



भारत सरकार
Government of India
विद्युत मंत्रालय
Ministry of Power
पूर्वी क्षेत्रीय विद्युत समिति



Eastern Regional Power Committee

14, गोल्फ क्लब रोड, टॉलीगंज, कोलकाता-700033

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सं./NO. पू.क्षे.वि.स./PROTECTION/2022/1686

दिनांक /DATE: 30.03.2022

सेवा में / To,

संलग्न सूची के अनुसार / As per list enclosed.

विषय : दिनांक - 11.03.2022 को आयोजित 112वीं पीसीसी बैठक का कार्यवृत्त ।

Sub: Minutes of the 112th PCC meeting held on 11.03.2022.

Sir,

11.03.2022 को आयोजित 112वीं पीसीसी बैठक का कार्यवृत्त पू.क्षे.वि.स. की वेबसाइट (<http://www.erpc.gov.in/>) पर उपलब्ध है। कृपया देखें।

Please find the minutes of the 112th PCC meeting of ERPC held on 11.03.2022 available at ERPC website (<http://www.erpc.gov.in/>).

यदि कोई अवलोकन हो, तो कृपया इस कार्यालय को यथाशीघ्र भेजा जाए।

Observations, if any, may please be forwarded to this office at the earliest.

भवदीय / Yours faithfully,

P.P. Jena
30.03.2022

(पी.पी.जेना / P.P.Jena)
Executive Engineer (PS)
कार्यपालक अभियंता(पी.एस)

LIST OF ADDRESSES:

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Executive Director, ERLDC, POSOCO, Tollygunge, Kolkata-700033	The Head Maithon Power Limited, Maithon Office, MA 5 Gogna, Dist. Dhanbad, Jharkhand State, PIN-828207
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Director, Shiga Energy Pw. Ltd., 5th Floor, DLF Building No. 8, Tower-C, Gurgaon - 722002	DGM (E&I), HALDIA ENERGY LIMITED, BARIK BHAWAN, KOKATA-700072, FAX: 033-22360955
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Minutes
of
112th PCC Meeting

Date: 30.03.2022
Eastern Regional Power Committee
14, Golf Club Road, Tollygunge
Kolkata: 700 033

EASTERN REGIONAL POWER COMMITTEE

MINUTES OF 112th PROTECTION COORDINATION SUB-COMMITTEE MEETING HELD ON 11.03.2022 AT 10:30 HOURS

PART – A

ITEM NO. A.1: Confirmation of minutes of 111th Protection Coordination sub-Committee Meeting held on 11th February 2022 through MS Teams online platform.

The minutes of 111th Protection Coordination sub-Committee meeting held on 11.02.2022 was circulated vide letter dated 28.02.2022.

Members may confirm.

Deliberation in the meeting

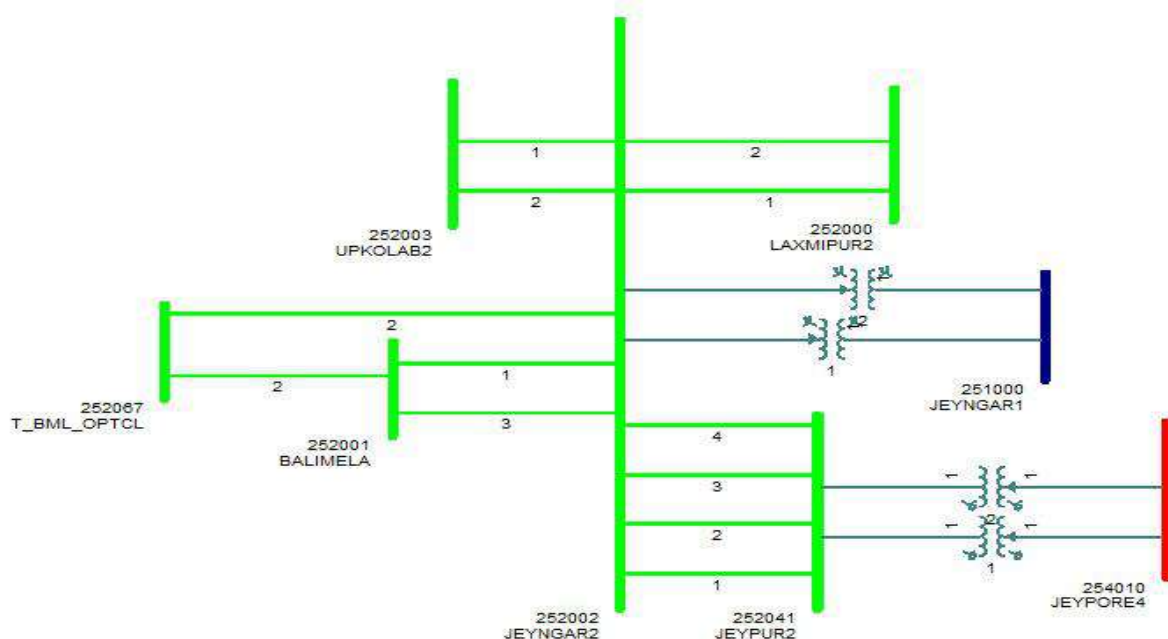
Members confirmed the minutes of 111th PCC Meeting.

PART – B

ITEM NO. B.1: Disturbance at 220 kV Jayanagar (OPTCL) S/s on 27.02.2022 at 11:17 hrs

There was a fault in 220 kV Jaynagar-Laxmipur circuit-1 and the Jaynagar end failed to clear the fault. Subsequently total power failure occurred at 220/132 kV Jaynagar, 220 kV Balimela & 220 kV Upper Kolab S/s.

220 kV Bus-1 at Jeypore (PG) along with 400/220 kV ICT-1 & 3 also tripped during the incident.



Detailed report received from OPTCL is attached at **Annexure B.1.1**.

Load Loss: 40 MW, Gen. Loss: 90 MW

Outage Duration: 01:04 Hrs

OPTCL may explain.

Deliberation in the meeting

*OPTCL representative explained the event with help of a presentation. The presentation is attached at **Annexure B.1.2**.*

He explained that the fault was in 220 kV Jaynagar-Laxmipur D/C at 3-4 km from Laxmipur end.

- For 220 kV Jaynagar-Laxmipur circuit-2, the relay sensed the fault in zone 2 from Jayanagar end and issued trip command to breaker after which both main and tie circuit breaker of line got opened. Relay at laxmipur end sensed the fault in zone 1 and the line got tripped.*
- For 220 kV Jaynagar-Laxmipur circuit-1, relay at Jayanagar end sensed the fault in zone 2 protection and issued trip command to breaker. Though the main circuit breaker got opened however tie circuit breaker did not open leading the fault feeding from Jayanagar end. Laxmipur end sensed the fault through earth fault overcurrent relay and tripped.*
- Regarding non-operation of tie circuit breaker for 220 kV Jaynagar-Laxmipur circuit-1, he submitted that the CB was in gas lockout mode and the gas pressure of Y-phase limb was near to lockout border line. He added that due to rise in atmospheric temperature the lockout mode got reset at 12:45 Hrs and tie CB tripped through TNC switch.*
- On enquiry from PCC regarding LBB operation for 220 kV Jaynagar-Laxmipur circuit-1 in case of non -opening of Tie CB, he informed that LBB protection along with bus bar differential protection was not in service at Jayanagar S/s due to faulty bay units.*
- It was informed that due to long fault clearing time of around 43 seconds, R phase wave trap got burnt at Jayanagar S/S.*

Balimela representative informed that at the time of incident, heavy jerk was observed at their end, however the voltage dip and current rise was not sufficient for pickup of the distance protection relay at their end. The unit was hand tripped by the operator at 11:18 hrs subsequently there was no fault feeding from their end.

PCC advised Balimela HEP to share DR of the incident with ERPC/ERLDC. Also they were advised to review resistive reach settings of the relay as per ERPC protection philosophy.

Upper Kolab representative informed that all the three circuits from U. Kolab got tripped from their end. The U. Kolab-Jayanagar D/C line got tripped in zone-1 protection after 41 seconds of the fault initiation. They clarified that as voltage dip and current rise was very less, delayed triggering of the relay was observed. He further added that unit #2 at Upper Kolab was tripped in generation reverse power flow & the unit #1 was hand tripped. PCC advised OHPC investigate the reason for zone-1 operation of their relay at their end.

After detailed deliberation, PCC opined that the fault was of high resistive nature as a result the voltage dip & current rise was not significant at remote end substations which led to delayed pick up

by the respective relays and accordingly advised concerned utilities to review the resistive reach setting of the relay at their end in line with the guidelines finalised in 100th PCC meeting.

Powergrid representative informed that relay at their end for all four circuits of Jayanagar- PGCIL line sensed the fault in zone 3 and got tripped. However, Y phase circuit breaker for 220 kV Jeypore-Jaynagar-3 did not get open due to issue with trip coil which led to operation of LBB relay and subsequently 220 kV Main Bus-1 at Jeypore (PG) got tripped.

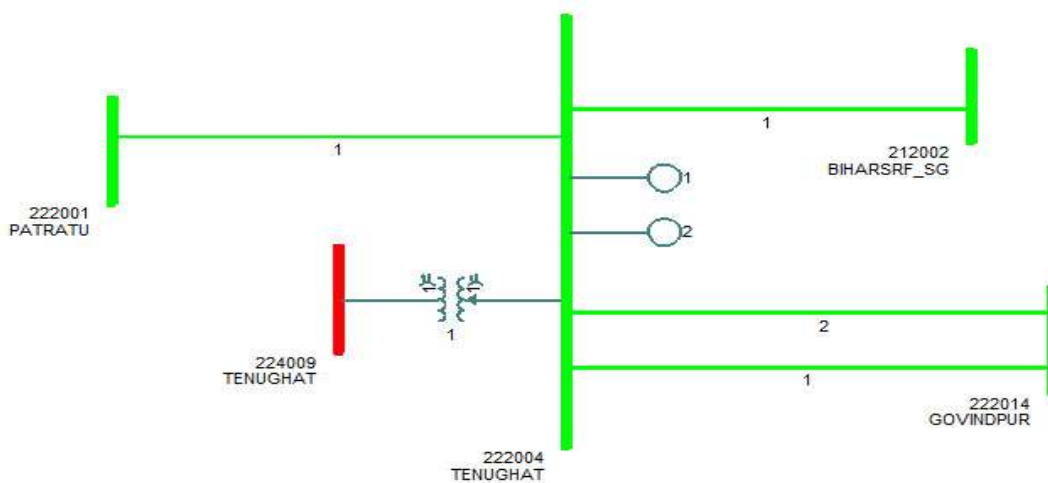
PCC advised OPTCL to restore LBB/bus bar protection at 220 kV Jayanagar S/s at the earliest and till the timethe busbar protection is put back into service, the zone-4 time settings of all 220 kV feeders may to be reduced 250 msec.

OPTCL was also advised to review resistive reach settings as per the guidelines finalized in 100th PCC meeting.

ITEM NO. B.2: Disturbance at 220 kV Tenughat (TVNL) S/s on 04.02.2022 at 05:53 Hrs

On 04th February 2022 at 05:53 Hrs, all emanating lines from 220 kV Tenughat (TVNL) along with two running units tripped at Tenughat.

Detailed report from ERLDC is attached at **Annexure B.2**.



Relay Indications:

Time	Name	End 1	End 2	PMU Observation
05:53	220 kV Tenughat-Patratu	Didn't trip	PTPS: Y_N, Zone 1, 51.26 km, 3.097 kA	6 kV dip in Y_ph; 1.5 kV dip in R_ph and B_ph at Biharsharif. Fault Clearance time: 350 msec
	220 kV Tenughat-Biharsharif	Didn't trip	Biharsharif: Y_N, Zone-2, 1.8 kA	
	220 kV Tenughat-Govindpur-2	Tenughat: Y_N, 1.73 km, 3.56 kA	Govindpur: Y_N, Zone-2 carrier received	
	Tenughat U#1 & U#2	-	-	

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Gen. Loss: 300 MW, Load Loss: 10 MW

Outage Duration: 01:13 Hrs

TVNL may explain.

Deliberation in the meeting

ERLDC representative explained the event based on the DR analysis:

- *Before the disturbance, Tenughat-Govindpur-1 was switched off under voltage regulation and 220 kV Maithon-Dumka D/c was under continuous shutdown. The 220 kV Tenughat-Govindpur-2 was radially feeding Govindpur and downstream areas.*
- *At 05:53 Hrs, Y phase fault developed in 220 kV Tenughat-Govindpur-2 line at 1.73 km from Tenughat end. The relay at Tenughat end sensed the fault in zone-1 protection & issued trip command. Delayed opening of Y-phase breaker(180ms) was observed during the event.*
- *Govindpur end relay sensed the fault in Zone-2 and subsequently after receiving carrier from TVNL end, the line got opened from Govindpur end within 100 msec.*

He explained that there might be a simultaneous fault occurred in 220 kV Bus at Tenughat at the same time which resulted in tripping of 220 kV Tenughat-Biharsharif line from Biharsharif end in zone 2 protection. The relay at Tenughat end for 220 kV Tenughat-Biharsharif sensed the fault in zone 4. For 220 kV Tenughat-PTPS, PTPS end sensed the fault in zone 1 and got tripped and Tenughat end sensed the fault in zone 4 however tripping was not observed from Tenughat end.

During the incident, the unit #1 also got tripped within 80 milliseconds in high set overcurrent protection.

TVNL representative stated that no physical fault was found within the 220 kV Tenughat switchyard.

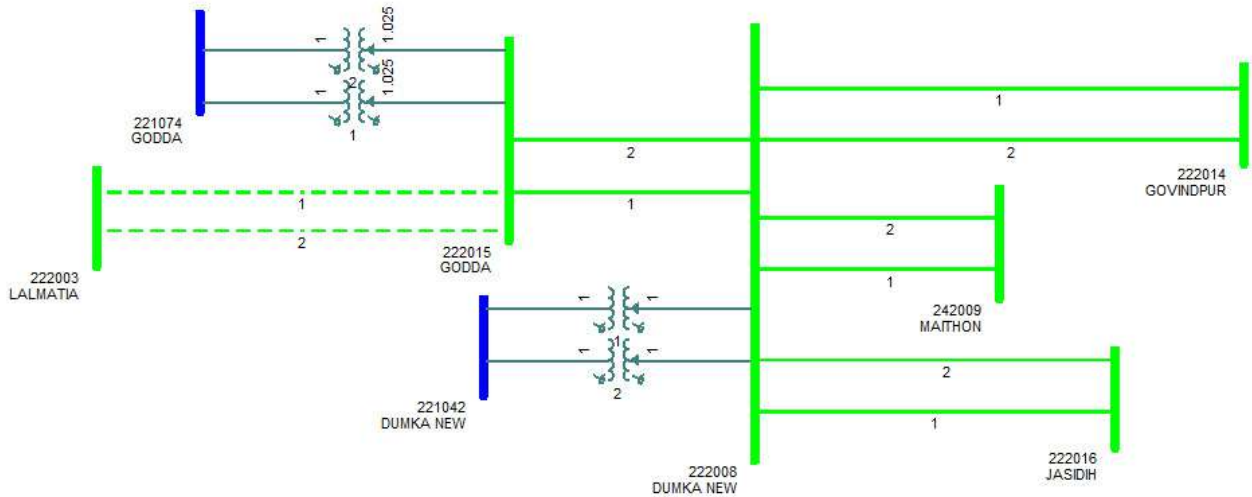
After detailed deliberation, PCC advised TVNL to revise the unit overcurrent settings immediately. Regarding nonoperation of busbar protection, TVNL was advised to test the busbar relay at the earliest & the report may be submitted to ERPC/ERLDC.

Regarding tripping of 220 kV Tenughat-PTPS line from PTPS end in zone-1 protection, JUSNL representative informed that the relay setting was found to be in order & the relay operated satisfactorily in subsequent events.

ITEM NO. B.3: Tripping of 220 kV Dumka- Godda line on 03.02.2022 at 07:37 Hrs and 04.02.2022 at 02:30 Hrs

A. Tripping of 220 kV Dumka - Godda line on 03.02.2022 at 07:37 Hrs

On 3rd February 2022 at 07:37 Hrs, 220 kV Dumka-Godda D/c and 220 kV Dumka-Jasidih D/c tripped on overvoltage protection leading to total power failure at Godda & Jasidih. Inclement weather was reported during the event.



Load Loss: 92 MW

Outage Duration: 04:47 Hrs

JUSNL may explain.

Deliberation in the meeting

JUSNL representative informed that due to inclement weather, load crash occurred in the nearby areas which led to tripping of 220 kV Dumka-Godda D/c and 220 kV Dumka-Jasidih D/c on overvoltage protection from Dumka end.

ERLDC representative informed that tripping had occurred due to improper overvoltage settings at Dumka end. He further added that revised settings with proper time and voltage grading had been shared with JUSNL on 10th March 2022.

PCC advised JUSNL to implement revised overvoltage settings at the respective substations at the earliest.

B. Tripping of 220 kV Dumka- Godda line on 04.02.2022 at 02:30 Hrs

On 4th February 2022 at 02:30 Hrs, 220 kV Dumka-Godda-2 tripped on O/V protection leading to total power failure at Jasidih as 220 kV Dumka-Godda-1 was already tripped on O/V at 01:58 Hrs on same day. Inclement weather was reported during this event also.

Load Loss: 22 MW

Outage Duration: 08:41 Hrs

JUSNL may explain.

Deliberation in the meeting

ERLDC representative informed that 220 kV Dumka-Godda-2 tripped on O/V protection from Godda end which led to total power failure at Godda as 220 kV Dumka-Godda-1 was already tripped on O/V at 01:58 Hrs on same day. He further added that revised settings with proper time and voltage grading had been shared with JUSNL on 10th March 2022.

PCC advised JUSNL to implement revised overvoltage settings at the respective substations at the earliest.

ITEM NO. B.4: Disturbance at Teesta-V (NHPC) S/s on 02.02.2022 at 19:02 Hrs

All three running units at Teesta-5 tripped due to failure of UPS supply. However, both 400 kV buses at Teesta -5 remained charged through 400 kV Teesta 5-Rangpo D/c lines.

Disturbance report received from NHPC/ERLDC is attached at **Annexure B.4.**

Relay Indications:

Time	Name	End1	End2	PMU Observation
19:02	U#1, U#2, U#3 at Teesta-5	Loss of auxiliary supply		2 kV rise in each phase at Rangpo

Gen. Loss: 510 MW

Outage Duration: 00:49 Hrs

NHPC may explain.

Deliberation in the meeting

NHPC representative informed that during restoration of MCB(UPS supply) of SCADA workstation. short circuit occurred due to which both main and standby UPS got tripped. Subsequently supply to rotor earth fault relay AC injection module got interrupted which led to operation of master trip relay and tripping of all three running units of Teesta-V.

As remedial measure, they informed that as a remedial measure they are planning to implement additional AC supply to rotor earth fault relay AC injection module from DC Battery bank through DC/AC converter for which testing had already been done and it would be implemented soon.

ITEM NO. B.5: Disturbance at 220 kV Rongnichu S/s on 09.02.2022 at 17:48 Hrs

220 kV Rangpo-Rongnichu D/c tripped from Rongnichu end during testing of relays at Rongnichu end. No generation loss occurred as both units of Rongnichu was under overhauling.

No Gen. Loss and Load Loss

Outage Duration: 00:15 Hrs

Ronginchi HEP (MBPCL) may explain.

Deliberation in the meeting

PCC advised all the utilities to take proper precaution while doing testing work so that such type of spurious tripping incidents can be avoided.

ITEM NO. B.6: Total Power Failure at Teesta III S/s on 25.02.2022 at 13:27 Hrs

On 25th February 2022 at 13:27 Hrs, 400 kV Teesta 3-Rangpo-1 and 400 kV Teesta 3-Dikchu tripped due to R_B_N fault. No generation or load loss occurred as all hydro units of Teesta-III were out of bar.

Disturbance report from ERLDC is attached at **Annexure B.6.**

Relay Indications:

Time	Name	End 1	End 2	PMU Observations
13:27	400 kV Teesta 3-Rangpo-1	Teesta 3: R_B_N, Zone 1, 4.2 km,	Rangpo: R_B_N, Zone 1, 63.5 km, Ir: 6.2 kA, Ib: 3.9 kA	97 kV dip in R_ph and 126 kV dip in B_ph voltage at Rangpo
	400 kV Teesta 3 Dikchu	Teesta 3: O/V St-2	Dikchu: R_B_N, Zone-1,Ir: 3.89 kA, Ib: 4.1 kA	

Outage Duration: 01:23 Hrs

TUL & Dikchu HEP may explain.

Deliberation in the meeting

TUL representative informed that the fault was developed in 400 kV Teesta 3-Rangpo-1 line. Relay at Teesta-III end sensed the fault in zone-1 protection and tripped the line. At Rangpo end, relay sensed the fault in zone-2, however after receiving carrier from Teesta 3 end, line got tripped within 100 ms from Rangpo end.

Regarding tripping of 400 kV Teesta 3-Dikchu line, TUL representative informed that relay at Teesta 3 end had sensed the fault in zone-4 however the line was tripped in zone-1 from Dikchu end within 100 ms. Subsequently the line got tripped on overvoltage stage-II protection from Teesta-III end.

They added that the overvoltage setting was kept at of 120% per phase (277 kV) and during incident per phase voltage of 311 kV was observed which led to relay initiation.

Regarding tripping of 400 kV Teesta 3-Dikchu line from Dikchu end, Dikchu HEP representative informed that main-2(ABB) relay had sensed the fault in zone-1 and issued trip command to the breaker. They clarified that the zone setting for zone-I was kept at 80 % as per the protection philosophy.

PCC advised Dikchu HEP to share DR of the event along with distance protection settings of the line with ERPC/ERLDC.

ITEM NO. B.7: Major grid events other than GD/GI

B.7.1: Bus tripping occurred in Eastern Region during February 2022

The following incident of bus bar tripping has been observed in Feb-22.

Element Name	Tripping Date	Reason	Utility
220 kV Main Bus-1 at Jeypore (PG)	27-02-2022 at 11:17 Hrs	LBB of 220 kV Jeypore-Jaynagar-3 operated	PG Odisha Projects

Powergrid may explain.

Deliberation in the meeting

Powergrid representative informed that during the disturbance at 220 kV Jeypore S/s of OPTCL on 27.02.2022, relay at Jeypore(PG) end for all the four circuits of 220 kV Jeypore-Jeypore line sensed the fault in zone-3 and issued trip command.

The Y-phase circuit breaker for 220 kV Jeypore-Jeypore-3 did not open due to issue with trip coil resulting in operation of LBB relay. Subsequently 220 kV Main Bus-1 at Jeypore (PG) got tripped.

He mentioned that the trip coil of circuit breaker had already been replaced.

B.7.2: Tripping of 330 MVar Bus Reactors at Angul

On 18.02.2022, 330 MVar Bus Reactor 1 & 2 tripped at Angul S/s at 12:23 & 12:20 hrs respectively on operation of PRV/Buchholz/PRD.

Detailed report from PG Odisha Projects is attached at **Annexure B.7.2**.

Powergrid may explain.

Deliberation in the meeting

Powergrid representative informed that 330 MVar Bus Reactor 1 & 2 tripped at Angul S/s at 12:23 & 12:20 hrs respectively on operation of PRV/Buchholz/PRD.

On investigation, many control cables and power cables were found damaged among which 02 nos of 3.5C 70 sq mm cables were found punctured and caught fire. Due to collateral damage, many control cables also got damaged. They informed that insulation failure of the cable led to dc earth fault which resulted in tripping of elements.

As a remedial measure, fire in cable trench was extinguished immediately and damaged portion of cables was removed and healthy portion was joined using cable loops as temporary measure.

He further added that in order to avoid such incidents in future, they are trying to do periodic IR measurement of cable on yearly basis so that cables can be replaced if insulation level is not meeting up to specified limit.

ITEM NO. B.8: Multiple Tripping at 400/220 kV Jamshedpur S/s

At 17:06 Hrs on 08.02.2022, following lines tripped at 400/220 KV Jamshedpur S/s without any fault.

