Minutes
of
105th PCC Meeting

Date:07.09.2021
Eastern Regional Power Committee
14, Golf Club Road, Tollygunge
Kolkata: 700 033

EASTERN REGIONAL POWER COMMITTEE

MINUTES OF 105TH PROTECTION COORDINATION SUB-COMMITTEE MEETING HELD ON 23.08.2021 AT 10:30 HOURS

Member Secretary, ERPC chaired the meeting. The meeting was convened through Microsoft Teams online platform.

List of participants is enclosed at **Annexure-A.**

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.

Deliberation in the meeting

Members confirmed the minutes of 104th PCC Meeting.

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.

Relay Indications:

Time	Name	End 1	End 2	PMU Observation
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		

Load Loss: 185 MW

Outage Duration:00: 43 Hrs

WBSETCL may explain.

Deliberation in the meeting

WBSETCL representative explained the sequence of events as follows:-

- *On the day of disturbance, DCRM test of circuit breakers was going on for all the feeders one by one by engaging bus-transfer bay.*
- *After completion of test in 220 kV New Town AA-III-Subhasgram feeder, they restored the same with previous configuration. However, the bus isolator B i.r.o.220 KV Bus Transfer Bay was still in closed condition.*
- *Further, while preparing for DCRM test in 220 kV New Town AA-III-Rajarhat feeder, the operating person mistakenly closed the Bus isolator A of Transfer Bus Coupler bay without opening the Bus isolator B of the same bay.*
- *As a result, a parallel path of 220 KV Bus Coupler was established and current through CTs of Bus Coupler got halved. Due to mismatch of current, bus zone-A & bus zone-B got operated.*
- *At the same time busbar protection operated and tripped all the feeders of 220 kV Bus-1 & 2 at New Town AA-III S/s.*
- *Also, it was informed that the check zone of busbar protection mal-operated during the above incident and resulted in busbar protection operation.*
- *They further submitted that there was a interlock scheme for isolator operation to avoid any parallel path between the two buses. However the scheme was not functional on that day due to issues in DC supply.*

They stated that testing team had inspected all the wirings in busbar panel & checked the operation of Bus Bar relay (87B & 87 CH) after the incident however, the reason for mal-operation of Check zone relay during the event could not be found out.

Further they informed that thorough inspection of CT circuits wiring in the switchyard w.r.t. busbar protection has been planned and the same would be carried out after getting shutdown approval of individual bay.

PCC observed that had the interlock scheme been in operation, the disturbance could have been prevented. PCC advised West Bengal to restore the isolator interlock scheme at the earliest and till that time the substation personnel shall be advised to take precautionary measures while carrying out the isolator operations.

PCC also advised West Bengal to submit the findings after carrying out inspection of the CT circuits in switchyard.

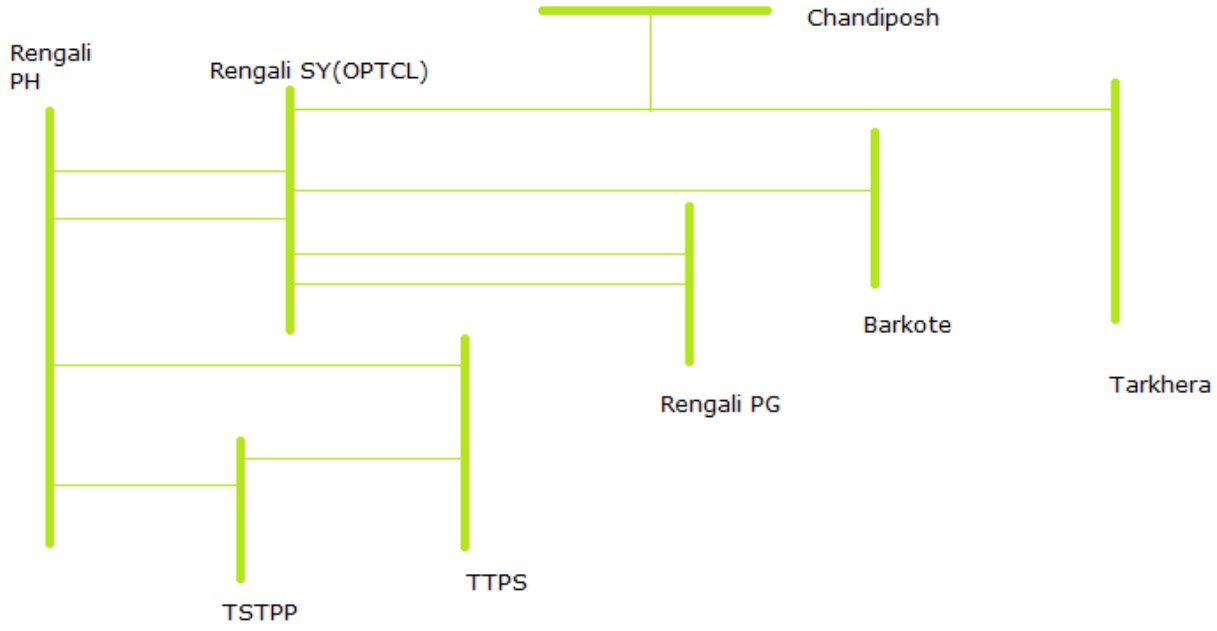
The detailed report from WBSETCL is attached at ***Annexure B.1.***

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.

Deliberation in the meeting

OHPC representative clarified that there was no fault in downstream i.e.33 kV system on the day of disturbance. However, all 220 kV feeders at Rengali PH tripped from Rengali PH end on overvoltage protection. Simultaneously generating units#1,2, & 4 got tripped on reverse power flow protection which resulted in total power failure at Rengali PH S/s.

- *Regarding overvoltage settings protection at Rengali PH end, they informed that the settings are uniform for all the 220 kV lines & the values are as follows.*
  - *Main-1 relay(old): 136 % with instantaneous tripping*
  - *Main-2 relay (new relay): 125 % with 5 seconds delay.*
- *They added that during the disturbance the overvoltage protection of main-2 relay got operated and tripped all the feeders.*

It was informed that no tripping was observed from remote end of the lines.

During analysis, it was observed that the overvoltage condition was being observed at Rangali PH only whereas no such condition was reported at nearby OPTCL substations. Also, it was informed that similar incident of tripping of the lines at Rengali PH in overvoltage protection was reported in the month of October-2020.

PCC opined that the earth resistance of substation is an important factor for localized overvoltage condition and suggested OHPC to do root cause analysis of the event in order to find out the reason for overvoltage.

After detailed deliberations, PCC further advised the followings to OHPC:

