Agenda
for
105th PCC Meeting

Date:23.08.2021
Eastern Regional Power Committee
14, Golf Club Road, Tollygunge
Kolkata: 700 033

EASTERN REGIONAL POWER COMMITTEE

AGENDA FOR 105TH PROTECTION COORDINATION SUB-COMMITTEE MEETING TO BE HELD ON 23.08.2021 AT 10:30 HOURS

PART – A

ITEM NO. A.1: Confirmation of minutes of 104th Protection Coordination sub-Committee Meeting held on13thJuly2021 through MS Teams.

The minutes of 104th Protection Coordination sub-Committee meeting held on 13.07.2021 circulated vide letter dated 30.07.2021.

Members may confirm.

PART – B

ITEM NO. B.1: Disturbance at 220 kV New Town AA-III(WBSETCL) Substation on 14/07/2021 at 11:54 Hrs

At 11:54 hrs, both buses of 220 kV New Town AA-III S/S tripped due to operation of bus bar protection leading to load loss in New town region and corresponding tripping of associated transmission lines.

The detailed report from ERLDC is attached at **Annexure B.1.**

Relay Indications:

<table>
<tr><th>Time</th><th>Name</th><th>End 1</th><th>End 2</th><th>PMU Observation</th></tr>
<tr><td rowspan="7">11:54 Hrs</td><td>220 kV New Town AA III-Rajarhat D/C</td><td rowspan="3">Bus fault at New Town AA-III</td><td>Yet to be received</td><td rowspan="7">No fault observed in PMU,20kV voltage reduction observed in all phases at Rajarhat</td></tr>
<tr><td>220 kV New Town AA III-Subhashgram</td><td>Not tripped from Subhashgram end</td></tr>
<tr><td>220 kV New Town AA III-KLC Bantala</td><td>Yet to be received</td></tr>
<tr><td>220 kV Bus I & Bus II at Newtown AA III</td><td colspan="2" rowspan="3">Bus fault at New Town AA-III</td></tr>
<tr><td>2* 220 kV/132 kV 160 MVA ICTs</td></tr>
<tr><td>3* 220/33 kV 50 MVA ICTs</td></tr>
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Load Loss: 185 MW

Outage Duration:00: 43 Hrs

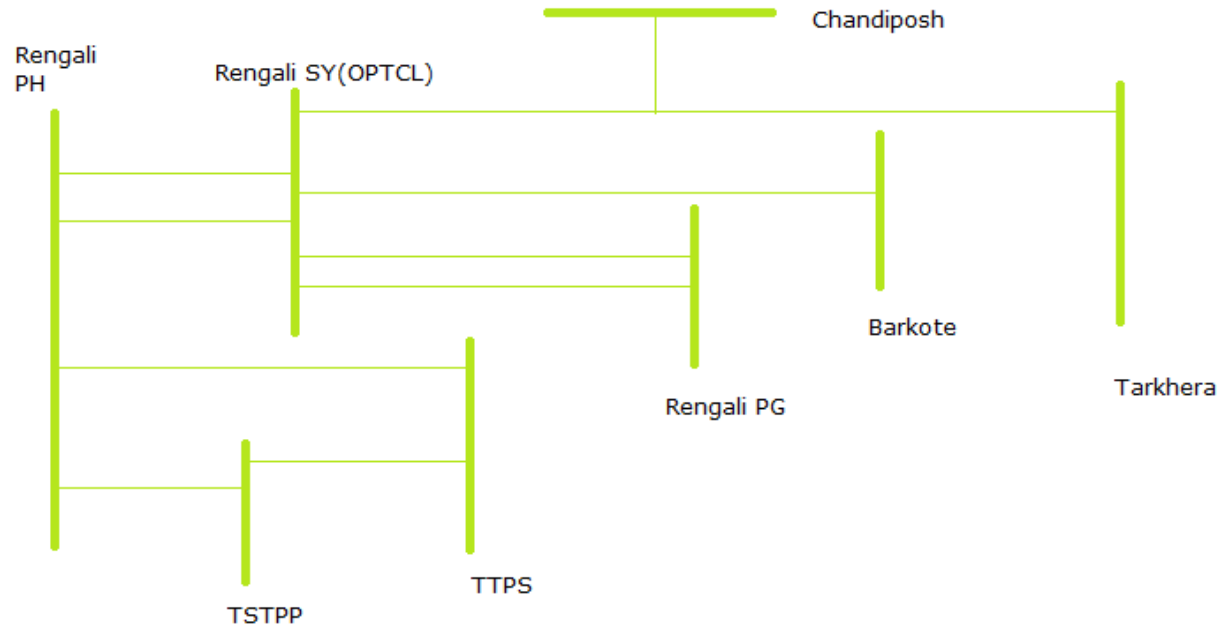
WBSETCL may explain.

ITEM NO. B.2: Total Power Failure at 220 kV Rengali HEP on 27/07/2021 at 08:57 Hrs

At 08:57 hrs, all feeders connected to Rengali PH S/s tripped along with Unit # 1, 2, 4 and 5. As per the information received, there was a fault in the downstream i.e. 33kV system at Rengali PH which get cleared at 220 kV Rengali PH end.

Relay Indications:

Time	Name	End 1	End 2	PMU Observation
08:57 Hrs	220kV Rengali PH-TSTPP S/C	B-Earth fault and overcurrent in the downstream of 33 kV	Yet to receive	PMU captured at Rengali shows B-Earth fault and slight dip in voltage
	220kV Rengali PH-TTPS S/C	Yet to receive	Yet to receive	
	220kV Rengali PH-Rengali (OPTCL) -1	Yet to receive	Yet to receive	
	220kV Rengali PH-Rengali (OPTCL) -2	Yet to receive	Yet to receive	



The detailed report from ERLDC is attached at **Annexure B.2.**

Following issues are observed related to this grid disturbance –

- Fault of 33 kV System got cleared from 220 kV system. All the protection system of downstream (33 kV and above) failed to clear the fault which led to tripping of all 220 kV lines.
- All four 220 kV lines tripped on O/V from Rengali PH only. Line didn't trip from remote ends.
- All generating units (U#1, U#2, U#4, U#5) tripped on Reverse Power Flow protection. Reason for reverse power flow and settings may be shared.
- There was loss of evacuation path due to tripping of all emanating lines. Whether any Over-frequency relay picked up in any unit need to be answered by concerned utility Over-frequency settings may be shared.
- Root cause analysis need to be done to identify faulty system

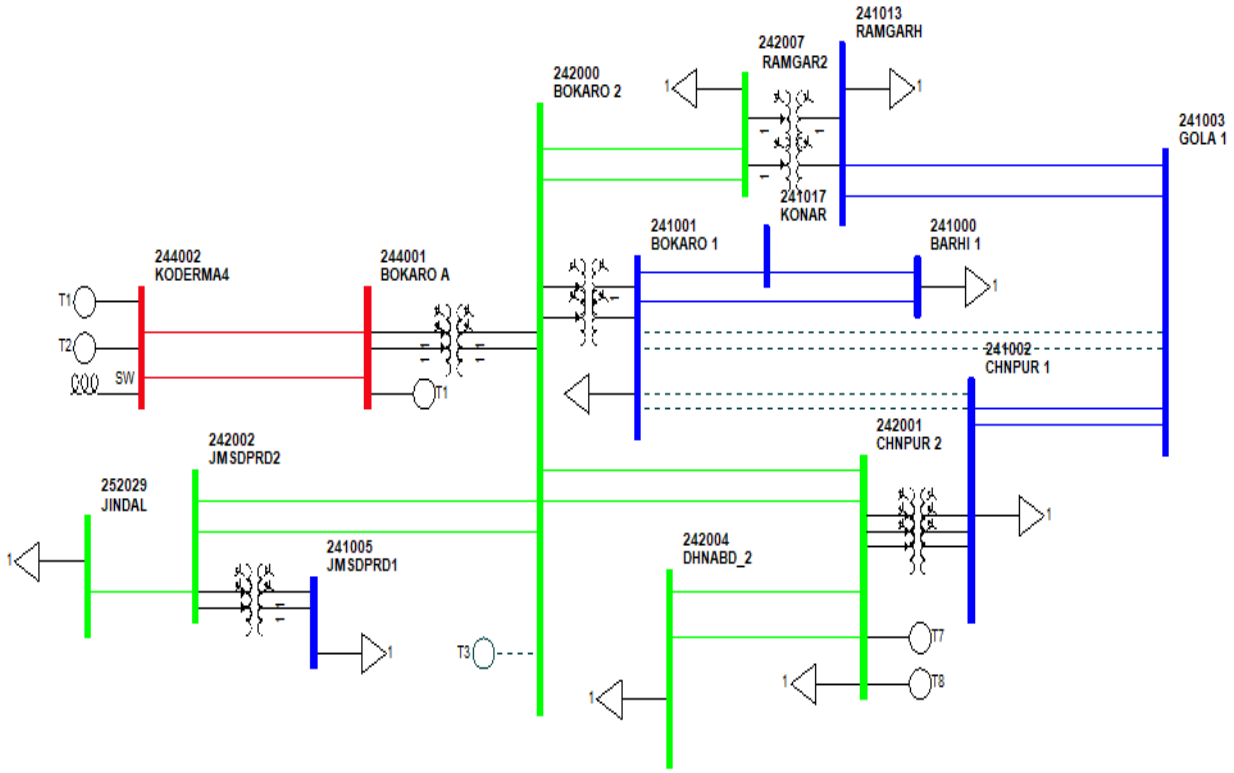
Gen. Loss: 178 MW

Outage Duration: 04:38 Hrs

OHPC & OPTCL may explain.

ITEM NO. B.3: Total Power Failure at 220 kV Bokaro Substation on 18/07/2021 at 19:37 Hrs

At 19:37 hrs, Bus differential protection of 220 kV Bus 1&2 at Bokaro TPS- B operated. As a result all the feeders connected to 220 kV Bus I & Bus II got tripped leading to total power failure at 220/132 kV Bokaro S/S, 220/132 kV Ramgarh, 132 kV Patratu, 132 kV North Karnpura.



Relay Indications :

Time	Name	End 1	End 2	PMU Observation
19:37 Hrs	220 kV Bus I & Bus II at Bokaro	Bus differential relay operated due to bus fault at BTPS-B	NA	PMU captured at Bokaro shows fault was cleared in around 1.5 seconds after first dip.
	2*315 MVA 400/220 kV ICTs at Bokaro			
	150 MVA 220/132 kV ICT I at Bokaro			
	220 kV Bokaro – Chandrapura D/C		Yet to be received	
	220 kV Bokaro – Jamshedpur D/C			
	220 kV Bokaro – Ramgarh D/C			
	132 kV Gola-Ramgarh-I	R/I of L-55 at Gola end- D.P. - B, O/C, E/F, VAJ 86, Zone 2.		
	132 kV Gola-Ramgarh-I	R/I of L-56 at Gola end- D.P - B, C, B/U, O/C, E/F, and Zone 3.	R/I of L-56 at Ramgarh end- 21M1, R & B ph. , 21M2 B-Ph.	

The detailed report from ERLDC is attached at **Annexure B.3.**

Load Loss: 254 MW

Outage Duration :00: 32Hrs

DVC may explain.

ITEM NO. B.4: Total Power Failure at 220 kV Parulia(DVC) Substation on 28/07/2021 at 02:26 Hrs

At 02:20hrs ,220 kV Parulia(DVC)–DSTPS-1 tripped in R-Y-Earth fault followed by tripping of 220 kV Parulia (DVC)-Parulia PG D/C and Parulia DVC –DSTPS-2 in Y-Earth fault.

220 kV Parulia(DVC)–Muchipara D/C was already in open condition leading to complete blackout of 220 kV Parulia DVC S/S along with interruption of power supply at DSP (Tamla) affecting power failure at oxygen plant as well.

The following issue was observed in this grid incident –

Unwanted tripping of 220 kVParulia (PG)- Parulia (DVC) through Back Up O/C Hi Set Protection was observed at PGCIL End , much before clearing of fault present in 220 kV Parulia -DSTPS line 2 from both ends in zone 1.

Relay Indications:

Time	Name	End1	End2	PMU Observation
02:20	220kV Parulia DVC-DSTPS-1	Z-1,No annunciation	R-Y-Earth,Z-1,A/R successful ,0.1kM,Ir=16.23kA,13.43kA	PMU captured at Durgapur shows R-YEarth fault cleared in 100ms seconds and dip of around 35 kV.
02:26	220kV Parulia DVC-DSTPS-2	Y-Earth,Z-1	Y-Earth,Z-1,5.34 kM, Fc= 6.9 kA; Conductor snap at LOC:68	PMU captured at Durgapur shows YEarth fault cleared in 100ms seconds and dip of around 48 kV
	220kV Parulia DVC-Parulia PG1	Y-Earth,Z3,Iy=2.188kM,Iy=7.93kA	High set O/c operated within 100ms	
	220kV Parulia DVC-Parulia PG-within 100ms. 2	Y-Earth,Z3,Iy=2.359kM,Iy=7.389kA		

The detailed report from ERLDC is attached at **Annexure B.4.**

Load Loss: 140 MW

Outage Duration :00: 42 Hrs

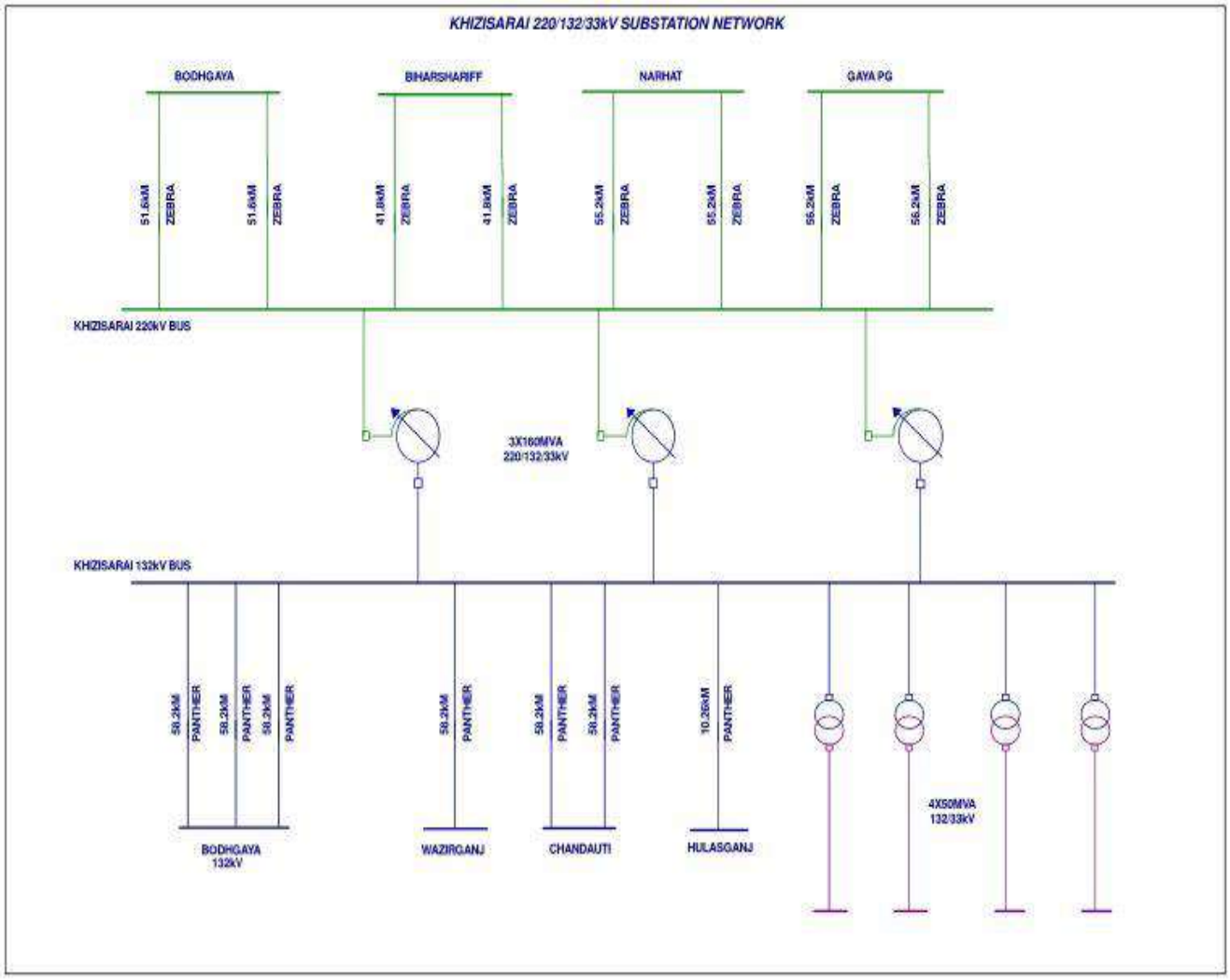
DVC and Powergrid may explain.

ITEM NO. B.5: Disturbance at 220 kV Khizisarai Substation on 25/07/2021 at 19:05 Hrs

At 19:05 hrs, 220kV Gaya-Khizisarai-1 tripped in Yphase to Earth fault from Khizisarai end. At the same time 220kV Biharshariff-Khizisarai-D/C tripped in R-Y-Earth fault leading to turning Khizisarai bus dead.

Relay Indications:

Time	Name	End 1	End 2	PMU Observation
19:04 Hrs	220 kV Gaya-Khizisarai-1	Y-Earth ,2.04kA,56.2kM (100 %),A/R successful	Yet to receive	PMU captured at Chandauti and Biharshariff shows existence of R-Y fault with 3kV and 20 kV dip in both the phases respectively and fault clearing time was within 160 msec.
	220kV Khizisarai-Biharshariff -1		R-Y-Earth, Z2,71.04 kM, Ir= 3.9kA, Iy:=2.5kA, Ib=646.8 A, Fr=7.9ohm	
	220kV Khizisarai-Biharshariff -2		R-Y-Earth, Z3,74 kM, Ir- 3.kA, Iy=2.7kA, Ib=656.1 A129.4kV,Fr=9.1ohm	



The detailed report from ERLDC is attached at **Annexure B.5.**
Load Loss: 300 MW

Outage Duration:00: 15Hrs

BSPTCL/BGCL may explain.

ITEM NO. B.6: Disturbance at 220 kV Darbhanga(BSPTCL) Substation on 28/07/2021 at 07:32 Hrs

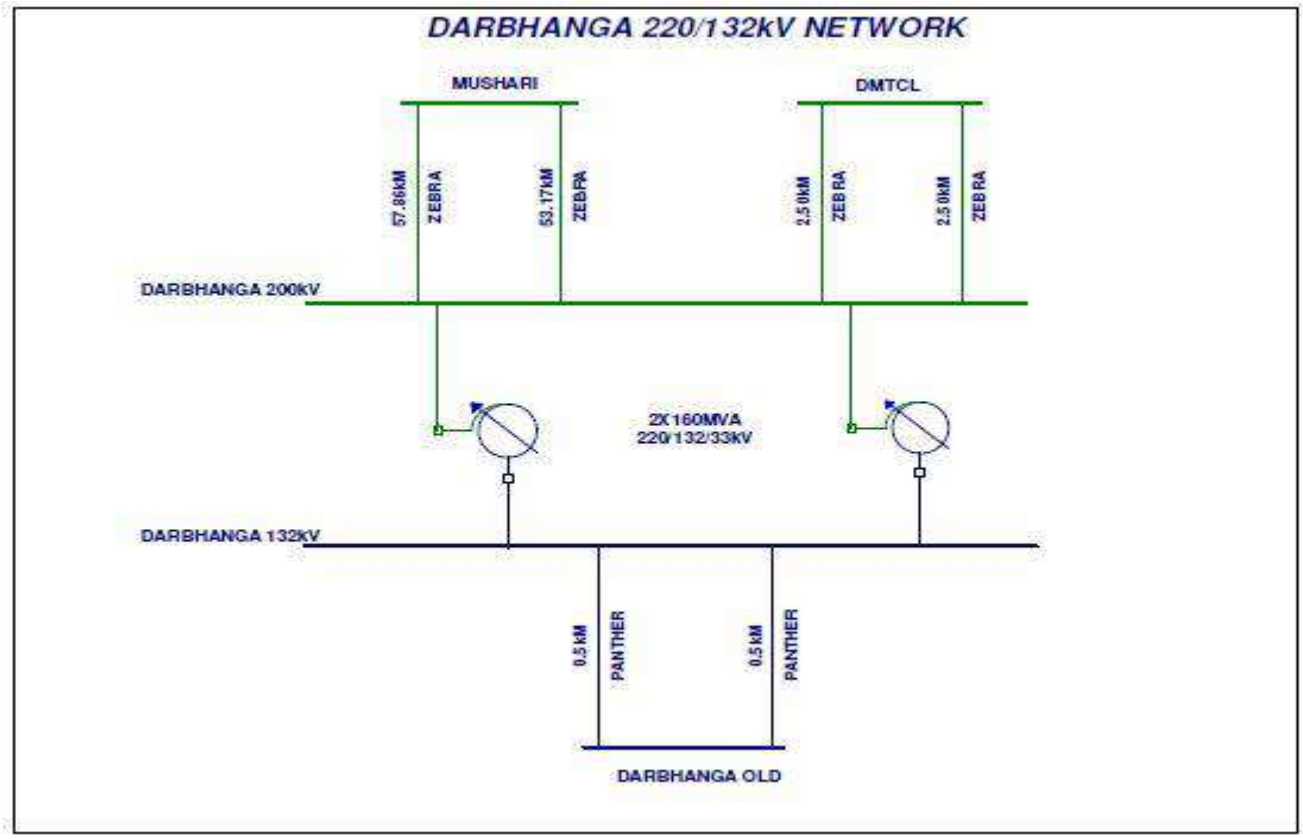
At 07:33 Hrs, HV side R phase bushing of 220/132 KV (160 MVA) ATR got blasted and resulted in tripping of ATR due to operation of differential protection.

Subsequently, 220/132 KV 200 MVA ATR-1 tripped on O/C. This led to total power failure on 132 KV side of Darbhanga (BSPTCL). 220 KV Darbhanga (BSPTCL)-Musahari-2 sensed the same fault and tripped from Musahari end only. Later, all 220 KV lines at Darbhanga (BSPTCL) were manually hand-tripped due to fire in the substation initiated due to blasting of Bushing.

Following issues are observed in this incident:

- 220/132 KV 200 MVA ATR-1 should not trip on O/C immediately as total load after tripping of ATR-2 was less than 100% of its rating. O/C settings of both 220/132 KV ATRs need to be reviewed and revised as margin available.
- 220 KV Darbhanga (BSPTCL)-Musahari tripped from Musahari end only in Zone 1.

The detailed report from ERLDC is attached at **Annexure B.6.**



Relay Indications:

Time	Name	End 1	End 2	PMU Observation
07:33 Hrs	220/132 KV 160 MVA ATR-2 at Darbhanga (BSPTCL)	Differential relay operated		PMU at Muzaffarpur captured R_N fault which was captured within 100 msec
	220/132 KV 200 MVA ATR-1 at Darbhanga (BSPTCL)	Tripped on O/C		
	220 KV Darbhanga (BSPTCL)-Musahari-2	Darbhanga: Didn't trip (hand-tripped at 07:36 Hrs)	Musahari: R_N, Z I	
07:36 Hrs	220 KV Darbhanga (BSPTCL)-Musahari-1	hand-tripped (Line was idle charged from Darbhanga)		
07:36 Hrs	220 KV Darbhanga (BSPTCL)-Darbhanga (DMTCL)-1	Manually hand-tripped from BSPTCL end	Didn't trip	
07:36 Hrs	220 KV Darbhanga (BSPTCL)-Darbhanga (DMTCL)-2			

Load Loss: 211 MW

Outage Duration:02: 05 Hrs

BSPTCL may explain.

ITEM NO. B.7: Disturbance at 220/132 kV Sonenagar(BSPTCL) Substation

A) On 16/07/2021 at 19:04 Hrs

During testing of 220/132 kV ICT-3 at Sonenagar, 220 kV Chandauti-Sonenagar D/C tripped due to operation of LBB protection resulting in total power failure at 220/132 kV Sonenagar S/s.

It resulted in interruption of power supply to Sonenagar, Aurangabad, Japla and Nagaruntari (Jharkhand).

Relay Indications:

Time	**Name**	**End 1**	**End 2**	**PMU Observation**
19:04 Hrs.	220 kV Chandauti - Sonenagar - 1	Yet to receive	LBB operated	No fault observed in PMU.
	220 kV Chandauti - Sonenagar - 2	Yet to receive	LBB operated	
	132 kV Sonenagar – Sonenagar D/C	NA		

Load Loss: 157 MW

Outage Duration : 00:11 Hrs

B) On 31/07/2021 at 12:13 Hrs

220 kV Chandauti-Sonenagar D/C tripped due to bus bar operation of bus bar 1 at Sonenagar. Both the circuits were connected to bus bar 1 at Sonenagar.

Load Loss: 12 MW
Outage Duration : 00:11 Hrs

Further in 104th PCC Meeting, BSPTCL was advised to implement week infeed/radial feeder protection at Sonenagar end for 220 kV Chanduati – Sonenagar lines and advised Powergrid to implement permissive overreach (POP) protection at Chandauti end for the above line.

BSPTCL & Powergrid may explain.

ITEM NO. B.8: Total Power Failure at 220 kV Ronginchu HEP

A) On 14/07/2021 at 11: 27 Hrs

220 kV Rangpo-Ronginchu-2 was under shutdown since 08:15 hrs on 14-07-2021. Power generated at Ronginchu HEP was being evacuated through 220 kV Rangpo-Ronginchu – 1 which was the only available connection between Ronginchu HEP and rest of grid.

At 11:27 hrs, 220 kV Rangpo- Rongnichu-1 tripped from Ronginchu end leading to loss of evacuation path for Ronginchu HEP.

Relay Indications :

Time	Name	End 1	End 2	PMU Observation
11:27	220 kV Rangpo-Ronginchu-1	Did not trip	Tripped from Ronginchu end	Around 0.5 kV dip has been observed in all phases Rangpo PMU.

Gen. Loss: 73 MW

Outage Duration: 02:04 Hrs

Ronginchu HEP and Powergrid may explain.

B) On 15/07/2021 at 01:38 Hrs

On 15-07-2021 at 01:38 hrs, 220 kV Rangpo-Rongnichu-1 tripped from Rongnichu end due to overcurrent relay operation. Both running units at Rongnichu HEP tripped due to loss of evacuation path as 220 kV Rangpo-Rongnichu circuit II was already under shutdown.

Relay Indications:

Time	Name	End 1	End 2	PMU Observation
01:38	220 kV Rangpo-Ronginchu-1	Did not trip	Tripped from Ronginchu end	No voltage dip observed in Rangpo PMU.

Following issues were observed related to this disturbance –

- As seen from DR in both cases no fault has been observed and also line did not tripped from Rangpo end as can also be seen from DR.
- As there was no Fault in line, wrong overcurrent relay setting was suspected for such mal-tripping which was later confirmed by Rongnichu that there was a problem with the logic of REL650 Relay. It was rectified. E/F trip settings of P442 and REL650 were revised from PU-80A & TMS-0.5 to PU-200A &TMS- 0.515 in IEC SI curve. DT setting of 80A/0.6 Sec was disabled.

Gen. Loss :80 MW

Outage Duration : 00:32 Hrs

Ronginchu HEP and Powergrid may explain.

ITEM NO. B.9: Bus tripping occurred in Eastern Region during June /July-2021

During June/July 2021, following incidents of bus bar tripping had been observed in Eastern Region.

Element Name	Tripping Date	Reason	Utility
400 kV Main bus - 1 at Motihari	02-06-2021 at 21:17 Hrs.	LBB operated while making charging attempt for 400 KV Barh-Motihari-1 line	DMTCL
400 kV Main bus - 2 at Motihari	06-07-2021 at 12:14 Hrs.	Flashover occurred in isolator bay of Raxaul II	DMTCL
220KV MAIN BUS - 2 AT TSTPP	02/07/2021 at 15:23 Hrs.	spurious bus bar protection operated at 220 KV main bus 2	TSTPP

Regarding event on 02/06/21 following deliberations took place in 104th PCC Meeting –

DMTCL informed that 400 kV Barh-Motihari-1 line got tripped due to conductor snapping in the line. During charging attempt of the line, LBB operated and tripped the 400 kV Bus-1 at Motihari S/s.

They informed that the data related to this tripping could not be extracted from the relays due to issue in software version of the relay. The same would be resolved within a day.

PCC advised DMTCL to analyze the tripping after extracting the DR information from the relays and submit a report to ERPC/ERLDC regarding the above tripping.

DMTCL and TSTPP(NTPC) may explain.

ITEM NO. B.10: Repeated Tripping of Transmission Lines

B.10.1: 220 kV Purnea -Khagaria and associated Issues

It has been observed that 220 kV Purnea -Khagaria circuit has tripped multiple times in last few months.

Line tripping details are mentioned below-

Sr No.	Element Name	Tripping Date	Tripping Time	Relay (Purnea end)	Relay (Khagaria end)
1	220KV-KHAGARIA-NEW PURNEA-2	27-05-2021	23:22	NEW PURNEA: Y-B, 36KM, IY-5.55KA, IB-5.54KA	
2	220KV-KHAGARIA-NEW PURNEA-2	25-05-2021	04:24		Khagaria- B-N Zone-1 FC: 1.144kA Distance: 58.27km
3	220KV-KHAGARIA-NEW PURNEA-2	12-05-2021	16:34	New Purnea- Z1 Y-B FC-Iy-7kA Ib-7kA FD-24.6kA -Distance: 72.5km,	Khagaria Z1 Y-B- FC-Iy-1.39kA Ib-1.50kA
4	220KV-KHAGARIA-NEW PURNEA-2	08-05-2021	02:57	PURNEA - Y_B , IY 4.5 KA , IB	KHAGARIA , - Y_B , IY - 1.75 KA , IB -1.83 KA , 47.39 KM

				- 4.5 KA , FD - 47.39 KM	
5	220KV-KHAGARIA-NEW PURNEA-2	03-05-2021	18:38	New Purnea: Y_B_N, 58.8 KM, Iy=Ib=4.2 kA	Khagaria: Y_B_N, 34.1 KM, Iy=Ib= 1.90 kA
6	220KV-KHAGARIA-NEW PURNEA-2	01-07-2021	06:25		KHAGARIA:- Z-1, 26.35KM, R-N FAULT, IR= 1.95KA
7	220KV-KHAGARIA-NEW PURNEA-2	02-07-2021	19:56	NEW PURNEA: A/R SUCCESSFUL, R-N, 4.6KA, 40KM	
8	220KV-KHAGARIA-NEW PURNEA-2	06-07-2021	11:24	NEW PURNEA - FAULT - B_N , FD - 43.4 KM , FC - 3.14 KA (A/R , SUCCESSFUL)	TRIP FROM KHAGARIA SIDE - B_N , FD- 74.12 KM , FC - 1.042 KA
9	220KV-KHAGARIA-NEW PURNEA-2	16-07-2021	12:03	New Purnea: B_N, 61.1 KM, 2.771 kA	
10	220KV-KHAGARIA-NEW PURNEA-2	17-07-2021	04:04		KHAGARIA:- Distance Protection Operated-Phase Zone-1 Ir: 2.11kA, Distance: 17.2km

Issues associated with these tripping based on preliminary investigation carried out by ERLDC are provided below:

1. **Protection Issue:** It has been observed that whenever there is a fault in any phase, that phase gets opened immediately but after 500ms of that other two phases are also getting opened. Line current of rest 2 phases are becoming zero which can be observed from attached DRs for all cases. This is observed at Purnea end.
2. **Issue of Auto reclose** can also be seen in attached DR which shows that A/R is not occurring when rest 2 phases are being opened, this can be properly analyzed for root cause identification and mitigation.
3. **Fault due to Arc over / Tree Fault:** From DR signature analysis it is observed that in all cases, faults are occurring at voltage peak as arc over is occurring at voltage peak due to high electrical stress. Fault currents are symmetrical and have no DC offset due to vegetation fault occurring at peak and with increasing nature of current.

Details related to analysis for these events are attached at **Annexure B.10.1.**

BSPTCL & Powergrid may explain.

