV Fatehgarh_II(PG)-AHEJ3L PSS HB_FGRAH_PG (AHEJ3L) (AHEJ3L) Ckt-1

PMU Plot of frequency at 765kV Bhadla(PG)

10:14hrs/17-Sept-22

PMU Plot of phase voltage magnitude at TPREL RE Station

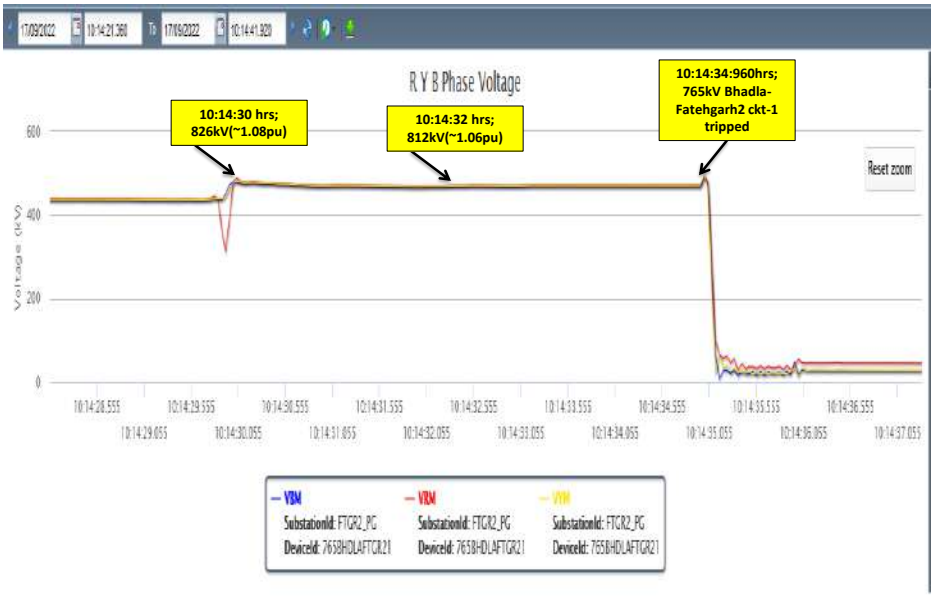
10:14hrs/17-Sept-22

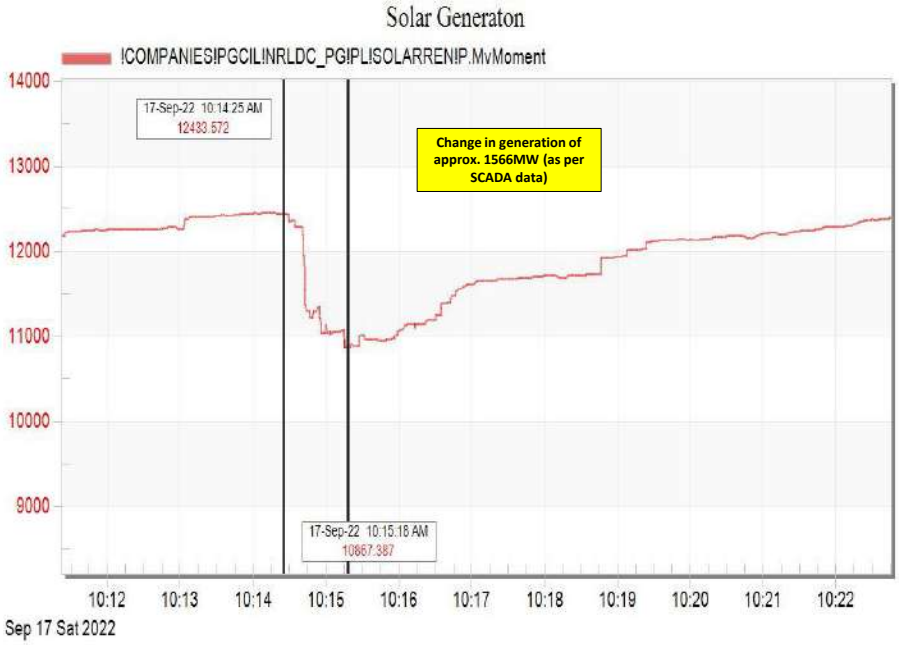
PMU Plot of phase voltage magnitude at ADNHB RE Station

10:14hrs/17-Sept-22

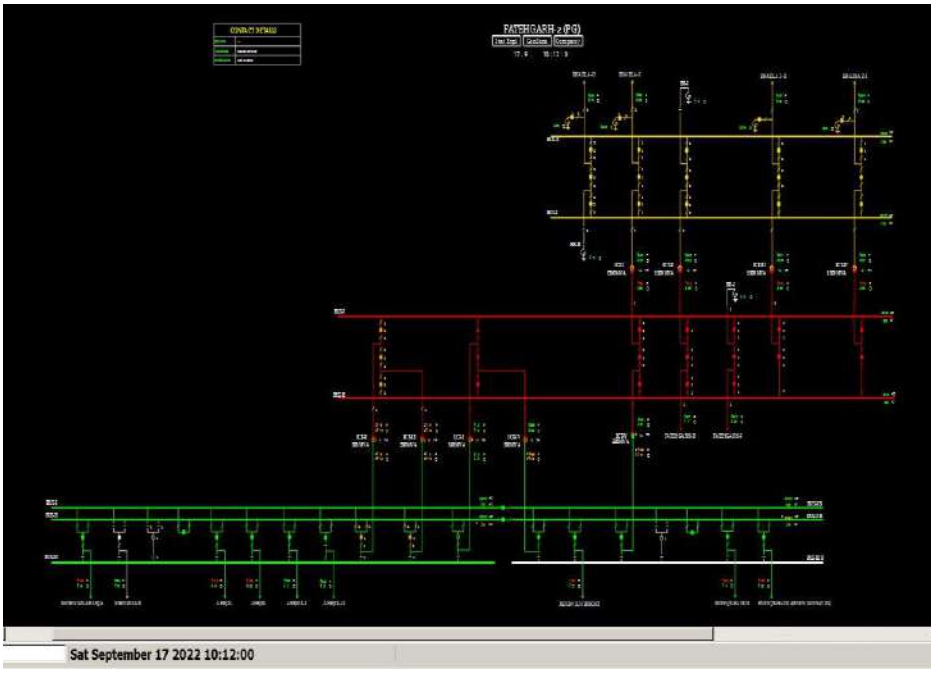
PMU Plot of phase voltage magnitude at Fatehgarh2(PG)

10:14hrs/17-Sept-22

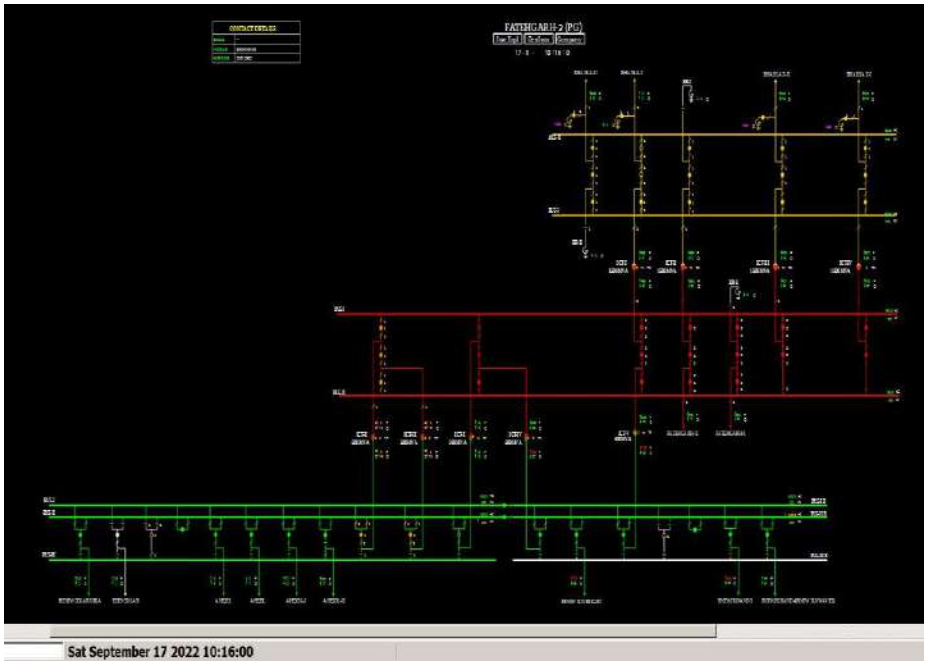




SCADA SLD of 765/400/220kV Fatehgarh2(PG) before the tripping

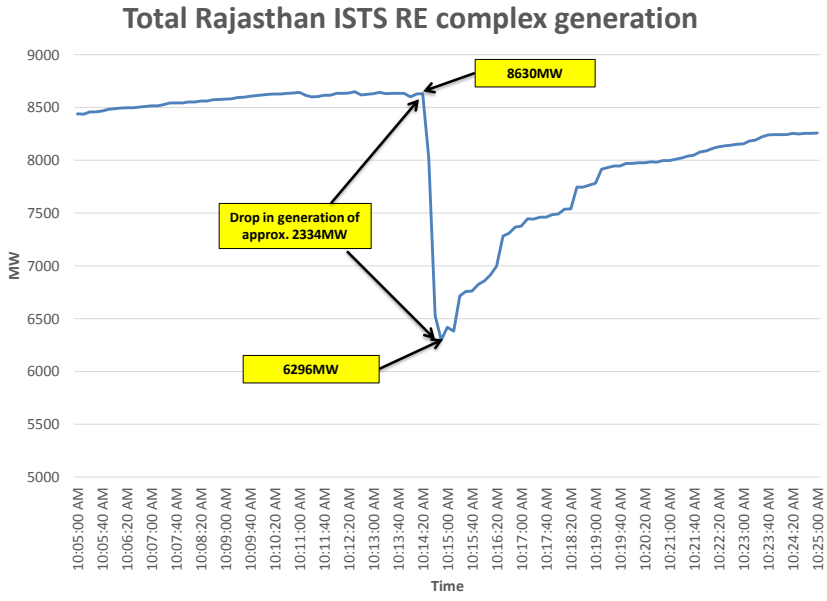


SCADA SLD of 765/400/220kV Fatehgarh2(PG) after the tripping

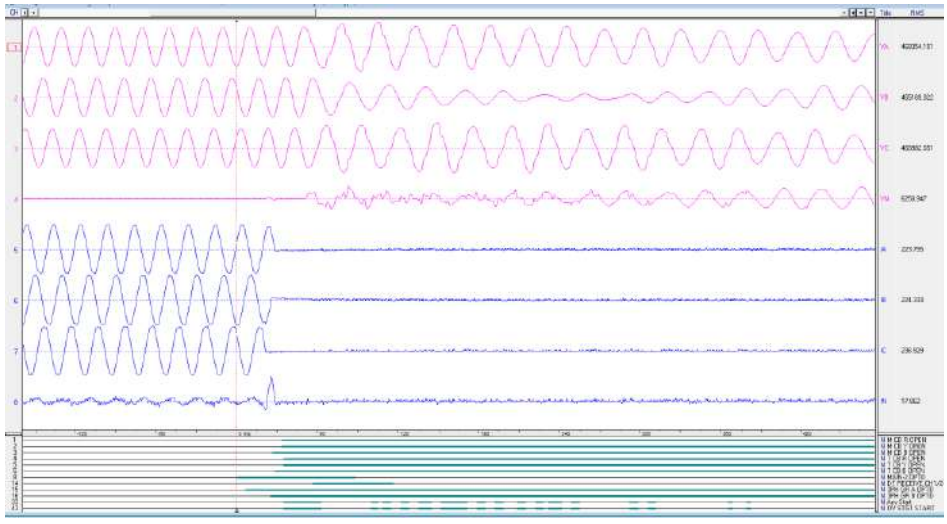


SCADA SOE

Time	Station Name	Voltage(kV)	Element Name	Element Type	Element Status	Remark
10:14:29,945	FTGR2_P	220	09AGESL	Circuit Breaker	disturbe	
10:14:30,099	AHEJ2_I	220	04FTGR21	Circuit Breaker	Open	Line CB at AHEJ2L end of 220kV Fatehgarh2-AHEJ2L ckt opened
10:14:30,267	AHEJ3_I	220	04FTHGR2	Circuit Breaker	Open	Line CB at AHEJ3L end of 220kV Fatehgarh2-AHEJ2L ckt opened
10:14:31,024	FTGR2_P	220	09AGESL	Circuit Breaker	Close	Line CB at Fatehgarh2 end of 220kV Fatehgarh2-AHEJ2L ckt closed
10:14:35,055	BHDLA_P	765	16FTGR21	Circuit Breaker	Open	Main CB at Bhadla end of 765kV Bhadla-Fatehgarh2 ckt-1 opened
10:14:35,056	BHDLA_P	765	17FTR2T1	Circuit Breaker	Open	Tie CB at Bhadla end of 765kV Bhadla-Fatehgarh2 ckt-1 opened
10:14:35,080	FTGR2_P	765	12BHDLA1	Circuit Breaker	Open	Main CB at Fatehgarh2 end of 765kV Bhadla-Fatehgarh2 ckt-1 opened
10:14:35,081	FTGR2_P	765	11TIE	Circuit Breaker	Open	Tie CB at Fatehgarh2 end of 765kV Bhadla-Fatehgarh2 ckt-1 opened

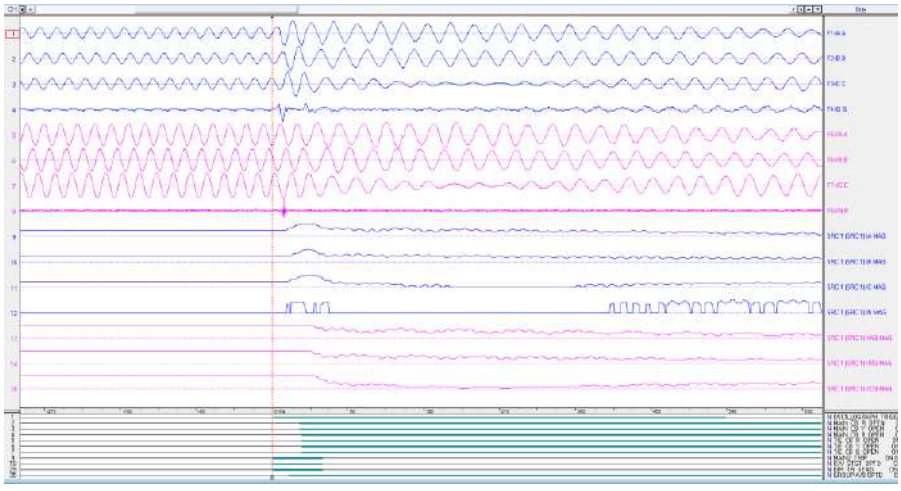


DR of 765 KV Fatehgarh_II(PG)-Bhadla(PG)(End) (FBTL) Ckt-1



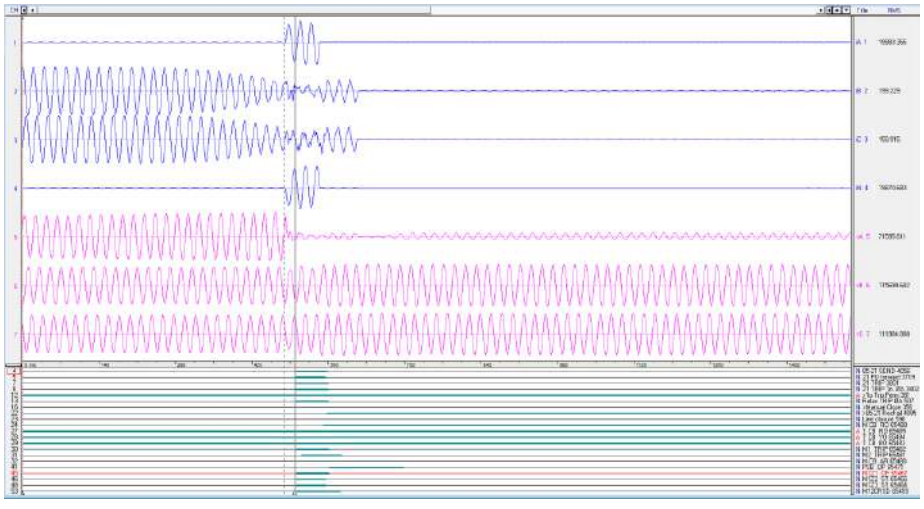
DT received at Bhadla end, OV stage-1 started.

DR of 765 KV Fatehgarh_II(PG)(End)-Bhadla(PG)(FBTL) Ckt-1



OV stage-1 operated at Fatehgarh end. Voltage = 815 kV.

DR of 220 KV Fatehgarh_II(PG)(End)-AHEJ2L PSS HB_FGRAH_PG (AHEJ2L) (AHEJ2L) Ckt-1



Z-1 operated from Fatehgarh2 end. R-N fault.

Observations

Analysis of tripping (As reported):

- At 10:14:29:840hrs, R-N phase to phase fault occurred on 220kV Fatehgarh2- AHEJ2L ckt due to blast of R-ph CT at Fatehgarh2 end. As per PMU, R-N phase to earth fault which cleared within 120ms is observed.
- On this fault, 220 KV Fatehgarh_II(PG)-AHEJ2L PSS HB_FGRAH_PG (AHEJ2L) (AHEJ2L) Ckt-1 tripped. At the same time, 220 KV Fatehgarh_II(PG)-AHEJ3L PSS HB_FGRAH_PG (AHEJ3L) (AHEJ3L) Ckt-1 tripped from AHEJ3L end only.
- Due to tripping of aforementioned lines, RE generation of AHEJ2L & AHEJ3L total 560MW lost.
- During the fault, phase voltage at other RE stations went below 0.85pu. As voltage dropped below 0.85pu, almost all the RE stations dropped their MW on LVRT operation. However, active power (MW) of few of the RE stations didn't recover after clearance of fault within defined time(as per LVRT).
- As per SCADA, total drop in solar generation of approx. 1566MW(including AHEJ2L & AHEJ3L generation) is observed during the event.
- Due to significant drop in MW, rise in voltage is observed at ISTS RE pooling stations and further after 5sec, 765 KV Fatehgarh_II(PG)-Bhadla(PG) (FBTL) Ckt-1 tripped from Bhadla end on over voltage stage-1 protection.

Points of concern:

- Why did 220 KV Fatehgarh_II(PG)-AHEJ3L PSS HB_FGRAH_PG (AHEJ3L) (AHEJ3L) Ckt-1 trip?
- DR, EL & tripping report need to be shared.
- Remedial action taken report to be shared.

Multiple elements tripping at Khodri(Utt)

02:27hrs on 06.10.2022

Antecedent Condition and Tripped Elements

Antecedent Condition:-

- NR Load : 46719 MW
- Affected state load : 1311 MW
- Frequency : 50.03Hz
- Bus voltage (affected S/s) : 211kV
- weather condition : Normal
- IR exchange : 13974MW
- Generation loss/Load loss: Generation loss of approx. 60MW (as per SCADA).
- Duration of interruption: Restoration time: 02:56hrs, Energy unserved: 0.029MU
- Nature of fault : B-N fault, Fault clearing time: 1160ms

Following elements tripped:-

1. 220 KV Sarsawan(UP)-Khodri(UK) (UP) Ckt-1
2. 220 KV Saharanpur(UP) -Khodri(UK) (UP) Ckt-1
3. 60 MW UNIT 1 at Khodri HEP
4. 60 MW UNIT 2 at Khodri HEP
5. 60 MW UNIT 4 at Khodri HEP

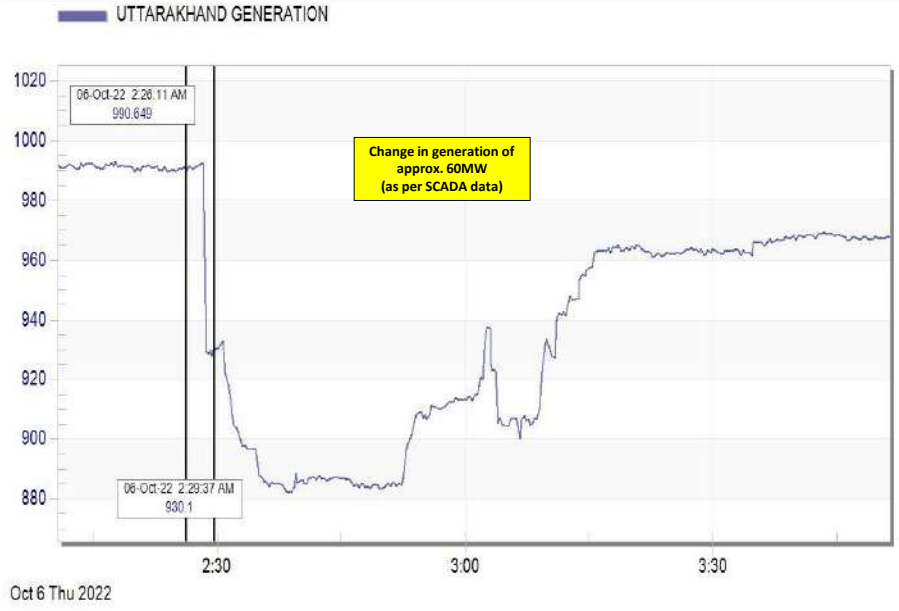
PMU Plot of frequency at Roorkee(PG)

02:27hrs/06-Oct-22

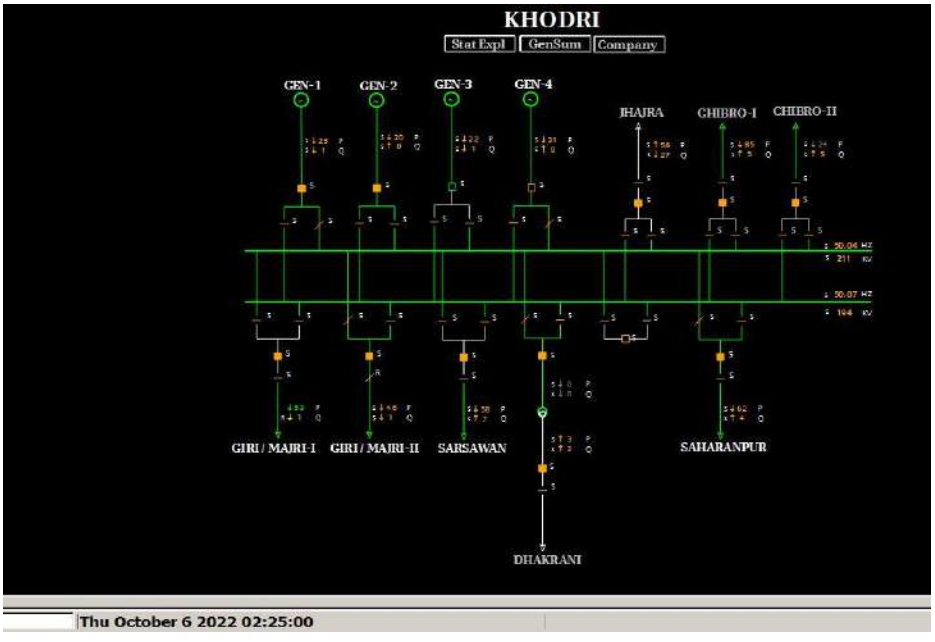
PMU Plot of phase voltage magnitude at Roorkee(PG)

02:27hrs/06-Oct-22

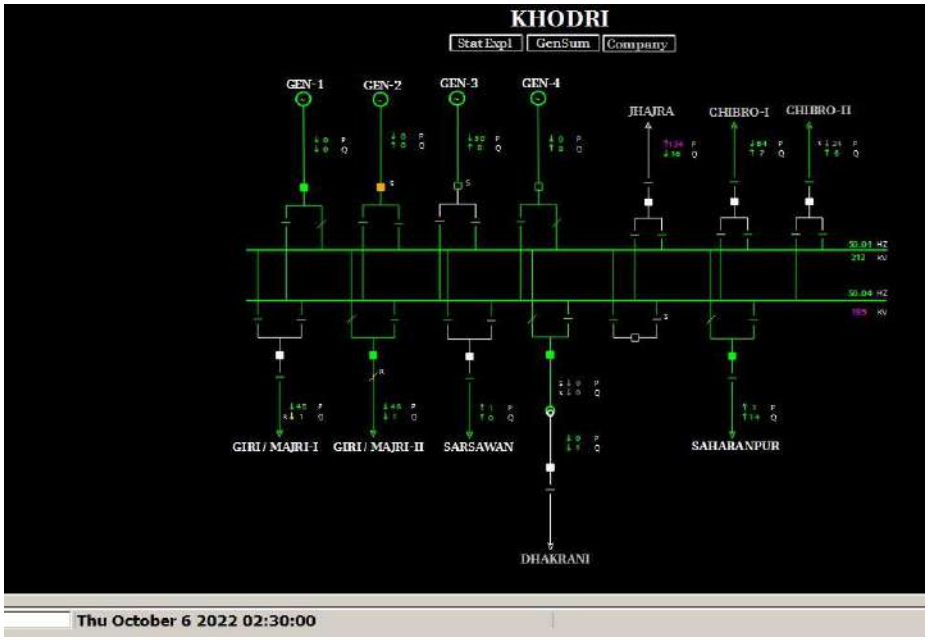
Uttarakhand generation during the event



SLD of 220kV Khodri(Utt) before the event



SLD of 220kV Khodri(Utt) after the event



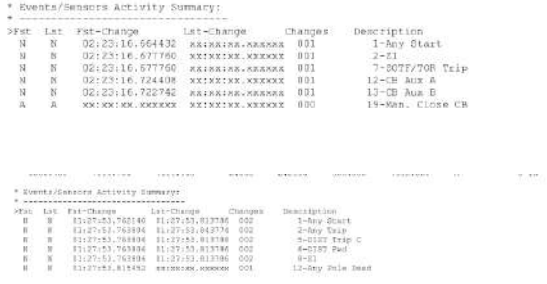
SCADA SOE

Time	Stationa Name	Voltage	Element Name	Element Type	Element Status	Remark
02:27:54,882	SHARN_UP	220kV	02KHODR2	Circuit Breaker	Open	Line CB at Sharanpur end of 220 KV Saharanpur(UP) - Khodri(UK) (UP) Ckt-1 opened
02:27:55,814	SRSWN_U	220kV	01KHODRI	Circuit Breaker	disturbe	

Details received from 220 kV Saharanpur (UP)

1. Time & Date of Event:	06/10/2022 02:27 HRS
2. Station Name:	220kV SAHARANPUR (UP)
3. Name of tripped elements and other tripped elements:	220kV SAHARANPUR-Khodri line
4. Triggering Incident:	PERSISTANT CURRENT IN neutral for setting of 20% E/F
5. Flag details DR/EL	CP-DPT RP - M1-Gen.Trip, Def Trip,86A,86B Ir-138.78A, Iy-199.9A, Ib-192.65A, In=210A M2-NIL
6. Event Description	
7. Restoration Time:	06/10/2022 04:07
8. Remedial Action Taken:	

Details received for 220 kV Sarsanwa – Khodri - 1



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* Events/Sensors Activity Summary:
* ---------------------------------
>Pst  Lst  Pst-Change       Lst-Change       Changes   Description
  N    N    02:23:16.664432  xx:xx:xx.xxxxxx  001         1-Any Start
  N    N    02:23:16.677760  xx:xx:xx.xxxxxx  001         2-Z1
  N    N    02:23:16.677760  xx:xx:xx.xxxxxx  001         7-DOTF/70R Trip
  N    N    02:23:16.724408  xx:xx:xx.xxxxxx  001        12-CB Aux A
  N    N    02:23:16.722742  xx:xx:xx.xxxxxx  001        13-CB Aux B
  A    A    xx:xx:xx.xxxxxx  xx:xx:xx.xxxxxx  000        19-Man. Close CB
```