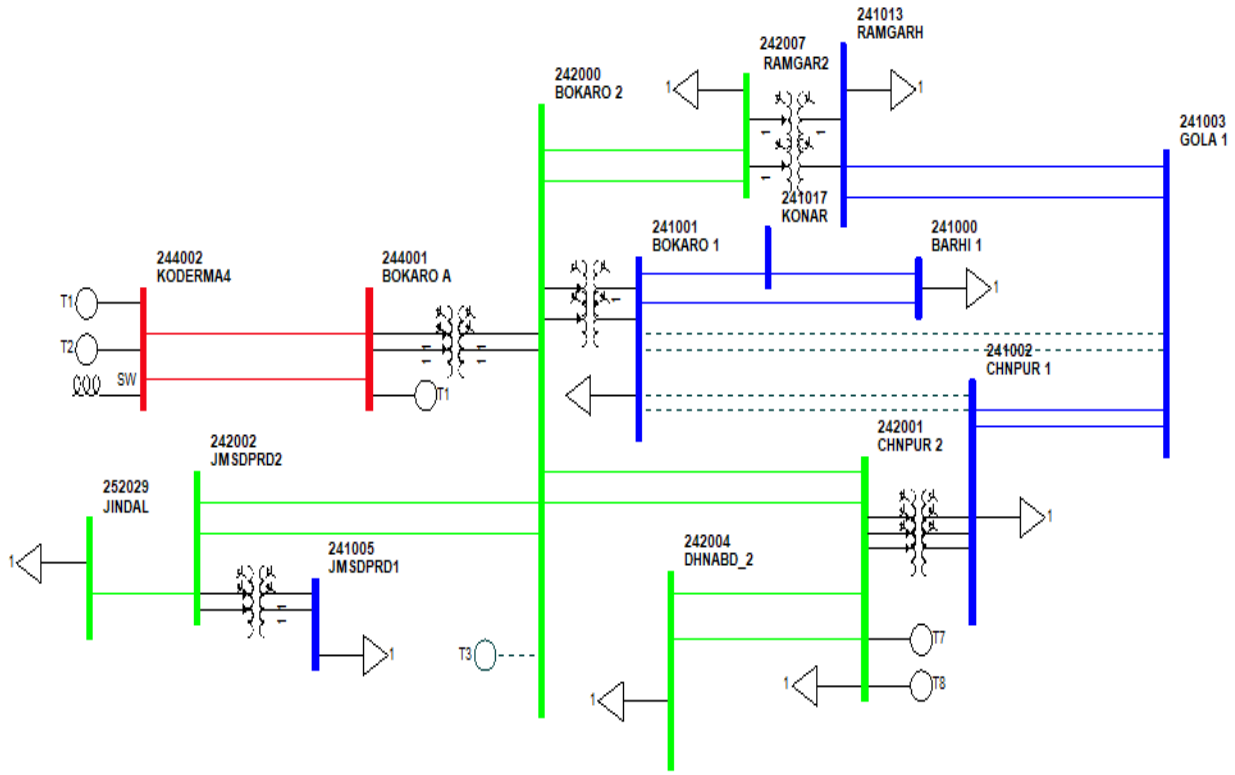
- *to check the earth resistance of the individual earth pits as well as structures in the substation.*
- *to verify DAVR settings and operation of limiters in DAVR for the generating units for any discrepancies.*
- *to set overvoltage settings in all the relays in range of 135 % to 140 % at their end for all feeders with proper time and voltage grading. PCC also advised OHPC to develop a uniform philosophy for overvoltage settings in consultation with SLDC Odisha, OPTCL & ERLDC.*
- *to find out the reason for tripping of the generating units in reverse power flow protection.*

OHPC was advised to submit a detailed report on root cause analysis of the above event.

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 resultall the feeders connected to 220 kV Bus I & Bus II got trippedleading 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.

Deliberation in the meeting

The event was explained by DVC as follows:

- *The roof of the control room at 220 kV BTPS-B S/s was in bad condition and some part of the roof was damaged.*
- *Due to heavy rainfall on the day of disturbance, water seepage occurred through the roof and there was water ingress in the busbar relay panel. Subsequently due to internal shorting in the panel caused by water ingress, busbar protection operated for both main bus-1 & main bus-2 and resulted in tripping of all the feeders connected to 220 kV buses leading to total power failure at 220 kV BTPS-B s/s.*
- *After the disturbance at BTPS-B, total load of 132 kV Ramgarh, Patratu & North Karnpura S/s was supplied through 132kV Ramgarh-Gola D/C. Due to overloading of the circuits, jumper snap occurred near Ramgarh end in Gola-2 circuit and 132 kV Ramgarah-Gola-2 got tripped. Subsequently 132 kV Ramgarah-Gola-1 also got tripped due to overloading.*

On enquiry from ERLDC regarding clearance of fault in 1.5 second, DVC replied that Y-phase pole discrepancy relay operated for 220 kV BTPS B-CTPS circuit-1 that resulted in delay in fault clearance.

Regarding remedial measure DVC informed that repair work of roof of control room is already completed and no water seepage issue has been resolved.

They informed that the busbar panel was dried to remove the moistures and it was put back into service after necessary testing. They further informed that they are planning to replace old electro-mechanical relays of busbar panel with numerical relays for which NIT had already been issued.

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 observedat 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.

Deliberation in the meeting

DVC explained the disturbance as follows:

- *At 02:20 hrs, 220kV Parulia (DVC)-DSTPS-1 tripped from both end in zone 1 of distance protection on R-Y to ground fault.*
- *Due to tripping of the above circuit, 220 kV Parulia (DVC)-DSTPS-2 got overloaded and at 02:26 hrs, there was conductor snapping in the line near to Parulia end. The fault was cleared from the both end in zone-1 distance protection within 100 msec.*
- *However, at the same time 220 kV Parulia(PG)-Parulia(DVC) D/C line sensed the fault and got tripped from Parulia(PG) end within 100 msec on overcurrent high set protection.*
- *The tripping of 220 kV Parulia(PG)-Parulia(DVC) D/C line resulted in complete blackout of 220 kV Parulia DVC S/S along with interruption of power supply at DSP (Tamla) affecting the oxygen plant unit as well.*

Powergrid informed that high set protection in the line was earlier enabled to prevent the fault feeding by 400/220 kV ICTs at Parulia station due to delayed clearance of fault in DVC system. They added that now they has disabled the high set protection in 220 kV Parulia(PG)-Parulia(DVC) D/C line at Parulia (PG) end after the disturbance.

They requested to DVC for early commissioning of line differential protection in 220 kV Parulia(PG)-Parulia(DVC) D/C line as per the decision of previous PCC&TCC. Regarding the same, DVC updated that pilot wire protection for the line is already in service and the same was tested and found healthy.

Further they updated that Control & Protection system upgradation work is under progress at 220KV Parulia DVC station and fiber based line differential protection would be implemented for the above tie line by November-21.

Regarding A/R operation at DSTPS end during the R-Y phase to earth fault in 220 kV Parulia (DVC)-DSTPS-2 circuit, DVC replied that there was some issue in A/R scheme of Main-1 relay of the line. The scheme would be checked after availing line shutdown.

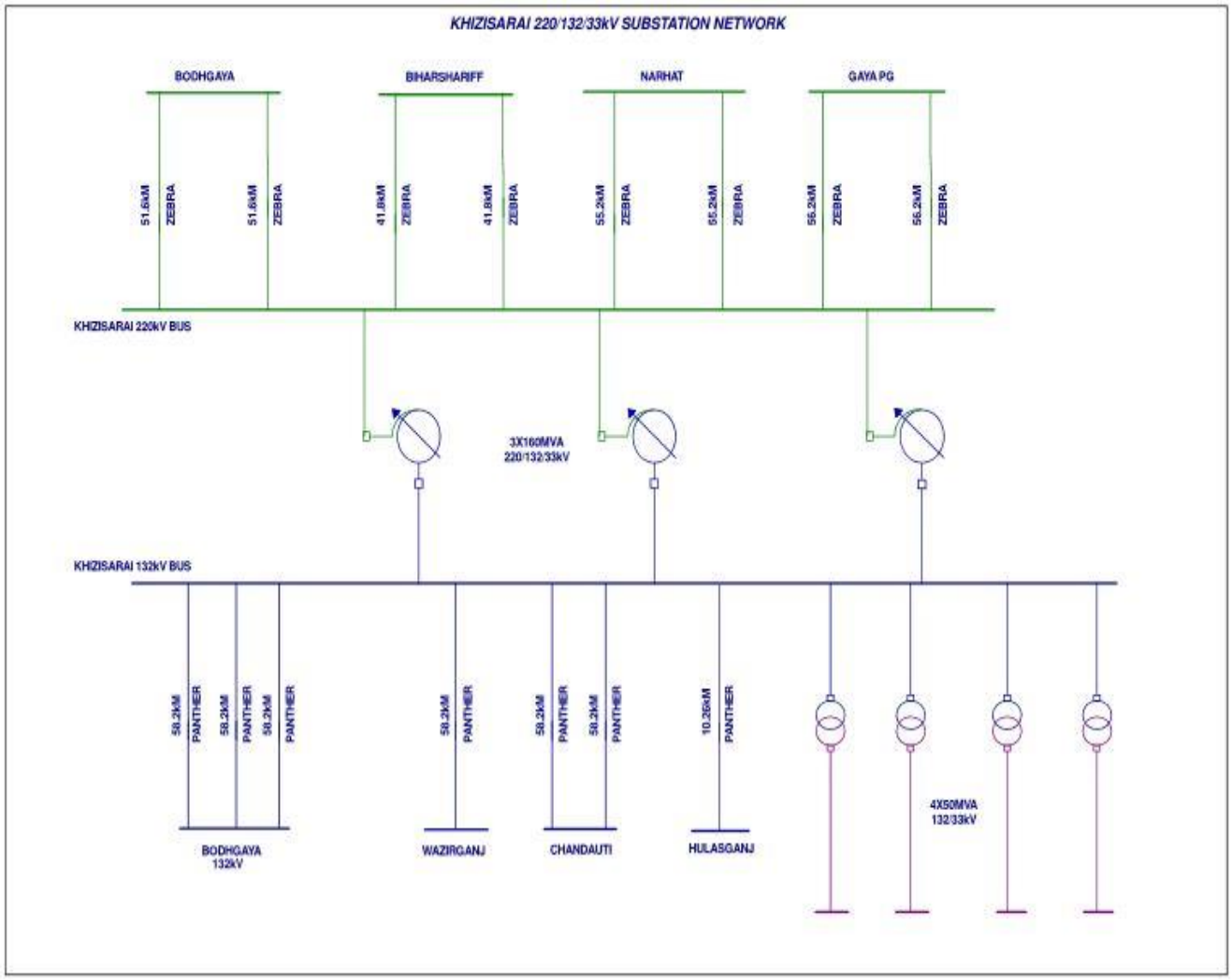
PCC advised DVC to restore the A/R scheme after checking the same at DSTPS end.