B.10.2: Repeated Tripping of 220 kV Budhipadar-Korba & 220 kV Budhipadar-Raigarh line and associated Issues

It has been observed that 220 kV Budhipadar-Korba & 220 kV Budhipadar-Raigarh ckts had tripped multiple occasions in last few months. Based on available DR analysis, it was observed that faults are occurring due to ROW vegetation issues. In addition to that , protection and Auto reclosure issues are also observed for these circuits.

The report by ERLDC is attached at **Annexure B.10.2.**

The details of line tripping are given below:

SL NO	ट्रिप हुए पारेषण तत्त्व का नाम / Name of Transmission element tripped	ट्रिप होने की तिथि /Date of Tripping	ट्रिप होने का समय/ Time of Tripping	रिले संकेत स्थानीय छोर /Relay Indication LOCAL END	रिले संकेत दूरस्थ छोर/ Relay Indication REMOTE END	टिप्पणि/ Remarks
1	220 kV BUDIPADAR-RAIGARH	7-May-21	18:57	Y-N,FD 47KM,FC 3.38KA		3 Phase tripping for single phase fault at the instant of fault .No auto reclose attempt as ,No A/R scheme due to non availiabilty of PLCCat Budhipadar end .Suspected Row issue /Vegetation fault observed from DR in each month tripping of these lines are observed.
2	220 kV BUDIPADAR-KORBA-1	7-May-21	18:57	Y-N,FD 55KM,FC 2.33KA		3 Phase tripping for single phase fault at the instant of fault .No auto reclose attempt as ,No A/R scheme due to non availiabilty of PLCCat Budhipadar end .Suspected Row issue /Vegetation fault observed from DR in each month tripping of these lines are observed.
3	220 kV BUDIPADAR-KORBA-1	19-May-21	12:07	Z1, B-N, 3.15kA, 32Km	Z-2 from Raigarh	3 Phase tripping for single phase fault at the instant of fault .No auto reclose attempt as ,No A/R scheme due to non availiabilty of PLCCat Budhipadar end .Suspected Row issue /Vegetation fault observed from DR in each month tripping of these lines are observed.
4	220 kV BUDIPADAR-RAIGARH	31-May-21	18:35	Z-1, B-N, FC: 4.63 KA, FD: 16.5 Km	Z-2 from Raigarh	3 Phase tripping for single phase fault at the instant of fault .No auto reclose attempt as ,No A/R scheme due to non availiabilty of PLCCat Budhipadar end .Suspected Row issue /Vegetation fault observed from DR in each month tripping of these lines are observed.
5	220 kV BUDIPADAR-KORBA-2	8-Jun-21	19:42		Z-2 from Raigarh	3 Phase tripping for single phase fault at the instant of fault .No auto reclose attempt as ,No A/R scheme due to non availiabilty of PLCCat Budhipadar end .Suspected Row issue /Vegetation fault observed from DR in each month tripping of these lines are observed.
6	220 kV BUDIPADAR-KORBA-2	14-Jun-21	17:57	Budhipadar:R_N, 3.65 kA, 42.3 KM		3 Phase tripping for single phase fault at the instant of fault .No auto reclose attempt as ,No A/R scheme due to non availiabilty of PLCCat Budhipadar end .Suspected Row issue /Vegetation fault observed from DR in each month tripping of these lines are observed.
7	220 kV BUDIPADAR-RAIGARH	7-Jul-21	12:06	Budhipadar end-Z1 B-N, FC-4.09 kA FD-11.9 km,	Z-2 from Raigarh	3 Phase tripping for single phase fault at the instant of fault .No auto reclose attempt as ,No A/R scheme due to non availiabilty of PLCCat Budhipadar end .Suspected Row issue /Vegetation fault observed from DR in each month tripping of these lines are observed.

OPTCL may explain.

ITEM NO. B.11: Status of Islanding Schemes in Eastern Region

1. KBUNL Islanding Scheme

In special meeting held on 08.06.2021, following deliberations were made –

1. KBUNL Islanding scheme would be designed considering both units of KBUNL stage-II (2x195 MW) as participating generator and connected radial loads at Gopalganj along with in-house load of KBUNL.

2. The islanding frequency will be at 48.6 Hz and this is subject to revision based on the suggestion received from KBUNL/OEM on underfrequency settings of the generator units.

3. Based on the revised simulation study result, ERLDC would communicate the desired frequency band to KBUNL for their units for stable operation of the islanding scheme. KBUNL would review the proposed range for frequency settings in consultation with their engineering wing & OEM and communicate their observation to ERLDC in this regard. They would also take up for dynamic simulation study with regard to islanding mode of operation of the units.

4. KBUNL would confirm the provision of Islanding mode of operation in the governors of their Stage-II units.

5. Based on the response received from KBUNL to the above queries, a separate meeting would be convened to discuss further course of action.

6. KBUNL would expedite the construction work related to implementation of Islanding scheme in switchyard. They would also take up with concerned OEM for testing and commissioning of islanding relay panel at their end.

7. BSPTCL to submit the present status of the availability of communication channels (i.e. availability and status of OPGW, PLCC, DTPC coupler) in the transmission lines/substations considered under KBUNL islanding scheme.

In 104th PCC Meeting , *NTPC informed that they had approached OEM for getting their views/observations with regard to Islanding mode of operation in KBUNL units. However, no response have been received from them till date.*

Regarding proposed range in frequency settings, they mentioned that the settings have been forwarded to their engineering wing for review.

MS, ERPC stressed that the islanding scheme is being monitored in highest level of Govt of India & advised all concerned utilities to take the matter on priority & expedite the work related to implementation of islanding schemes.

NTPC replied that they would furnish the latest updates within a week.

Regarding bay construction work at KBUNL switchyard, they updated that it would be completed within the target date i.e. Sep'21.

BSPTCL submitted the present status of the communication channels in the transmission lines under KBUNL scheme. They submitted that all pending work would be completed within a month.

KBUNL may update.

2. CTPS Islanding Scheme

In special meeting held on 08.06.2021, following deliberations were made :

1. ERLDC would share the simulation study report with all concerned in DVC i.e. SLDC DVC, SPE wing of DVC & CTPS-B.

2. The CTPS-B islanding scheme is to de designed with two units of CTPS-B (2x250 MW) generating station as participating generator and connected loads at CTPS, Putki, Biada, Nimiaghata & Patherdih.

3. The islanding frequency for CTPS-B islanding system was decided as 48.4 Hz.

4. CTPS-B would take up with their OEM for confirmation of the following

➢ Provision of Islanded mode of operation in the governor of CTPS-B units.
➢ Provision for increasing the turbine over frequency settings to a higher value or enhancement of the time delay in existing settings.
➢ Detail study of islanding response of CTPS units based on the necessary simulation at islanding frequency of 48.4 Hz.
➢ Detailed study on dynamics of governor and turbine during formation of island at islanding frequency of 48.4 Hz.

5. DVC would take up with concerned OEM for necessary installation & testing of islanding panel at CTPS-B end.

In special meeting held on 06.08.2021, *following deliberations took place –*

Regarding increasing the turbine over frequency settings to a higher value or enhancement of the time delay in existing settings, they informed that their C & I wing as well as OEM had expressed their reservation in raising the overfrequency setting or increasing the time delay.

Representative of SPE wing of DVC updated that necessary discussion for implementation of the scheme at CTPS-B is going on with M/s GE for finalization of the scope of work & other modalities. He submitted that the tender process for implementation of islanding scheme would be initiated within two weeks.

DVC was advised to prepare the detail action plan for implementation of the scheme along with time line for each milestone and submit it to ERPC secretariat within fortnight. They were also advised to take all measures in expediting the implementation work.

DVC may update.

3. IB-TPS Islanding Scheme

In special meeting held on 09.04.2021, OPGC representative informed the followings:

a) PLCC work has already been completed and the signal is available at their end.
b) The annual overhauling of IBTPS is scheduled on 17th April 2021 for 25 days.
c) OEM (BHEL) is developing a new scheme and the same would be implemented during the overhauling period after getting confirmation from OEM.

OPGC was advised to share the requisite details to ERPC secretariat at the earliest.

In 104th PCC Meeting ,OPGC informed that as per the recommendation of their OEM(M/s BHEL), since governor of the Ib TPS units are quite old, the units can be run in islanded mode of operation

only if the load variation lies within 5 %.

PCC opined that the load variation is inherent in any of the islanding system. However, the islanding study is always carried out considering 5 % droop of the unit & keeping other constraints of the units into consideration. In case of any technical constraints, UFR based load shedding within island or any other SPS mechanism can be implemented.

PCC advised OPGC to consult their OEM & submit the OEM recommendation/observation regarding all the constraints in the generating units with respect to islanding mode of operation to ERLDC by July'21.

***In special meeting held on 06.08.2021**, following deliberations took place –*

OPGC representative informed that work order had been placed on OEM M/s BHEL for implementation of the Islanding scheme at IB TPS units. However, they are facing great difficulty in getting the response from OEM.

MS, ERPC advised OPGC to submit all the relevant documents with regard to their communication with OEM to ERPC secretariat so that the issue may be taken up with appropriate authority.

OPGC was also advised to take up the issue with their highest authority as well as with the OEM for expediting the implementation of islanding scheme.

OPGC may update.

4. Patna Islanding Scheme

In special meeting held on 29.06.2021, BSPTCL was advised to submit the followings:

- Revised load details of Patna city (excluding the traction load & loads covered under AUFLS) considering maximum load that can be accommodated under islanding scheme as 550 MW. Also, the above load figures may be calculated based on the actual load pattern for last 1-2 years period.
- Network map indicating all 220 kV & 132 kV substation details which are to be included in the islanding scheme along with the disconnection points. The network map has to be prepared taking into consideration the substations/lines to be commissioned in near future. The timeline of the upcoming substation/lines has also to be submitted.
- To submit availability as well as type of communication systems present in lines/substations inside the island network.
- Further the proposed load & network connections for Islanding scheme need to be modelled and submitted as PSSE base case.

***In special meeting held on 06.08.2021** following deliberations took place –*

1. SLDC Bihar was advised to submit the following:

I. Revised base case considering the following:

- *Peak load scenario of 2021-22(March-22)of the Patna Islanding area.*
- *Off-peak load scenario of 2021-22(March-22) in Patna Islanding area.*
- *Critical/essential loads of Patna (Load to be considered during islanding operation with one unit of NPGC).*

II. *The disconnection points may be reviewed by SLDC, Bihar considering their operation philosophy in practice.*

III. *The present status of the availability of communication channels(i.e. availability & status of OPGW/PLCC, DTPC coupler)in transmission lines/substations considered under the Patna Islanding scheme.*

IV. *SLDC Bihar was also advised to make a provision of dedicated page in SCADA display in their control room for Patna Islanding Scheme. Through the display, vital parameters like actual generation & load within the electric boundary of the island, voltage, frequency, power flow in peripheral lines can be monitored.*

2. NPGC was advised to submit the inhouse load quantum of Nabinagar units to ERPC and ERLDC.

3. BGCL was advised to submit the present status of the work for 440/220/132 kV Jakhanpur S/s and its associated 220kV and 132 kV lines along with the target date of completion to ERPC and ERLDC.

4. It was decided that tentative frequency for triggering of the islanding operation would be considered at 48.4 Hz. This frequency would be reviewed after completion of the islanding simulation study by ERLDC.

On receipt of the revised base case and confirmation of disconnection points and by Bihar, ERLDC would carry out further study & submit their observation within two weeks.

SLDC Bihar & NTPC may update.

5. Ranchi Islanding Scheme

In special meeting held on 29.06.2021, JUSNL was advised to submit the followings:

- Category wise bifurcation of the load (essential, critical etc.)
- Details of new substation/lines to be commissioned in near future with timeline and their connectivity and load details.
- Network map indicating all 220 kV & 132 kV substation details which are to be included in the islanding scheme along with the disconnection points. The network map has to be prepared taking into consideration the substations/lines to be commissioned in near future. The timeline of the upcoming substation/lines has also to be submitted.
- The proposed load & network connections for Islanding scheme need to be modelled and submitted as PSSE base case.
- Availability as well as type of communication systems present in lines/substations inside the island network.

In special meeting held on 06.08.2021 *following deliberations took place –*

1) *The Ranchi islanding scheme would be designed considering the present network configuration excluding the new/upcoming substations.*

2) *The island would be formed with one unit of TenughatTPS(150-160 MW average generation) & Inland IPP(50-55 MW average generation) as participating generator & essential/critical loads of Ranchi to the tune of 180 MW.*

3) *JUSNL would submit the revised base case considering only critical/essential loads of Ranchi which is to be considered under islanding scheme along with the disconnection points.*
4) *Considering the age of Tenughat units and to enhance the success rate of island, it was decided that triggering frequency for of the islanding operation would be kept at 48.5 Hz. This frequency would be reviewed after completion of the islanding simulation study by ERLDC.*

5) *On receipt of the revised base case & disconnection details, ERLDC would carry out further study & submit their observation within two weeks.*

SLDC Jharkhand may update.

ITEM NO. B.12: LMU Replacement for ensuring healthiness of PLCC link at Maithon end for 400 kV Maithon-Mejia lines – Powergrid

400KV Maithon-Mejia Ckt.-I, II & III have old BPL make PLCCs and these links had repetitive cards / modules failure history in the past.

In order to rectify this, Powergrid had planned to replace those old BPL make PLCC with ABB make PLCC. During retrofitting work, significant loss was observed inside the LMUs which was installed with BPL panel. Therefore these old LMUs need to be replaced for healthiness of line.

They informed that line shutdown is required for replacement of LMU. For circuit 1, planned shutdown was already approved in OCC and LMU would be replaced during that period. Powergrid had requested to provide 3 hours shutdown for Circuit-II & III on dated 10.08.2021 & 11.08.2021 respectively.

It was proposed by Powergrid that the Shutdown for the replacement of PLCC work may be approved as System improvement purpose and outage of the feeders may not be affected in their Regional Availability.

Powergrid may elaborate. Members may discuss.

ITEM NO. B.13: Tripping Incidence in month of July 2021

Tripping incidents in the month of July 2021 which needs explanation from constituents of either of the end is enclosed at **Annexure B.13.**

Concerned utilities may explain.

PART- C:: OTHER ITEMS

ITEM NO. C.1: Collection of substation data by PRDC

PRDC is collecting the substation data and maintaining the database for the Eastern Region. The data for following new substations are to be collected:

Sl No.	SubStation Name	Location	Owner	Data Collection Status
1	NEW_JEERAT	WEST BENGAL	PMJTL	Under Construction
2	PANAGARH	WEST BENGAL	WBSETCL	Completed
3	MOHITNAGAR	WEST BENGAL	WBSETCL	Completed
4	BARUIPUR	WEST BENGAL	WBSETCL	Under Construction
7	MEDINIPORE	WEST BENGAL	PMJTL	Completed
8	SATASANKHA	ODISHA	OPTCL	Completed
9	JAYPATNA	ODISHA	OPTCL	Completed
10	SUNDARGARH	ODISHA	PGCIL	Completed
11	DARLIPALLI	ODISHA	NTPC	No
12	CHANDAUTI	BIHAR	PMTL	Completed
13	KHAGARIA 220kV	BIHAR	PMTL	Completed
14	MOKAMAH	BIHAR	BGCL	Completed
15	DUMRAON NEW	BIHAR	BGCL	Completed
17	SITAMARHI	BIHAR	PMTL	Completed

PRDC may update.

ITEM NO. C.2: Backup Overcurrent Relay coordination for Sikkim Complex.

In 97th PCC following deliberations were made,

It was informed that IDMT characteristics were implemented at Jorethang and Tashiding.

In 103rd PCC following deliberations took place –

Powergrid informed that the protection philosophy for backup protection of lines & ICTs being followed by them in Sikkim Complex is as follows:

- Philosophy of T-op for Lines = (Z3 + 0.1) Sec,
- Philosophy of T-op for Transformer = (Z3+0.1) for O/C & (Z3+0.2) for E/F

However, the proposed settings for ICTs based on PRDC study is:

- T-op for HV & LV side=0.8 Sec for O/C and T-op for HV & LV= 1.4 sec for E/F

They suggested to review the proposed settings in line with their existing settings for lines & ICTs in Sikkim Complex.

They further informed thatzone 3 settings of 400 kV Kishangunj-Rangpoline is 1.5 second whereasproposed settings for backup overcurrent relay of line is 1.2 second which would result in tripping of DEF before zone 3 of distance protection.

PCC advised PRDC to carry out revised study considering the existing zone-3 settings by Powergrid and share report among concerned utilities for implementation of revised settings at their end.

In 104th PCC, PRDC informed that the revised study considering the zone-3 settings of the transmission lines in Sikkim Complex would be completed within a week.

PCC advised PRDC to share the report among concerned utilities for implementation of revised settings at their end.

Further, the revised study had been carried out by PRDC considering the Powergrid philosophy in practice & existing zone-3 settings of the line. The report is enclosed at **Annexure C.2.** It is requested to implement the proposed settings at respective ends.

Members may update.

ITEM NO. C.3: Transformer overcurrent earthfault Setting Guidelines-ERLDC

In the recent past few uncoordinated tripping of Transformers have been observed where conservative earth fault overcurrent setting is found to be the main reason.

As presently there are no setting guidelines in the protection philosophy of ERPC on this aspect, there is a need for introducing a general guideline to help utilities avoiding any conservative setting and uncoordinated tripping. One such general guideline for the earth fault overcurrent setting is provided below for discussion.

A. The primary requirement for the stage 1 setting should be to detect earth faults at the local bus bar, where the transformer winding is connected. Therefore, a fault calculation should be made as per figure 1. This calculation provides the current fed to the protection i.e. $3I_{0fault1}$. To assure that step 1 calculation to have selectivity for other earth-fault protection in the network, a short delay may be selected. Normally, a delay in the range of 0.3 – 0.4 s is appropriate under such conditions.

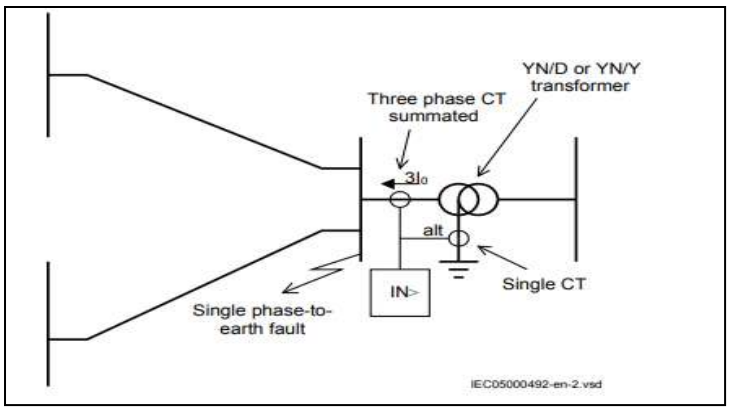


Figure 1: Step 1 fault calculation 1

Further to ensure selectivity to delayed line faults clearance at the local bus (typically distance protection operation in zone 2 in 0.5 sec), the current setting must be set high enough so that these faults do not result in unwanted step 1 trip of transformer on earth fault stage 1 setting.

Therefore, a fault calculation as shown in figure 2 is also required to be done. If the fault is located at the borderline between the instantaneous and delayed operation of the line protection (such as Distance protection or line residual overcurrent protection), the above calculation gives the current fed to the protection i.e. $3I_{0fault2}$ the setting of step 1 can be chosen within the interval shown relation given below for the above calculations.

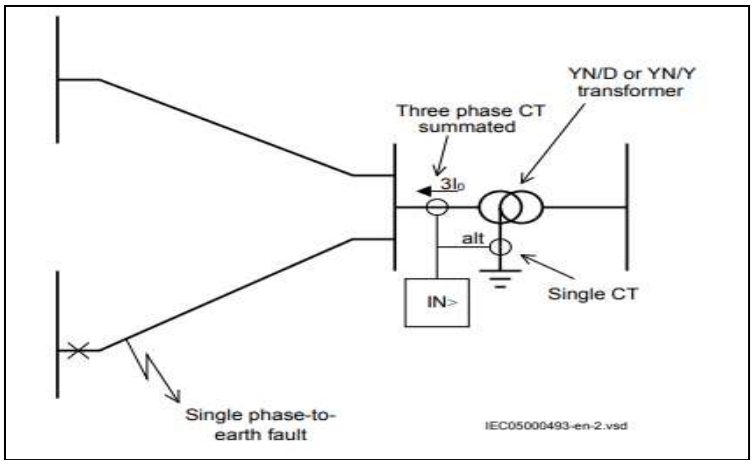


Figure 2: Step 1 fault calculation 1

$$3I_{0fault2} \cdot lowmar < I_{step1} < 3I_{0fault1} \cdot highmar$$

Where **lowmar** is a margin to assure selectivity (typical 1.2) and **highmar** is a margin to assure fast fault clearance of busbar fault (typical 1.2)

Earth fault overcurrent Stage 2 setting:

The setting of the sensitive step-2 is dependent on the chosen time delay therefore often a relatively long definite time delay or inverse time delay is selected. For this, a very low current setting (Minimum setting possible) can be selected as it is required to detect earth faults in the transformer winding, close to the neutral point. However, zero-sequence currents that can occur during normal operation of the power system are also required to be considered while selecting this current value for pickup.

ERLDC vide e-mail dated 02/07/2021 circulated the recommendation for backup O/C & E/F settings for Transformers among all the utilities.

In 104th PCC meeting,

PCC advised ERLDC to do modifications in the draft recommendation according to suggestions received from utilities and share with all the utilities.

PCC also informed that these are general recommendations and these guideline may be fine-tuned by the utilities as per their existing practices.

Further, ERLDC vide e-mail dated 19/07/2021 circulated the revised recommendation for backup O/C & E/F settings for Transformers among all the utilities. The report is enclosed at ***Annexure C.3.***

Members may discuss.

ITEM NO. C.4: Status of implementation of fiber optic-based differential protection for short lines--ERLDC

In the 38th ERPC meeting (held on 29th & 30th June 2018), the implementation of fiber optic-based differential protection for the following short line was decided and agreed upon by WBSETCL and DVC.

[1] 220KV Subhasgram (POWERGRID)-Subhasgram (WBSETCL) D/C: Line length = 0.8 KM
[2] 132KV Malda (POWERGRID)-Malda (WBSETCL) D/C: Line length = 5.94 KM,
[3] 220KV Alipurduar (POWERGRID)-Alipurduar (WBSETCL) D/C: Line length = 6.377 KM,
[4] 220KV Durgapur (POWERGRID)-Durgapur (DVC) D/C: Line length = 1 KM,
[5] 400KV Durgapur (POWERGRID)-Bidhan Nagar (WBSETCL) D/C: Line length = 11 KM,
[6] 132KV Birpara (POWERGRID)-Birpara (WBSETCL) D/C: Line length = 0.3 KM,
[7] 132KV Siliguri (POWERGRID)-NJP (WBSETCL) S/C: Line length = 10 KM,
[8] 132KV Siliguri (POWERGRID)-NBU (WBSETCL) S/C: Line length = 10 KM

WBSETCL and DVC may update the present status.

ITEM NO. C.5: Protection coordination of the New Transmission elements to be charged in Eastern Region

C.4.1 : FTC of 400 kV Jeerat(WB)-New Jeerat(PMJTL) I&II along with Main Bus II

As per information received at ERLDC, following elements will be first time charged at 400 kV New Jeerat S/S.

1. **400 kV Jeerat (WB)-New Jeerat (PMJTL SS) Ckt-I,** (Total Length-25 KM, Quad Moose) along with associated 400 kV Bays.at Jeerat (Bay No-C02), and New Jeerat (Main Bay No-403).

2. **400 kV Jeerat (WB)-New Jeerat (PMJTL SS) Ckt-II**, (Total Length-25 KM, Quad Moose) along with associated 400 kV Bays at Jeerat (Bay No-C01), and New Jeerat (Main Bay No-406).

3. **400 kV Main Bus-II** (Quad AAAC Bull Conductor) at New Jeerat SS.

Protection coordination may be required as per the following table.

Reason	S/S may be affected	Remarks	Utility to respond	Response received
FTC of 400 kV Jeerat (WB)-New Jeerat (PMJTL SS) Ckt-I&II	New Jeerat	Protection coordination to be done for all newly connected elements as per ERPC's guidelines. Busbar protection to be ensured.	PMJTL	Protection coordination has been done as per ERPC's guidelines
	Jeerat(WBSETCL)	Protection coordination to be done for all newly connected elements as per ERPC's guidelines.	WBSETCL	Protection coordination has been done as per ERPC's guidelines.
	S/S connected to Jeerat(WBSETCL)):	Adjacent Shortest line will be now Jeerat-New Jeerat(25	POWERGRID ER-2 / WBPDCL/ WBSETCL	Protection coordination has been done as per ERPC's guidelines.

	Sagardighi ,Bakreswar , Chanditala, Subhasgram, Rajarhat	km). Hence Zone-2 of adjacent lines may overlap with this section so ,Z-2 time grading for co-ordination required.. Kindly check and confirm any setting revision if any change in adjacent short and long line.		(Settings received also)

PMJTL ,WBSETCL & WBPDCL may update.

PART- D:: FOLLOW-UP OF PREVIOUS PCCM

ITEM NO. D.1: Disturbance at 220 kV Biharsharif Substation on 01.06.2021 at 17:10 Hrs

On 01.06.2021 at 17:10 hrs, all 220 kV lines, emanating from 220 kV Biharshariff (BSPTCL) tripped. As per the information received, R phase CT at LV side of 400/220 kV ICT- 2 got busted resulting in tripping of all emanating lines. Total load loss was around 180 MW at Ekangasarai / Rajgir / Baripahari / Hatida / Harnaut / Barh / Nalanda in Bihar system.

***In 104th PCC Meeting**,*

BSPTCL stated that they had taken up with their higher authority for early commissioning of the busbar protection at Biharshariff.

PCC advised BSPTCL to implement reduced time setting of the zone-4 protection in distance relay to 250 msec until the busbar protection at 220 kV Biharsharif get implemented.

Regarding simultaneous tripping of parallel ICTs at Biharshariff, they informed that necessary checking and tests had been carried out for all CTs on LV side of the ICTs. Further, shutdown of the ICT has been planned to carry out detail checking of the cable/wiring between HV & LV side of the ICTs.

They proposed for disabling the feature of extending inter-trip command from LV side to HV side of the ICT to avoid unwanted tripping of the parallel ICTs during any nearby fault. PCC advised BSPTCL to discuss the issue with Powergrid and if required, the same may be implemented in consultation with Powergrid.

BSPTCL & Powergrid may update.

ITEM NO. D.2: Total power failure at 220 kV BTPS(BSPTCL)S/s on 01.06.2021 at 17:03 Hrs

On 01.06.2021 at 17:12 hrs, the following elements got tripped resulting in total power failure at 220 kV BTPS.

I. 220 kV Hazipur-BTPS circuit- 1
II. 220 kV Mokama-BTPS-2

III. 220 kV BTPS-Begusarai D/C
IV. 220 kV Begusarai-Purnea(PG) circuit-I
V. 220 kV Begusarai-Khagaria circuit-2
VI. 220 kV Begusarai- New Samastipur (Ujiyarpur) D/C
VII. 220 kV Mokama(BGCL)-Biharshariff D/C

In 104th PCC Meeting following deliberations took place –
Regarding overvoltage setting at BTPS end, BTPS intimated that the setting was 110 % with time delay of 5 sec for all the 220 kV lines.

PCC observed that O/V settings of 110 % i.e. 242 kV is quite conservative keeping in view the fact that maximum permissible voltage limit as per CEA grid standard for 220 kV system is 245 kV. Also, it was observed that there was no voltage grading/time grading between the parallel lines emanating from BTPS end.

PCC opined that overvoltage settings, if kept in service, the tripping shall be set more than the permissible voltage limit. Also the settings need to be graded in terms of time/voltage for parallel lines connected to the same S/s. PCC advised BTPS to review their overvoltage protection settings in coordination with SLDC, Bihar in line with the above guidelines and the same may be submitted to ERLDC/ERPC as well.

BTPS further informed that high voltage is generally observed at BTPS end & the average voltage remain in the range of 230-235 kV.

PCC advised BTPS to share the voltage data along with the reactive power absorption data of their generating units to SLDC Bihar as well as to ERLDC for review.

BSPTCL& BTPS may update.

ITEM NO. D.3: Multiple tripping of 132 kV Sultanganj-Deoghar-S/C.

It has been observed that in recent times 132 Sultanganj-Deoghar S/C has been tripprd multiple times. In the month of June'21, the line had tripped 5 times with Y phase to earth fault on each occasion.

Forced outage on account of tripping of this circuit reduces the reliability of both the JUSNL and BSPTCL system (Chitra, Deoghar Railway).

In 104th PCC Meeting, *BSPTCL informed that the line length is around 90 kM out of which aprrox. 60 km falls under Bihar jurisdiction. JUSNL responded that only 8 km of 132 kV Sultanganj-Deoghar line from Deoghar end is under JUSNL jurisdiction.*

PCC advised BSPTCL & JUSNL to reconfirm their jurisdiction in 132 kV Sultanganj-Deoghar line and to coordinate with each other in resolving the ambiguity related to the jurisdiction issue.

BSPTCL stated that regular patrolling was carried out for their section of the line and clearance issues had been found in certain locations. They added that they are facing difficulties in clearing the vegetation in some of the locations due to local issue.

PCC advised BSPTCL & JUSNL to resolve all pending clearance issues in their respective sections at the earliest.

They further apprehended that in some of the trippings, the fault location is more than 100 km which indicates that fault was in some other line from Deoghar end. As the faults did not get cleared from Deoghar end, it resulted in tripping of the 132 kV Sultanganj-Deoghar line from Sultanganj

end. PCC advised JUSNL to review the protection settings of the relays at Deoghar end for all the other lines.

BSPTCL & JUSNL may update.

ITEM NO. D.4: Disturbance at Bodhgaya S/S on 17/05/2021 at 23:06 Hrs

At 23:06 hrs, 220 kV Gaya-Bodhgaya-1 & 2 tripped from Gaya end only. At the same instance, all 220/132 KV ICTs at Bodhgaya also tripped causing load loss of 150 MW at Chandauti, Sherghati, Imamganj, Bodhgaya&Rafiganj Traction. 220 KV Bodhgaya-Khijasarai D/C was hand-tripped from Bodhgaya end.

In 104th PCC Meeting ,*Regarding implementation of bus bar protection at Bodhgaya S/s and relay upgradation work for configuring Disturbance Recorder, BSPTCL updated that they had taken up the issue with their higher authority.*

Regarding review of backup overcurrent settings of all ICTs, BSPTCL informed that they would review the settings soon.

PCC advised BSPTCL to review the ICT backup protection settings at Bodhgaya S/s at the earliest and the settings may be shared with Powergrid so that zone 3 settings at Gaya end can be coordinated properly.

BSPTCL may update.

ITEM NO. D.5: Disturbance at Rengali S/s on 28/05/2021 at 07:45 Hrs

Due to CVT failure of 220 kV Rengali-TSTPP S/C at Rengali end, all 220 kV lines connected to 220 kV Rengali (OPTCL) S/S and 220 kV Rengali PH got tripped. Y phase jumper snapping of 220 kV Rengali-Rengali – 2 at 220 kV Rengali (OPTCL) Bus A was also reported at the same time.

The event has led to total power supply failure at 220 kV Rengali Hydropower station and 220 kV Rengali (OPTCL) S/s.

In 104th PCC Meeting, *SLDC Odisha informed that disturbance report had been submitted to ERPC/ERLDC. It was observed from the report that there was no tripping at Rengali PH end during the disturbance. Also the zone-4 timing had been set at 1200msec for all the relays. As a result220 kV Rengali PH-TSTPP line & 220 kV Rengali PH-TTPS line got tripped from remote end in zone-3 protection before tripping of the lines at Rengali end.*

PCC advised OHPC to revise the zone-4 settings of all the lines at their end as per the ERPC protection philosophy.PCC also advised to review the settings of 220 kV Rengali PH-Rengali(OPTCL) lines at their end.

OPTCL informed that they had revised zone-4 time settings for 220 kV Rengali – Rengali PH lines to 250 msec at OPTCL end.

Regarding commissioning of Bus bar protection at Rengali(OPTCL) end, they informed that they had taken up the issue withtheir higher authority.

OHPC may update.