```
* Events/Sensors Activity Summary:
* ---------------------------------
>Pst  Lst  Pst-Change       Lst-Change       Changes   Description
  N    N    01:27:53.760140  01:27:53.813786  002         1-Any Start
  N    N    01:27:53.763904  01:27:53.843776  002         2-Any Trip
  N    N    01:27:53.763904  01:27:53.813786  002         5-DIST Trip C
  N    N    01:27:53.763904  01:27:53.813786  002         6-DIST Fwd
  N    N    01:27:53.763904  01:27:53.813786  002         8-Z1
  N    N    01:27:53.815482  xx:xx:xx.xxxxxx  001        12-Any Pole Dead
```

1. Time & Date of Event:	06/10/2022 02:27 HRS
2. Station Name:	220kV Sarsawa (UP)
3. Name of tripped elements and other tripped elements:	220kV Sarsawa-Khodri line
4. Triggering Incident:	B-N fault
5. Flag details DR/EL	M1- B ph, Trip Zone-1, ARLO IR=211mA ,IY=161mA, IB=5.46A M2-B Ph, ZONE-1,ARLO , IR=167.0A, IY-128.9A, IB-4.32kA
6. Event Description	R-N fault sensed at 29.1 km distance from 220kV Sarsawa end
7. Restoration Time:	06/10/2022 03:32 HRS
8. Remedial Action Taken:	

Observations

Analysis of tripping (As reported):

- As reported, at 02:27 hrs, 220 KV Sarsawan (UP)-Khodri (UK) (UP) Ckt-1 tripped from both ends on B-N phase to earth fault. Fault distance was ~52km from Khodri end.
- At the same time, 220 KV Saharanpur (UP) -Khodri (UK) (UP) Ckt-1 tripped from Saharanpur end o nly followed by tripping of 60MW unit-1, 2 & 4 at Khodri HEP carrying total ~60MW.
- As per PMU at Roorkee (PG), B-N phase to earth fault with delayed clearance in 1160ms is observed.
- As per SCADA, change of approx. 60MW in Uttarakhand generation is observed.

Points of concern:

- Exact location and nature of fault?
- Reason of delayed clearance of fault?
- Why did 220 KV Saharanpur (UP) -Khodri (UK) (UP) Ckt-1 trip from Saharanpur end?
- On which protection 60MW unit-1, 2 & 4 at Khodri HEP had tripped?
- DR, EL of tripped elements & tripping report of the event need to be shared.
- Remedial action taken report to be shared.

Multiple elements tripping at 220/132kV Hiranagar (J&K)

04:31hrs on 16.10.2022

Antecedent Condition and Tripped Elements

Antecedent Condition:-

- NR Load : 39282 MW
- Affected state load(J&K, Ladakh) : 1382 MW
- Frequency : 50.01Hz
- weather condition : Normal
- IR exchange : 8744MW

Following elements tripped:-

1. 220 KV Samba(PG)-Hiranagar(PDD) (PG) Ckt-1
2. 220 KV Samba(PG)-Hiranagar(PDD) (PDD JK) Ckt-2
3. 220kV Bishna – Hiranagar ckt 05:47 hrs
4. 220kV Ghatti – Hiranagar ckt
5. 220kV BUS 1 Hiranagar(JK PDD)
6. 220/132kV 200 MVA ICT 1
7. 220/132kV 120 MVA ICT2

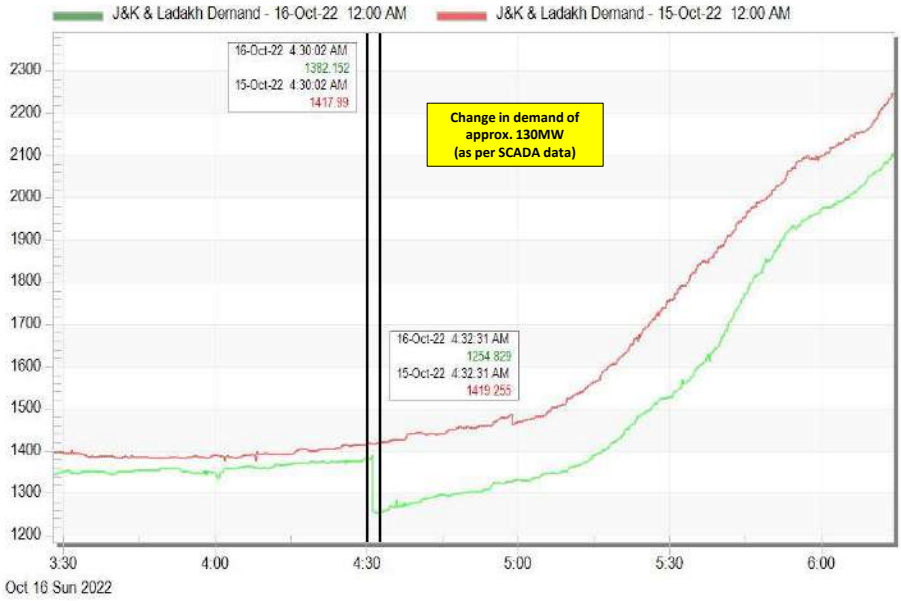
PMU Plot of frequency at Sambha(PG)

04:31hrs/16-Oct-22

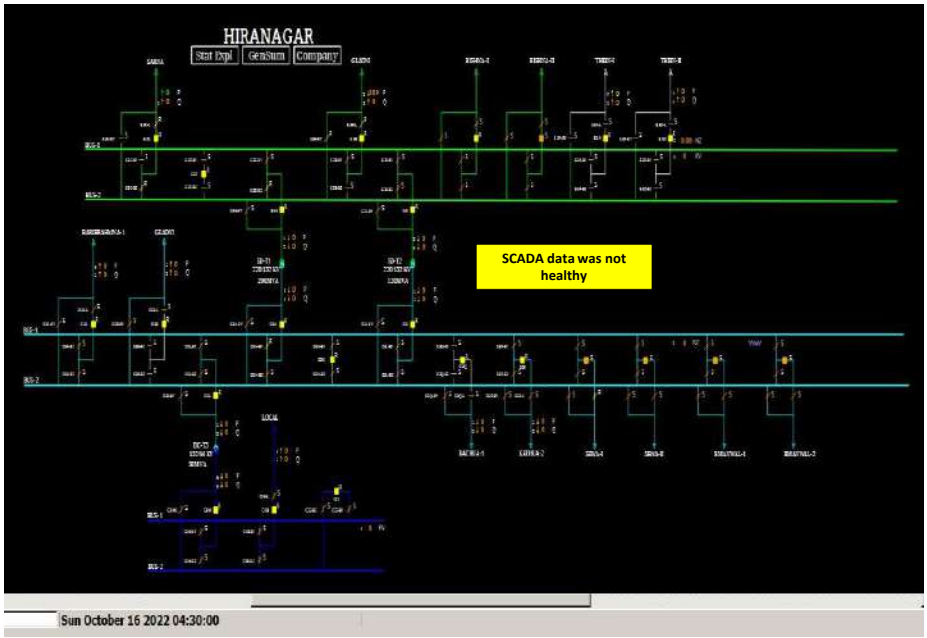
PMU Plot of phase voltage magnitude at Sambha(PG)

04:31hrs/16-Oct-22

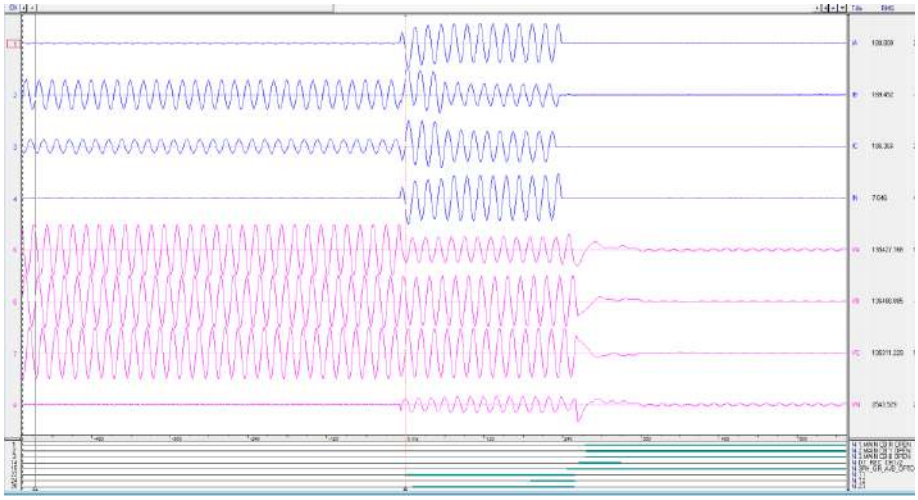
J&K(UT) & Ladakh(UT) demand during the event



SLD of 220/132kV Hiranagar(JK) before the event



DR of 220 kV Samba (End) – Hiranagar - 1



DT received at Samba end. Z-3 started and fault appears to be in B phase.

Observations

Analysis of tripping (As reported):

- At 04:31 hrs, R-N phase to earth fault occurred on 220kV Hiranagar-Ghatti ckt, fault distance was ~6.94km from Hiranagar end.
- As reported by NR-2 POWERGRID, fault distance was ~14km (~100%) from Sambha(PG) end.
- On this fault, all the elements connected at 220kV Hiranagar(JK) tripped from Hiranagar end.
- 220 KV Samba(PG)-Hiranagar(PDD) (PG) Ckt-1 tripped from Sambha end on DT received from Hiranagar end and 220 KV Samba(PG)-Hiranagar(PDD) (PG) Ckt-2 didn't trip from Sambha end.
- As per PMU at Sambha(PG), R-N phase to earth fault with delayed clearance in 320ms is observed
- As per SCADA, load loss of approx. 130MW observed in J&K(UT) & Ladakh(UT) control area.

Points of concern:

- As fault was on 220kV Hiranagar-Ghatti ckt, why did all the elements connected at 220kV Hiranagar (J&K) trip from Hiranagar end?
- Which protection had operated at Hiranagar end?
- DR, EL of tripped elements & tripping report of the event need to be shared.
- Remedial action taken report to be shared.

Multiple elements tripping at 220kV Simbholi(UP)

10:17hrs on 20.10.2022

Antecedent Condition and Tripped Elements

Antecedent Condition:-

- NR Load : 47639 MW
- Affected state load(UP) : 13281 MW
- Frequency : 50.01Hz
- weather condition : Normal
- IR exchange : 3124MW
- Generation loss/Load loss: Load loss of approx. 65MW in UP control area.
- Duration of interruption: ~33 min (Restoration time : 10:50 hrs),
- energy unserved: .035MU

Following elements tripped:-

1. 220kV Hapur_765- Simbholi (UP) Ckt-1
2. 220kV Hapur_765-Simbholi(UP) Ckt-2
3. 220 KV Meerut(PG)-Simbholi(UP) (PG) Ckt-1 13:01 hrs
4. 220 KV NAPP(NP)-Simbholi(UP) (UP) Ckt-1 12:54 hrs

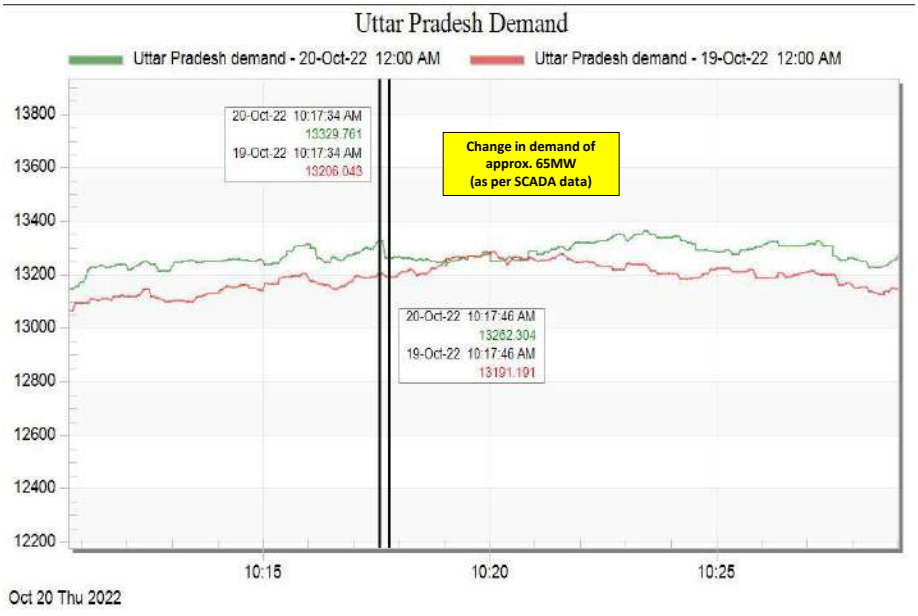
PMU Plot of frequency at Meerut(PG)

10:17hrs/20-Oct-22

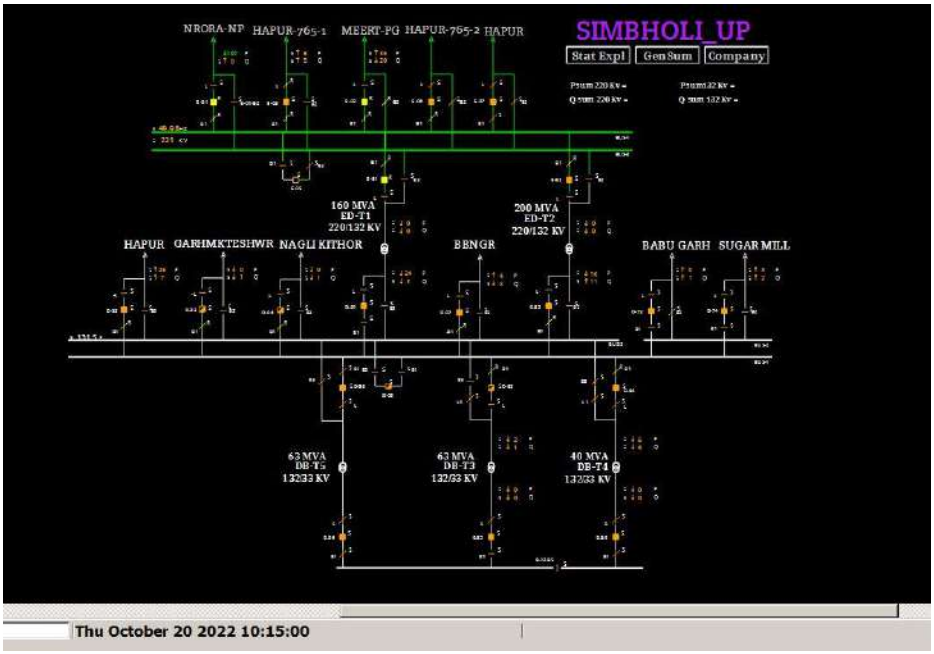
PMU Plot of phase voltage magnitude at Meerut(PG)

10:17hrs/20-Oct-22

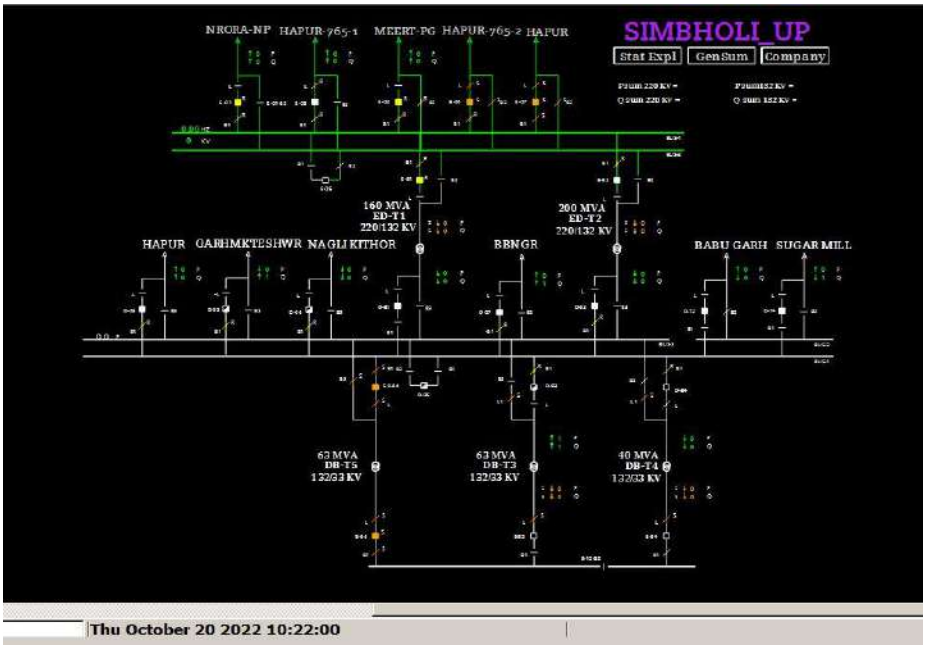
Uttar Pradesh demand during the event



SLD of 220kV Simbholi(UP) before the event



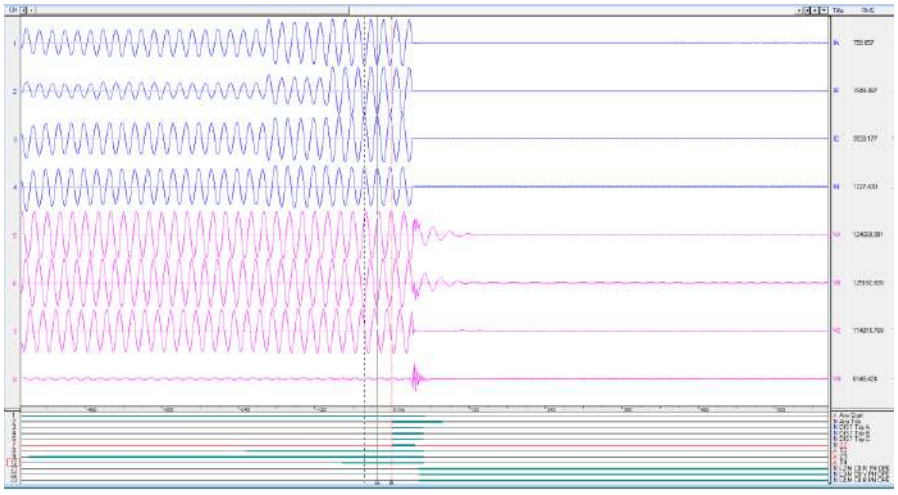
SLD of 220kV Simbholi(UP) after the event



SCADA SOE

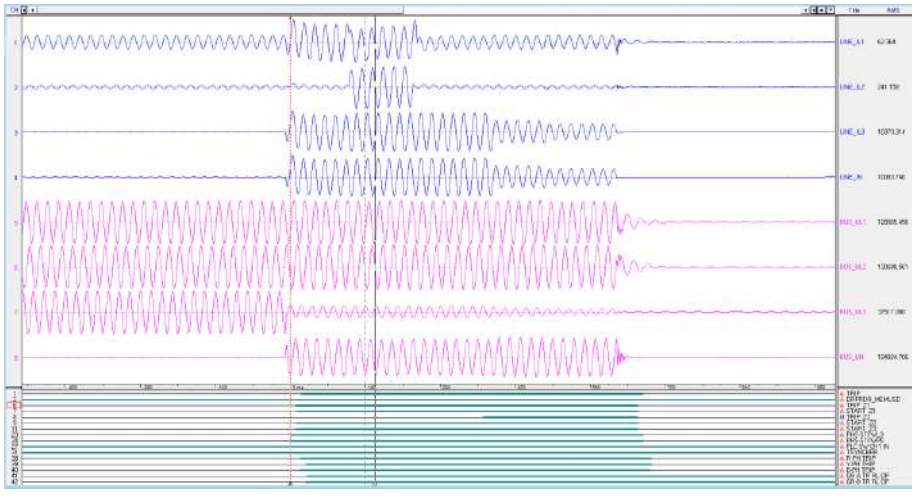
Time	Station Name	Voltage	Element Name	Element Type	Element Status	Remark
10:17:10,351	MEERUT	220kV	03SBHLI	Circuit Breaker	Open	Line CB at Meerut(PG) end of 220 KV Meerut(PG)-Simbholi(UP) (PG) Ckt-1 opened
10:17:47,112	HAPR7_U	220kV	212SBHL1	Circuit Breaker	Open	Line CB at Hapur_765(UP) end of 220kV Hapur_765-Simbholi(UP) Ckt-1 opened
10:17:47,114	HAPR7_U	220kV	203SBHLI	Circuit Breaker	Open	Line CB atHapur_765(UP) end of 220kV Hapur_765-Simbholi(UP) Ckt-2 opened
10:20:40,327	HAPR2_U	220kV	07SBHLI	Circuit Breaker	Open	Line CB at Hapur2(UP) end of 220kV Hapur- Simbholi (UP) Ckt opened

DR of 220 kV Meerut (End) – Simbholi - 1



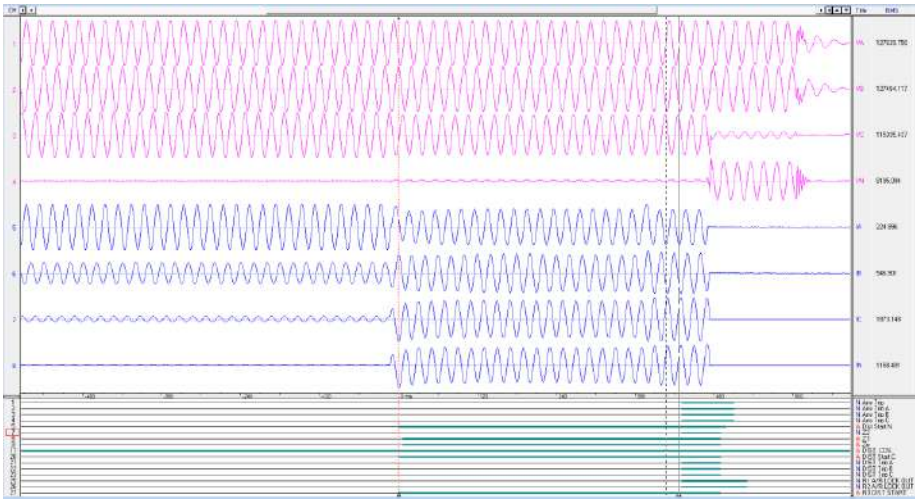
Y-B phase fault evident. Line tripped on Zone-2 from Meerut end.

DR of 220 kV Simbholi (End) – NAPP - 1



Y-B phase fault evident. Line tripped on Zone-1 from Simbholi end.

DR of 220 kV NAPP (End) – Simbholi - 1



B phase fault evident. Line tripped on Zone-2 from NAPP end. Carrier out of service alarm coming.

Observations

Analysis of tripping (As reported):

- As reported at 10:17 hrs, B-N phase to earth fault occurred on 220kV Hapur-Simbholi (UP) ckt due to da mage of polymer insulator of line, fault distance was 54.19km & ~5km and fault current was 2.4kA & 9.8 kA from Simbholi & Hapur end respectively.
- On this fault, distance protection operated at both ends. Line tripped from Hapur end but due to failure of mechanical mechanism of breaker at Simbholi end, B-ph pole of breaker got stuck and hence line did n't trip from Simbholi end.
- As breaker of 220kV Hapur-Simbholi (UP) ckt at Simbholi end didn't open, LBB of this CB operat ed. However, due to defective wiring between busbar protection & LBB line protection, the CBF (Circuit Breaker Failure) initiation wasn't detected by busbar protection and busbar could not ope rate. Hence all 220 kV lines emanating from Simbholi S/s tripped from remote end in zone 2.
- As per PMU, B-N phase to earth fault with delayed clearance in 640msec is observed.
- As per SCADA, change in demand of approx. 50MW is observed in UP control area.

Points of concern:

- LBB initiation wiring of 2 Nos of 220 kV feeders at Simbholi S/s (220 kV Simbholi - Hapur ckt & 220 KV Si mbholi -765 kV Hapur ckt-I) was found defective.
- LBB operation testing is also required on other 220 feeders for ensuring smooth functioning of protecti on system, same will be done by availing shutdown of remaining feeders one by one.
- Healthiness of protection system needs to be ensured. Routine testing of protection system need to be done.

Multiple elements tripping at 400/220kV Kashipur (Utt)

13:39hrs on 24.10.2022

Antecedent Condition and Tripped Elements

Antecedent Condition:-

- NR Load : 39507 MW
- Affected state load (Uttarakhand) : 864 MW
- Frequency : 50.20Hz
- Weather condition : Normal
- IR exchange : 509MW
- Load loss of approx. 210MW in Uttarakhand control area.

Following elements tripped:-

1. 400/220 kV 315 MVA ICT 1 at Kashipur(UK)
2. 400/220 kV 315 MVA ICT 2 at Kashipur(UK)
3. 220 KV Pantnagar(UK)-Bareilly(UP) (UP) Ckt-1
4. 220 KV Kashipur-Pantnagar(UK) Ckt
5. 220 KV Kashipur-Jafarpur(UK) Ckt
6. 132 KV Almora-Bhowali(UK) Ckt

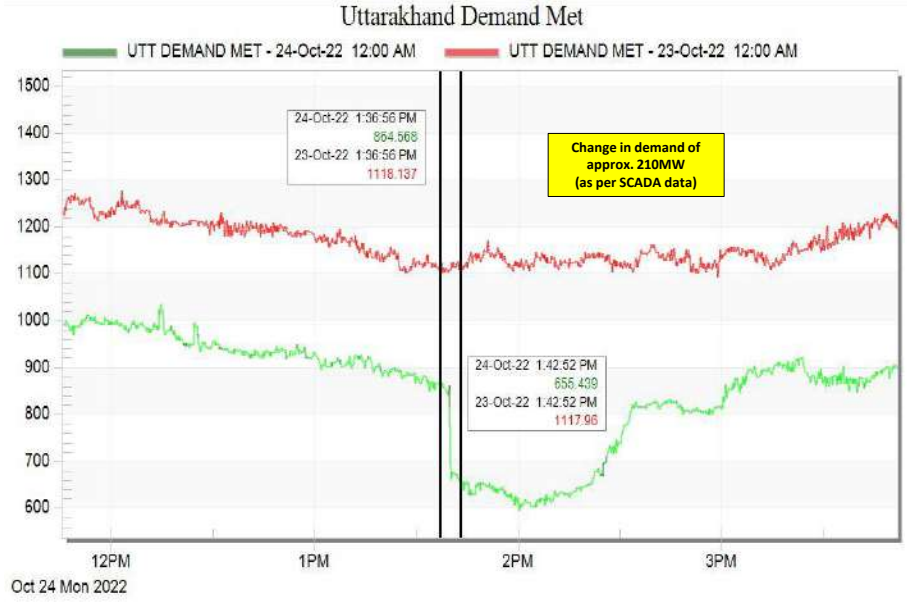
PMU Plot of frequency at Roorkee(PG)

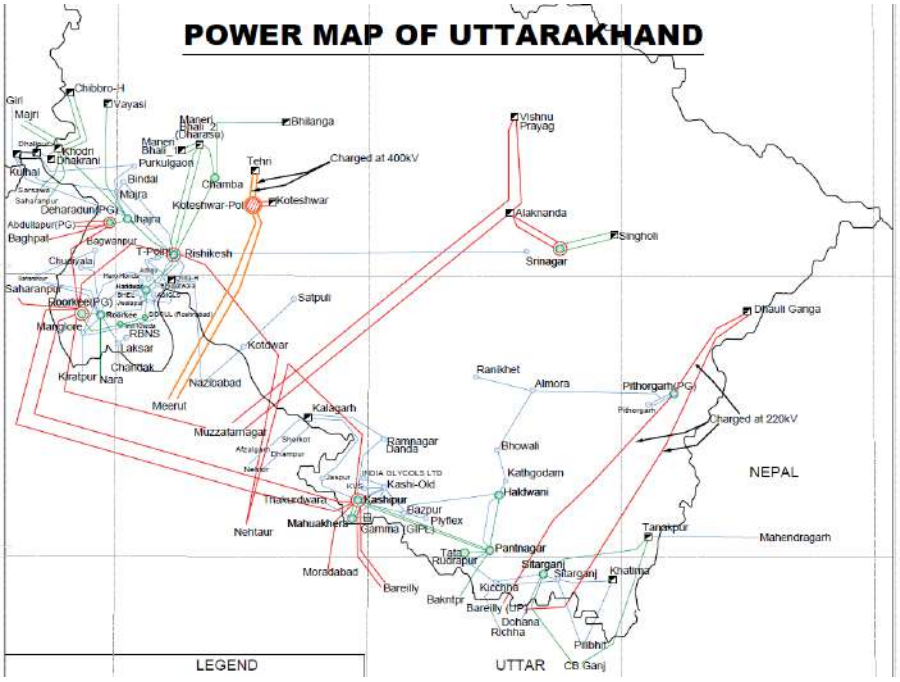
13:39hrs/24-Oct-22

PMU Plot of phase voltage magnitude at Roorkee(PG)

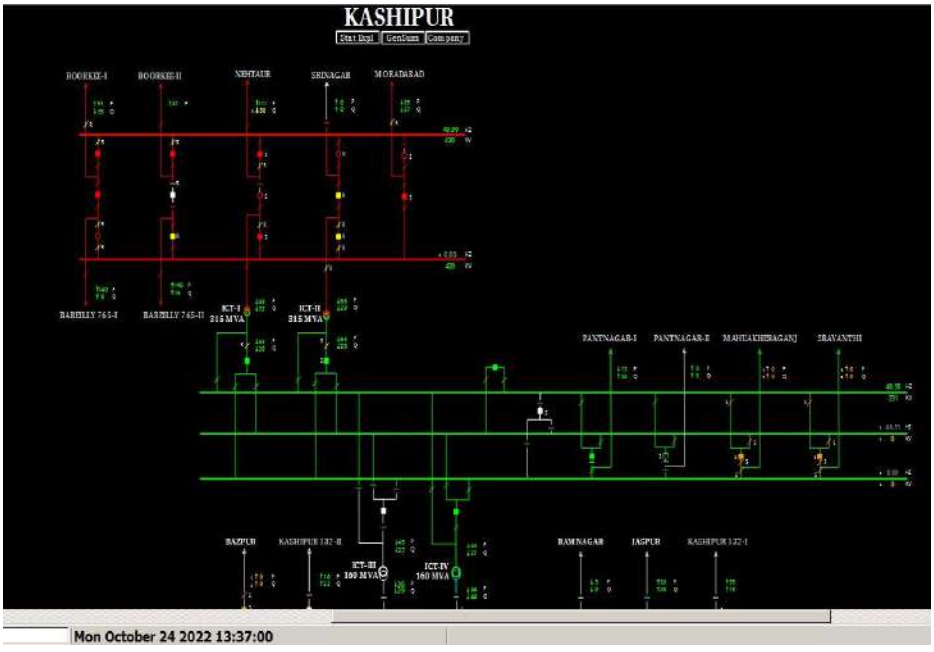
13:39hrs/24-Oct-22

Uttarakhand demand during the event

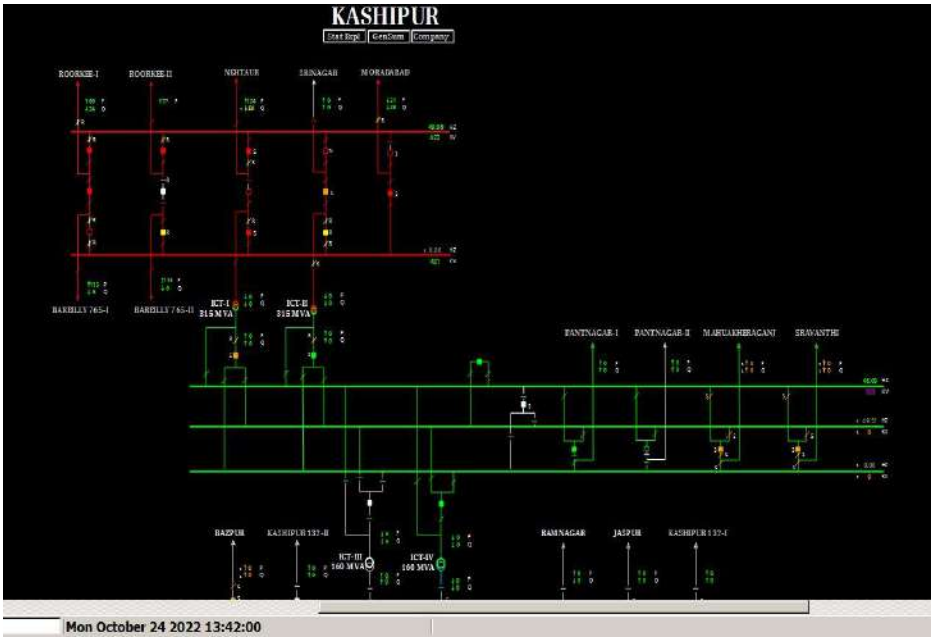




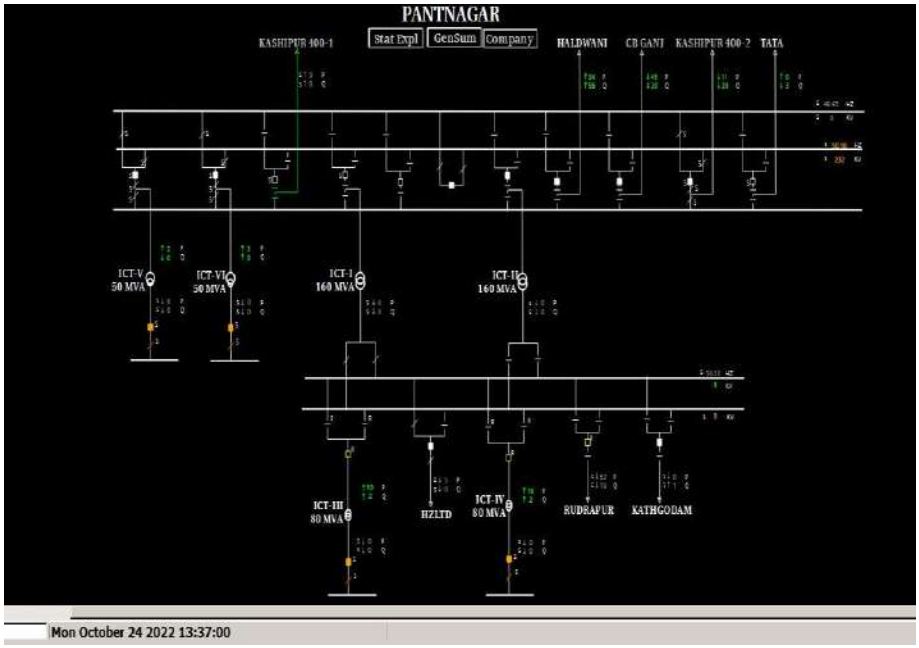
SLD of 400/220kV Kashipur(PG) before the event



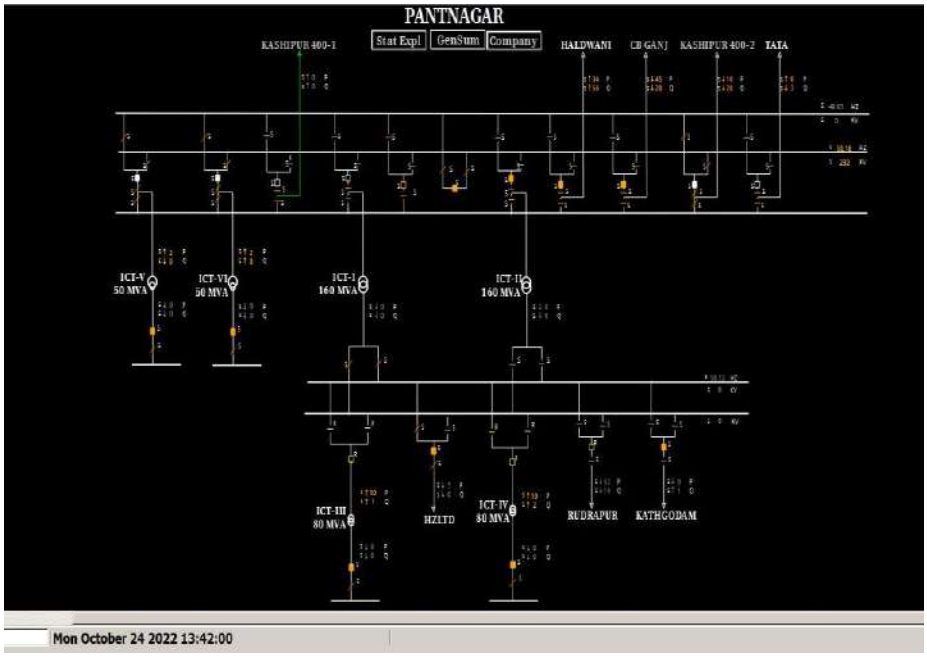
SLD of 400/220kV Kashipur(PG) after the event



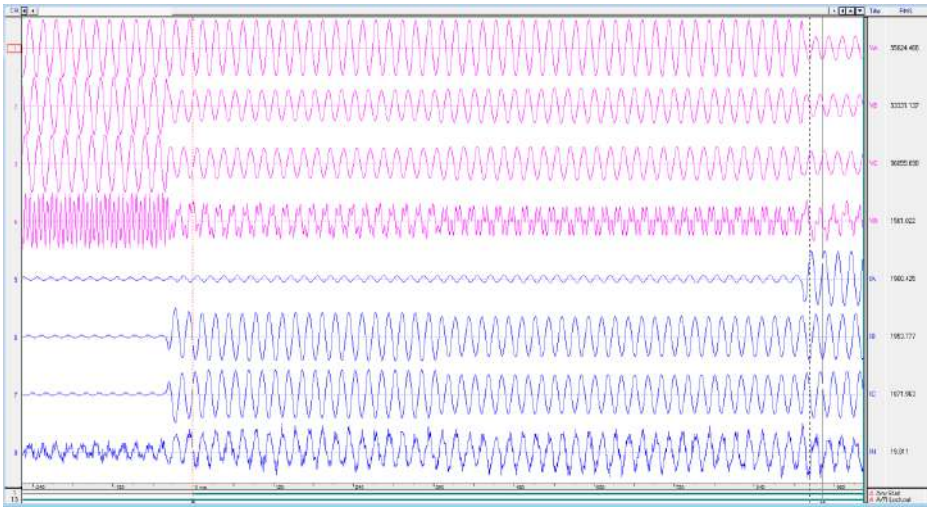
SLD of 220/132kV Pantnagar(Utt) before the event



SLD of 220/132kV Pantnagar(Utt) after the event

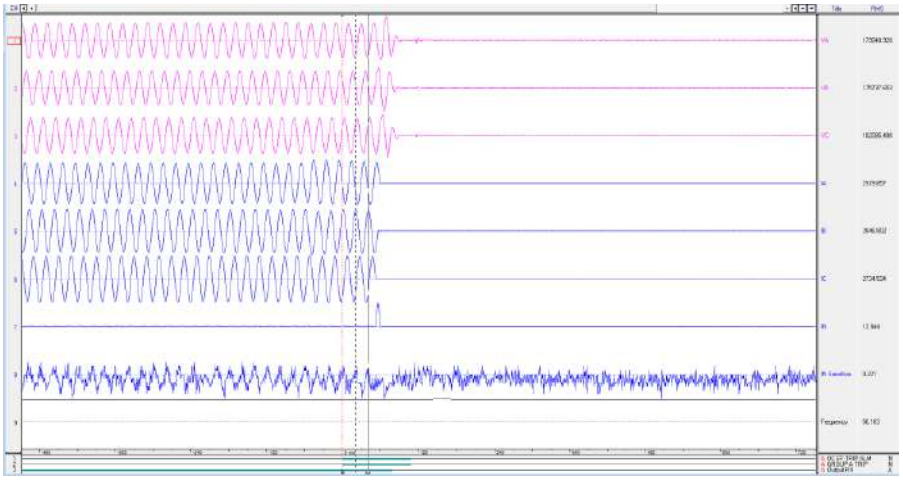