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.

Deliberation in the meeting

220 kV Gaya-Khizisarai circuit-2 was under shutdown prior to the disturbance.

BGCL representative informed that there was a R-Y phase to ground transient fault in 220 kV Gaya-Khizisarai circuit-1 near to Khizirsarai end. The fault was cleared by Khizirsarai end relay in zone-1 of distance protection. At Gaya end, the relay sensed Y phase to ground fault in zone-2 and auto recloser was initiated for the line after receiving the carrier from Khizirsarai end. However both Y & B phase got opened and after one second, both the breakers got reclosed.

Regarding this abnormal operation of auto recloser scheme at Gaya end, Powergrid explained that opening of B-pole was due to wrong configuration in the scheme and the same had been rectified after the disturbance.

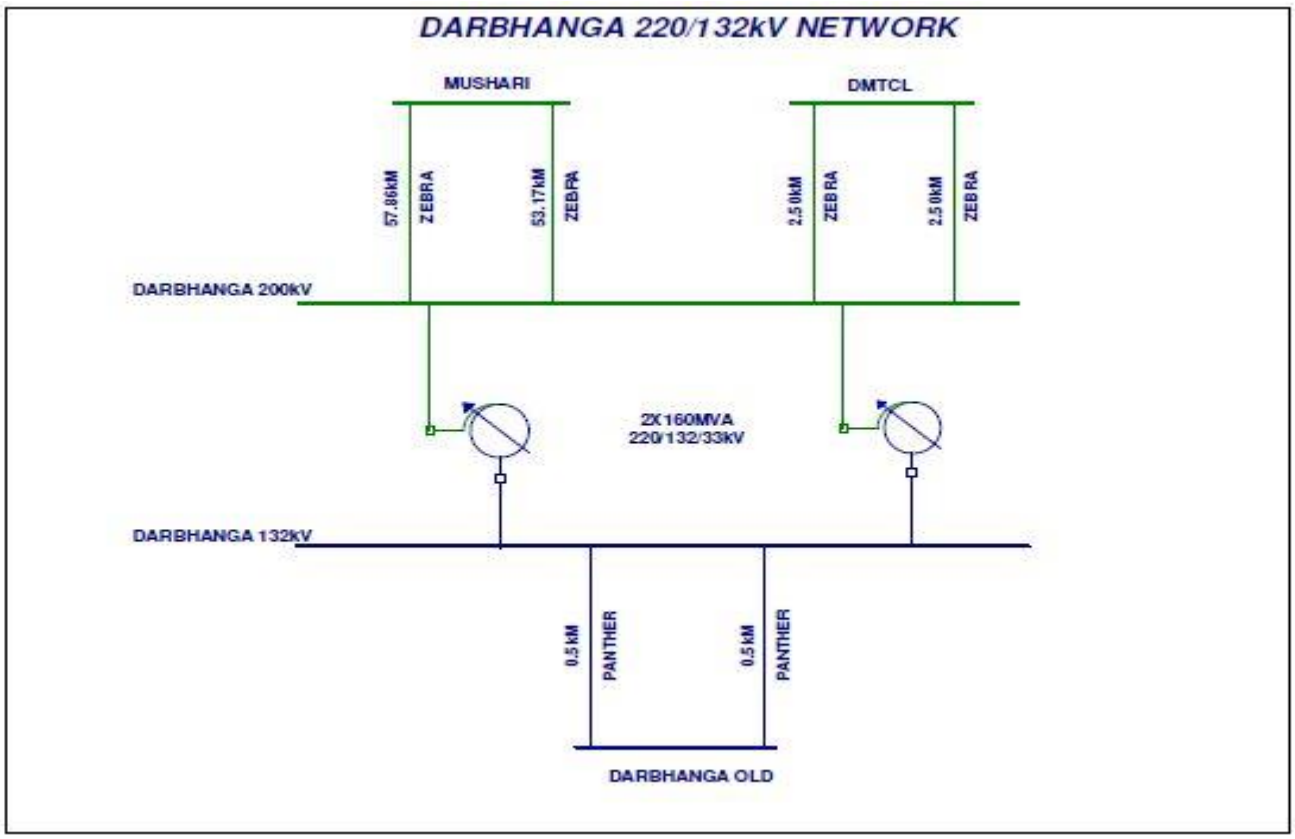
BSPTCL informed that 220 kV Biharshariff-Khizisarai-D/C also sensed the fault in zone 2 at Biharshariff end and tripped instantaneously.

They submitted that instantaneous tripping at Biharsharif end was due to timer configuration issue in the relays. The same had been rectified.

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.



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	Manually hand-	Didn't trip	

	Darbhanga (BSPTCL)-Darbhanga (DMTCL)-1	tripped from BSPTCL end		
07:36 Hrs	220 KV Darbhanga (BSPTCL)-Darbhanga (DMTCL)-2			

Load Loss: 211 MW

Outage Duration: 02: 05 Hrs

BSPTCL may explain.

Deliberation in the meeting

BSPTCL informed that prior to the incident, 220/132 kV ATRs at Darbhanga was catering total load of 211 MW.

At 07:22 Hrs., HV side R phase bushing of 220/132 KV, 160 MVA ATR-2 got blasted and resulted in tripping of ATR on transformer differential protection.

Due to tripping of 160 MVA ATR, entire load came into the 200 MVA ATR-1 and ATR-1 got tripped in overcurrent protection.

Regarding overcurrent settings of ATR at Darbhanga, BSPTCL replied that the setting was 90 % of ATR full load current with 350 milliseconds time delay. They added that as per their philosophy, transformer overcurrent setting was 80-90 % of full load capacity.

After detailed deliberation, members opined that the overcurrent setting at below full load capacity of the transformer is conservative and not desirable. The same may result in unnecessary tripping of the ATRs during contingencies of nearby elements and may result in severe affect to reliability of the grid.

PCC advised BSPTCL to review their philosophy of transformer overcurrent settings in consultation with OEMs guidelines and advised to increase the overcurrent settings of transformers at least to 100 % with suitable time delay. Further the setting of 80-90 % loading in ATRs can be kept as alarm for notice of the control room personnel.

PCC also advised BSPTCL to carry out root cause analysis for failure of R phase bushing of 220/132 KV 160 MVA ATR and share the report to ERPC/ERLDC.

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 &Powergridmay explain.

Deliberation in the meeting

Regarding event on 16/07/2021, BSPTCL informed that 220/132 kV 160 MVA ICT-3 at Sonenagar was under commissioning stage. During testing of this ICT, the DC supply got inadvertently extended to LBB protection which in turn initiated busbar protection and tripped all the elements at 220 kV Sonenagar S/s.

PCC advised BSPTCL to take proper precautionary measure before carrying out such testing of the equipment so as to avoid the inadvertent initiation of LBB/Busbar protection. PCC suggested that the 96 trip relays may be kept in off position or DC supply fuse to the concerned panel may be kept off during the testing of the equipment.