ITEM NO. D.6: Total Power Failure at Dumka S/s on 15/05/2021 at 12:01 Hrs

Due to tower collapse of 220 kV Farakka-Lalmatia S/C in April 2021, local load at 220 kV Dumka and Godda S/S were being radially fed from 400/220 kV Maithon S/S through 220 kV Maithon-

Dumka D/C and 220 kV Dumka-Godda D/C. 220 kV Maithon-Dumka-1 was under shutdown for attending the hotspot at connector of R-phase pole circuit breaker of the line.

At 12:02 hrs 220 kV Maithon Dumka – 2 tripped on R phase to earth fault resulting in total power failure at Goda, Dumka S/S and nearby areas.

In 104th PCC Meeting following deliberations took place –

Regarding PLCC issue, Powergrid informed that carrier was not being received from Dumka end & the issue needs to be resolved by JUSNL.

JUSNL stated that OEM of the PLCC had already been communicated in this regardhowever they are yet to receive any communication from them.

PCC expressed serious concern for delay in resolving the PLCC issue for 220 kV Maithon-Dumka lines and advised JUSNL to take up this issue on priority & resolve the same at the earliest.

JUSNL may update.

ITEM NO. D.7: Disturbance at Jasidih(JUSNL) S/S on 27/05/2021 at 10:13 Hrs

On 27-05-2021, demand in Jharkhand system was low because of thunderstorm and heavy rainfall caused by CycloneYaas. This had resulted in high voltage at various parts of JUSNL network.

At 03:22 hrs, 220 kV Dumka-Jasidih D/C were hand tripped at Dumka end because of overvoltage. Charging of 220 KV Dumka-Jasidih – 1 was attempted at 03:51 Hrs and 07:01 Hrs and finally it was charged at 09:50 Hrs.

At 10:13 hrs, 220 kV Dumka Jasidih – 1 tripped from Dumka end due to operation of overvoltage stage 1. With this 132 kV Dumka – Dumka D/C and 132 kV Dumka – Deoghar D/C also got tripped. This has led to loss of supply at 220/132 kV Jasidih and 132 kV Dumka substation.

In 104th PCC Meeting, *JUSNL informed that they are in process of developing a philosophy for overvoltage settings at 220 kV level for their system and the same would be submitted to ERPC and ERLDC as soon as the report gets finalised.*

JUSNL may update.

ITEM NO. D.8: Grid event at 132 kV Motihari (DMTCL) S/S on 21-04-2021 at 20:19 hrs

On 21st April 2021 at 19:00 hrs, 132 kV side of 400/132 kV 315MVA ICT-3 (Ownership is with PowergridMithilanchal Transmission Ltd) at Motihari was being charged through 132 kV GIS Bus 1. Just after charging of new ICT, 132kV Main bu\s-1 at Motihari tripped due to Bus extension module SF6 gas pressure low trip at 19:01 Hrs. Following feeders which were connected with 132kV Main bus – 1 at Motihari tripped:

- 132 kV side of 400/132 kV ICT – 1 at Motihari
- 132 kV Betiya – 1
- 132 kV Motihari – 1
- 132 kV Raxaul – 1

In 103rd PCC Meeting ,Powergrid informed that to find out the root cause of the incident, both the OEMs involved in GIS system at Motihari were discussing with each other. Also, a joint investigation of affected GIS module at Motihari (DMTCL) in presence of both the OEM engineersis to be planned after getting shutdown consent from SLDC, Bihar. The report would be submitted after the investigation.

DMTCL informed that 132 kV bus along with 132 kV Motihari – Raxaul-2 can be restored after assessing the damage in the GIS system during the proposed joint inspection by OEM engineer.

PCC advised Powergrid to coordinate with DMTCL & SLDC Bihar for getting the necessary shutdown at Motihari S/s to carry out the inspection by OEM engineers.

In 104th PCC Meeting, *DMTCL informed that their OEM engineers had visited the site and assessed the damage at DMTCL portion. It was found that isolator of 132 kV Raxaul-1 circuit with 132 kV bus-1 got damaged. They informed that both 132 kV bus-1 & bus-2 at DMTCL were charged after separating the damaged bus extension portion. Also all the 132 kV lines at DMTCL including 132 kV Motihari-Raxaul-2 had been restored. However both the 132 KV Raxaul circuits were connected to main bus-2 only. The report by their OEM had been forwarded to Powergrid also.*

Regarding investigation of affected GIS module at Motihari (DMTCL), it was informed that visit of other OEM i.e. M/s Hyosung had been scheduled in this week. After completion of this visit, report would be submitted by PMTL.

MS, ERPC informed that several communications had been received from CEA regarding the above incident on21/04/2021. He advised PMTL to expedite the investigation and share the final report at the earliest.

Powergrid & DMTCL may update.

ITEM NO. D.9: Repeated delayed clearance of faults at 220 kV Chandil STPS S/C

In March 2021, 220 kV Chandil STPS S/C tripped repeatedly due to various short circuit faults at 6-12 km from STPS.

In 103rd PCC Meeting, JUSNL informed that they have taken up the issue with OEM for through checking of PLCC panel at Chandil end. The OEM visit is expected in first week of July'21.

PCC advised JUSNL to expedite the process to resolve the PLCC issue at Chandil end.

In 104th PCC Meeting, *JUSNL informed that OEM visit has been rescheduled to 3rd week of July'21.*

JUSNL may update.

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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 फैक्स : 033-24235809/5029 Website:www.erldc.org, Email ID- erldc@posoco.in

घटना संख्या: **14-07-2021/1** दिनांक: **20-07-2021**

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

Summary of the event (घटना का सारांश):

On 14-07-2021 at 11:54 hrs both buses at 220 kV New Town AA-III S/S tripped due to operation of bus bar protection leading to load loss in New town region and corresponding tripping of associated transmission lines. All lines were restored by 12:37 hrs.

- **Date / Time of disturbance:** 14-07-2021 at 11:54 hrs.
- **Event type:** GD - 1
- **Systems/ Subsystems affected:** 220 kV New Town AA-III S/S.
- **Load and Generation loss**.
    - No generation loss was reported during the event.
    - Around 54 MW load loss was reported during the event.

Major elements tripped (प्रमुख ट्रिपिंग):

- 220 kV Bus 1 & Bus 2 at Newtown AA III
- 220 kV New Town AA III-Rajarhat D/C
- 220 kV New Town AA III-Subhashgram S/C
- 220 kV New Town AA III-KLC Bantala
- 2*160 MVA 220/132 kV ICTs at New Town AA III
- 3*50 MVA 220/33 kV ICTs at New Town AA III

Network across the affected area (प्रभावित क्षेत्र का नक्शा)

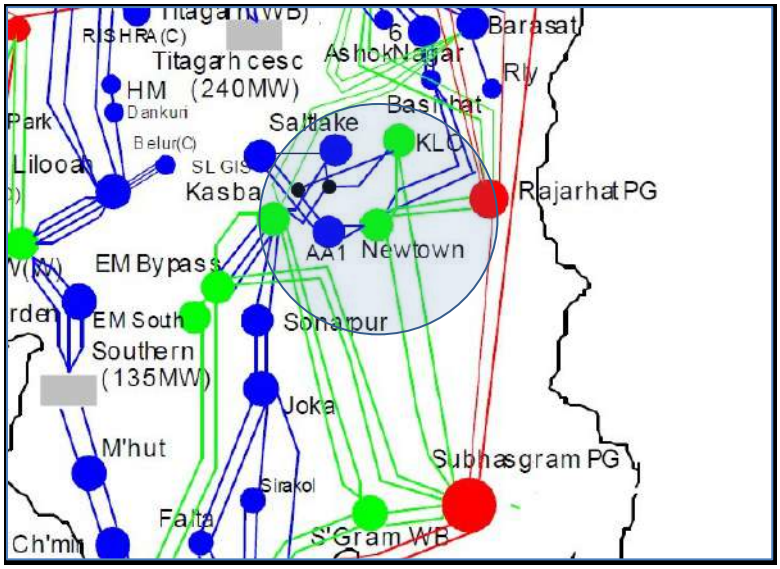


Figure 1: Network across the affected area

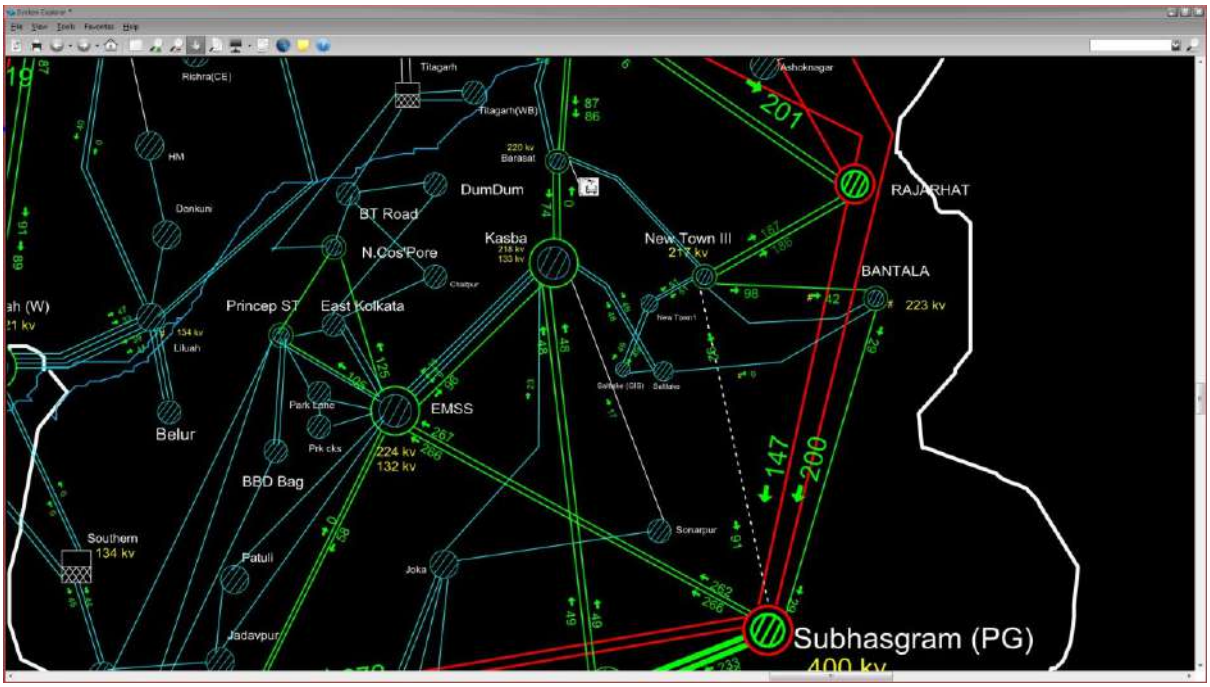


Figure 2: SCADA snapshot for of the system

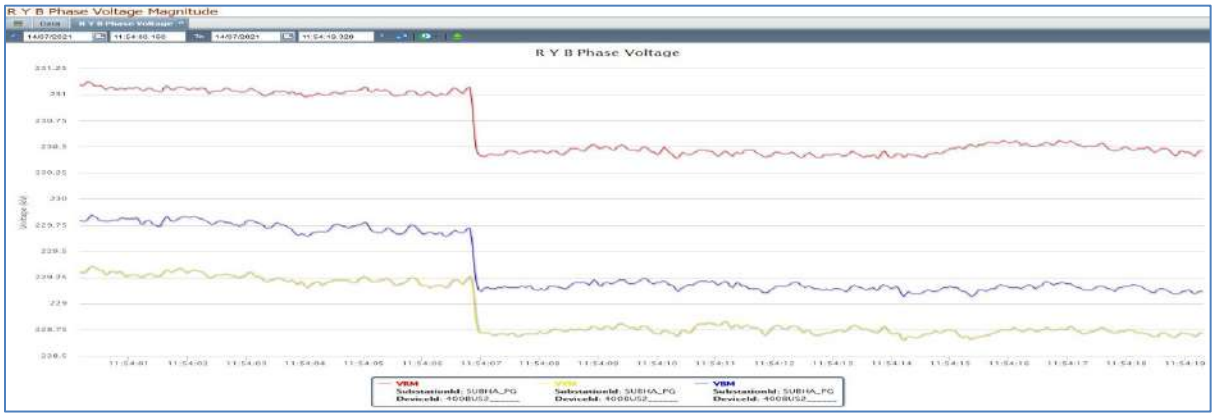


Figure 3: PMU captured at Subhashgram shows no fault and 1kV dip in voltage is observed.

Figure 4: PMU captured at Rajarhat shows no fault and 20 kV dip in voltage is observed in all phases.

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

समय	नाम	उप केंद्र 1 रिले संकेत	उप केंद्र 2 रिले संकेत	पीएमयू पर्यवेक्षण
11:54 Hrs.	220 kV New Town AA III-Rajarhat D/C	Bus fault at New Town AA-III	Yet to be received	No fault observed in PMU,20kV voltage reduction observed in all phases at Rajarhat
	220 kV New Town AA III-Subhashgram		Not tripped from Subhashgram end	
	220 kV New Town AA III-KLC Bantala		Yet to be received	
	220 kV Bus I & Bus II at Newtown AA III	Bus fault at New Town AA-III		
	2* 220 kV/132 kV 160 MVA ICTs			
	3* 220/33 kV 50 MVA ICTs			

Restoration (पूर्वावस्था की प्रप्ति)

Transmission/Generation element name	Trip Time	Restoration time
220 kV Bus I & Bus II at Newtown AA III	11:54	12:12
220 kV New Town AA III-Rajarhat D/C		12:12
220 kV New Town AA III-Subhashgram		12:36
220 kV New Town AA III-KLC Bantala		12:37
2*220 kV/132 kV 160 MVA ICTs		12:13
3*50 MVA 220/33 kV ICTs		12:15

Analysis of the event (घटना का विश्लेषण):

- At 11:54 hrs due to operation of bus bar protection at New Town Action Area-III both buses tripped leading to load loss in New town region and corresponding tripping of associated transmission lines.
- New town load restored by 12:15 hrs.
- All lines restored by 12:37 hrs.

Protection issues observed (सुरक्षा समस्या):

- Reason for Busbar operation may be shared, as observed from PMU no fault was observed at that time .(**WBSETCL to explain**)
- What are the precautions and action taken in this regard to avoid such kind of tripping's in future.

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	**WBSETCL**

Fault clearance in more than 100 ms at 400 kV level and above and 160 ms at 220 kV levels	1. CEA Grid standard 2010 -3.e CEA Transmission Planning Criteria	**WBSETCL**
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)	**WBSETCL**

Status of Reporting (रिपोर्टिंग की स्थिति):

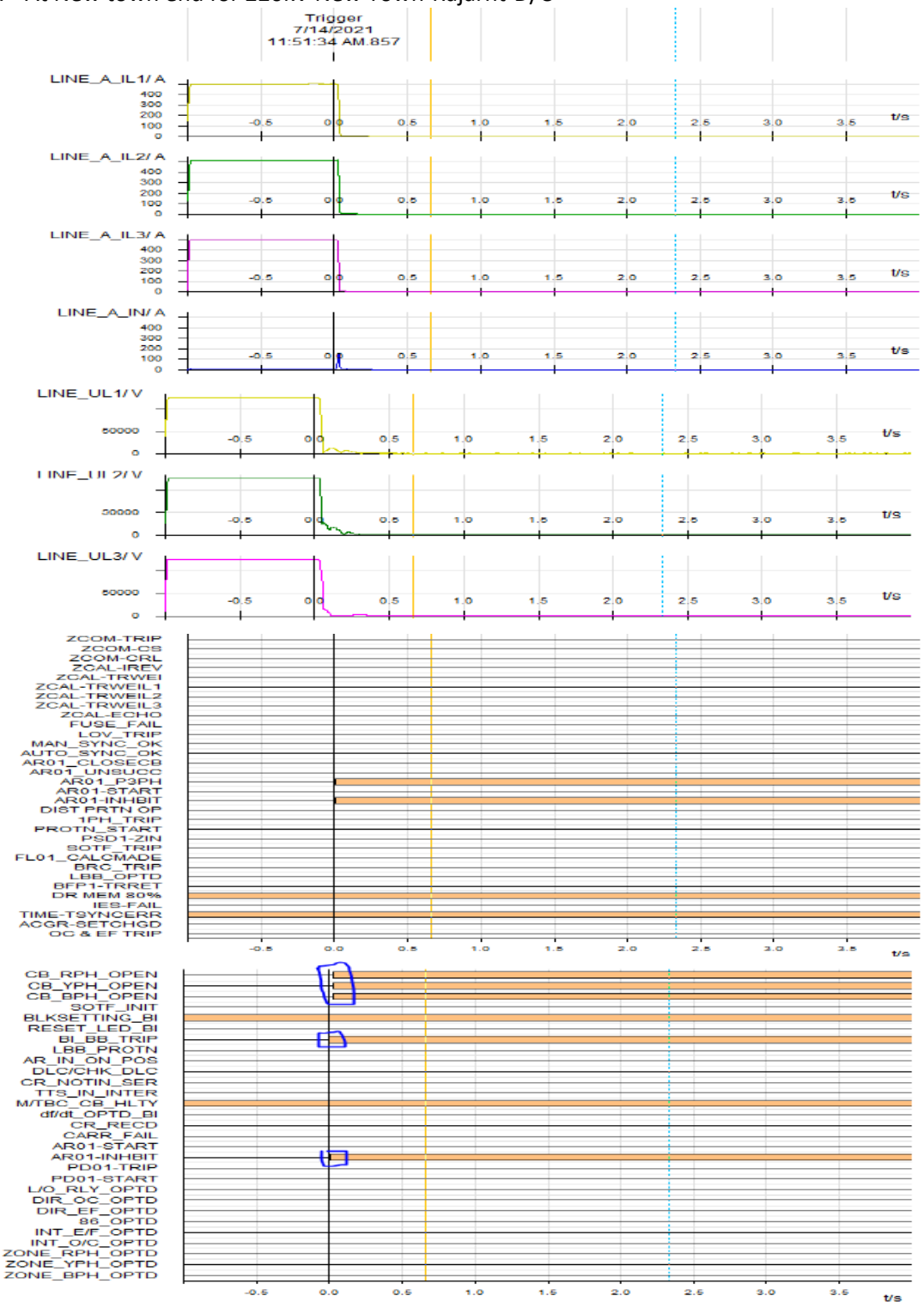
- DR/EL yet to be received from WBSETCL.
- DR/EL yet to be received from PG-ER-2.

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

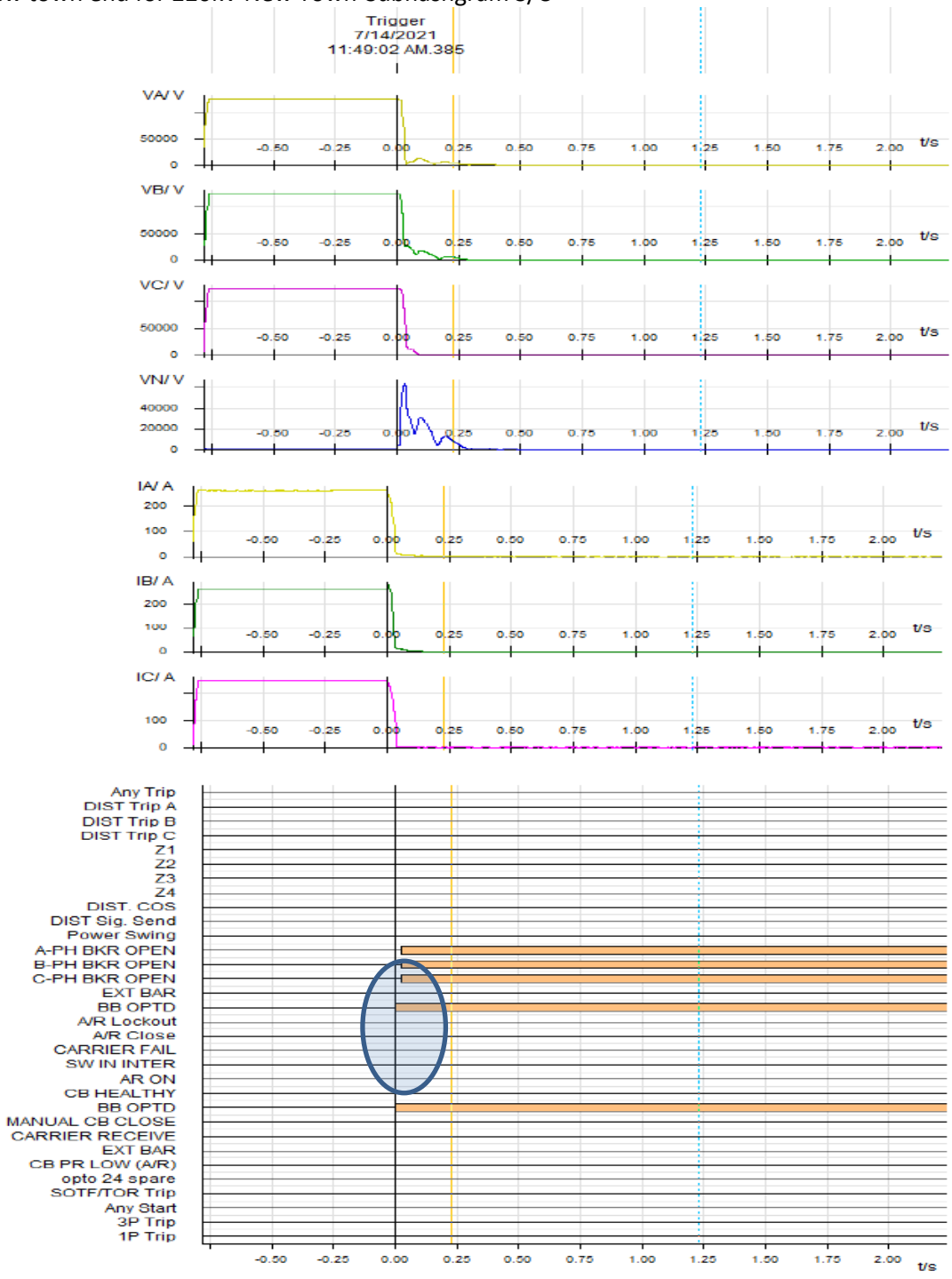
Sequence of event not recorded at time of event.

Annexure 2: DR recorded at 220kV New town

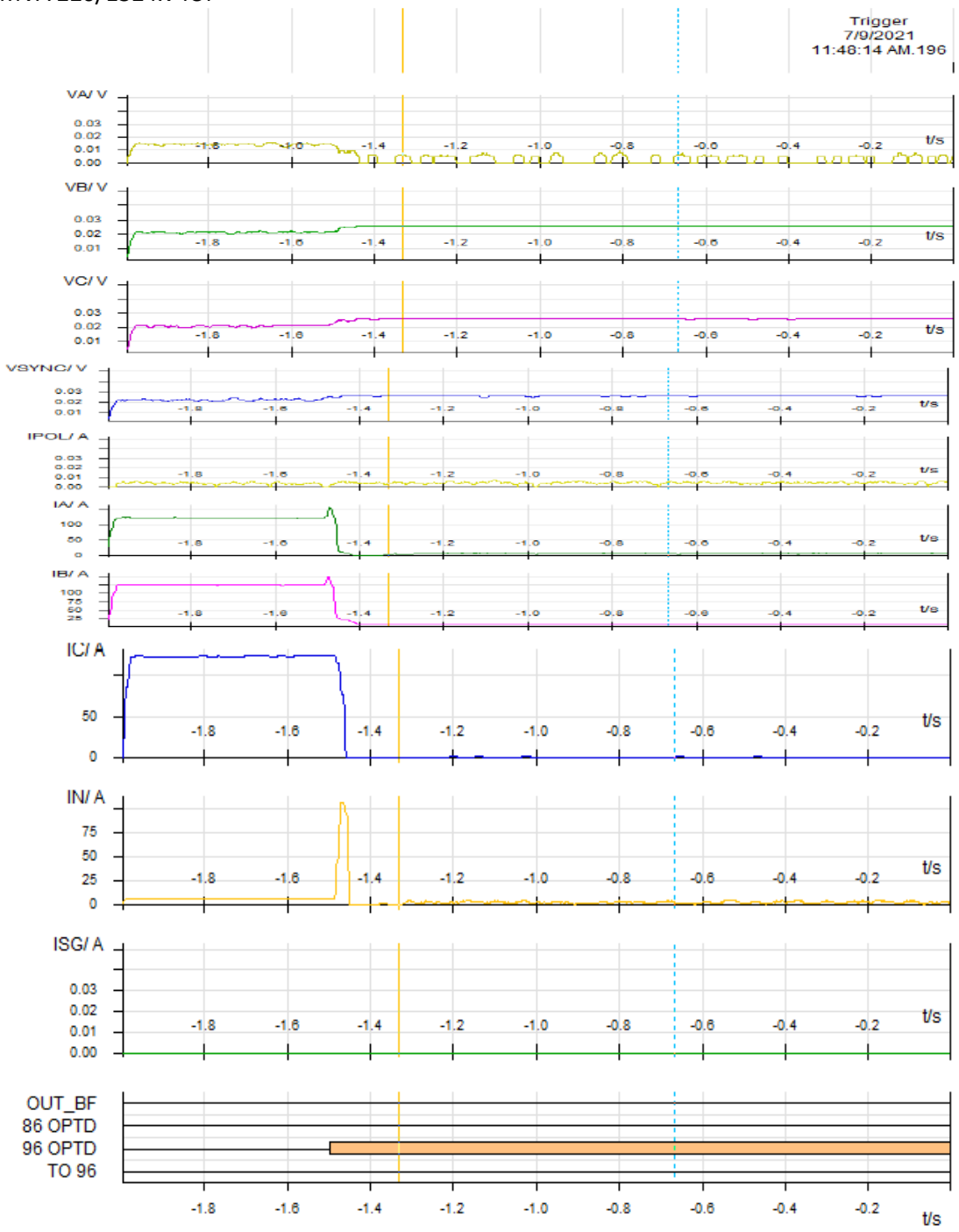
A. At New town end for 220kV New Town-Rajarht-D/C



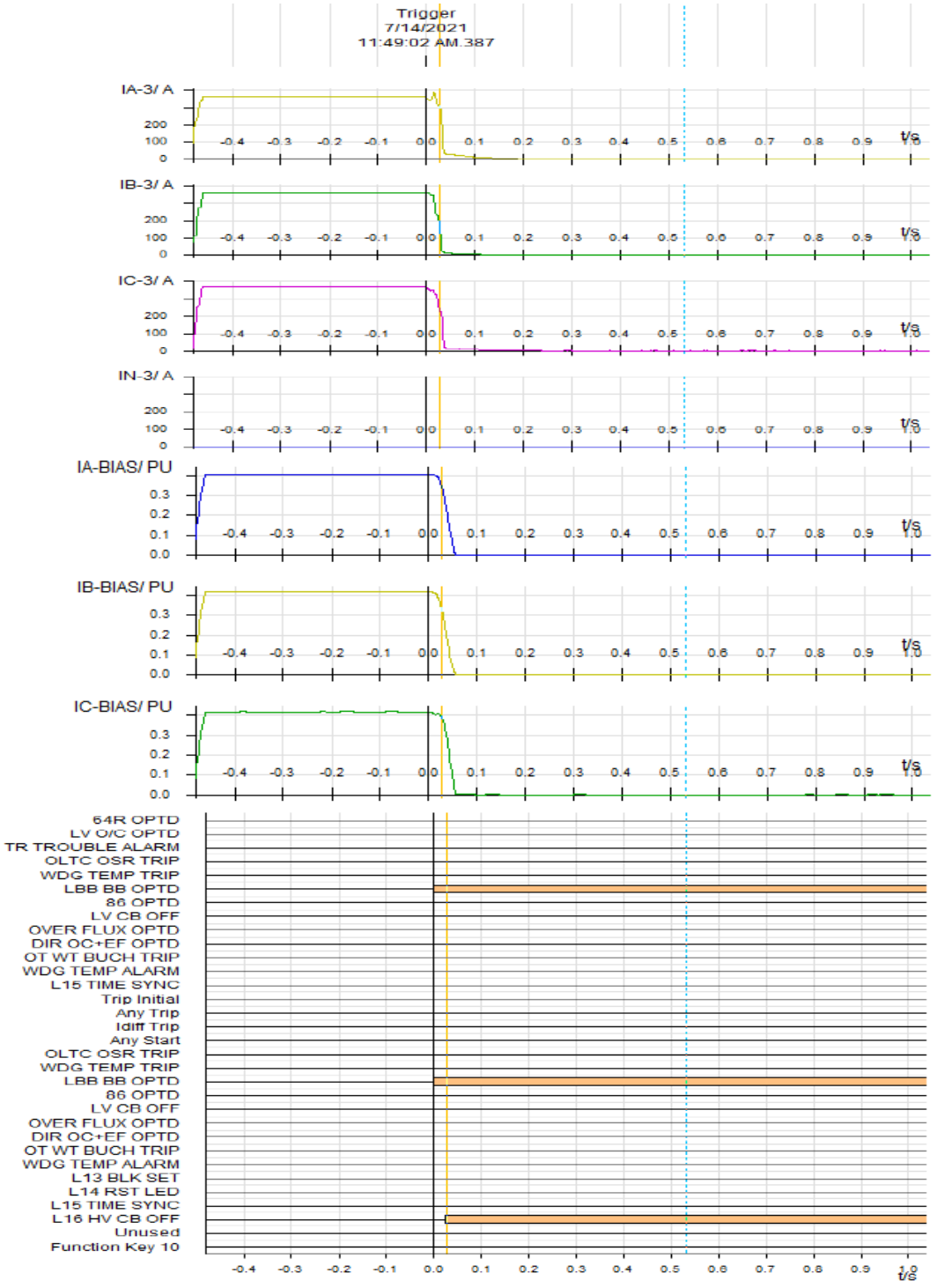
B. At New town end for 220kV New Town-Subhashgram S/C



C. For 160MVA 220/132 kV ICT



D. For 50MVA 220/33 kV ICT



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घटना संख्या: **27-07-2021/1** दिनांक: **27-07-2021**

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

Summary of the event (घटना का सारांश):

At 08:57 hrs all feeder connected to Rengali PH tripped along with Units 1, 2, 4 and 5 due to earth fault and overcurrent in the downstream of 33kV system at Rengali PH leading to complete power failure at Rengali PH. All feeder and Unit restored by 13:35Hrs.

- **Date / Time of disturbance:** 27-07-2021 at 08:57 hrs.
- **Event type:** GD - 1
- **Systems/ Subsystems affected:** 220 kV Rengali PH
- **Load and Generation loss**.
  - Around 178 MW generation loss was reported during the event.
  - No load loss reported during the event .