DR of Pantnagar (End) – Bareily - 1



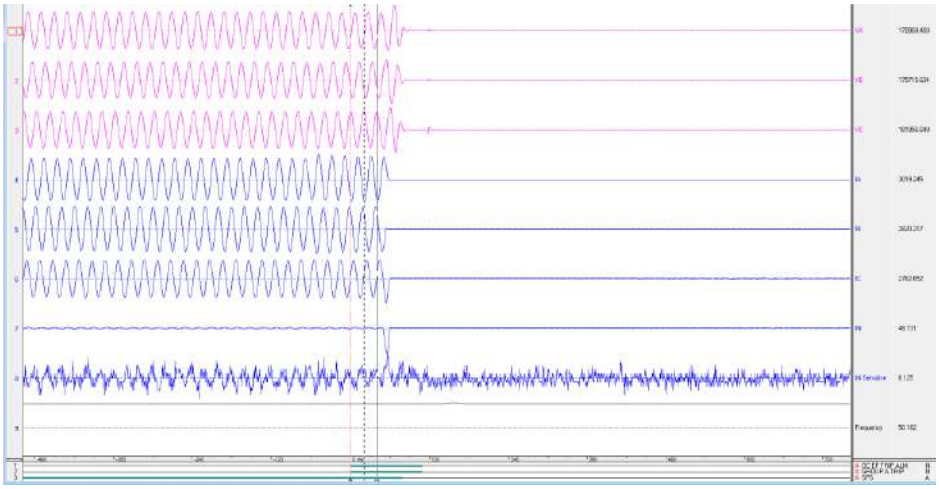
Y-B phase fault evident then converting to L-L-L fault.

DR of Kashipur ICT- 1



Y-B phase fault evident. ICT tripped on OC/EF.

DR of Kashipur ICT- 2



Y-B phase fault evident. ICT tripped on OC/EF.

Observations

Analysis of tripping (As reported):

- As reported at 13:39 hrs, Y-phase conductor of 220 KV Kashipur-Jafarpur(UK) Ckt (220 KV Kashipur-Pantnagar(UK) Ckt-2 LILO at Jafarpur) broke from gantry at Kashipur end and got in contact with top cover of CT hence created bus fault on 220kV Bus at Kashipur(UK).
- As per PMU, Y-B fault which further converted into R-Y-B fault with delayed clearance of 1800ms is observed.
- On this fault, 220 KV Kashipur-Jafarpur(UK) Ckt tripped on distance protection operation in Z-1 but as fault had co nverted into bus fault and bus bar protection is not in service at 400/220kV Kashipur S/s, 400/220 kV 315 MVA ICT 1 & ICT 2 at Kashipur(UK) tripped on overcurrent protection operation. At the same time, 220 KV Pantnagar(UK)-Bareilly(UP) (UP) Ckt-1 (Z-3 time delay 800ms) and 220 KV Kashipur-Pantnagar(UK) Ckt (Z-3 time delay 1000ms) tripp ed from remote end on distance protection operation in Z-3.
- As reported, bus bar protection is not in service at 400/220kV Kashipur(Utt) S/s.
- With the tripping of aforementioned elements, all load of Haldwani and Pantnagar shifted on 132kV Almora-Bhowal i due to which it got overloaded and tripped on over-current protection after approx. 5sec of occurrence of fault.
- As per SCADA, change in demand of approx. 210MW is observed in Uttarakhand control area.

Points of concern:

- Commissioning work of bus bar protection at 400/220kV Kashipur S/s need to be expedite. Upto its coming in service reverse zones may be put at 160 ms.
- Zone-3 time delay setting at Bareilly(UP) end of 220 KV Pantnagar(UK)-Bareilly(UP) (UP) Ckt-1 may be revised to 1200 ms from 800ms for better protection coordination.
- SCADA SOE data of tripped elements are not available at NRLDC. Availability of the same need to be ensured.
- Remedial action taken report to be shared.

Multiple elements tripping at 400/220kV Muzaffarnagar(UP)

00:35 hrs on 05.05.2022

Antecedent Condition and Tripped Elements

Antecedent Condition:-

- NR Load : 48071 MW
- Affected state load (Uttar Pradesh) : 15366 MW
- Frequency : 49.98 Hz
- Weather condition : Inclement weather condition
- IR exchange : 6710 MW
- Load loss of approx. 19 MW in Uttar Pradesh Control area.

Following elements tripped:-

1) 400/220 kV 315 MVA ICT 3 at Muzaffarnagar(UP)
2) 400/220 kV 315 MVA ICT 1 at Muzaffarnagar(UP)
3) 400/220 kV 315 MVA ICT 2 at Muzaffarnagar(UP)
4) 220kV feeders to Shamli, Charla, Muzaffarnagar-2
5) 132kV feeders to Jansath, Jolly road, Purquazi

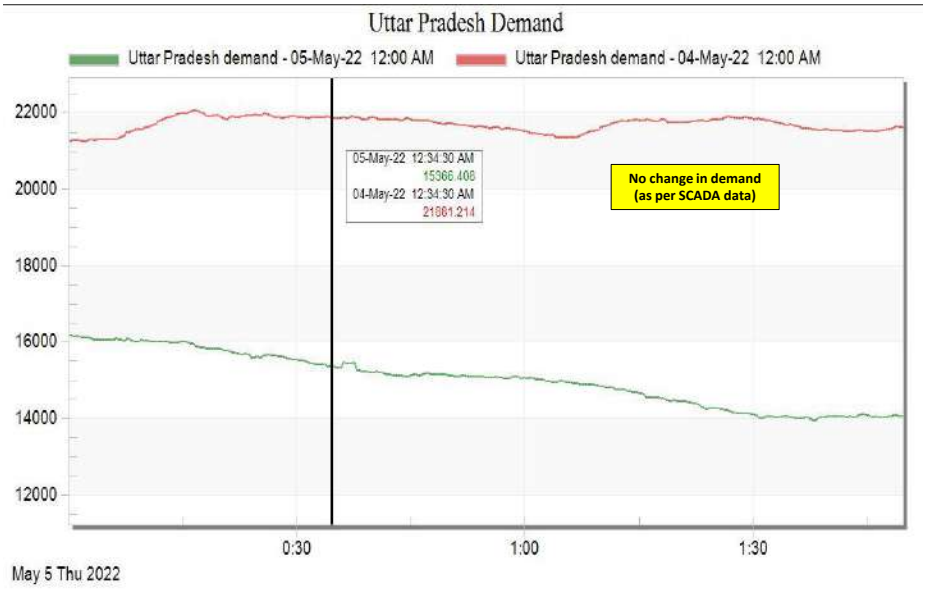
PMU Plot of frequency at Bassi(PG)

00:35hrs/05-May-22

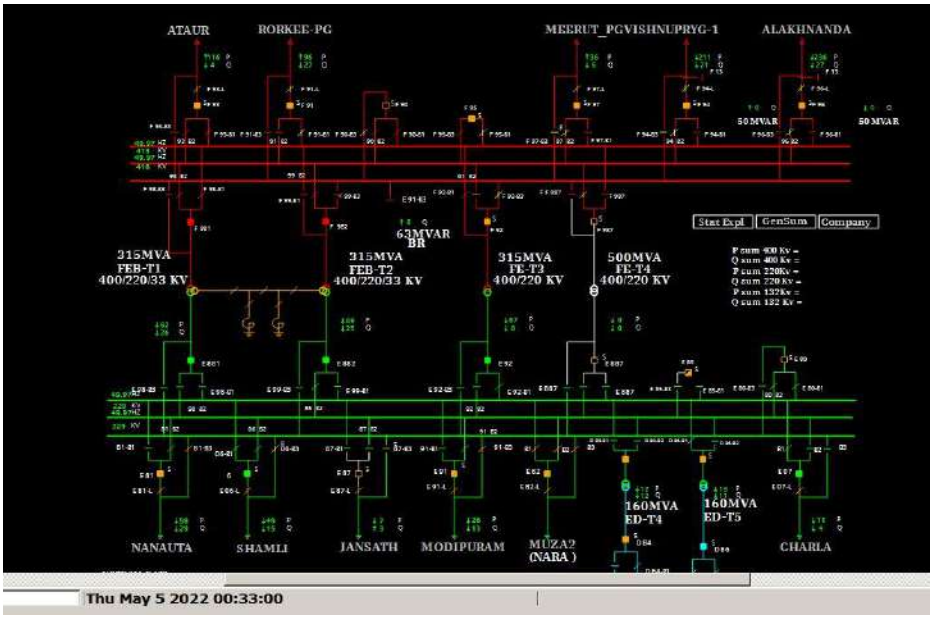
PMU Plot of phase voltage magnitude at Muzaffarnagar(UP)

00:35hrs/05-May-22

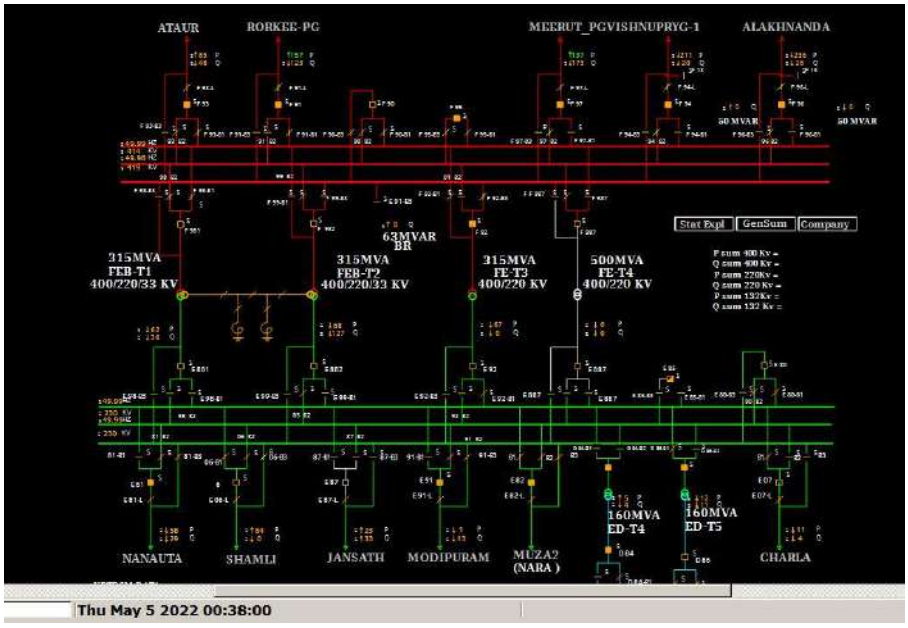
Uttar Pradesh demand during the tripping



SLD of 400/220kV Muzaffarnagar(UP) before the event



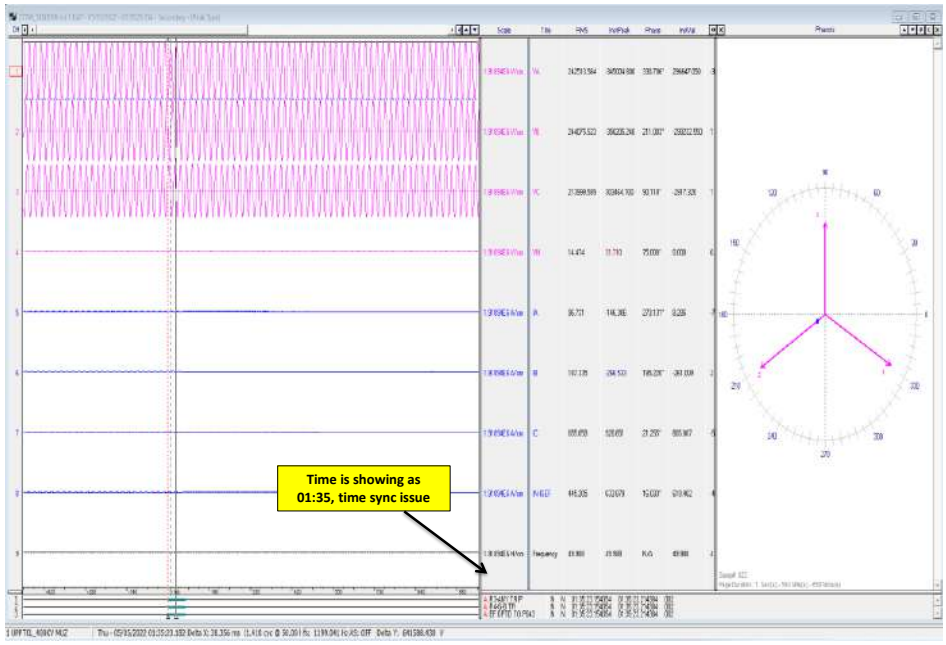
SLD of 400/220kV Muzaffarnagar(UP) after the event



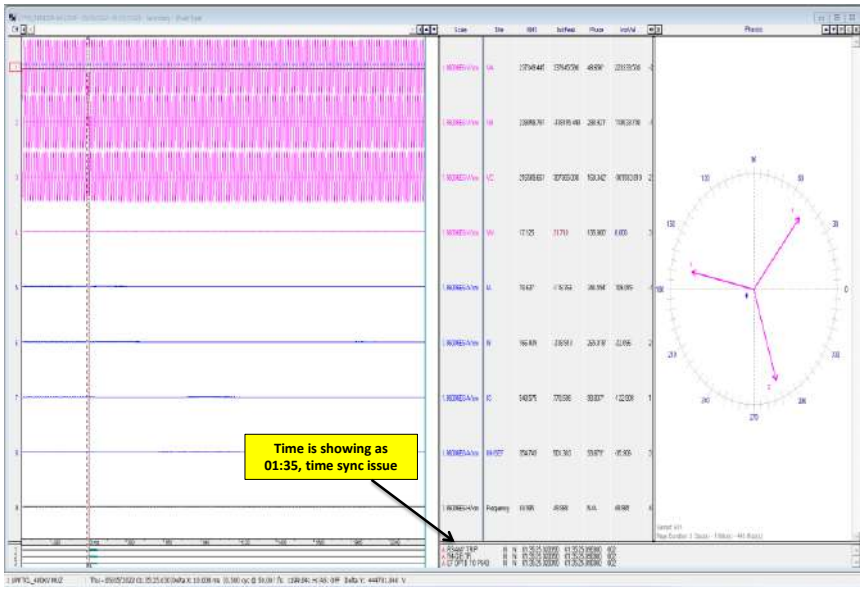
SCADA SOE

Time	Station Name	Voltage	Element Name	Element Type	Element Status	Remark
00:35:26,865	MUZA1_UP	220kV	07CHRLA	Circuit Breaker	Open	Line CB at Muzaffarnagar end of 220kV Muzaffarnagar Charla ckt opened
00:35:26,909	CHARLA_UP	220kV	E_01(MUZA1)	Circuit Breaker	Open	Line CB at Charla end of 220kV Muzaffarnagar-Charla ckt opened
00:35:29,015	MUZA1_UP	400kV	F_99(T2)	Circuit Breaker	Open	CB at 400kV side of 400/220 kV 315 MVA ICT 2 at Muzaffarnagar(UP) opened
00:35:29,020	MUZA1_UP	220kV	E_99(T2)	Circuit Breaker	Open	CB at 220kV side of 400/220 kV 315 MVA ICT 2 at Muzaffarnagar(UP) opened
00:35:29,171	MUZA1_UP	400kV	F_98(T1)	Circuit Breaker	Open	CB at 400kV side of 400/220 kV 315 MVA ICT 1 at Muzaffarnagar(UP) opened
00:35:29,177	MUZA1_UP	220kV	E_98(T1)	Circuit Breaker	Open	CB at 220kV side of 400/220 kV 315 MVA ICT 1 at Muzaffarnagar(UP) opened
00:35:31,203	MUZA1_UP	132kV	D_86(T5)	Circuit Breaker	Open	
00:35:31,517	MUZA1_UP	132kV	D_71(PRQZI)	Circuit Breaker	Open	Line CB at Muzaffarnagar end of 132kV Muzaffarnagar Purqazi ckt opened
00:35:31,521	MUZA1_UP	220kV	E_06(SHMLI)	Circuit Breaker	Open	Line CB at Muzaffarnagar end of 220kV Muzaffarnagar Shamli ckt opened
00:35:31,525	MUZA1_UP	132kV	D_74(JNSTH)	Circuit Breaker	Open	Line CB at Muzaffarnagar end of 132kV Muzaffarnagar Jansath ckt opened
00:35:31,923	MUZA1_UP	220kV	E_92(T3)	Circuit Breaker	Open	CB at 220kV side of 400/220 kV 315 MVA ICT 3 at Muzaffarnagar(UP) opened
00:35:32,319	MUZA1_UP	132kV	D_73(JLYRD)	Circuit Breaker	Open	Line CB at Muzaffarnagar end of 132kV Muzaffarnagar Jolly Road 1 ckt opened
00:35:32,320	MUZA1_UP	220kV	E_82(MUZA2)	Circuit Breaker	Open	Line CB at Muzaffarnagar end of 220kV Muzaffarnagar Muzaffarnagar2(NARA) ckt opened

DR of 400/220kV ICT-1 at Muzaffarnagar(UP)



DR of 400/220kV ICT-2 at Muzaffarnagar(UP)



Observations

Analysis of tripping (As reported):

- In antecedent condition, 400/220 kV 315 MVA ICT 1,ICT 2 & ICT 3 at Muzaffarnagar(UP) were carrying 62MW, 69MW & 67MW respectively.
- As reported at 00:35 Hrs, B-N phase to earth fault occurred on 220kV Muzaffarnagar-Charla ckt in Z-1 with distance of 33km from Muzaffarnagar end. As CB of this line didn't open, fault kept persisting and later this CB got damage. Further after 3 sec, 400/220 kV 315 MVA ICT 1 & ICT 2 at Muzaffarnagar(UP) tripped on backup O/C, E/F protection operation. Further after 2sec, 220kV Muzaffarnagar-Shamli ckt and 220kV Muzaffarnagar-Jansath ckt tripped on SPS operation. Further after 300ms, 400/220 kV 315 MVA ICT 3 at Muzaffarnagar(UP) also tripped. At the same time, 220kV Muzaffarnagar-Modipuram ckt was hand tripped. 132kV line to Purqazi, Jolly Road and Jeneseth also tripped during same time.
- As per PMU, B-N phase to earth fault with delayed clearance in 5120ms is observed. As reported by SLDC-UP, load loss of around 19MW occurred during the event.

Observations

Brief of details received

- ✓ B ph pole of CB of 220 kV MZN -CHARLA line damaged at 400 kV MZN end during the fault.
- ✓ Later fault cleared with the tripping of ICTs on back up O/C E/F.
- ✓ Due to overloading on ICTs (ICT1,ICT2,ICT3), 132 kV Purkaji, 132 kV Bhopa road, 132 kV jolly road1 ,220 kV lines Janshat and Shamli line tripped on SPS operation.
- ✓ LBB protection also didn't operate. After checking logic and settings of 220 kV Bus Bar & according to relay engineer, breaker status was disserted (open) So LBB didn't operate. Scheme and logics of Bus bar relay need to be checked by Engineer (SEL BUS BAR relay Engineer)
- ✓ 220 kV MZN-NARA and 220 kV MZN-Modipuram line were opened manually from MZN end.
- ✓ 220 kV MZN-Badhaikalan, 220 kV MZN-Modipuram lines were tripped from remote end also.

Points for Discussion:

- Whether **bus bar relay logic** has been corrected? Confirmation of the same need to be shared.
- **Reason of delayed clearance of fault** needs to be investigated and to be shared.
- Whether **distance protection (Z-2 or Z-3) initiated from remote end of 220kV lines?** If not operated then same needs to be analysed and corrective action to be taken wherever necessary.
- **ICT-1&2 DR is not time synced**. Time sync of each and every recording devices need to be ensured.

Observations

Points for Discussion:

- As per SOE, CB of 220kV Muzaffarnagar-Charla ckt opened within time. **Exact location and nature of fault?**
- As per PMU, fault cleared after approx 5sec. Such high delayed clearance of fault affects reliability and security of grid. **Reason of delayed clearance of fault** needs to be investigated and to be shared.
- If CB of 220kV Muzaffarnagar-Charla ckt got stuck then **why did LBB didn't operate**?
- Whether **distance protection (Z-2 or Z-3) initiated from remote end of 220kV lines?** If not operated then same needs to be analysed and corrective action to be taken wherever necessary.
- SCADA data of 400/220kV was suspected during the event. MW flow of 400/220kV ICTs and 220kV lines for around 10min duration during the event may be shared for analysis.
- On which protection 400/220 kV 315 MVA ICT 3 at Muzaffarnagar(UP) had tripped? And why was delay of around 2sec between tripping of ICT 3 with ICT 1 & ICT 2?
- 132kV lines to Purquazi, jolly Road1 and Jenseth also tripped during the event. Reason of tripping of these lines to be shared.
- Remedial action taken report to be shared.

Multiple elements tripping at 220kV Hissar(BBMB) & 220kV Hissar IA(HV)

16:09 hrs on 10.05.2022

Antecedent Condition and Tripped Elements

Antecedent Condition:-

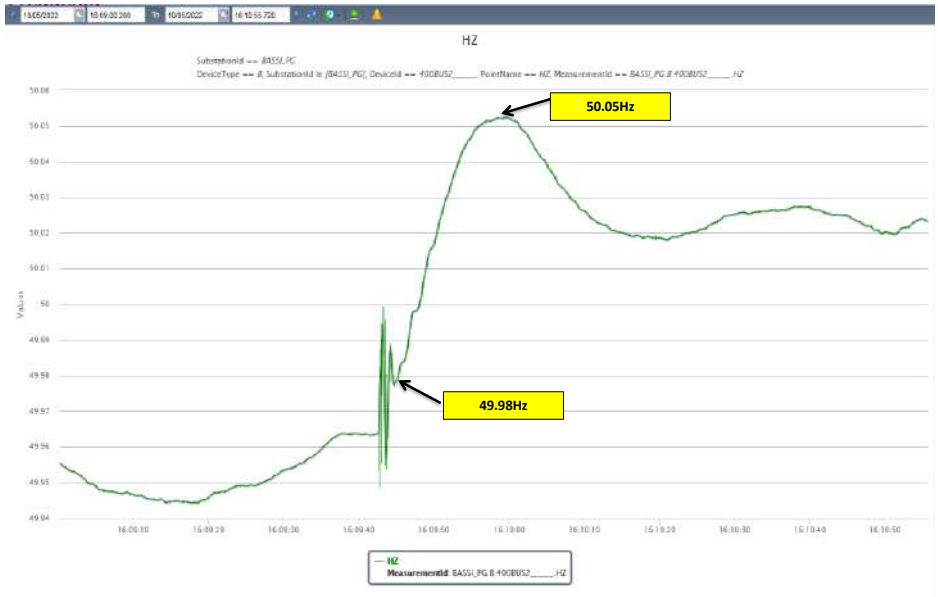
- NR Load : 62265 MW
- Affected state load (Haryana) : 8304 MW
- Frequency : 49.99 Hz
- Weather condition : Normal
- IR exchange : 10796 MW
- Load loss of approx. 700 MW in Haryana Control area.

Following elements tripped:-

1) 220 KV Hissar(BB)-Chirawa(RS) (BB) Ckt-1
2) 220 KV Hissar(BB)-Jindal Steel(HR) (HVPNL) Ckt-1