- 400 kV Jamshedpur-Baripada-1
- 400 kV Jamshedpur-TISCO-1
- 400 kV Jamshedpur-Mejia-1

The lines were tripped on DT receipt from remote ends.

Further, 400 kV Jamshedpur-DSTPS (Andal)-1 had tripped twice in the month of February'22 from Jamshedpur end on DT receipt.

Powergrid and DVC may explain.

Deliberation in the meeting

Powergrid representative informed that during isolator replacement work in the Jamshedpur S/s, dc earth fault occurred which led to initiation and sending of DT signal to remote end of 400 kV Jamshedpur-Baripada-1, 400 kV Jamshedpur-TISCO-1 and 400 kV Jamshedpur-Mejia-1 along with 400/220 kV ICT 2.

Regarding tripping of 400 kV Jamshedpur-DSTPS (Andal)-1, he informed that the line was tripped on each occasion on receipt of DT signal from remote end i.e. DSTPS end. He added that the issue had already been communicated to DVC.

PCC advised DVC to resolve the carrier related issue in PLCC in coordination with Powergrid.

ITEM NO. B.9: Tripping Incidence in month of February-2022

Tripping incidents in the month of February-2022 which needs explanation from constituents of either of the end is attached.

Concerned utilities may explain.

Deliberation in the meeting

*Members explained the tripping incidences. The updated status is enclosed at **Annexure B.9**.*

PART-C::OTHER ITEMS

ITEM NO. C.1: Tripping of ICTs in ER due to maloperation/auxiliary issues--ERLDC

Several ICTs had tripped in the last few months due to spurious tripping whose details are as follows-

Element Name	Tripping Date	Tripping Time	Reason
400/220KV 315 MVA ICT-2 AT KHARAGPUR	03-03-2022	12:05	Tripped on PRD
400KV/220KV 315 MVA ICT 2 AT INDRAVATI.	24-02-2022	19:58	Emergency hand tripped for safty measure
400KV/220KV 315 MVA ICT 1 AT INDRAVATI.	24-02-2022	19:39	Buchholz relay operated
400KV/132KV 200 MVA ICT 2 AT LAKHISARAI	22-02-2022	07:50	LBB Relay operated in Lakhisarai-Lakhisarai #2 at PG end
400KV/132KV 200 MVA ICT 1 AT LAKHISARAI	22-02-2022	07:50	LBB Relay operated in Lakhisarai-Lakhisarai #2 at PG end
330MVAR 765KV B/R-2 AT ANGUL	18-02-2022	12:20	As informed by site fire occurred in the cable trench and some of the cables has burnt causing dead earth fault
330MVAR 765KV B/R-1 AT ANGUL	18-02-2022	12:23	As informed by site fire occurred in the cable trench and some of the cables has burnt causing dead earth fault
400KV/220KV 315 MVA ICT 2 AT BOKARO-A TPS	08-02-2022	19:48	Master trip operated While DC checking of 220 kV Ramgarh-Bokaro D/c
400KV/132KV 315 MVA ICT 3 AT BANKA (PG)	04-12-2021	12:39	Mal-operation of LBB relay for main bay of ICT
400KV/132KV 200 MVA ICT 2 AT BANKA (PG)	04-12-2021	12:39	Mal-operation of LBB relay for main bay of ICT
400KV/132KV 200 MVA ICT 1 AT BANKA (PG)	04-12-2021	12:39	Mal-operation of LBB relay for main bay of ICT
400KV/220KV 315 MVA ICT 3 AT BIHARSARIFF	29-11-2021	19:01	SPARKING IN MARSHALLING BOX LED TO TRIPPING OF ICT
330MVAR 765KV B/R-1 AT NEW JEERAT	15-11-2021	01:56	Due to cable damage by rat bite
400KV/220KV 315 MVA ICT 1 AT JAMSHEDPUR	20-11-2021	18:32	Overhead line differential protection operated , CT secondary cable of OH differential protection core is damaged near CT MB at JUSNL end.
765KV/400KV 1500 MVA ICT 1 AT ANGUL	21-10-2021	17:49	WTI protection maloperation
400KV/132KV 200 MVA ICT 2 AT KAHALGAON	18-10-2021	20:30	TRIPPED DURING SYNCHRONIZATION OF 132KV-KHSTPP-KH (BSEB) LINE
765KV/400KV 1500 MVA ICT 1 AT ANGUL	16-10-2021	16:49	WINDING TEMPERATURE INDICATOR TRIP
400KV/220KV 315 MVA ICT 2 AT BOKARO-A TPS	01-10-2021	12:08	REMOTE PROT. OPTD. AND 86A, 86B.

Concerned utilities may explain. Members may discuss.

Deliberation in the meeting

ERLDC representative informed that number of spurious tripping of ICTs was observed in last few months which is a serious concern for reliability of eastern regional grid.

The concerned utilities explained the tripping as follows:

400/132 kV ICTs at Lakhisarai(Powergrid): In spite of was done during the line shutdown, neutral current was observed leading to triggering of LBB. Subsequently busbar protection operated & the ICT also got tripped.

400/132 kV ICTs at Banka(Powergrid): Due to issue in auxiliary contact, LBB protection mal-operated. The contact has already been replaced.

Bus reactor at New Jeerat(Powergrid): On investigation of the tripping, cable damage was found by rat bite. As a remedial measure they suggested to replace the cable with armoured cable.

765/400 kV ICT1 at Angul (Powergrid): Cable cut was found. Due to water spillage through the cable cut, DC earth fault was developed resulting in operation of WTI protection.

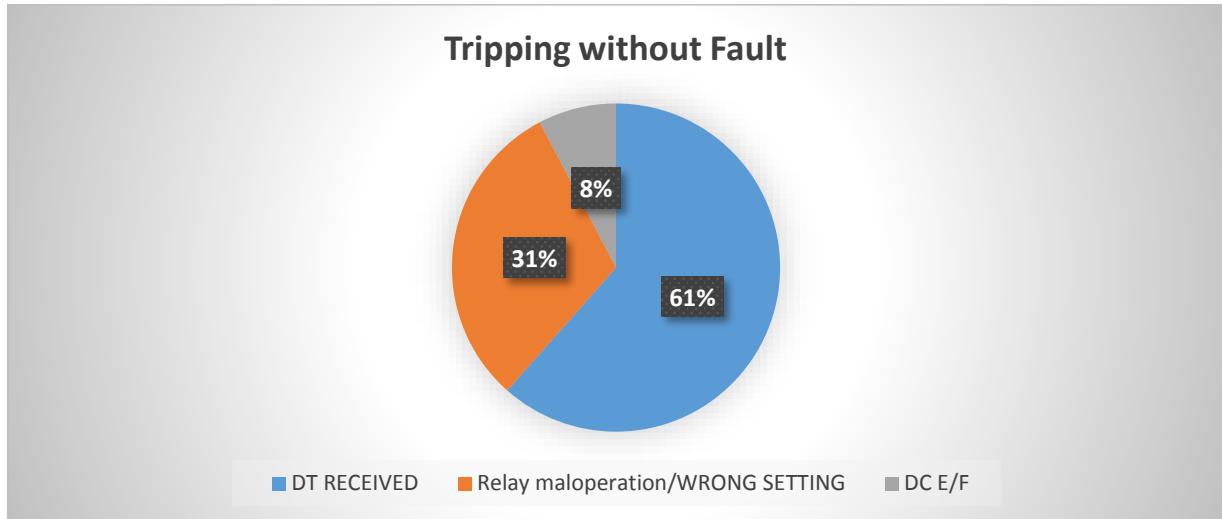
400/132 kV ICT2 at Kharagpur(WBSETCL): sulphur was deposited on micro fuse contacts of PRD due to which PRD protection operated and ICT got tripped. The contacts had already been replaced.

ITEM NO. C.2: Tripping of transmission lines without any fault--ERLDC

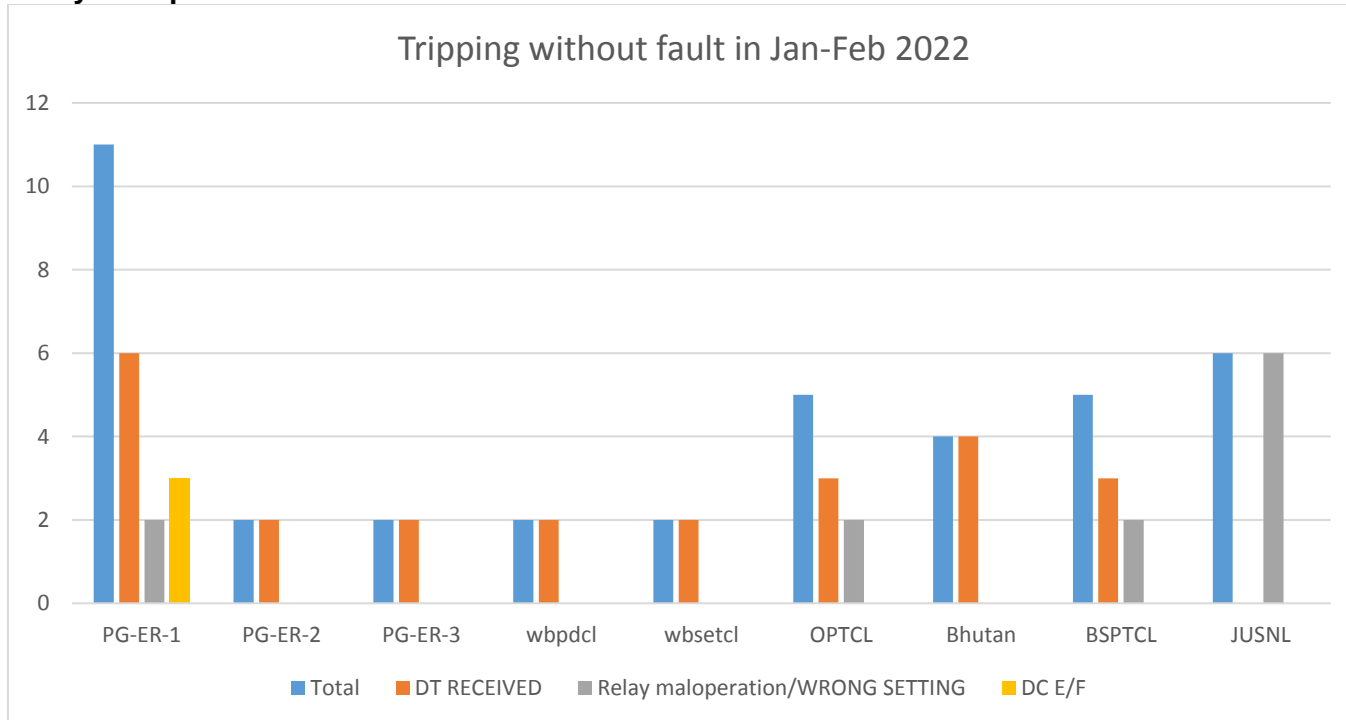
Almost 44% of line tripping in last two months had occurred without any fault in the line, mostly due to spurious operation of relay, sending of DT, etc. which had adversely impacted reliability and resiliency of the grid. Details of these tripping is as follows –

	Total Tripping	Tripping without fault
Jan'22	41	14
Feb'22	53	27
Total	94	41

Categorization of tripping without any fault



Utility wise performance:



Members may discuss.

Deliberation in the meeting

ERLDC representative informed that almost 44% of line tripping in last two months in ER grid had occurred without any fault in the line. He pointed out that most of tripping had occurred on account of DT receipt.

PCC expressed concern over the spurious tripping of the transmission lines without any fault in the line and opined that this would adversely impacting reliability & security of the grid.

PCC advised all the utilities to take appropriate measure in finding out the reason behind spurious tripping of line and to rectify it as soon as possible so that the undesirable tripping of lines can be eliminated.

ITEM NO. C.3: Status of Bus Bar protections at various 220 kV substations for compliance of CEA Regulations

JUSNL, OPTCL & WBSETCL are requested to submit list of 220 kV s/s where Bus Bar Protection is not available/non-functional along with action plan to commission the same.

Concerned utilities may update.

Deliberation in the meeting

PCC advised JUSNL, WBSETCL and OPTCL to share the status of bus bar protection in 220 kV s/s of their system within a week.

ITEM NO. C.4: Review of Line Reactor Tripping scheme in case of Single-Phase A/R in 400 kV Ranchi-MPL D/C

Line reactor tripping logic was implemented in 400 kV Ranchi-MPL D/C for single phase A/R to avoid any secondary arcing/LC resonance during autorecloser in case of single-phase fault.

Now, 400 kV Ranchi-MPL D/c has been LILoed at 400/220 kV Dhanbad (NKTL) in the month of July'21. Line reactor tripping scheme maybe reviewed as line length and compensation has changed.

In 111th PCC meeting, Powergrid was advised to furnish their views on line reactor tripping scheme(during single phase autoreclosing in the line) for the revised configuration of 400 kV Ranchi-MPL D/C line.

Powergrid may update.

Deliberation in the meeting

Powergrid representative informed that the line reactor tripping scheme can be removed for the revised configuration of 400 kV Ranchi-MPL D/C line as the line length had been reduced by 25 km.

PCC opined that the line reactor tripping scheme can be removed and thereafter the line can be put under observation for LC resonance issue during autorecloser in the line. Accordingly, PCC advised Powergrid to modify the settings in revised configuration of 400 kV Ranchi-MPL D/C line.

ITEM NO. C.5: Follow-up of Decisions of the Previous Protection Sub-Committee Meeting(s)

The decisions of previous PCC meetings are attached.

Members may update the latest status.

Deliberation in the meeting

*Updated status for decisions of previous PCC meetings is given at **Annexure C.5**.*

ITEM NO. C.6: Automation of Protection Settings extraction from PDMS

To facilitate protection co-ordination and protection audit, automation of protection setting extraction from the database is required. In this regard, a model excel sheet was shared with PRDC and automation of extraction of settings from PDMS was also discussed.

PRDC may update.

Deliberation in the meeting

ERLDC representative informed that a sample data format has already been shared with M/s PRDC for necessary action.

PRDC representative informed that their IT team is looking into it and the facility of relay data extraction from protection database is expected to be implemented by July-2022.

ITEM NO. C.7: Protection Audit in Eastern Region

Protection audit is a primary activity to ensure power system protection implemented at substations and power plants are well coordinated and is as per CEA standards. Due to COVID-19, the activity could not be started since March 2020. Since then, various events have occurred where issues of protection coordination have been observed and several new substation and grid element has been connected with the grid. Therefore, it is now prime requirement to re-commence protection audit of substations and power plants in the Eastern Region. In view of this, following activities have been decided to streamline the audit process:

PCC activities

- Formation of Three-Four core audit teams-All utilities to nominate their members
- Nodal officer from all utilities to co-ordinate with audit activities
- Identification of S/s to be audited
- Finalization of audit format

Pre-audit activities

- Utilities of S/s thus identified to check and update latest protection settings in PDMS database within next 7 days
- S/s to fill up pre-requisite data as per format attached before visit of audit team

Input to be obtained from protection database

- SLD of the S/s
- List of elements
- Updated settings from PDMS database (PDF/excel)

- Model setting for the elements of substation being audited

On the day of Audit at Substation/Plants

- Verification of protection setting as per details provided.
- All testing reports
- Equipment’s healthiness status, DC healthiness, Aux system healthiness etc.

Audit team observation will be shared with utilities and in PCC for action plans and compliance monitoring.

Format for protection audit checklist is attached at **Annexure C.7.**

Nomination for audit team was received from WBSETCL.

In 110th PCC Meeting, ERPC Secretariat informed that third party protection audit for the year 2022 would be commenced as soon as the current covid situation gets improved.

It was further informed that protection audit of following substations in Odisha would be carried out at first.

- 765/400 kV Jharsuguda(Powergrid) S/s
- 765 kV NTPC Darlipalli S/s
- 400/220kV Lapanga(OPTCL) S/s
- 220 kV Budhipadar(OPTCL) S/s
- 220 kV IB TPS(OPGC) S/s

PCC advised the concerned utilities to verify and update existing relay data and protection settings available in PDMS for the above mentioned substations before the field visit by audit team.

PCC further advised utilities to submit their comments, if any, regarding the protection audit procedure and format for finalization of the document.

In 111th PCC, PCC advised concerned utilities of Odisha to verify and update existing relay data and protection settings available in PDMS before the field visit by audit team.

Members may update.

Deliberation in the meeting

PCC informed that protection audit of mentioned substations would be carried out in tentatively in second week of April 2022 and further advised concerned utilities of Odisha to verify and update existing relay data and protection settings available in PDMS before the field visit by audit team.

ITEM NO. C.8: New Element Integration

C.8.1: LILO of 400 kV Patna-Balia 3 & 4 at Naubatpur

As per information received at ERLDC, LILO of 400 kV Patna-Balia 3 & 4 at Naubatpur is going to be first time charged.

Line parameters are as below:

Name	Conductor Type	Length (km)
400 kV Patna-Naubatpur D/c	Quad Moose	25.452 km
400 kV Naubatpur-Balia D/c	Quad Moose	155.818 km

Protection Co-ordination may be reviewed as per below table:

Reason	Settings to be reviewed in	At Sub-Station	Utility	Remarks
LILO of 400 kV Patna-Balia-3&4 at Naubatpur	400 kV Patna-Naubatpur D/c	Patna, Naubatpur	ER-1, BGCL	Protection coordination to be done for newly connected element as per ERPC guidelines.
	400 kV Naubatpur-Balia D/c	Naubatpur, Balia	BGCL, ER-1	Protection coordination to be done for newly connected element as per ERPC guidelines.
	400 kV NPGC-Patna D/c	NPGC	NPGC	Zone-2 time delay maybe reviewed as shortest line from Patna will now be 400 kV Patna-Naubatpur (25.542 km),
	400 kV Barh-Patna Q/c	Barh	NTPC Barh	
	400 kV Saharsa-Patna D/c	Saharsa	PMTL	

ER-1 is requested to get the confirmation of protection settings from Balia end.

PLCC end to end testing confirmation for 400 kV Patna-Naubatpur D/c and 400 kV Naubatpur-Balia D/c also to be submitted.

All constituents are requested to confirm the changes done, if any, and share the settings at the earliest to facilitate FTC of the LILO arrangement.

Concerned utilities may update.

Deliberation in the meeting

Concerned utilities were advised to share revised protection settings for their respective ends to ERPC/ ERLDC.

C.8.2: Protection coordination of the 220 kV Bolangir (Pg)-220 kV Kesinga(OPTCL)

As per information received at ERLDC, the 220 kV Bolangir (Pg)-220 kV Kesinga(OPTCL) will be charged shortly.

Detail of the line is as follows:

Name	Conductor type	Length
220 kV Bolangir (Pg)-220 kV Kesinga(OPTCL)	ACSR Zebra	80.5 km

Protection coordination may be required as per the following table.

Reason	S/S may be affected	Remarks	Utility to respond	Response received
220 kV Bolangir (Pg)-220 kV Kesinga(OPTCL)	220 kV Bolangir (Pg)	Protection coordination to be done for all newly connected elements as per ERPC's guidelines	Powergrid-ER-3	
	Kesinga(OPTCL)	Protection coordination to be done for all newly connected elements as per ERPC's guidelines	OPTCL	

220 kV Bolangir (OPTCL)- 220 kV Kesinga (83.3km-ACSR Zebra) is already charged hence Zone-3 settings at 220 Kv Bolangir (Pg) may change as adjacent longest line was previously 220 kV Bolangir (OPTCL) -Bargarh (65 km) however at present adjacent longest line is 220 kV Bolangir (OPTCL)- 220 kV Kesinga (83.3km-ACSR Zebra).

Following Details to be shared:

- Status of carrier protection and PLCC channel of 220 kV Bolangir (Pg), 220 kV Bolangir (OPTCL), 220 kV Kesinga(OPTCL) section may be shared.
- In case of revision of existing protection setting at S/s revised protective relay setting may be shared.
- Protective relay setting of all newly charged (or to be charged) elements may be shared.

Concerned utilities may update.

Deliberation in the meeting

Concerned utilities were advised to share revised protection settings for their respective ends to ERPC/ ERLDC.

DISTURBANCE REPORT OF JAYANAGAR GRID SUBSTATION**Date:** 27/02/2022, Time: 11:16 Hrs**Name of the Grid S/S:** 220/132/33KV GSS Jayanagar,**220KV Bus system :** 1 and ½ Scheme.

Bus-1: PGCIL-3, Laxmipur-2, Laxmipur-1, Therubali-3, Upper Kolab-1, Upper Kolab-2 and Auto-1.

Bus-2: PGCIL-1, PGCIL-2, PGCIL-4, Balimela-2, Balimela-1, Balimela-3 and Auto-2.

Weather Condition : Sunny**Pre-Fault Load Flow in 220KV bays:**

Sl.No	Bus-1 Feeder/Bay Name	MW	Load Flow
1	PGCIL-3	5MW	Export
2	LAXMIPUR-2	2MW	Export
3	LAXMIPUR-1	2MW	Export
4	THERUBALI-3	0	
5	UPPER KOLAB-1	23MW	Import
6	UPPER KOLAB-2	23MW	Import
7	160MVA AUTO-1	25MW	Export

Sl.No	Bus-II Feeder/Bay Name	MW	Load Flow
8	PGCIL-1	5MW	Export
9	PGCIL-2	5MW	Export
10	PGCIL-4	5MW	Export
11	BALIMELA-2	10MW	Import
12	BALIMELA-1	10MW	Import
13	BALIMELA-3	10MW	Import
14	160MVA AUTO-2	25MW	Export

Therubali-3 feeder and its Tie is in shutdown condition.

Tripping Details at Jayanagar end:

- At 11: 16 Hrs 220KV Jayanagar-Laxmipur D/C line (Feeder: I & II) tripped in distance protection with Zone -2 (Distance : 64KM with fault current 2.48KAmps and 53KM with fault current above 2.2 KAmps respectively).
- Due to above fault, DP relay and backup relay both detected the fault and initiated tripping command for both main CB & Tie CB of Jayanagar-Laxmipur-1 feeder with Zone-2 time. So, main CB tripped with 350ms but its **Tie CB did not tripped. So fault persisted for long time.** Also its LBB protection with busbar differential protection not in service condition since long due to its faulty bay units.
- Main CB & Tie CB of Jayanagar-Laxmipur-2 tripped as per the set time.
- No other feeder tripped at Jayanagar end due to above said fault.
- Jayanagar Grid local load not affected due to Machhkund load.

Tripping Details at Remote end:

- PGCIL end: DP relay operated and all four feeders tripped in Z-3 with fault current 0.8 to 0.9KAmps.
- Laxmipur End: Circuit-1 tripped in Z-1 with 3.4KM (IR= 4KAmps) and Circuit-2 tripped in E/F> with IN current 1.01KA.
- Balimela P/H end: Tripping details of three 220KV feeders not provided. But as per the information feeders not tripped at Baliemla end.
- Upper Kolab P/H end: Proper tripping details not provided. But as per the DR data it has been observed that fault persisted up to 42 sec at their end in both circuits.
- Auto Trf. downstream 132KV Source end:
 - 132KV Dabugaon end source tripped in Zone-3 with Ia=624A,Ib=360A & Ic=203A
 - 132KV Meenakshi P/H end tripped in O/C within the time.

Root Cause Analysis:

1. Line fault of 220KV Jayanagar-Laxmipur Circuit-1 not cleared due to non-tripping of its TIE-CB after command initiated by relays . Also the CB did not tripped by TNC switch . Observed that the CB is in gas lockout mode and the gas pressure of Y-phase limb was near to lockout border line. Due to this all remote end feeders affected and fault continued up to long time. At 12:45 Hrs due to rise in atmospheric temperature the lockout mode gone and tie CB tripped through TNC switch.
2. As per the information of Grid operation team, the defective annunciation module misled to get the status of Gas lockout.
3. Due to long fault clearing time, wave trap of R-Phase (at Jayanagar End) burnt.
4. Fault continued up to 43sec due to delay in fault clearance from Upper Koaab/Balimela P/H ends.