Further, PCC expressed serious concern for repeated grid disturbances in 220 kV Sonenagar S/s and advised BSPTCL to take immediate measures for resolving the protection related issues at Sonenagar.

Regarding event on 31/07/2021, BSPTCL informed that due to reverse CT polarity, bus bar protection got initiated during testing of upcoming ICT-3 which resulted in tripping of 220 kV Chandauti-Sonenagar D/C from their end. They further informed that polarity issue has already been rectified after the incident.

On query, regarding implementation of permissive overreach (POP) protection at Chandauti end for 220 kV Chanduati – Sonenagar lines, Powergrid informed the same had already been implemented at their end. PCC advised BSPTCL to implement week infeed/radial feeder protection at Sonenagar end for 220 kV Chanduati – Sonenagar lines at the earliest.

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.

Deliberation in the meeting

220 kV Rangpo-Ronginchu-2 was under shutdown before the events.

Rongnichu HEP representative informed that for both the events of 14/07/21 & 15/07/21, there was no fault in the line and 220 kV Rangpo-Ronginchu-1 got tripped from Rongnichu end in overcurrent protection due to wrong settings in the relay at their end.

They submitted that the settings had been revised as follows:

- *Old Settings: PU= 80A & TMS= 0.5*
- *New Settings: PU=200A & TMS= 0.515*

They stated that after revision of the settings, no further tripping has been observed in the line.

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 02/06/21following 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.

Deliberation in the meeting

Regarding event on 02/06/21, DMTCL informed that they are unable to extract the DR for the event from the relay. Further, the relay input signals were also checked and found in order. The tripping could not be analyzed due to non-availability of DR.

Regarding event on 06/07/2021, they informed that 132 kV Bus-2 got tripped during restoration work of 132 kV main Bus-1 at Motihari S/S. The tripping occurred due to flash over in isolator bay of 132 kV Motihari – Raxaul-II circuit.

They further informed that restoration work had been already completed.

Regarding disturbance on 02/07/2021, TSTPP representative explained the event as follows:

- *220 kV TSTPP – Rengali PH line was under shutdown for replacement of Main-2 distance protection relay at their end.*
- *The disturbance occurred during returning of the shutdown after completion of the relay replacement work.*
- *From the DR analysis, it was observed that current of 438A, 367A and 315 A flowed through R, Y & B phases respectively for more than 1 sec in 220 kV Rengali PH line during the event. This resulted in triggering of SOTF protection & trip signal was sent to master trip relay.*
- *As current was persisting for 1 sec, LBB protection operated after 200 msec and tripped all the feeders connected to 220 kV main bus-2 at TSTPP.*
- *They explained that a parallel path for ground return current was created with closed line earth switches at both end of the line which resulted in flow of current through CTs in spite of line was under shutdown.*

The detailed report from TSTPP is attached at ***Annexure B.9.***

PCC enquired about any fault in parallel/nearby transmission line during this event. However, no such incidents were reported.

TSTPP submitted that they would adopt the following precautionary measure to avoid this type of event in future:

- *LBB protection link of the concerned line under outage would be kept out of service during line maintenance work. After completion of the work and getting confirmation of opening of line and bay earth switch for the line, LBB protection would be taken into service & line would be charged.*

PCC suggested that as an additional precautionary measure, local earthing of the CT may be done for the line under shutdown in order to avoid any unwanted tripping in the substation during fault in the other healthy circuits and as well as for safety measures.

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 - 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 SUCCESS FUL, 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 , SUCCESS FUL)	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 afault 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.

Deliberation in the meeting

BSPTCL representative informed that in most of the line tripping events of 220 kV Khagaria-New Purnia-2, R phase to ground fault was observed at 16 – 18 km from New Purnea end.

Accordingly, they had conducted tower top patrolling on 11th Aug 2021 and 14th Aug 2021 in concerned section of the line and found that R -phase insulator was damaged at 4 nos. of locations. The insulators had been replaced on these locations.

Further, they informed that vegetation was cleared & tree cutting was also carried out in concerned section to resolve any clearance issues.

ERLDC pointed out that in tripping incidents involving single phase to ground fault, it was observed that at New Purnea end faulted phase gets opened immediately but after 500ms of that other two phases are also getting opened. This had resulted in non-operation of auto-recloser for phase – ground faults.

BSPTCL replied that dead time of pole discrepancy relay at New Purnea end was kept at 500 milliseconds due to which other two phases were getting opened after 500 milliseconds of opening of faulted phase. They had revised dead time of pole discrepancy relay to 1.1 second.

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-Raigarhckts 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.

Deliberation in the meeting

ERLDC pointed out that 220 kV Budhipadar-Korba & 220 kV Budhipadar-Raigarh circuits had tripped multiple occasions in last few months. In most of tripping incidents, it was observed that faults had occurred at 50-60 km from Budhipadar end and most of faults were associated with vegetation and clearance issue. They further informed that due to non-availability of PLCC at Budhipadar end auto recloser scheme was not in service for these lines.

Regarding tripping of the lines, OPTCL replied that after repeated tripping events in month of May and June 2021, they had carried out line patrolling and cleared all vegetation issues at identified fault locations. However repeated tripping were being observed again in August -2021 and they informed that they would carry out thorough patrolling of the line in order to resolve any ROW/clearance issues.

PCC advised OPTCL to resolve RoW /clearance issues in the line by Sept' 21.

Regarding implementation of auto-recloser scheme, they replied that as an interim measure, auto-recloser at Budhipadar end would be implemented without PLCC similar to as done for 220 kV Katapalli -Bolangir (PG) line.

PCC advised OPTCL to resolve auto-reclose issue at Budhipadar end by 15th Sep'21.

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.

Deliberation in the meeting

Regarding bay construction work at KBUNL switchyard, NTPC informed that construction work of three nos. bays had been completed and work related to 4th bay is in progress.

ERPC secretariat informed that time line for implementation of KBUNL islanding scheme had been decided as December-21 and advised NTPC to complete the pending bay construction work by target date i e Sep 2021.

PCC also advised NTPC to share the e-mail confirmation regarding proposed range in frequency settings of the KBUNL Stage-II units to ERPC/ERLDC

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 over-frequency 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.

Deliberation in the meeting

PCC advised DVC to submit present status of the implementation work as well as a detail action plan with time line for each milestone for implementation of CTPS islanding scheme.

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.

Deliberation in the meeting

OPGC representative intimated that after special meeting dated 06/08/21, they tried to communicate OEM (M/s BHEL) several times however no response was received from the OEM till date.

PCC 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.

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.

Deliberation in the meeting

SLDC Bihar representative informed that the revised base cases would be submitted within two days.

PCC advised SLDC Bihar to coordinate with BGCL for submitting 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.

PCC advised NTPC to submit the in-house load quantum of Nabinagar STPP units to ERPC and ERLDC.

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.

Deliberation in the meeting

JUSNL informed that revised base case along with the disconnection points for Ranchi Islanding Scheme had been sent to ERLDC.

ERLDC stated that the details had been received from JUSNL and they would carry out the study & submit their report within two week.

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, Powergridhad 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 theShutdown 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.

Deliberation in the meeting

Powergrid informed that 400KV Maithon-Mejia Circuit-I, II & III have old BPL make PLCCs and frequent failure had been observed in cards / modules of the PLCC panel. They were facing difficulties in getting service support from the BPL. In order to rectify this, they have planned to replace those old BPL make PLCC with ABB make PLCCs.

They intimated that during retrofitting work, significant loss was observed inside the LMUs which was installed along with BPL panel. Therefore, these old LMUs also need to be replaced for healthiness of communication network of the line.

Powergrid proposed that since replacement of PLCC work is for system improvement purpose, outage of the feeders on account of above purpose may not be affected in their Regional Availability.

PCC advised Powergrid to furnish relevant details regarding the losses observed in LMU panel after installation of new PLCC panel in the lines. Further, it was opined that if there is sufficient improvement in PLCC communication is being achieved by replacing the LMUs, the above event may be considered as system improvement. Powergrid was also advised to submit practices followed in other regions regarding the consideration for such type of works.