Major elements tripped (प्रमुख ट्रिपिंग):

- Rengali PH unit 1,2,4,5
- 220kV Rengali PH-TSTPP S/C
- 220kV Rengali PH-Rengali (OPTCL) D/C
- 220kV Rengali PH-TTPS S/C

Network across the affected area (प्रभावित क्षेत्र का नक्शा)

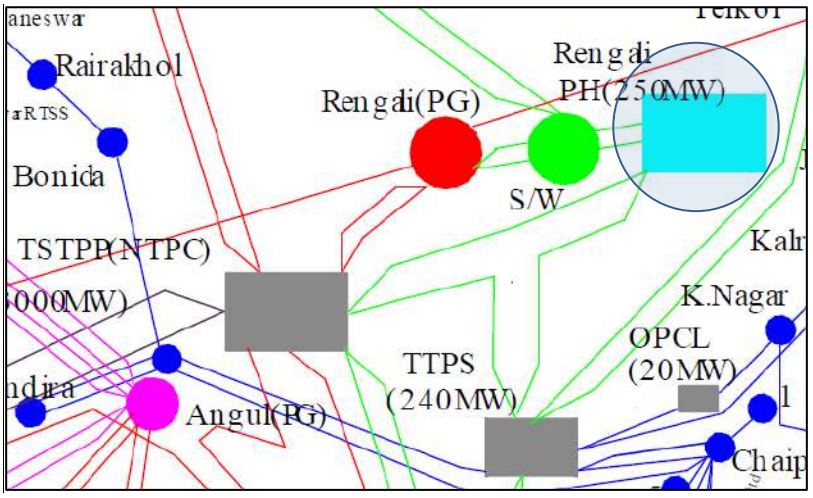


Figure 1: Network across the affected area

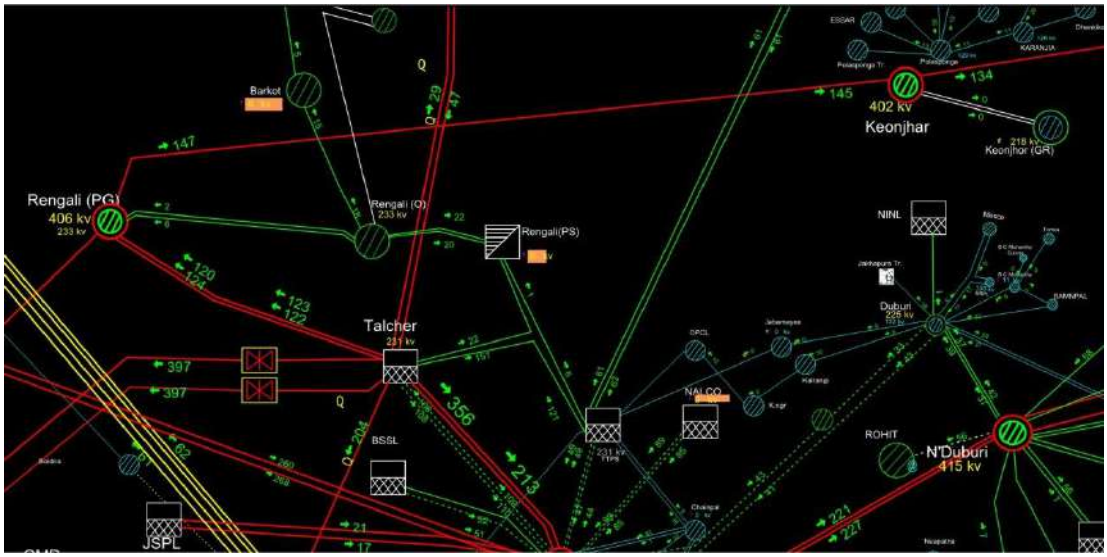


Figure 2: SCADA snapshot for of the system

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

समय	नाम	उप केंद्र 1 रिले संकेत	उप केंद्र 2 रिले संकेत	पीएमयू पर्यवेक्षण
08:57 Hrs.	220kV Rengali PH-TSTPP S/C	B-Earth fault and overcurrent in the downstream of 33 kV	Yet to receive	PMU captured at Rengali shows B-Earth fault and slight dip in voltage
	220kV Rengali PH-TTPS S/C	Yet to receive	Yet to receive	
	220kV Rengali PH-Rengali (OPTCL) -1	Yet to receive	Yet to receive	
	220kV Rengali PH-Rengali (OPTCL) -2	Yet to receive	Yet to receive	

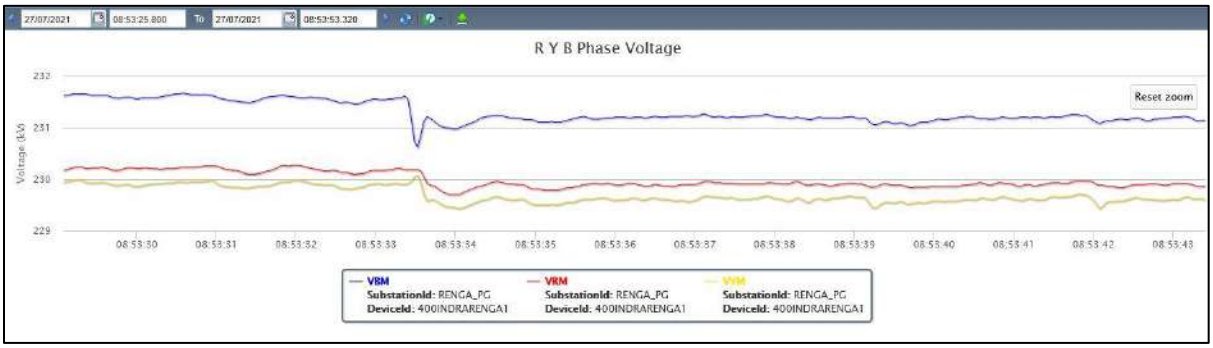


Figure 3: PMU captured at Rengali shows B-Earth fault and slight dip in voltage

Restoration (पूर्वावस्था की प्रप्ति)

Transmission/Generation element name	Restoration time
220kV Rengali PH-TSTPP S/C	13:35
220kV Rengali PH-Rengali (OPTCL) -2	09:23
220kV Rengali PH-Rengali (OPTCL) -1	09:30
220kV Rengali PH-TTPS S/C	11:00
Rengali PH Unit-1	12:17
Rengali PH Unit-2	11:46
Rengali PH Unit -4	10:26
Rengali PH Unit-5	09:58

Analysis of the event (घटना का विश्लेषण):

- At 08:57 hrs all feeder connected to Rengali PH tripped along with Unit 1, 2, 4, 5 On investigation it was found that, there was earth fault B-Earth and over current in downstream 33 kV side system leading to complete blackout of 220kV Rengali PH
- Generation loss of 178 MW. All feeder and Unit restored by 13:35Hrs.

Protection issues observed (सुरक्षा समस्या):

- Fault of 33kv System got cleared from 220 kv system. All the protection system of downstream (33Kv and above) failed to clear the fault which led to tripping of all 220 kV lines is gross violation of protection. OPTCL may explain.
- All four 220 kv lines tripped on O/V from Rengali PH only. Line didn't trip from remote ends. Detailed analysis required for appearing of O/V at Rengali PH. Reason for non-tripping of lines from remote ends maybe shared. OHPC and OPTCL may explain.
- All generating units (U#1, U#2, U#4, U#5) tripped on Reverse Power Flow protection. Reason for reverse power flow and settings may be shared. OHPC may explain.
- There was loss of evacuation path due to tripping of all emanating lines. Whether any Over-frequency relay picked up in any unit. Settings may be shared. OHPC may explain.
- Root cause analysis to be done to identify faulty system and rectification of the same.

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	**OHPC,OPTCL,NTPC**
Fault clearance in more than 100 ms at 400 kV level and above and 160 ms at 220 kV levels	1. CEA Grid standard 2010 -3.e CEA Transmission Planning Criteria	

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)	**OHPC**

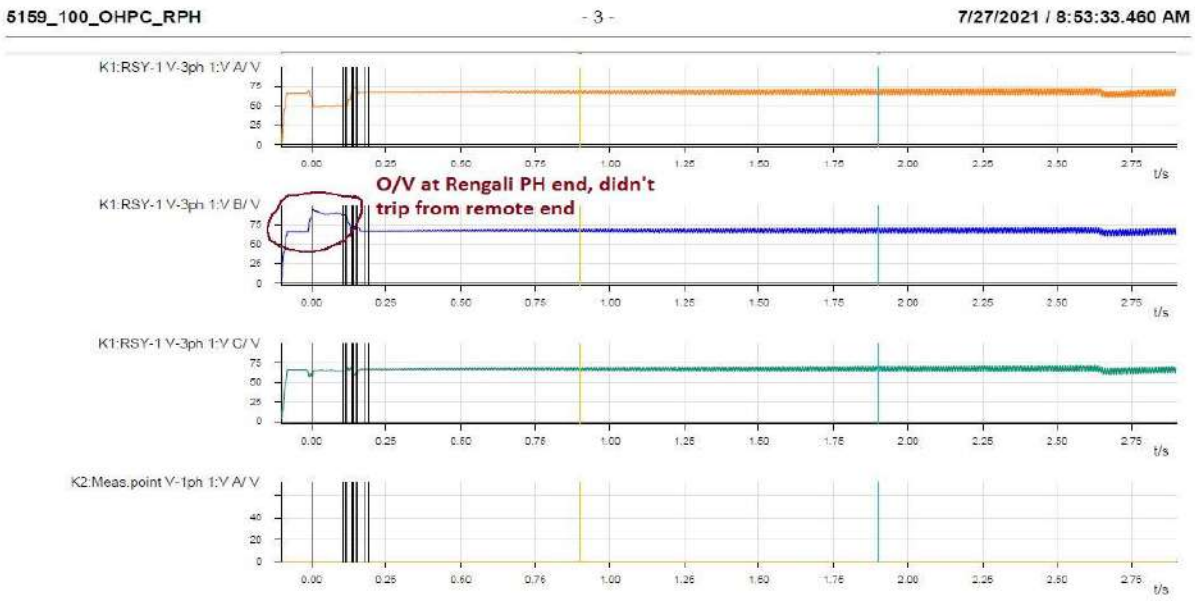
Status of Reporting (रिपोर्टिंग की स्थिति):

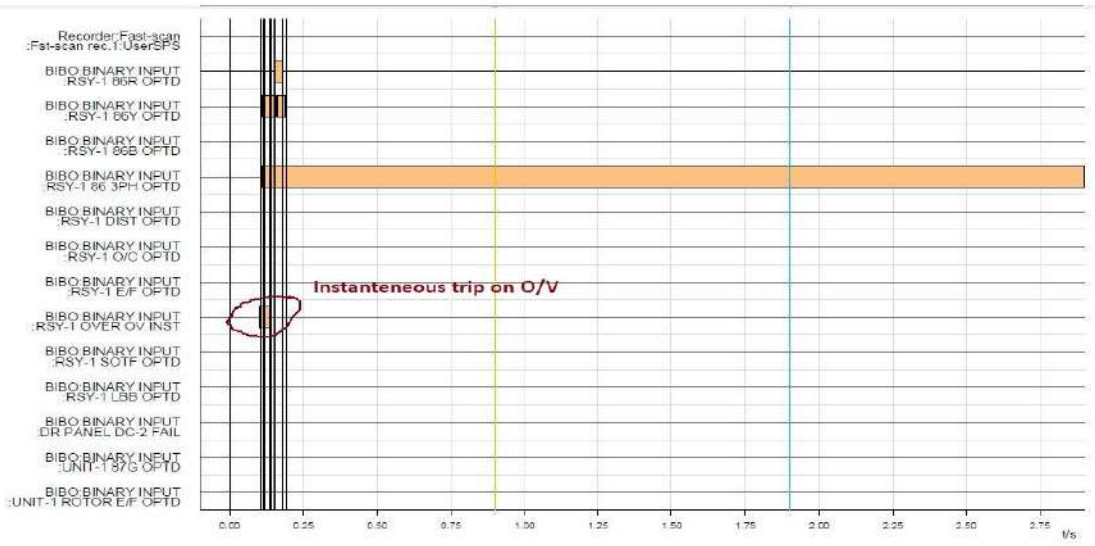
- DR/EL received from OHPC/OPTCL is not in proper format. Comtrade files may be shared.
- DR/EL yet to receive from NTPC.

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 at Rengali PH

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:RSY-1 86R OPTD
BIBO BINARY INPUT
:RSY-1 86Y OPTD
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:RSY-1 86B OPTD
BIBO BINARY INPUT
:RSY-1 86 3PH OPTD
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:RSY-1 OVER OV INST
BIBO BINARY INPUT
:RSY-1 SOTF OPTD
BIBO BINARY INPUT
:RSY-1 LBB OPTD
BIBO BINARY INPUT
:DR PANEL DC-2 FAIL
BIBO BINARY INPUT
:UNIT-1 87G OPTD
BIBO BINARY INPUT
:UNIT-1 ROTOR E/F OPTD
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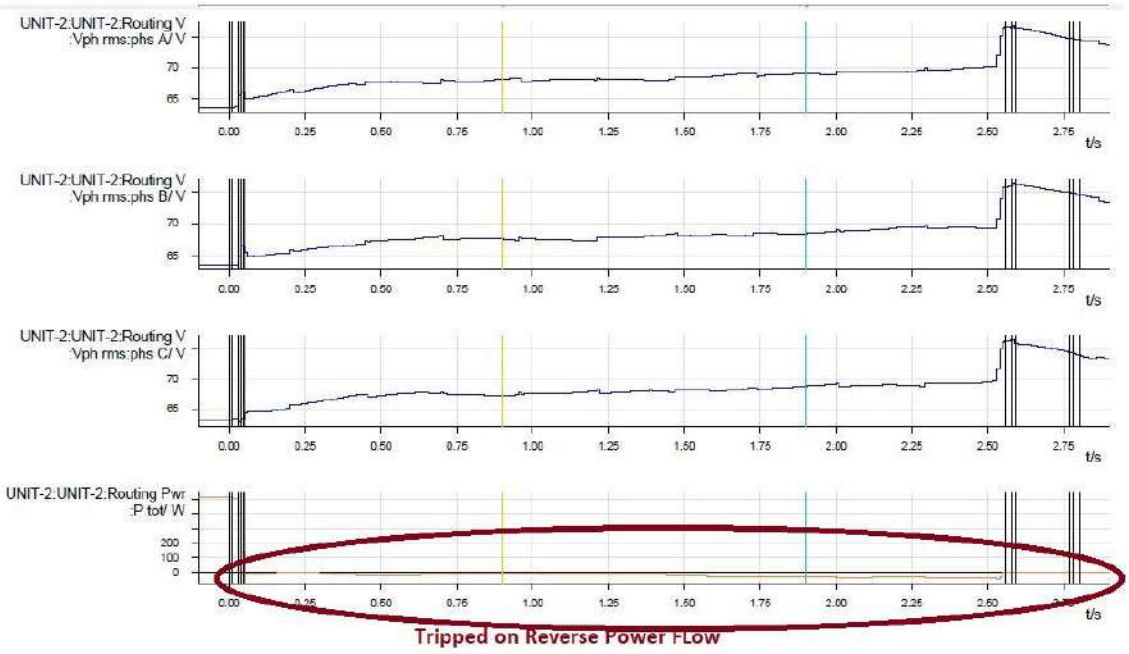
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2.00
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t/s
Tripped on Reverse Power FLow

पावर सिस्टम ऑपरेशन करपोरेशन लिमिटेड
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घटना संख्या: **18-07-2021/1** दिनांक: **20-07-2021**

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

Summary of the event (घटना का सारांश):

On 18-07-2021 at 19:37 hrs, Bus differential protection of 220 kV Bus 1&2 at Bokaro TPS- B operated. Consequently, 220 kV Bus I & Bus II at Bokaro TPS -B tripped, leading to total power failure at 220/132 kV Bokaro S/S, 220/132 kV Ramgarh, 132 kV Patratu, 132 kV North Karnpura. Total 254 MW load loss occurred

- **Date / Time of disturbance:** 18-07-2021 at 19:37 hrs.
- **Event type:** GD - 1
- **Systems/ Subsystems affected:** 220/132 kV BTPS-B, 220/132kV Ramgarh, 132kV Patratu, and 132kV North Karnpura.
- **Load and Generation loss**.
    - No generation loss was reported during the event.
    - Around 254 MW load loss was reported during the event at Ramgarh, Patratu, North Karnpura (Traction loss of 10 MW at Barkakana and Ray).

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

- 150 MVA 220/132 KV ICT 2 was under shutdown.

Major elements tripped (प्रमुख ट्रिपिंग):

- 220 kV Bus I & Bus II at Bokaro
- 220 kV Bus coupler at Bokaro
- 220 kV Bokaro – Chandrapura D/C
- 220 kV Bokaro – Ramgarh D/C
- 220 kV Bokaro – Jamshedpur D/C
- 2*315 MVA 400/220 kV ICTs at Bokaro
- 150 MVA 220/132 kV ICT I at Bokaro
- 132 kV Gola-Ramgarh D/C

Network across the affected area (प्रभावित क्षेत्र का नक्शा)

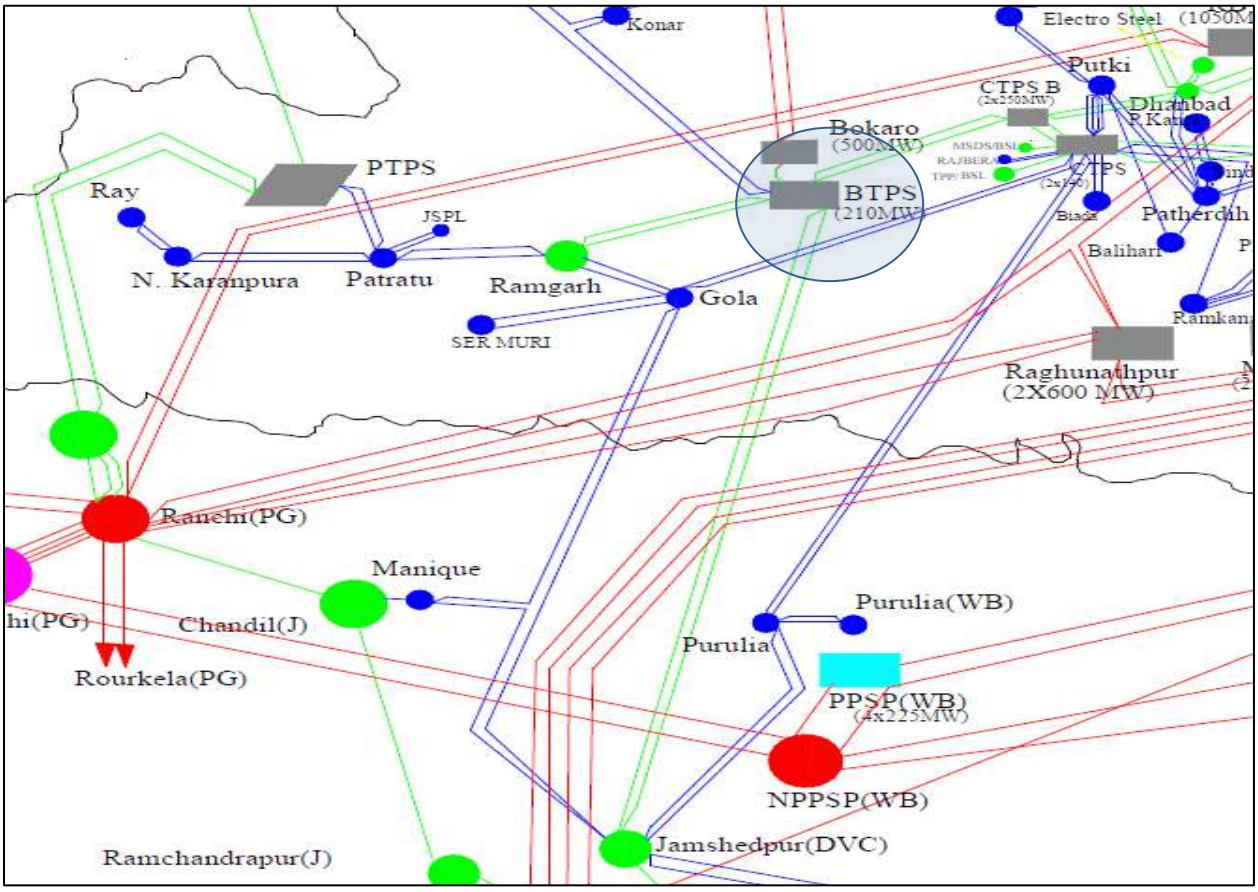


Figure 1: Network across the affected area

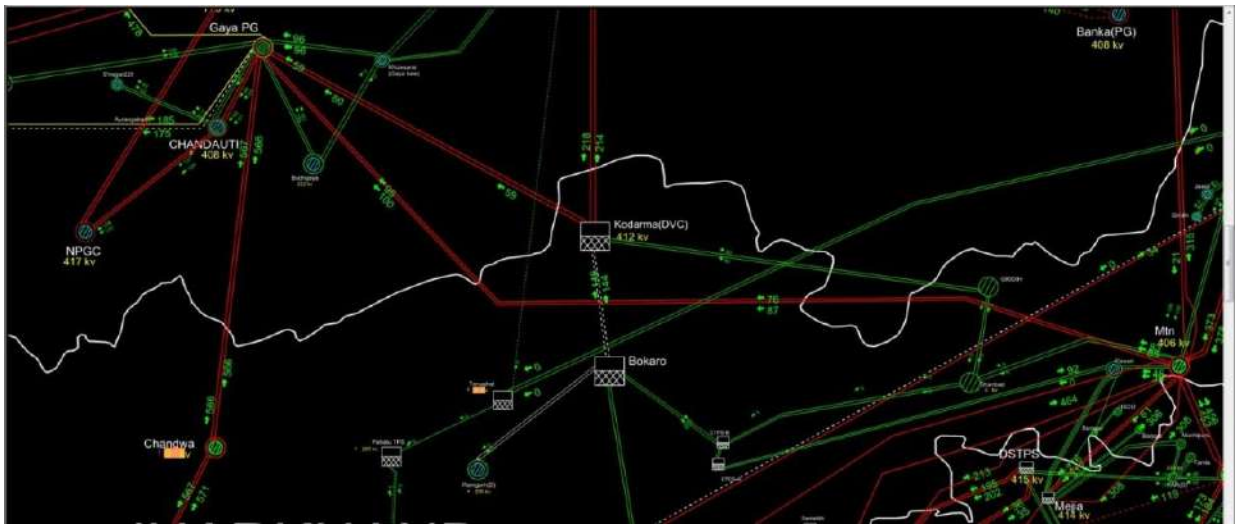


Figure 2: SCADA snapshot for of the system

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

समय	नाम	उप केंद्र 1 रिले संकेत	उप केंद्र 2 रिले संकेत	पीएमयू पर्यवेक्षण
19:37 Hrs.	220 kV Bus I & Bus II at Bokaro	Bus differential relay operated due to bus fault at BTPS-B	NA	PMU captured at Bokaro shows fault was cleared in around 1.5 seconds after first dip.
	2*315 MVA 400/220 kV ICTs at Bokaro			
	150 MVA 220/132 kV ICT I at Bokaro			
	220 kV Bokaro – Chandrapura D/C		Yet to be received	
	220 kV Bokaro – Jamshedpur D/C			
	220 kV Bokaro – Ramgarh D/C			
	132 kV Gola-Ramgarh-I	R/I of L-55 at Gola end- D.P. - B, O/C, E/F, VAJ 86, Zone 2.		
	132 kV Gola-Ramgarh-I	R/I of L-56 at Gola end- D.P - B, C, B/U, O/C, E/F, and Zone 3.	R/I of L-56 at Ramgarh end- 21M1, R & B ph. , 21M2 B-Ph.	

Figure 3: PMU captured at Bokaro shows fault was cleared in around 1.5 seconds after first dip

Restoration (पूर्वावस्था की प्रप्ति)

Transmission/Generation element name	Trip Time	Restoration time
150 MVA 220/132 kV ICT 1	19:37 Hrs	19:55
220 kV Bus 1 at BTPS- B		19:55
220 kV Bus 2 at BTPS- B		19:55
132 kV Ramgarh-Gola D/C		20:09
315 MVA 400/220 kV ICT 1		23:01
315 MVA 400/220 kV ICT 2		21:37
220 kV Bokaro-Chandrapura D/C		21:15
220 kV Bokaro-Ramgarh D/C		21:45
220 kV Bokaro-Jamshedpur D/C		21:20

Analysis of the event (घटना का विश्लेषण):

At 19:37 hrs, As reported by BTPS-B Station, due to suspected water seepage in the 220kV bus-Tie panel of BTPS-B, the Bus-bar relay got damaged and Bus-bar protection operated for both Main Bus-1 & Main Bus-2.

- Consequently, 220 kV Bus I & Bus II at Bokaro B tripped along with tripping of 220kV BTPS-B - Ramgarh D/C and 220kV BTPS-B-Jamshedpur D/C, leading to total power failure at 220/132kV Ramgarh,132 kV Patratu and 132 kV North Karnpura.
- Based on the preliminary report received from BTPS-B bus bar relay of 220kV BTPS-B was damaged leading to operation bus-bar protection followed by tripping of all connected 220kV transmission lines and associated 220/132 kV ICTs along with station transformers and auto transformers connected to Main bus 1 and 2 through bus bar trip relay 96 from BTPS-B end.
- Consequent to the tripping of 220kV BTPS-B – Ramgarh D/C, the total load of Ramgarh, Patratu & North Karnpura S/Ss fell on 132kV Ramgarh-Gola D/C, resulting in tripping of both the circuits due to overload at Gola end and Ramgarh end also.
- 220/132 kV Jamshedpur S/S availed power through 220kV Jamshedpur-Joda Tie-line and from CTPS through 132kV D/C Jamshedpur-Purulia-CTPS link.132kV BTPS-B availed power from 132kV Konar through 132kV BTPS-B-Konar S/C.
- Also, as reported one of the jumpers of L-55-132kV Ramgarh-Gola-1 got failed at Loc. No. 76.

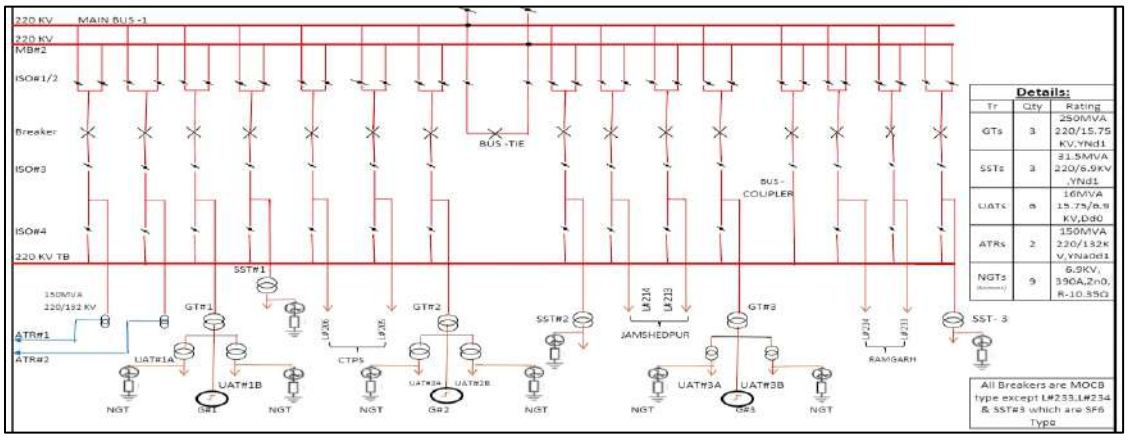


Figure 4: SLD of 220kV BTPS-B S/S

Bus Arrangement at 220 kV Bus of BTPS-B Station prior to the incident: -(As received from shared BTPS preliminary report)
MB-1:- ATR-1, SST-1, ICT-2, L-205(220kV BTPS-B – CTPS Ckt-1), L-213(220kV BTPS-B - Jamshedpur Ckt-1) & L-233 (220kV BTPS-B – Ramgarh Ckt1).
MB-2:- ATR-2, SST-2, ICT-1, L-206(220kV BTPS-B – CTPS Ckt-2), L-214(220kV BTPS-B - Jamshedpur Ckt-2) & L-234 (220kV BTPS-B – Ramgarh Ckt-2).

Protection issues observed (सुरक्षा समस्या):

- As per PMU plot it appears that 220 kV BTPS bus voltage became zero after 1.5 seconds, whether there was sequential tripping of 220 kV lines and if so reason may be shared.(DVC to explain).
- What are the precautions and action taken in this regard to avoid such kind of tripping's in future .

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	**DVC**
Fault clearance in more than 100 ms at 400 kV level and above and 160 ms at 220 kV levels	1. CEA Grid standard 2010 -3.e CEA Transmission Planning Criteria	**DVC**
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)	**DVC**

Status of Reporting (रिपोर्टिंग की स्थिति):

- DR/EL yet to be received from DVC.

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

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 फैक्स : 033-24235809/5029 Website:www.erldc.org, Email ID- erldc@posoco.in

घटना संख्या: **28-07-2021/1** दिनांक: **13-08-2021**

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

Summary of the event (घटना का सारांश):

At 02:20hrs 220 kV Parulia DVC –Durgapur STPS (Andal)-1 tripped in R-Y-Earth fault followed by tripping of 220 kV Parulia DVC-Parulia PG D/C and Parulia DVC –Durgapur STPS (Andal)-2 in Y-Earth fault at 02:26 hrs.220 kV Parulia DVC –Muchipara D/C were already in open condition leading to complete blackout of 220 kV Parulia DVC S/S along with interruption of power supply at DSP (Tamla) affecting power failure at oxygen plant as well. All load restored by 03:08 hrs by charging of 220kV Purulia DVC-Parulia PG D/C.