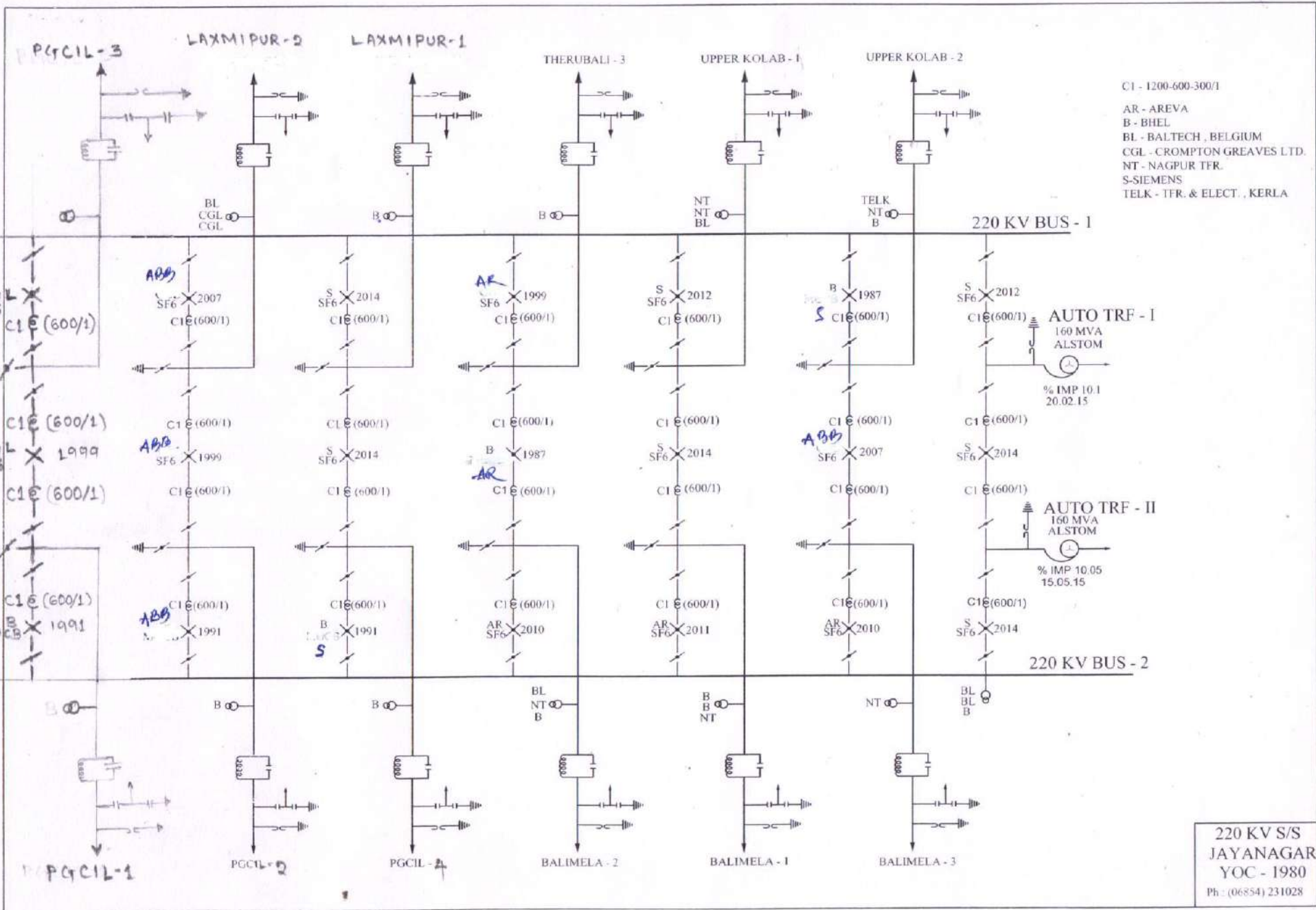
REMEDIAL MEASURES:

1. SF6 Gas pressure filled up to desire level in the Y-phase limb of Laxmipur-1 Tie CB.
2. Damaged Wave trap of R-phase removed from the structure.
3. Faulty feeder (220KV Laxmipur-1) kept in shutdown condition for necessary check-up at fault location point.
4. Faulty annunciation module replaced with old one.

Restoration Element: At 12:18 Hours the restoration process started by taking supply from Upper Kolab P/H end. Then one by one other feeders charged except faulty ones.

Note:

1. After the incident, from protection point of view all circuits have been checked and everything found in order.
2. The event logger system of Jayanagar 220KV system not working since 1 year.
3. The Busbar differential with LBB protection scheme is in out of service since long due to unhealthiness of its bay units.
4. Due to GPS IRIG-B error , date & time of relays are showing different.



C1 - 1200-600-300/1
 AR - AREVA
 B - BHEL
 BL - BALTECH, BELGIUM
 CGL - CROMPTON GREAVES LTD.
 NT - NAGPUR TFR.
 S-SIEMENS
 TELK - TFR. & ELECT., KERLA

220KV SYSTEM DISTURBANCE REPORT

GRID S/S NAME: 220/132/33KV JAYANAGAR

DATE: 27/02/2022

TIME: 11:16 HRS

220KV Bus system : 1 and ½ Scheme.

Bus-1: PGCIL-3, Laxmipur-2, Laxmipur-1, Therubali-3, Upper Kolab-1, Upper Kolab-2 and Auto-1.

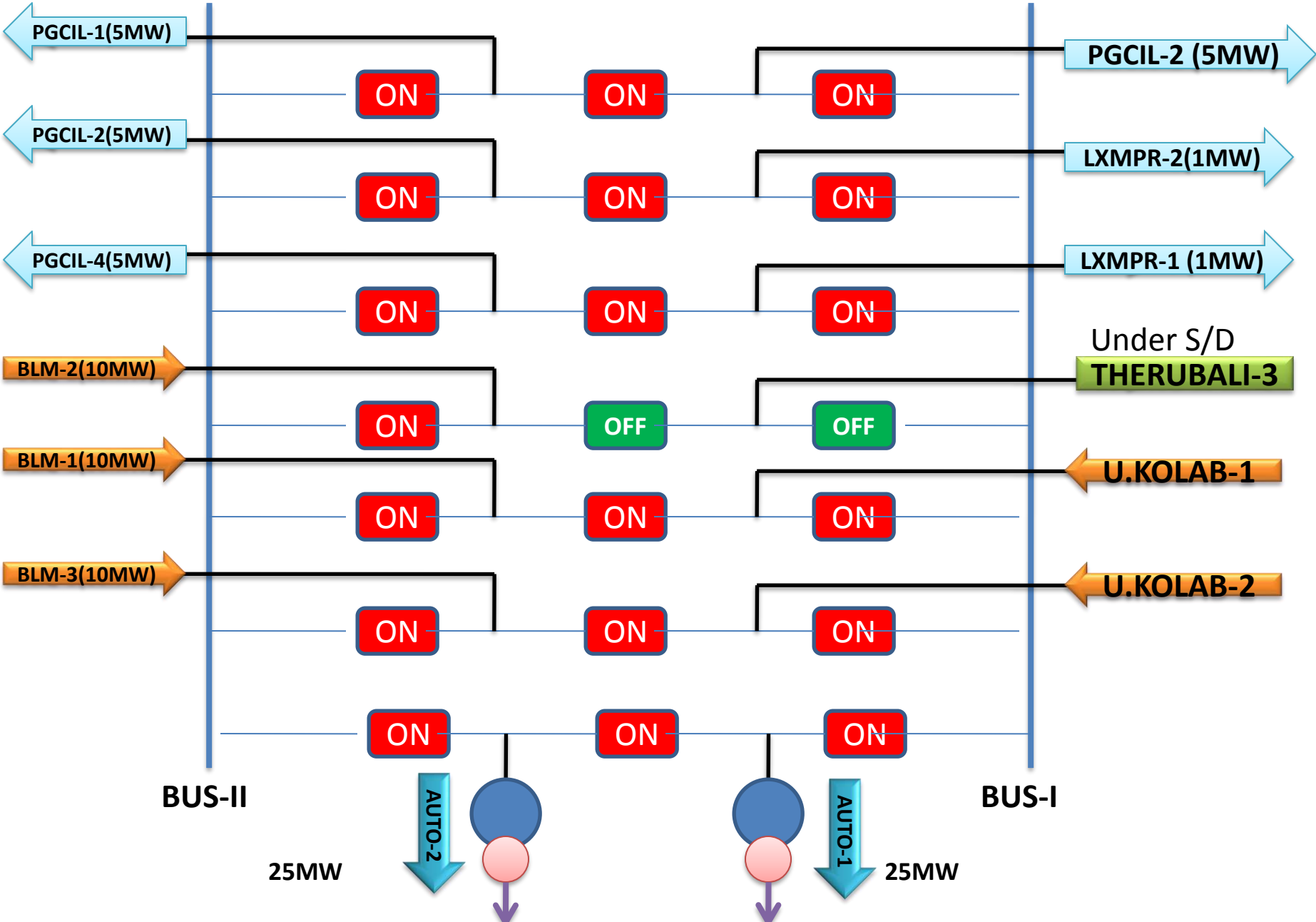
Bus-2: PGCIL-1, PGCIL-2, PGCIL-4, Balimela-2, Balimela-1, Balimela-3 and Auto-2.

Weather Condition : Sunny

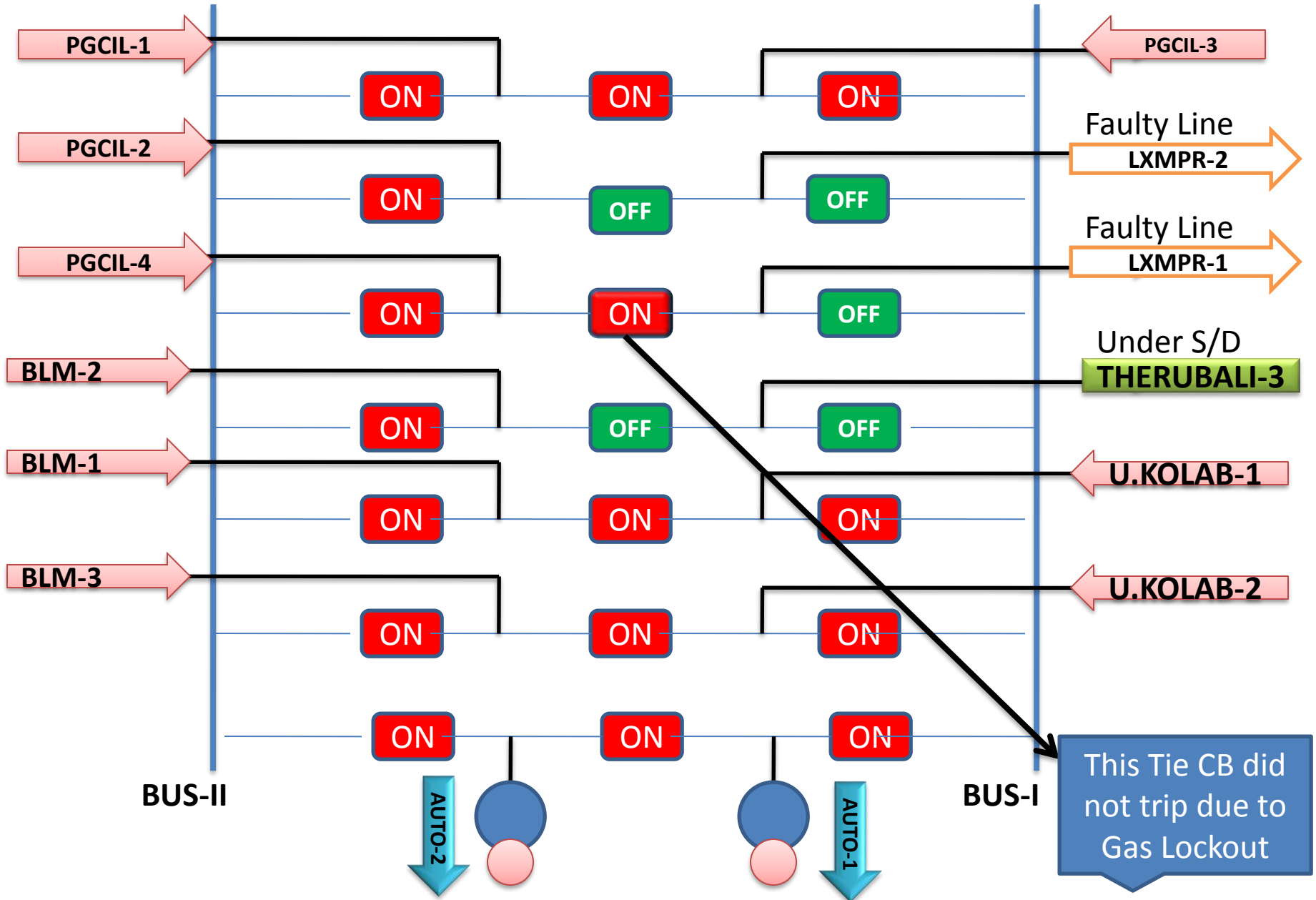
Pre-Fault Load Flow in 220KV bays :

Sl.No	Bus-1 Feeder/Bay Name	MW	Load Flow		Sl.No	Bus-II Feeder/Bay Name	MW	Load Flow
1	PGCIL-3	5MW	Export		8	PGCIL-1	5MW	Export
2	LAXMIPUR-2	2MW	Export		9	PGCIL-2	5MW	Export
3	LAXMIPUR-1	2MW	Export		10	PGCIL-4	5MW	Export
4	THERUBALI-3	0			11	BALIMELA-2	10MW	Import
5	UPPER KOLAB-1	23MW	Import		12	BALIMELA-1	10MW	Import
6	UPPER KOLAB-2	23MW	Import		13	BALIMELA-3	10MW	Import
7	160MVA AUTO-1	25MW	Export		14	160MVA AUTO-2	25MW	Export

PRE FAULT LOAD PATTERN OF DIFFERENT 220KV FEEDERS



POST FAULT CONDITION



RELAY INDICATION DETAILS

Sl.No	Feeder Name	Local End	Remote End
1	Jayanagar-PGCIL Ckt-1	NO TRIP	DP operated with Zone-3, with current 0.9KA
2	Jayanagar-PGCIL Ckt-2	NO TRIP	DP operated with Zone-3, with current 0.9KA
3	Jayanagar-PGCIL Ckt-3	NO TRIP	DP operated with Zone-3, with current 0.9KA
4	Jayanagar-PGCIL Ckt-4	NO TRIP	DP operated with Zone-3
5	Jayanagar-Laxmipur-1	Z-2 WITH Distance-64KM, IR=2.49KA, IB=0.03KA, IC=0.03KA	DP operated with Zone-1, with 3.4KM, IR: about 4KA.
6	Jayanagar-Laxmipur-2	Z-2 WITH Distance-53KM, IR=2.2KA, IB=0.02KA, IC=0.02KA	Tripped in E/F>, with IR:0.54KA and IN:1.01KA. Due to communication error DR not extracted from MICOM P437 relay.
7	Jayanagar-Therubali-3	Under Shutdown	*****
8	Jayanagar - Balimela 1	NO TRIP	Details not available. As per the information the CB not tripped at Balimela end.
9	Jayanagar - Balimela 2	NO TRIP	Details not available. As per the information the CB not tripped at Balimela end.
10	Jayanagar - Balimela 3	NO TRIP	Details not available. A per the information the CB not tripped at Balimela end.
11	Jayanagar - U Kolab-1	NO TRIP	Details not available. But as per DR fault cleared after 42 Sec
12	Jayanagar - U Kolab-2	NO TRIP	Details not available. But as per DR fault cleared after 42 Sec
13	160MVA Auto-1	NO TRIP	Downstream 132KV sources, Dabugaon GSS: DP optd. with Z-3. and Meenaksi P/H: O/C & E/F optd. as per set time
14	160MVA Auto-2	NO TRIP	

Laxmipur-1 feeder Wave Trap at Jayanagar GSS



R-ph
Wave
Trap

Analysis:

- 1. Line fault of 220KV Jayanagar-Laxmipur Circuit-1 not cleared due to non-tripping of its TIE-CB after command initiated by relays . Also the CB did not trip by TNC switch . It was observed that the CB was in gas lockout mode and the gas pressure of Y-phase limb was near to lockout border line. Due to non-tripping of this TIE-CB all remote end feeders were affected and fault continued for along time. At 12:45 Hrs due to rise in atmospheric temperature the lockout mode got reset and tie CB tripped through TNC switch.**
- 2. As per the information of Grid operation team, the defective annunciation module mislead to get the status of Gas pressure low & CB lockout.**
- 3. Due to long fault clearing time, wave trap of R-Phase (at Jayanagar End) burnt.**
- 4. Fault continued up to 43sec due to delay in fault clearance from Upper Kolab/Balimela PH ends.**

Note:

- 1. The event logger system of Jayanagar 220KV system not working due to CPU problem of HMI**
- 2. The Busbar differential with LBB protection scheme is in out of service since long due its faulty bay units.**
- 3. Due to GPS IRIG-B error , date & time of relays are showing different.**

REMEDIAL MEASURES:

- 1. SF6 Gas pressure filled in the Y-phase limb of Laxmipur-1 Tie CB.**
- 2. Damaged Wave trap of R-phase removed from the circuit.**
- 3. Faulty feeder (220KV Laxmipur-1) kept in shutdown condition for necessary check-up at fault location point.**
- 4. Faulty annunciation module replaced.**

Restoration Element:

At 12:18 Hours the restoration process started by taking supply from Upper Kolab P/H end. Then one by one other feeders charged except faulty ones.

पावर सिस्टम ऑपरेशन करपोरेशन लिमिटेड

(भारत सरकार का उद्यम)

POWER SYSTEM OPERATION CORPORATION LIMITED

(A Government of India Enterprise)



Eastern Regional Load Despatch Centre: 14, Golf Club Road, Tollygunge, Kolkata-700 033.

CIN: U40105DL2009GOI188682

फ़ोन: 033- 24235755, 24174049 फ़ैक्स : 033-24235809/5029 Website: www.erldc.org, Email ID- erldc@posoco.in

घटना संख्या: 04-02-2022/1

दिनांक: 21-02-2022

Report on the grid event in Eastern Region (पूर्वी क्षेत्र में ग्रिड घटना पर रिपोर्ट)

1. Summary of the event (घटना का सारांश):

At 05:53 Hrs on 04th February 2022, all emanating lines from 220 kV Tenughat (TVNL) tripped. Two running units at Tenughat also tripped. This resulted in 300 MW generation loss at Tenughat power plant. Govindpur and downstream areas were being radially fed through 220 kV Tenughat-Govindpur-2 only. This led to load loss of around 10 MW at Deoghar, Dumka, Pakur, Giridih, Jamua, Saria, Godda, Jasidih. Inclement weather was persisting in major areas of Jharkhand at the time of the event.

- **Date / Time of disturbance:** 04-01-2022 at 05:53 hrs.
- **Event type:** GD - 1
- **Systems/ Subsystems affected:** 220 kV Tenughat S/s
- **Load and Generation loss.**
 - 300 MW generation loss reported during the event.
 - 10 MW load loss was reported during the event at Deoghar, Dumka, Pakur, Giridih, Jamua, Saria, Godda, Jasidih.

2. Important Transmission Line/element if out (महत्वपूर्ण संचरण लाइने जो बंद है):

- 220 kV Tenughat-Govindpur-1 was switched off for voltage regulation
- 220 kV Maithon-Dumka D/c was under continuous shutdown.

3. Major elements tripped (प्रमुख ट्रिपिंग)

- 220 kV Tenughat-Patratu
- 220 kV Tenughat-Biharsharif
- 220 kV Tenughat-Govindpur-2

4. Network across the affected area (प्रभावित क्षेत्र का नक्शा)

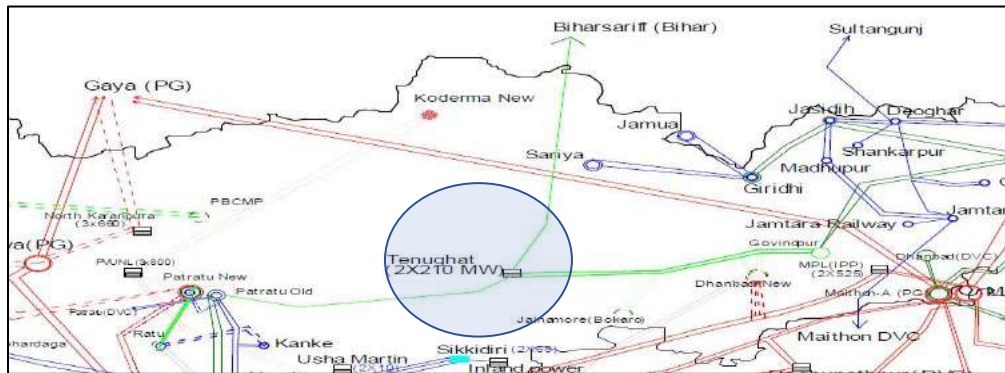


Figure 1: Network across the affected area

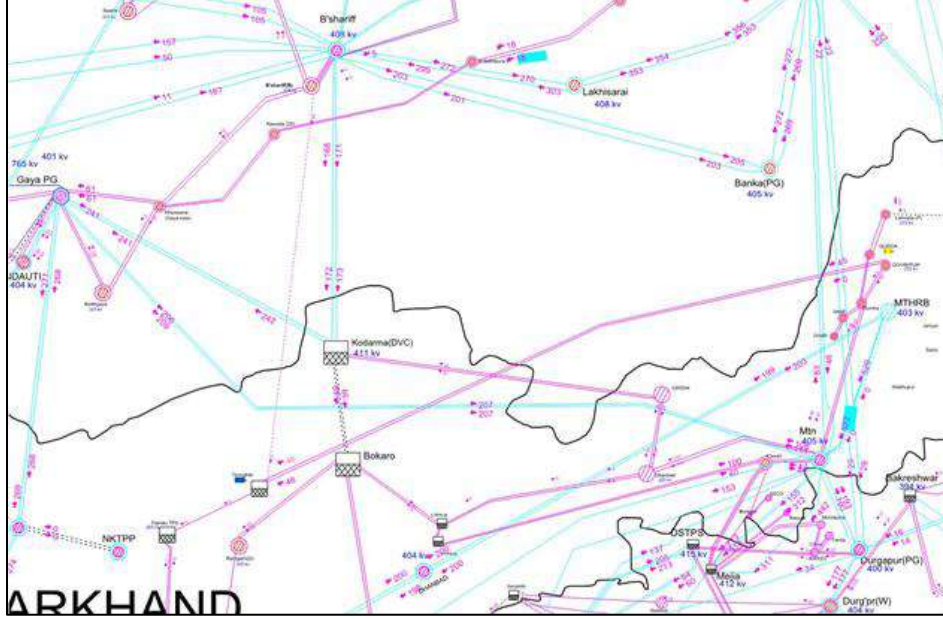


Figure 2: SCADA snapshot for of the system

Relay indication and PMU observation (रिले संकेत और पीएमयू पर्यवेक्षण):

समय	नाम	उप केंद्र 1 रिले संकेत	उप केंद्र 2 रिले संकेत	पीएमयू पर्यवेक्षण
05:53	220 kV Tenughat-Patratu	Didn't trip	PTPS: Y_N, Zone 1, 51.26 km, 3.097 kA	6 kV dip in Y_ph; 1.5 kV dip in R_ph and B_ph at Bihar Sharif. Fault Clearance time: 350 msec
	220 kV Tenughat-Bihar sharif	Didn't trip	Bihar Sharif: Y_N, Zone-2, 1.8 kA	
	220 kV Tenughat-Govindpur-2	Tenughat: Y_N, 1.73 km, 3.56 kA	Govindpur: Y_N, Zone-2 carrier received	
	Tenughat U#1 & U#2	-	-	