ITEM NO. B.13: N-1 reliability issue of 2 X 315 MVA 400/220 kV Ranchi ICTs—ERLDC

2 X 315 MVA 400/220 kV Ranchi ICTs are the primary source of power to the capital city of Ranchi. The downstream network from 400/220 kV Ranchi substation of PGCIL is presently having four lines (Three 220 kV lines to 220/132 kV Hatia (JUSNL) and one 220 kV line to Chandil substation. With increasing load and inadequate Tenughat generation, the load on these ICTs has reached more than 220 MW each since the last few quarters during peak hours. Thus, the ICTs were not satisfying the N-1 criteria.

In Aug 2021, 220 kV Ranchi-Ramgarh circuit was commissioned by DVC. With This line, the 400/220 kV ICTs loading increased each by 40-60 MW (total drawal by DVC through the line being 80-120 MW). This additional loading had aggravated the N-1 reliability issue of Ranchi ICTs.

In addition, any tripping of Bokaro ICTs would cause severe loading of Ranchi ICTs due to this newly commissioned line(one ICT tripping would lead to tripping of other ICT on overload).

Members may discuss.

Deliberation in the meeting

ERLDC representative informed that with commissioning of 220 kV Ranchi-Ramgarh D/C line of DVC, the loading of the 400/220 kV ICTs at Ranchi had been further increased and this has aggravated the n-1 reliability concern of ICTs at Ranchi. They stated that immediate measures are required to address this issue.

PCC decided that a special meeting may be convened among DVC, JUSNL, Powergrid, ERLDC & ERPC secretariat to discuss and finalize remedial measures to address the reliability issue of ICTs at Ranchi.

ITEM NO. B.14: 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 attached.

Concerned utilities may explain.

Deliberation in the meeting

Explanation from constituents related to tripping incidents in the month of July 2021 is attached at ***Annexure B.14.***

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 status of data collection for new substations is given below:

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

Deliberation in the meeting

Members noted.

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-Rangpolineis 1.5 secondwhereasproposed 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.

It is requested to implement the proposed settings at respective ends.

Members may update.

Deliberation in the meeting

PCC advised all concerned utilities to implement the proposed settings in the line at their respective ends as given in the report attached at ***Annexure C.2.***

ITEM NO. C.3: Transformer overcurrent earth-fault 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.

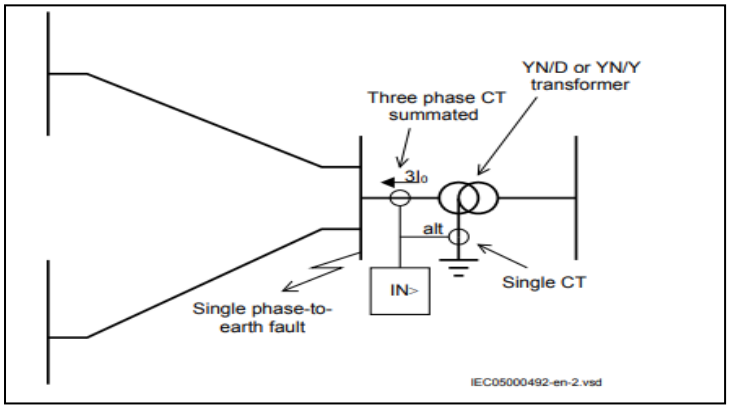


Figure 1: Step 1 fault calculation 1

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.

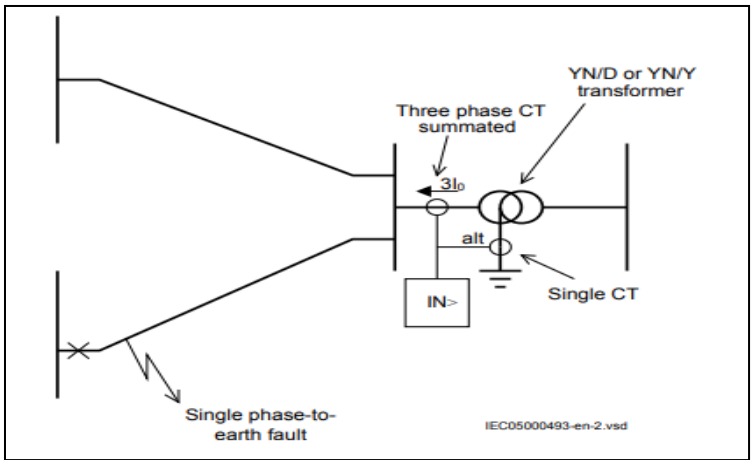


Figure 2: Step 1 fault calculation 1

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

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 104thPCC 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.

Deliberation in the meeting

It was informed that no further comments had been received from utilities on the revised guidelines for backup O/C & E/F settings for transformers.

PCC finalized the above recommendation on backup O/C & E/F settings for transformers and advised all utilities to follow the guidelines for configuration of backup O/C & E/F settings of Transformers in their system.

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

Further, Powergrid suggested that PRDC to provide calculation sheet for defining protection settings for 765 kV, 400 kV, 220 kV and 132 kV level for eastern region that would help all utilities in protection coordination.

PCC advised PRDC to provide calculation sheet for defining protection settings for 765 kV and 400 kV level for eastern region to ERPC. Further, after completion of this task, same could be done for 220 kV and 132 kV level for eastern region.

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] 400KV Durgapur (POWERGRID)-Bidhan Nagar (WBSETCL) D/C: Line length = 11 KM,
[5] 132KV Birpara (POWERGRID)-Birpara (WBSETCL) D/C: Line length = 0.3 KM,
[6] 220KV Durgapur (POWERGRID)-Durgapur (DVC) D/C: Line length = 1 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.

Deliberation in the meeting

WBSETCL informed that as per recommendation of 38th ERPC Meeting, the implementation of fiber optic-based differential protection was taken up for transmission lines under sl no. 1 to 5.

For 220KV Subhasgram (POWERGRID)-Subhasgram (WBSETCL) D/C line, they informed that the differential relays had already been commissioned however due to unavailability of communication network the communication link was not functional and presently these relays are working as distance protection relay. They added that visit of OEM engineers has been planned for completion of the pending work.

Regarding other lines, they informed that relays had been procured and sent to the respective sites along with fiber communication equipment. The commissioning work was getting delayed due to Covid Pandemic & unavailability of OEM engineers.

PCC advised WBSETCL to pursue the matter with OEM for expediting the commissioning work for the above lines.

DVC informed that line differential protection for 220KV Durgapur (POWERGRID)-Durgapur (DVC) D/C line would be commissioned by October' 21.

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)): Sagardighi ,Bakreswar , Chanditala, Subhasgram, Rajarhat	Adjacent Shortest line will be now Jeerat-New Jeerat(25 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	POWERGRID ER-2 / WBPDCL/ WBSETCL	Protection coordination has been done as per ERPC's guidelines. (Settings received also)

		adjacent short and long line.		

PMJTL ,WBSETCL& WBPDCL may update.

Deliberation in the meeting

PCC advised PMJTL & WBSETCL to share protection settings file for their respective ends to ERPC/ ERLDC.

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.

Deliberation in the meeting

BSPTCL representative updated the status as follows:

- *The time setting of zone-4 protection in distance relay for all lines connected to 220 kV Biharsharif S/s had been reduced to 250 msec.*

- *Regarding implementation of busbar protection, they had taken up with their higher authority for early commissioning of the busbar protection at Biharshariff.*

- *Regarding checking of cables/wiring for ICTs, they informed that ICT-1 & ICT-3 are connected through common cable for which simultaneous s/d of both ICTs are required to carry out the activity. The checking would be done after getting the shutdown approval.*

Powergrid intimated that they had received proposal from site for disabling the feature of extending inter-trip command from LV side to HV side of the ICT. They informed that they are considering to extend inter trip command through numerical relay instead of 86 relays and final recommendation in this regard would be sent to site for implementation at the earliest.

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.

Deliberation in the meeting

It was informed that a proposed overvoltage settings for lines connected at 220 kV BTPS S/s was submitted by BTPS to SLDC, Bihar for their comments.

PCC advised SLDC Bihar to review the proposed settings and submit their observations at the earliest.

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.