- **Date / Time of disturbance:** 28-07-2021 at 02:26 hrs.
- **Event type:** GD - 1
- **Systems/ Subsystems affected:** 220 kV Parulia DVC, 220kV DSP.
- **Load and Generation loss**.
    - No generation loss was reported during the event.
    - Around 140 MW load loss was reported during the event at Parulia and DSP

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

- 220 kV Parulia DVC-Muchipara D/C

Major elements tripped (प्रमुख ट्रिपिंग):

- 220 kV Parulia DVC-Parulia PG D/C
- 220 kV Parulia DVC- Durgapur STPS(Andal) D/C

Network across the affected area (प्रभावित क्षेत्र का नक्शा)

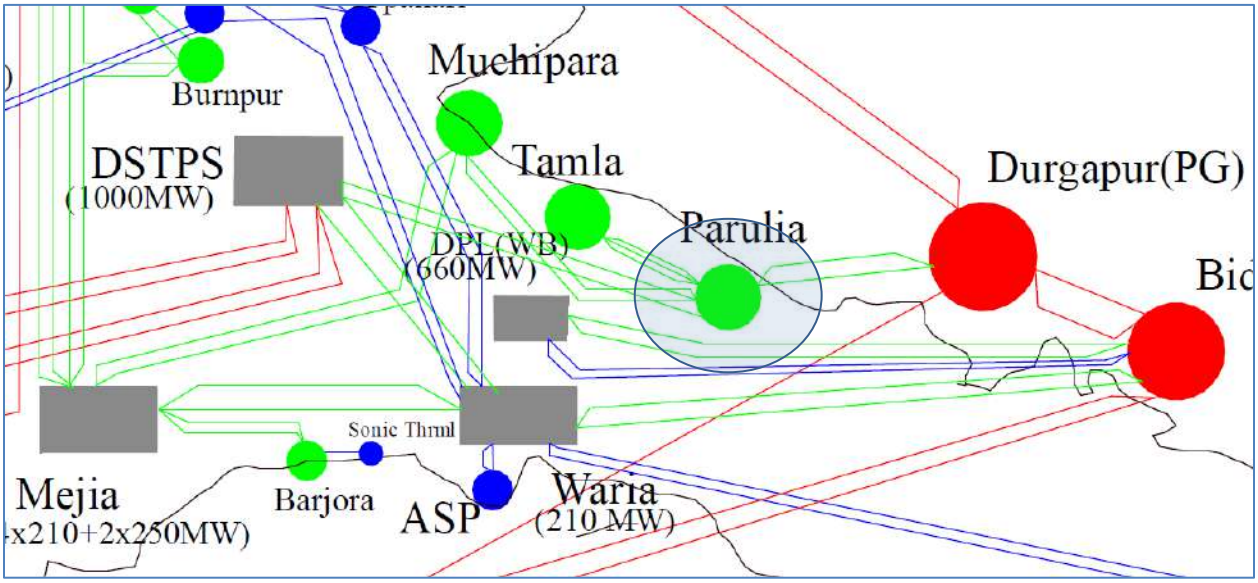


Figure 1: Network across the affected area

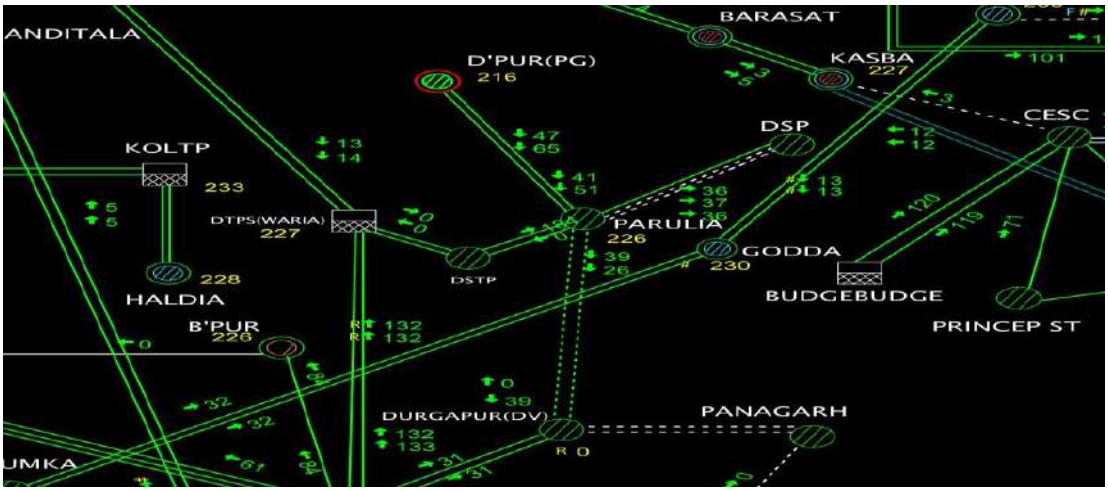


Figure 2: SCADA snapshot for of the system

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

समय	नाम	उप केंद्र 1 रिले संकेत	उप केंद्र 2 रिले संकेत	पीएमयू पर्यवेक्षण
02:20	220kV Parulia DVC-DSTPS-1	Z-1,No annunciation	R-Y-Earth,Z-1,A/R successful ,0.1kM,Ir=16.23kA,13.43kA	PMU captured at Durgapur shows R-Y-Earth fault cleared in 100ms seconds and dip of around 35 kV.
02:26	220kV Parulia DVC-DSTPS-2	Y-Earth,Z-1	Y-Earth,Z-1,5.34 kM, Fc= 6.9 kA; Conductor snap at LOC:68	PMU captured at Durgapur shows Y-Earth fault cleared in 100ms seconds and dip of around 48 kV
	220kV Parulia DVC-Patulia PG-1	Y-Earth,Z-3,Iy=2.188kM,Iy=7.93kA	High set O/c operated within 100ms.	
	220kV Parulia DVC-Patulia PG-2	Y-Earth,Z-3,Iy=2.359kM,Iy=7.389kA		

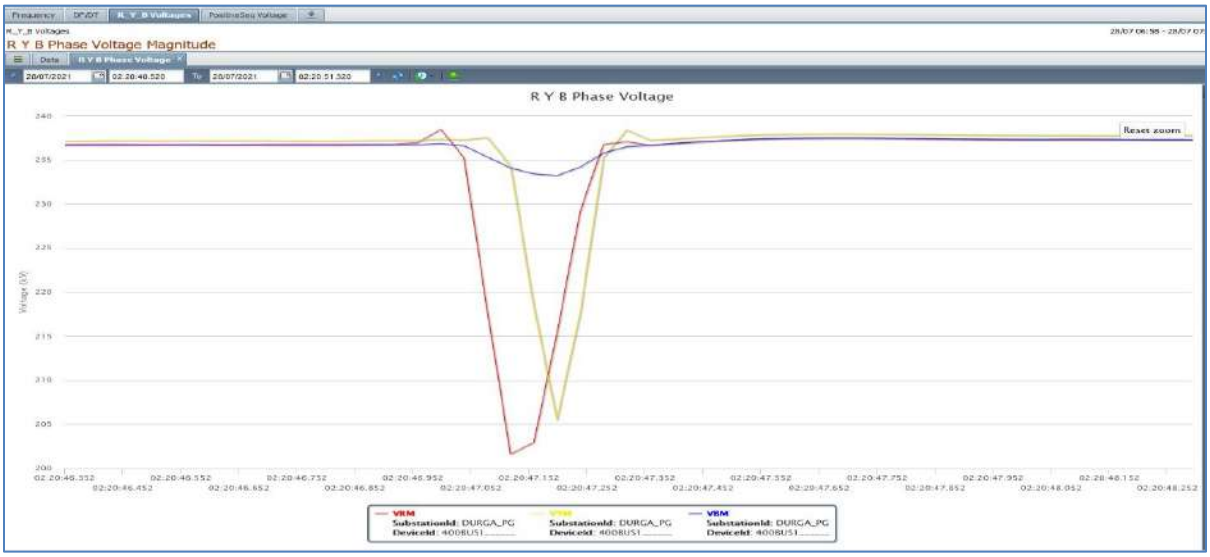


Figure 3: PMU captured at Durgapur shows R-Y-Earth fault cleared in 100ms seconds and dip of around 35 kV.

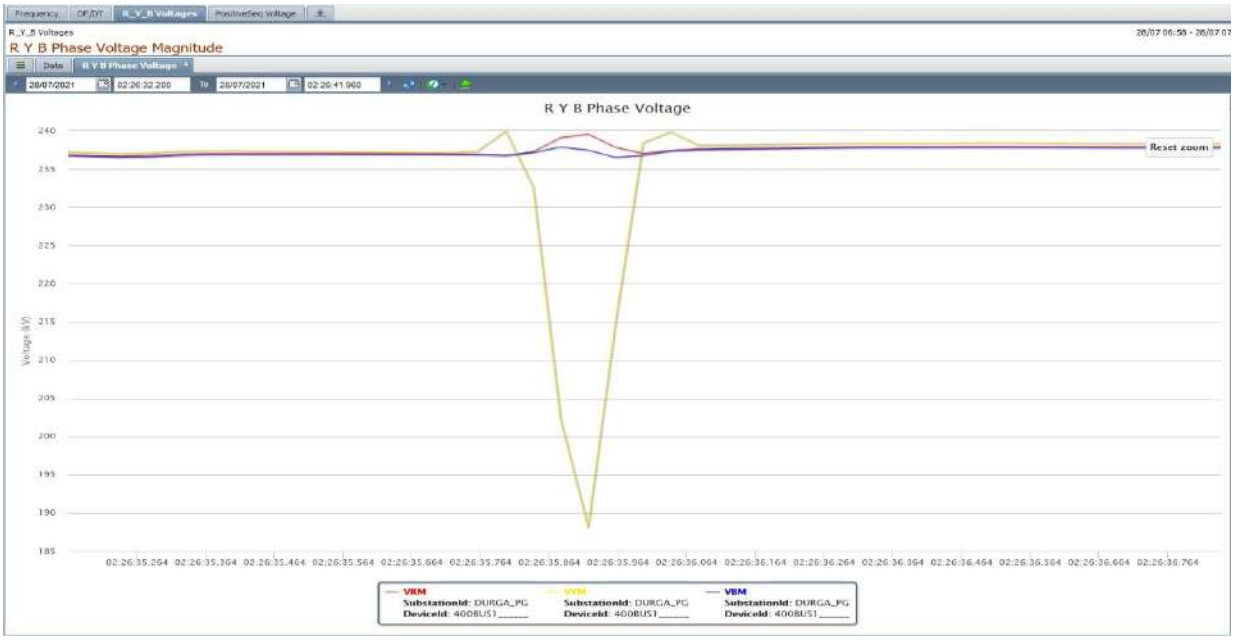


Figure 4: PMU captured at Durgapur shows Y-Earth fault cleared in 100ms seconds and dip of around 48 kV.

Restoration (पूर्वावस्था की प्रप्ति)

Transmission/Generation element name	Restoration time
220kV Parulia DVC-DSTPS-1	07:48
220kV Parulia DVC-DSTPS-2	19:17
220kV Parulia DVC-Parulia PG-1	03:08
220kV Parulia DVC-Parulia PG-2	03:08

Analysis of the event (घटना का विश्लेषण):

- At 02:20hrs 220 kV Parulia DVC –Durgapur STPS (Andal)-1 tripped in R-Y-Earth fault with A/R successful from Andal end. Before occurrence of fault loading in both the lines was around 138 MW.(Whether A/R occurred from Andal end for Phase to phase fault -DVC to explain)
- Hence due to tripping of circuit-1 loading of 220kV Purulia-DSTPS D/C shifted to circuit 2 and loading of circuit 2 became around 237 MW (**DVC report Annexure: 3**) .Leading to overloading of line and conductor snap at LOC no: 68(Location 3 from Parulia end) after 6 minutes from tripping of circuit 1 .
- Fault of 220 kV Parulia DVC –Durgapur STPS (Andal)-2 was sensed by both end and was cleared within 100ms .Although the fault of line was cleared within 100ms same fault was sensed by Durgapur (PG) end and tripped on O/C high set protection within 100ms.(Which should not occur).
- 220 kV Parulia DVC –Muchipara D/C were already in open condition leading to complete blackout of 220 kV Parulia DVC S/S along with interruption of power supply at DSP (Tamla) affecting power failure at oxygen plant as well.
- Total load loss reported was around 140MW at Parulia S/S and at DSP, Parulia bus charged at 02:43 hrs by extending power from Mejia via 220kV Parulia-Muchipara circuit.
- All load restored by 03:08 hrs by charging of 220kV Parulia DVC-Parulia PG D/C.

Protection issue (सुरक्षा समस्या):

- At 02:26 Hrs of 28.07.21 there was a fault in one of DVC's 220KV lines [Parulia -DSTPS Ckt # 2] which was cleared from both ends through Zone 1 Distance Protection and within about 80ms as evident from the PMU snapshots .
- However, before DVC line could clear the fault, both 220 Kv line of Parulia (PG)- Parulia (DVC) tie lines [1Km length] tripped at PGCIL End only through Back Up O/C Hi Set Protection.
- This unwanted tripping had caused total loss of power at DVC Parulia SS which in turn caused blackout in three Oxygen plants at Durgapur and the captive power plant (SAIL).
- Such an excess tripping from PGCIL End had also occurred on 18th May, 2021 at 18:58 hrs when a Parulia DSP Ckt # 3 CT had burst at Parulia end. On that day too, the fault was cleared from DVC end through Distance Protection Zone 1 well within 100ms. Although DSP End fault clearing had been somewhat delayed but PGCIL lines had tripped through their O/C Hi-Set protection (within about50ms) before DVC end breakers could clear the fault.

Following observations were made by DVC &ERLDC

- Normally instantaneous O/C protection should be kept OFF in transmission lines as it always has a chance to overtrip for faults external to protected line section as has happened the extant case in spite of our line protection clearing the fault well within the stipulated time of 160ms as per grid code [Section 4.7 (b) of IEGC effective 1st April 2006].
- DVC had already tested the pilot wire protection of both the tie lines in the months of January and February 2021 and no abnormality was found in the protection circuit.
- In view of the above points DVC requests PGCIL to kindly review their Pick Up level for O/C Hi Set Protection of both these lines so that they do not operate for faults beyond Parulia DVC 220KV bus as it is not prudent for their Hi-Set to operate for any faults external to their line.
- Moreover if PGCIL have to time grade their protection with DVC, a minimum coordination time of 200ms needs to be provided so that DVC end breakers get an opportunity to clear their own faults earlier. Thus PGCIL will have to set 300ms as the delay time for their Line Hi –Set O/C Protection if at all the protection is necessary at their end.

Response of PowerGrid ER-2

- DVC has been conveyed that the Control & Protection system upgradation work under progress at 220KV Parulia DVC station and will be complete soon. Further upgradation planned for 220KV Durgapur-Parulia D/C Line with Fiber based Line differential Protection and likely to be executed in next 2-3 months.
- Considering above Powergrid ER-2 is going to disable the High Set O/C setting of 220KV lines. Simultaneously, we will reduce the Z2 timing of 220KV Lines from 350 mSec to 300 mSec.
- The ICTs at Durgapur station are very old and delayed fault clearing will reduce the equipment life. Hence requested to adhere the schedule timeline as commenced.

  DVC is advised to strictly adhere to protection replacement as per the timeline.
  Confirmation of disabling High set O/C at PG end for Lines.(PG-ER-2)

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	**DVC,PG-ER-2**
Fault clearance in more than 100 ms at 400 kV level and above and 160 ms at 220 kV levels	1. CEA Grid standard 2010 -3.e CEA Transmission Planning Criteria	
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)	**PG-ER-2**

Status of Reporting (रिपोर्टिंग की स्थिति):

- DR/EL not received from DVC.
- DR/EL not received from PG-ER-2.

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

Yet to receive.

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 फैक्स : 033-24235809/5029 Website:www.erldc.org, Email ID- erldc@posoco.in

घटना संख्या: **25-07-2021/1** दिनांक: **27-07-2021**

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

Summary of the event (घटना का सारांश):

At 19:05 hrs 220kV Gaya-Khizisarai-2 was under shutdown and 220kV Gaya-Khizisarai-1 tripped in Y-Earth fault from Khizisarai end and at the same time 220kV Biharshariff-Khizisarai D/C tripped in R-Y-Earth fault leading to Khizisarai bus becoming dead. All load restored by 19:20 hrs.

- **Date / Time of disturbance:** 25-07-2021 at 19:05 hrs.
- **Event type:** GD - 1
- **Systems/ Subsystems affected:** 220 kV Khizisarai S/S.
- **Load and Generation loss**.
    - No generation loss was reported during the event.
    - Around 300 MW load loss was reported during the event (Nawada, Jahanabad, Sheikhpura, Wazirganj & Ataula).

Major elements tripped (प्रमुख ट्रिपिंग):

- 220 kV Gaya-Khizisarai-1
- 220 kV Khizisarai-Biharshariff D/C

Important Transmission Line if out (महत्वपूर्ण संचरण लाइने जो बंद है):

- 220 kV Gaya-Khizisarai-2
- 220 kV Bodhgaya-Khizisarai-D/C (Was under open condition)

Network across the affected area (प्रभावित क्षेत्र का नक्शा)

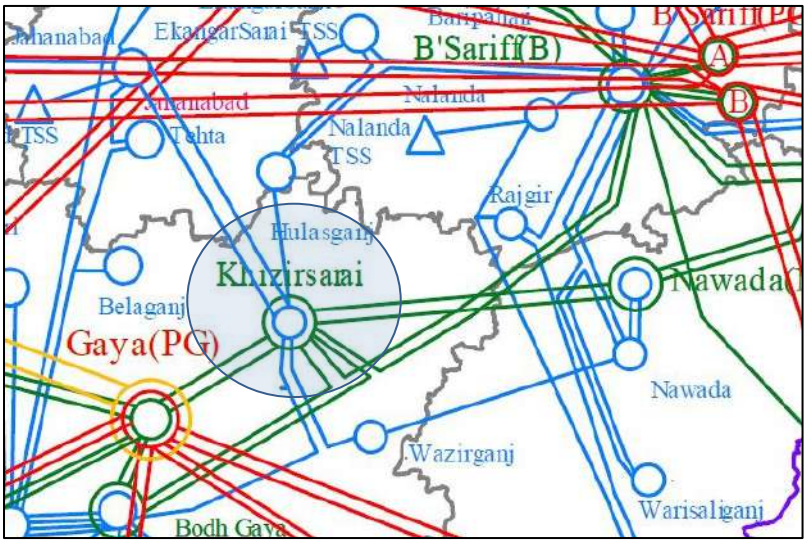


Figure 1: Network across the affected area

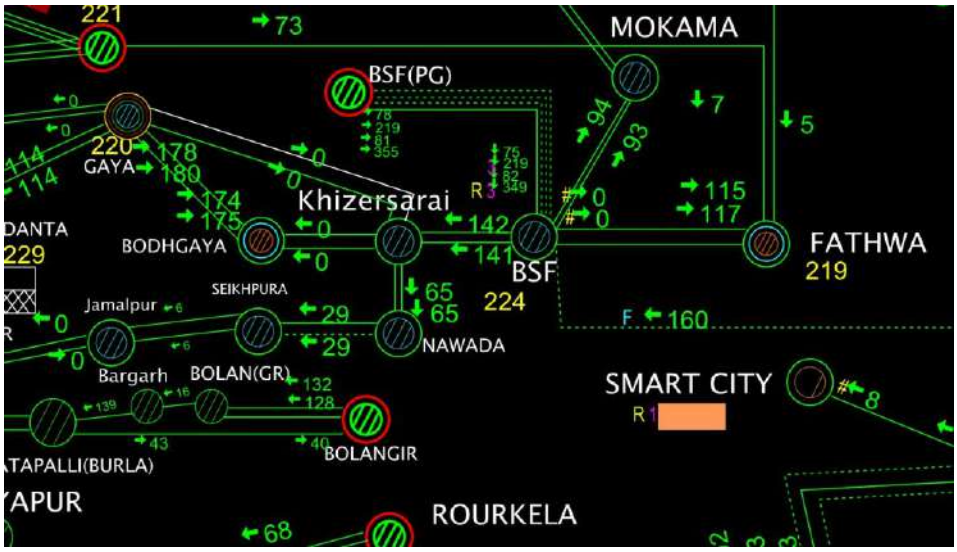


Figure 2: SCADA snapshot for of the system

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

समय	नाम	उप केंद्र 1 रिले संकेत	उप केंद्र 2 रिले संकेत	पीएमयू पर्यवेक्षण
19:04 Hrs.	220 kV Gaya-Khizisarai-1	Y-Earth ,2.04kA,56.2kM (100 %),A/R successful	Yet to receive	PMU captured at Chandauti and Biharshariff shows existence of R-Y fault with 3kV and 20 kV dip in both the phases respectively and fault clearing time was within 160 msec.
	220 kV Khizisarai-Biharshariff -1		R-Y-Earth, Z2,71.04 kM, Ir= 3.9kA, Iy:=2.5kA, Ib=646.8 A, Fr=7.9ohm	
	220 kV Khizisarai-Biharshariff -2		R-Y-Earth, Z3,74 kM, Ir- 3.kA, Iy=2.7kA, Ib=656.1 A129.4kV,Fr=9.1ohm	

Figure 3: PMU captured at Chandauti shows 3kV dip in R and Y phases indicating fault in R-Y phases.

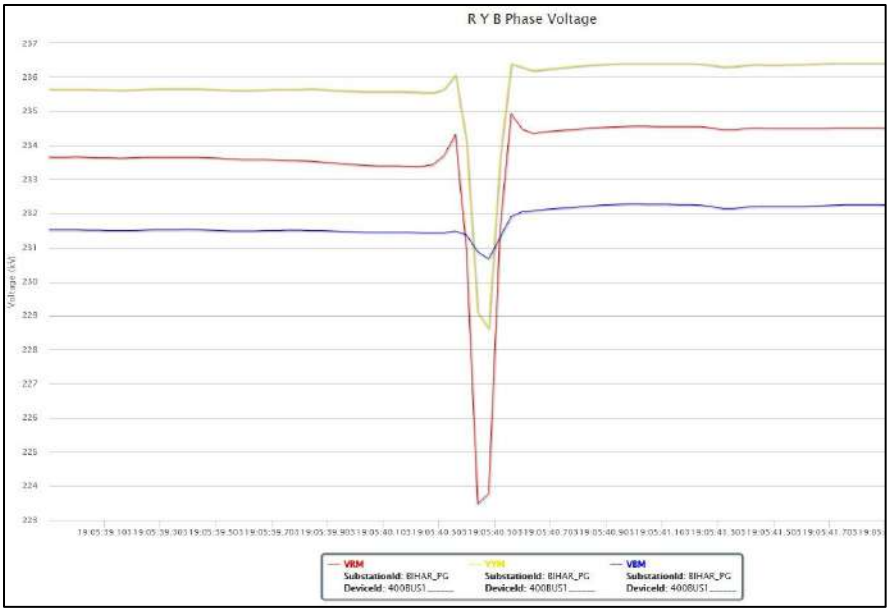


Figure 4: PMU captured at Biharshariff shows 20 kV dip in R and Y phases indicating fault in R-Y phases

Restoration (पूर्वावस्था की प्रप्ति)

- 220 kV Biharsariff-Khizisarai-1 restored at 19:20 hrs.
- 220 kV Biharshariff -Khizisarai-2 restored at 19:15 hrs.
- 220 kV Gaya-Khizisarai-1 restored at 11:39 hrs on26/07/2021.

Analysis of the event (घटना का विश्लेषण) and Protection issues observed (सुरक्षा समस्या):

- At 19:05 hrs 220kV Gaya-Khizisarai-1 tripped in Y-Earth fault. Single phase Y-N fault was only detected at Gaya end in Zone-2 but it received carrier signal from Khezisarai end (So it must have sensed the fault in z-1) so Gaya end Auto reclose initiated but Y and B both phases got opened and after 1 second both phases also got reclosed .(**PG-ER-1 to explain)** .

- While from DR of Gaya it appears that at Khezesarai end 3 phase tripping occurred at the fault instance. It may have sensed Phase to phase fault.**(BSPTCL ,BGCL to explain).**Fault distance from Gaya showing full length showing fault at Khezesarai end .

- Biharshariff D/C also tripped instantaneously sensing the same fault (R-Y) .Ckt-1 sensed zone-2 and ckt-3 sensed in zone-3 from BiharShariff end indicating fault at Khezesarai end but it tripped without delay. Reason for instantaneous tripping may be looked**.(BSPTCL to explain).**

- It also appears from DR of Biharshariff end for Khezesarai end that Line voltage became zero instantaneously which indicated tripping from Khezesarai end also immediately so what protection operated at Khezesarai end as fault should be in reverse direction **.(BSPTCL&BGCL to explain).**

- If khezesari D/C tripping could have been avoided load loss would have not occurred as it seems fault was not in this line.

- Location and nature of Fault may be investigated and root cause may be shared as fault seems to be at Khezesarai s/s end .

- Necessary protection co-ordination and Time setting of Zones of Distance protection needs to be reviewed and action may be taken to avoid such multiple tripping's leading to load loss.

- DR is required at Khizisarai end to analyse further.

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	**BSPTCL**
Fault clearance in more than 100 ms at 400 kV level and above and 160 ms at 220 kV levels	1. CEA Grid standard 2010 -3.e CEA Transmission Planning Criteria	**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)	**BSPTCL**

Status of Reporting (रिपोर्टिंग की स्थिति):

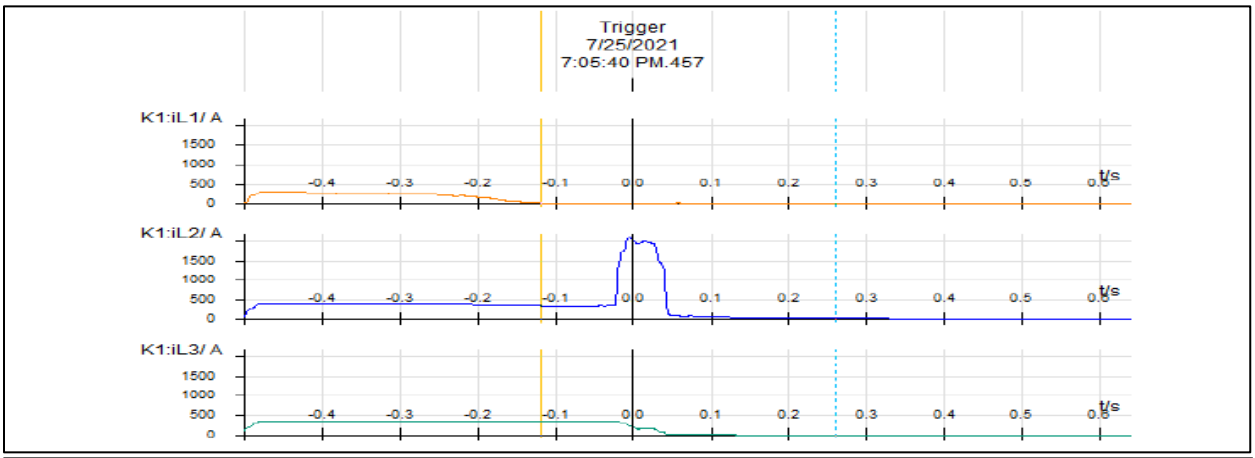
- DR/EL received from PG-ER-1&BSPTCL.
- DR/EL yet to be received from BGCL.

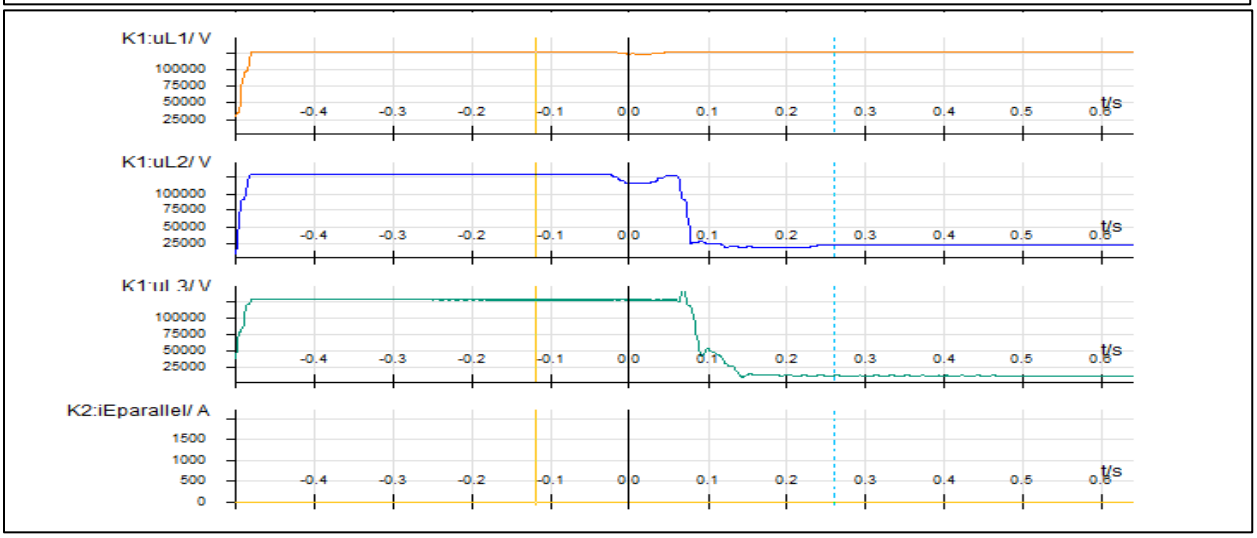
Annexure 1: Sequence of events recorded at ERLDC SCADA data at the time of the event.

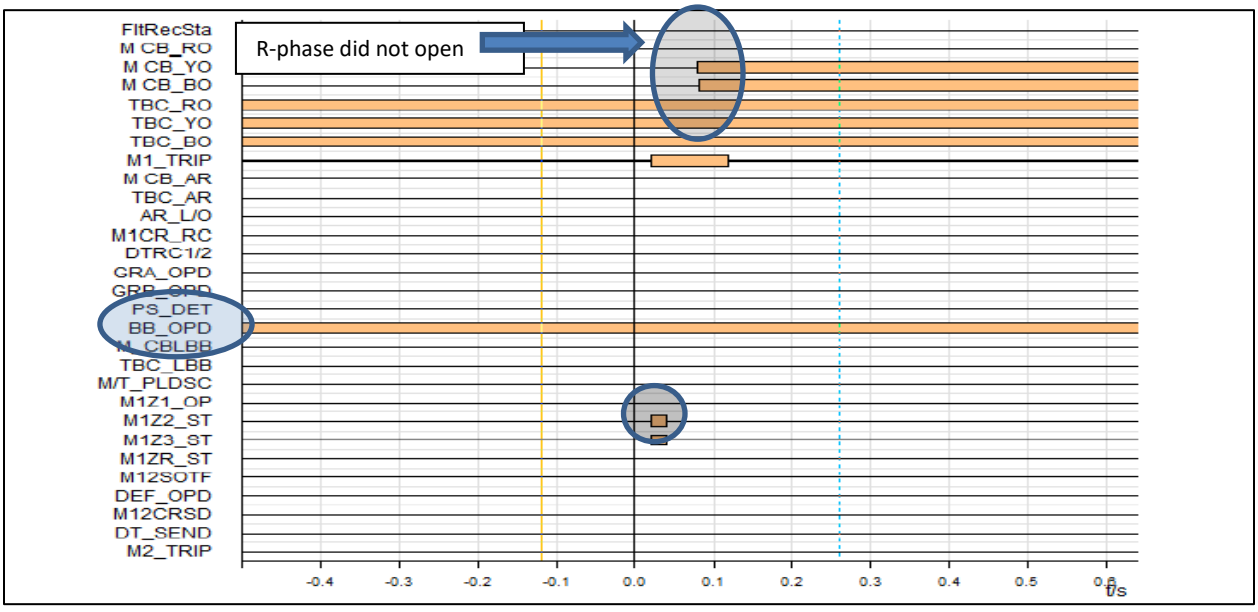
Sequence of event not recorded at time of event.