3) 220 KV Hissar-Sangrur (BB) Ckt-2 220 KV Hissar-Sangrur (BB) Ckt-1
4) 220KV Bus 2 at Hissar(BB), 220 KV
5) Bhiwani-Hissar (BB) Ckt-2
6) 220 KV Hissar(PG)-Hissar IA(HV) (PG) Ckt-2
7) 220 KV Hissar(BB)-Hissar IA(HV) (BBMB) Ckt-2
8) 220 KV Bhiwani-Hissar (BB) Ckt-1
9) 220 KV Hissar(BB)-Hissar IA(HV) (HVPNL) Ckt-1
10) 220 KV Hissar(PG)-Hissar IA(HV) (PG) Ckt-1

PMU Plot of frequency at Bassi(PG)

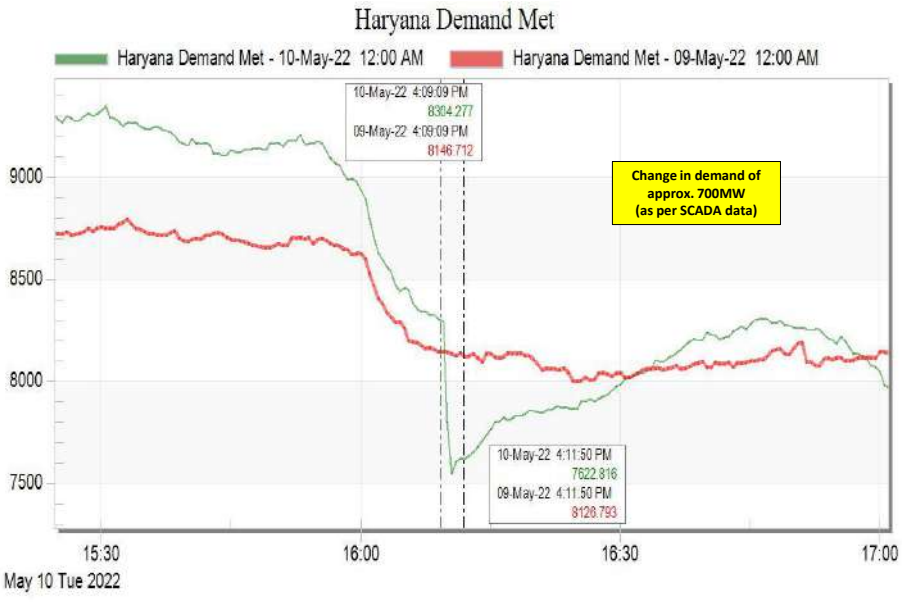
16:10hrs/10-May-22



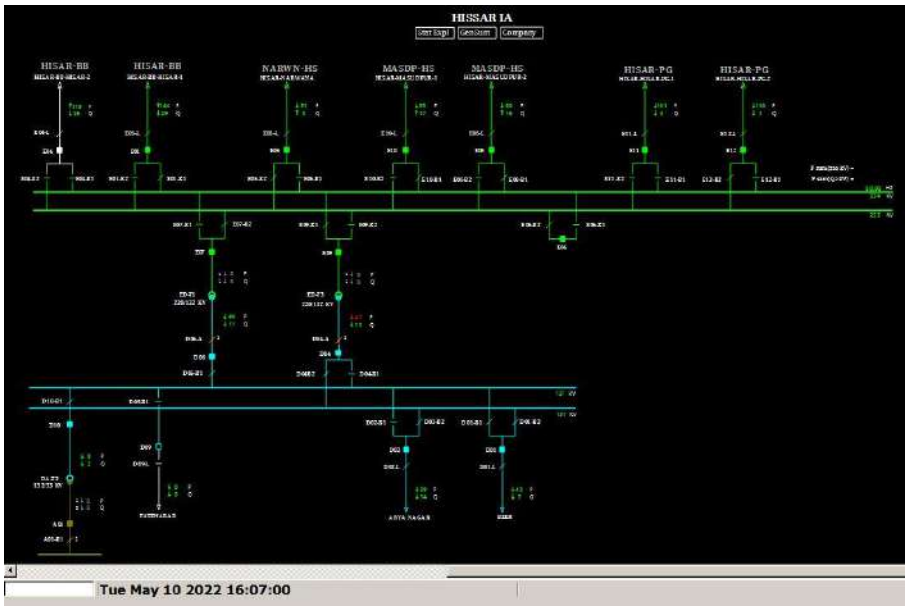
PMU Plot of phase voltage magnitude at Hissar(PG)

16:10hrs/10-May-22

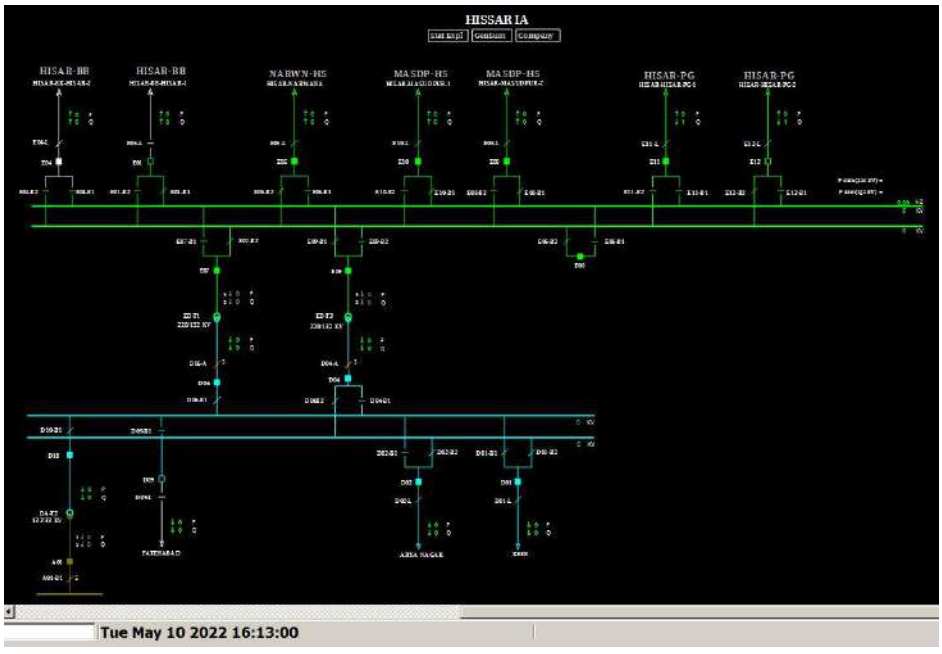
Haryana demand during the tripping



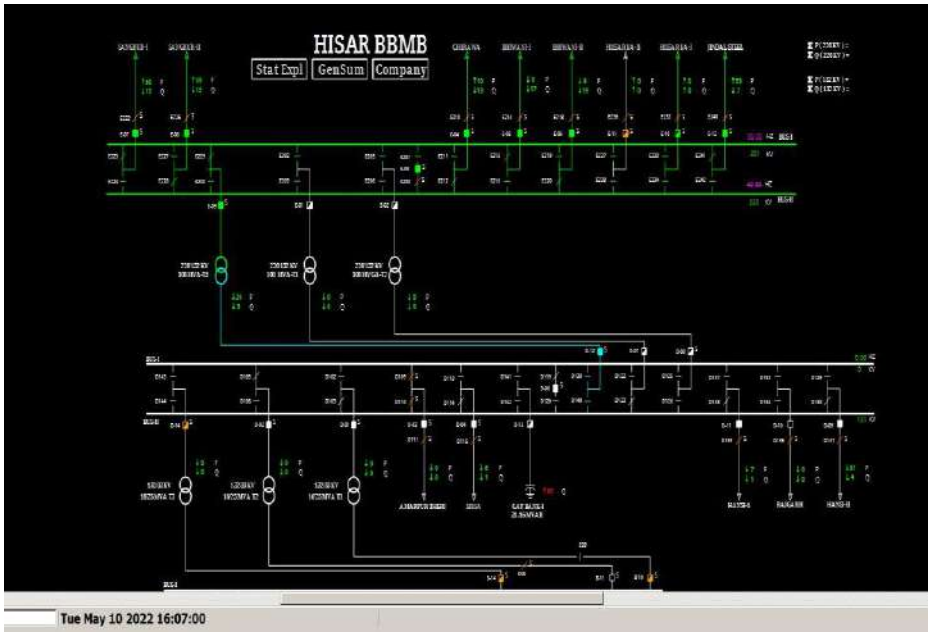
SLD of 220kV Hissar IA before the event



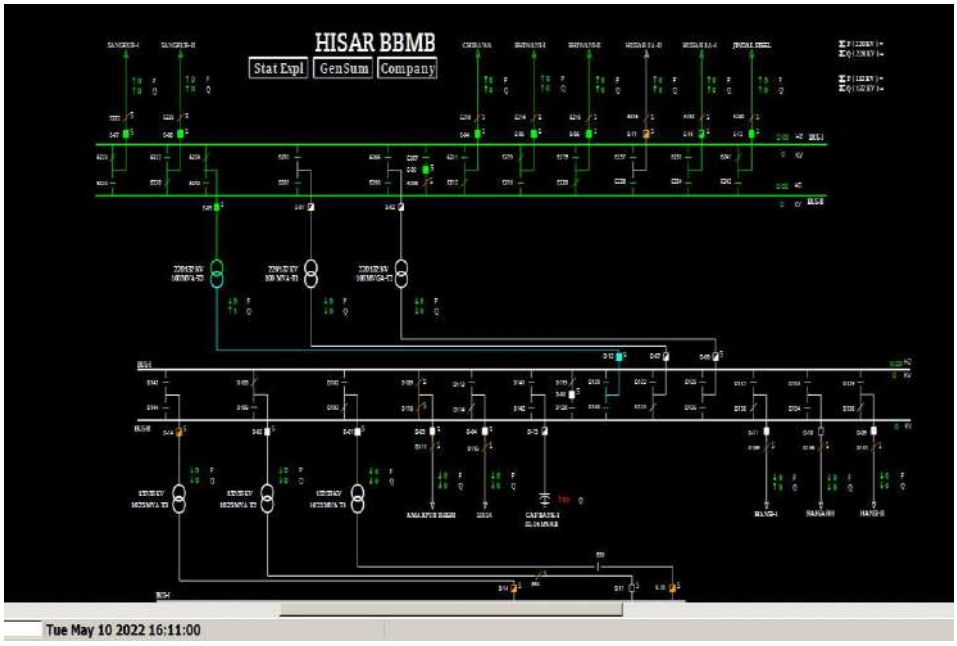
SLD of 220kV Hissar IA after the event



SLD of 220kV Hissar (BBMB) before the event



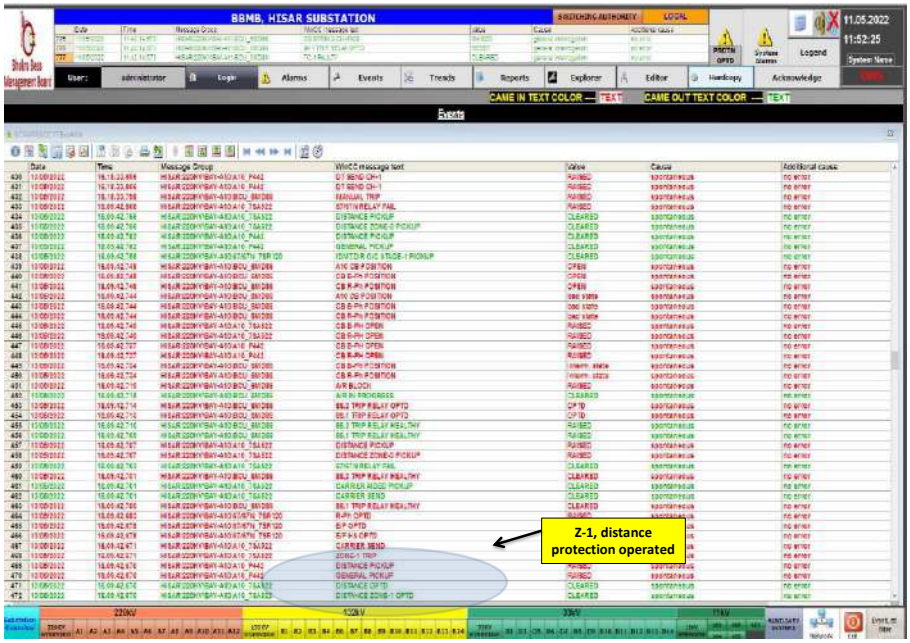
SLD of 220kV Hissar (BBMB) after the event



SCADA SOE

Time	Station Name	Voltage	Element Name	Element Type	Element Status	Remark
16:09:42,655	HISSAR	220kV	01HISBB1	Circuit Breaker	Open	Line CB at Hissa IA end of 220kV Hissar IA-Hissar(BB) ckt-1 opened
16:09:42,975	HISSAR	220kV	12HISPG2	Circuit Breaker	Open	Line CB at Hissa IA end of 220kV Hissar IA-Hissar(PG) ckt-2 opened
16:09:43,136	NARWANA	220kV	10HISAR	Circuit Breaker	Open	Line CB at Narwana end of 220kV Hissar IA-Narwana ckt opened
16:09:43,312	MASUDPUR	220kV	01HISAR1	Circuit Breaker	Open	Line CB at Masudpur end of 220kV Hissar IA-Masudpur ckt-1 opened
16:09:43,315	MASUDPUR	220kV	02HISAR2	Circuit Breaker	Open	Line CB at Masudpur end of 220kV Hissar IA-Masudpur ckt-2 opened
16:09:43,332	BHIWANI	220kV	02HISAR2	Circuit Breaker	disturbe	
16:09:43,379	SANGRUR	220kV	03HISAR1	Circuit Breaker	Open	Line CB at Sangrur end of 220kV Hissar(BB)-Sangrur ckt-1 opened
16:09:43,384	SANGRUR	220kV	04HISAR2	Circuit Breaker	Open	Line CB at Sangrur end of 220kV Hissar(BB)-Sangrur ckt-2 opened
16:09:43,398	HISSAR	220kV	06HISAR1	Circuit Breaker	disturbe	
16:09:43,471	BHIWANI	220kV	01HISAR1	Circuit Breaker	Open	

Event logger of BBMB end



DR summary of 220kV Hissar_IA(end)-Hissar(BB) ckt-1

SIEMENS

7SA612 V4_6 Var_prn_17_14_52
Indications

SIMATIC

Trip Log - 000440 / 3/13/1994
4:42:34.338 AM - 220 IA Hisar

12.05.22 17:14:52

1 Indications

1.1 Trip Log - 000440 / 3/13/1994 4:42:34.338 AM - 220 IA Hisar 12052022 / Folder / 7SA612 V4.6 Var/7SA612 V04.62.01

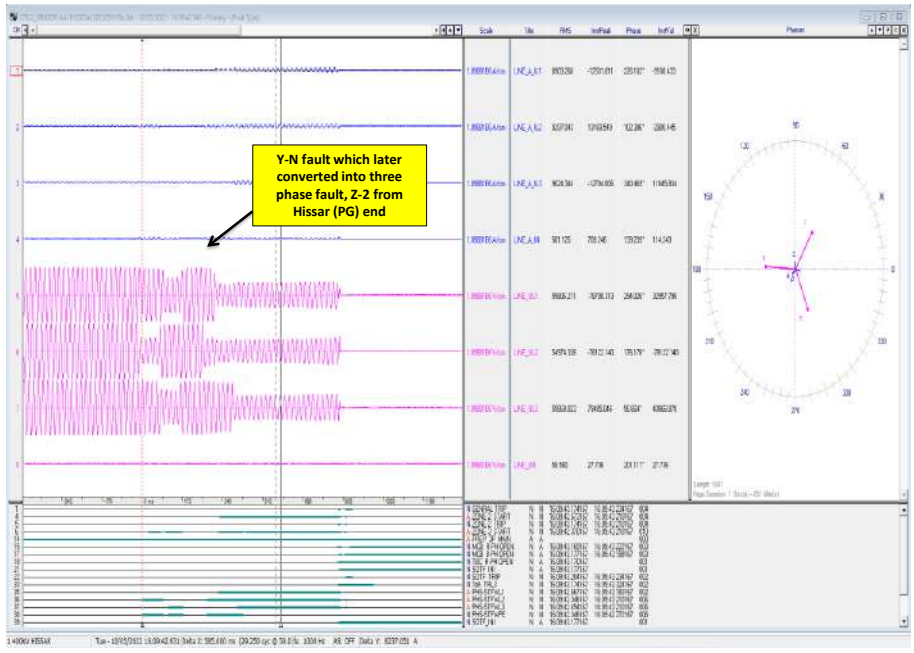
Trip Log - 000440 / 3/13/1994 4:42:34.338 AM - 220 IA Hisar 12052022 / Folder / 7SA612 V4.6 Var/7SA612 V04.62.01

Number	Indication	Value	Date and time	Cause	State
00301	Power System fault	440 - ON	13.03.1994 04:42:34.338		
00302	Fault Event	443 - ON	13.03.1994 04:42:34.338		
03684	Distance Pickup L2E	ON	1 ms		
03702	Distance Loop L2E selected forward	ON	1 ms		
03805	Distance TRIP command Phases L123	ON	1 ms		
00533	Primary fault current IL1	0.01 kA	3 ms		
00534	Primary fault current IL2	13.11 kA	3 ms		
00535	Primary fault current IL3	0.04 kA	3 ms		
03671	Distance PICKED UP	OFF	99 ms		
03702	Distance Loop L2E selected forward	OFF	99 ms		
00511	Relay GENERAL TRIP command	OFF	103 ms		
01124	Fault Locator Loop L2E	ON	50 ms		
01117	Flt Locator: secondary RESISTANCE	0.22 Ohm	50 ms		
01118	Flt Locator: secondary REACTANCE	0.14 Ohm	50 ms		
01114	Flt Locator: primary RESISTANCE	0.36 Ohm	50 ms		
01115	Flt Locator: primary REACTANCE	0.24 Ohm	50 ms		
01119	Flt Locator: Distance to fault	1.1 km	50 ms		
01120	Flt Locator: Distance [%] to fault	35.6 %	50 ms		

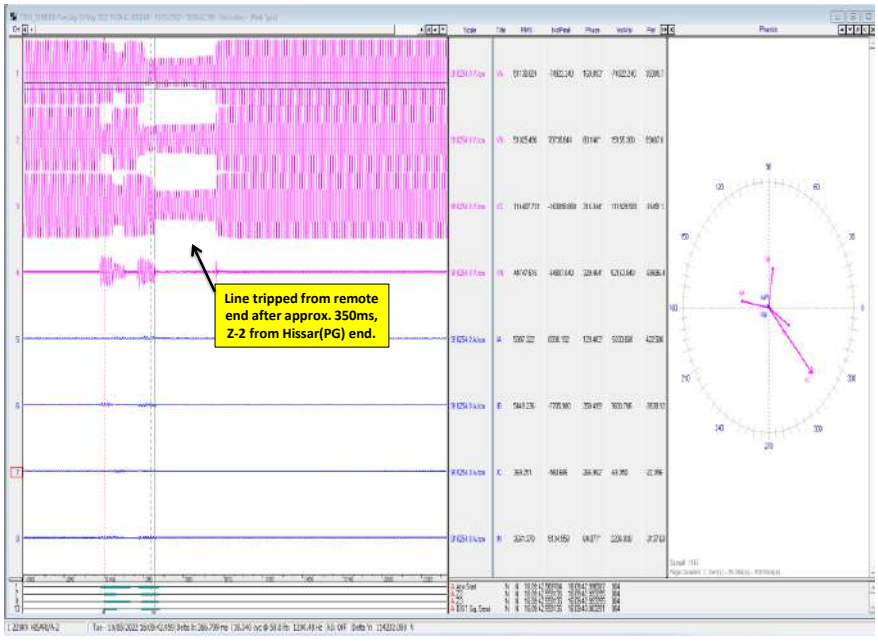
Date & time not sync

Y-N fault,

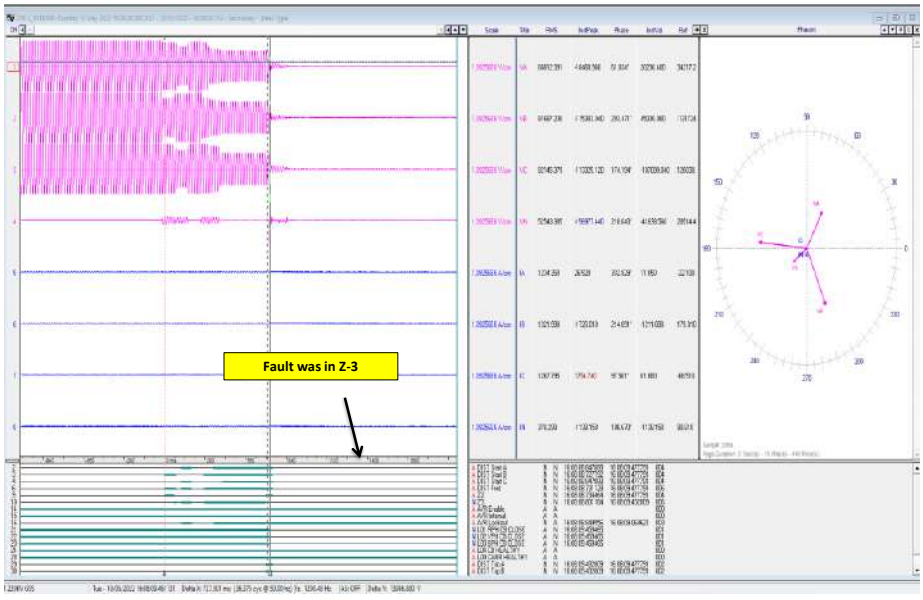
DR summary of 220kV Hissar(PG)(end)-Hissar_IA ckt-1



DR summary of 220kV Hissar(PG)(end)-Hissar_IA ckt-2



DR summary of 220kV Hissar(BB)-Chirawa(Raj)(end) ckt-1



Observations

Analysis of tripping (As reported):

- As reported at 16:09 Hrs, **Bus fault occurred due to bursting of Y-Ph CT of 220 KV Hissar(BB)-Hissar IA(HV) (HVPNL) Ckt-1 at Hissar IA end.** During same time, bus bar protection at Hissar_BB operated which resulted into tripping of all 220kV lines i.e, 220 KV Hissar(BB)-Chirawa(RS) (BB) Ckt-1, 220 KV Hissar(BB)-Jindal Steel(HR) (HVPNL) Ckt-1, 220 KV Hissar-Sangrur (BB) Ckt-1 & Ckt-2, 220 KV Bhiwani-Hissar (BB) Ckt-2, 220 KV Hissar(BB)-Hissar IA(HV) (HVPNL) Ckt-1 & Ckt-2. At the same time, 220 KV Hissar(PG)-Hissar IA(HV) (PG) Ckt-1 & Ckt-2 also tripped from Hissar IA end and 220kV Hissa IA-Masudpur ckt-1 & Ckt-2, 220kV Hissa IANarwana ckt-1 tripped from remote end only.
- As per PMU, **Y-N fault which later converted into three phase fault with delayed clearance in 840ms is observed**.
- As per SCADA, change in load of approx. 700MW in Haryana control area is observed. In antecedent condition, 220 KV Hissar(BB)-Hissar IA(HV) (HVPNL) Ckt-1 & Ckt-2, 220 KV Hissar(PG)-Hissar IA(HV) (PG) Ckt-1 & Ckt-2 were carrying 144MW, 119MW, 101MW & 110MW respectively.

Observations

Points for Discussion:

- As per PMU, Y-ph fault which later converted into three phase fault and same was cleared with delay of 840ms. **Exact location and nature of fault to be shared**. And **reason of delayed clearance of fault also to be shared.**
- Why did 220kV Hissar IA-Masudpur ckt-1 & 2 and 220kV Hissar IA-Narwana ckt-1 not trip from Hissar IA end?
- Why did bus bar protection operate at Hissar(BBMB) end operate as fault was at 220kV Hissar IA(Har) substation?
- CB status of tripped elements from Hissar(BBMB) is not available with NRLDC. Availability of same needs to be ensured.
- Remedial action taken report to be shared.
- **DR not received from BBMB end.**
- **Time sync issue at Hissar_IA end.**

Multiple elements tripping at 400 kV Greater Noida (UP)

22:46 hrs on 20.05.2022

Antecedent Condition and Tripped Elements

Antecedent Condition:-

- NR Load : 65282 MW
- Affected state load (Uttar Pradesh) : 22673 MW
- Frequency : 50.02 Hz
- Weather condition : Normal
- IR exchange : 14598 MW
- Load loss of approx. 750 MW in Uttar Pradesh Control area.

Following elements tripped:-

1) 400/220 kV 315 MVA ICT 1 at Gr.Noida(UPC)
2) 400/220 kV 315 MVA ICT 2 at Gr.Noida(UPC)
3) 400/220 kV 500 MVA ICT 5 at Gr.Noida(UPC)
4) 400/220 kV 500 MVA ICT 6 at Gr.Noida(UPC)

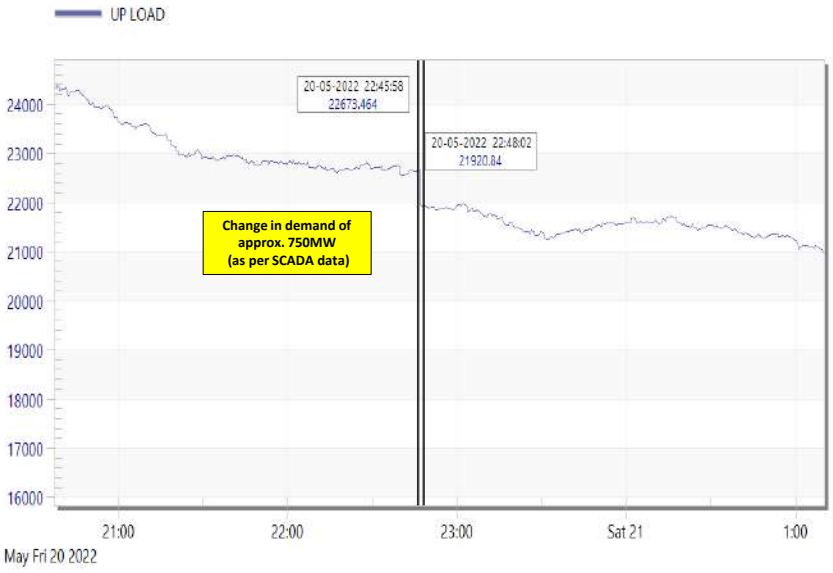
PMU Plot of frequency at Dadri Thermal(NT)

22:46hrs/20-May-22

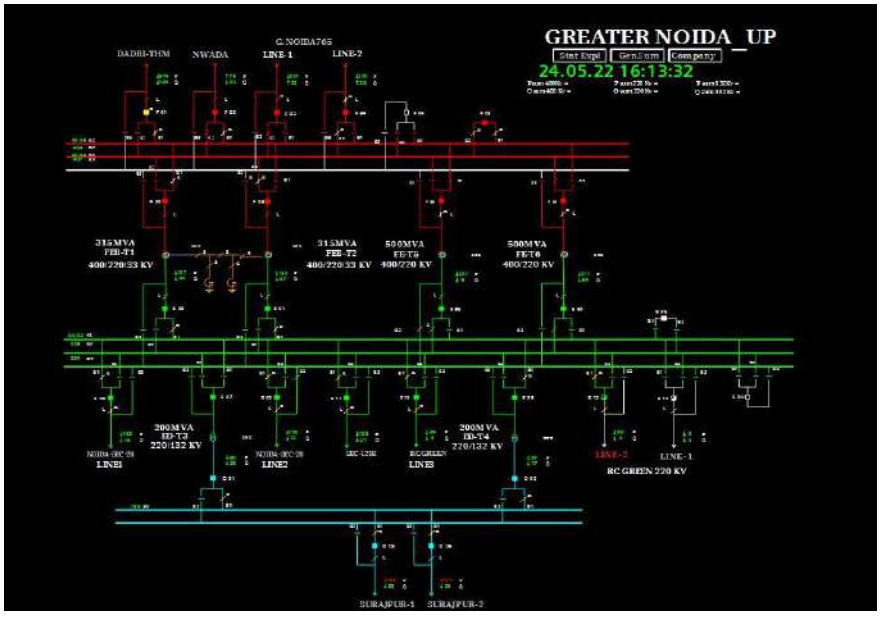
PMU Plot of phase voltage magnitude at Dadri Thermal(NT)

22:46hrs/20-May-22

Uttar Pradesh demand during the tripping



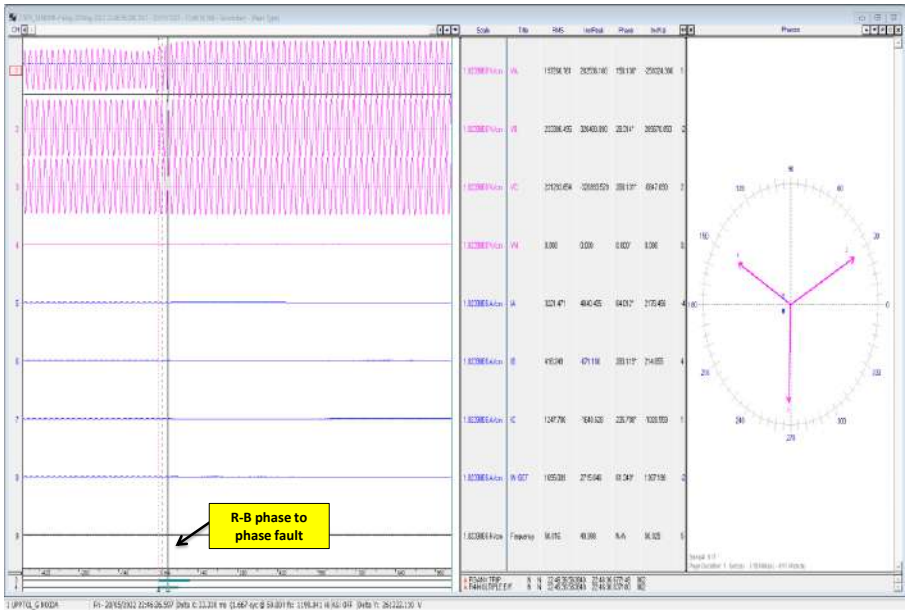
SLD of 400/220kV Gr. Noida(UP)



SCADA SOE

Time	Station Name	Voltage	Element Name	Element Type	Element Status
22:46:36,299	SC148_U	220kV	12SC129	Circuit Breaker	Open
22:46:36,470	NOIDA_UP	220kV	E_84(GNODA-2)	Circuit Breaker	Open
22:46:36,509	GNODA_UP	400kV	F_85(T5)	Circuit Breaker	disturbe
22:46:36,515	GNODA_UP	400kV	F_86(T6)	Circuit Breaker	Open
22:46:36,529	GNODA_UP	220kV	E_86(T6)	Circuit Breaker	Open
22:46:36,535	GNODA_UP	220kV	E_85(T5)	Circuit Breaker	Open
22:46:36,551	GNODA_UP	400kV	F_03(T2)	Circuit Breaker	Open
22:46:36,556	GNODA_UP	220kV	E_01(T2)	Circuit Breaker	Open
22:46:36,598	GNODA_UP	220kV	E_06(T1)	Circuit Breaker	Open
22:46:36,611	GNODA_UP	400kV	F_06(T1)	Circuit Breaker	disturbe
22:46:36,629	GNODA_UP	220kV	E_12(RCGRN)	Circuit Breaker	disturbe

DR of 400/220kV ICT-1 at Gr. Noida



Observations

Analysis of tripping (As reported):

- As per information received from Executive Engineer (T&C) Gr. Noida, R-N fault occurred on 220kV Gr. Noida-RC Green ckt.-I.
- Auto Recloser attempt was taken by circuit breaker and got unsuccessful due to persistent fault.
- After this, 3 phase tripping command did not issue by relay.
- Due to this all ICTs at 400kV Gr. Noida tripped on E/F protection.
- As per PMU, R-B double phase to earth fault with delayed clearance in 1280ms is observed.
- As per SCADA, change in load of approx. 750MW observed in UP control area.

Points for Discussion:

- Reason of delayed clearance of fault in 220kV Gr. Noida- RC green ckt ?
- DR of 220kV Gr. Noida- RC green ckt need to be shared.
- **Proper operation of A/R** need to ne ensured.
- As per concerned field officer 220kV Noida 129-Noida 148 line tripped at the same time which needs to be analyzed. DR of the same need to be shared.
- **Remedial action taken report to be shared**.

Multiple elements tripping at 400 /220kV Sohna Road(GPTL)

16:22 hrs on 30.05.2022

Antecedent Condition and Tripped Elements

Antecedent Condition:-

- NR Load : 58418 MW
- Affected state load (Haryana) : 7277 MW
- Frequency : 50 Hz
- Weather condition : Rain with Thunderstorm/windstorm
- IR exchange : 8766 MW
- Load loss of approx. 100 MW in Haryana Control area.

Following elements tripped:-

1) 220 KV Sohna Road (GPTL)-Badshahpur(HV) (HVPNL) Ckt-2
2) 220 KV Sohna Road (GPTL)-Badshahpur(HV) (HVPNL) Ckt-1
3) 400 KV Gurgaon(PG)-Sohna Road (GPTL) (GPTL) Ckt-1
4) 220 KV Sohna Road (GPTL)-GurgaonSec72(HV) (HVPNL) Ckt-1

PMU Plot of frequency at Gurgaon(PG)

16:22hrs/30-May-22

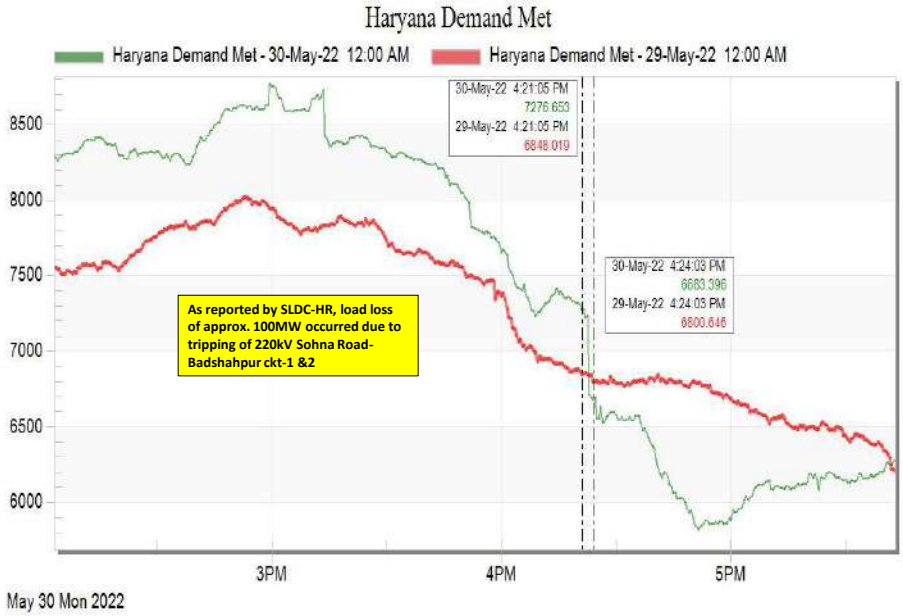
PMU Plot of phase voltage magnitude at Gurgaon(PG)