Deliberation in the meeting

BSPTCL confirmed that line length of 132 kV Sultanganj-Deoghar S/C is 92 km, out of which 84 km from Sultanganj end comes under BSPTCL jurisdiction and rest 8 km from Deoghar end comes under JUSNL jurisdiction.

Regarding clearance issues, they informed that line shutdown has been planned on 26th Aug 2021 in order to resolve pending clearance issues.

Regarding protection settings of relays at Deoghar end, JUSNL informed that 132 kV Jamtara – Deoghar was LILOed at Chitra in Aug-2020. As a result line length of shortest and longest line at Deoghar S/S and Jamtara S/S had got changed and the protection settings at respective ends need to be reviewed. They further submitted that the settings at Deoghar and Jamatara end are being reviewed and revised settings would be implemented shortly.

PCC advised JUSNL to share the details regarding change in configuration in 132 kV Deoghar-Jamtara line to BSPTCL & DVC and advised BSPTCL & DVC to review the protection settings at 132 kV Sultanganj & Maithon S/s respectively.

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.

Deliberation in the meeting

BSPTCL informed that they had shared ICT backup protection settings of Bodhgaya S/s with Powergrid.

PCC advised Powergrid to revise zone 3 settings at Gaya end for 220 kV Gaya-Bodhgaya lines in coordination with ICT backup protection settings at Bodhgaya S/s.

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,SLDCOdisha 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.

Deliberation in the meeting

PCC advised OHPC to reduce zone 4 timer settings to 400 milliseconds at Rengali PH end for all the outgoing lines.

PCC also advised OHPC to review zone-4 timer settings for outgoing lines at all other generating stations as per the ERPC protection philosophy.

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.

Deliberation in the meeting

JUSNL informed that as per the information received from site, the make of PDH unit at Dumka is different from Maithon end. They further informed that for establishing communication between both end and for successful A/R operation, PDH of PLCC must be of same make on either end.

PCC advised JUSNL to re-verify the make of PDH at Maithon end in coordination with Powergrid. In case the PDH make is same on either end, they shall resolve carrier issue in consultation with OEM.

In case the PDH make on either end is different, then the PDH may be replaced or new PDH may be purchased to restore the PLCC communication.

PCC opined that as the onus of restoration of PLCC in 220 kV Maithon-Dumka line lies with JUSNL, JUSNL shall take appropriate action to restore the PLCC at the earliest.

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.

Deliberation in the meeting

JUSNL informed that a draft philosophy for overvoltage settings had been prepared by them and the same was circulated among their field offices for comments.

They added that after incorporating the observations received from field units, the final report would be shared with ERPC/ERLDC for review.

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 Powergrid Mithilanchal Transmission Ltd) at Motihari was being charged through 132 kV GIS Bus 1. Just after charging of new ICT, 132kV Main bus-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 engineers is 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.

Deliberation in the meeting

PMTL representative informed that the investigation report for failure of bus extension module was submitted to PSETD division of CEA. PCC advised PMTL to share the disturbance report to ERPC also.

Regarding restoration of the damaged GIS section, PMTL intimated that they had received two offers from OEM i.e. M/s TBEA.

- *First one is for bus extension module, for which offer had already been accepted and in process for approval.*
- *Other offer is for adjacent damaged bay (132 kV DMTCL-Raxaul-2) for which cost negotiation are going on with OEM.*

Regarding timeline to complete the work, PMTL informed that since all materials required for restoration work are to be imported from China, it would take some time for restoration.

PCC advise PMTL to process both offer simultaneously so that restoration work of damaged GIS module may be completed at the earliest.

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.

Deliberation in the meeting

JUSNL informed that OEM had visited the site on 17th July 2021 and had identified some issues with PLCC panel.

They further informed that work order for rectification work of PLCC panel would be placed after receiving the cost estimate from OEM and submitted that PLCC issue at Chandil would be resolved by October'21.

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Annexure A

List of Participants in 105th PCC Meeting held on 23.08.2021 (Monday) at 10:30 AM through MS Teams online meeting platform

Full Name	User Action	Timestamp
ERPC Kolkata	Joined	8/23/2021, 10:27:03 AM
CE CTD	Joined	8/23/2021, 10:27:06 AM
S K Das, NHPC	Joined	8/23/2021, 10:27:06 AM
Ankur Kumar (Guest)	Joined	8/23/2021, 10:27:06 AM
SLDC-ODISHA (Guest)	Joined	8/23/2021, 10:27:06 AM
DEBDAS MUKHERJEE WBPDCL (Guest)	Joined	8/23/2021, 10:27:06 AM
Amaresh Mallick, ERLDC (Guest)	Joined	8/23/2021, 10:27:06 AM
Ch Mohan Rao, (Guest)	Joined	8/23/2021, 10:27:06 AM
M K KIRTANIA, PG (Guest)	Joined	8/23/2021, 10:27:06 AM
Cornelius marandi (Guest)	Joined	8/23/2021, 10:27:06 AM
Alok Pratap Singh ,ERLDC (Guest)	Joined	8/23/2021, 10:27:40 AM
Sukdev (PG) (Guest)	Joined	8/23/2021, 10:28:03 AM
Dilip kant Jha Eee Bsptcl (Guest)	Joined	8/23/2021, 10:28:28 AM
Deepak Vinnakota PRDC (Guest)	Joined	8/23/2021, 10:28:33 AM
JAGANATH PANI NHPC (Guest)	Joined	8/23/2021, 10:29:18 AM
Pavan sldc (Guest)	Joined	8/23/2021, 10:29:32 AM
Akash Modi (Guest)	Joined	8/23/2021, 10:29:38 AM
Deepak Kr. EEE, BSPTCL (Guest)	Joined	8/23/2021, 10:29:52 AM
electrical orissa	Joined	8/23/2021, 10:29:57 AM
D.K.JAIN ED ERLDC (Guest)	Joined	8/23/2021, 10:30:26 AM
Arindam Bsptcl (Guest)	Joined	8/23/2021, 10:30:55 AM
D K Bauri, SE, ERPC (Guest)	Joined	8/23/2021, 10:30:58 AM
A SHUKLA AEE CRITL JUSNL (Guest)	Joined	8/23/2021, 10:31:32 AM
Rahul Anand	Joined	8/23/2021, 10:31:50 AM
nitya saron mondal	Joined	8/23/2021, 10:31:52 AM
Prachi Gupta (Guest)	Joined	8/23/2021, 10:32:41 AM
Saugato Mondal , ERLDc" (Guest)	Joined	8/23/2021, 10:32:42 AM
dolagobind patel (Guest)	Joined	8/23/2021, 10:33:31 AM
gaurav (Guest)	Joined	8/23/2021, 10:34:09 AM
Rahul Kumar (Guest)	Joined	8/23/2021, 10:34:38 AM
shadab hasan (Guest)	Joined	8/23/2021, 10:35:00 AM
Saibal ERLDC (Guest)	Joined	8/23/2021, 10:35:15 AM
Rakesh Oraon (Guest)	Joined	8/23/2021, 10:35:16 AM
Pavan sldc (Guest)	Joined	8/23/2021, 10:35:49 AM
U K MISHRA (Guest)	Joined	8/23/2021, 10:35:52 AM
Rajiv Kumar Singh (Guest)	Joined	8/23/2021, 10:36:01 AM
Teesta-V Power Station (Guest)	Joined	8/23/2021, 10:36:03 AM
Kumar Amrendra Madanpuri (Guest)	Joined	8/23/2021, 10:36:04 AM
Chandan Kumar	Joined	8/23/2021, 10:36:28 AM
Rakesh Kumar Singh	Joined	8/23/2021, 10:36:43 AM
Raj Protim ERLDC (Guest)	Joined	8/23/2021, 10:37:51 AM
Kishore Chandra Bhoi (Guest)	Joined	8/23/2021, 10:37:58 AM
PP CHAND ERLDC (Guest)	Joined	8/23/2021, 10:38:23 AM
Sudipta ranjan Nayak (Guest)	Joined	8/23/2021, 10:39:10 AM