Annexure 2: DR recorded at Gaya end for 220kV Gaya-Khizisarai-1

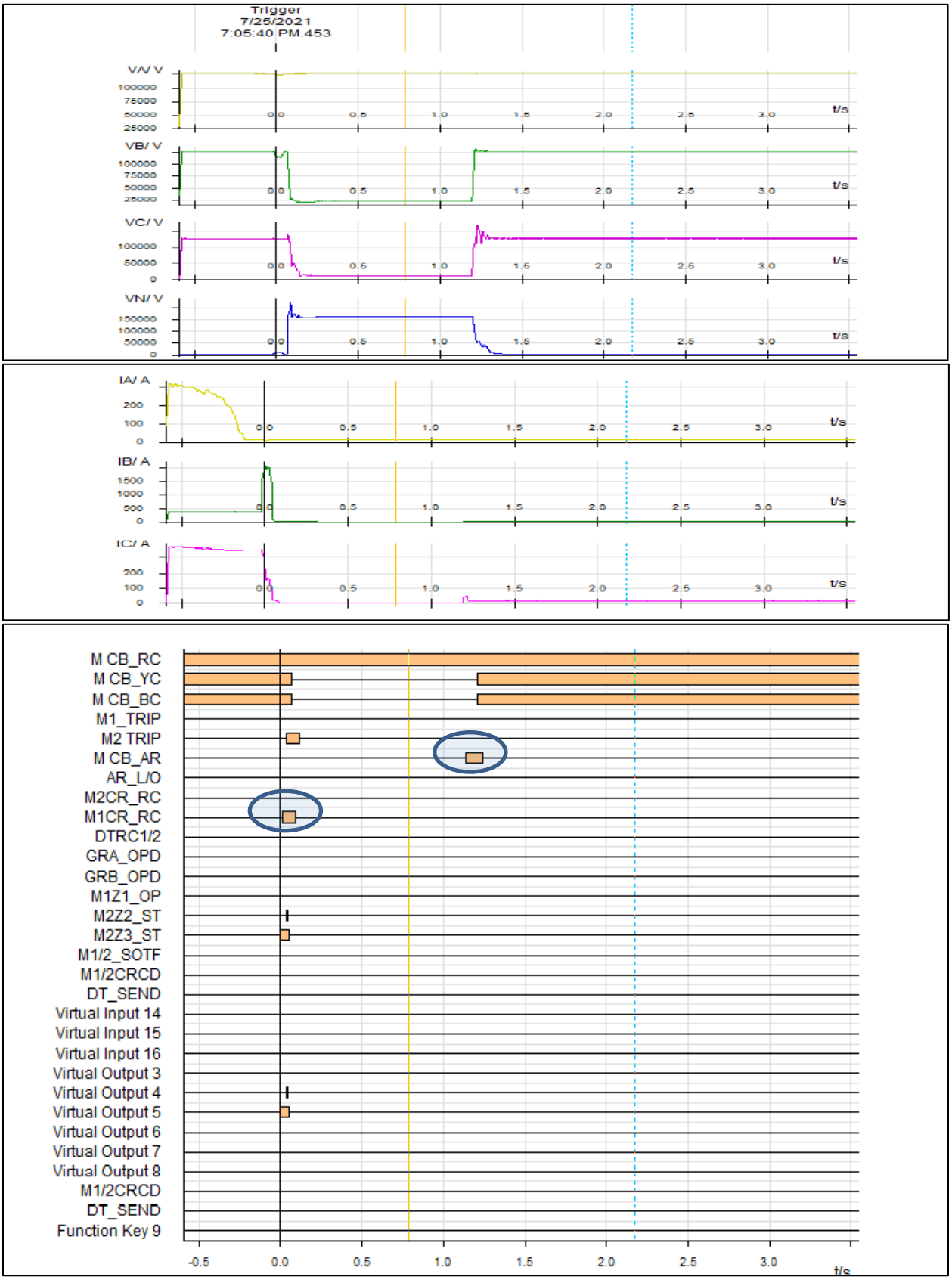
Main 1



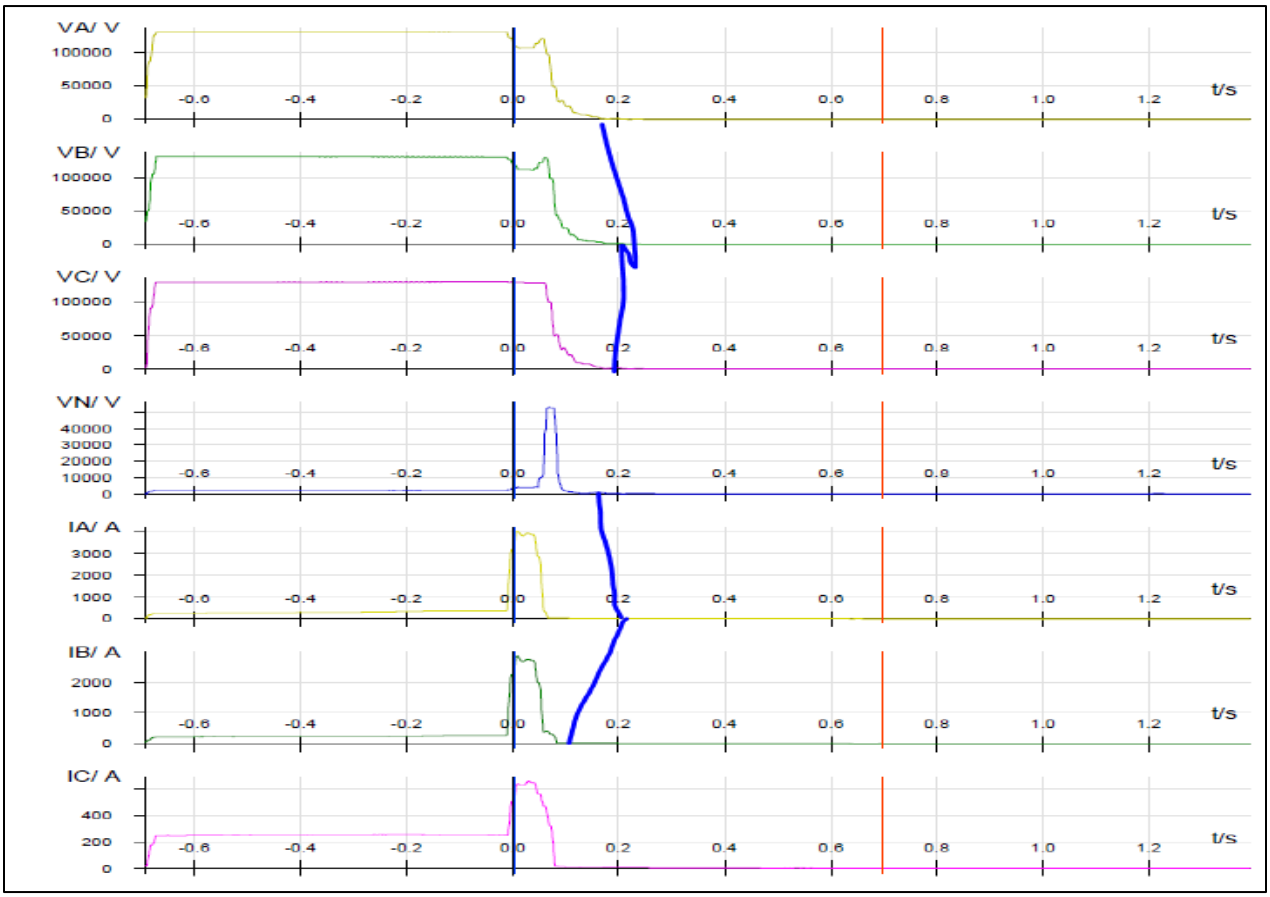


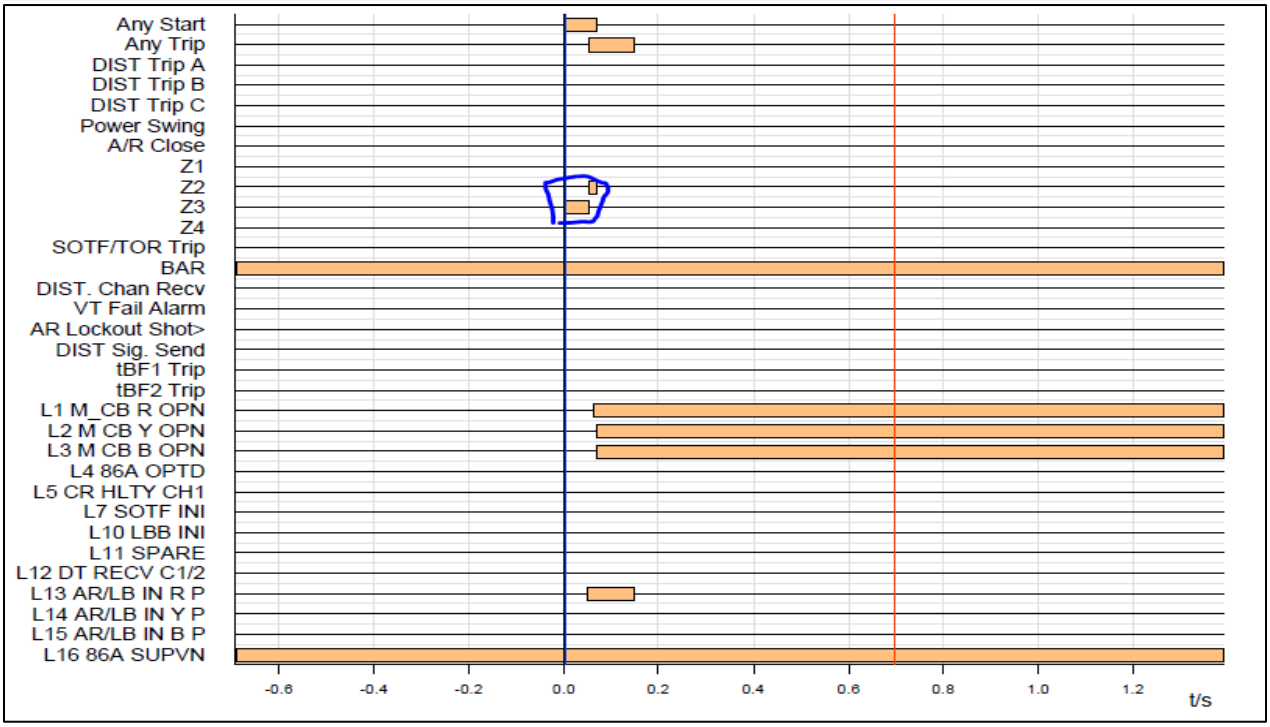


Main-2

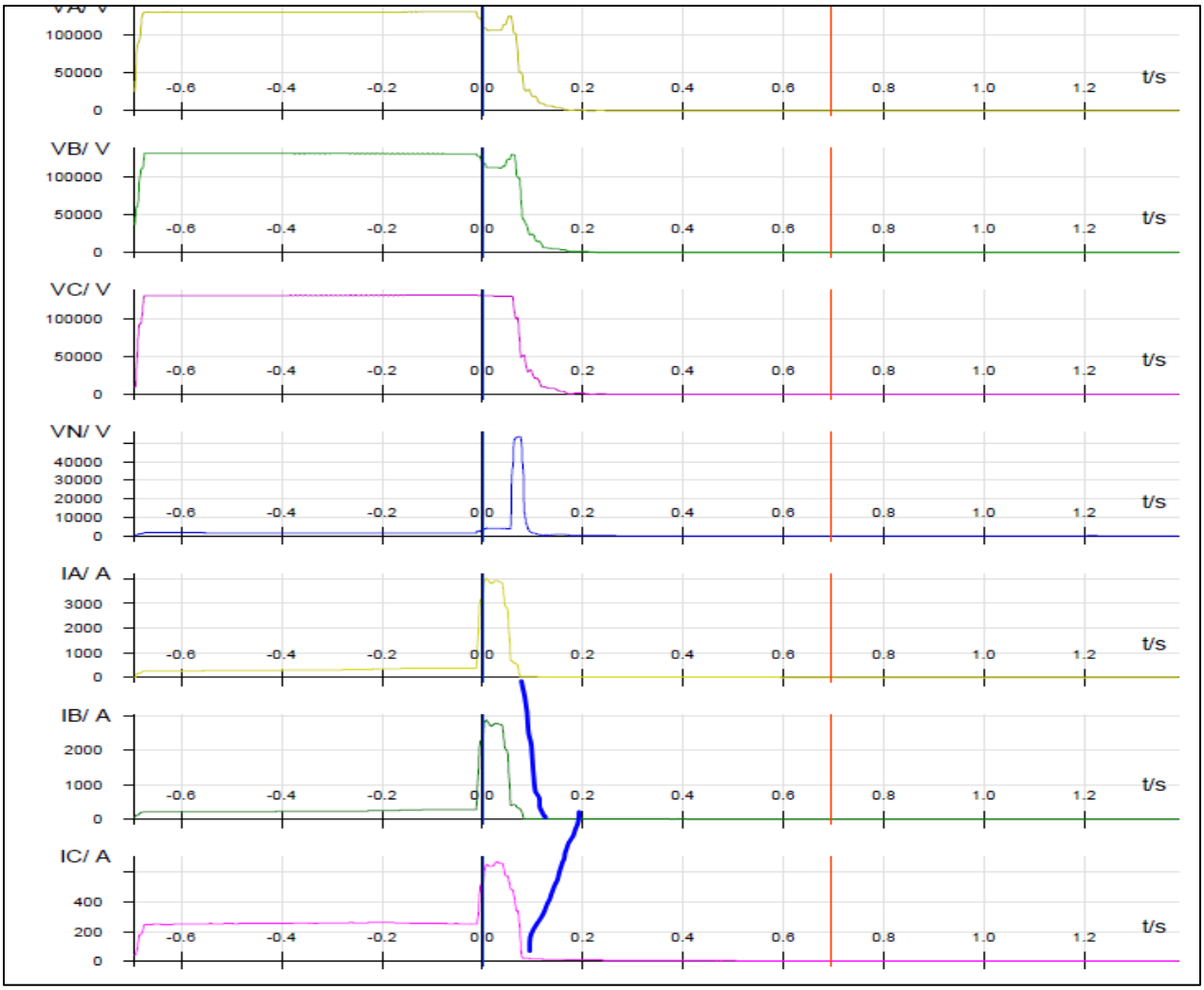

Trigger
7/25/2021
7:05:40 PM.453
VA/ V
VB/ V
VC/ V
VN/ V
IA/ A
IB/ A
IC/ A
t/s
M CB_RC
M CB_YC
M CB_BC
M1_TRIP
M2 TRIP
M CB_AR
AR_L/O
M2CR_RC
M1CR_RC
DTRC1/2
GRA_OPD
GRB_OPD
M1Z1_OP
M2Z2_ST
M2Z3_ST
M1/2_SOTF
M1/2CRCD
DT_SEND
Virtual Input 14
Virtual Input 15
Virtual Input 16
Virtual Output 3
Virtual Output 4
Virtual Output 5
Virtual Output 6
Virtual Output 7
Virtual Output 8
M1/2CRCD
DT_SEND
Function Key 9

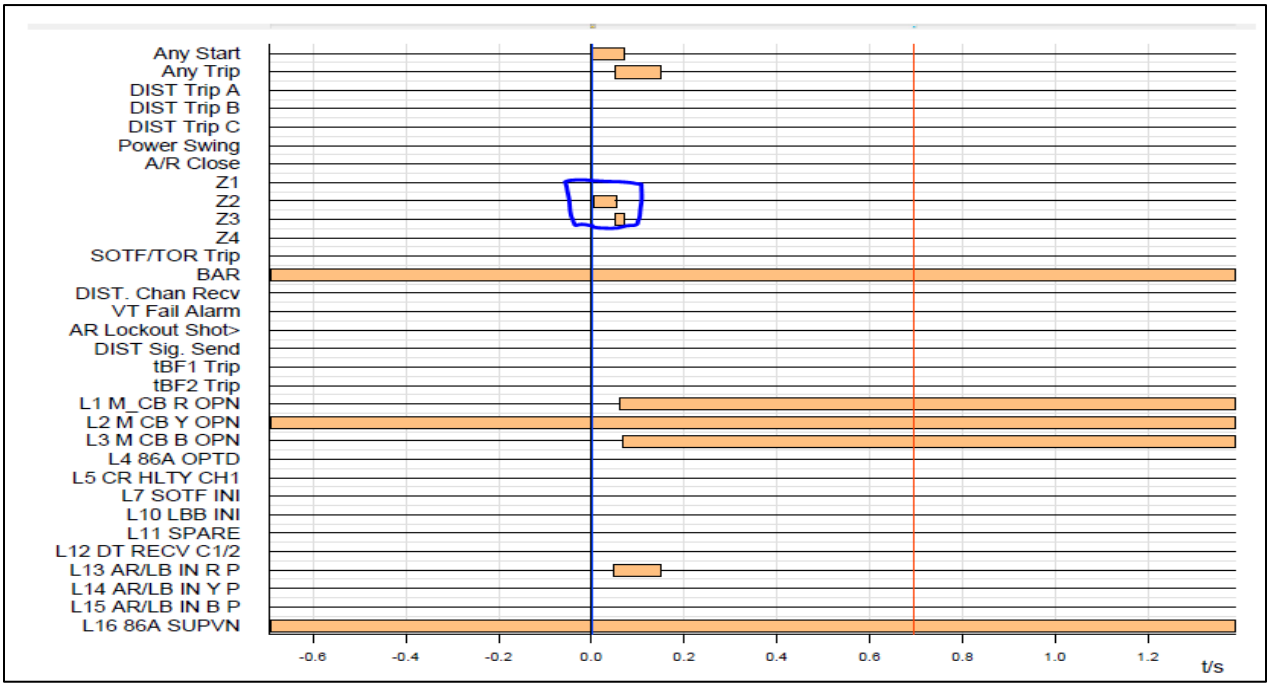
DR recorded at Biharshariff end for 220Kv Biharshariff-Khezesarai-1





DR recorded at Biharshariff end for 220Kv Biharshariff-Khezesarai-2





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 फैक्स : 033-24235809/5029 Website:www.erldc.org, Email ID- erldc@posoco.in

घटना संख्या: **28-07-2021/2** दिनांक: **28-07-2021**

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

Summary of the event (घटना का सारांश):

At 07:33 Hrs, 220/132 KV (160 MVA) ATR-2 ,R phase HV Bushing blasted and tripped due to operation of differential protection. Subsequently, 220/132 KV 200 MVA ATR-1 tripped on O/C. This led to total power failure on 132 KV side of Darbhanga (BSPTCL). 220 KV Darbhanga (BSPTCL)-Musahari-2 sensed the same fault and tripped from Musahari end only. Later, all 220 KV lines at Darbhanga (BSPTCL) was manually hand-tripped due to fire in the substation initiated due to blasting of Bushing.

- **Date / Time of disturbance:** 28-07-2021 at 07:33 hrs.
- **Event type:** GD - 1
- **Systems/ Subsystems affected:** 220 kV Darbhanga (BSPTCL)
- **Load and Generation loss**.
    - No generation loss reported during the event.
    - Around 211 MW load loss reported during the event .

Major elements tripped (प्रमुख ट्रिपिंग):

- 160 MVA ATR-2
- 200 MVA ATR-1
- 220 KV Darbhanga (BSPTCL)-Musahari-2
- 220 KV Darbhanga (DMTCL)-Darbhanga (BSPTCL) D/c

Network across the affected area (प्रभावित क्षेत्र का नक्शा)

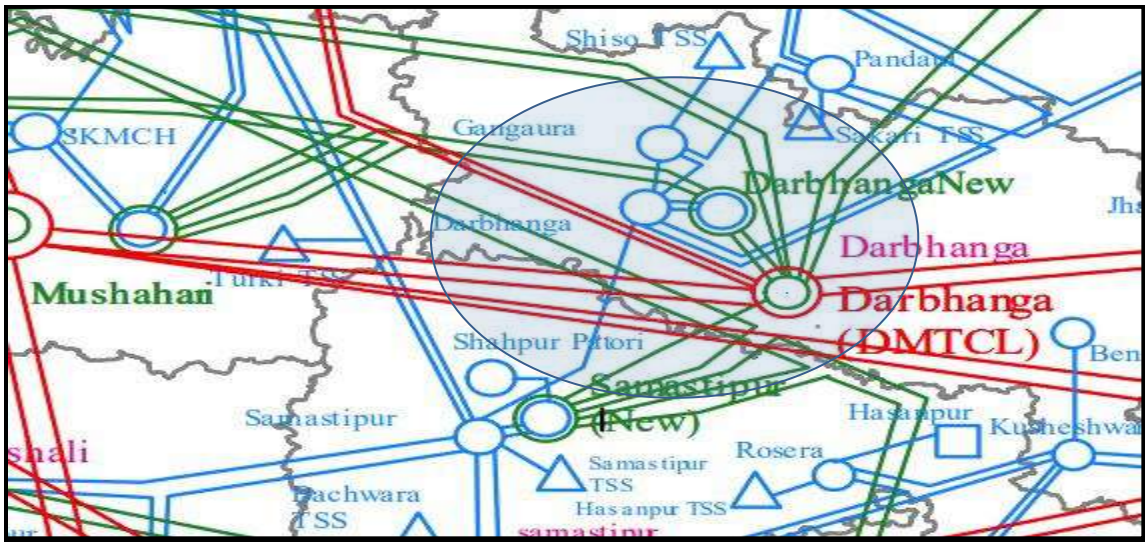


Figure 1: Network across the affected area

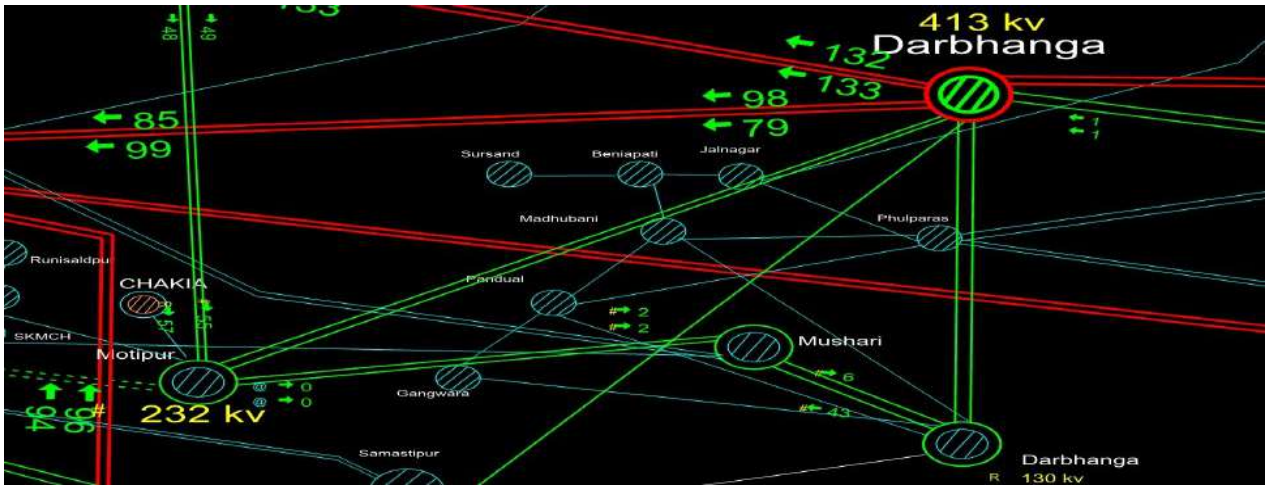


Figure 2: SCADA snapshot for of the system

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

समय	नाम	उप केंद्र 1 रिले संकेत	उप केंद्र 2 रिले संकेत	पीएमयू पर्यवेक्षण
07:33 Hrs	220/132 KV 160 MVA ATR-2 at Darbhanga (BSPTCL)	Differential relay operated		PMU at Muzaffarpur captured R_N fault which was captured within 100 msec
	220/132 KV 200 MVA ATR-1 at Darbhanga (BSPTCL)	Tripped on O/C		
	220 KV Darbhanga (BSPTCL)-Musahari-2	Darbhanga: Didn't trip (hand-tripped at 07:36 Hrs)	Musahari: R_N, Z I	
07:36	220 KV Darbhanga (BSPTCL)-Musahari-1	hand-tripped (Line was idle charged from Darbhanga)	-	
07:36	220 KV Darbhanga (BSPTCL)-Darbhanga (DMTCL)-1	Manually hand-tripped from BSPTCL end	Didn't trip	
07:36	220 KV Darbhanga (BSPTCL)-Darbhanga (DMTCL)-2	Manually hand-tripped from BSPTCL end	Didn't trip	

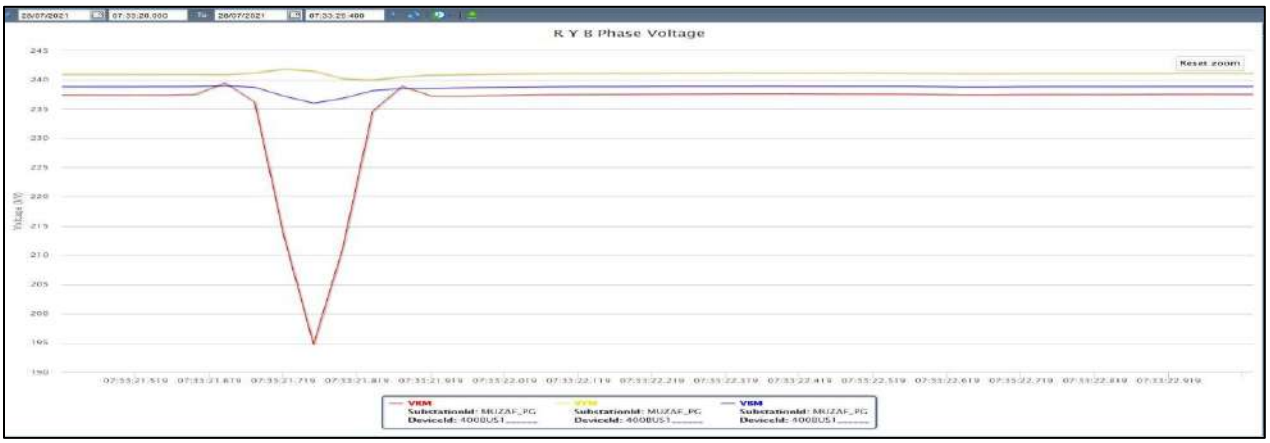


Figure 3: PMU captured at Muzaffarpur shows R-Earth fault with clearance less than 100 Ms.

Restoration (पूर्वावस्था की प्रप्ति)

Transmission/Generation element name	Restoration time
220/132 KV 160 MVA ATR-2 at Darbhanga (BSPTCL)	Under breakdown
220 KV Darbhanga (BSPTCL)-Darbhanga (DMTCL)-1	09:37
220 KV Darbhanga (BSPTCL)-Darbhanga (DMTCL)-2	09:37
220 KV Darbhanga (BSPTCL)-Musahari-1	10:38
220 KV Darbhanga (BSPTCL)-Musahari-2	10:38
220/132 KV 200 MVA ATR-1 at Darbhanga (BSPTCL)	10:48

Analysis of the event (घटना का विश्लेषण):

- At 07:33 Hrs, 220/132 KV (160 MVA)ATR-2 R phase HV side Bushing blasted which led to tripping of this ATR on differential protection.
- Due to Tripping of ATR-2 ,ATR-1 of 200 MVA tripped on Overcurrent due to overload as loading of single remaining ATR became 200Mw which led to load loss of Darbhanga.
- It has been observed that Remaining ATR of 200 MVA tripped within 300ms which indicates towards the conservative overcurrent setting of ATR .As per the received setting it appears that Pickup is at 180 Mw with 350 msec delay .
- O/C setting may be reviewed and revised as margin available with increased delay so that on tripping of One ATR other ATR tripping may be avoided and this will also give sufficient time to take manual action to avoid overload to safeguard the ATR tripping and load loss. **BSPTCL may explain**
- At 07:33 Hrs, 220 KV Darbhanga-Musahari-2 tripped from Musahari end only as it sensed the same fault first in Zone-2 and then in Zone-1 which caused tripping of line immediately. (No A/R in this line). **BSPTCL may explain.**
- Rest lines protection initiated (Local-z4 and remote zone-2) sensing the fault but did not operate as all got reset due to fault clearance within 100ms.
- Rest lines as mentioned below were hand tripped due to fire hazard in substation.
- 220 KV Darbhanga-Musahari-1 (idle charged from Darbhanga) was hand-tripped at 07:36 Hrs.
- 220 KV Darbhanga (BSPTCL)-Darbhanga (DMTCL) D/c was hand-tripped from BSPTCL end at 07:36 Hrs. Both lines remained charged from DMTCL end.

Protection issues observed (सुरक्षा समस्या):

- 220/132 KV 200 MVA ATR-1 should not trip on O/C immediately as total load after tripping of ATR-2 was less than 100% of its rating. O/C settings of both 220/132 KV ATRs to be reviewed and revised as margin available.
- 220 KV Darbhanga (BSPTCL)-Musahari tripped from Musahari end only in Z I.
    - Zone II started first then converted to Z-1.
    - Three phase tripping occurred; it seems single phase A/r scheme was not in service.
    - No carrier signal sent to other end.

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	**BSPTCL**
Fault clearance in more than 100 ms at 400 kV level and above and 160 ms at 220 kV levels	1. CEA Grid standard 2010 -3.e CEA Transmission Planning Criteria	
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)	**BSPTCL**

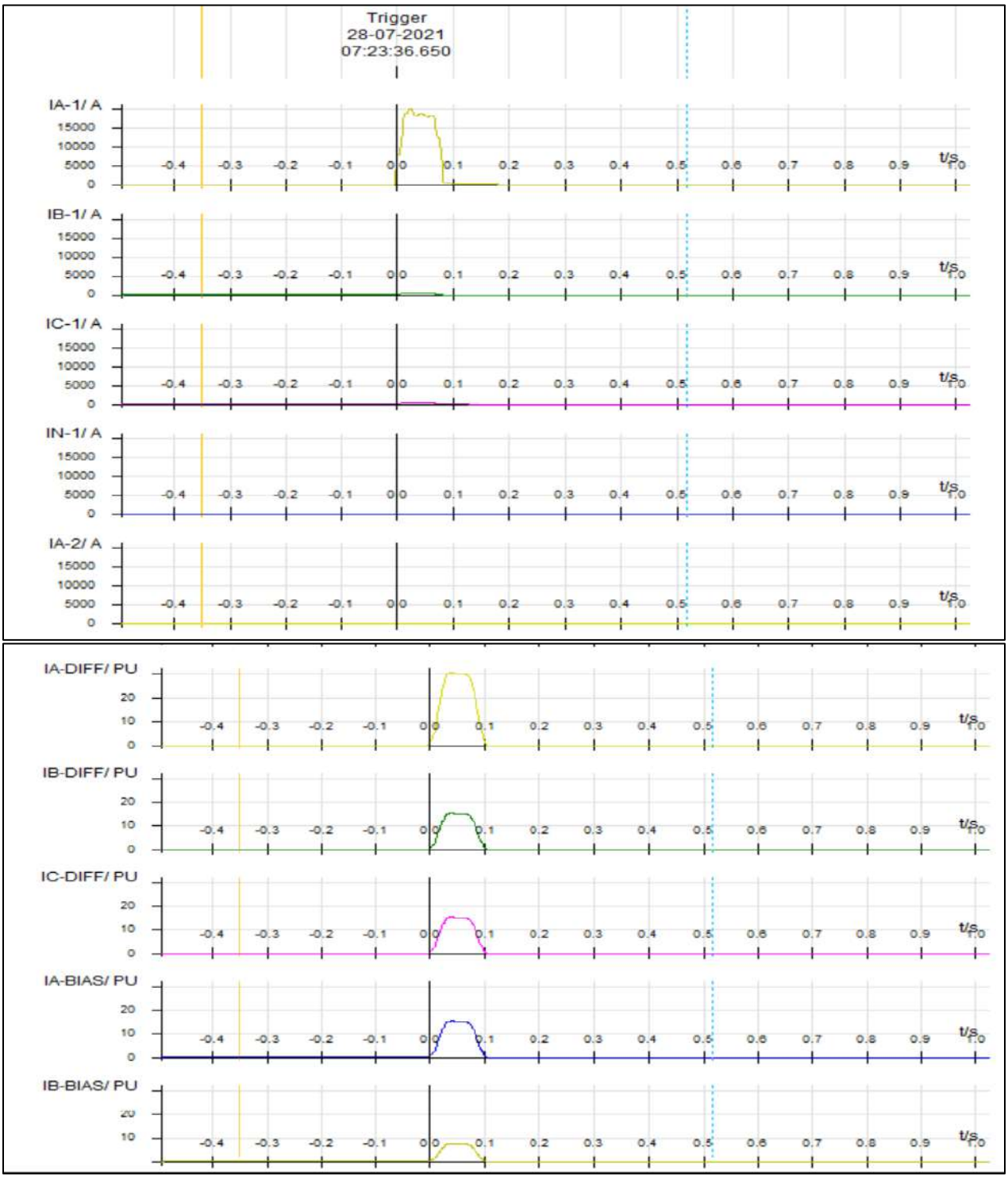
Status of Reporting (रिपोर्टिंग की स्थिति):

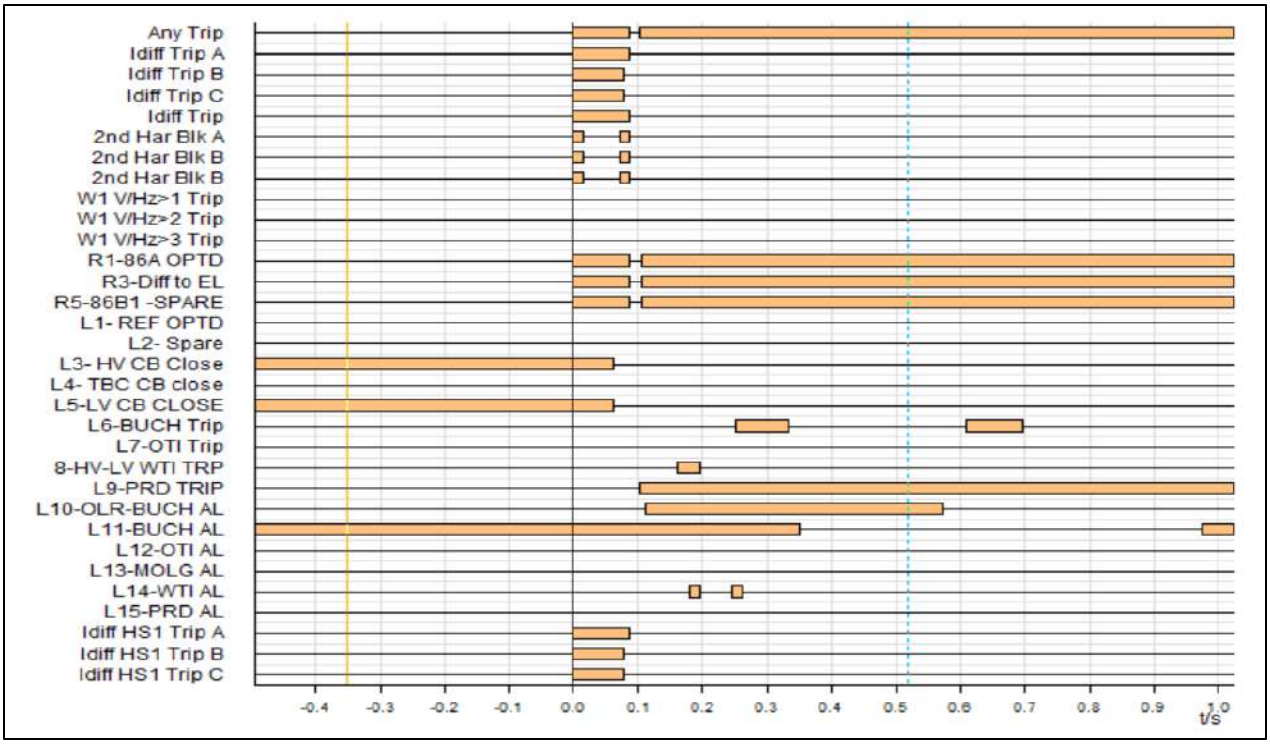
- DR/EL received from BSPTCL.

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.