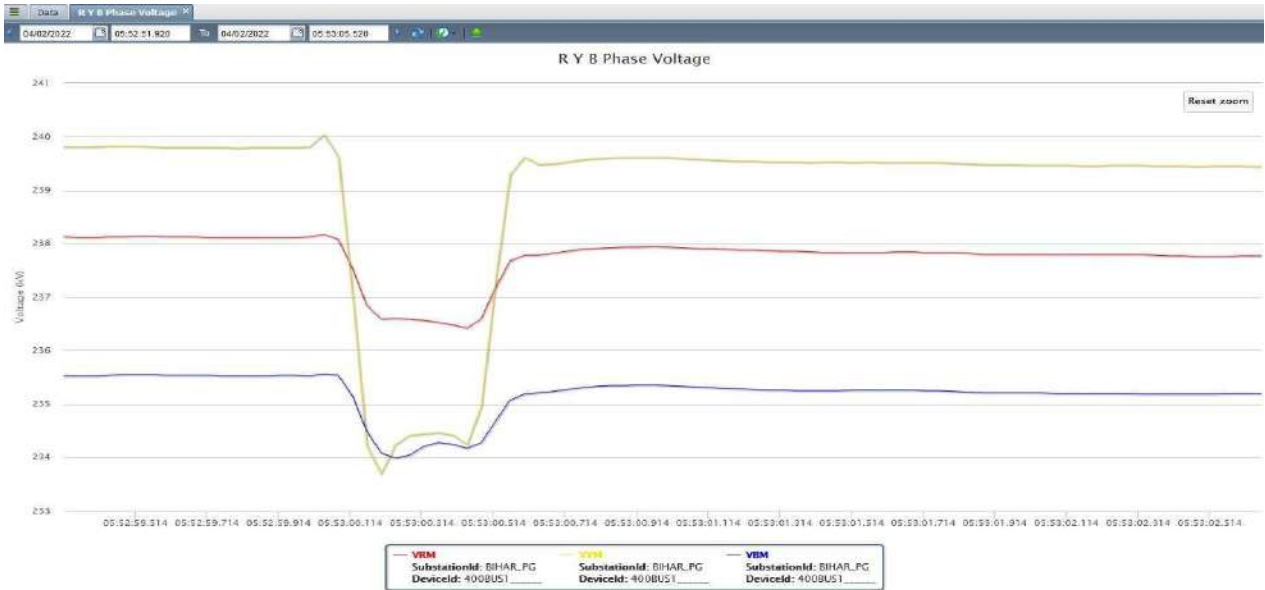
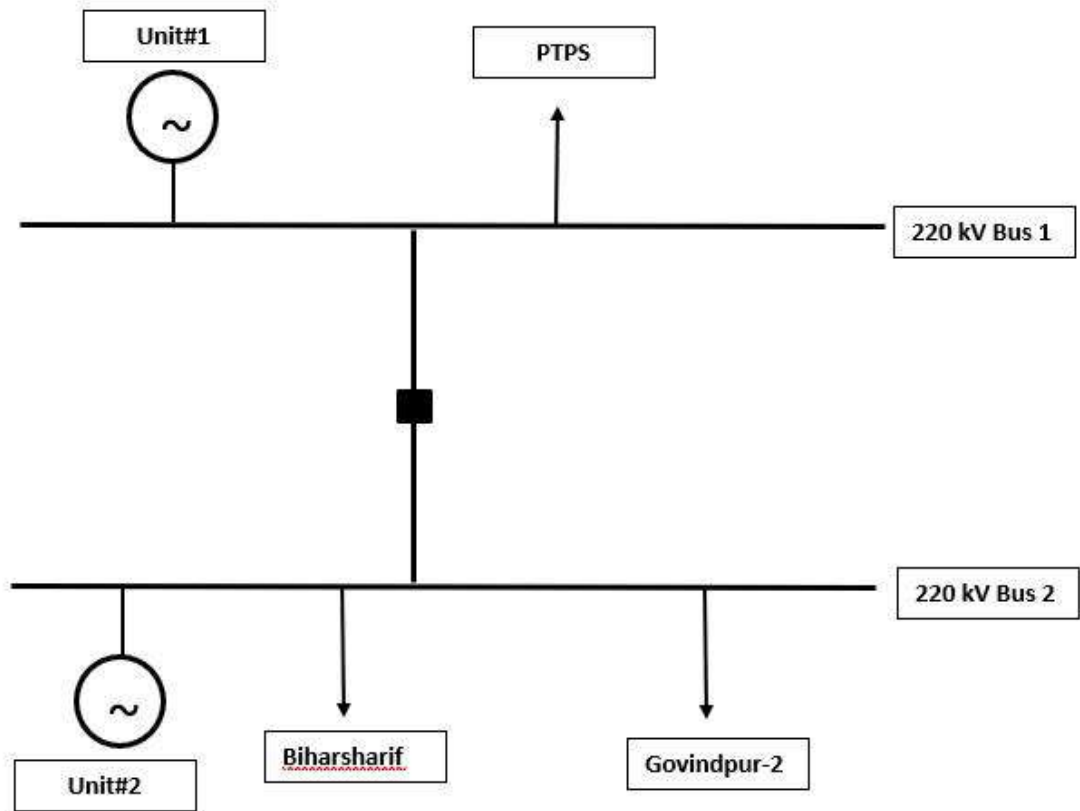


Figure 3: PMU voltage snapshot of 400/220 kV Bihar sharif S/s

5. Restoration (पूर्वावस्था की प्रप्ति)

Transmission/Generation element name	Restoration time
220 kV Tenughat-Patratu	06:16
220 kV Tenughat-Biharsharif	06:38
220 kV Tenughat-Govindpur-2	10:09
Tenughat U#1	12:15
Tenughat U#2	14:45

6. Analysis of the event (घटना का विश्लेषण):



220 kV Bus arrangement at Tenughat

- **Antecedent Condition:** 220 kV Tenughat-Govindpur-2 was radially feeding Govindpur and downstream areas as 220 kV Tenughat-Govindpur-1 was switched off under voltage regulation and 220 kV Maithon-Dumka D/c was under continuous shutdown.

DR Analysis

➤ 220 kV Tenughat-Govindpur

- Y_earth fault struck 220 kV Tenughat-Govindpur-2 at 1.73 km from Tenughat. R_ph and B_ph opened within 100 msec, Y_ph breaker opened after 180 msec at Tenughat.
- Govindpur saw the fault in Zone-2 and received carrier, thus line got opened from Govindpur within 100 msec.
- With inception of this fault, it seems another fault occurred in 220 kV bus side at Tenughat. Another incident of same nature (fault in bus side) occurred last month.

➤ 220 kV Tenughat-Patratu

- Patratu sensed the fault in Zone-1 and tripped within 100 msec. **Zone settings maybe checked.**
- Tenughat picked up fault in Zone-4, however within 100 msec, fault disappeared after tripping from remote end. Didn't trip from Tenughat.

➤ 220 kV Tenughat-Biharsharif

- 220 kV Tenughat-Biharsharif opened from Biharsharif end in Zone-2 after 350 msec.
- Tenughat sensed the fault in Zone-4. Didn't trip.

➤ 210 MW U#1 at Tenughat: Tripped immediately within 80 msec.

7. Protection issue (सुरक्षा समस्या):

- Two simultaneous faults occurred at Tenughat. Fault in line (220 kV Tenughat-Govindpur) was cleared within 180 msec, still fault persisted till 350 msec, till opening of breaker of 220 kV Tenughat-Biharsharif from Biharsharif, which indicates fault was in 220 kV Bus at Tenughat also. Why didn't bus bar operate at Tenughat. **TVNL may explain.**
- 220 kV Tenughat-Patratu tripped in Zone-1 from Patratu for a Zone-2 fault. **JUSNL may check Zone settings.**
- U#1 tripped immediately within 80 msec. **O/c Hi-set settings maybe reviewed.**
- Y_ph of 220 kV Tenughat-Govindpur at Tenughat opened after 180 msec while other two breaker opened within 100 msec. **JUSNL may explain.**

8. Recommendations (सुझाव):

- Installation of Numerical bus bar protection scheme may be explored at the earliest as same kind of fault is causing complete outage of S/s.
- As bus bar protection has not operated even with such high fault current at Tenughat during this event, all bus bar circuitry should be properly checked along with complete bus bar scheme at Tenughat with injection kit. Besides, complete substation should also be inspected for any insulator tracking or flashover as the event had occurred during fog condition in early morning hours.
- U#2 of Tenughat has electromechanical relay. Numerical relay maybe installed for the unit to ensure security and reliability in line with CEA standard.
- DR channels should be configured properly as per DR standards ratified in PCC and these DRs should be time synchronised.

9. Non-compliance observed (विनियमन का गैर-अनुपालन):

Issues	Regulation Non-Compliance	Utility
DR/EL not provided within 24 Hours	1. IEGC 5.2 (r) 2. CEA grid Standard 15.3	JUSNL, TVNL, BSPTCL
Incorrect/ mis-operation / unwanted operation of Protection system	1. CEA Technical Standard for Construction of Electrical Plants and Electric Lines: 43.4.A. 2. CEA (Technical standards for connectivity to the Grid) Regulation, 2007: Schedule Part 1. (6.1, 6.2, 6.3)	JUSNL and TVNL
Non-Availability of Numerical Bus Bar/LBB Protection at 220 kV and above S/s	1. CEA Technical Standard for Construction of Electrical Plants and Electric Lines 43.4.A 2. CEA Technical Standard for Construction of Electrical Plants and Electric Lines 43.4.C.4 3. CEA (Technical standards for connectivity to the Grid) Regulation, 2007 – 6.1, 6.4.	JUSNL, TVNL
DR/EL are not time synchronized	1. Indian Electricity Grid Code 4.6.3 2. CEA Technical Standard for Construction of Electrical Plants and Electric Lines: 43.4.D. 3. CEA (Technical standards for connectivity to the Grid) Regulation, 2007: Schedule Part 1.7.	JUSNL, TVNL, BSPTCL

10. Status of Reporting (रिपोर्टिंग की स्थिति):

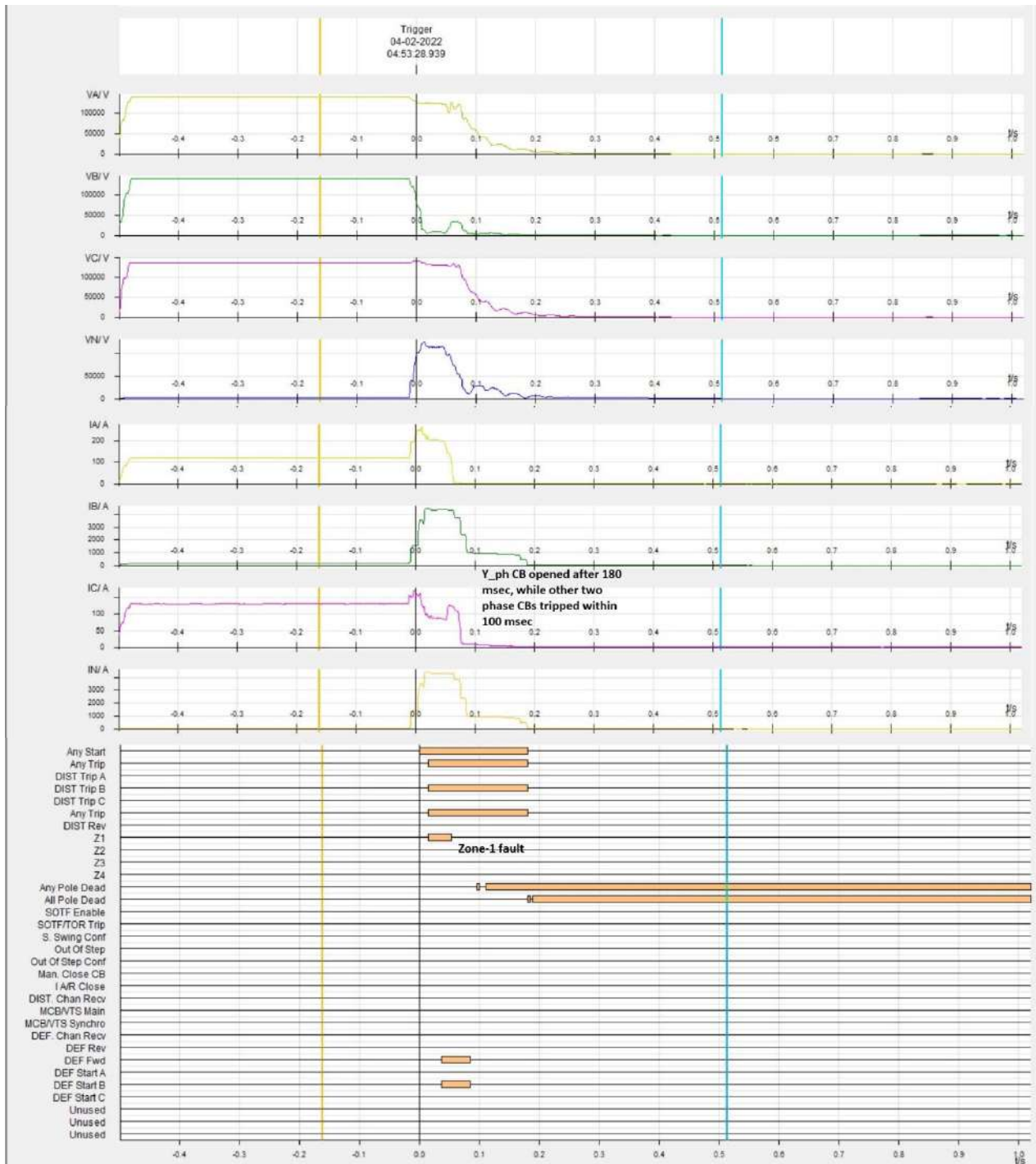
- DR/EL received from JUSNL, TVNL, BSPTCL.

Annexure 1: Sequence of events recorded at ERLDC SCADA data at the time of the event.

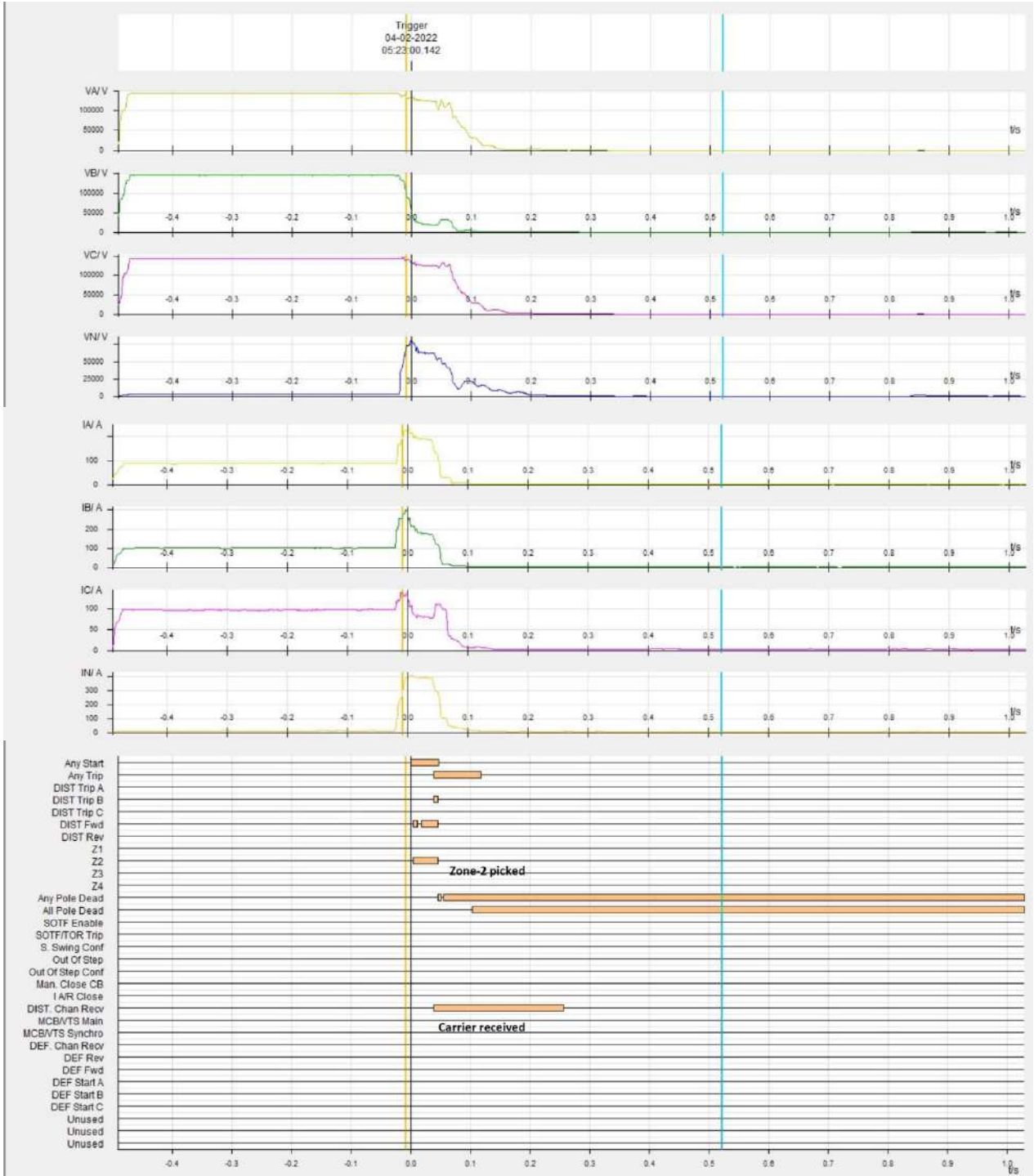
Sequence of event not recorded at time of event.

Annexure 2: DR recorded

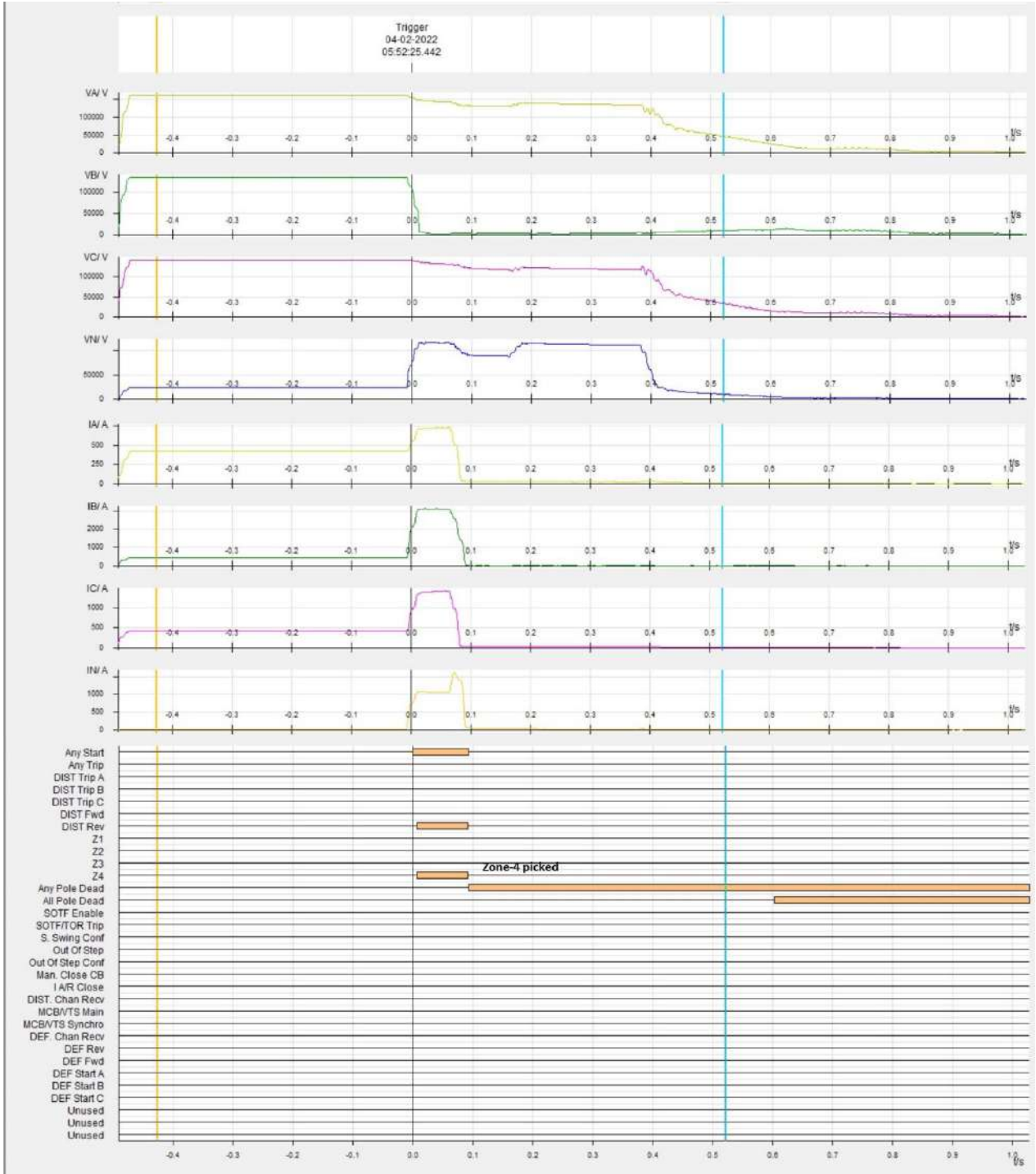
DR of 220 kV Tenughat-Govindpur (Tenughat end)



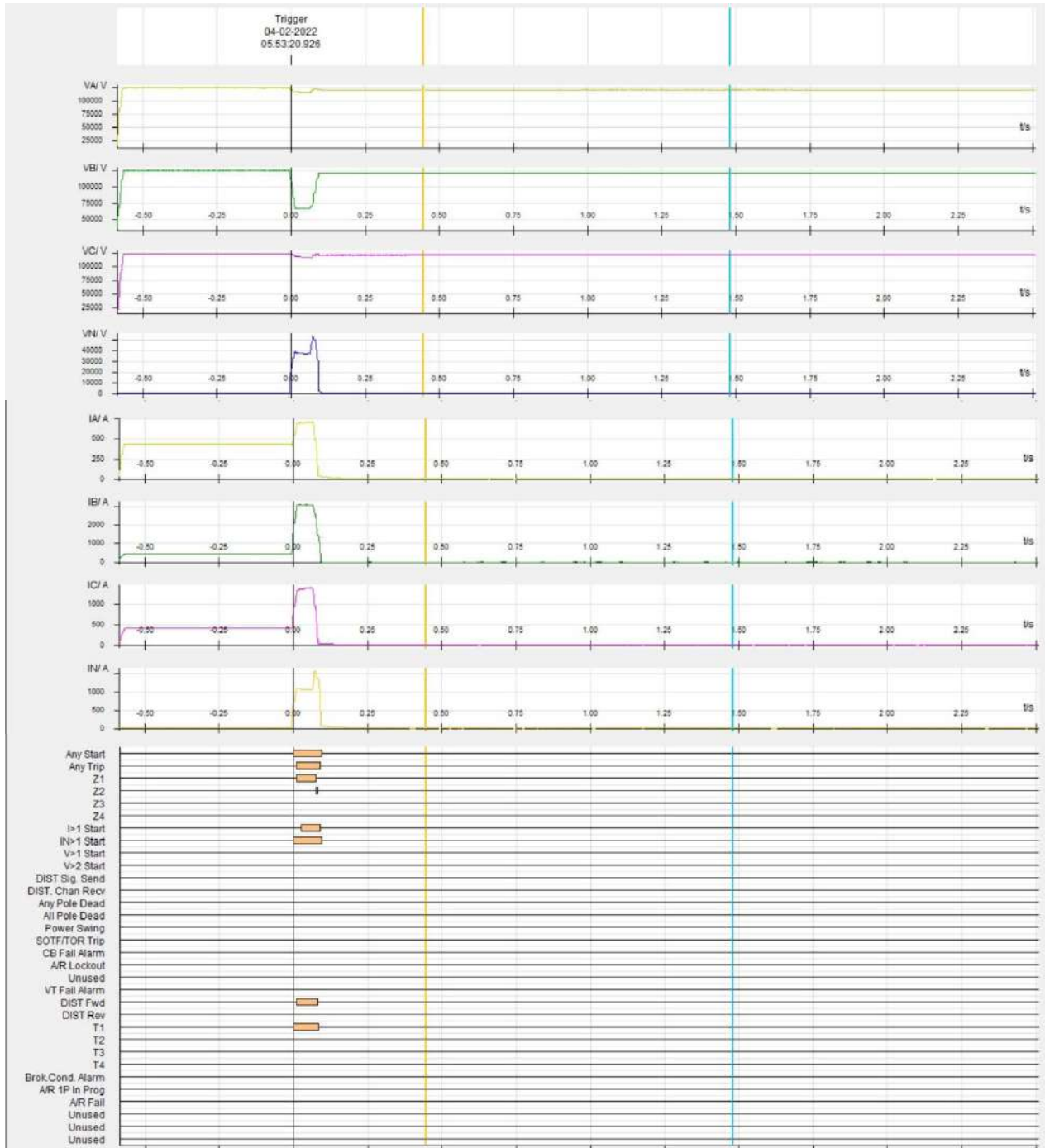
DR of 220 kV Tenughat-Govindpur (Govindpur end)