EMR Meramundali (Guest)	Joined	8/23/2021, 10:39:10 AM
Hari Ram Swarnakar (Guest)	Joined	8/23/2021, 10:39:28 AM
Saurav Sahay Ch. Mgr ERLDC (Guest)	Joined	8/23/2021, 10:39:33 AM
DGM CRITL JUSNL (Guest)	Joined	8/23/2021, 10:41:25 AM
Aishwary Shukla AEE CRITL JUSNL (Guest)	Joined	8/23/2021, 10:42:26 AM
SMS SAHOO, DGM,OPTCL (Guest)	Joined	8/23/2021, 10:42:34 AM
GAGAN KUMAR EEE (Guest)	Joined	8/23/2021, 10:43:32 AM
SR.Mahapatra (Guest)	Joined	8/23/2021, 10:44:28 AM
D Tripathi, DVC (Guest)	Joined	8/23/2021, 10:44:29 AM
deepak thakur, BSPTCL (Guest)	Joined	8/23/2021, 10:45:22 AM
s choudhary (Guest)	Joined	8/23/2021, 10:45:37 AM
Deepak EEE SLDC (Guest)	Joined	8/23/2021, 10:47:04 AM
Sucharit Mondal (Guest)	Joined	8/23/2021, 10:47:47 AM
Varun Vineet, EEE/ CRITL/BSPTCL (Guest)	Joined	8/23/2021, 10:49:12 AM
pavan sldc (Guest)	Joined	8/23/2021, 10:49:22 AM
Saibal Ghosh,ERLDC (Guest)	Joined	8/23/2021, 10:49:47 AM
SANJEEV KUMAR (Guest)	Joined	8/23/2021, 10:50:03 AM
saroj kumar bohidar (Guest)	Joined	8/23/2021, 10:51:30 AM
Suraj Gupta (Guest)	Joined	8/23/2021, 10:52:18 AM
abhinaba basu (Guest)	Joined	8/23/2021, 10:54:25 AM
SMA SAHOO,DGM,OPTCL,BHUBANESWAR (Guest)	Joined	8/23/2021, 10:55:34 AM
R.L.PASWAN, GM TZ-II, DUMKA (Guest)	Joined	8/23/2021, 10:57:05 AM
TUSHAR RANJAN_SLDC RANCHI (Guest)	Joined	8/23/2021, 10:57:55 AM
Dharm Das Murmu, CRITL, JUSNL (Guest)	Joined	8/23/2021, 11:05:03 AM
Ishani Choudhury (Guest)	Joined	8/23/2021, 11:07:02 AM
BIHAR GRID COMPANY	Joined	8/23/2021, 11:09:30 AM
Rajesh .	Joined	8/23/2021, 11:09:58 AM
s choudhary (Guest)	Joined	8/23/2021, 11:10:03 AM
\\\\"\\\\\\\"\\\\\\\\\\\\\\\"madan mohan (Guest)	Joined	8/23/2021, 11:10:28 AM
aditya kumar jha jha	Joined	8/23/2021, 11:13:10 AM

Annexure B.1

Incident report of total supply failure occurred at Newtown AA III 220 KV Sub-Station at 11:54 hr. On 14.07.2021.

1. **Date and time of Incident:**

   14.07.2021 at 11:54Hrs.

2. **Location of Incident:**

   Newtown AA-III 220KV Substation

3. **Type of Incident:**

   Bus Bar Main zone A, zone B and Check zone operated.(No Fault)

Description of incident:

O&M was doing DCRM test of 220 KV CB i.r.o. Subashgram(PG) Ckt.(connected to Bus **B**), engaging Bus Transfer bay. After completion of test, they restored the same with previous configuration except opening of bus isolator **B** i.r.o. 220 KV Bus Transfer Bay.

Then O&M was preparing to do DCRM test of 220 KV Rajarhat Ckt#1(connected to Bus **A**), engaging Bus Transfer bay. While closing the Bus isolator A of Bus Transfer bay (at that time CB of Bus Transfer bay was in OFF condition.), Bus Bar operation took place.

4. Relay Indication:

At Bus-coupler: MainZone A optd(87A), Main Zone-B optd(87B), Check zone optd(87CH),96.
96 relay operated at all other feeders and transformers.

5. **List of lines and units tripped during the event** :
All 220 KV Bays connected to Bus A (220KV Rajarhat Ckt-I,II, 160MVA Tr-I,II & III), all 220 KV Bays connected to Bus B 220KV (Subashgram(PG), KLC, 50MVA Tr-I,II & III) and 220 KV Buscoupler

6. **Antecedent condition prior to the event :**
220KV Rajarhat Ckt-I,II, 160MVA Tr-I,II & III were at 220KV Bus-A
220KV Subhasgram,KLC,50MVA Tr-I,II & III were at 220KV Bus-B

7. **List of elements (which have influence on the event) which were under outage prior to the event:** Nil

8. **Amount of load and generation loss in MW:**
At Newtown AA-III 220KV Substation: 53MW
At Basirhat end: 10MW

9.Amount of energy unserved in MU to consumer/customer

10.**Duration of the event (Duration may be considered when more than half elements have been restored):**

Duration: From 11:55Hrs to 12:15Hrs. total 20minutes.

11.Catering load from alternate source (if done after the event)

12.Root cause for tripping of lines (Source of fault if any; Malfunction of protection system if any):

Particulars of BusBar Relay: Make-ABB, Type- RADHA (Non Numerical).

Sequence of operation has been mentioned in Sl. No.3, Description of incident.

After completion of DCRM test i.r.o. CB of 220 KV Subashgram(PG) Ckt.(connected to Bus **B**), (O&M) was preparing for next DCRM test of Rajarhat # 1 Ckt. (Connected to Bus **A**).

Operational persons mistakenly closed the Bus isolator A of Transfer Bus Coupler bay without opening of Bus isolator B of Transfer Bus Coupler bay.

During checking it has been found that inter locking scheme was not functional. As a consequence one parallel path of 220 KV Bus Coupler was established and current through CTs of Bus Coupler was halved. So 87A & 87B was operated due to mismatch of current.

But operation of Check zone(87CH) was abnormal as Check zone connection of all bay CTs except Bus Coupler (independent of isolator selection) are directly made to relay.

So Check zone Relay (87CH) was mal-operated.

It is to be mentioned here that Check zone relay is stable during through fault condition before and even after the incident(14.07.2021) on 19.07.2021.

However, on 1st August, Testing team has inspected & checked the operation of Bus Bar relay (87B & 87 CH), taking shutdown of Bus B, but the reason of operation of Check zone relay on 14.07.2021could not be ascertained. Further thorough inspection including CT circuits will have to be made after getting shutdown of individual bay.

13.**Remedial action taken (if any):**

a) Isolator inter locking scheme which was not functional, should be restored as early as possible to avoid such type of incident in future.

10.Restoration of elements

11.Weather condition during the event.

12.**DR/EL in comtrade format (.cfg and .dat) recorded for the tripping of lines and units** :

Already uploaded in PDMS

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: **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)