16:22hrs/30-May-22

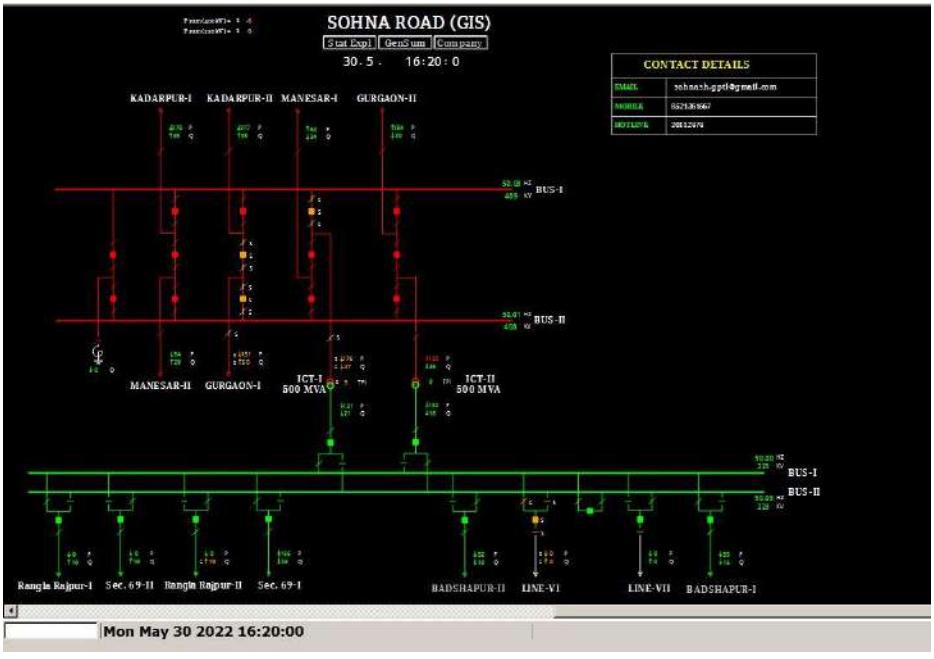
PMU Plot of phase voltage magnitude at Gurgaon(PG)

16:22hrs/30-May-22

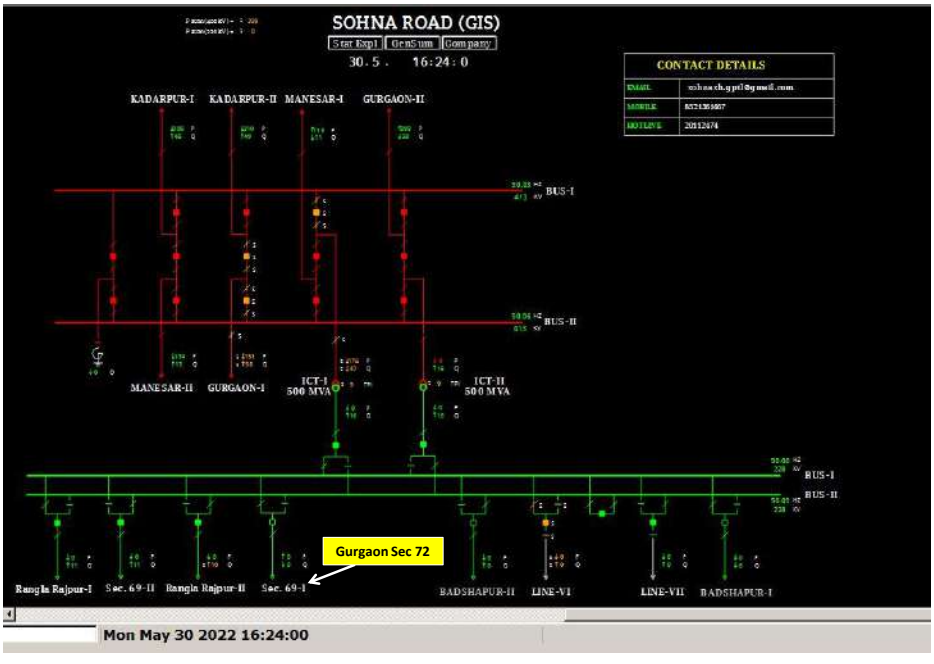
Haryana demand during the tripping



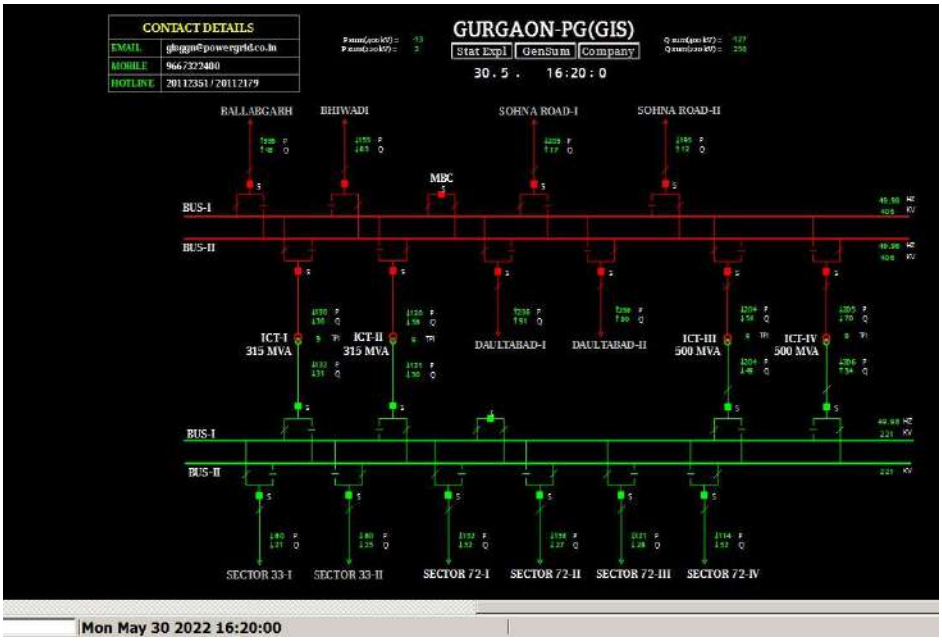
SLD of 400/220kV Sohna Road(GPTL) before the tripping



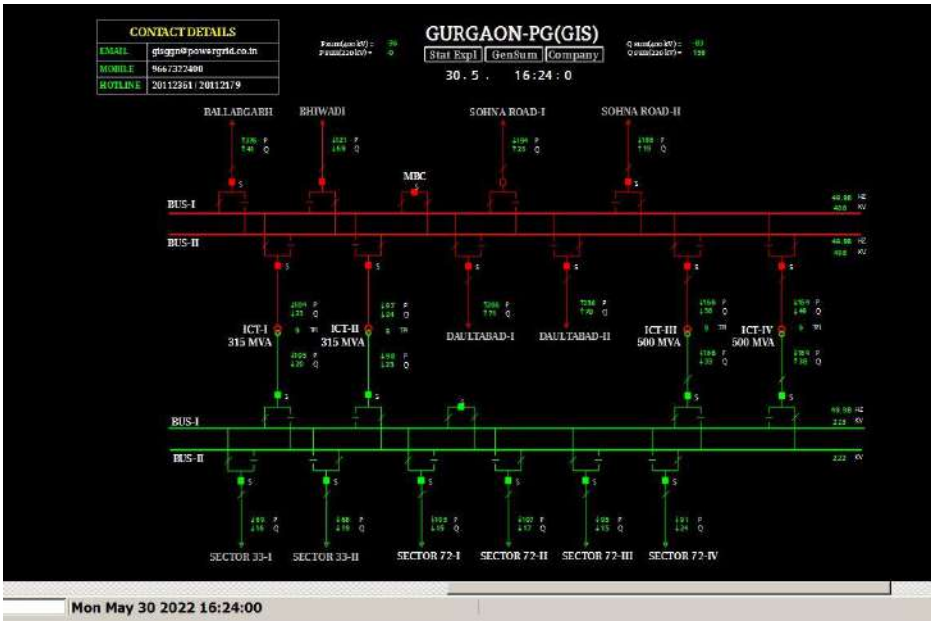
SLD of 400/220kV Sohna Road(GPTL) after the tripping



SLD of 400/220kV Gurgaon(PG) before the tripping



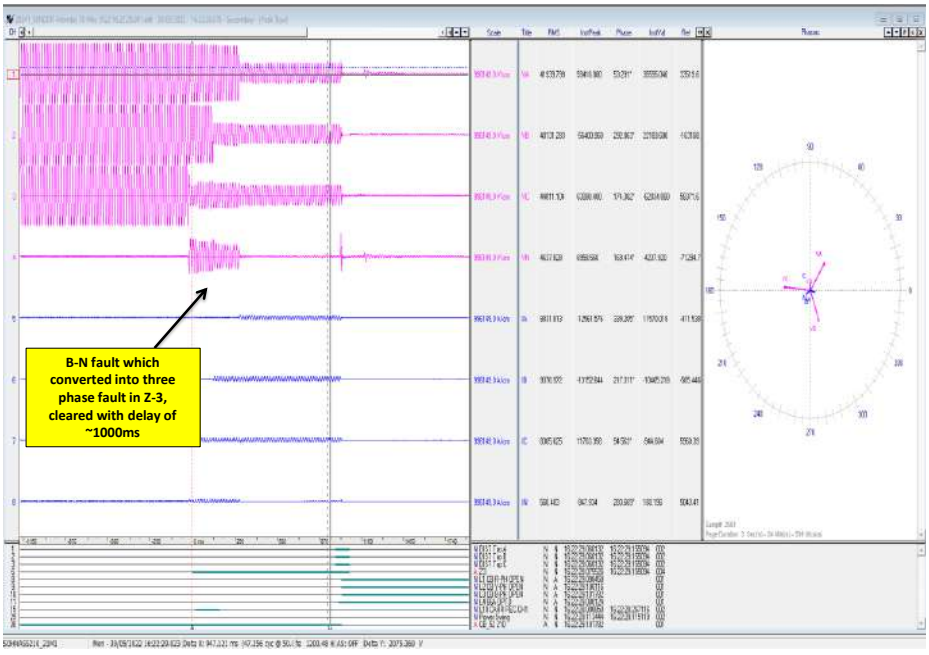
SLD of 400/220kV Gurgaon(PG) before the tripping



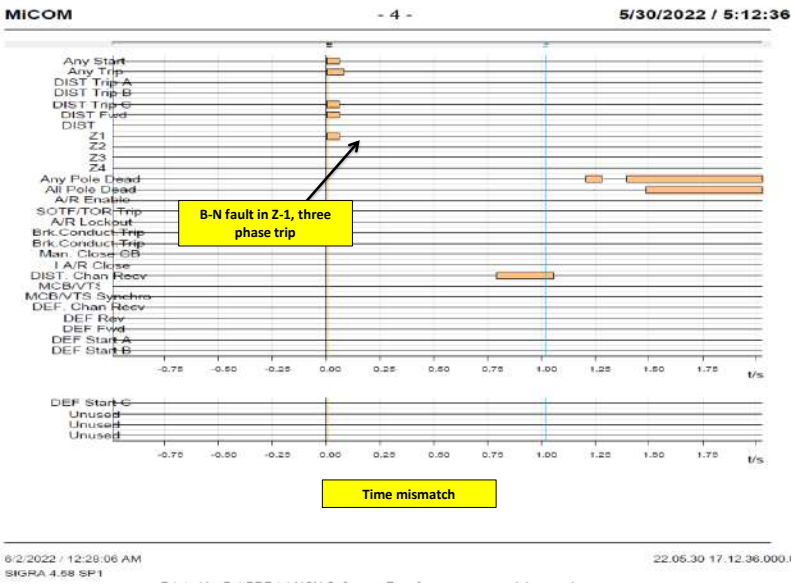
SCADA SOE

Time	Station Name	Voltage	Element Name	Element Type	Element Status	Remark
16:22:28,099	BADSHAPUR	220kV	07SOHRD1	Circuit Breaker	disturbe	
16:22:29,093	SOHNA_I	220kV	10BDSPR1	Circuit Breaker	Open	Line CB at Sohna Road end of 220kV Sohna Road - Badhshahpur ckt-1 opened
16:22:29,300	BADSHAPUR	220kV	14SOHRD2	Circuit Breaker	disturbe	
16:22:30,297	SOHNA_I	220kV	06BDSPR2	Circuit Breaker	Open	Line CB at Sohna Road end of 220kV Sohna Road - Badhshahpur ckt-2 opened
16:22:30,362	SEC72GURGAON	220kV	09MBC	Circuit Breaker	Open	
16:22:30,608	SEC72GURGAON	220kV	05SOHNA1	Circuit Breaker	Open	Line CB at Gurgaon Sec 72 end of 220kV Gurgaon Sec 72 - Sohna Road ckt-1
16:22:31,422	SOHNA_I	220kV	04SC69I	Circuit Breaker	Open	Line CB at Sohna Road end of 220kV Sohna Road - Sec 69 ckt-1 opened
16:22:50 ***	GURGAON	400kV	06SOHNA1	Circuit Breaker	disturbe	
16:22:51 ***	GURGAON	400kV	06SOHNA1	Circuit Breaker	Close	
16:22:52 ***	GURGAON	400kV	06SOHNA1	Circuit Breaker	Open	Line CB at Gurgaon end of 400kV Gurgaon - Sohna Road ckt-1 opened

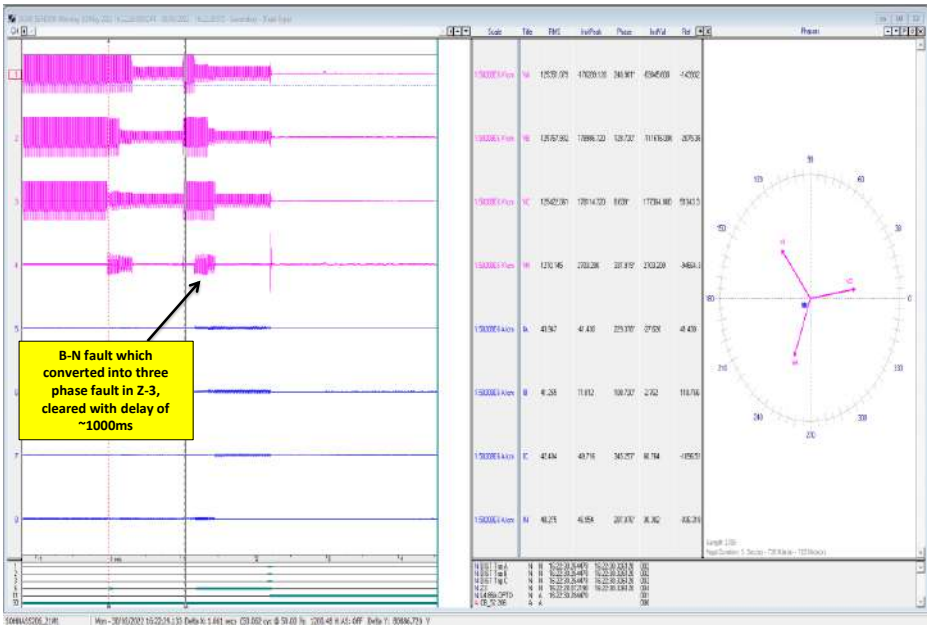
DR of 220kV Sohna Road(end)-Badshahpur ckt-1



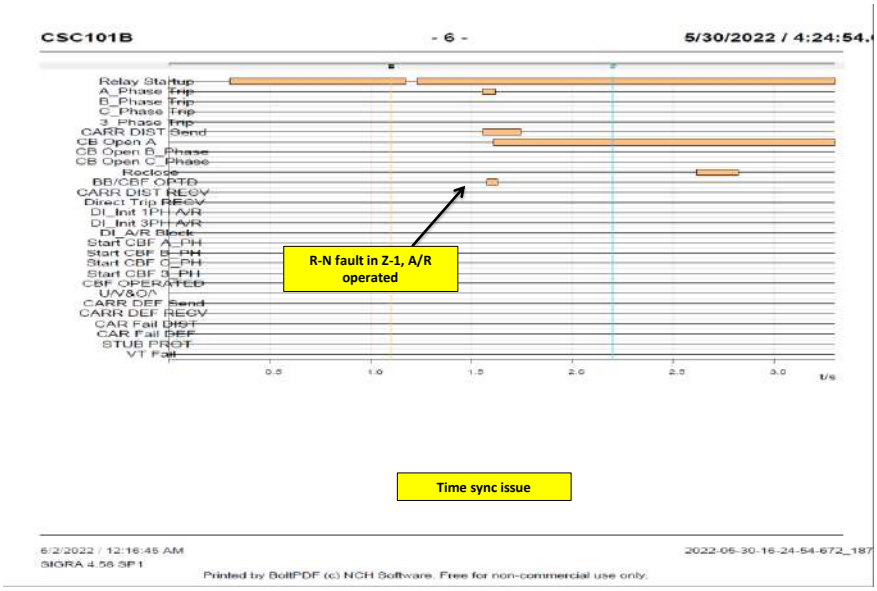
DR of 220kV Sohna Road-Badshahpur(end) ckt-1



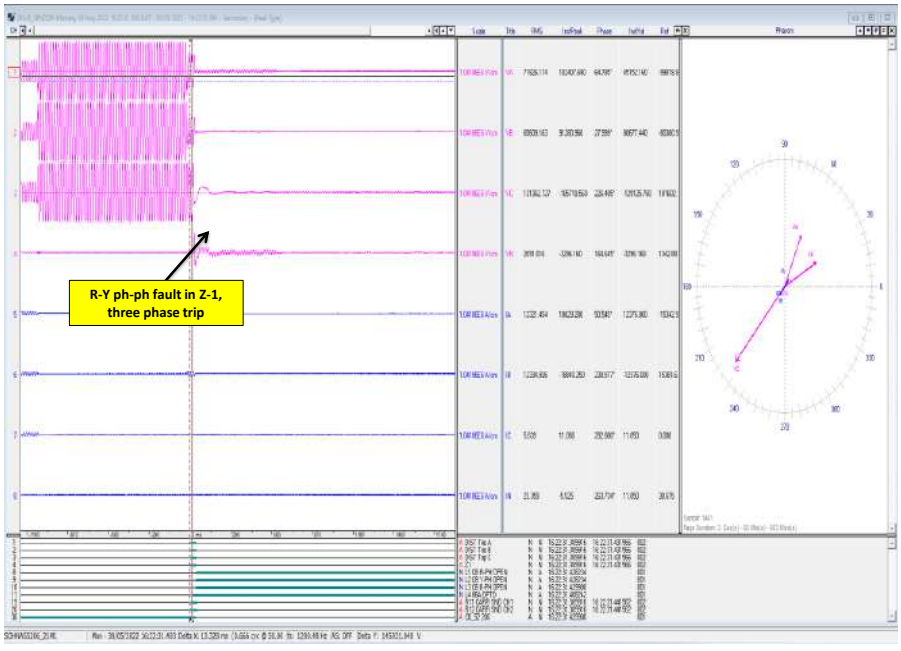
DR of 220kV Sohna Road(end)-Badshahpur ckt-2



DR of 220kV Sohna Road-Badshahpur(end) ckt-1



DR of 220kV Sohna Road(end)-Gurgaon Sec72(end) ckt-1



Observations

Analysis of tripping (As reported):

- In antecedent condition, 220 KV Sohna Road (GPTL)-Badshahpur(HV) (HVPNL) Ckt-1 & Ckt-2 were carrying approx. 55MW each.
- As reported at 16:22hrs, 220 KV Sohna Road (GPTL)-Badshahpur(HV) (HVPNL) Ckt-1 & Ckt-2 both tripped on **R-N & B-N phase to earth fault respectively**. As information received from SLDC-HR through verbal communication, **fault occurred due to damage of wave trap of both the lines during thunderstorm/windstorm** (inclement weather condition).
- At the same time, 220 KV Sohna Road (GPTL)-GurgaonSec72(HV) (HVPNL) Ckt-1 also tripped on R-Y phase to phase fault.
- Further after approx. 20secs(as per SCADA SOE at NRLDC), 400 KV Gurgaon(PG)-Sohna Road (GPTL) (GPTL) Ckt-1 also tripped on R-N phase to earth fault.
- Due to tripping of 220 KV Sohna Road (GPTL)-Badshahpur(HV) (HVPNL) Ckt-1 & Ckt-2, load loss of approx. 100MW occurred which later restored through Samaypur after approx. 15-20mins.
- As per PMU at Gurgaon(PG), at 16:22:30, R-Y-B three phase to earth fault with delayed clearance in 2240ms occurred followed by R-N phase to earth fault with unsuccessful A/R operation at 16:22:50.

Observations

Points for Discussion:

- Exact location & nature of fault?
- Reason of delayed clearance of fault.
- **Sohna road sensed fault in Z-3, what was the location of fault?**
- It seems that, distance protection at Sohna Road(GPTL) & Gurgaon(PG) are not well coordinated with each other. Same needs to be reviewed in coordination with each other.
- **Time sync issue in DR of Badshahpur end**.
- Remedial action taken report to be shared.

Multiple elements tripping at 220kV Dhauliganga HEP (NHPC)

10:19 hrs on 15.06.2022

Antecedent Condition and Tripped Elements

Antecedent Condition:-

- NR Load : 70383 MW
- Affected state load (Uttar Pradesh) : 22498 MW
  (Uttarakhand) : 2108 MW
- Frequency : 50.05 Hz
- Weather condition : Normal
- IR exchange ` : 11893 MW
- Generation loss of approx. 140 MW

Following elements tripped:-

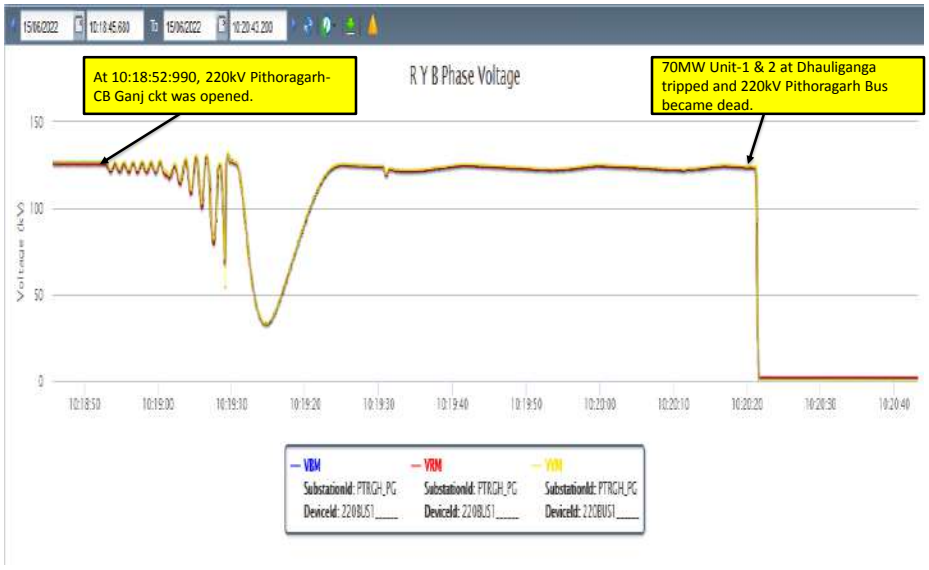
1) 132 KV Pithoragarh(PG)-Almora(PTCUL) (PTCUL) Ckt-1
2) 70 MW Dhauliganga HPS - UNIT 2
3) 70 MW Dhauliganga HPS - UNIT 1

PMU Plot of frequency at CB Ganj(UP)

10:20hrs/15-June-22

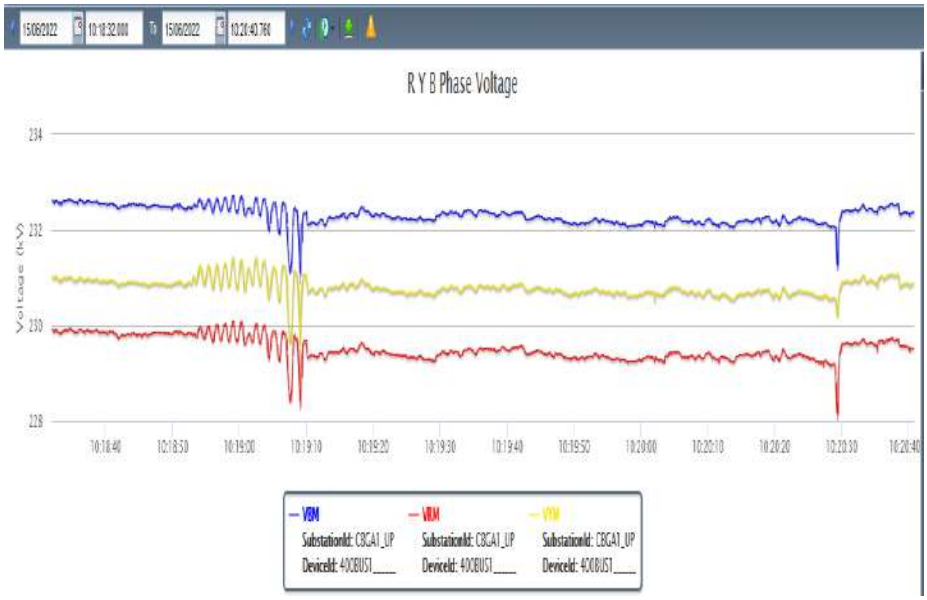
PMU Plot of phase voltage magnitude at Pithoragarh(PG)

10:20hrs/15-June-22

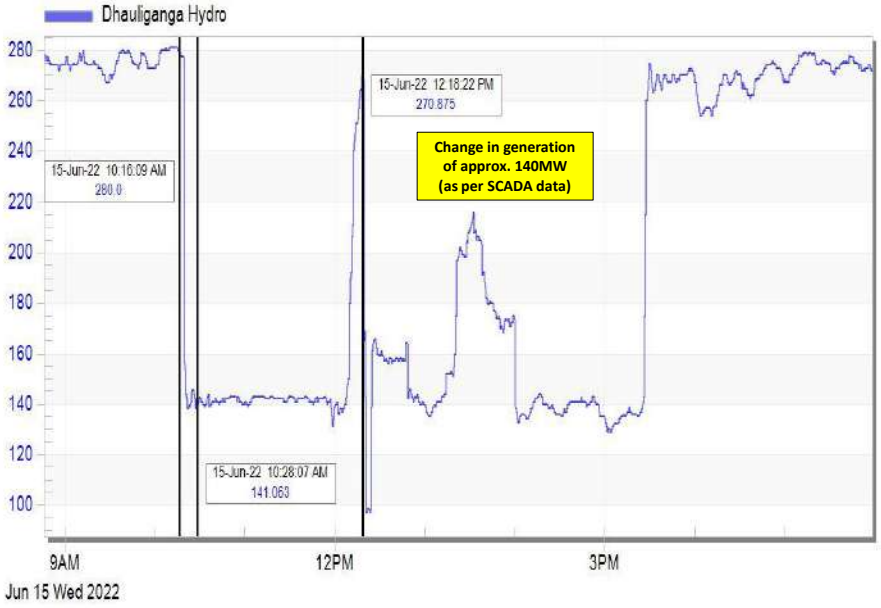


PMU Plot of phase voltage magnitude at CB Ganj(UP)

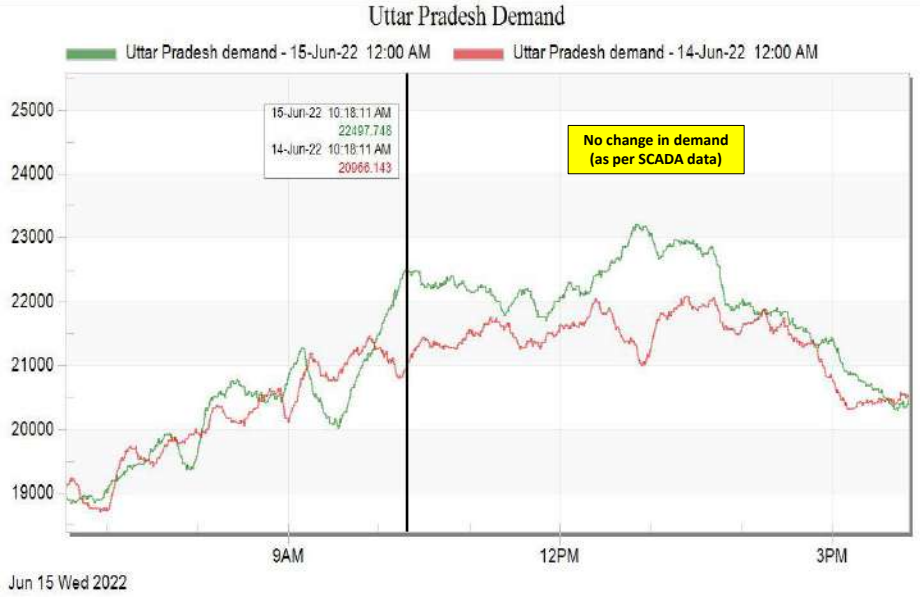
10:20hrs/15-June-22



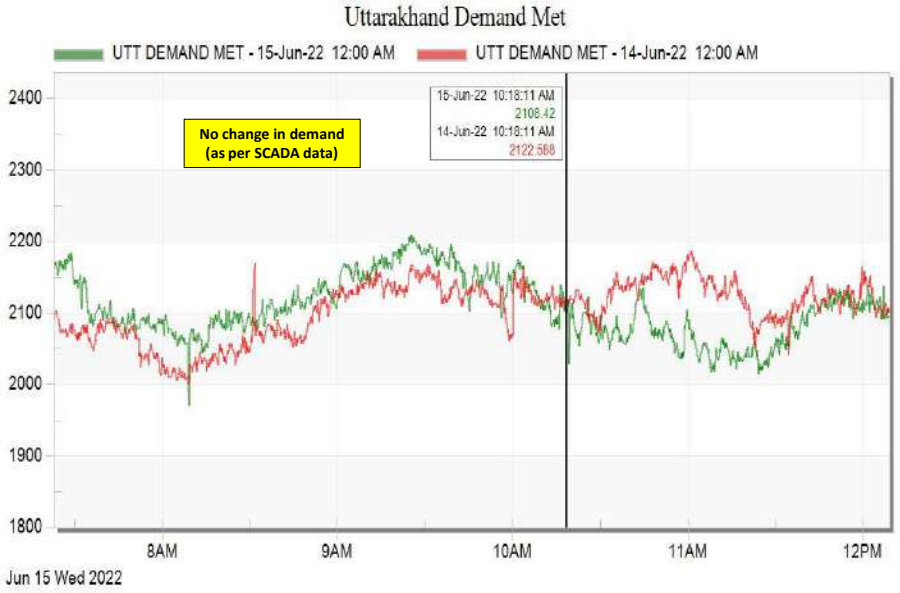
Dhauliganga HEP generation during the tripping



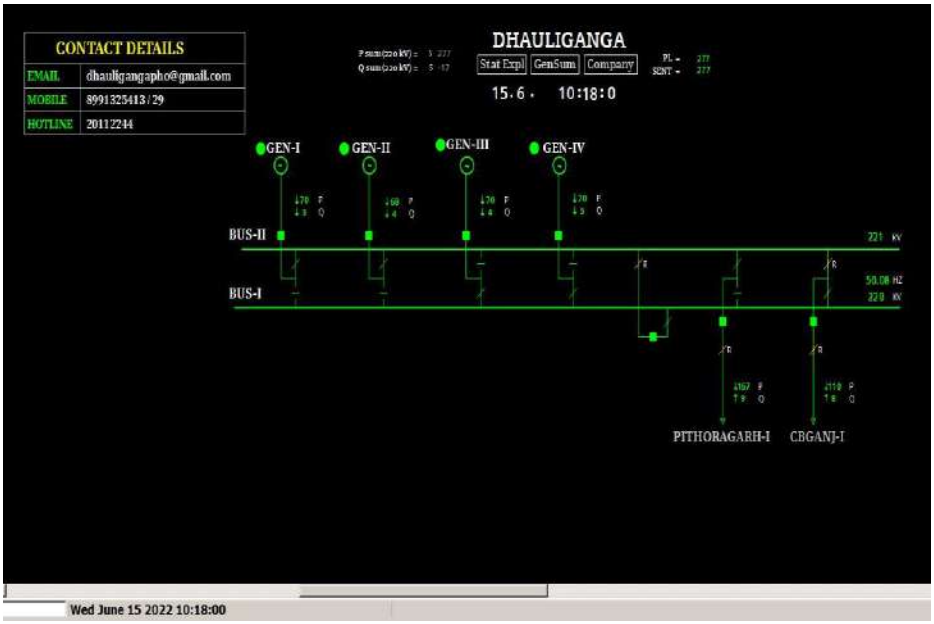
Uttar pradesh demand during the tripping



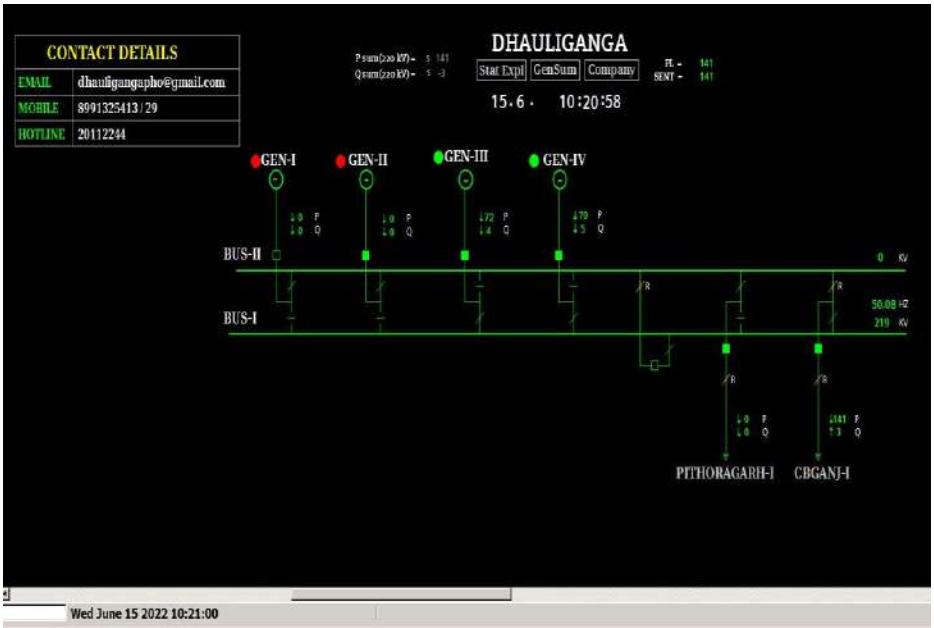
Uttarakhand demand during the tripping



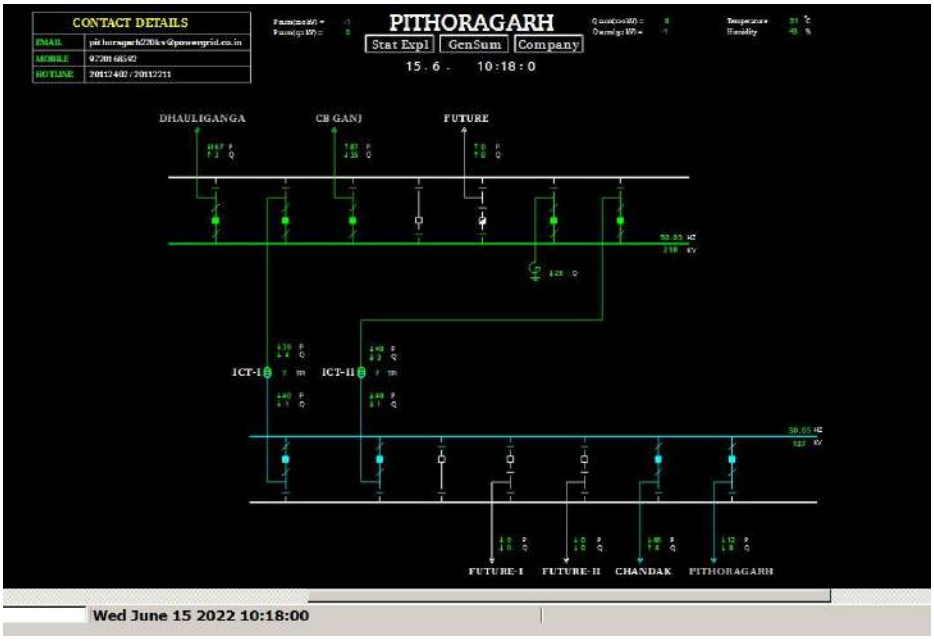
SLD of 220kV Dhauliganga(NHPC) before the tripping



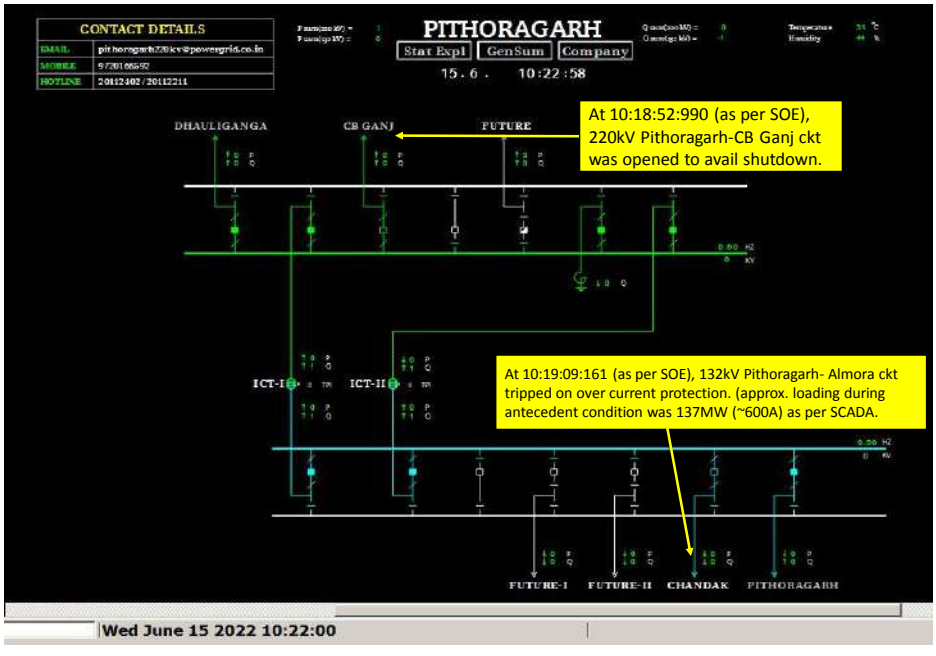
SLD of 220kV Dhauliganga(NHPC) after the tripping



SLD of 220/132kV Pithoragarh(PG) before the tripping

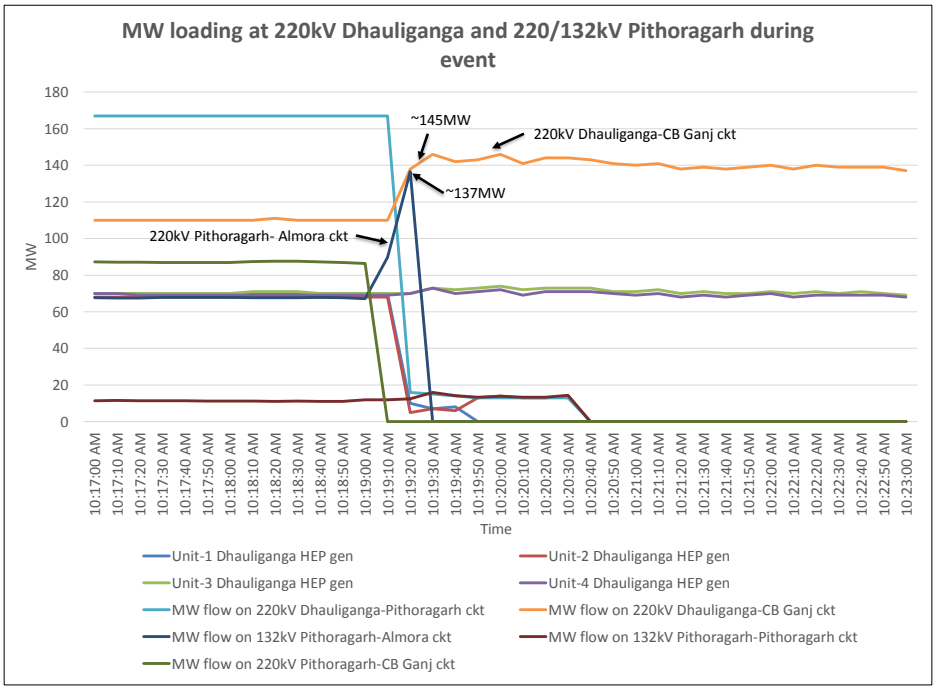


SLD of 220/132kV Pithoragarh(PG) after the tripping



SCADA SOE

Time	Station Name	Voltage	Element Name	Element Type	Element Status	Remark
10:18:52,990	PITHORAGARH	220kV	3CBGA1	Circuit Breaker	Open	Line CB at Pithoragarh end of 220kV Pithoragarh-CB Ganj ckt opened
10:19:09,161	PITHORAGARH	132kV	6CHNDK	Circuit Breaker	Open	Line CB at Pithoragarh end of 132kV Pithoragarh-Chandak ckt opened
10:19:10,171	CBGA1_UP	220kV	10PTRGH	Circuit Breaker	Open	Line CB at CB Ganj end of 220kV Pithoragarh-CB Ganj ckt opened
10:19:13 ***	DHAULIGANGA	220kV	07MBC	Circuit Breaker	Open	Bus coupler breaker at 220kV Dhauliganga opened
10:19:36 ***	DHAULIGANGA	220kV	03H01	Circuit Breaker	Open	CB of 70MW Unit-1 at Dhauliganga HEP opened
10:20:20	DHAULIGANGA	220kV	07MBC	Circuit Breaker	Open	
10:20:20	DHAULIGANGA	220kV	03H01	Circuit Breaker	Open	
10:20:28 ***	DHAULIGANGA	220kV	04H02	Circuit Breaker	Open	CB of 70MW Unit-2 at Dhauliganga HEP opened



Description of event

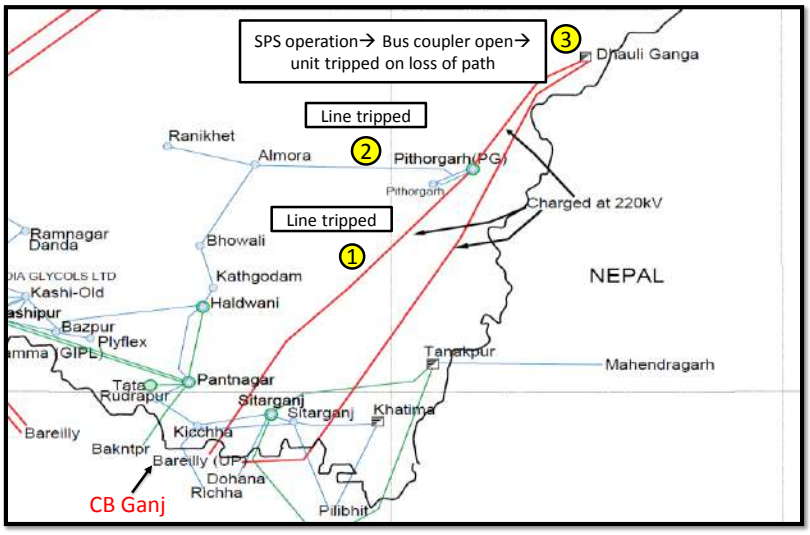


Fig: Network showing connectivity of Dhauliganga, Pithoragarh & CB Ganj

Observations

Analysis of tripping (As reported):

- In antecedent condition, 70MW Dhauliganga Unit-3 & 4, 220kV Dhauliganga-CB Ganj ckt (carrying 110MW) were connected to 220kV Bus-1 at Dhauliganga HEP and 70MW Dhauliganga Unit-1 & 2, 220kV Dhauliganga – Pithoragarh ckt(carrying 167MW) were connected to 220kV Bus-2 at Dhauliganga HEP. 220kV Pithoragarh- Almora ckt was carrying 67MW during antecedent condition.
- At 10:18:52:990 (as per SOE), 220kV Pithoragarh-CB Ganj ckt was opened to avail shutdown. At the same time, oscillations also observed (as per PMU plot of frequency and voltage at Pithoragarh).
- With the opening of 220kV Pithoragarh-CB Ganj ckt, MW loading of 220kV Dhauliganga-CB Ganj ckt & 220kV Pithoragarh- Almora ckt rose to 145MW & 137MW respectively (as per SCADA).
- Further after approx. 16secs, at 10:19:09:161(as per SOE,), 132kV Pithoragarh- Almora ckt tripped on over current protection. (approx. loading during antecedent condition was 137MW (~600A) as per SCADA.
- With the tripping of 132kV Pithoragarh- Almora ckt, path of evacuation of Dhauliganga generation from Pithoragarh side lost.
- Further after approx. 4secs at 10:19:13 (as per SOE), bus coupler breaker at Dhauliganga opened (on SPS operation) and 70MW Dhauliganga Unit-1 & 2 tripped on loss of evacuation path.

Points for Discussion:

- What is the over current protection setting of 132kV Pithoragarh-Almora ckt?
- Dhauliganga(NHPC) may share the event logger details of SPS operation.
- Remedial action taken report to be shared.

Multiple elements tripping at 400/220kV Bikaner(RS)

15:24 hrs on 21.06.2022

Antecedent Condition and Tripped Elements

Antecedent Condition:-

- NR Load : 56639 MW
- Affected state load (Rajasthan) : 9964 MW
- Frequency : 49.97 Hz
- Weather condition : Wind/sand storm
- IR exchange : 10395 MW
- No load loss

Following elements tripped:-

1) 400 KV Bikaner-Bhadla (RS) Ckt-1
2) 400 KV Bikaner(RS)-Sikar(PG) (RS) Ckt-1
3) 400 KV Bikaner(PG)-Bikaner(RS) (PG) Ckt-1
4) 400 KV Bikaner(RS)-Deedwana(MTS) (RS) Ckt-1
5) 400 KV Suratgarh SCTPS(RVUN)-Suratgarh(RS) (RS) Ckt-1
6) 400 KV Suratgarh SCTPS(RVUN)-Suratgarh(RS) (RS) Ckt-2
7) 400 KV Suratgarh(RVUN)-Bikaner(RS) (RS) Ckt-1
8) 400 KV Bikaner-Merta (RS) Ckt-1
9) 400/33 kV 125 MVA ICT 1 at Bikaner RENEW Solar(RENEW)
10) 400/220 kV 315 MVA ICT 2 at Bikaner(RS)
11) 125 MVAR Bus Reactor No 2 at 400KV Bikaner(RS)
12) 400/220 kV 315 MVA ICT 1 at Bikaner(RS)
13) 400 KV Suratgarh SCTPS(RVUN)-Bikaner(RS) (RS) Ckt-1
14) 400 KV Suratgarh SCTPS(RVUN)-Bikaner(RS) (RS) Ckt-2
15) 400 KV Suratgarh(RVUN)-Ratangarh(RS) (RS) Ckt-2

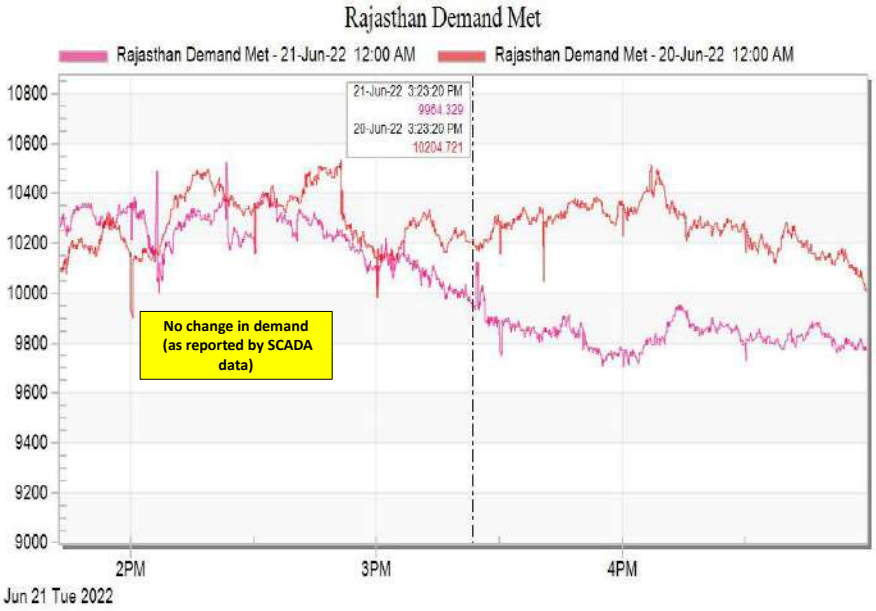
PMU Plot of frequency at Bikaner765(PG)

15:24hrs/21-June-22

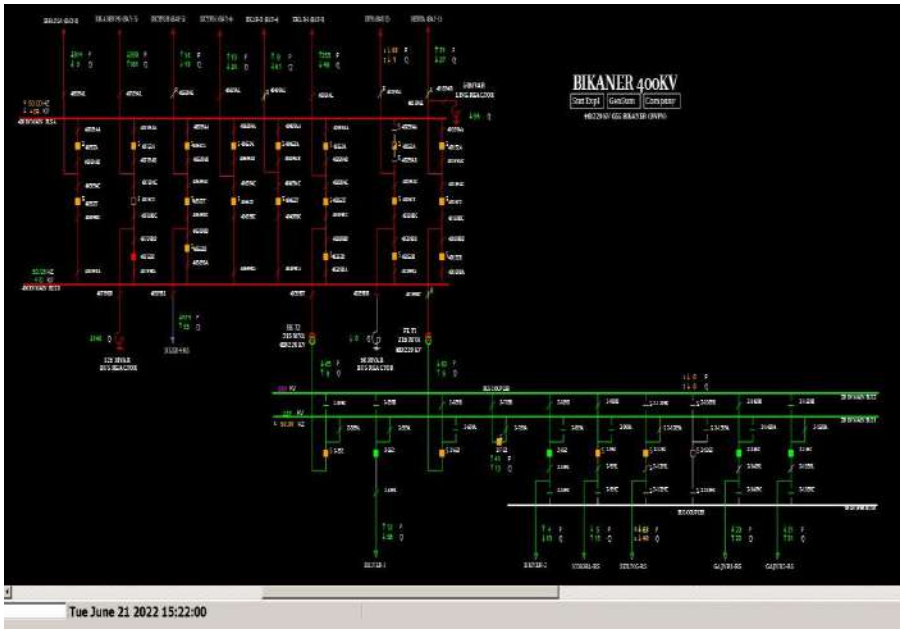
PMU Plot of phase voltage magnitude at Bikaner765(PG)

15:24hrs/21-June-22

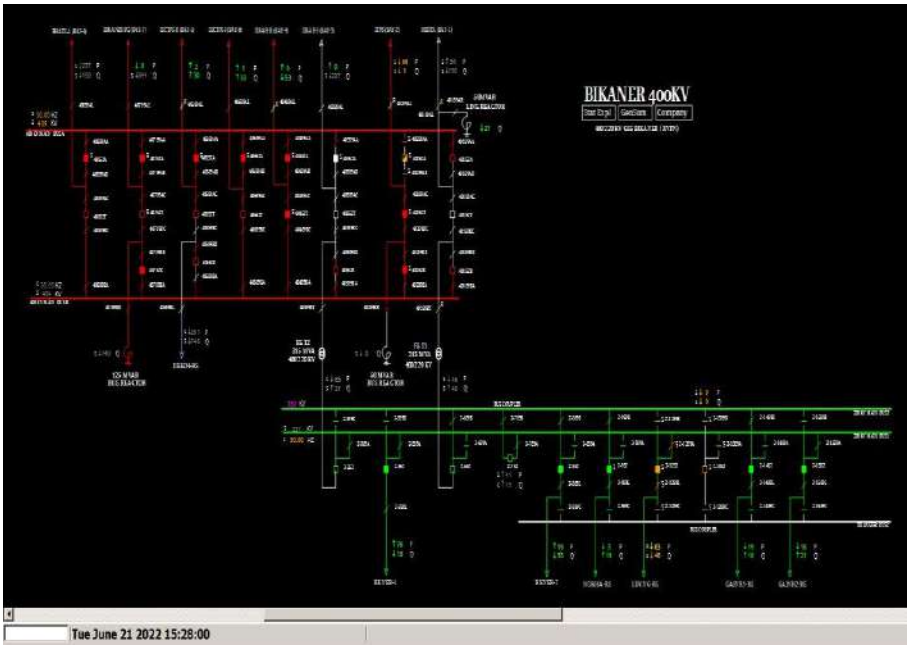
Rajasthan demand during the tripping



SLD of 400/220kV Bikaner(RS) before the tripping



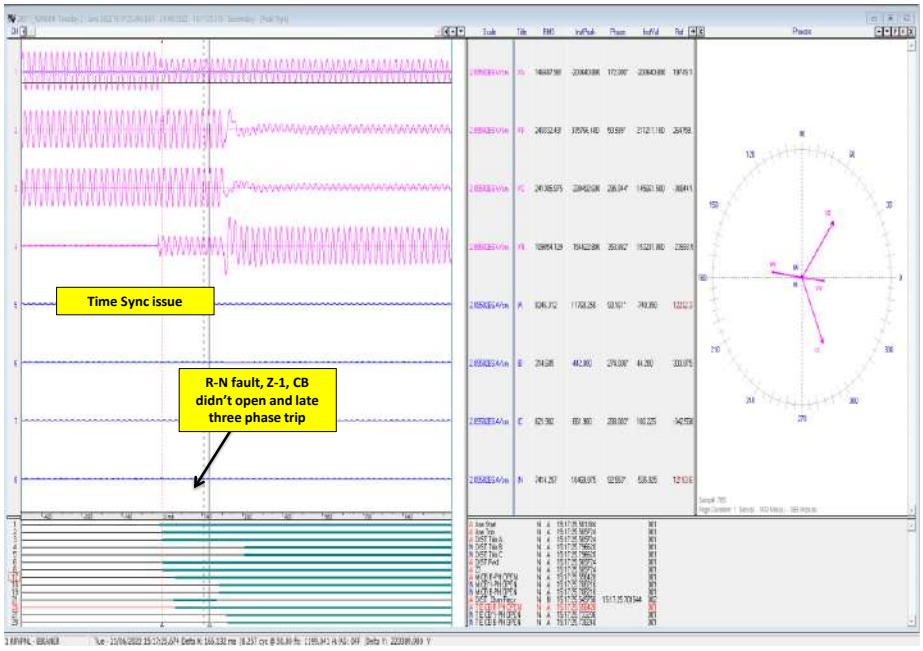