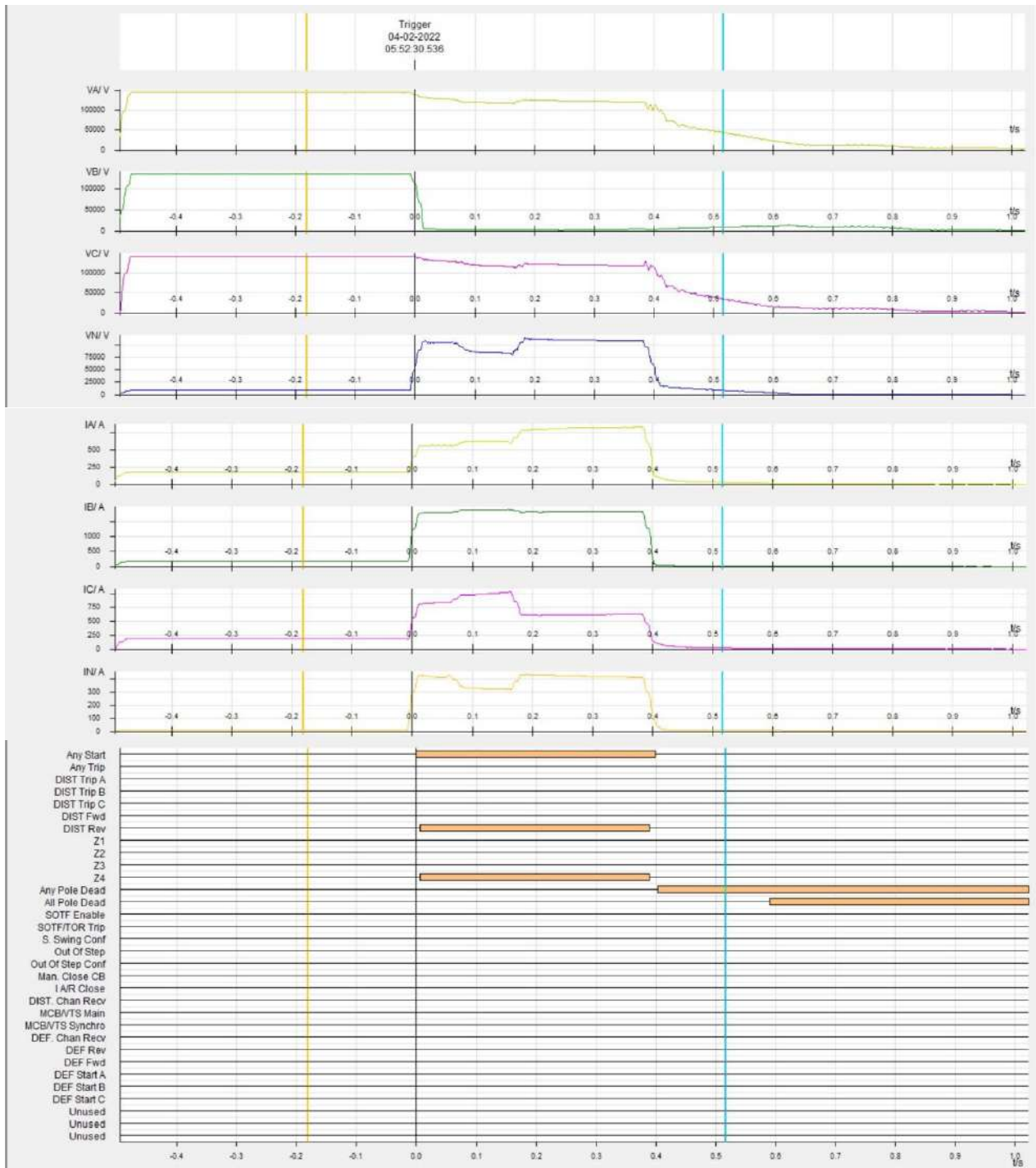
DR of 220 kV Tenughat-PTPS (Tenughat end)



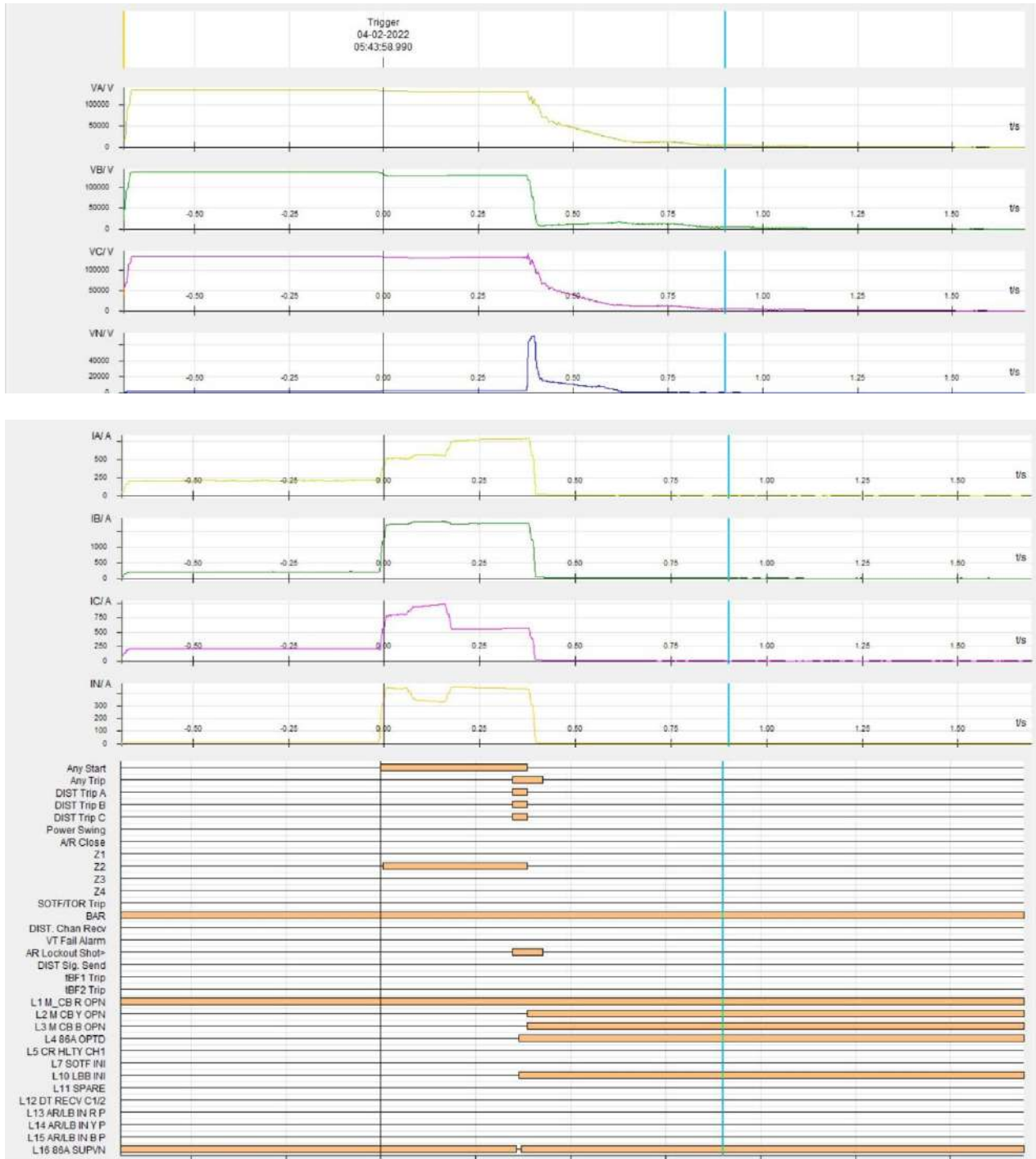
DR of 220 kV Tenughat-PTPS (PTPS end)



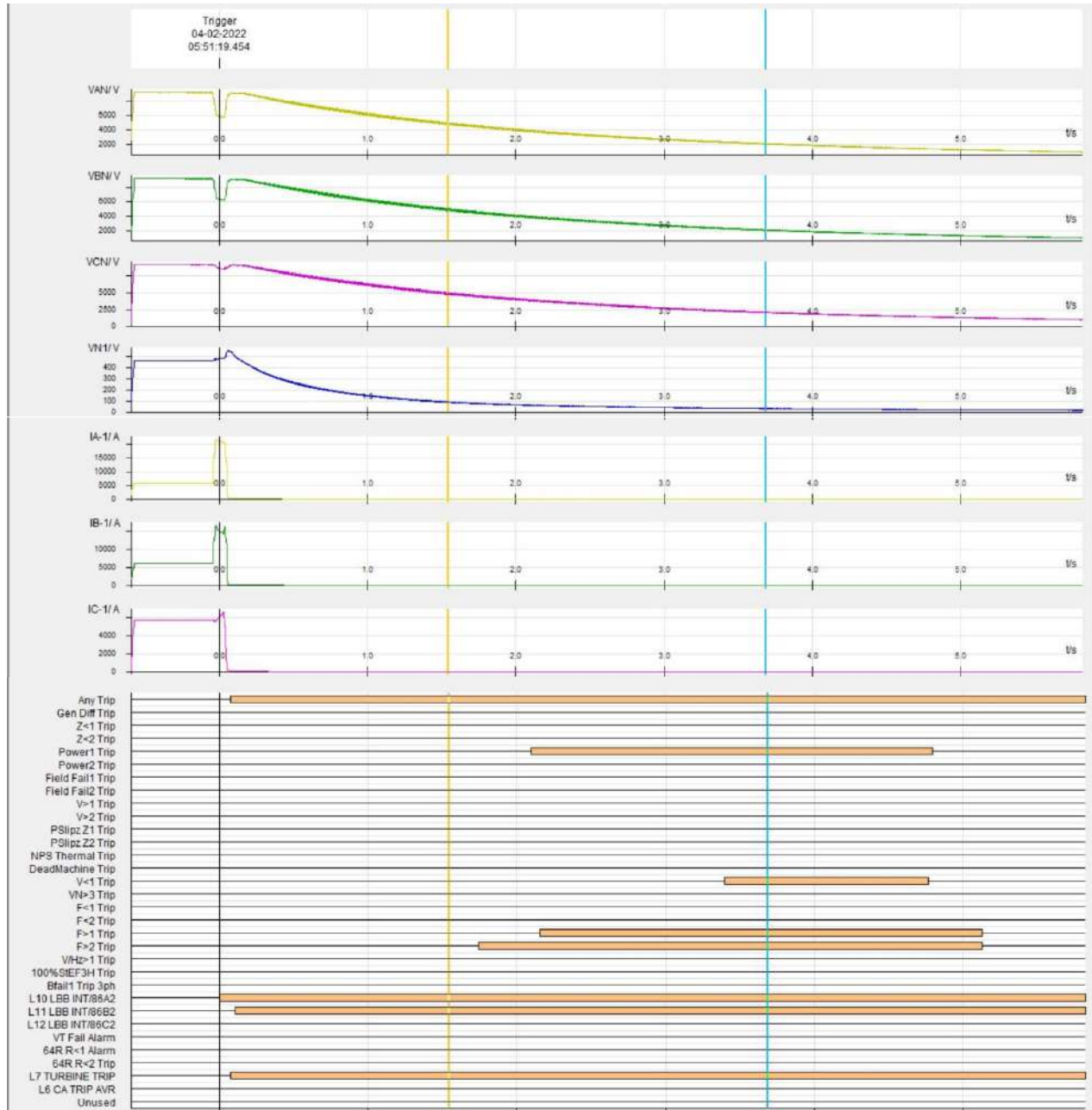
DR of 220 kV Tenughat-Biharsharif (Tenughat end) 05:57:17 Hrs



DR of 220 kV Tenughat-BiharSharif (BiharSharif end)



DR of 210 MW U#1



पावर सिस्टम ऑपरेशन करपोरेशन लिमिटेड

(भारत सरकार का उद्यम)

POWER SYSTEM OPERATION CORPORATION LIMITED

(A Government of India Enterprise)



Eastern Regional Load Despatch Centre: 14, Golf Club Road, Tollygunge, Kolkata-700 033.

CIN: U40105DL2009GOI188682

फ़ोन: 033- 24235755, 24174049 फ़ैक्स : 033-24235809/5029 Website: www.erldc.org, Email ID- erldc@posoco.in

घटना संख्या: 02-02-2022/1

दिनांक: 14-02-2022

Report on the grid event in Eastern Region (पूर्वी क्षेत्र में ग्रिड घटना पर रिपोर्ट)

1. Summary of the event (घटना का सारांश):

At 19:02 Hrs on 2nd February 2022, all three running units at Teesta-5 tripped due to DC supply failure. Both 400 kV buses remained charged through 400 kV Teesta 5-Rangpo D/c lines. 510 MW generation loss occurred at Teesta 5.

- **Date / Time of disturbance:** 02-02-2022 at 19:02 hrs.
- **Event type:** GI - 1
- **Systems/ Subsystems affected:** 400 kV Teesta-5 S/s
- **Load and Generation loss.**
 - 510 MW generation loss reported during the event.
 - No load loss was reported during the event.

2. Important Transmission Line/element if out (महत्वपूर्ण संचरण लाइने जो बंद है):

- NIL

3. Major elements tripped (प्रमुख ट्रिपिंग)

- 3*168 MW Units at Teesta-5

4. Network across the affected area (प्रभावित क्षेत्र का नक्शा)

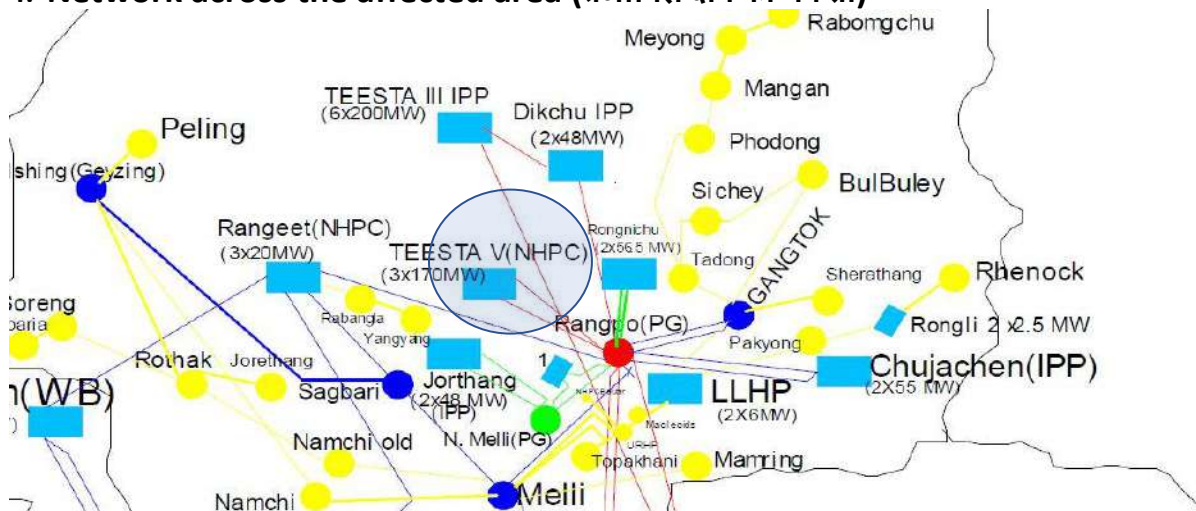


Figure 1: Network across the affected area

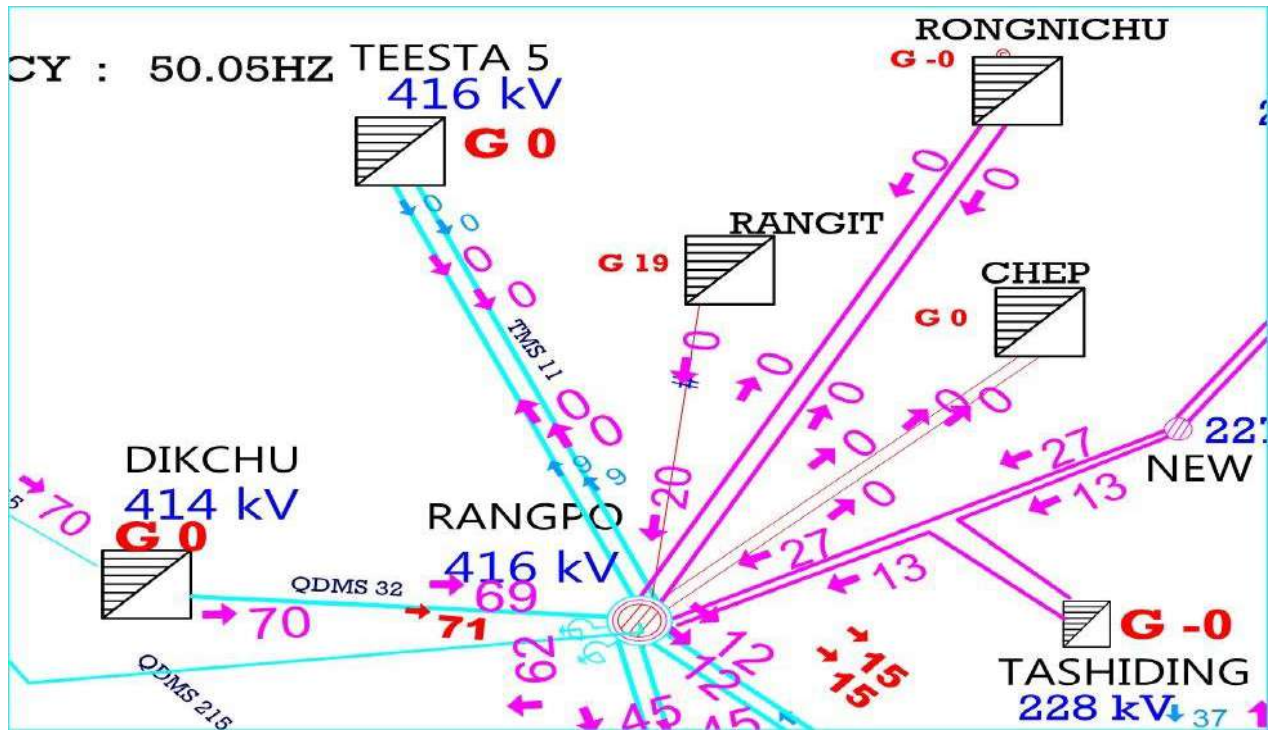


Figure 2: SCADA snapshot for of the system

Relay indication and PMU observation (रिले संकेत और पीएमयू पर्यवेक्षण):

समय	नाम	उप केंद्र 1 रिले संकेत	उप केंद्र 2 रिले संकेत	पीएमयू पर्यवेक्षण
19:02	U#1,U#2,U#3 at Teesta-5	Loss of auxiliary supply	-	2 kV rise in each phase at Rangpo

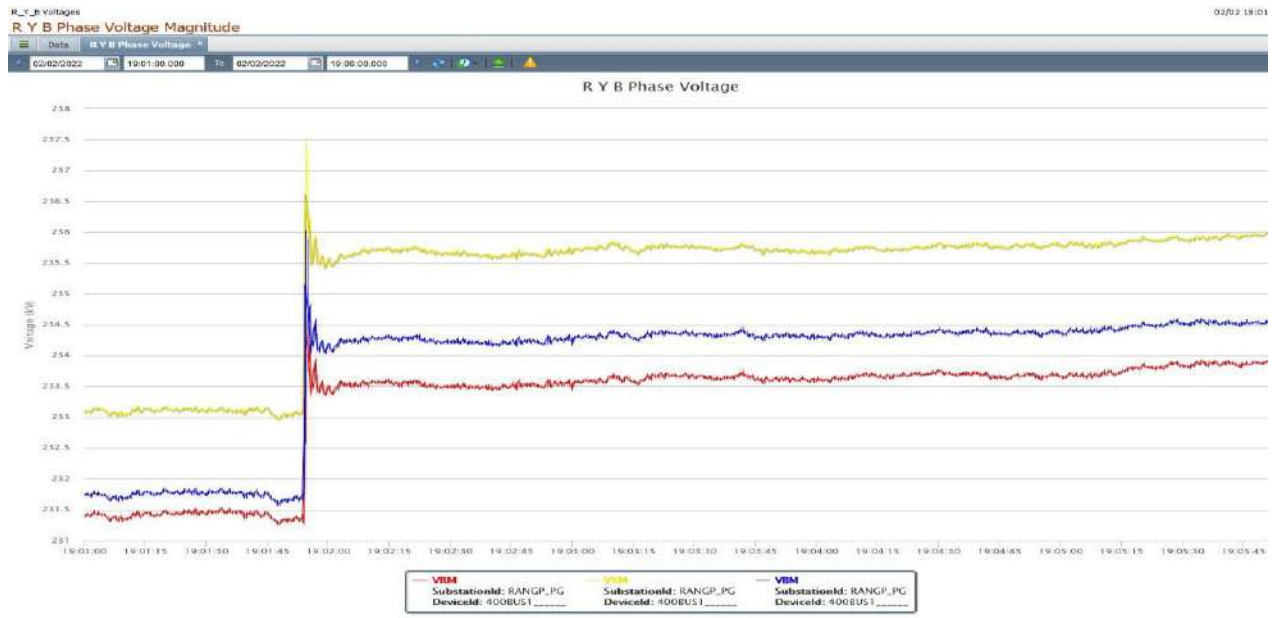


Figure 3: PMU voltage snapshot of 400/220 kV Rangpo S/s

5. Restoration (पूर्वावस्था की प्रप्ति)

Transmission/Generation element name	Restoration time
Teesta-5 168 MW U#1	19:43
Teesta-5 168 MW U#2	19:51
Teesta-5 168 MW U#3	19:56

6. Analysis of the event (घटना का विश्लेषण):

- As reported, UPS supply MCB of SCADA workstations got tripped. During its, restoration, both main and standby UPS got tripped.
- UPS supply is feeding AC injection module of rotor earth fault relay. As per scheme, failure of UPS supply to the relay activated master trip and all three running units got tripped.

7. Non-compliance observed (विनियमन का गैर-अनुपालन):

Issues	Regulation Non-Compliance	Utility
DR/EL not provided within 24 Hours	1. IEGC 5.2 (r) 2. CEA grid Standard 15.3	Teesta-5

8. Status of Reporting (रिपोर्टिंग की स्थिति):

- Disturbance report received from Teesta 5.

Annexure 1: Sequence of events recorded at ERLDC SCADA data at the time of the event.