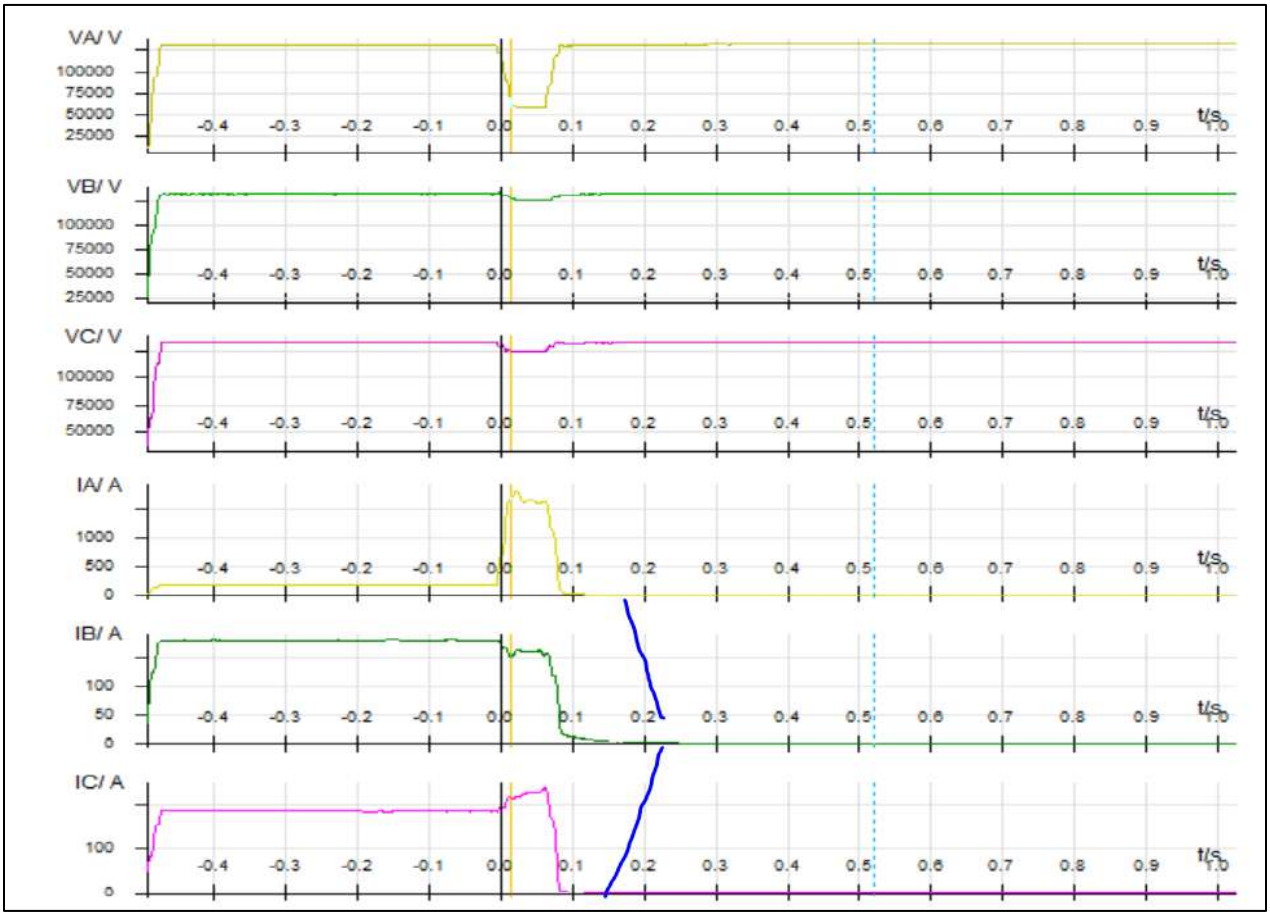
Annexure 2: DR recorded at BSPTCL end for ATR

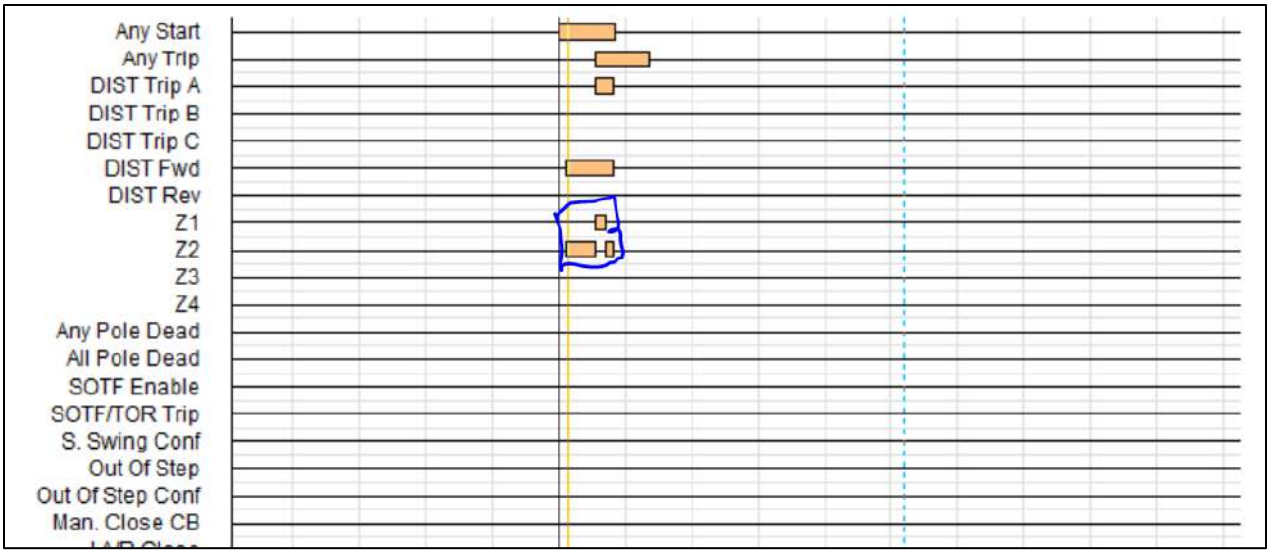




DR recorded at MUSAHARI end for Darbhanga-Musahari-II:

Three phase Current at Musahari end became zero




Any Start
Any Trip
DIST Trip A
DIST Trip B
DIST Trip C
DIST Fwd
DIST Rev
Z1
Z2
Z3
Z4
Any Pole Dead
All Pole Dead
SOTF Enable
SOTF/TOR Trip
S. Swing Conf
Out Of Step
Out Of Step Conf
Man. Close CB

Repeated Tripping of 220 kV Purnea -Khagaria and associated Issues

It has been observed that 220 kv Purnea -Khagaria has tripped multiple times in last few months, where as per DR analysis it has been observed that faults are occurring due to, ROW vegetation issue, along with issues related to protection and A/R are also observed. So BSPTCL is requested to do proper patrolling and line maintenance ,for ensuring healthiness of line. Line tripping details are mentioned below,

Sr NO	Element Name	Tripping Date	Tripping Time	Relay (Purnea end)	Relay (Khagaria end)
1	220KV-KHAGARIA-NEW PURNEA-2	27-05-2021	23:22	NEW PURNEA: Y-B, 36KM, IY-5.55KA, IB-5.54KA	
2	220KV-KHAGARIA-NEW PURNEA-2	25-05-2021	04:24		Khagaria- B-N Zone-1 FC: 1.144kA Distance: 58.27km
3	220KV-KHAGARIA-NEW PURNEA-2	12-05-2021	16:34	New Purnea- Z1 Y-B FC-Iy-7kA Ib-7kA FD-24.6kA - Distance: 72.5km,	Khagaria Z1 Y-B- FC-Iy-1.39kA Ib-1.50kA
4	220KV-KHAGARIA-NEW PURNEA-2	08-05-2021	02:57	PURNEA - Y_B , IY 4.5 KA , IB - 4.5 KA , FD - 47.39 KM	KHAGARIA , - Y_B , IY - 1.75 KA , IB - 1.83 KA , 47.39 KM
5	220KV-KHAGARIA-NEW PURNEA-2	03-05-2021	18:38	New Purnea: Y_B_N, 58.8 KM, Iy=Ib=4.2 kA	Khagaria: Y_B_N, 34.1 KM, Iy=Ib= 1.90 kA
6	220KV-KHAGARIA-NEW PURNEA-2	01-07-2021	06:25		KHAGARIA:- Z-1, 26.35KM, R-N FAULT, IR= 1.95KA
7	220KV-KHAGARIA-NEW PURNEA-2	02-07-2021	19:56	NEW PURNEA: A/R SUCCESSFUL, R-N, 4.6KA, 40KM	
8	220KV-KHAGARIA-NEW PURNEA-2	06-07-2021	11:24	NEW PURNEA - FAULT - B_N , FD - 43.4 KM , FC - 3.14 KA (A/R , SUCCESSFUL)	TRIP FROM KHAGARIA SIDE - B_N , FD- 74.12 KM , FC - 1.042 KA
9	220KV-KHAGARIA-NEW PURNEA-2	16-07-2021	12:03	New Purnea: B_N, 61.1 KM, 2.771 kA	
10	220KV-KHAGARIA-NEW PURNEA-2	17-07-2021	04:04		KHAGARIA:- Distance Protection Opeated,R-Phase Zone-1 Ir: 2.11kA, Distance: 17.2km

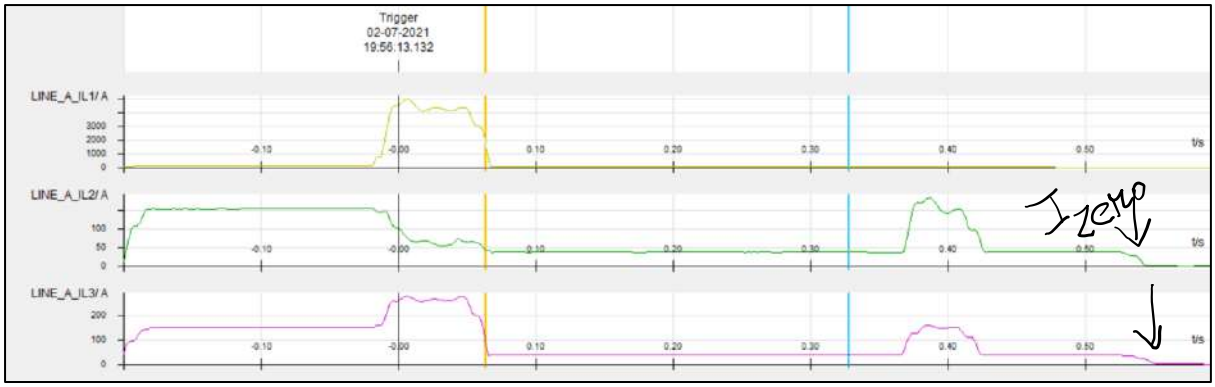
Issues are mentioned below in details

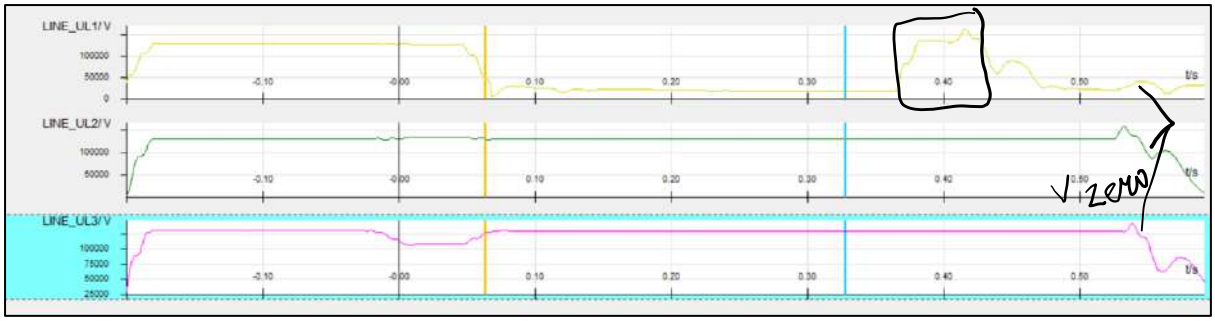
Protection Issue:

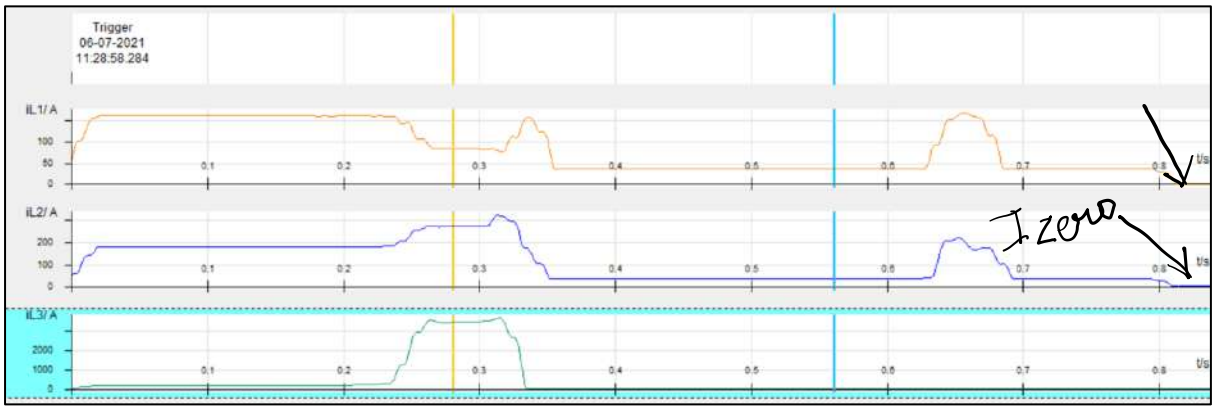
It has been observed that for all cases whenever there is fault in any phase , that phase is being opened immediately but after 500ms of that other rest two phases are also being opened as observed from Purnea end DR .

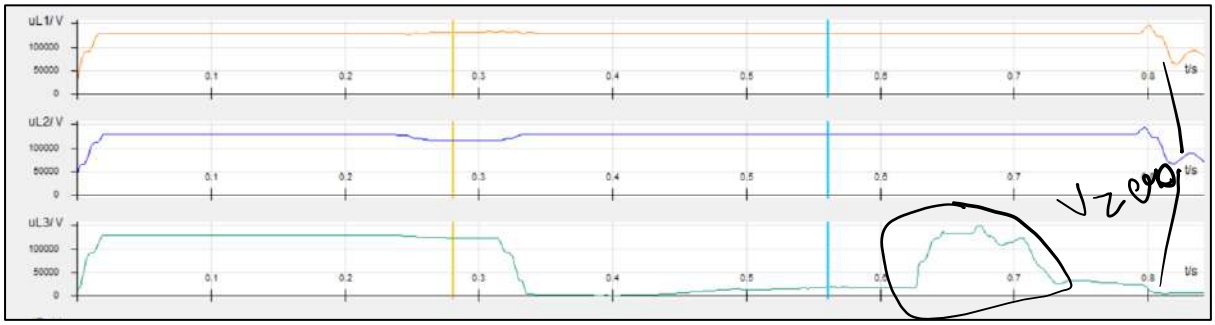
Line current of rest 2 phases are becoming zero which can be observed from below attached DRs for all cases.

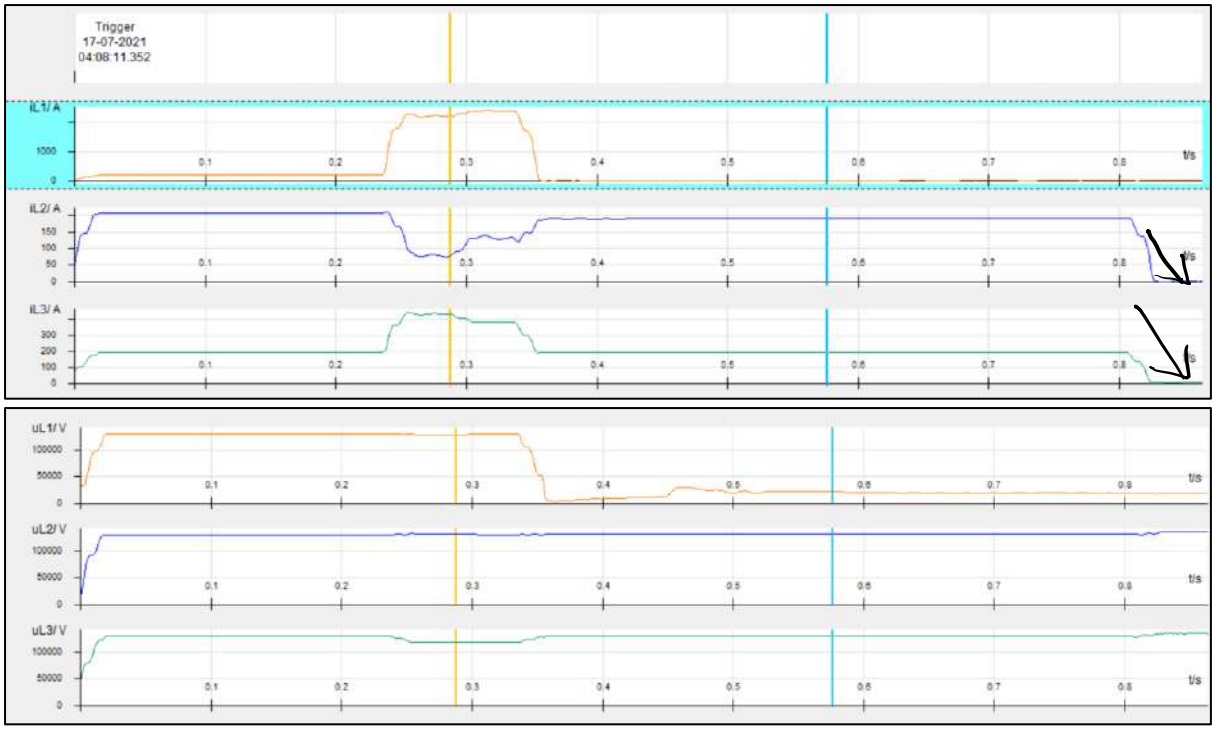
Issue of Auto reclose can also be seen in below attached DR that ,A/r is not occurring as rest 2 phases are being opened, this can be properly analysed for root cause identification and mitigation.


Trigger
02-07-2021
19:56.13.132
LINE_A_IL1/ A
LINE_A_IL2/ A
LINE_A_IL3/ A
I zero


LINE_UL1/ V
LINE_UL2/ V
LINE_UL3/ V
V zero

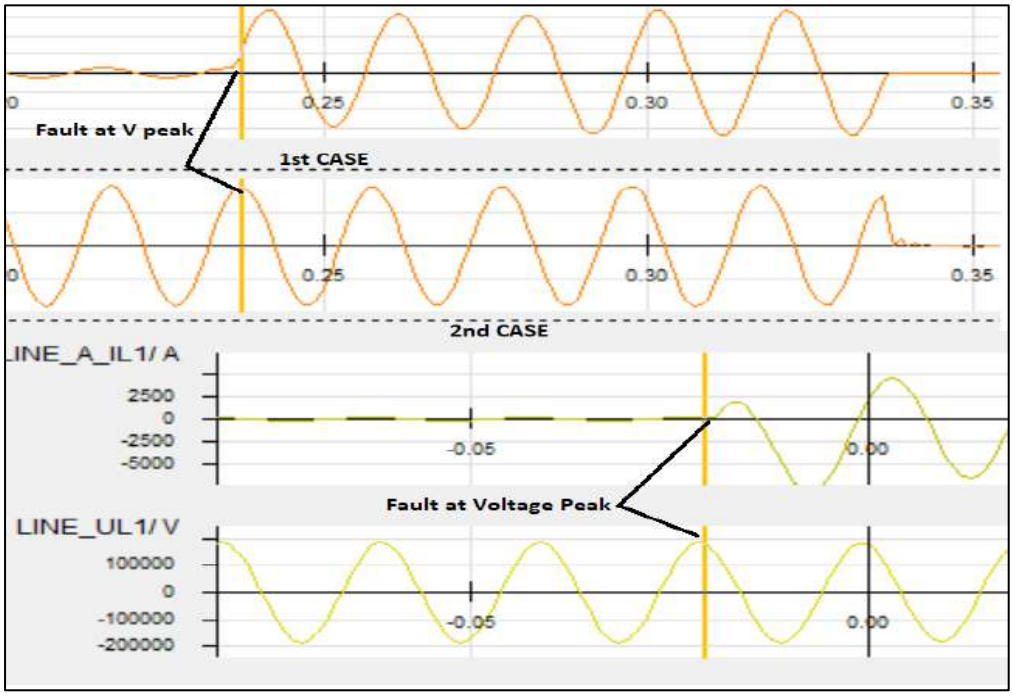

Trigger
06-07-2021
11:28:58.284
iL1/ A
iL2/ A
iL3/ A
I zero


uL1/ V
uL2/ V
uL3/ V
V zero



Fault due to Arc over / Tree Fault:

From DR signature analysis it is observed that in all cases, fault seems to be due to vegetation issue as all faults are occurring at voltage peak as arc over is occurring at voltage peak due to high electrical stress. Fault currents are symmetrical and have no Dc offset due to vegetation fault occurring at peak and with increasing nature of current.



Repeated Tripping of 220 kV Budhipadar-Korba-Raigarh and associated Issues

It has been observed that 220 kv **Budhipadar-Korba-Raigarh** has tripped multiple times in last few months, where as per DR analysis it has been observed that faults are occurring due to, ROW vegetation issue, along with issues related to protection and A/R are also observed. So OPTCL is requested to do proper patrolling and line maintenance ,for ensuring healthiness of line and protection ,as the line is of importance being Inter-Regional . Line tripping details are mentioned below,

SL NO	ट्रिप हुए पारेषण तत्त्व का नाम / Name of Transmission element tripped	ट्रिप होने की तिथि /Date of Tripping	ट्रिप होने का समय/ Time of Tripping	रिले संकेत स्थानीय छोर /Relay Indication LOCAL END	रिले संकेत दूरस्थ छोर/ Relay Indication REMOTE END	टिप्पणि/ Remarks
1	220 kV BUDIPADAR-RAIGARH	7-May-21	18:57	Y-N,FD 47KM,FC 3.38KA		3 Phase tripping for single phase fault at the instant of fault .No auto reclose attempt as ,No A/R scheme due to non availiabilty of PLCCat Budhipadar end .Suspected Row issue /Vegetation fault observed from DR in each month tripping of these lines are observed.
2	220 kV BUDIPADAR-KORBA-1	7-May-21	18:57	Y-N,FD 55KM,FC 2.33KA		3 Phase tripping for single phase fault at the instant of fault .No auto reclose attempt as ,No A/R scheme due to non availiabilty of PLCCat Budhipadar end .Suspected Row issue /Vegetation fault observed from DR in each month tripping of these lines are observed.
3	220 kV BUDIPADAR-KORBA-1	19-May-21	12:07	Z1, B-N, 3.15kA, 32Km	Z-2 from Raigarh	3 Phase tripping for single phase fault at the instant of fault .No auto reclose attempt as ,No A/R scheme due to non availiabilty of PLCCat Budhipadar end .Suspected Row issue /Vegetation fault observed from DR in each month tripping of these lines are observed.
4	220 kV BUDIPADAR-RAIGARH	31-May-21	18:35	Z-1, B-N, FC: 4.63 KA, FD: 16.5 Km	Z-2 from Raigarh	3 Phase tripping for single phase fault at the instant of fault .No auto reclose attempt as ,No A/R scheme due to non availiabilty of PLCCat Budhipadar end .Suspected Row issue /Vegetation fault observed from DR in each month tripping of these lines are observed.
5	220 kV BUDIPADAR-KORBA-2	8-Jun-21	19:42		Z-2 from Raigarh	3 Phase tripping for single phase fault at the instant of fault .No auto reclose attempt as ,No A/R scheme due to non availiabilty of PLCCat Budhipadar end .Suspected Row issue /Vegetation fault observed from DR in each month tripping of these lines are observed.
6	220 kV BUDIPADAR-KORBA-2	14-Jun-21	17:57	Budhipadar:R_N, 3.65 kA, 42.3 KM		3 Phase tripping for single phase fault at the instant of fault .No auto reclose attempt as ,No A/R scheme due to non availiabilty of PLCCat Budhipadar end .Suspected Row issue /Vegetation fault observed from DR in each month tripping of these lines are observed.
7	220 kV BUDIPADAR-RAIGARH	7-Jul-21	12:06	Budhipadar end-Z1 B-N, FC-4.09 kA FD-11.9 km,	Z-2 from Raigarh	3 Phase tripping for single phase fault at the instant of fault .No auto reclose attempt as ,No A/R scheme due to non availiabilty of PLCCat Budhipadar end .Suspected Row issue /Vegetation fault observed from DR in each month tripping of these lines are observed.

Following Issues are found:

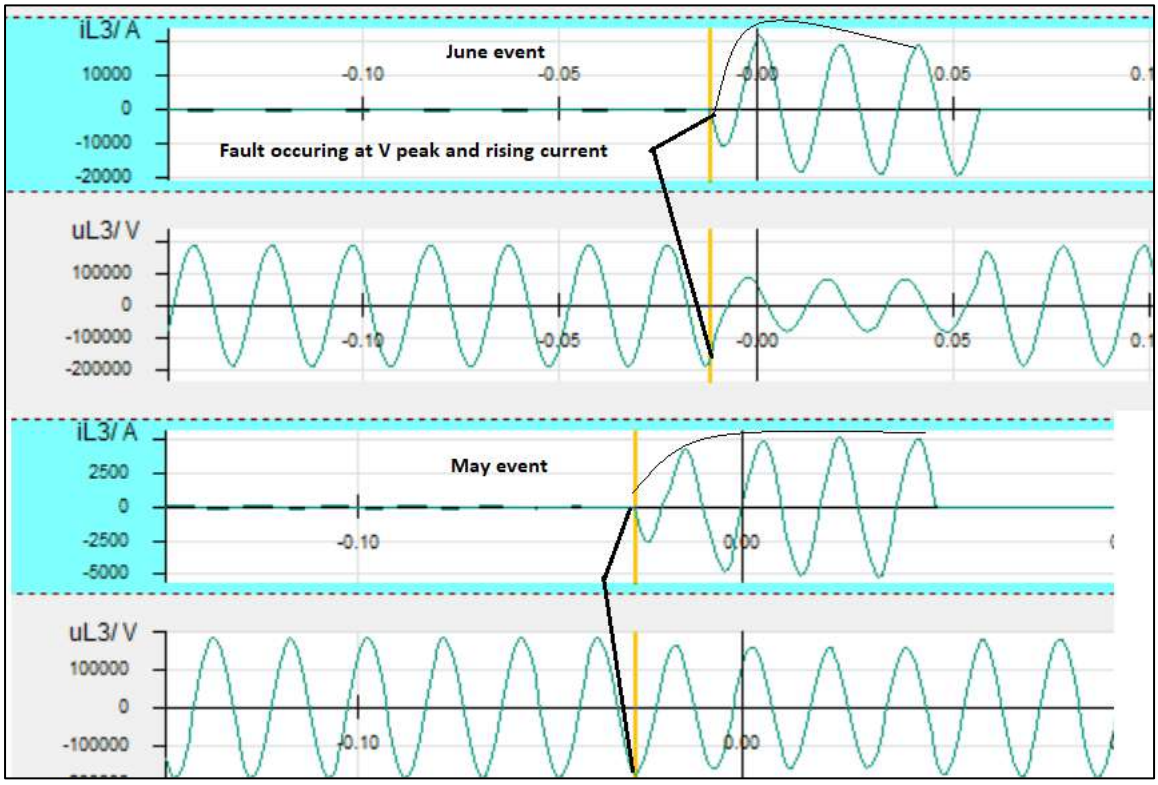
(1)Fault due to Arc over / Tree Fault (Vegetation Fault) and Fault Distance:

From DR signature analysis it is observed that in all cases, fault seems to be due to vegetation issue as all faults are occurring at voltage peak as arc over is occurring at voltage peak due to high electrical stress. Fault currents are symmetrical and have no Dc offset due to vegetation fault occurring at peak and with increasing nature of current.
All faults are of SLG nature ,DR attached below for both lines.

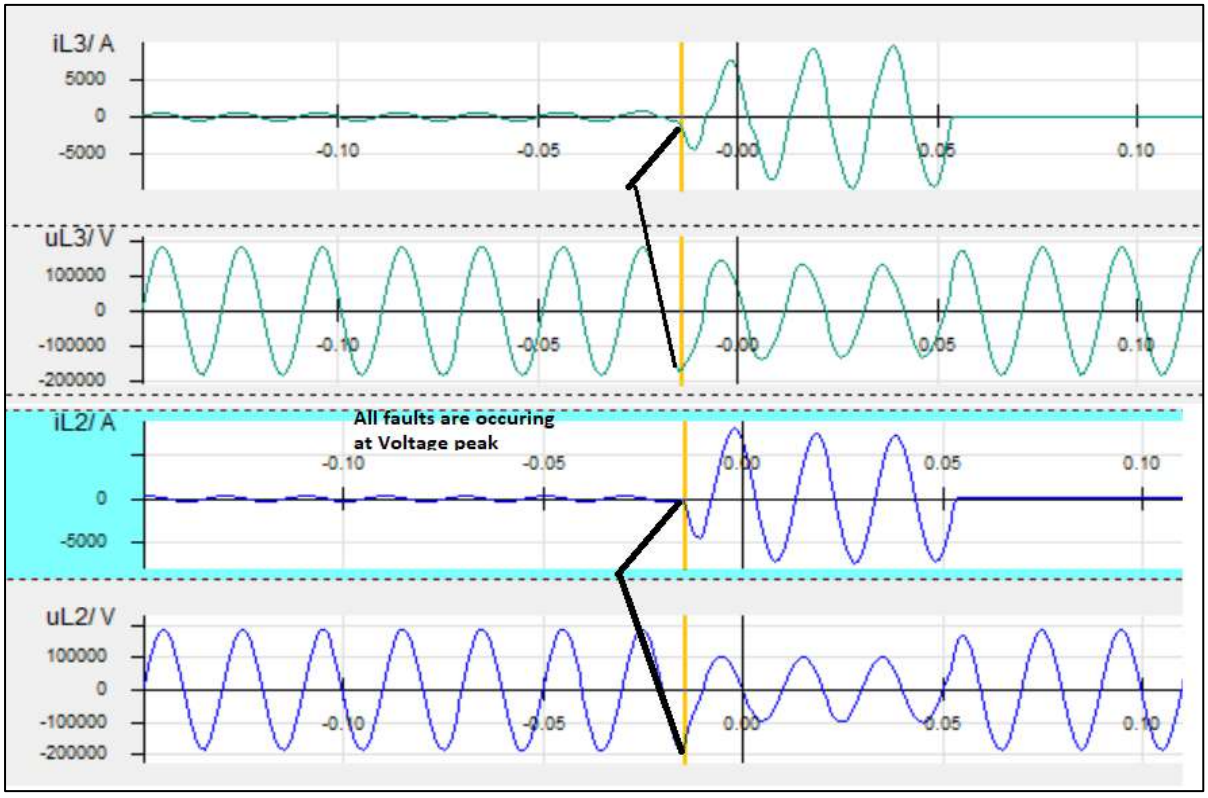
(2) Fault Distance as can be Observed for both the lines is most of the times in Zone-2 from RAIGARH and Korba end hence near to Budhipadar ,hence OPTCL is requested to to do proper

patrolling and line maintenance ,for ensuring healthiness of line considering the importance of line as being Inter regional line.

For Korba line DR shown for two event same thing observed for all cases.



For Raigarh line DR shown for two event same thing observed for all cases.



(3) Non operation of A/R due to Non-Availability of PLCC :

As per information available PLCC is not available at Budhipadar end due to which A/R is not implemented for these lines. Hence lines are tripping for transient Single line to ground faults also interrupting the power flow and hampering the reliability of inter-regional link .

As a interim measure A/R can be enabled without PLCC (Carrier) as done in case of 220 kV Katapalli - Bolangir (PG) line where also due to Issue in PLCC at Katapalli end A/R is enabled without carrier, seeing the importance of line . So that at least for SLG faults in Z-1 ,A/R will operate and reliability can be improved. Possibility may be explored.