SLD of 400/220kV Bikaner(RS) after the tripping



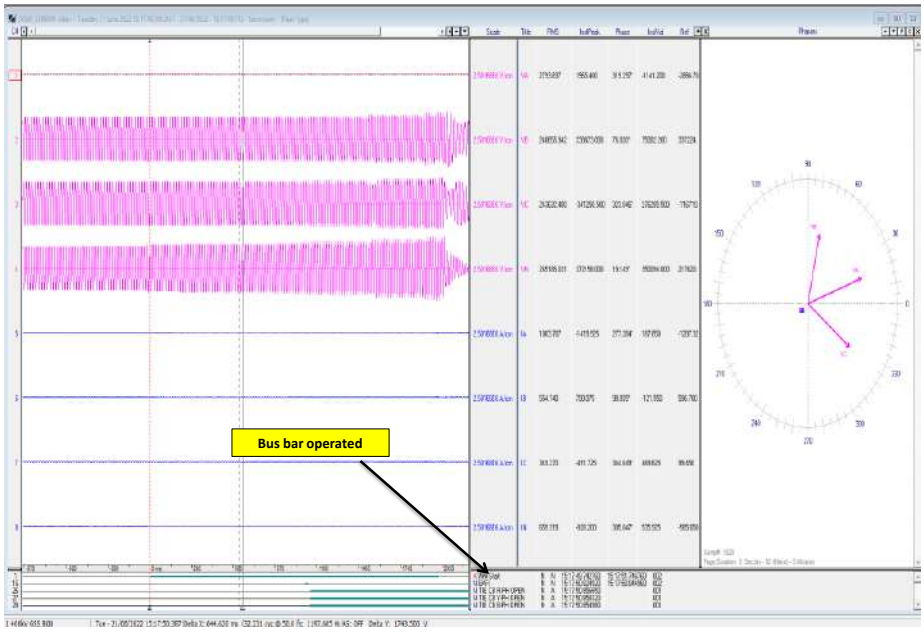
SCADA SOE

Time	Station Name	Voltage	Element Name	Element Type	Element Status	Remark
15:24:08,968	SURAT_THER	400kV	26INTRC2	Circuit Breaker	Open	
15:24:09,006	SCTPS_R	400kV	10INTR1	Circuit Breaker	Open	
15:24:09,038	GAJNER	220kV	03TBC	Circuit Breaker	Open	
15:24:09,095	BIKNR_I	400kV	06T2	Circuit Breaker	Open	Main CB at 400kV side of 400/33kV 125MVA ICT-2 at Bikaner Renew opened
15:24:09,101	BIKNR_I	33kV	ICT2	Circuit Breaker	Open	CB at 33kV side of 400/33kV 125MVA ICT-2 at Bikaner Renew opened
15:24:09,103	BIKNR_I	400kV	03T1	Circuit Breaker	Open	Main CB at 400kV side of 400/33kV 125MVA ICT-1 at Bikaner Renew opened
15:24:09,104	BIKNR_I	33kV	ICT1	Circuit Breaker	Open	CB at 33kV side of 400/33kV 125MVA ICT-1 at Bikaner Renew opened
15:24:09,104	BIKNR_I	400kV	02TIE	Circuit Breaker	Open	Tie CB at 400kV side of 400/33kV 125MVA ICT-1 at Bikaner Renew opened
15:24:10,024	SURAT_THER	400kV	22BKNER	Circuit Breaker	disturbe	
15:24:10,036	SIKAR	400kV	29BKN1TI	Circuit Breaker	Open	Tie CB at Sikar end of 400kB Bikaner(RS)-Sikar ckt-1 opened
15:24:10,039	SIKAR	400kV	28BKNR1	Circuit Breaker	Open	Main CB at Sikar end of 400kB Bikaner(RS)-Sikar ckt-1 opened
15:24:10,040	SURAT_THER	400kV	23TIE	Circuit Breaker	Open	
15:24:28,088	BIKANER400	400kV	05SURFUT	Circuit Breaker	disturbe	
15:24:47,113	BIKANER400	400kV	01DEED41	Circuit Breaker	disturbe	
15:25:12,064	BIKANER400	400kV	08SURIT2	Circuit Breaker	Open	Tie CB at Bikaner(RS) end of 400kV Bikaner-SSCTPS ckt 2 opened
15:25:14,964	BIKANER400	400kV	01DEED41	Circuit Breaker	Open	Main CB at Bikaner(RS) end of 400kV Bikaner-Deedwana ckt opened
15:25:39,679	MERTA	400kV	18BKNR41	Circuit Breaker	Open	Main CB at Merta end of 400kV Bikaner-Merta ckt opened
15:25:39,679	MERTA	400kV	17TIE	Circuit Breaker	Open	Tie CB at Merta end of 400kV Bikaner-Merta ckt opened
15:25:40,733	BIKANER400	400kV	05SURFUT	Circuit Breaker	Open	Tie CB at Bikaner(RS) end of 400kV Bikaner-Deedwana ckt-1 opened
15:25:43,847	BIKANER400	400kV	02DEDFUT	Circuit Breaker	Open	
15:25:59,948	BIKANER400	400kV	14MER_T1	Circuit Breaker	Open	Tie CB at Bikaner end of 400kV Bikaner-Merta ckt opened

DR of 400kV Bikaner(end)-Deedwana ckt



DR of 400kV Bikaner(end)-Sikar ckt



Observations

Analysis of tripping (As reported):

- 400/220kV Bikaner(RS) have one and half breaker bus scheme.
- During antecedent condition, 400 KV Bikaner(RS)-Deedwana(MTS) (RS) Ckt-1, 400/220 kV 315 MVA ICT 1 & ICT 2 at Bikaner(RS) and 125 MVAR Bus Reactor No 2 at 400KV Bikaner(RS) were connected to 400kV Bus-2 and 400kV lines to Merta, Sikar-ckt-1&2, Bhadla(PG), SCTPS ckt-1&2 and STPS were connected to 400kV Bus-1.
- At 15:24 hrs, during wind storm/sand storm, **Tower no 91 & 92 of 400 KV Bikaner(RS)-Deedwana(MTS) (RS) Ckt-1 collapsed followed by blast of R-ph pole of CB of 400 KV Bikaner(RS)-Deedwana(MTS) (RS) Ckt-1.** As per PMU, Y-N phase to earth fault with delayed clearance in 1600ms followed by R-N fault is observed.
- As per details received from SLDC-RS, bus bar protection of bus-2 operated which resulted in tripping of 400 KV Bikaner(RS)-Deedwana(MTS) (RS) Ckt-1, 400/220 kV 315 MVA ICT 1 & ICT 2 at Bikaner(RS) and 125 MVAR Bus Reactor No 2 at 400KV Bikaner(RS).
- At the same time, elements connected at 400kV Bus-1 of Bikaner(RS) also tripped on protection operation at remote end and DT received at Bikaner.
- 400/33 kV 125 MVA ICT 1 at Bikaner RENEW Solar(RENEW) also tripped during same time on LV SEF (stand by earth fault) protection operation.

Points for Discussion:

- Exact location and nature of Y-N fault?
- **Reason of delayed clearance of Y-N fault?**
- Why did 400kV lines connected at 400kV Bus-1 trip, as fault was in 400 KV Bikaner(RS)-Deedwana(MTS) (RS) Ckt-1 (connected at 400kV Bus-2) ?
- Remedial action taken report to be shared.

Multiple elements tripping at 220/132kV Sitarganj(PG)

20:27 hrs on 17.07.2022

Antecedent Condition and Tripped Elements

Antecedent Condition:-

- NR Load : 62793 MW
- Affected state load (Uttarakhand) : 2022 MW
- Frequency : 49.83 Hz
- Weather condition : Normal
- IR exchange : 12632 MW
- Load loss of approx. 55MW in Uttarakhand control area.

Following elements tripped:-

1) 132 KV Pilibhit(UP)-Sitarganj(PTCUL) Ckt-1
2) 220/132 kV 100 MVA ICT 3 at Sitarganj(PG)
3) 220/132 kV 100 MVA ICT 2 at Sitarganj(PG)
4) 220/132 kV 100 MVA ICT 1 at Sitarganj(PG)
5) 132 KV Sitarganj(PG)-Sitarganj(PTCUL) Ckt-2
6) 132 KV Sitarganj(PG)-Sitarganj(PTCUL) Ckt-3
7) 132 KV Sitarganj(PG)-Sitarganj(SIDCUL) Ckt-1
8) 220 KV Tanakpur(NH)-Sitarganj(PG) Ckt-1

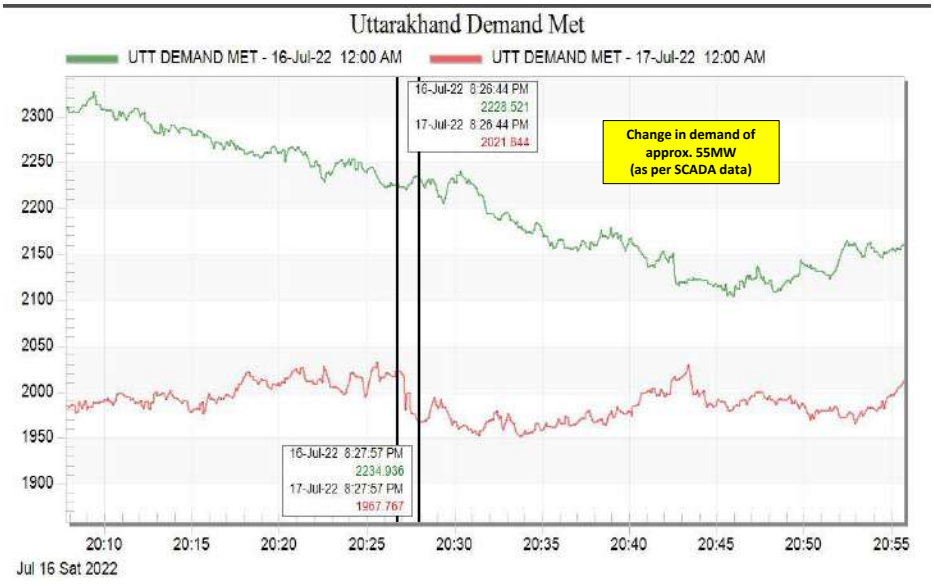
PMU Plot of frequency at CB Ganj(UP)

20:27hrs/17-July-22

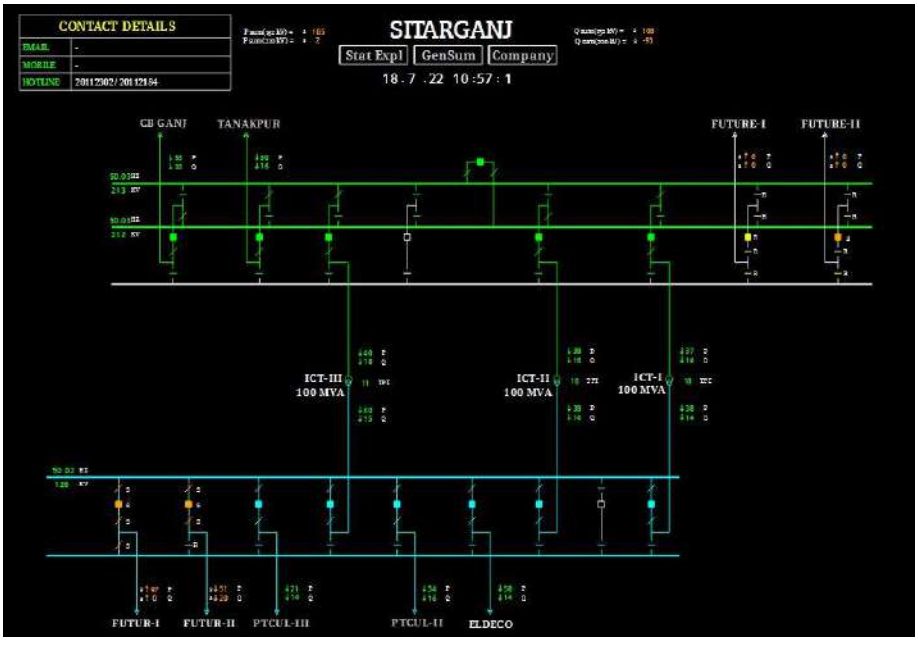
PMU Plot of phase voltage magnitude at CB Ganj(UP)

20:27hrs/17-July-22

Uttarakhand demand during the event



SLD of 220/132kV Sitarganj(PG)



SCADA SOE

Time	Station Name	Voltage	Element Name	Element Type	Element Status	Remark
20:26:08,651	SITARGANJ	132kV	04T3	Circuit Breaker	Open	CB at 132kV side of 220/132kV 100MVA ICT-3 opened
20:26:28,351	SITARGANJ	220kV	06T2	Circuit Breaker	Open	CB at 132kV side of 220/132kV 100MVA ICT-2 opened
20:26:39,322	SITARGANJ	132kV	09T1	Circuit Breaker	Open	CB at 132kV side of 220/132kV 100MVA ICT-1 opened
20:26:47,948	SITARGANJ	220kV	07T1	Circuit Breaker	Open	CB at 220kV side of 220/132kV 100MVA ICT-1 opened
20:27:00,890	TANAKPUR	220kV	05SITAR	Circuit Breaker	disturbe	
20:27:01,243	SITARGANJ	220kV	03T3	Circuit Breaker	Open	CB at 220kV side of 220/132kV 100MVA ICT-2 opened
20:27:03:988	SITARGANJ	132kV	KHATI	Circuit Breaker	Open	

Observations

Analysis of tripping (As reported):

- 220/132kV Sitarganj(PG) substation feeds load of Uttarakhand through 132kV feeders. It is having three 220/132kV 100MVA ICTs.
- As reported, at 20:27hrs, one snake climbed on R-phase main bus isolator of 132kV Kichha line at Sitarganj. It caused R-ph bus fault at 132kV Sitarganj. As per PMU at CB Ganj(UP), R-N phase to earth fault with delayed clearance in 1080ms is observed.
- On this bus fault, three 132kV feeders to Sitarganj(PTCUL), three 220/132kV 100MVA ICTs at Sitarganj(PG) tripped and 132kV Sitarganj(PG) became dead. At the same time, 220 KV Tanakpur(NH)-Sitarganj(PG) (PG) Ckt-1 tripped on Z-3 distance protection operation.
- As per SCADA, load loss of approx. 55MW occurred in Uttarakhand control area.

Points for Discussion:

- Reason of delayed clearance of fault?
- Whether bus bar protection operated at 132kV Sitarganj(PG)?
- DR, EL & tripping report needs to be shared.
- Remedial action taken report to be shared.

Multiple elements tripping at 220kV Mogan(PSTCL)

11:50 hrs on 30.07.2022

Antecedent Condition and Tripped Elements

Antecedent Condition:-

- NR Load : 54092 MW
- Affected state load (Punjab) : 10452 MW
- Frequency : 50.08 Hz
- Weather condition : Normal
- IR exchange : 1519 MW
- Load loss of approx. 130MW in Punjab control area.

Following elements tripped:-

1) 220 KV Moga(PG)-MOGAN(PS) (PSTCL) Ckt-2
2) 220 KV Moga(PG)-MOGAN(PS) (PSTCL) Ckt-3
3) 220 KV Moga(PG)-MOGAN(PS) (PSTCL) Ckt-4
4) 220 KV Moga(PG)-MOGAN(PS) (PSTCL) Ckt-1
5) 220kV Mogan-Baghapurana(PS) ckt-1
6) 220kV Mogan-Baghapurana(PS) ckt-2
7) 220kV Mogan-Bajakhanna(PS) ckt
8) 220kV Mogan-Ferozpur(PS) ckt
9) 132kV Mogan-Dhale (PS) ckt

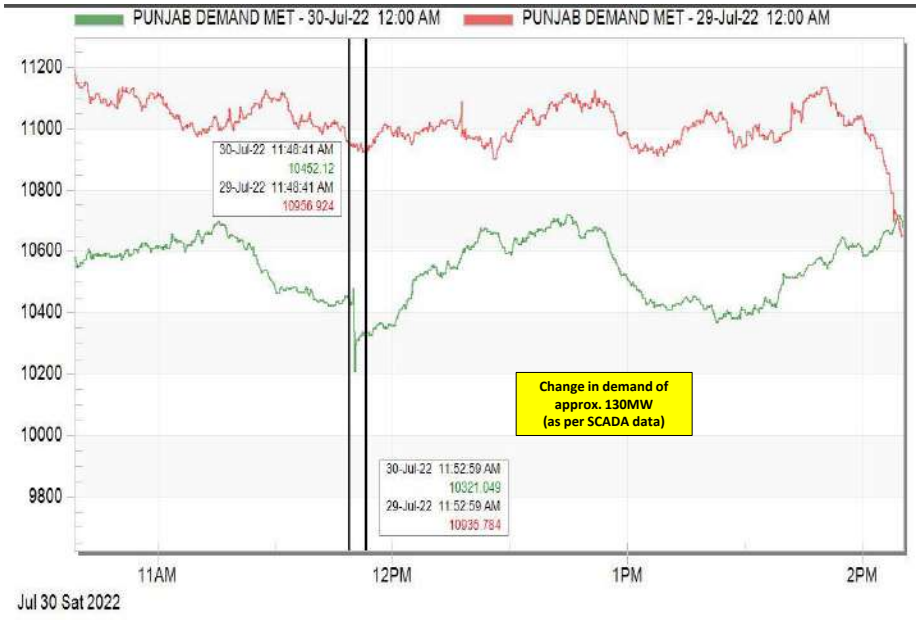
PMU Plot of frequency at Moga(PG)

11:50hrs/30-July-22

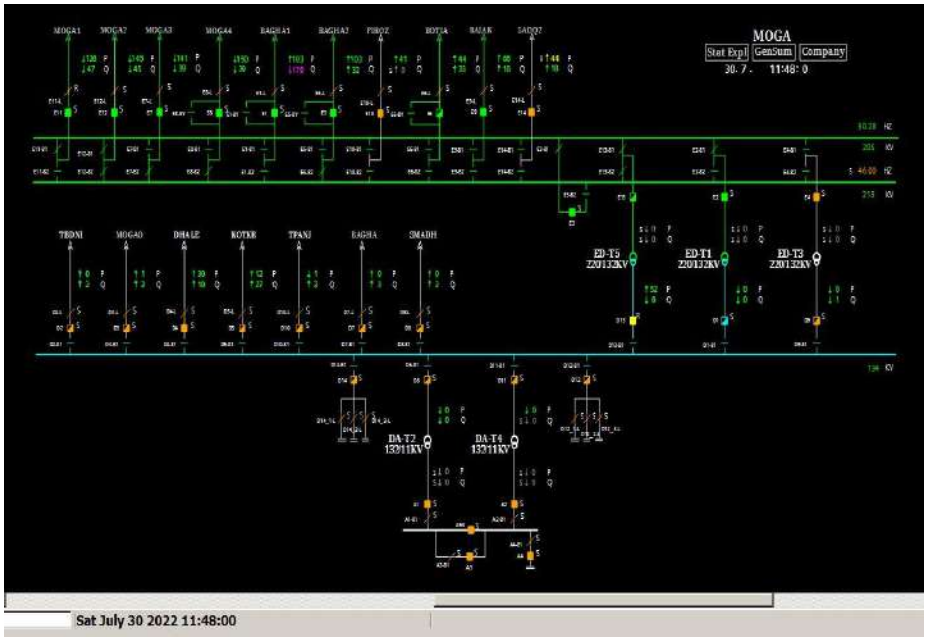
PMU Plot of phase voltage magnitude at Moga(PG)

11:50hrs/30-July-22

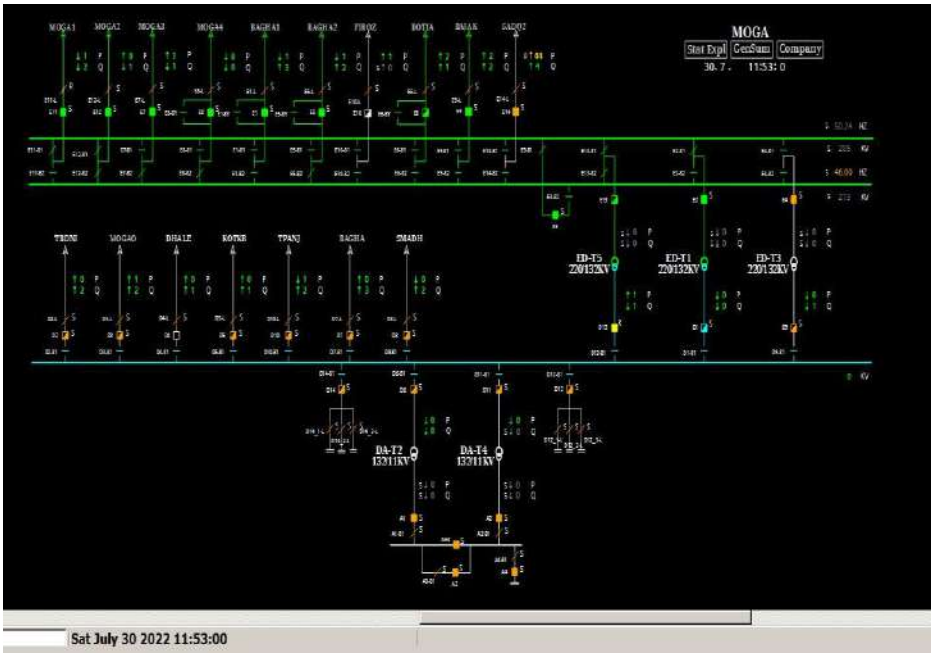
Punjab demand during the event



SLD of 220/132kV Mogan(PSTCL) before the tripping



SLD of 220/132kV Mogan(PSTCL) after the tripping



SCADA SOE

Time	Station Name	Voltage	Element Name	Element Type	Element Status	Remark
11:49:53,923	MOGA__PG	220kV	07MOGAN2	Circuit Breaker	Open	Line CB at Moga(PG) end of 220 KV Moga(PG)-MOGAN(PS) (PSTCL) Ckt-2 opened
11:49:53,954	MOGA__PG	220kV	03MOGAN3	Circuit Breaker	Open	Line CB at Moga(PG) end of 220 KV Moga(PG)-MOGAN(PS) (PSTCL) Ckt-3 opened
11:49:53,975	MOGA__PG	220kV	05MOGAN4	Circuit Breaker	Open	Line CB at Moga(PG) end of 220 KV Moga(PG)-MOGAN(PS) (PSTCL) Ckt-4 opened
11:49:53,983	MOGA__PG	220kV	06MOGAN1	Circuit Breaker	Open	Line CB at Moga(PG) end of 220 KV Moga(PG)-MOGAN(PS) (PSTCL) Ckt-1 opened
11:50:01,886	MOGAN_PS	132kV	4DHALE	Circuit Breaker	Open	Line CB at Mogan(PS) end of 132kV Mogan-Dhale ckt opened
11:50:02,856	BAGHA_PS	220kV	2MOGAN2	Circuit Breaker	Open	Line CB at Baghapurana end of 220kV Baghapurana-Mogan ckt-2 opened
11:50:02,856	BAGHA_PS	220kV	1MOGAN1	Circuit Breaker	Open	Line CB at Baghapurana end of 220kV Baghapurana-Mogan ckt-1 opened
11:50:16,723	MOGAN_PS	220kV	10FIROZ	Circuit Breaker	disturbe	
11:50:36,156	BAJAK_PS	220kV	5MOGAN	Circuit Breaker	disturbe	

Observations

Analysis of tripping (As reported):

- As reported, at 11:50hrs, R-phase conductor of 220kV Mogan-Bajakhanna(PS) ckt snapped at Mogan end. On this fault, bus bar protection operated at Mogan(PSTCL) end.