2/2/2022 19:01	947	0221F007	TEEST_PG	400_Unit1_CB	Open
2/2/2022 19:01	958	0221F009	TEEST_PG	400_Unit3_CB	Open
2/2/2022 19:01	971	0221F008	TEEST_PG	400_Unit2_CB	Open

Annexure 2: Report from Teesta-5

Detailed Analysis Report
NHPC LTD

A. Introduction:	
1. Time and Date of Event	On 02/02/2022 at 19:02 hrs.
2. Substation(s) Affected along with voltage level	Teesta-V पावर स्टेशन
3. Brief Event summary	Due to failure of UPS supply, all the three running units were tripped on activation of master trip relay.
B. Antecedent Conditions:	
1. Weather Information	Normal
2. Additional relevant information viz. power flow, shutdown etc.	1. All the three units were running. 2. Two Lines were in operation.
C. Event Data:	
1. Change in Frequency.	N.A.
2. Generation Loss/Load Loss.	510 MW
3. Single Line Diagram (SLD) of affected Area:	NA
4. Name and time of the tripped elements in time chronology:	Unit#1 at 19:02 hrs. on 02-Feb-2022, Unit#2 at 19:02 hrs. on 02-Feb-2022, Unit#3 at 19:02 hrs. on 02-Feb-2022
5. Location and type of fault.	UPS Power Supply System
6. Flag Details, DR and EL for each affected element:	Not Applicable
7. Appropriate Graphical Plot:	N.A.
8. Equipment failure (if any):	NIL.
D. Event Description/ Analysis of the Event	1. The UPS supply MCB of work stations of SCADA system got tripped. During restoration of the tripped MCB, both main & standby UPS got tripped. 2. The AC injection module of rotor Earth fault relay is feeding from UPS supply. As per original scheme, failure of UPS supply to rotor Earth fault relay, activates master trip relay and accordingly all the three running units got tripped.
E. Restoration	
1. Restoration time of tripped elements in time chronology	Unit#1 at 19:56 hrs. on 02-Feb-2022, Unit#2 at 19:51 hrs. on 02-Feb-2022, Unit#3 at 19:43 hrs. on 02-Feb-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.	1. In the instant case it is evident that both main & standby UPS were tripped simultaneously leading to failure of UPS supply. Tripping of both UPS before tripping of Incomer MCB to ACDB is undesirable. Appropriate remedial precautions shall be taken to avoid similar type of faults in future.
G. Lesson Learnt	NIL.
A. Any other Information	NIL.

पावर सिस्टम ऑपरेशन करपोरेशन लिमिटेड

(भारत सरकार का उद्यम)

POWER SYSTEM OPERATION CORPORATION LIMITED

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Eastern Regional Load Despatch Centre: 14, Golf Club Road, Tollygunge, Kolkata-700 033.

CIN: U40105DL2009GOI188682

फ़ोन: 033- 24235755, 24174049 फ़ैक्स : 033-24235809/5029 Website:www.erldc.org, Email ID- erldc@posoco.in



घटना संख्या: 25-02-2022/1

दिनांक: 28-02-2022

Report on the grid event in Eastern Region (पूर्वी क्षेत्र में ग्रिड घटना पर रिपोर्ट)

1. Summary of the event (घटना का सारांश):

At 13:27 Hrs on 25th February 2022, 400 kV Teesta 3-Rangpo-1 and 400 kV Teesta 3-Dikchu tripped due to R_B_N fault. Consequently, Teesta 3 S/s became dead. No generation or load loss occurred as all hydro units at Teesta 3 was out of bar.

- **Date / Time of disturbance:** 25-02-2022 at 13:27 hrs.
- **Event type:** GD - 1
- **Systems/ Subsystems affected:** 400 kV Teesta 3 S/s
- **Load and Generation loss.**
 - No generation loss reported during the event.
 - No load loss was reported during the event.

2. Important Transmission Line/element if out (महत्वपूर्ण संचरण लाइने जो बंद है):

- NIL

3. Major elements tripped (प्रमुख ट्रिपिंग)

- 400 kV Teesta 3-Rangpo-1
- 400 kV Teesta 3-Dikchu

4. Network across the affected area (प्रभावित क्षेत्र का नक्शा)

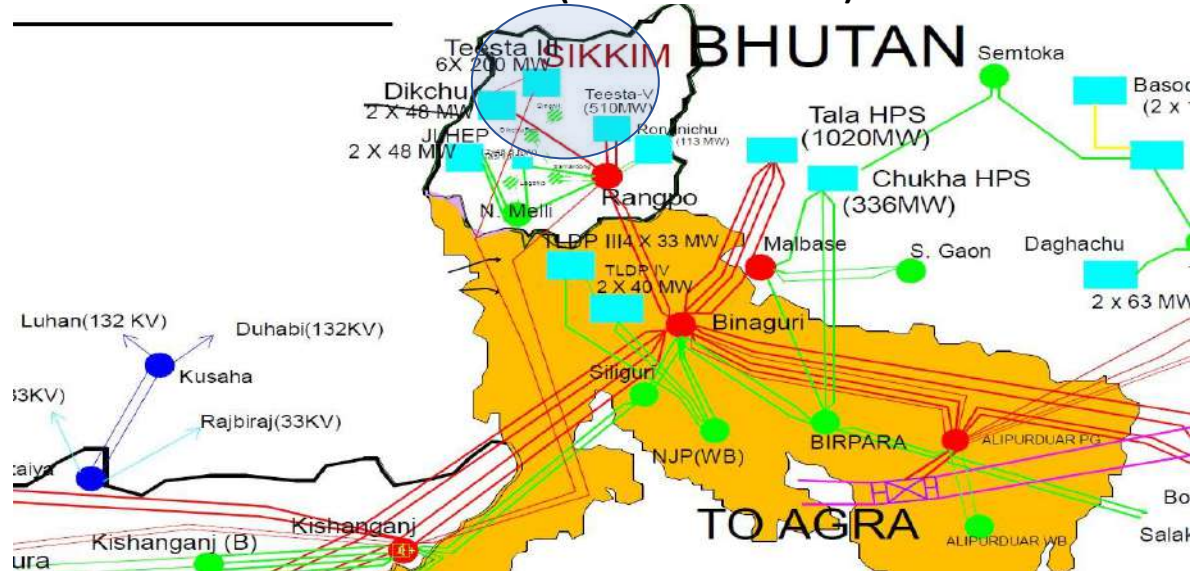


Figure 1: Network across the affected area

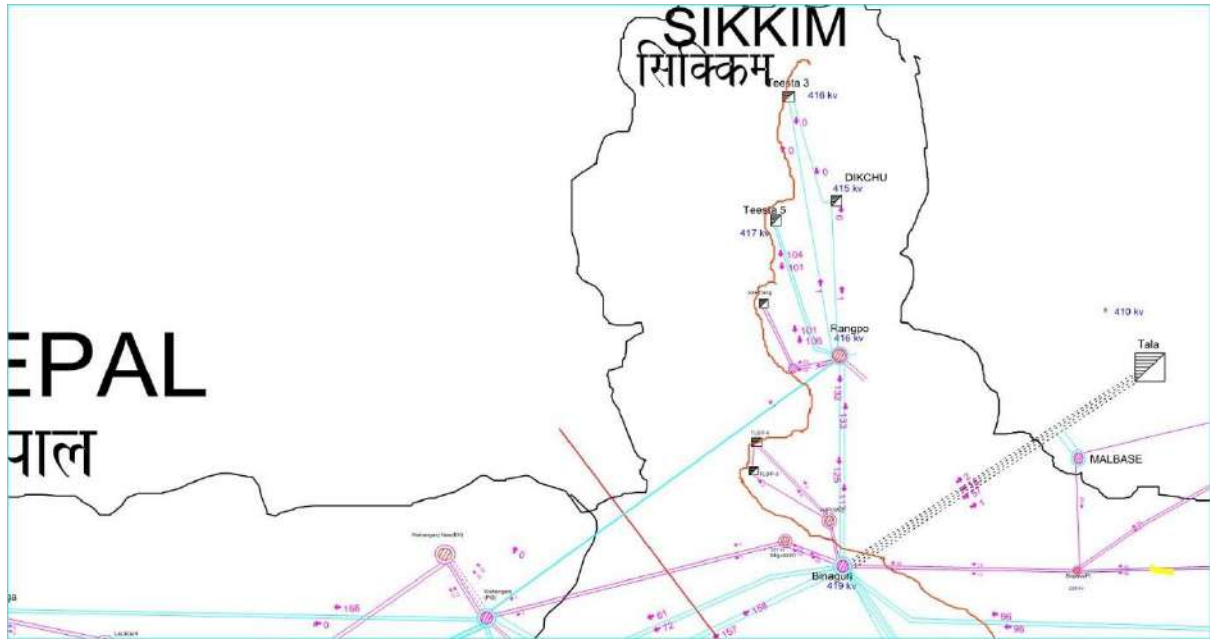


Figure 2: SCADA snapshot for of the system

Relay indication and PMU observation (रिले संकेत और पीएमयू पर्यवेक्षण):

समय	नाम	उप केंद्र 1 रिले संकेत	उप केंद्र 2 रिले संकेत	पीएमयू पर्यवेक्षण
13:27	400 kV Teesta 3-Rangpo-1	Teesta 3: R_B_N, Zone 1, 4.2 km,	Rangpo:R_B_N, Zone 1, 63.5 km, Ir: 6.2 kA, Ib: 3.9 kA	97 kV dip in R_ph and 126 kV dip in B_ph voltage at Rangpo
	400 kV Teesta 3 Dikchu	Teesta 3: O/V St-2	Dikchu: R_B_N, Zone-1, Ir: 3.89 kA, Ib: 4.1 kA	

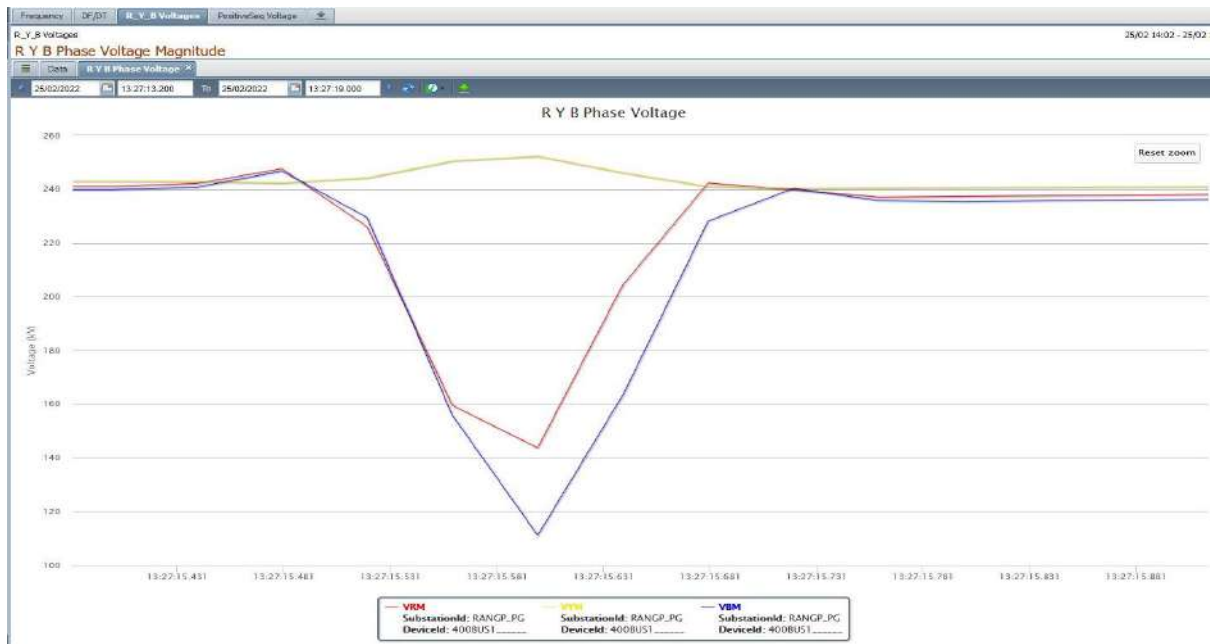


Figure 3: PMU voltage snapshot of 400/220 kV Rangpo S/s

5. Restoration (पूर्वावस्था की प्रप्ति)

Transmission/Generation element name	Restoration time
400 kV Teesta 3-Rangpo	15:26
400 kV Teesta 3-Dikchu	14:50

6. Analysis of the event (घटना का विश्लेषण):

- There was a transient ph-ph-Earth (R_B_N fault) in 400 kV Teesta 3-Rangpo line. Findings may be shared by TUL.

400 kV Teesta 3-Rangpo:

- Teesta 3: Distance protection operated. Tripped within 100 msec in Zone 1
- Rangpo: Zone-2 started and carrier received. Tripped within 100 msec

400 kV Teesta 3-Dikchu

- Teesta 3: Zone-4 started, tripped on O/V St.2. Phase Voltage of healthy phase (Y_ph) touched 311 kV.
- Dikchu: Tripped in Zone-1 within 100 msec. Later DT received from remote end.

7. Protection issue (सुरक्षा समस्या):

- Phase voltage in healthy phase (Y_ph) touched 311 kV in 400 kV Teesta 3-Dikchu line at Teesta-3. **TUL may explain.**
- Dikchu picked up a Zone-2 fault in Zone-1. Zone settings maybe checked. **Dikchu may explain.**

8. Non-compliance observed (विनियमन का गैर-अनुपालन):

Issues	Regulation Non-Compliance	Utility
Incorrect/ mis-operation / unwanted operation of Protection system	1. CEA Technical Standard for Construction of Electrical Plants and Electric Lines: 43.4.A. 2. CEA (Technical standards for connectivity to the Grid) Regulation, 2007: Schedule Part 1. (6.1, 6.2, 6.3)	Dikchu

9. Status of Reporting (रिपोर्टिंग की स्थिति):

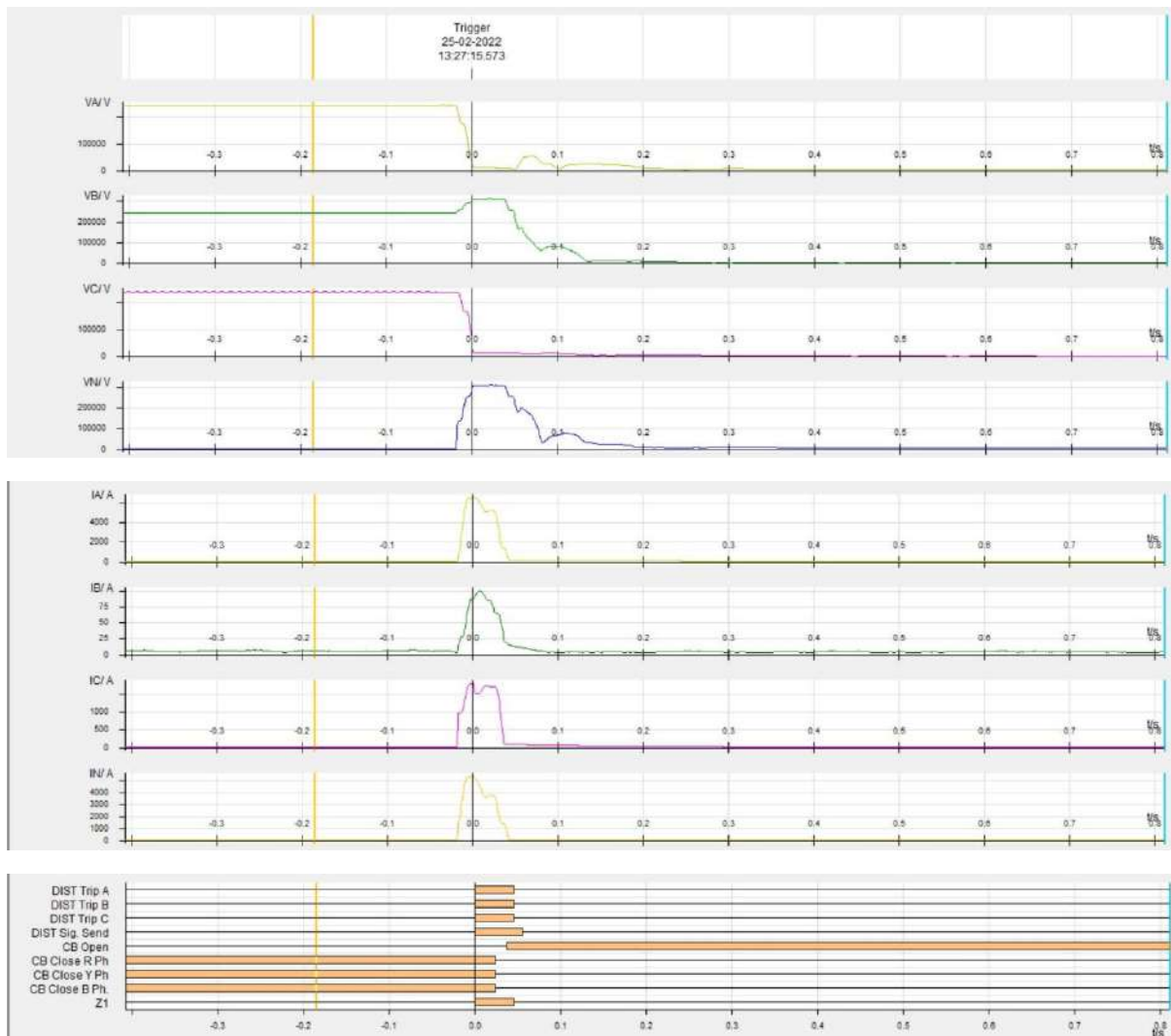
- DR/EL received from Teesta 3, Dikchu, Rangpo

Annexure 1: Sequence of events recorded at ERLDC SCADA data at the time of the event.

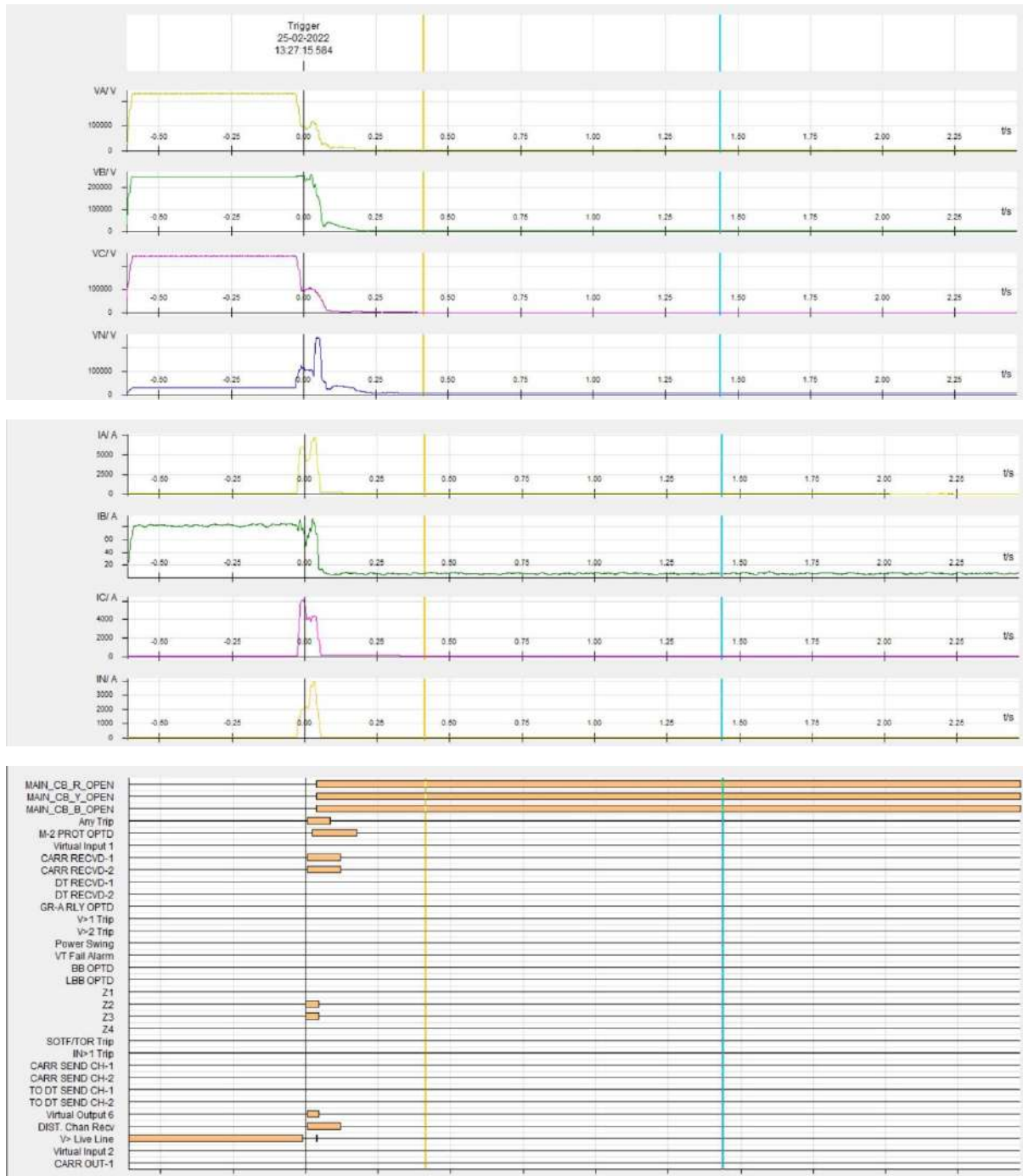
TIME	STATION	DESCRIPTION	STATUS
25-02-2022 13:27:15.622	RANGP_PG	400_TEES3_PG_CB	Open
25-02-2022 13:27:15.631	DKCHU_PG	400_TEES3_PG_RANGP_PG_Tie	Travel
25-02-2022 13:27:15.745	DKCHU_PG	400_TEES3_PG_RANGP_PG_Tie	Open