List of important transmission lines in ER which tripped in JULY-2021

S.NO	LINE NAME	TRIP DATE	TRIP TIME	Relay Indication LOCAL END	Relay Indication REMOTE END	Reason	Fault Clearance time in	Remarks	LOCAL END UTILITY	REMOTE END UTILITY	Utility to update	Utility Response
1	220KV-BEGUSARAI-KHAGARIA-2	7-1-21	06:25	BEGUSARIA :- NOT TRIP	KHAGARIA:- Z-1, 26.35KM, R-N FAULT, IR= 1.95KA	R-Earth	<100		NO	NO		
2	220KV-KHAGARIA-NEW PURNEA-2	7-1-21	06:25	KHAGARIA:- Z-1, 26.35KM, R-N FAULT, IR= 1.95KA	PURNEA :- NOT TRIP	R-Earth	<100		NO	NO		
3	400KV-RANCHI-RAGHUNATHPUR-3	7-1-21	13:01	Ranchi: R-N fault, FC: 124kM, FC: 3.23kA	RTPS : Z-1 Trip, R-ph FC: 8.38KA FD: 50.57KM (32.52%)	R-Earth	<100	At the instance of A/R In circuit 2, line tripped from both ends ,Rnad B phase opened first then after 1 second y phase also got opened .No fault as such observed in this circuit.Reason for tripping may be analysed and shared.	NO	YES	DVC/PG-ER-1	
4	400KV-RANCHI-RAGHUNATHPUR-2	7-1-21	13:01	Ranchi: DT Received		R-Earth	<100	Fault in line then at the time of Auto reclsoe ,again fault persisting leading to R phase breaker opening immidiately but rest Y and B phases were closed from ranchi end and tripped after 1 second.	NO	YES	DVC/PG-ER-1	

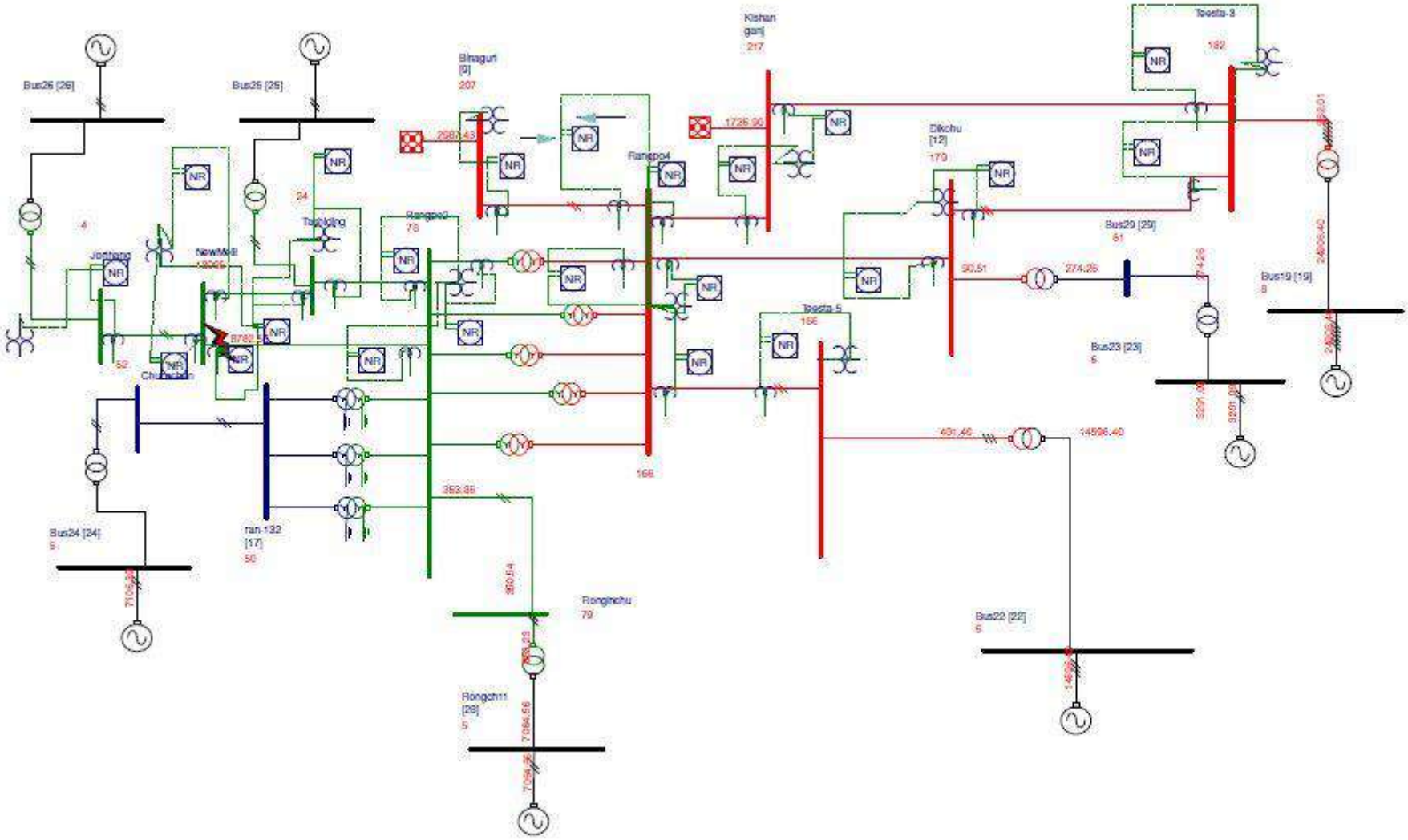
5	400KV-PPSP-BIDHANNAGAR-2	7-1-21	13:34	Bidhannagar- zone 1, 86.3km, 3.3KA, Blue -n. PPSP- zone 1 , blue -n	Bidhannagar- zone 1, 86.3km, 3.3KA, Blue -n.	B-Earth	<100	NO A/R sttempted	NO	YES		
6	400KV-MEERAMUNDALI-MENDHASAL-II	7-1-21	17:25	Meramundali end:-R-E, IR-10.35 KA, DIST= 20.1		R-Earth	<100	A/R unsuccessful at Mendhasal	NO	YES		
7	220KV-KHAGARIA-NEW PURNEA-1	7-2-21	19:56	NEW PURNEA: A/R SUCCESSFUL, R-N, 4.6KA, 40KM	FAULT - R_N , FD- 63.24km , FC - 1.207kA	R-Earth	200		NO	NO		
8	400KV-NEW DUBURI-MEERAMUNDALI-2	7-2-21	17:41	MEERAMUNDALI: R-N, FC- 14.18KA ;	R-N, 2.9KA, 84KM	R-Earth	<100		YES	NO		
10	220KV-CHANDIL-STPS(WBPDCL)-1	7-3-21	15:10	chandil:- Z-1, 60.2KM, IR-3.21KA, IB-3.65KA, R-B FAULT	STPS: RB, Z1, Ir: 3.71KA, Ib: 3.94KA, 51.6km	R-B-Earth	<100		YES	YES		
11	400KV-NEW PURNEA-MUZAFFARPUR-1	7-3-21	15:06	NPRN-R-PH, 135KM, 3.22KA, A/R UNSUCCESFUL	127KM, 3.08KA, A/R UNSUCCESFUL	R-Earth	<100	A/R successful tripped in reclaim time.	NO	NO		
12	400KV-PUSAULI(PG)-DALTONGANJ-2	7-4-21	18:18	SASARAM END RELAY INDICATION: Y-N FAULT; FC: 7.7KA; 28 KM FROM SASARAM	Daltongunj: Y-N, 1.8kA, 162km	Y-Earth	<100	A/R Unsuccessful. Charging attempted at 19:02 hrs from Pusauli end but line didn't hold.	YES	YES		
14	220KV-BIHARSARIFF-TTPS-1	7-6-21	12:35		Tenughat: Z1, 126.8 kM, Ia 254 A IB 280.5 A IC 370.7 A	B-Earth	<100	NO A/R attempted	YES	NO	JUSNL	
15	220KV-KHAGARIA-NEW PURNEA-1	7-6-21	11:24	NEW PURNEA - FAULT - B_N , FD - 43.4 KM , FC - 3.14 KA (A/R , SUCCESSFUL)	TRIP FROM KHAGARIA SIDE - B_N , FD- 74.12 KM , FC - 1.042 KA	B-Earth	<100		NO	NO		
18	220KV-SILIGURI-KISHANGANJ(PG)-1	7-6-21	03:40	Siliguri: R-B, 93.85km, Ir-2.18kA, Ib-1.939kA,	kishangunj: R-B, 18.2km, Ir-9.22kA, Ib-6.65kA;	R-B-Earth	<100		YES	NO		

19	400KV-SUBHASGRAM(PG)-RAJARHAT-1	7-7-21	14:50	S'gram- Z1 B-N FC-9.2 kA FD-9.3 km		B-Earth	<100	At the instant of fault obly B phase opened but no A/R occurred hence after 1.5 sec all 3 poles opened due to suspected PD operation.	YES	YES	PG-ER-2	
20	220KV-BUDHIPADAR-RAIGARH-1	7-7-21	12:06	Budhipadar end-Z1 B-N, FC-4.09 kA FD-11.9 km, Raigarh end Z2 B-N FD= 69.2 km	Raigarh end Z2 B-N FD= 69.2 km	B-Earth	<100		YES	NO		
21	400KV-TSTPP-ROURKELA-1	7-7-21	17:03	TSTPP-Z1 Y-N FC-5 kA FD-69.97 km;	Rourkela- A/R successful, Y-N, Z1, 3.60kA, 97.595 km	Y-Earth	<100	A/R successful at ROURKELA end only.	NO	YES	NTPC TALCHER	
22	220KV-JAMSHEDPUR-JINDAL-1	7-12-21	12:07	JAMSHEDPUR (DVC)-R-N, Z1, FD- 34KM, FC-2.7KA;	JINDAL:R-N, 1.2KA, 111KM	R-Earth	<160		NO	NO		
23	400KV-PPSP-BIDHANNAGAR-2	16/07/2021	23:28	PPSP end: Rph, Z1, 58.8km	Bidhannagar end: Rph, Z1, 124.4km, 2.68kA	R-Earth	<100		NO	NO		
24	400KV-JEERAT-SAGARDIGHI-1	16/07/2021	13:19	11.79 kA	181.9 KM, Z III, 2.081 kA	R-Earth	<100	A/R unsuccessful as per PMU	NO	YES		
25	220KV-PUSAULI-DEHRI-1	16/07/2021	11:53	Pusauli: Y_N, 38.29 KM, 3.44 kA	Dehri: Y_N, 19.82 KM, 2.97 kA	Y-Earth	<100	PD operated at sasaram end ,due to non A/R while at Dehri end it seems 3 phase A/R attempted	NO	YES	PG-ER-1,BSPTCL	
26	220KV-KHAGARIA-NEW PURNEA-2	16/07/2021	12:03		New Purnea: B_N, 61.1 KM, 2.771 kA	B-Earth	<100	Multiple faults.	YES	NO		
27	220KV-KHAGARIA-NEW PURNEA-2	17/07/2021	04:04	Phase Zone-1 Ir: 2.11kA, Distance: 17.2km	PURNEA:- A/R OPERATED	R-Earth	<100		NO	NO		
28	400KV-MEDINIPUR-NEW CHANDITALA-2	18/07/2021	22:30	Medinipur: R_B_N, 73.8 KM, Ir: 3.989 kA, Ib: 4.620 kA	New Chanditala: R_B_N, 17.24 KM, Ir: 12.14 kA, Ib: 11.53 kA	R-B-Earth	<100		NO	NO		

29	220KV-DARBHANGA (DMTCL)-SAMASTIPUR-1	18/07/2021	11:08	FC: 6.102 KA, FD: 26.29 km	YB Fault, Z1, FC: 5.9 KA, FD: 17.9 km	Y-B-Earth	<100		NO	NO		
30	400KV-GAYA-KODERMA-2	19-07-2021	14:53	GAYA: 126.5km, 2.92KA, R-N	KODERMA:- LIGHTING ARRESTER BLAST	R-Earth	<100	A/R unsuccessful at GAYA end	YES	NO		
31	220KV-CHANDIL-RANCHI-1	19-07-2021	13:45	CHANDIL:= R-Y FAULT, 75.5KM, IB-0.17KA, IR-2.57KA, IY= 2.35KA,	RANCHI:- R-Y FAULT, 15.9KM, IR-7.92KA, IY-6.41KA.	R-Y-Earth	<100		YES	YES		
32	400KV-NEW DUBURI-MEERAMUNDALI-1	22-07-2021	12:32	New Duburi: R_N, 5.25 kA, 39.1 KM.	A/r successful from Meeramundali only	R-Earth	<100	3 Phase tripping from New Dubri end directly	NO	YES	OPTCL	
33	220KV-TENUGHAT-BIHARSARIFF-1	23-07-2021	17:38	BIHARSARIF: B-N, Fc= 1.908 kA, z-1, Fd= 89.95 km	B-N, Z-1, 72.77 km, 1.93 kA	B-Earth	<100	No A/r operation.3 phase tripping from TTPS end .	NO	YES	BSPTCL	
34	220KV-DARBHANGA (DMTCL)-MOTIPUR-2	24-07-2021	12:32	Darbhanga: Y_B_N, Iy: 1.76 kA, Ib: 1.74 kA, 101 KM	Y_B_N, FD - 7.227 KM	Y-B-Earth	<100		NO	YES		
35	220KV-GAYA-KHIZERSARAI-1	25-07-2021	19:05	GAYA: 56.2 KM(100%), Y-N, 2.04KA, A/R SUCCESSFUL		Y-Earth	<100		NO	NO		
36	220KV-BEGUSARAI-NEW PURNEA-1	25-07-2021	22:27	New Purnea: Y_N, 83.2 KM, 2.26 kA,	A/r successful from New Purnea only	Y-Earth	<100		NO	YES		
37	220KV-DARBHANGA(DMTCL)-LAUKAHI-2	26-07-2021	14:26	DRABHANGA (DMTCL): R-N, Z1, 70KM, 2.8KA;	LAUKAHI: R-N, 24.38KM, 3KA	R-Earth	<100		NO	NO		
39	220KV-TASHIDING-RANGPO-1	27-07-2021	23:17	Rangpo: Y-B, Fd= 33.1 km, Iy= 5.8 kA, Ib= 5.4 kA		Y-B-Earth	<100	Same fault distance with Phase to phase fault of same nature Y phase fault first converted to YB .	NO	YES	TASHDING	

41	400KV-BARH-PATNA-4	28-07-2021	15:57	BARH: R-N, Z2, 69KM, 6.25KA; PATNA: R-N, Z1, 20KM, 11.9KA		R-Earth	<100	At the time of A/R delayed clearance observed from Barh end .From Patna end Carrier was sent still delayed clearance was observed at the time of A/R..	NO	YES	NTPC BARH	
42	400KV-NEW PURNEA-BIHARSARIFF(PG)-1	30-07-2021	11:13	Purnea end: Y-B fault, FD=25.74km, FC=14.67 kA.	Biharsharrif end: Y-B fault, FD=195.4km, FC=3.57kA.	Y-B-Earth	<100		YES	YES		
43	220KV-MAITHON-DHANBAD-2	30-07-2021	10:38	Dhanbad: B_N, Z I, 4.24 kA	.Tripped from Dhanbad only	B-Earth	<100		NO	NO		
44	220KV-MAITHON-DHANBAD-1	30-07-2021	10:32	Maithon: B_N, 55.3 KM, Z II, 3.23 kA	Dhanbad: B_N, 12.8 KM, 4.25 kA	B-Earth	<100		NO	NO		

Network:


Bus26 [26]
Bus25 [25]
Binaguri
[9]
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Kishan
ganj
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Teesta-3
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Dikchu
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Rangpo4
Rangpo2
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Tarkiding
Jorthang
NewMelli
Chuzachen
Teesta 5
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Bus29 [29]
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Bus19 [19]
8
Bus23 [23]
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Bus24 [24]
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Rongnichu
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Rongchi1
[28]
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Bus22 [22]
5
166

This is the maximum conditions by taking all generators are on at individual generating stations.

Line	Relay Connected at	CT Ratio in A	Fault Location	Fault Current seen by the Relay	Existing				Proposed			
					Ie> in A (Primary)	Characteristics	TMS/ Time Delay	Top (sec)	Ie> in A (Primary)	Characteristics	TMS	Top in sec
Binaguri-Rangpo	Rangpo end	2000/1	Binaguri	2257	200	IEC NI	0.568	1.6	400	IEC NI	0.402	1.6
Binaguri-Rangpo	Binaguri end	2000/1	Rangpo	3021	200	IEC NI	0.638	1.6	400	IEC NI	0.472	1.6
Kishangunj-Rangpo	Rangpo end	3000/1	Kishangunj	1804	1200	IEC NI	0.514	8.7	600	IEC NI	0.254	1.6
Kishangunj-Rangpo	Kishangunj end	3000/1	Rangpo	1690	400	IEC NI	0.28	1.3	600	IEC NI	0.239	1.6
Rangpo- Dikchu	Rangpo end	3000/1	Dikchu	6830	200	IEC NI	0.61	1.1	600	IEC NI	0.392	1.1
Rangpo- Dikchu	Dikchu end	3000/1	Rangpo	6620	600	DT	1.5	1.5	600	IEC NI	0.422	1.2
Rangpo- TeesthaV	Rangpo end	2000/1	Teestha V	7814	200	IEC NI	0.6	1.1	400	IEC NI	0.481	1.1
Rangpo- TeesthaV	TeesthaV end	2000/1	Rangpo	3853	-	-	-		400	IEC NI	0.397	1.2
Kishangunj-Teestha III	Kishangunj end	3000/1	Teestha III	925	400	IEC NI	0.28	2.3	600	IEC NI	0.068	1.1
Kishangunj-Teestha III	Teestha III end	2000/1	Kishangunj	1555	-	-	-	-	400	IEC NI	0.236	1.2
Dikchu-Teestha III	Dickchu end	3000/1	Teestha III	3453	400	DT	1.5	1.5	600	IEC NI	0.305	1.2
Dikchu-Teestha III	Teestha III end	3000/1	Dikchu	5867	-	-	-		600	IEC NI	0.4	1.2
Rangpo 220Kv Bus												
Rangpo-Tasheding	Rangpo end	1600/1	Tasheding	1966	320	IEC NI	0.38	1.4	320	IEC NI	0.24	0.9
Rangpo-Tasheding	Tasheding end	800/1	Rangpo	1446	160	DT	1.2		160	IEC NI	0.39	1.2
Rangpo- Newmelli	Rangpo end	1600/1	Newmelli	3173	320	IEC NI	0.399	1.1	320	IEC NI	0.30	0.9
Rangpo- Newmelli	Newmelli end	1600/1	Rangpo	3075	320	IEC NI	0.33	0.9	320	IEC NI	0.30	0.9
Tasheding-Newmelli	Tasheding end	800/1	Newmelli	1956	160	IEC NI	0.24	0.65	160	IEC NI	0.37	1
Tasheding-Newmelli	Newmelli end	1600/1	Tasheding	2164	320	IEC NI	0.314	1.1	320	IEC NI	0.25	0.9
Newmelli-Jorethang	Newmelli end	400/1	Jorethang	6986	-	-	0.473	-	80	IEC NI	0.60	0.9
Newmelli-Jorethang	Jorethang end	400/1	Newmelli	3715	100	DT	0.6	0.6	80	IEC NI	0.57	1

Rangpo - Ronginchu	Rangpo end	1600/1	Ronginchu	6078	208	IEC NI	0.52	1	208	IEC NI	0.45	0.9
Rangpo - Ronginchu	Ronginchu end	400/1	Rangpo	6091	60	DT	0.5	0.5	80	IEC NI	0.65	1
Line	**Relay Connected at**	**CT Ratio in A**	**Fault Location**	**Fault Current seen by the Relay**	**Existing**				**Proposed**			
					I> in A (Primary)	**Characteristics**	**TMS/ Time Delay**	**Top (sec)**	**I> in A (Primary)**	**Characteristics**	**TMS**	**Top (sec)**
Newmelli-Jorethang	Jorethang end	400/1	Newmelli	1009	300	IDMT	0.09	0.42	300	IEC NI	0.11	0.6

Relay Connected	**CT Ratio in A**	**Fault Current seen by the Relay**	**Existing**						**Proposed**					
			I> in A (Primary)	**Characteristics**	**TMS**	**Top (sec)**	**I>**	**Time delay**	**I> in A (Primary)**	**Characteristics**	**TMS**	**Top (sec)**	**I>>(Primary)**	**Time delay**
315 MVA Transformer 400 kV Side	2000/1	3526.33	682	IEC NI	0.21	0.9			682	IEC NI	0.21	0.9	4086	0.05
315 MVA Transformer 220 kV Side	1600/1	770	1240	IEC NI	0.11	1.6			1240	IEC NI	0.11	1.6		

Relay Connected	**CT Ratio in A**	**Fault Current seen by the Relay**	**Existing**						**Proposed**					
			IN> in A (Primary)	**Characteristics**	**TMS**	**Top (sec)**	**IN>>**	**Time delay**	**In> in A (Primary)**	**Characteristics**	**TMS**	**Top (sec)**	**IN>>**	**Time delay**
315 MVA Transformer 400 kV Side	2000/1	423	91	IEC NI	0.51	2.28			91	IEC NI	0.22	1		
315 MVA Transformer 220 kV	1600/1	719.8	165	IEC NI	0.51	2.38			165	IEC NI	0.36	1.7		

The grid fault levels of connected stations were considered is as tabulated in table below

SL NO.	STATION NAME	3-phase FAULT MVA	3-phase FAULT CURRENT (Amps)	1-phase FAULT MVA	1-phase FAULT CURRENT (Amps)
1	BINAGURI 400kV	24461	35307.1	19496.993	28141
2	KISHANGANJ 400kV	23602	34067	16428.708	23713
3	TEESTA-3 400kV	14836	21414	15239.5	21996.4
4	DIKCHU 400kV	13253.6	19129.9	11835.275	17083
5	TEESTA-5 400kV	14899	21504	13829.3	19960.9
6	RANGPO 400kV	17283	23237	16572.1	23919.8
7	RANGPO 220kV	13699	32419	12635	33160
8	TASHIDING 220kV	6331	11099	2690.914	7062
9	NEW MELLI 220kV	5344	13444	4893.6	12842.9
10	JORTHANG 220kV	6947	9958	2891.617	7589
11	RONGINCHU 220kV	9032.627	23.704	4694.68	12320

Note: For all the lines and transformer relay settings are Directional FWD.

Protection Function	Feature	DVC	CESC	POERGRID	WB
HV/LV side OC stage 1	Directionality	No directional	No directional	Forward	Forward
	Setting are calculated based on fault level of Other side bus of ICT in same Substation	Yes	Yes	Yes	Yes
	Fault level of Remote end Substation also considered in the setting	No	No	No	No
	Coordinated with Remote end substations Line's zone-3 time	Yes	Yes	Yes	Yes
	Time	IEC normal inverse	IEC normal inverse	IEC normal inverse	IEC normal inverse
HV/LV side OC stage 2	Directionality	Not Used	Not Used	Non directional	Non directional
	Setting are calculated based on fault level of Other side bus of ICT in same Substation			No	No
	Fault level of Remote end Substation also considered in the setting			No	No
	Time			Definite	Definite
HV/LV side EF stage 1	Directionality	No directional	No directional	Forward	Disabled
	Setting are calculated based on fault level of Other side bus of ICT in same Substation	Yes	Yes	Yes	
	Fault level of	No	No	No	

	Remote end Substation also considered in the setting				
	Coordinated with Remote end substations Line's zone-3 time	Yes	Yes	Yes	
	Time	IEC normal inverse	IEC normal inverse	IEC normal inverse	
HV/LV side EF stage 2	**Directionality**	Not used	Not used	Non directional	Disabled
	Setting are calculated based on fault level of Other side bus of ICT in same Substation			No	
	Fault level of Remote end Substation also considered in the setting			No	
	Time			Definite	
Transformer Thermal over loading	**Directionality**	Not used	Not used	Non directional	Non directional
	Tripping/Alarm			Alarm only	Alarm only
	Time			Definite time ,	Definite time

Recommendation:

1. **HV/LV Directional over current low set (stage-1):** For upcoming projects and projects going for R &M may set it as follows:

   Direction- Forward (towards transformer)
   MTA/RCA- for cross polarization may be set as per OEM recommendation
   P.S.-- 130 to 150% of transformer rated current
   Characteristics- IEC normal inverse
   TMS- Should be calculated considering LV/HV bus fault level and must be coordinated with remote substation zone-3 time.
   TMS HV/LV

$$(\textbf{Remote end Z3 time} + \textbf{safety margin of } 0.1 \textbf{ to } 0.2 \textbf{ sec}) * ((\frac{\textbf{Fault current contribution for LV/HV bus fault}}{\textbf{Pick up cuurent}})^{0.02} - 1)$$

For existing projects their existing philosophy may be followed by the utilities however following must be ensured:

1. Protection coordination with remote end lines zone-3 time
2. Coordination with LV and HV side must be ensured for non-directional OC setting

2. **HV/LV Directional over current high set (stage-2):** For upcoming projects and projects going for R &M may set it as follows:

Direction- Non-directional
MTA/RCA- NA
P.S.-- $= (110\ to\ 130) * \frac{MVA\ rating}{\%\ impedance * volatge * 1.732}$

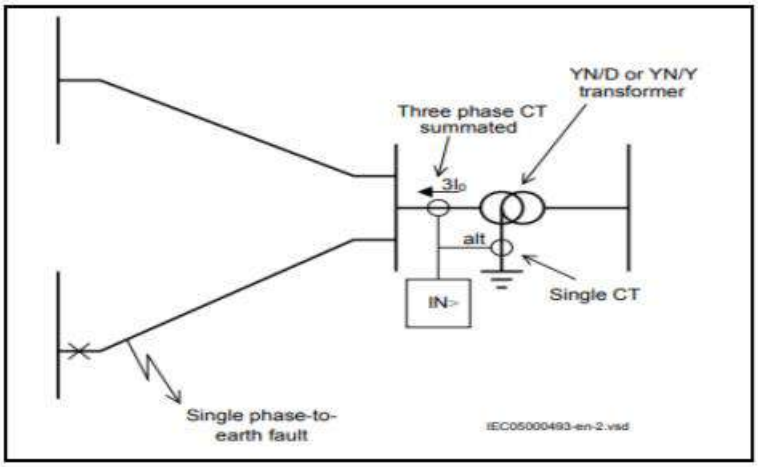
Characteristics- Definite time 50-100 ms

Choice of utilizing the same setting is left with the utilities.

For existing projects their existing philosophy may be followed by the utilities however following must be ensured:

1. Coordination should be such that it should not trip for close in line fault before the line tripping

3. **HV/LV earth fault low set:**
From the analysis of the all utilities practice it is seen that the setting are consistent with the upper limit as proposed in the OCC meeting. However in the lower limit side it is not directly ensured that for a remote end substation fault the same will not pick up as shown below.



Following the DVC's practice the line DEF and Transformer DEF can be coordinated. The overall recommendation is as follows for the satge-1 setting:

Direction- Forward (towards transformer)
MTA/RCA- for cross polarization may be set as per OEM recommendation
P.S.-- 20 to 50% of transformer rated current. However it must be greater than all line's DEF setting connected to LV/HV side of the Transformer taking into account the applicable ratio correction.
Characteristics- IEC normal inverse
TMS- Should be calculated considering LV/HV bus fault level and must be coordinated with remote substation zone-3 time.

If REF is used then the choice of implementing the above protection may be left with the utility.

TMS HV/LV

$$\frac{(\boldsymbol{Remote\ end\ Z3\ time + safety\ margin\ of\ 0.1\ to\ 0.2\ sec}) * ((\frac{\boldsymbol{Fault\ current\ contribution\ for\ LV/HV\ bus\ fault}}{\boldsymbol{Pick\ up\ cuurent}})^{0.02} - 1)}{0.14}$$

For existing projects their existing philosophy may be followed by the utilities however following must be ensured:

1. Protection coordination with remote end lines zone-3 time
2. Coordination with LV and HV side must be ensured for non-directional EF setting. In case of non-directional setting, its pick up should be greater than all connected lines in both HV and LV bus.

4. **HV/LV Directional over current high set (stage-2):** For upcoming projects and projects going for R &M may set it as follows:

Direction- Non-directional
MTA/RCA- NA
P.S.-- $= (110\ to\ 130) * \frac{MVA\ rating}{\%\ impedance * volatge * 1.732}$

Characteristics- Definite time 50-100 ms

Choice of utilizing the same setting is left with the utilities.

For existing projects their existing philosophy may be followed by the utilities however following must be ensured:

1. Coordination should be such that it should not trip for close in line fault before the line tripping

5. **Transformer overload protection:**

Direction- Non directional
P.S.- 110 to 120 % of transformer rated current
Characteristics- Definite time and alarm only
TMS- As per transformer OEM guideline or as per utilities choice.

Annexure-1: POWERGRID setting guide line for Transformer OC and EF:

400/220kV and 220/132kV transformer over current setting

HV side Protection:

a) HV Directional over current low set

Direction- Forward (towards transformer),
MTA or RCA – OEM specific
for GE: (+ve) 60 deg for cross polarization,
for ABB: (+ve) 65 deg for cross polarization
P.S.- 150% of transformer rated current,
Characteristics- IEC normal inverse,
TMS- TMS shall be such that for fault in remote end bus, relay shall issue trip command after Zone-3 timing of downstream line = (Zone-3 Timing + 0.1 sec) x { (IFault / Ipickup)0.02 -1 })/0.14

b) HV Directional over current high set

Direction- Non-directional,
MTA or RCA - NA
P.S.- 110% of Max. Current of Transformer in HV side = 110% * {(MVA rating / % Imp.) / (1.732 * Voltage)}
Characteristics- Definite time
TMS- 50ms

c) HV Directional earth fault low set

Direction- Forward (towards transformer)
MTA or RCA - (-ve) 45 deg for zero seq. polarisation
P.S.- 20% of transformer rated current
Characteristics- IEC normal inverse,
TMS- TMS shall be such that for fault in remote end bus, relay shall issue trip command after backup earth fault of downstream line = (Z3 timing + 0.2 sec) x { (IFault / Ipickup)0.02 -1 }

d) HV Directional earth fault high set

Direction- Non-directional,
MTA or RCA - NA,
P.S.- 110% of Max. Current of Transformer = 110% * {(MVA rating / % Imp.) / (1.732 * Voltage)}
Characteristics- Definite time
TMS- 50ms

LV side Protection:

e) LV Directional over current low set

Direction- Forward (towards transformer)
MTA or RCA - OEM specific
for GE: (+ve) 60 deg for cross polarization,
for ABB: (+ve) 65 deg for cross polarization
P.S.- 150% of transformer rated current
Characteristics- IEC normal inverse
TMS- TMS shall be such that for fault in remote end bus, relay shall issue trip command after Zone-3 timing of upstream line = (Zone-3 Timing + 0.1 sec) x { (IFault / Ipickup)0.02 -1 })/0.14

f) LV Directional over current high set

Direction- Non-directional
MTA or RCA - NA
P.S.- 110% of Max. Current of Transformer in LV side = 110% * {(MVA rating / % Imp.) / (1.732 * Voltage)}
Characteristics- Definite time
TMS- 50ms

g) LV Directional earth fault low set

Direction- Forward (towards transformer)
MTA or RCA - (-ve) 45 deg for zero seq. polarisation
P.S.- 20% of transformer rated current
Characteristics- IEC normal inverse,
TMS- TMS shall be such that for fault in remote end bus, relay shall issue trip command after backup earth fault of downstream line = (Z3 timing + 0.2 sec) x { (IFault / Ipickup)0.02 -1 }

h) HV Directional earth fault high set

Direction- Non-directional,
MTA or RCA - NA,
P.S.- 110% of Max. Current of Transformer = 110% * {(MVA rating / % Imp.) / (1.732 * Voltage)}
Characteristics- Definite time
TMS- 50ms

i) Transformer overload protection

Direction- Non directional
P.S.- 110% of transformer rated current
Characteristics- Definite time
TMS- 5 sec.
Alarm only

j) VTS for directional o/c. relay

VTS status – blocking,
VTS mode –auto,
VTS Time delay – 5 Sec