- Due to bus bar protection operation, all 220kV lines connected at Mogan(PSTCL) tripped. Line tripped due to bus bar protection operation are 220 KV Moga(PG)-MOGAN(PS) (PSTCL) Ckt-1,2,3 & 4, 220kV Mogan-Baghapurana(PS) ckt-1 & 2, 220kV Mogan-Ferozpur(PS) ckt, 220kV Mogan-Bajakhanna(PS) ckt and 132kV Mogan-Dhale (PS) ckt.
- As per PMU, R-N phase to earth fault with the delayed clearance of 720ms is observed.
- As per SCADA, change in load of approx. 130MW is observed in Punjab control area.
- 220 KV Moga(PG)-MOGAN(PS) (PSTCL) Ckt-1,2,3 & 4 were restored at 14:20hrs.

Points for Discussion:

- Exact location and nature of fault?
- Reason of delayed clearance of fault?
- To which bus 220kV Mogan-Bajakhanna(PS) ckt was connected during antecedent condition? Why did elements connected to both the bus trip?
- DR, EL & tripping report needs to be shared.
- Remedial action taken report to be shared.

Multiple elements tripping at 400kV Alaknanda(UP) & 220kV Singoli Bhatwari(PTCUL)

01:12 hrs on 23.08.2022

Antecedent Condition and Tripped Elements

Antecedent Condition:-

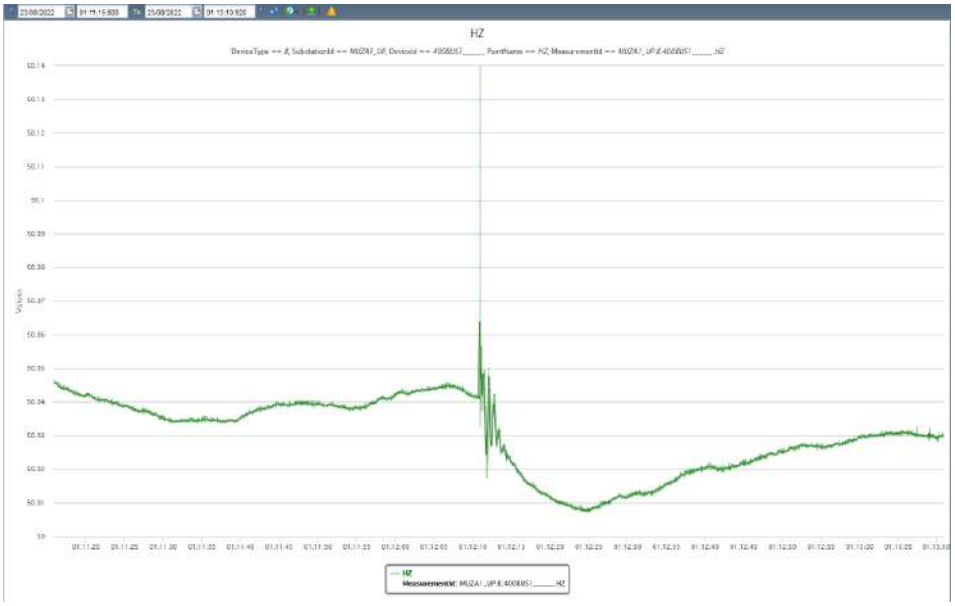
- NR Load : 66349 MW
- Affected state load (Uttarakhand) : 1972 MW
  (Uttar Pradesh) : 23562 MW
- Frequency : 50.04 Hz
- Weather condition : Normal
- IR exchange : 17912 MW
- Load loss of approx. 25 MW in Uttarakhand control area.
- Generation Loss of approx. 414 MW (342 MW at Alaknanda HEP & 72MW at Singoli Bhatwari HEP).

Following elements tripped:-

1) 400 KV Alaknanda GVK(UPC)-Srinagar(UK) (UK) Ckt-1
2) 220 KV Singoli Bhatwari(Singoli(LTUHP))-Srinagar(UK) (PTCUL) Ckt-1
3) 400 KV Alaknanda GVK(UPC)-Muzaffarnagar (UP) Ckt-1
4) 220 KV Singoli Bhatwari(Singoli(LTUHP))-Srinagar(UK) (PTCUL) Ckt-2
5) 400 KV Alaknanda GVK(UPC)-Vishnuprayag(JP) (UP) Ckt-1
6) 33 MW Singoli Bhatwari HEP - UNIT 2, 33 MW Singoli Bhatwari HEP - UNIT 3

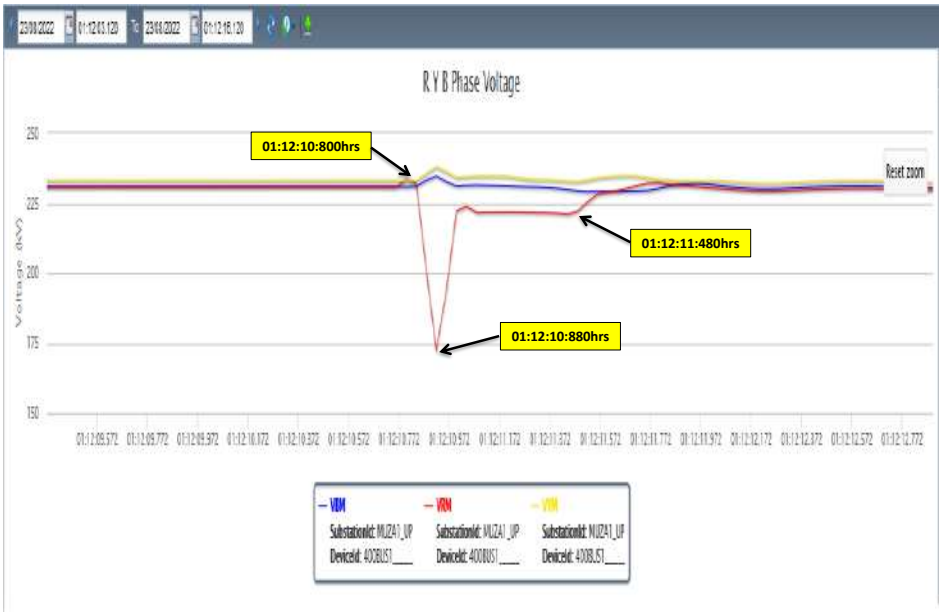
PMU Plot of frequency at Muzaffarnagar(UP)

01:12hrs/23-Aug-22

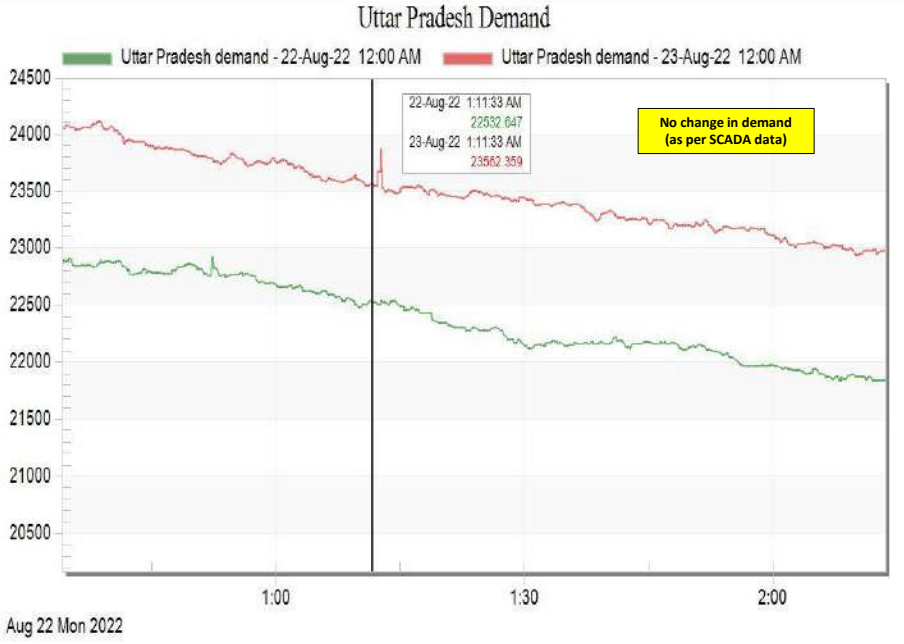


PMU Plot of phase voltage magnitude at Muzaffarnagar(UP)

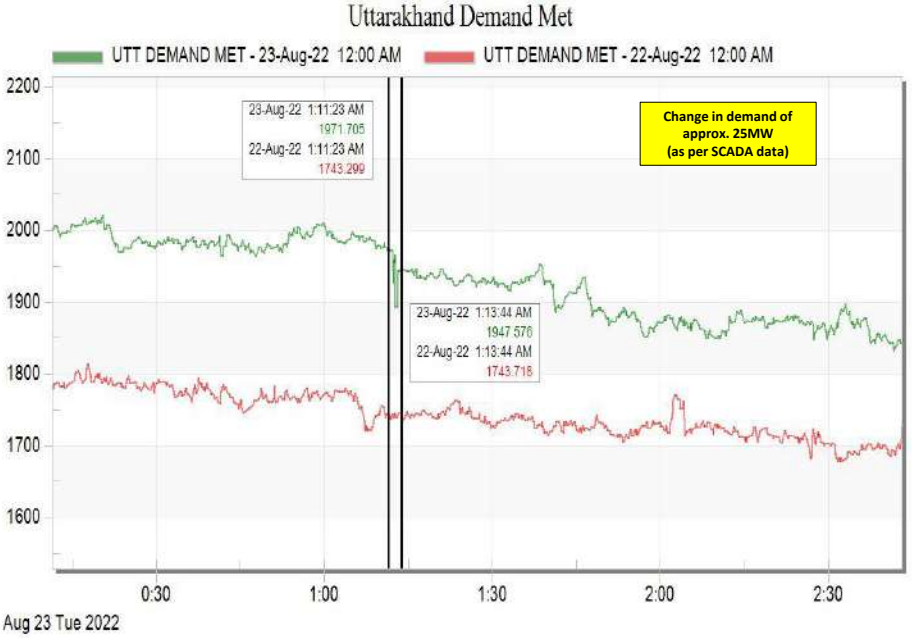
01:12hrs/23-Aug-22



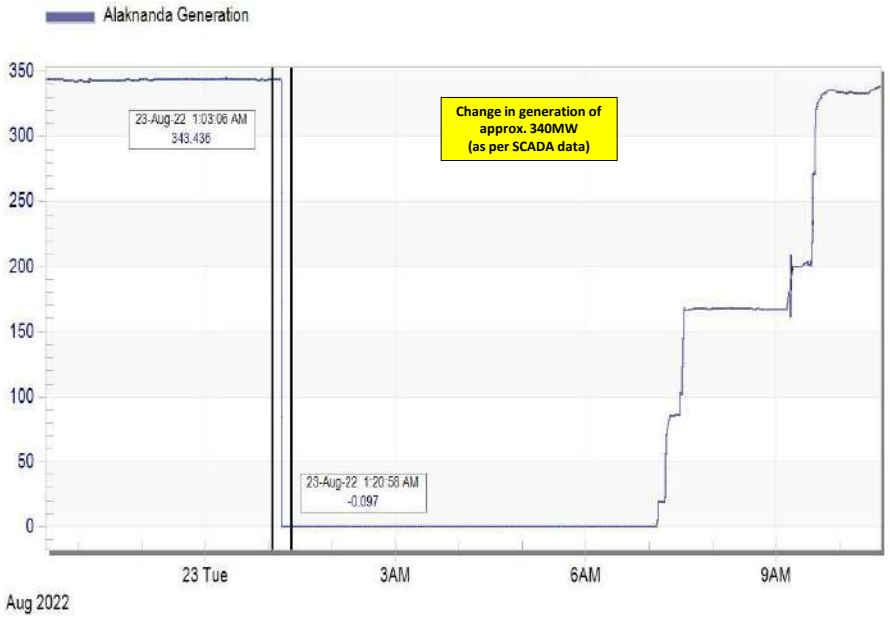
Uttar Pradesh demand during the event



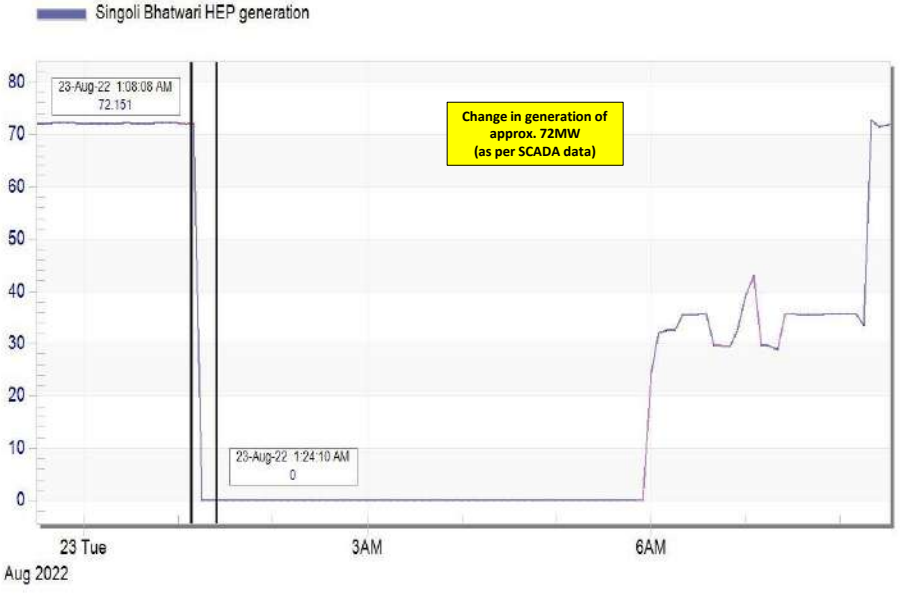
Uttarakhand demand during the event



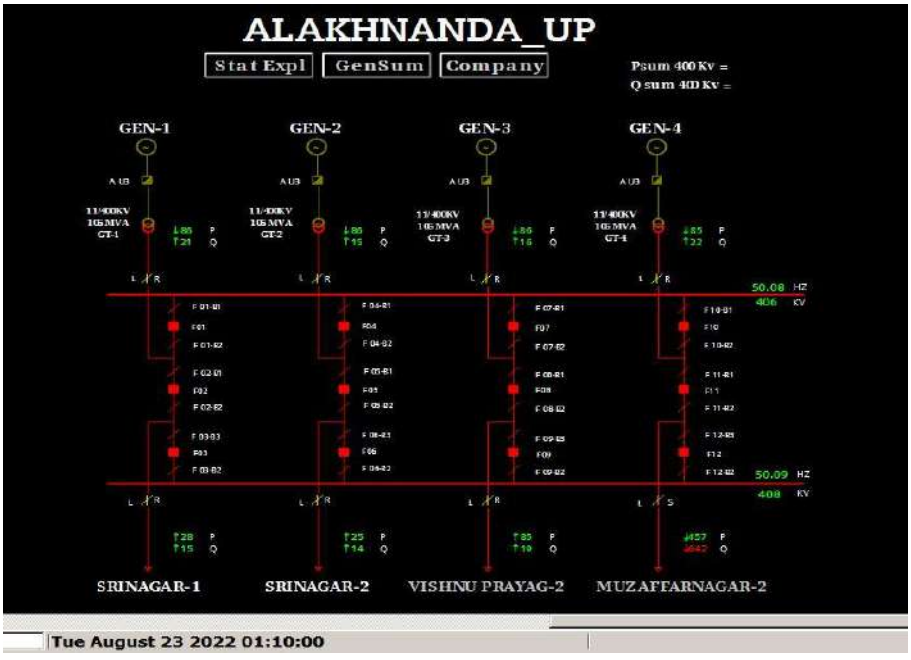
Alaknanda HEP generation during the event



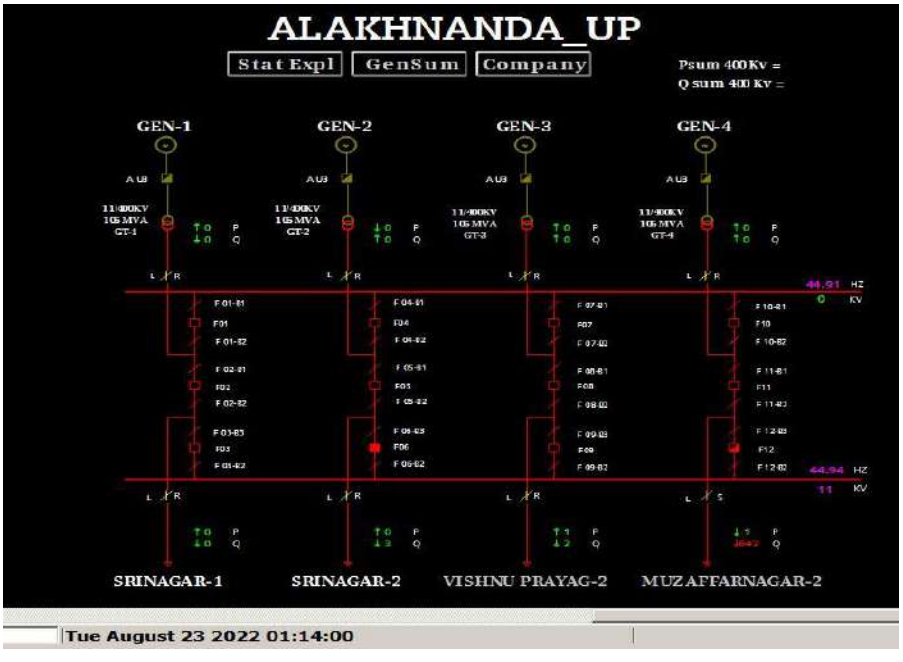
Singoli Bhatwari HEP generation during the event



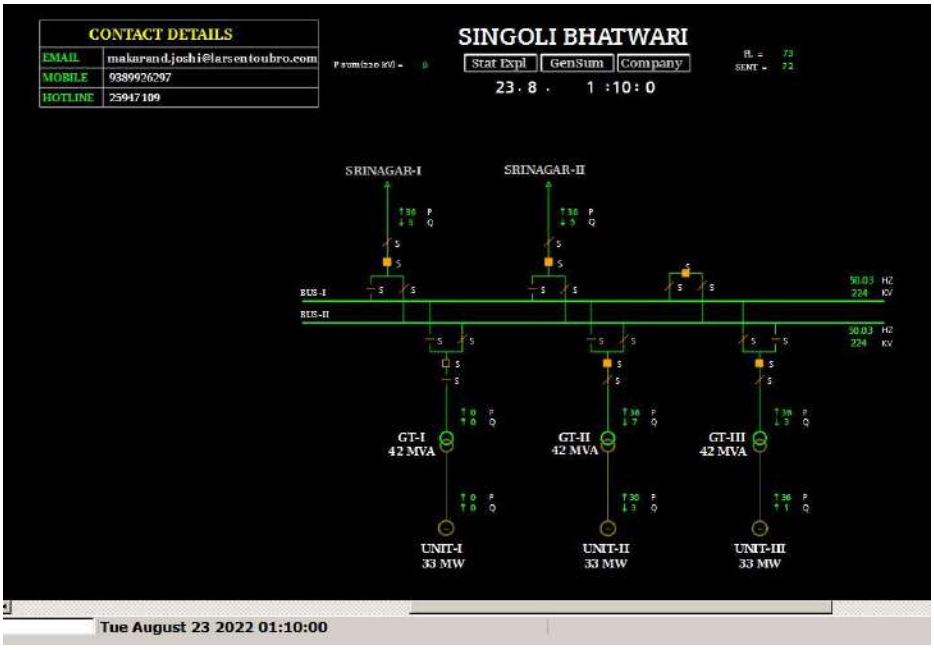
SLD of 400kV Alaknanda(UP) before the tripping



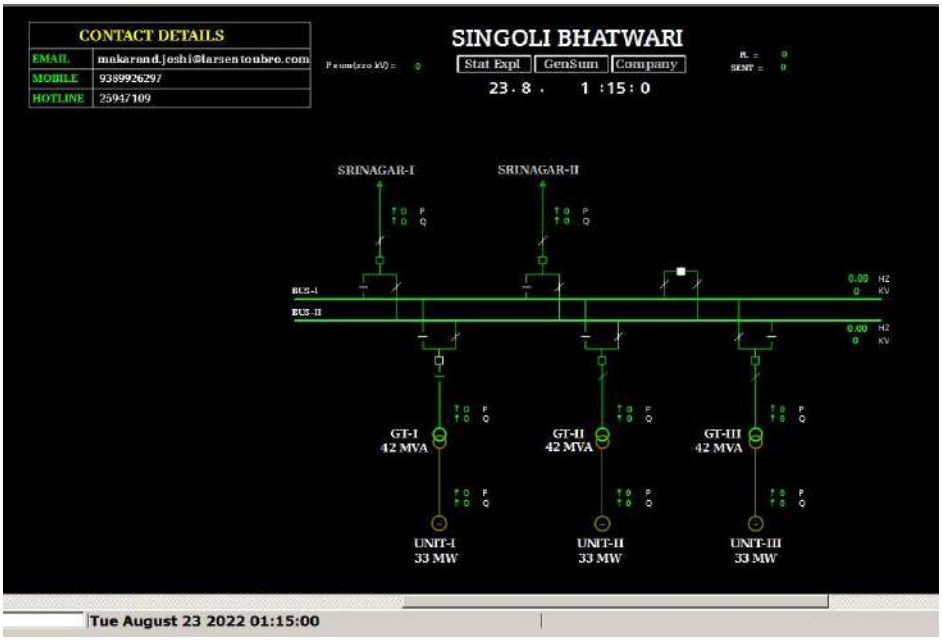
SLD of 400kV Alaknanda(UP) after the tripping



SLD of 220kV Singoli Bhatwari before the tripping



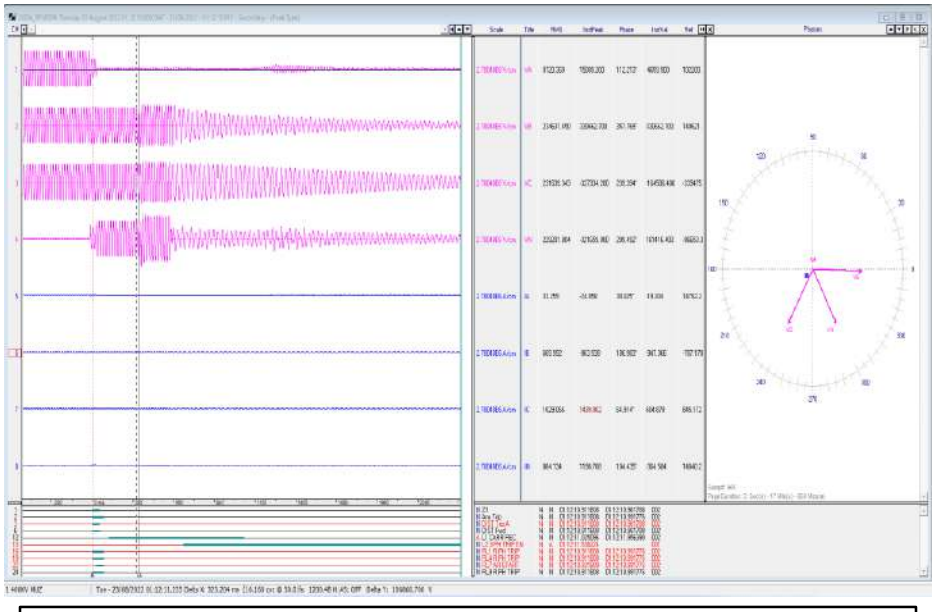
SLD of 220kV Singoli Bhatwari after the tripping



SCADA SOE

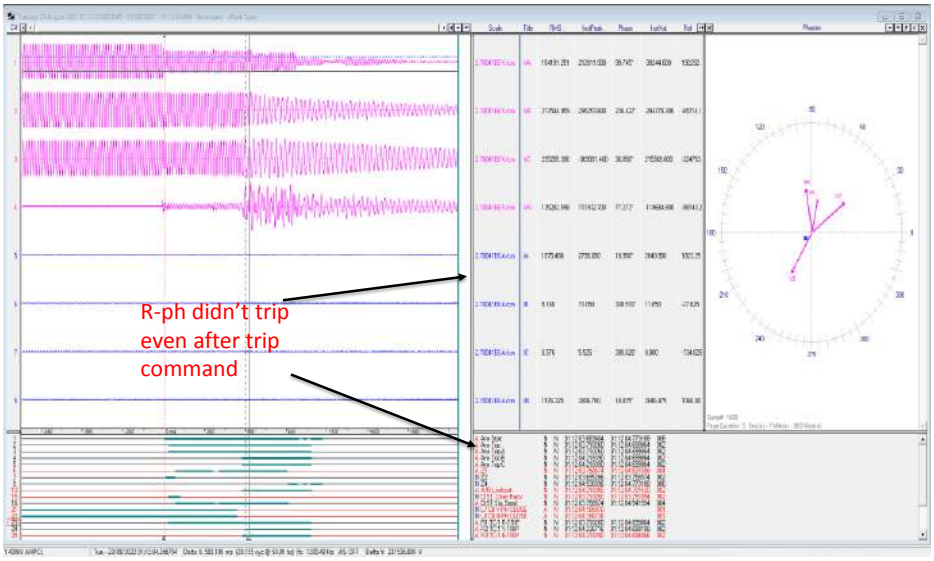
Time	Station Name	Voltage	Element Name	Element Type	Element Status	Remark
01:12:10,996	MUZA1_UP	400kV	96ALKND	Circuit Breaker	Open	Line CB at Muzaffarnagar end of 400 KV Alaknanda -Muzaffarnagar (UP) Ckt opened
01:12:12,142	SIMBH_I	220kV	02SRNGR	Circuit Breaker	Open	Line CB at Simbholi end of 220 KV Singoli Bhatwari(Singoli(LTUHP))-Srinagar(UK) (PTCUL) Ckt-2 opened
01:12:12,142	SIMBH_I	220kV	01SRNGR	Circuit Breaker	Open	Line CB at Simbholi end of 220 KV Singoli Bhatwari(Singoli(LTUHP))-Srinagar(UK) (PTCUL) Ckt-1 opened
01:12:13,193	ALKND_UP	400kV	12MUZA2	Circuit Breaker	disturbe	Main CB at Alaknanda end of 400 KV Alaknanda -Muzaffarnagar (UP) Ckt opened
01:12:13,193	ALKND_UP	400kV	09VSNPG2	Circuit Breaker	Open	Main CB at Alaknanda end of 400 KV Alaknanda GVK(UPC)-Vishnuprayag(JP) (UP) Ckt opened
01:12:13,193	ALKND_UP	400kV	11H04MZ2	Circuit Breaker	Open	Tie CB at Alaknanda end of 400kV Alaknanda -Muzaffarnagar (UP) Ckt-1 & 82.5MW Alaknanda HEP Unit-4 opened
01:12:13,193	ALKND_UP	400kV	03SRNGR1	Circuit Breaker	Open	
01:12:13,193	ALKND_UP	400kV	08H03VP2	Circuit Breaker	Open	Tie CB at Alaknanda end of 400kV Alaknanda -Muzaffarnagar (UP) Ckt-1 & 82.5MW Alaknanda HEP Unit-3 opened
01:12:13,193	ALKND_UP	400kV	05H02SR2	Circuit Breaker	Open	Tie CB at Alaknanda end of 220 KV Singoli Bhatwari(Singoli(LTUHP))-Srinagar(UK) (PTCUL) Ckt-2 & 82.5MW Alaknanda HEP Unit-2 opened
01:12:13,193	ALKND_UP	400kV	02H01SR1	Circuit Breaker	Open	Tie CB at Alaknanda end of 220 KV Singoli Bhatwari(Singoli(LTUHP))-Srinagar(UK) (PTCUL) Ckt-1 & 82.5MW Alaknanda HEP Unit-2 opened
01:12:14,342	SIMBH_I	220kV	05H03	Circuit Breaker	disturbe	
01:12:14,342	SIMBH_I	220kV	04H02	Circuit Breaker	Open	CB of 33MW Singoli Bhatwari HEP Unit-2 opened
01:12:14,792	ALKND_UP	400kV	10H04	Circuit Breaker	Open	Main CB of 82.5MW Alaknanda HEP Unit-4 opened
01:12:14,792	ALKND_UP	400kV	07H03	Circuit Breaker	Open	Main CB of 82.5MW Alaknanda HEP Unit-3 opened
01:12:14,792	ALKND_UP	400kV	04H02	Circuit Breaker	Open	Main CB of 82.5MW Alaknanda HEP Unit-2 opened
01:12:14,792	ALKND_UP	400kV	01H01	Circuit Breaker	Open	Main CB of 82.5MW Alaknanda HEP Unit-1 opened
01:12:14,942	SIMBH_I	220kV	05H03	Circuit Breaker	Open	CB of 33MW Singoli Bhatwari HEP Unit-3 opened
01:13:31,509	VISNU_UP	400kV	07MUZA1	Circuit Breaker	Open	Line CB at Vishnuprayag end of 400 KV Alaknanda GVK(UPC)-Vishnuprayag(JP) (UP) Ckt opened

DR of 400kV Alaknanda-Muzaffarnagar(end) ckt



R-ph of line tripped from Muzaffarnagar end on R-N fault in Z-1, A/R started but three phase trip after ~500ms.

DR of 400kV Alaknanda(end)-Muzaffarnagar ckt



Trip command to R-ph sent but it didn't trip and later after ~500ms trip command to Y & B ph also sent. As per information received, R-ph CB didn't open as it was stuck and later line tripped on LBB protection operation. However, LBB protection channel in not available in DR of line.

Observations

Analysis of tripping (As reported):

- 400kV Alaknanda (UP) have one and half breaker bus scheme.
- During antecedent condition, 400 KV Alaknanda GVK(UPC)-Muzaffarnagar (UP) Ckt & 400 KV Alaknanda GVK(UPC)-Vishnuprayag(JP) (UP) Ckt were carrying 457MW & -85MW respectively.
- As reported, at 01:12hrs, R-N phase to earth fault occurred on 400 KV Alaknanda GVK(UPC)-Muzaffarnagar (UP) Ckt, fault distance was 20.3km & fault current was ~10.5kA from Muzaffarnagar end. As per PMU at Muzaffarnagar(UP), R-N phase to earth fault with delayed clearance in 680ms is observed.
- As per DR received of 400 KV Alaknanda GVK(UPC)-Muzaffarnagar (UP) Ckt, A/R operation started at Muzaffarnagar end but after approx. 500ms Y & B phase also tripped and at Alaknanda end, R-ph didn't open even after trip command was sent by relay, later three phase tripped after approx. 500ms.
- As informed by Alaknanda HEP, R-ph Main CB didn't open on tripping command by relay as it was stuck and later line tripped on LBB protection operation.
- At the same time, 400 KV Alaknanda GVK(UPC)-Vishnuprayag(JP) (UP) Ckt & 400kV Alaknanda-Sringar ckt-1 & Ckt-2 also tripped on LBB protection operation at Alaknanda end. Due to tripping of both the lines, all four (04) of 82.5MW units at Alaknanda HEP also tripped on loss of evacuation path.
- At the same time, 220 KV Singoli Bhatwari(Singoli(LTUHP))-Srinagar(UK) (PTCUL) Ckt-1 & Ckt-2 also tripped on over voltage stage-1 protection operation at Srinagar end followed by tripping of 33 MW Singoli Bhatwari HEP -UNIT 2 & 3 on loss of evacuation path.
- As per SCADA, change in load of approx. 25MW in Uttarakhand control area, loss in generation of ~342MW at Alaknanda HEP & ~72MW at Singoli Bhaywari HEP occurred.

Observations

Points for Discussion:

- As all the Main CB & Tie CB tripped at Alaknanda end and as per LBB protection only Main CBs connected at 400kV Bus-2 should have tripped, what is the tripping logic implemented at 400kV Alaknanda on LBB protection? Tripping logic of LBB protection at 400kV Alaknanda needs to be reviewed.
- As per DR of 400 KV Alaknanda GVK(UPC)-Muzaffarnagar (UP) Ckt, line tripped after ~500ms of tripping command. Channel of LBB protection is also not available in DR. As time delay of LBB protection is 200ms, tripping of line after ~500ms need to be reviewed.
- As per SCADA SOE, 220 KV Singoli Bhatwari(Singoli(LTUHP))-Srinagar(UK) (PTCUL) Ckt-1 & Ckt-2 tripped within 2.5secs of tripping of 400 KV Alaknanda GVK(UPC)-Muzaffarnagar (UP) Ckt. And as per protection philosophy, minimum time delay for OV stage-1 protection is 5secs. Hence, OV stage-1 protection setting of aforementioned tripped lines on over protection need to be reviewed.
- DR, EL & tripping report of all the tripped elements need to be shared.
- Remedial action taken report to be shared.

Multiple elements tripping at 220kV Hiranagar

18:00hrs on 29.08.2022

Antecedent Condition and Tripped Elements

Antecedent Condition:-

- NR demand Met- 62322MW
- Uttarakhand Demand Met- 2327MW
- Frequency- 49.97Hz
- Load Loss ~ 300MW in J&K
- Generation Loss ~ 80MW at Sewa-2
- Type of fault - Line to ground
- Fault clearing time (ms) – 760 ms
- Faulted Phase R-N

Following elements tripped:-

- 220kV Hiranagar-Ghatti
- 220kV Hiranagar-Samba-1
- 220kV Hiranagar-Samba-2
- 132kV Hiranagar-Sewa2 ckt-1
- 132kV Hiranagar-Sewa2 ckt-2
- Unit #1 at Sewa-2
- Unit #2 at Sewa-2
- Unit #3 at Sewa-2

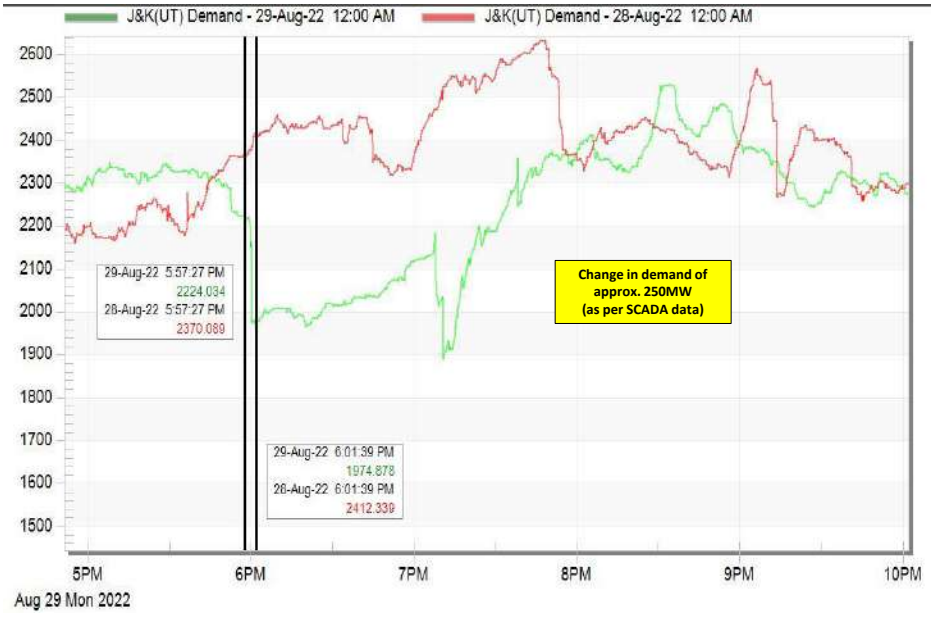