Annexure 2: DR recorded

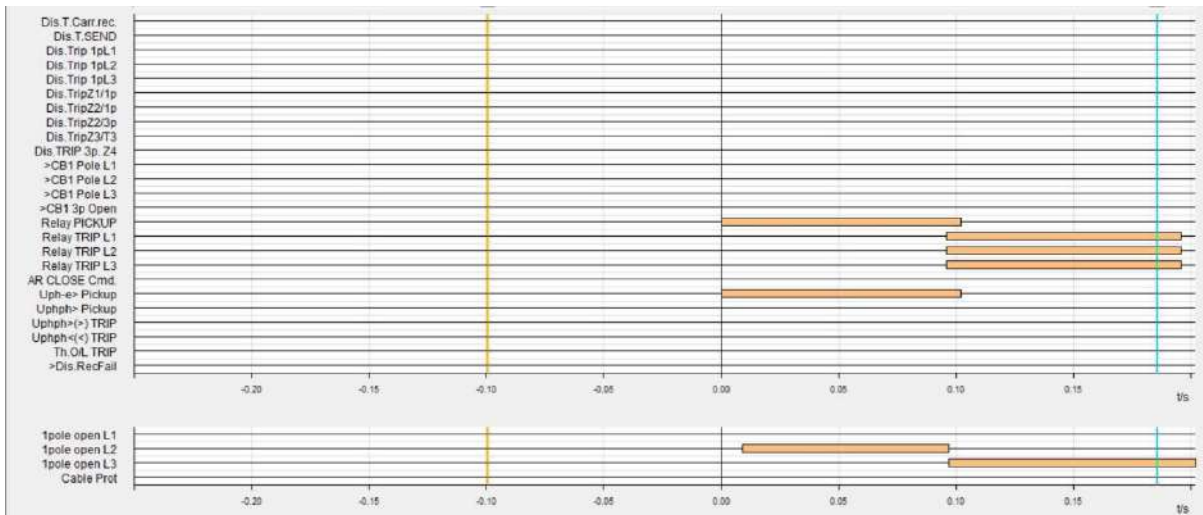
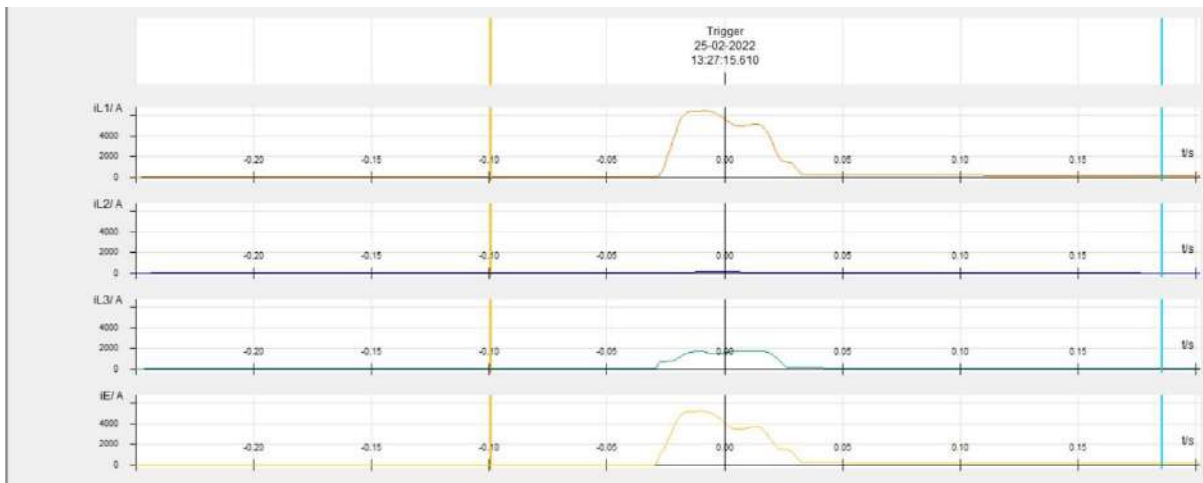
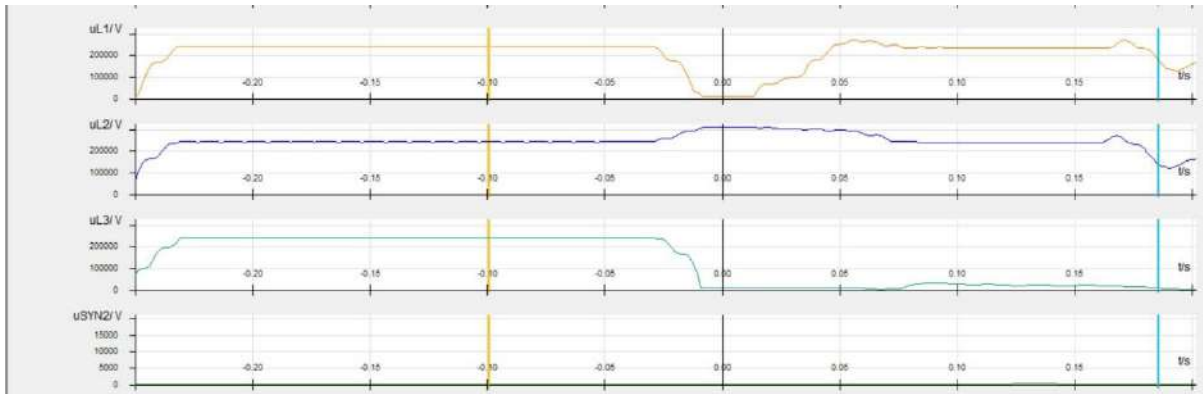
DR of 400 kV Teesta 3-Rangpo (Teesta 3)



DR of 400 kV Teesta 3-Rangpo (Rangpo)



DR of 400 kV Teesta 3-Dikchu (Teesta 3)

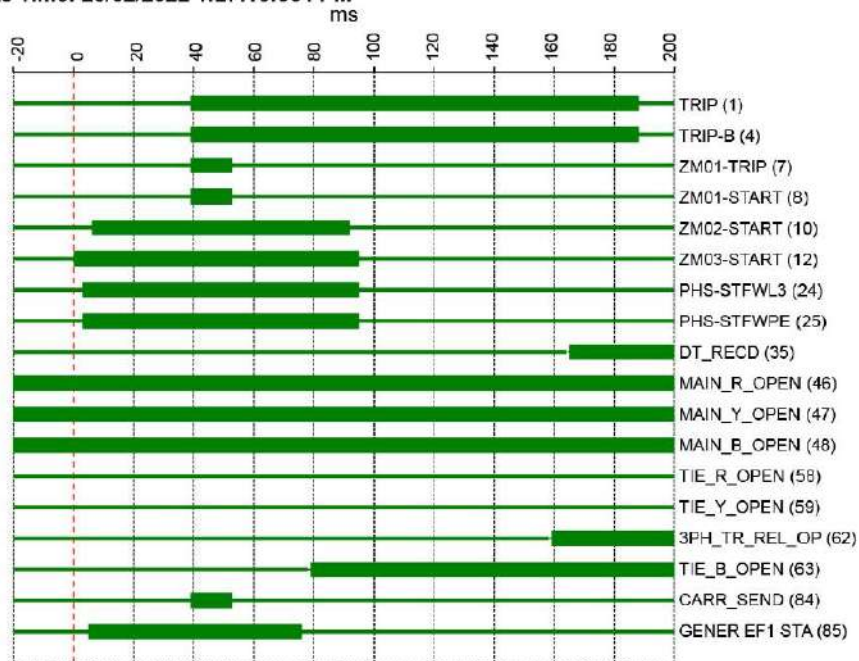


DR of 400 kV Teesta 3-Dikchu (Dikchu)



Binary Time Diagram

Trig Date Time: 25/02/2022 1:27:15:564 PM



**Trip Report for Tripping of 765 kV 330 MVAR Bus Reactor I & II on
dated 18.02.2022**

On dated 18.02.2022 330 MVAR 765 kV Bus Reactor I & II tripped at 12:23 & 12:20 hrs respectively on following indications.

- 765 kV 330 MVAR Bus Reactor I: - PRV trip B phase
- 765 kV 330 MVAR Bus Reactor II: - Buch /PRD operated R,Y,B phase.

Findings:

On physical inspection at site no actual operation was observed, further smoke was observed from common cable trench for Bus Reactor I & II. on visual inspection inside cable trench many control cables and power cables were found damaged. Among damaged cables 02 nos of 3.5 C 70 sq mm cables were found punctured and caught fire, due to collateral damage many control cables were damaged and insulation failure led to dc earth fault resulting in tripping of elements (31 no's of control cables) .



Damaged cables were emanating from MLDB and ELDB to NLP & ELP of switchyard, MCCB of MLDB & ELDB panel was found tripped.

Action taken:

- Fire in Cable trench was extinguished immediately by using DCP fire extinguisher.
- To avoid further untoward incidence DC supply to the feeders and AC supply for remaining cables were isolated.
- Damaged portion of cables was removed and healthy portion was joined using cable loops as temporary measure.



- DC Control Cables were powered on and no abnormalities observed in the system.
- However, AC Power Cables (except AC Supply for breakers) are yet to be powered after Insulation test.



Cause of Fire and Suggestion for improvement:

- Due to degradation of Insulation, Insulation failure might have caused the fire breakout in trench and damaged neighbouring cables.
- Therefore, periodic IR Measurement of cables may avoid such disaster.

List of important transmission lines in ER which tripped in February-2022

Sl. No.	LINE NAME	TRIP DATE	TRIP TIME	RESTORATION DATE	RESTORATION TIME	Relay Indication LOCAL END	Relay Indication REMOTE END	Reason	Fault Clearance time in msec	Remarks	DR/EL RECEIVED FROM LOCAL END	DR/EL RECEIVED FROM REMOTE END	LOCAL UTILITY	REMOTE UTILITY	UTILITY RESPONSE
1	220 KV BOALNGIR(PG)-BOLANGIR(NEW)	01-02-2022	12:22	01-02-2022	13:23	-	Bolangir (New): PD relay operated	No fault	NA	Details may be shared by OPTCL	No	No	PG Odisha Projects	OPTCL	PD relay maloperated
2	220 KV CHAIBASA(PG)-CHAIBASA-1	01-02-2022	12:24	01-02-2022	13:56	PG: Didn't trip	CT SF6 relay operated	No fault	NA	Loose contact in C&R panel	NA	Yes	PG ER-1	JUSNL	

3	221 KV CHAIBASA(PG)- CHAIBASA-1	01-02-2022	15:31	01-02-2022	15:57	PG: Didn't trip	CT SF6 relay operated	No fault	NA	Loose contact in C&R panel	NA	Yes	PG ER-1	JUSNL	Loose contact in C&R panel, TB replaced
4	400 KV NEW PURNEA- BIHARSHARIF-1	04-02-2022	05:10	04-02-2022	05:28	New Purnea: B_N, Zone- 1, 97.4 km, 6.0 kA, A/r succe ssful	Biharshari f: B_N, Zone-1, 56.06 km, 5.97 kA	B- Earth	100	No A/r attempt at Biharsharif	Yes	Yes	PG ER-1	PG ER-1	CB healthiness status was not available in main bay, loose contacts found. In tie bay, PLCC was unhealthy

5	400 KV BINAGURI- RANGPO-1	04-02-2022	10:18	04-02-2022	14:30	Binaguri: B_N, 56.7 km, 8.38 kA, A/r successful	Rangpo: B_N, 3.09 kA	B- Earth	600	Highly resistive fault. All three phase of tie bay opened at Binaguri during first instance of tripping. A/r successful from both ends. Tripped again within reclaim time.	Yes	Yes	PG ER-2	PG ER-2	Tie CB has old relay at Binaguri, to be replaced
6	400 KV MUZAFFARPUR- GORAKHPUR-1	04-02-2022	11:44	04-02-2022	13:12	Muzaffarpur: R_N, 62.77 km, 5.65 kA	-	R- Earth	100	Other two phase at Muzaffarpur tripped after 1.5 seconds. PG may explain	No	NA	PG ER-1	NR	A/r auxiliary contact burnt, PLCC unhealthy of tie bay.

7	400 KV MERAMUNDALI- MENDHASAL-2	04-02-2022	22:59	05-02-2022	01:08	Tripped from Mera mund ali end only	-	No fault	NA	Damaged cable in cable trench. Voltage not availbale in relay. Distance relay picked up and all three phase tripped	Yes	NA	OPTCL	OPTCL	
8	400 KV NEW DUBURI- MERAMUNDALI- 1	04-02-2022	23:18	05-02-2022	00:43	Tripped from Mera mund ali end only	-	No fault	NA	Damaged cable in cable trench. Voltage not availbale in relay. Distance relay picked up and all three phase tripped	NA	Yes	OPTCL	OPTCL	Theft attempt, Cable cut. Three phase CVT fuse fail logic for tripping blocking to be explored if possible

9	220 KV CHANDIL-SANTALDIH-1	06-02-2022	04:42	06-02-2022	05:17	Chandil: B_N, 89.3 km, 1.8 kA	Santal Dih: B_N, 19.54 km, 5.01 kA	B-Earth	100	A/r attempt not taken. Three phase tripping for single phase fault	Yes	No	JUSNL	WBPDCCL	Work order for PLCC scheme issued, to be completed in one month
10	220 KV PATNA-KHAGAU-3	09-02-2022	16:04	09-02-2022	19:15	-	DT received at Khagaul	No fault	NA	Details may be shared by BSPTCL/PG ER-1	NA	No	PG ER-1	BSPTCL	BGCL to check PLCC panels
11	400 KV NEW PPSP-NEW RANCHI-2	14-02-2022	16:02	14-02-2022	16:30	Tripped from New PPSP only. DT received		No fault	NA	WBSETCL/PG may explain	No	NA	WBSETCL	PG ER-1	CB status relay burnt at New Ranchi. DT sent to remote end

12	220 KV GAYA-BODHGAYA-2	14-02-2022	18:04	14-02-2022	18:20	Gaya: Didn't trip	Bodhgaya: DT received	No fault	NA	BSPTCL/PG may explain	NA	No	PG ER-1	BSPTCL	Main bay was under shutdown, DT sent during shifting from TBC to main bay. Protection logic was not changed before shifting
13	220 KV CHANDAUTI-SONENAGAR-1	14-02-2022	23:44	15-02-2022	00:50	Chandauti: A/r successful	Sonenagar : R_N, 2.43 kA, 20.96 km	R-Earth	100	Three phase tripping for single phase fault at Sonengar. A/r not in service at Sonengar	No	Yes	PMTL	BSPTCL	Changed A/r logic on 08.03.22. PUTT was giving three phase tripping command
14	221 KV CHANDAUTI-SONENAGAR-1	15-02-2022	02:00	15-02-2022	10:53	Chandauti: A/r successful	Sonenagar : R_N, 2.3 kA, 20 km	R-Earth	100	Three phase tripping for single phase fault at Sonengar. A/r not in service at Sonengar	No	Yes	PMTL	BSPTCL	

15	400 KV JHARSUGUDA- ROURKELA-3	23-02-2022	16:44	23-02-2022	17:19	Jhars uguda : DT receiv ed	No fault	NA	Details may be shared by PG	No	No	PG Odisha Projects	PG Odisha Projects	Main CB overhauling was undergoing at Rourkela. Positive DC was extended, thereby DT sent to remote end
16	400 KV BIHARSHARIF- VARANASI-2	24-02-2022	19:53	24-02-2022	21:06	Bihar sharif : B_N, 142 km, 2.8 kA, A/r succe ssful	B- Earth	100	A/r attempt after 2 seconds from Biharsharif. No A/r attempt at Varanasi.	No	NA	PG ER-1	NR	CB ready status of main bay was not available, thus PD operated. Spring was in discharged condition. Tie bay attempted A/r after 2 seconds as per logic. At Varansi A/r attempt failed after 1 second. Fault disappeared between 1-2 seconds

17	400 KV NEW PPSP- ARAMBAGH-1	24-02-2022	20:22	24-02-2022	21:29	Aram bagh: R_N, Zone 1, 42	New PPSP: R_N, 184 km, 1.65 kA, A/r	R- Earth	100	As per PMU, no A/r attempt at Arambagh	No	No	WBSETCL	WBSETCL	PLCC was unhealthy at Arambagh
18	220 KV GAYA- KHIZERSARAI-2	24-02-2022	22:58	24-02-2022	23:33	Gaya: R_N, 49.22 km, 4.219 kA	Khizersara i: R_N, 10.12 km, 7.612 kA, A/r successful	R- Earth	100	As per PMU, no A/r attempt at Gaya.	No	No	PG ER-1	BSPTCL	A/r logic issue at Gaya. Resolved.

SI No.	Name of the incidence	PCC Recommendation	Latest status
111th PCC Meeting			
1.	Total Power Failure at 220 kV Tenughat (TVNL) S/s on 01.01.2022 at 05:58 Hrs	In 111 th PCC, PCC advised TVNL following: <ul style="list-style-type: none"> to implement numerical busbar relay at 220 kV Tenughat S/s. to configure the DR as per the guidelines finalized in 74th PCC meeting. to check and rectify time synchronisation issues in the relays to submit Generator/GT overcurrent settings for review.	<i>Regarding numerical bus bar protection, TVNL representative informed that already proposal was approved by their higher authority and it would be implemented as soon as possible.</i>
2.	Disturbance at 220 kV Tenughat (TVNL) S/s on 25.01.2022 at 10:24 Hrs	In 111 th PCC, PCC advised TVNL to review the coordination of overcurrent protection settings on lv side of station transformer and to share the overcurrent protection settings of station transformer as well as both units of TTPS to ERPC.	
3.	DEF protection setting review in Sikkim complex in view of LILO of 400 kV Teesta 3-Kishanganj at Rangpo	In 111 th PCC, PCC decided that M/s PRDC would carry out the study for DEF relay setting coordination for Sikkim Complex with revised configuration of transmission network. PRDC was advised to coordinate with ERLDC for necessary information related to the study.	<i>PRDC was advised to coordinate with ERLDC for necessary information related to the study.</i>
110th PCC Meeting			

4.	Total Power Failure at 220 kV Soneneagar S/s on 15.12.2021 at 15:28 Hrs	<p>PCC advised BSPTCL following:</p> <ul style="list-style-type: none"> ➤ to investigate the root cause behind spurious receipt of carrier at Chandauti end by thorough checking of PLCC system at both the end in coordination with Powergrid. Further end to end testing may be done to ascertain the healthiness of PLCC. <p>to check whether POTT scheme is present on both end and if so, then timer settings of current reversal guard may to be checked and revised.</p>	<p>In 111th PCC, BSPTCL informed that during recent incident happened on 09/02/2022, auto-reclose operation was successful and no tripping incident was observed after the incident of 15.12.2021.</p> <p>PCC advised BSPTCL to complete the action points as advised in 110th PCC Meeting in coordination with Powergrid.</p>
5.	Total Power Failure at 220 kV Tarkera S/s on 21.12.2021 at 19:38Hrs	<p>PCC advised OPTCL to test the bus bar relay in order to find out any issues on secondary circuitry of the busbar unit.</p> <p>PCC stated that with available information, the reason for busbar operation at Tarkera cannot be explained and advised OPTCL/SLDC Odisha to submit event logger details as well as any other relevant information during the event which would help analyzing the event by PCC.</p>	<p>In 111th PCC, OPTCL informed that requisite details were sent to M/S Siemens for analysing root cause behind operation of bus bar protection. They further informed that as per their investigation they had found mismatch in CT ratio between site and relay settings for 3-4 feeders which might had resulted in spurious operation of bus bar protection. They had revised the CT ratio in relay however during revision of CT ratio, the feeder bay units went out of order. The faulty units would be rectified when service engineer of OEM would visit S/s.</p>
6.	Repeated Tripping of 132 kV Banka -Sultanganj D/C line	<p>PCC advised BSPTCL to submit a report on LBB issue after carrying out breaker timer test along with tower top patrolling findings. PCC further advised BSPTCL to take corrective actions like insulator replacement work in the identified tower locations before the onset of summer season.</p>	<p>In 111th PCC, BSPTCL vide mail dated 11/02/2022 informed that breaker timer test had been done and result was found satisfactory. Further they added that in LBB relay delay was found to be set to low value which was revised to the standard delay time.</p>

			Regarding tower top patrolling, they informed that patrolling had been done in said line and it was decided that approx. 200 disc insulators of the line would be replaced at earliest.
106th PCC Meeting			
7	Tripping of Bus-1 at 220 kV Ramchandrapur on 20/08/2021 at 20:24 Hrs	<p>In 106th PCC Meeting, PCC advised JUSNL following:</p> <ul style="list-style-type: none"> ➤ To restore the busbar protection at 220 kV Ramchandrapur S/s within a month. <p>In 109th PCC Meeting, JUSNL informed that they are in process to place fresh tender for implementation of PLCC as well as bus bar protection and it is expected that implementation of both would be completed by April 2022.</p> <p><i>In 111th PCC, JUSNL representative informed that PLCC card had been replaced.</i></p> <p><i>The bus bar protection implementation required extra cable to be laid for which purchase of cable had been initiated. The cable laying work would be started in March 2022.</i></p> <p><i>It was informed that laying of OPGW for 220 kV Ramchandrapur-Joda line would commence from March'22.</i></p>	<p><i>JUSNL representative informed that card had been installed for bus bar protection. However cable laying work is required to complete the busbar restoration work. The Purchase order has been placed & the work will be started soon.</i></p>
8	Total Power Failure at Dumka S/s on 15/05/2021 at 12:01 Hrs	JUSNL intimated that there was card issue in PLCC panel. The OEM (M/s ABB) had been communicated regarding the issue and the same would be resolved by September' 21.	<i>The revised estimate will be submitted to higher authority.</i>

		In 110 th PCC Meeting, JUSNL informed that approval had been received from higher authority and they are in process to issue the tender. They further informed that PLCC link would be restored by March-2022.	
9	Grid event at 132 kV Motihari (DMTCL) S/S on 21-04-2021 at 20:19 hrs	<p>In 109th PCC Meeting, PMTL representative informed that they are in process of placing the work order with TBEA authorized partners. The quotation has been received and work order would be placed by end of December 2021.</p> <p>In 110th PCC Meeting, PMTL representative informed that LOA had been awarded to vendor in last week of December 2021. The material supply is expected by first week of March 2022 and restoration work would be completed by end of March 2022.</p>	<i>PMTL representative informed that the despatch of material has been delayed by the vendor and the material is expected to reach at site by end of March'22.</i>

PROTECTION AUDIT REPORT

General information

Substation name:
SS voltage level:
Fault level of all equipment
(for that voltage level)
Date of commissioning
of the substation:
Region:
Audit date:
Name of utility which owns the
substation (e.g POWERGRID,
MSETCL, ADANI POWER, etc.)

Audit Team

Name	Company name
.....
.....

Regional representatives:

Name	Company name
.....
.....
.....
.....
.....
.....

Attached documents:

- 1 List of the faults that was/were not eliminated by the protection;
- 2 Record of previous trippings for last six months and associated fault analysis.
- 3 Single/three pole auto-recloser events, if any in last six months;
- 4 Details on periodicity of relay testing and latest relay test report
- 5 Communication from concerned department for the revised settings and record for implementation of the revised settings.
- 6 CT characteristics at all taps in case of multi-ratio CTs
- 7 df/dt, UFR relay details and settings if its available
- 8 Special Protection Schemes details if applicable. (Including test results & last operation records),
- 9 implemented schematic diagram for SPS

CONCLUSIONS OF PROTECTION AUDIT REPORT

Item no.	Issues	Remarks
1	Recommendations of last Protection Audit	Status of works&reason for pending/suggestions
2	Review of Existing Settings at Substations	
	Any inadvertently enabled settings/functions observed. (Yes/No)	
3	Disturbance recorder - list of 3 trippings in last 6 months	Recommended action
3.a	DR as well as EL records for the trippings available (Yes/No)	
3.b	Records available for Tripping analysis and corrective actions taken (Yes/no)	
3.c	Time Synch Matched Between EL signals and DR signals (Yes/No)	
3.d	Digital Signals of DR named properly (main CB Trip, Z1 Trip etc.) (Yes/No)	
4	Chronic reason of tripping, if any	Recommended action

Item no.	Issues	Remarks
5	Existing process for record of changes incorporated in the relay settings	See attached corespondence
6	Overvoltage grading for parallel line (time&pick up grading, provided or not)	Recommended action
7	Other deficiencies/Nonconformity observed (including the major non-conformaties mentioned in the audit format. ex: Single AC source etc.)	Recommended action

Appendix-9.4

CHECK LIST TO ENABLE AUDIT OF PRACTICES FOLLOWED IN PROTECTION APPLICATION & CRITERIA USED FOR SETTING CALCULATIONS IN 220KV, 400KV & 765KV SUBSTATIONS

CHECK-LIST: Check list for different protected objects & elements in fault clearance system are as under:

(put \surd mark in the appropriate box)

A. Transmission Lines (OHL and Cables)

1.	Independent Main-I and Main-II protection (of different make OR different type) is provided with carrier aided scheme	<input type="checkbox"/> YES	<input type="checkbox"/> NO
2.	Are the Main-I & Main-II relays connected to two separate DC sources (Group-A and Group-B)	<input type="checkbox"/> YES	<input type="checkbox"/> NO
3.	Is the Distance protection (Non-switched type, suitable for 1-ph & 3-ph tripping) as Main1 and Main2 provided to ensure selectivity & reliability for all faults in the shortest possible time	<input type="checkbox"/> YES	<input type="checkbox"/> NO
4.	Is both main-I & Main-II distance relay are numerical design having Quadrilateral or Polygon operating characteristic	<input type="checkbox"/> YES	<input type="checkbox"/> NO
5.	In the Main-I / Main-II Distance protection, Zone-I is set cover 80% of the protected line section	<input type="checkbox"/> YES	<input type="checkbox"/> NO
6.	In the Main-I / Main-II distance protection, Zone-2 is set cover 120% of the protected line section in case of Single circuit line and 150% in case of Double circuit line	<input type="checkbox"/> YES	<input type="checkbox"/> NO
7.	In the Main-I / Main-II distance protection, Zone-3 is set cover 120% of the total of protected line section plus longest line at remote end as a minimum.	<input type="checkbox"/> YES	<input type="checkbox"/> NO
8.	Resistive reach for Ground fault element set to give maximum coverage considering fault resistance, arc resistance & tower footing resistance. (In case, It is not possible to set the ground fault and phase fault reaches separately, load point encroachment condition imposed on Phase fault resistive reach shall be applied)	<input type="checkbox"/> YES	<input type="checkbox"/> NO
9.	Resistive reach for Phase fault element set to give maximum coverage subject to check of possibility against load point encroachment considering minimum expected voltage and maximum load.	<input type="checkbox"/> YES	<input type="checkbox"/> NO
10.	In case of short lines, is manufacturers recommendation considered in respect of resistive setting vis a vis reactance setting to avoid overreach.	<input type="checkbox"/> YES	<input type="checkbox"/> NO
11.	Is Zone-2 time delay of Main-I / Main-II distance relay set to 0.350 seconds ? In case any other value has been set for Zone-II timer, kindly specify the value and justification thereof.	<input type="checkbox"/> YES	<input type="checkbox"/> NO
12.	Is Zone-3 timer is set to provide discrimination with the operating time of relays at adjacent sections with which Zone-3 reach of relay is set to overlap. Please specify the Zone-3 time set.	<input type="checkbox"/> YES	<input type="checkbox"/> NO
13.	Is Zone-4 reach set in reverse direction to cover expected levels of apparent bus bar fault resistance, when allowing for multiple in feeds from other circuits?	<input type="checkbox"/> YES	<input type="checkbox"/> NO
14.	Is reverse looking Zone-4 time delay set as Zone-2 time delay?	<input type="checkbox"/> YES	<input type="checkbox"/> NO

Report of the Task Force on Power System Analysis Under Contingencies

15.	<p>Is Switch on to fault (SOTF) function provided in distance relay to take care of line energisation on fault?</p> <p>Whether SOTF initiation has been implemented using hardwire logic</p> <p>In case of Breaker and half switching scheme, whether initiation of line SOTF from CB closing has been interlocked with the other CB</p>	<input type="checkbox"/> YES <input type="checkbox"/> NO <input type="checkbox"/> YES <input type="checkbox"/> NO <input type="checkbox"/> YES <input type="checkbox"/> NO
16.	Whether VT fuse fail detection function has been correctly set to block the distance function operation on VT fuse failure	<input type="checkbox"/> YES <input type="checkbox"/> NO
17.	Is the sensitive IDMT directional E/F relay (either separate relay or built-in function of Main relay) for protection against high resistive earth faults?	<input type="checkbox"/> YES <input type="checkbox"/> NO
18.	Is additional element (Back-up distance) for remote back-up protection function provided in case of unit protection is used as Main relay for lines?	<input type="checkbox"/> YES <input type="checkbox"/> NO
19.	In case of Cables, is unit protection provided as Main-I & Main-II protection with distance as back-up.	<input type="checkbox"/> YES <input type="checkbox"/> NO
20.	Are the line parameters used for setting the relay verified by field testing	<input type="checkbox"/> YES <input type="checkbox"/> NO
21.	<p>Is Two stages Over-Voltage protection provided for 765 & 400kV Lines?</p> <p>Do you apply grading in over-voltage setting for lines at one station.</p> <p>Please specify the setting values adopted for: Stage-I : (typical value - 106 to 112 % , delay : 4-7 Sec) Stage-II: (typical value - 140 to 150%, delay: 0 to 100msec.)</p>	<input type="checkbox"/> YES <input type="checkbox"/> NO <input type="checkbox"/> YES <input type="checkbox"/> NO
22.	<p>Is 1-ph Auto –reclosing provided on 765, 400 & 220kV lines?</p> <p>Please specify the set value: Dead time: (typical 1 Sec) Reclaim time: (typical 25 Sec)</p>	<input type="checkbox"/> YES <input type="checkbox"/> NO
23.	<p>Is the Distance communication. Scheme Permissive Over Reach (POR) applied for short lines and Permissive Under Reach (PUR) applied for long lines?</p> <p>If any other communication scheme has been applied, please provide the detail with justification thereof.</p>	<input type="checkbox"/> YES <input type="checkbox"/> NO
24.	Is the Current reversal guard logic for POR scheme provided on Double circuit lines?	<input type="checkbox"/> YES <input type="checkbox"/> NO
25.	In case the protected line is getting terminated at a station having very low fault level i.e. HVDC terminal, whether weak end-infeed feature has been enabled in respective distance relay or not	<input type="checkbox"/> YES <input type="checkbox"/> NO
26.	In case of protected line is originating from nuclear power station, are the special requirement (stability of nuclear plant auxiliaries) as required by them has been met	<input type="checkbox"/> YES <input type="checkbox"/> NO
27.	<p>What line current , Voltage and Load angle have been considered for Load encroachment blinder setting and what is the resultant MVA that the line can carry without load encroachment.</p> <p>(In the absence of Load encroachment blinder function, this limit shall be applied to Zone-3 phase fault resistive reach.)</p>	I= V= Angle: S=
28.	<p>a) What are the Zones blocked on Power swing block function:</p> <p>b) Setting for Unblock timer: (typical 02 second)</p> <p>c) Out of Step trip enabled</p>	Z1 / Z2 / Z3 / Z4 Time: <input type="checkbox"/> YES <input type="checkbox"/> NO
29.	Whether the location of Out of step relay has been identified on the basis of power system simulation studies	<input type="checkbox"/> YES <input type="checkbox"/> NO

30.	<p>a) Is Disturbance recorder and Fault locator provided on all line feeder ?</p> <p>b) Whether standalone or built in Main relay</p> <p>c) Whether DR is having automatic fault record download facility to a central PC</p> <p>d) Whether DR is time synchronised with the GPS based time synchronising equipment</p> <p>e) Whether DR analog channels contain line phase & neutral current and line phase & neutral voltage.</p> <p>f) Whether DR digital channel as a minimum contain the CB status, Main-I & II trip status, LBB trip status, Over-voltage trip status, Stub protn trip status, Permissive and direct carrier receive status, Line reactor trip status.</p>	<p><input type="checkbox"/> YES <input type="checkbox"/> NO</p> <p>Standalone / built-in</p> <p><input type="checkbox"/> YES <input type="checkbox"/> NO</p> <p><input type="checkbox"/> YES <input type="checkbox"/> NO</p> <p><input type="checkbox"/> YES <input type="checkbox"/> NO</p> <p><input type="checkbox"/> YES <input type="checkbox"/> NO</p>
31.	Does the Setting document for the numerical relays (IED) contain all the settings for all functions that are used and indicates clearly the functions not used (to be Blocked / Disabled). Are all default settings validated or revised settings given in the setting document?	<p><input type="checkbox"/> YES <input type="checkbox"/> NO</p>

B. Power Transformers

1.	Do you use Group A and Group B protections connected to separate DC sources for power transformers	<p><input type="checkbox"/> YES <input type="checkbox"/> NO</p>										
2.	Do you follow CBIP guideline (274 & 296) for protection setting of transformer	<p><input type="checkbox"/> YES <input type="checkbox"/> NO</p>										
3.	Do you use duplicated PRD and Bucholtz initiating contact for power transformers at 765kV and 400kV levels	<p><input type="checkbox"/> YES <input type="checkbox"/> NO</p>										
4.	<p>Do you classify transformer protections as below in groups:</p> <table style="width: 100%; border: none;"> <tr> <td style="width: 50%;">Group A</td> <td style="width: 50%;">Group B</td> </tr> <tr> <td>• Biased differential relay</td> <td>Restricted earth fault (REF) relay</td> </tr> <tr> <td>• PRD , WTI</td> <td>Buchholz Protection, OTI</td> </tr> <tr> <td>• Back up Protection(HV)</td> <td>Back up Protection(MV)</td> </tr> <tr> <td>• Over fluxing protection(HV)</td> <td>Over fluxing protection(MV)</td> </tr> </table>	Group A	Group B	• Biased differential relay	Restricted earth fault (REF) relay	• PRD , WTI	Buchholz Protection, OTI	• Back up Protection(HV)	Back up Protection(MV)	• Over fluxing protection(HV)	Over fluxing protection(MV)	<p><input type="checkbox"/> YES <input type="checkbox"/> NO</p> <p>Group A or B</p>
Group A	Group B											
• Biased differential relay	Restricted earth fault (REF) relay											
• PRD , WTI	Buchholz Protection, OTI											
• Back up Protection(HV)	Back up Protection(MV)											
• Over fluxing protection(HV)	Over fluxing protection(MV)											
5.	In case of Breaker & half switching scheme, whether CT associated with Main & Tie Breakers are connected to separate bias winding of the low impedance Biased differential protection in order to avoid false operation due to dissimilar CT response.	<p><input type="checkbox"/> YES <input type="checkbox"/> NO</p>										
6.	Is Restricted earth fault (REF) protection used a high impedance type	<p><input type="checkbox"/> YES <input type="checkbox"/> NO</p>										
7.	Are Main protection relays provided for transformers are of numerical design.	<p><input type="checkbox"/> YES <input type="checkbox"/> NO</p>										
8.	<p>a) Are directional over current & earth fault relays provided as back-up protection of Transformer are of numerical design.</p> <p>b) Do the back-up earth fault relays have harmonic restrain feature</p>	<p><input type="checkbox"/> YES <input type="checkbox"/> NO</p> <p><input type="checkbox"/> YES <input type="checkbox"/> NO</p>										
9.	Is Fire protection system (HVW type) provided for power transformer and functioning	<p><input type="checkbox"/> YES <input type="checkbox"/> NO</p>										
10.	<p>a) Is the Disturbance recorder provided for Transformer feeder</p> <p>b) Whether standalone or built in Main relay</p> <p>c) Whether DR is having automatic fault record download facility to a central PC</p> <p>d) Whether DR is time synchronised with the GPS time synchronising equipment</p>	<p><input type="checkbox"/> YES <input type="checkbox"/> NO</p> <p>Standalone/built-in</p> <p><input type="checkbox"/> YES <input type="checkbox"/> NO</p> <p><input type="checkbox"/> YES <input type="checkbox"/> NO</p>										

11.	Does the Setting document for the numerical relays (IED) contain all the settings for all functions that are used and indicates clearly the functions not used (to be Blocked / Disabled). Are all default settings validated or revised settings given in the setting document?	<input type="checkbox"/> YES <input type="checkbox"/> NO
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C. Shunt Reactors

1.	Do you use Group A and Group B protections connected to separate DC sources for reactors	<input type="checkbox"/> YES <input type="checkbox"/> NO
2.	Do you follow CBIP guideline (274 and 296) for protection setting of reactors	<input type="checkbox"/> YES <input type="checkbox"/> NO
3.	Do you use duplicated PRD and Bucholtz initiating contact for Reactors at 765kV and 400kV levels	<input type="checkbox"/> YES <input type="checkbox"/> NO
4.	Do you classify Reactor protections as below in groups: <div style="display: flex; justify-content: space-around;"> <div style="text-align: left;"> Group A • Biased differential relay • PRD , WTI • Back up impedance protection </div> <div style="text-align: left;"> Group B R.E.F Protection Buchholz Protection, OTI Direction O/C & E/F relay </div> </div>	<input type="checkbox"/> YES <input type="checkbox"/> NO Group A or B
5	In case of Breaker & half switching scheme, whether CT associated with Main & Tie Breakers are connected to separate bias winding of the low impedance Biased differential protection in order to avoid false operation due to dissimilar CT response.	<input type="checkbox"/> YES <input type="checkbox"/> NO
6	Is Restricted earth fault (REF) protection used a high impedance type	<input type="checkbox"/> YES <input type="checkbox"/> NO
7	Are Main & back-up protection relays provided for Reactor are of numerical design.	<input type="checkbox"/> YES <input type="checkbox"/> NO
8	Is Fire protection system (HVW type) provided for Reactor and functioning	<input type="checkbox"/> YES <input type="checkbox"/> NO
9	a) Is the Disturbance recorder and Fault locator provided on all the Shunt Reactors used in 765 kV, 400 kV substations? b) Whether standalone or built in Main relay c) Whether DR is having automatic fault record download facility to a central PC	<input type="checkbox"/> YES <input type="checkbox"/> NO Standalone/built-in <input type="checkbox"/> YES <input type="checkbox"/> NO
10.	Does the Setting document for the numerical relays (IED) contain all the settings for all functions that are used and indicates clearly the functions not used (to be Blocked / Disabled). Are all default settings validated or revised settings given in the setting document?	<input type="checkbox"/> YES <input type="checkbox"/> NO

D. Bus bars

1.	Bus Bar protection for 765, 400 & 220kV buses is provided	<input type="checkbox"/> YES <input type="checkbox"/> NO
2.	Duplicated Bus bar protection is provided for 765kV and 400kV buses	<input type="checkbox"/> YES <input type="checkbox"/> NO
3.	CBIP guideline for Protection (274 and 296) settings is followed	<input type="checkbox"/> YES <input type="checkbox"/> NO
4	In an existing substation if CTs are of different ratios, is biased type bus protection provided.	<input type="checkbox"/> YES <input type="checkbox"/> NO
5	In stations where single bus bar protection is provided, is backup provided by reverse looking elements of distance relays or by second zone elements of remote end distance relays?	<input type="checkbox"/> YES <input type="checkbox"/> NO

6	In case of GIS where burn through time of SF6 is shorter than remote back up protection is the bus bar protection duplicated irrespective of voltage level?	<input type="checkbox"/> YES <input type="checkbox"/> NO
7	Since it is difficult to get shutdowns to allow periodic testing of bus protection, numerical bus protections with self-supervision feature is an answer. Is this followed?	<input type="checkbox"/> YES <input type="checkbox"/> NO
8	Does the Setting document for the numerical relays (IED) contain all the settings for all functions that are used and indicates clearly the functions not used (to be Blocked / Disabled). Are all default settings validated or revised settings given in the setting document?	<input type="checkbox"/> YES <input type="checkbox"/> NO

E. Disturbance Recorder (DR) and Event Logger (EL)

1	<p>a) Is the Disturbance recorder and Fault locator provided on all line feeders of 765, 400 & 220kV substations?</p> <p>b) Whether standalone or built in Main relay</p> <p>c) Whether DR is having automatic fault record download facility to a central PC</p> <p>d) Whether Central PC for DR , EL are powered by Inverter (fed from station DC)</p>	<input type="checkbox"/> YES <input type="checkbox"/> NO Standalone / built-in <input type="checkbox"/> YES <input type="checkbox"/> NO <input type="checkbox"/> YES <input type="checkbox"/> NO
2.	<p>Whether DR is having the following main signals for lines:</p> <p><u>Analogue signals:</u></p> <ul style="list-style-type: none"> • From CT: IA, IB, IC, IN • From VT: VAN, VBN, VCN • From Aux. VT: V0 <p><u>Digital Signals</u></p> <ul style="list-style-type: none"> • Main 1 Carrier receive • Main 1 Trip • Line O/V Stage I / Stage II • Reactor Fault Trip • Stub Protection Operated. • Main II Trip • Main II Carrier Receive • Direct Trip CH I / II • CB I Status (PH-R, Y & B) • CB II Status (PH R, Y & B) • Bus bar trip • Main / Tie CB LBB Operated • Main / Tie Auto-reclose operated. <p>DR for Transformer / Reactor feeder should contain analog channel like input currents & voltage. Binary signal include all protection trip input, Main & Tie CB status, LBB trip</p>	<input type="checkbox"/> YES <input type="checkbox"/> NO
3.	Whether substation (765, 400 , 220kV) is having Event logger facility (standalone or built-in-SAS)	<input type="checkbox"/> YES <input type="checkbox"/> NO
4.	Whether GPS based time synchronizing equipment is provided at the substation for time synchronizing of Main relays / DR/ Event logger / SAS/ PMU / Line Current Differential Relays	<input type="checkbox"/> YES <input type="checkbox"/> NO

F. Circuit Breakers

1.	Is breaker fail protection (LBB / BFR) provided for all the Circuit Breakers at 220kV , 400kV & 765kV rating	<input type="checkbox"/> YES <input type="checkbox"/> NO
3.	For Circuit Breaker connected to line feeder / transformer feeder, whether operation of LBB / BFR sends direct trip signal to trip remote end breaker ?	<input type="checkbox"/> YES <input type="checkbox"/> NO

4.	For lines employing single phase auto reclosing, Is start signal from protection trip to LBB / BFR relay is given on single phase basis?	<input type="checkbox"/> YES <input type="checkbox"/> NO
5.	Is separate relay provided for each breaker and the relay has to be connected from the secondary circuit of the CTs associated with that particular breaker?	<input type="checkbox"/> YES <input type="checkbox"/> NO
6.	Is LBB relay provided with separate DC circuit independent from Group-A and Group-B Protections?	<input type="checkbox"/> YES <input type="checkbox"/> NO
7.	Is the LBB initiation provided with initiating contact independent of CB trip relay contact?	<input type="checkbox"/> YES <input type="checkbox"/> NO
8.	Is Separation maintained between protective relay and CB trip coil DC circuit so that short circuit or blown fuse in the CB circuit will not prevent the protective relay from energizing the LBB scheme?	<input type="checkbox"/> YES <input type="checkbox"/> NO
9.	Is LBB relay initiated by Bus bar protection in addition to other fault sensing relays, since failure of CB to clear a bus fault would result in the loss of entire station if BFP relay is not initiated?	<input type="checkbox"/> YES <input type="checkbox"/> NO
10.	Is tripping logic of the bus bar protection scheme used for LBB protection also?	<input type="checkbox"/> YES <input type="checkbox"/> NO
11.	Are the special considerations provided to ensure proper scheme operation by using Circuit Breaker contact logic in addition to current detectors in cases breaker-fail relaying for low energy faults like buckholz operation?	<input type="checkbox"/> YES <input type="checkbox"/> NO
12.	Are the Current level detectors set as sensitive as the main protection? (Generally setting of 0.2 A is commonly practiced for lines and transformers)	<input type="checkbox"/> YES <input type="checkbox"/> NO
13.	Is timer set considering breaker interrupting time, current detector reset time and a margin? (Generally a timer setting of 200ms has been found to be adequate)	<input type="checkbox"/> YES <input type="checkbox"/> NO
14.	Is the back-up fault clearance time is shorter than the operating time of the remote protections (distance relay Zone-2) ?	<input type="checkbox"/> YES <input type="checkbox"/> NO
15.	Is the breaker failure protection provided with two steps (First stage – retrip own CB, Second stage- Trip all associated CBs) . This mitigates unwanted operation of breaker failure protection during maintenance and fault tracing.	<input type="checkbox"/> YES <input type="checkbox"/> NO
16.	Is the breaker failure protection hardware provided is separate from line /transformer feeder protection?	<input type="checkbox"/> YES <input type="checkbox"/> NO

G. Communication systems

1.	<p>a) Do you use PLCC for tele-protection of distance relays at 765, 400 & 220kV feeders</p> <p>b) Specify type of coupling</p> <p>c) Whether redundant PLCC channels provided for 400 & 765kV lines</p> <p>d) Specify number of PLCC channels per circuit :</p> <p>e) Whether dependability & security of each tele-protection channel measured & record kept ?</p>	<p style="text-align: center;"><input type="checkbox"/> YES <input type="checkbox"/> NO</p> <p style="text-align: center;">(Ph-Ph / Ph-G/ Inter-ckt)</p> <p style="text-align: center;"><input type="checkbox"/> YES <input type="checkbox"/> NO</p> <p style="text-align: center;">(One / two)</p> <p style="text-align: center;"><input type="checkbox"/> YES <input type="checkbox"/> NO</p>
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2.	a) In case you use OPGW for tele-protection, are they on geographically diversified route for Main-I and Main-II relay? b) Whether dedicated fibre is being used for Main-I / Main-II relay or multiplexed channel are being used.	<input type="checkbox"/> YES <input type="checkbox"/> NO Dedicated / multiplexed
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H. Station DC supply systems

1.	Do you have two separate independent DC system (220V or 110V) (Source-A and Source-B)	<input type="checkbox"/> YES <input type="checkbox"/> NO
2.	Do you have two independent DC system (48V) for PLCC (source-A and source-B)	<input type="checkbox"/> YES <input type="checkbox"/> NO
3.	There is no mixing of supplies from DC source-A and DC source-B	<input type="checkbox"/> YES <input type="checkbox"/> NO
4.	Whether the protection relays and trip circuits are segregated into two independent system fed through fuses from two different DC source	<input type="checkbox"/> YES <input type="checkbox"/> NO
5.	Whether Bay wise distribution of DC supply done in the following way: a) Protection b) CB functions c) Isolator / earth switch functions d) Annunciation / Indications e) Monitoring functions	<input type="checkbox"/> YES <input type="checkbox"/> NO
6	Whether following has been ensured in the cabling: a) Separate cables are used for AC & DC circuits b) Separate cables are used for DC-I & DC-II circuits c) Separate cables are used for different cores of CT and CVT outputs to enhance reliability & security	<input type="checkbox"/> YES <input type="checkbox"/> NO
7	Is guidelines prescribed in CBIP manual 274 & 296 followed in general	<input type="checkbox"/> YES <input type="checkbox"/> NO

I. PERFORMANCE INDICES

1.	Is there a system of periodically measuring Dependability & Security of Protection system (as given in CBIP manual 296) and recorded	<input type="checkbox"/> YES <input type="checkbox"/> NO
2.	Is there a system of periodically measuring Dependability of switchgear associated with Protection system and recorded	<input type="checkbox"/> YES <input type="checkbox"/> NO
3.	Is there a process of Root cause analysis of unwanted tripping events	<input type="checkbox"/> YES <input type="checkbox"/> NO
4.	Are improvement action like revision of relay setting, better maintenance practices, modernising & retrofitting of switching & protection system taken based on above data.	<input type="checkbox"/> YES <input type="checkbox"/> NO
5.	Is attention also given to DC supply system, tele-protection signalling, healthiness of tripping cables, terminations etc. in order to improve the performance of fault clearance system	<input type="checkbox"/> YES <input type="checkbox"/> NO

J. ADDITIONAL CHECKS FOR SERIES COMPENSATED LINES

1.	What is the operating principle of Main protection employed	<input type="checkbox"/> Distance <input type="checkbox"/> Line Current diff.
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2.	Are both main-I & Main-II distance relay are numerical design	<input type="checkbox"/> YES <input type="checkbox"/> NO
3.	Are both main-I & Main-II distance relay suitable for Series compensated lines	<input type="checkbox"/> YES <input type="checkbox"/> NO
4.	Are POR tele-protection scheme employed for distance relays	<input type="checkbox"/> YES <input type="checkbox"/> NO
5.	Position of Line VT provided on series compensated line	<input type="checkbox"/> Between Capacitor and line <input type="checkbox"/> Between Capacitor and Bus
6.	What is the under reaching (Zone 1) setting used in teleprotection schemes (Local & Remote end)	% of line length Rationale:
7.	What is the overreaching (Zone 2) setting in used teleprotection schemes	% of line length Rationale:
8.	What kinds of measurement techniques are used to cope with voltage inversion?	<input type="checkbox"/> Phase locked voltage memory <input type="checkbox"/> Intentional time delay Other, specify:
9.	Whether system studies carried out to check the possibility of current inversion due to series compensation	<input type="checkbox"/> YES <input type="checkbox"/> NO
10.	Whether any system studies conducted to find the impact of series compensation on the performance of protections installed on adjacent lines? If yes, how many lines were found to be affected. Pl. specify _____	<input type="checkbox"/> YES <input type="checkbox"/> NO
11	If YES, are the affected protections on adjacent lines changed / setting revised after the introduction of series compensation?	<input type="checkbox"/> YES <input type="checkbox"/> NO
12.	Is dynamic simulation done to fine tune settings of distance relay installed on series compensated double circuit lines?	<input type="checkbox"/> YES <input type="checkbox"/> NO
13.	Whether performance of directional earth fault relay verifies by simulation studies	<input type="checkbox"/> YES <input type="checkbox"/> NO
14.	When is flashover of spark gaps expected?	<input type="checkbox"/> For protected line Faults up to _____ ohms <input type="checkbox"/> For external faults an adjacent lines
15.	Whether measures taken for under/overreach problems at sub-harmonic oscillations?	<input type="checkbox"/> YES <input type="checkbox"/> NO
16.	Whether MOV influence considered while setting the distance relay reach	<input type="checkbox"/> YES <input type="checkbox"/> NO
17.	Have you experienced any security problems (Relay mal-operation) with high frequency transients caused by <input type="checkbox"/> Flashover of spark gaps <input type="checkbox"/> Line energisation Other, specify:	<input type="checkbox"/> YES <input type="checkbox"/> NO
18.	If YES, how the above problem has been addressed?	