PMU Plot of frequency at Sambha(PG)

18:00hrs/29-Aug-22

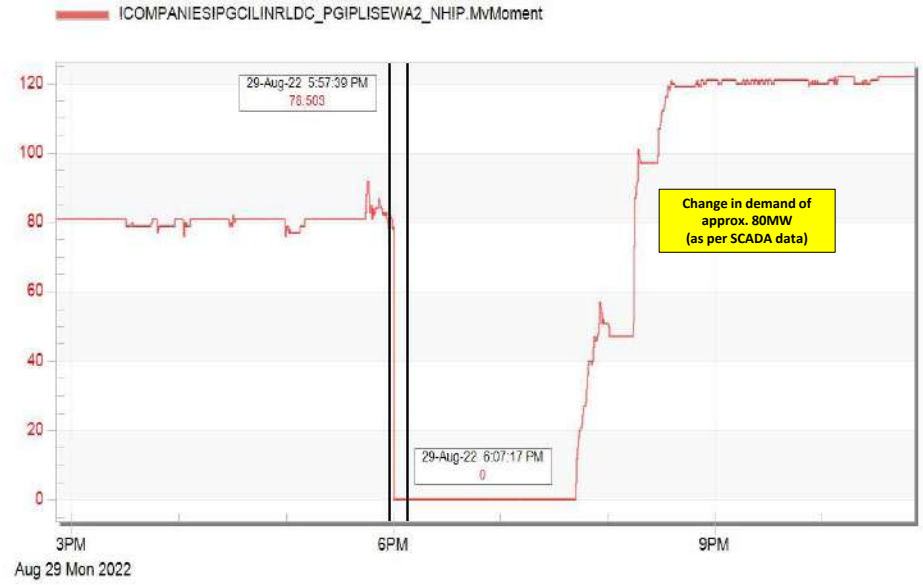
PMU Plot of phase voltage magnitude at Sambha(PG)

18:00hrs/29-Aug-22

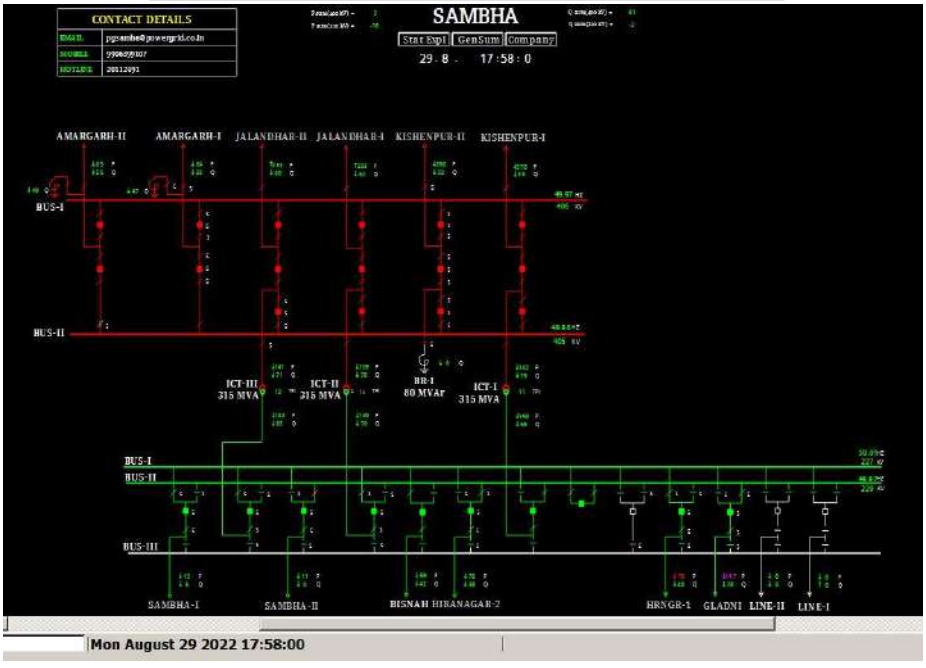
J&K demand during the event



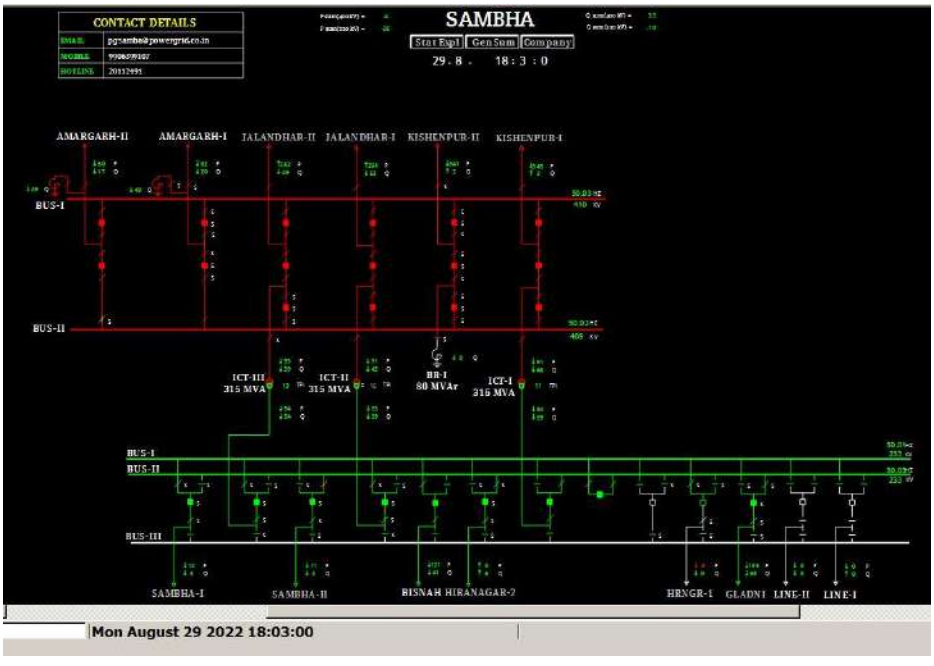
SEWA-2(NHPC) HEP generation during the event



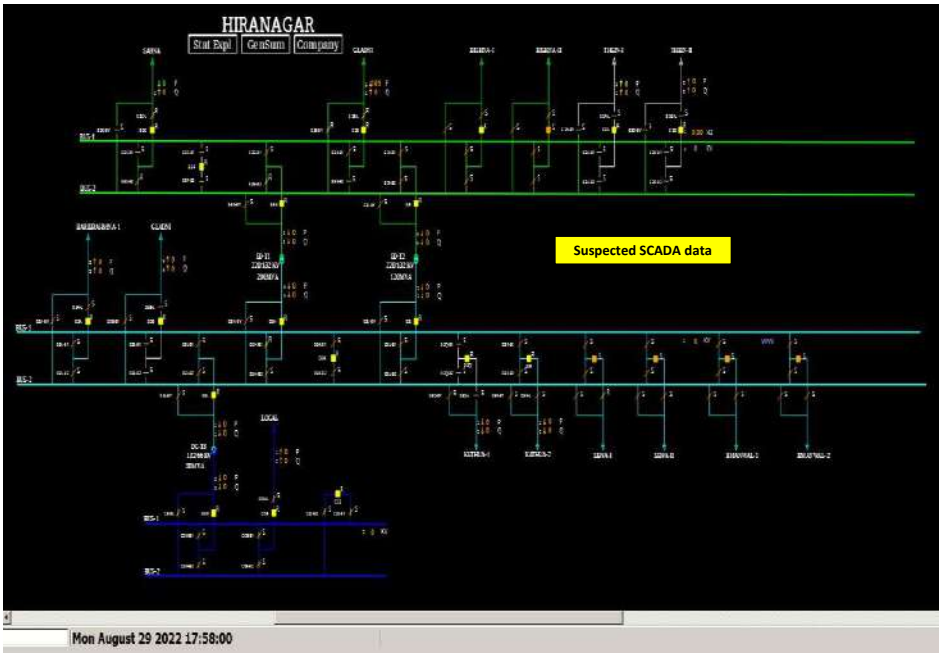
SLD of 400/220kV Sambha(PG) before the event



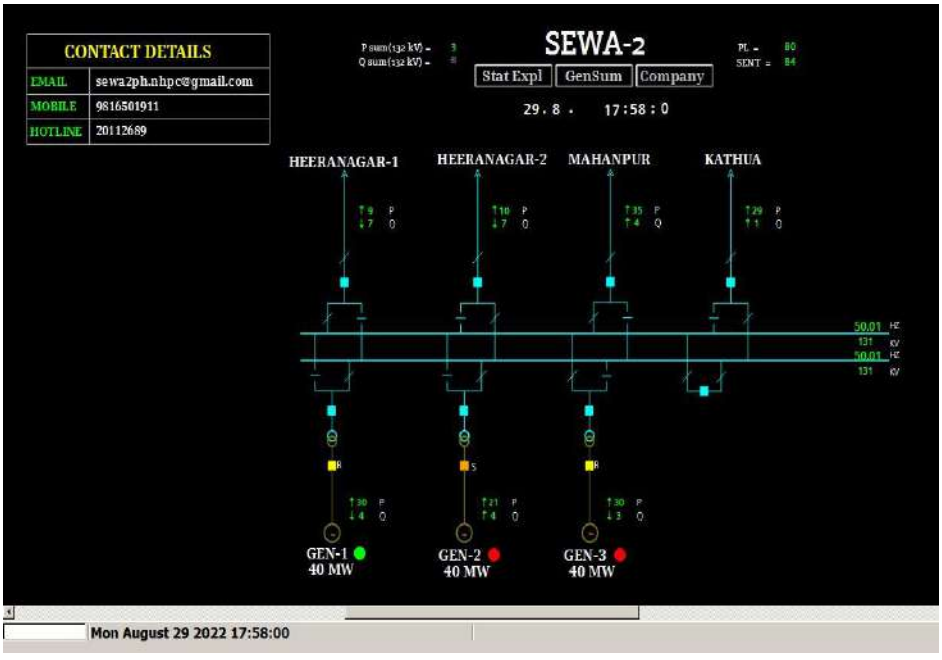
SLD of 400/220kV Sambha(PG) after the event



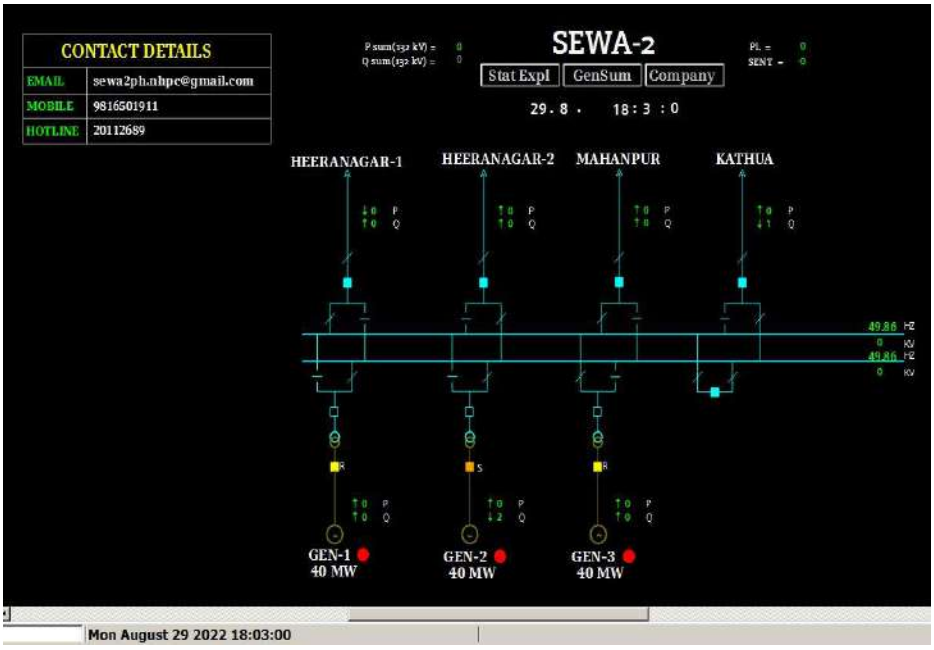
SLD of 220/132kV Hiranagar(J&K) before the event



SLD of 132kV Sewa-2(NHPC) before the event



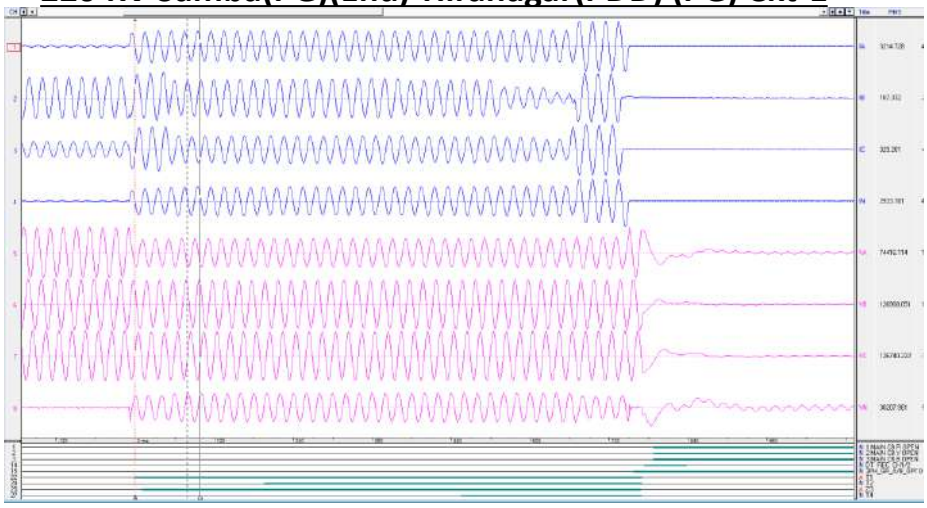
SLD of 132kV Sewa-2(NHPC) before the event



SCADA SOE

Time	Station Name	Voltage	Element Name	Element Type	Element Status	Remark
17:59:57,245	SAMBHA	220kV	04HRNGR	Circuit Breaker	Open	Line CB at Sambha end of 220kV Sambha-Hirangar ckt-1 opened
18:00:23:158	SEWA2	132kV	03U03	Circuit Breaker	Open	CB of 40MW Unit-3 opened
18:00:23:158	SEWA2	132kV	02U02	Circuit Breaker	Open	CB of 40MW Unit-2 opened
18:00:23:158	SEWA2	132kV	01U01	Circuit Breaker	Open	CB of 40MW Unit-1 opened

220 KV Samba(PG)(End)-Hiranagar(PDD) (PG) Ckt-1



1. Zone-3 started.
2. Line tripped on DT receive.
3. Power grid analysis

Sewa Unit-1,2&3 details

Detailed Analysis Report	
A. Introduction:	
1. Time and Date of Event	**On 29/08/2022 at 17:59 hrs.**
2. Substation(s) Affected along with voltage level	**Sewa-II पावर स्टेशन**
3. Brief Event summery	Due to islanding from grid, all the three running units tripped due to sudden load throwoff.
B. Antecedent Conditions:	
1. Weather Information	**Normal**
2. Additional relevant information viz. power flow, shutdown etc:	NA
C. Event Data:	
1. Change in Frequency.	N.A.
2. Generation Loss/Load Loss.	120 MW
3. Single Line Diagram (SLD) of affected Area:	NA
4. Name and time of the tripped elements in time chronology:	Unit#1 at 17:59:00 hrs. on 29-Aug-2022,Unit#2 at 17:59:00 hrs. on 29-Aug-2022,Unit#3 at 17:59:00 hrs. on 29-Aug-2022
5. Location and type of fault.	AT Hiranagar Sub station
6.Flag Details, DR and EL for each affected element:	Enclosed.
7. Appropriate Graphical Plot:	N.A.
8. Equipment Failure (if any):	NIL.
D. Event Description/ Analysis of the Event	1. Line#1, Line#2, Line#3 & Line#4:- All the four lines were in closed condition from Sewa-2 End, however isolated from grid due to tripping of lines from remote end. 4. Units:- Due to unavailability of power evacuation path & sudden load throw off, all the three running units tripped on operation of over speed protection.
E. Restoration	
1. Restoration time of tripped elements in time chronology	Unit#1 at 19:43:00 hrs. on 29-Aug-2022,Unit#2 at 19:43:00 hrs. on 29-Aug-2022,Unit#3 at 19:43:00 hrs. on 29-Aug-2022
2. Special finding/ issues identified during restoration	NIL.
A. Remedial Action	
1. Remedial Action Taken.	NIL.
2. Remedial Action to be taken along with time frame.	NIL. NIL.
G. Lesson Learnt	
A. Any other Information	NIL.

Units tripped due to loss of evacuation path.

Observations

Analysis of tripping (As reported):

- In antecedent condition, 220kV Sambha-Hirangar ckt-1 & Ckt-2 were carrying 79MW & 75MW respectively and 40MW Unit-1, 2 & 3 at Sewa-2 HEP were carrying 30MW , 21MW & 30MW respectively.
- As reported at 18:00hrs, R-N phase to earth fault occurred in 220kV Hiranagar-Ghatti ckt, fault distance was ~8.45km & fault current was 7.38kA from Hiranagar end. As per PMU at Sambha(PG), R-N phase to earth fault with delayed clearance in 760ms is observed.
- CB of 220kV Hiranagar-Ghatti ckt didn't open on this fault and after approx. 750ms other 220kV feeders at Hiranagar tripped and 220kV side of Hiranagar S/s became dead. 220kV Sambha-Hirangar ckt-1 tripped from both end & DT received at Sambha(PG) end and 220kV Sambha-Hirangar ckt-2 tripped from Hiranagar end only.
- As 220kV side of Hiranagar S/s became dead, island formed with Sewa-2 HEP generation & load at 132kv side of 220/132 Hiranagar(J&K). However, further after approx. 2secs, all three(03) 40MW units of Sewa-2(NHPC) tripped on over current protection operation and 132kV side of Hiranagar S/s also became dead due to loss of power supply.
- As per SCADA, load loss of approx. 250MW observed in J&K control area & generation loss of approx. 80MW is observed at Sewa-2(NHPC) HEP.

Points of concern:

- Why did R-N fault in 220kV Hiranagar-Ghatti ckt not clear in time? Reason of delayed clearance of fault?
- Which protection cleared the fault after ~760ms.
- Remedial action taken report to be shared.

Multiple elements tripping at 220/132kV Fatehabad(Har)

03-Sep-2022 19:26

Antecedent Condition and Tripped Elements

Antecedent Condition:-

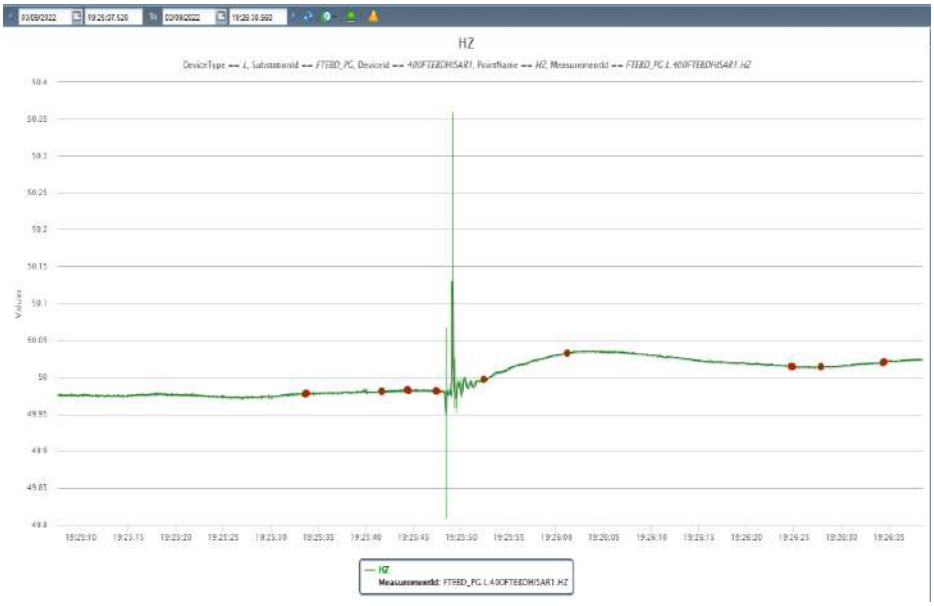
- Grid Frequency (Hz) 50.03
- Total IR Import (MW) 6516
- Northern Region Demand (MW) 67717
- Type of fault - Double line to ground
- Fault clearing time (ms) 400
- Faulted Phase - R-N fault followed by Y-B fault

Following elements tripped:-

1. 220 KV Hissar(PG)-Fatehabad(HV) (HVPNL) Ckt-2
2. 220 KV Fatehabad(PG)-Fatehabad(HV) (HVPNL) Ckt-2
3. 220 KV Fatehabad(PG)-Fatehabad(HV) (HVPNL) Ckt-1
4. 220 KV Hissar(PG)-Fatehabad(HV) (HVPNL) Ckt-1

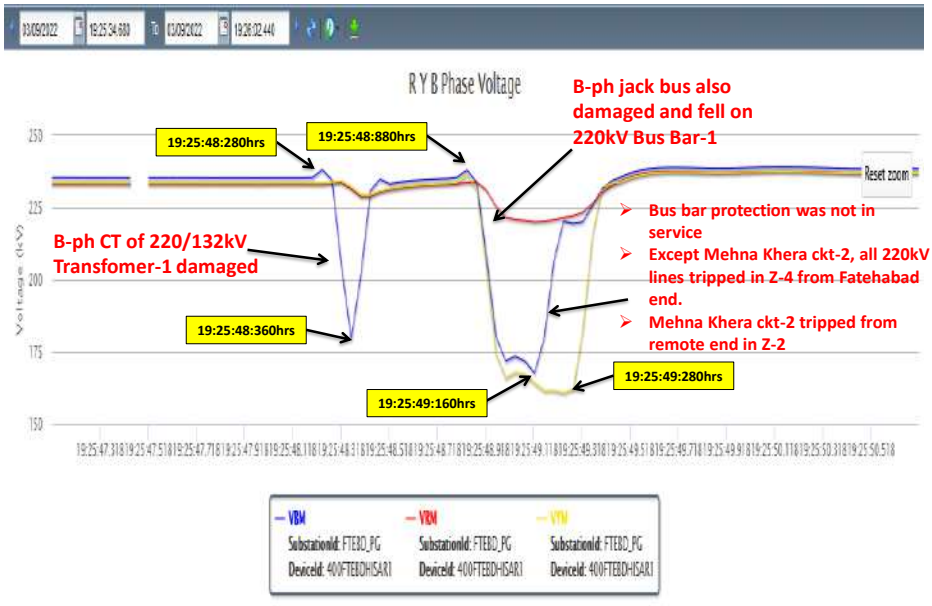
PMU Plot of frequency at Fatehabad(PG)

19:25hrs/03-Sept-22

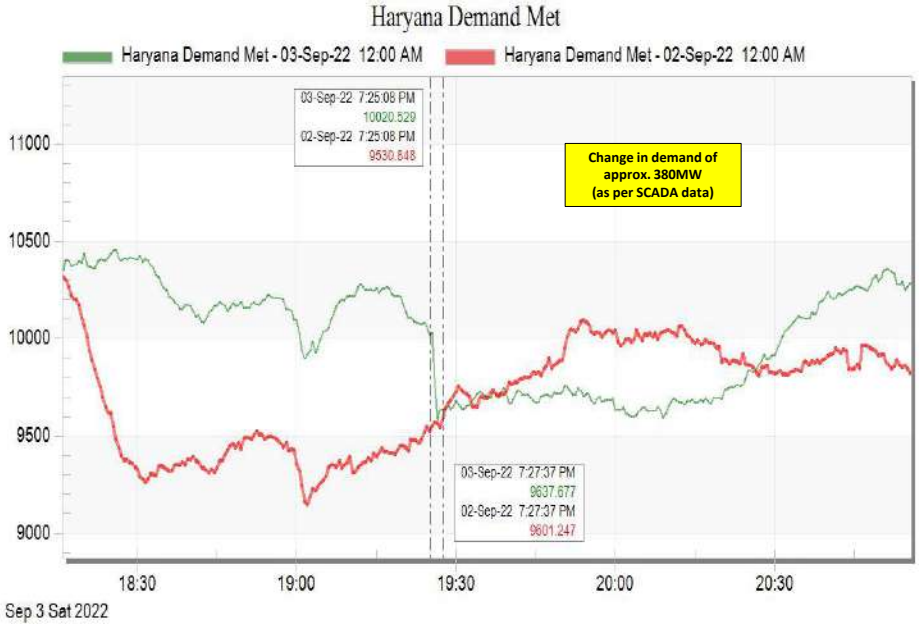


PMU Plot of phase voltage magnitude at Fatehabad(PG)

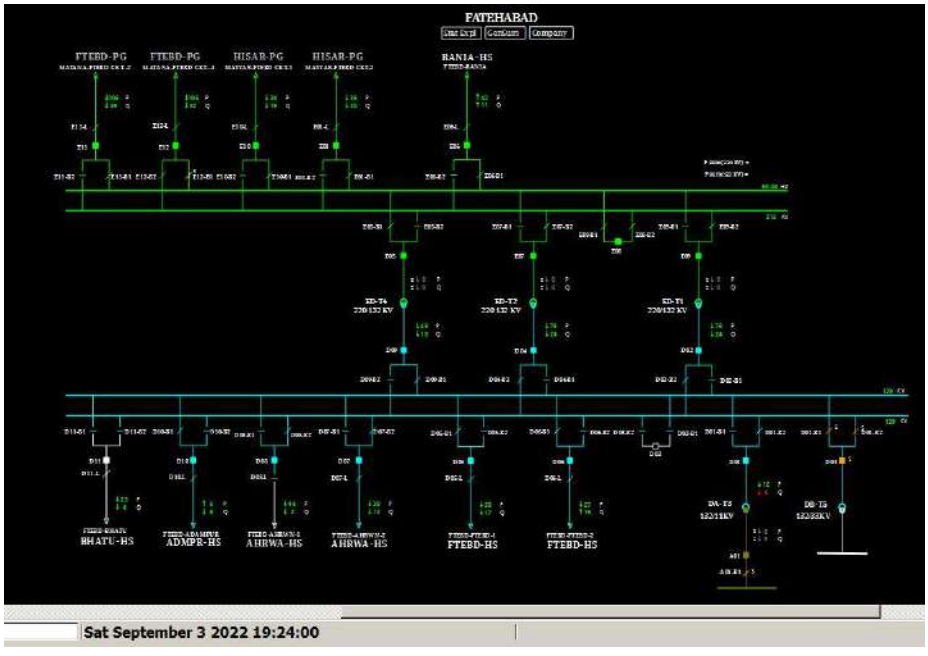
19:25hrs/03-Sept-22



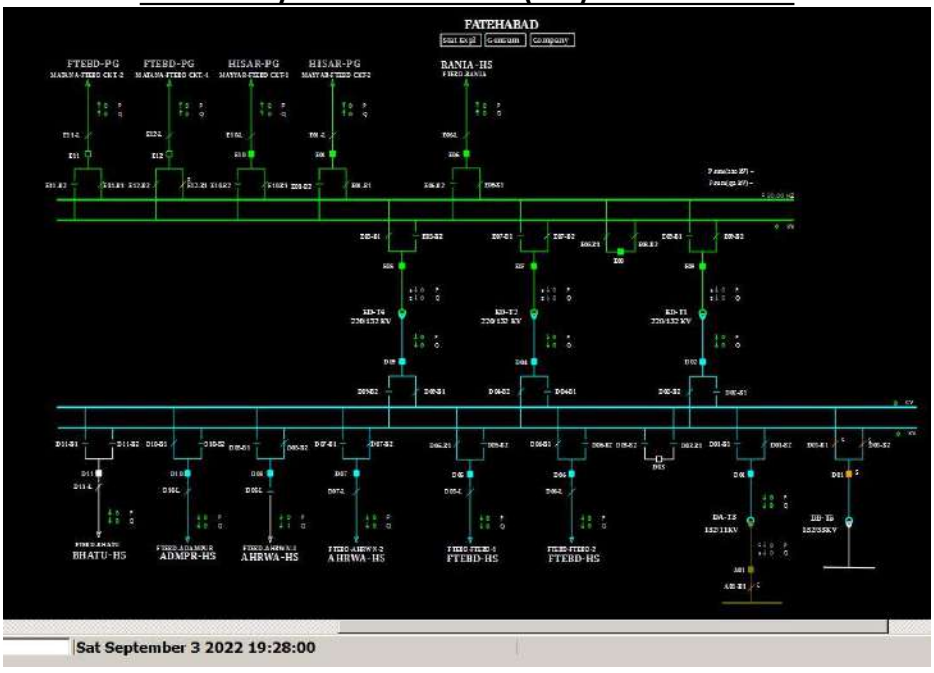
Haryana demand during the event



SLD of 220/132kV Fatehabad(Har) before the event



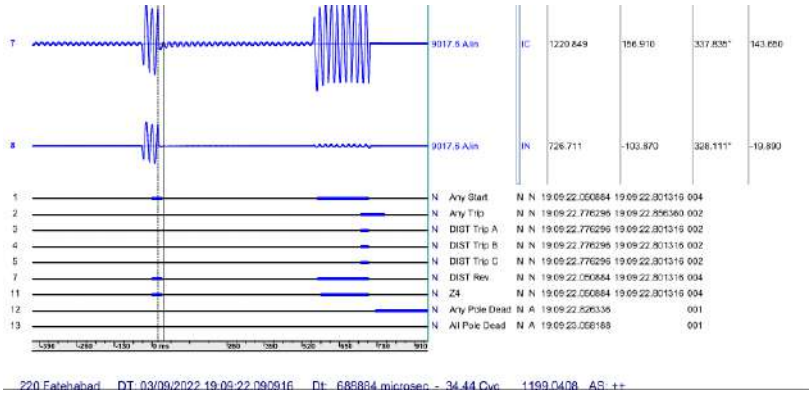
SLD of 220/132kV Fatehabad(Har) after the event



SCADA SOE

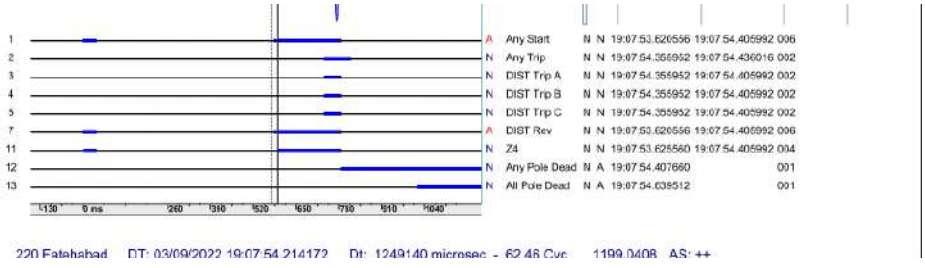
Time	Station Name	Voltage	Element Name	Element Type	Element Status	Remark
19:25:49,137	FATEHABAD	220kV	11FTEBD2	Circuit Breaker	Open	CB at Fatehabad(HV) end of 220 KV Fatehabad(PG)-Fatehabad(HV) (HVPNL) Ckt-2 opened
19:25:49,209	HISSAR	220kV	05FTEBD2	Circuit Breaker	Open	CB at Hissar(HV) end of 220 KV Hissar(PG)-Fatehabad(HV) (HVPNL) Ckt-2 opened
19:25:49,323	FATEHBAD	220kV	06FTEBD1	Circuit Breaker	Open	CB at Fatehabad(PG) end of 220 KV Fatehabad(PG)-Fatehabad(HV) (HVPNL) Ckt-1 opened
19:25:49,370	FATEHABAD	220kV	12FTEBD1	Circuit Breaker	Open	CB at Fatehabad(HV) end of 220 KV Fatehabad(PG)-Fatehabad(HV) (HVPNL) Ckt-1 opened

DR of 220 KV Hissar(PG)-Fatehabad(HV)(End) (HVPNL) Ckt-1



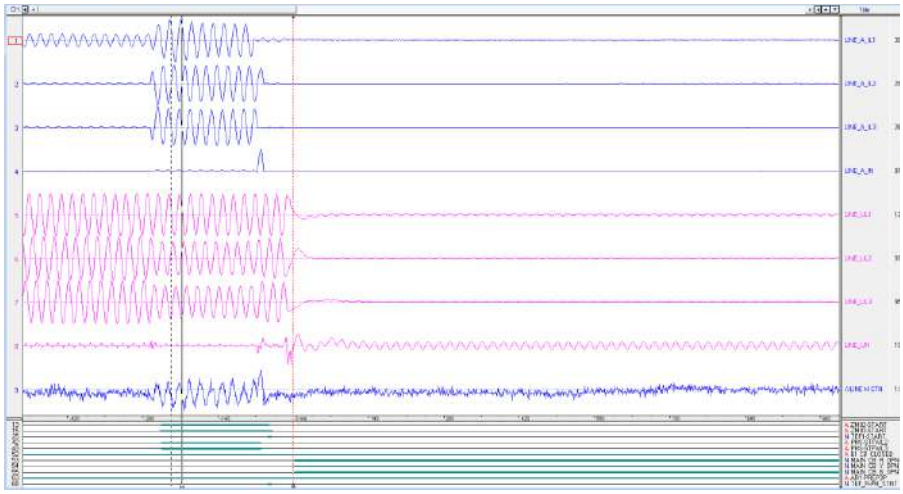
1. Zone-4, reverse operated
2. HVPNL Analysis report

DR of 220 KV Hissar(PG)-Fatehabad(HV)(End) (HVPNL) Ckt-2



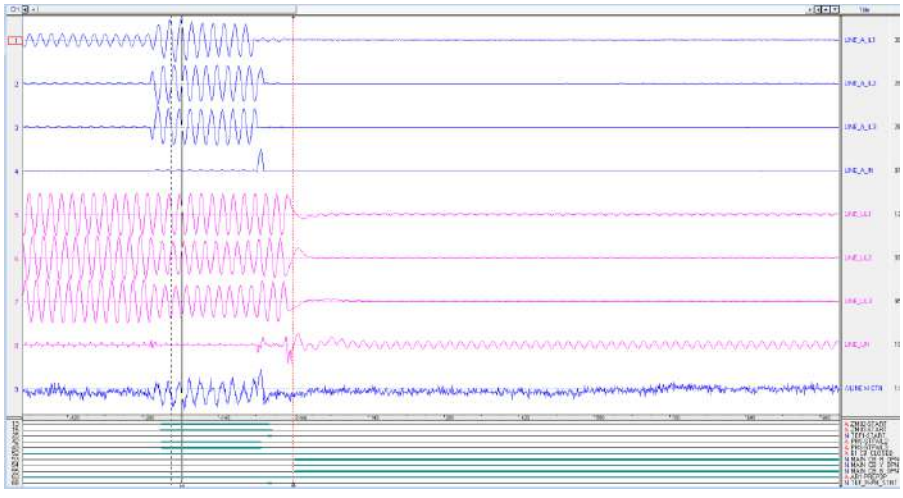
1. Zone-4, reverse operated.

DR of 220 KV Hissar(PG)(End)-Fatehabad(HV) (HVPNL) Ckt-2



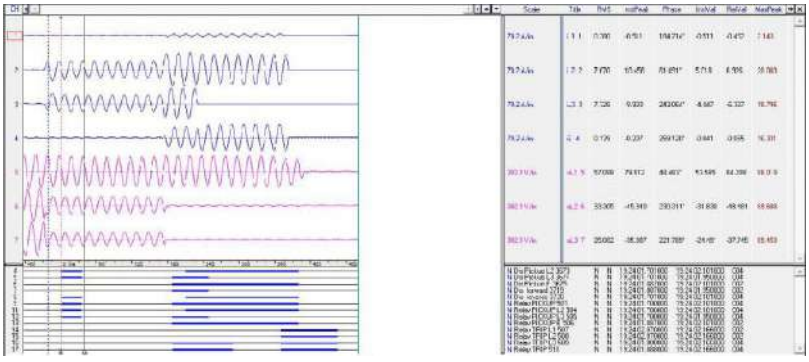
1. Zone-2 & 3 start visible.
2. Zone-2 Timer seems to be 250 ms

DR of 220 KV Hissar(PG)(End)-Fatehabad(HV) (HVPNL) Ckt-2



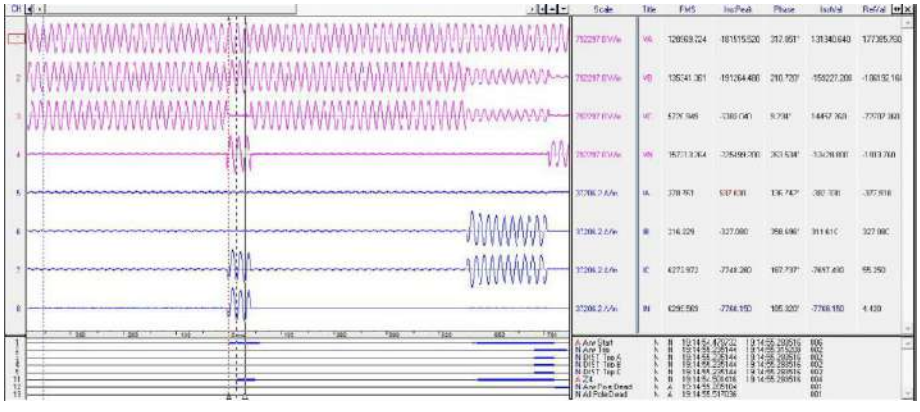
1. Zone-2 & 3 start visible.
2. Zone-2 Timer seems to be 250 ms
3. Power grid analysis report

DR of 220 KV Fatehabad(PG)-Fatehabad(HV) (End) (HVPNL) Ckt-2



1. Reverse zone tripped.
2. Time taken around 180 ms.

DR of 220 KV Fatehabad(PG)-Fatehabad(HV) (End) (HVPNL) Ckt-2



1. Reverse zone tripped
2. Time taken not clear

Observations

Analysis of tripping (As reported):

- 220/132kV Fatehabad(Har) substation have double main single breaker bus scheme.
- During antecedent condition, 220/132kV 100MVA Transformer-4, 220kV lines to Fatehabad(PG)ckt-2, Hissar(Har)ckt-2 & Mehna Khera ckt-2 were connected to 220kV Bus-1 and 220/132kV 100MVA Transformer-1&2, 220kV lines to Fatehabad(PG)ckt-1, Hissar(Har)ckt-1 & Mehna Khera ckt-1 were connected to 220kV Bus-2.
- As reported, Bus bar protection was not in service at 220kV Fatehabad(Har) since 15.07.2021 due to defective I/P & O/P extension device (P849). The relay was got repaired & configuration of same is pending from firm.
- At 19:26hrs, 220kV B-ph CT of 220/132kV 100MVA Transformer-1 damaged and blast. The transformer tripped on differential protection operation and fault cleared.
- Further after ~500ms, 220 kV B phase LA also damaged due to fire. 220kV B-ph Jack Bus also damaged and fell on 220kV Bus Bar-1 at Fatehabad(Har) which created bus fault.
- As per PMU, B-N fault followed by Y-B ph-ph fault with delayed clearance in 400ms is observed.
- As bus bar protection was not in service, all the 220kV lines except Mehna Khera ckt-2 tripped from Fatehabad(Har) end in Z-4. 220kV Fatehabad-Mehna Khera ckt-2 tripped from remote end in Z-2.
- As per SCADA, change in demand of approx. 380MW is observed in Haryana control area.

Points of concern:

- Bus bar protection relay needs to be configured at 220/132kV Fatehabad(Har) S/s at the earliest.
- Why did 220kV Fatehabad-Mehna Khera ckt-2 not trip in Z-4 at Fatehbad(Har) end? Z-4 settings of distance protection relay of 220kV Fatehabad-Mehna Khera ckt-2 at Fatehabad(Har) end need to be reviewed.
- Data of all the tripped elements are not availble in SCADA SOE. Availability of the same need to be ensured.
- Remedial action taken report to be shared.