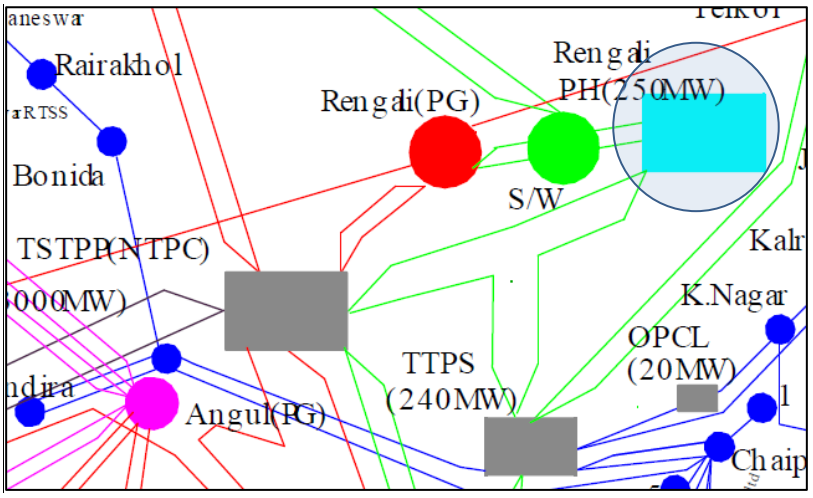


Figure 1: Network across the affected area

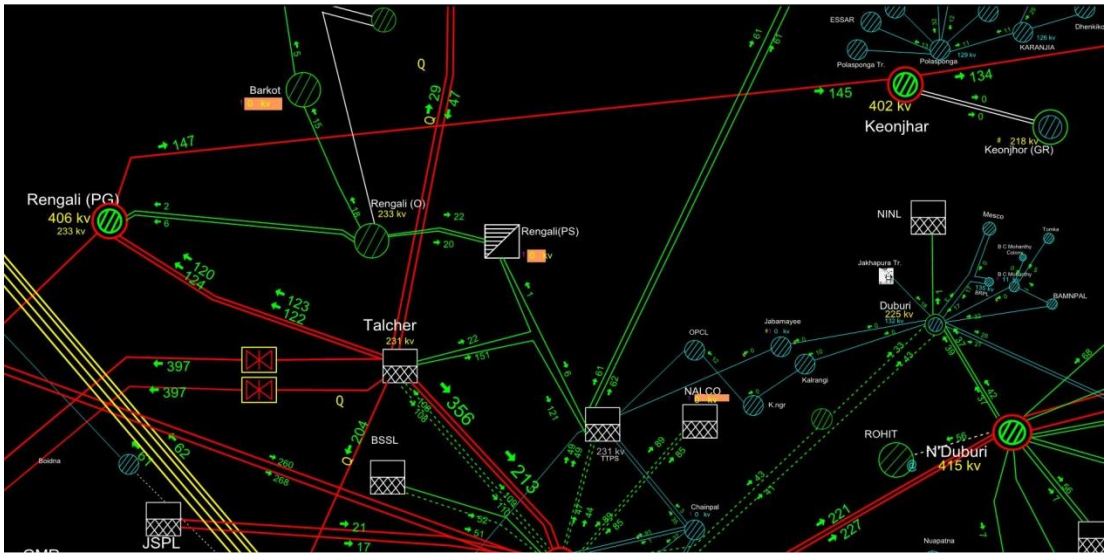


Figure 2: SCADA snapshot for of the system

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	

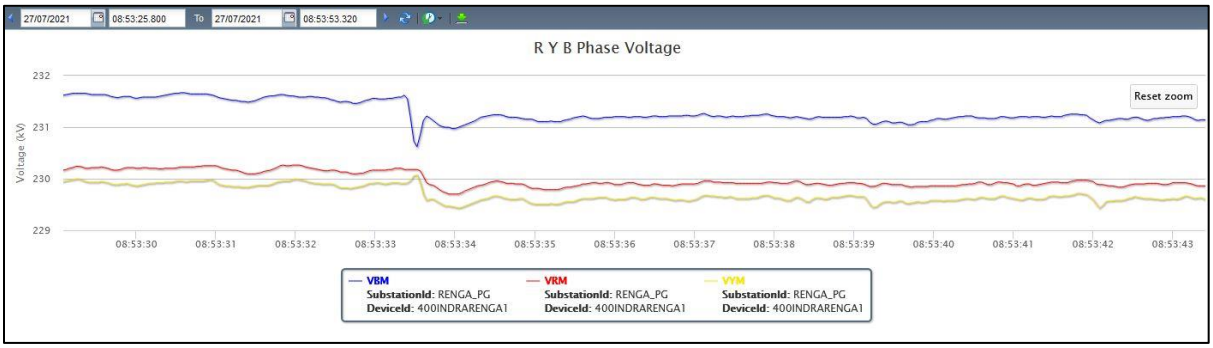


Figure 3: PMU captured at Rengali shows B-Earth fault and slight dip in voltage

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**

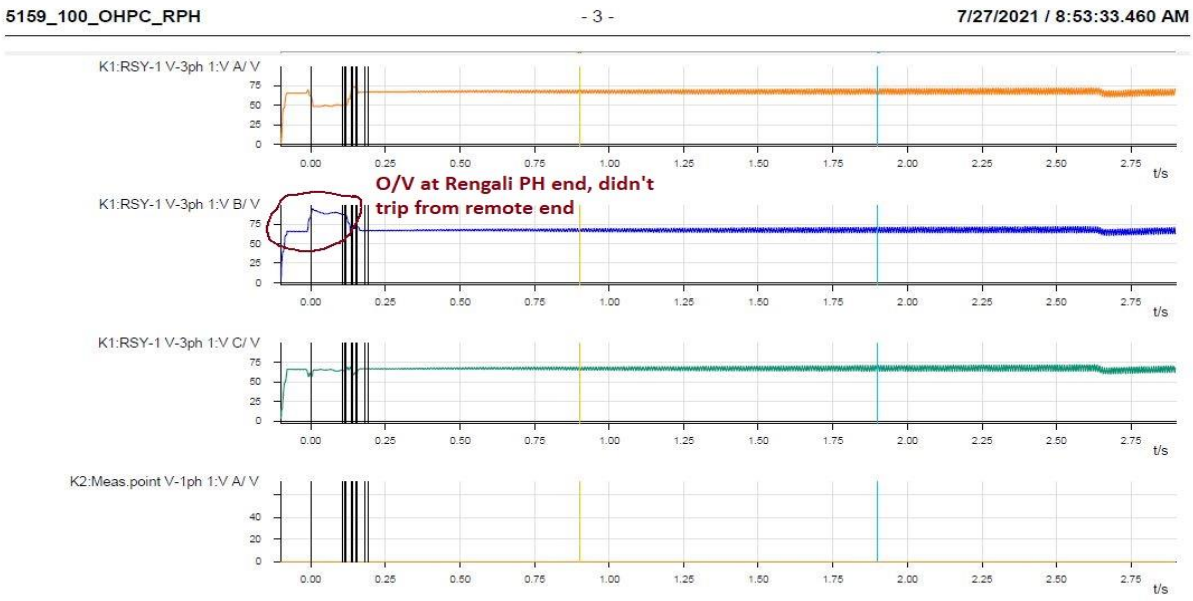
Status of Reporting (रिपोर्टिंग की स्थिति):

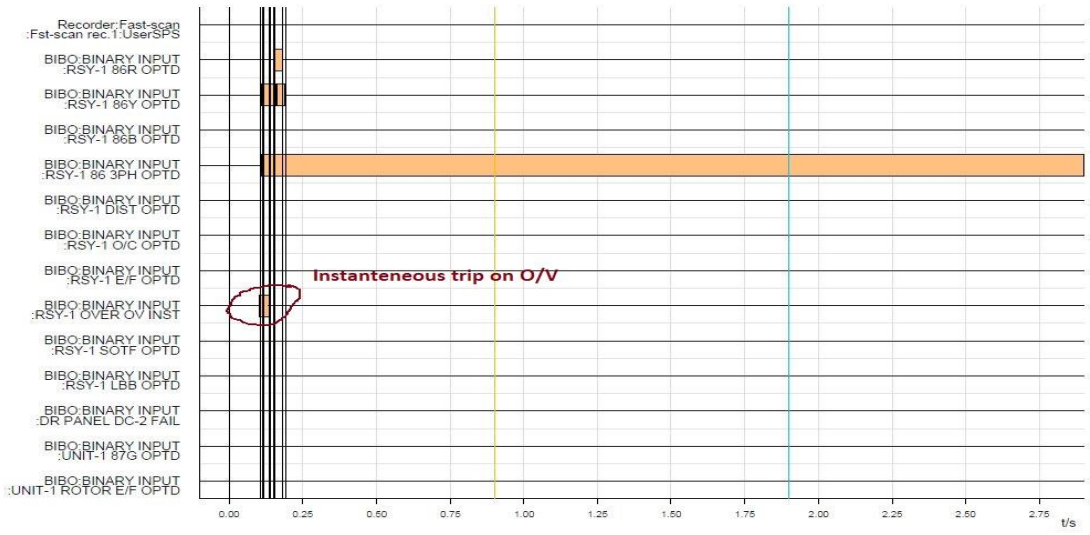
- DR/EL received from OHPC/OPTCL is not in proper format. Comtrade files may be shared.
- DR/EL yet to receive from NTPC.

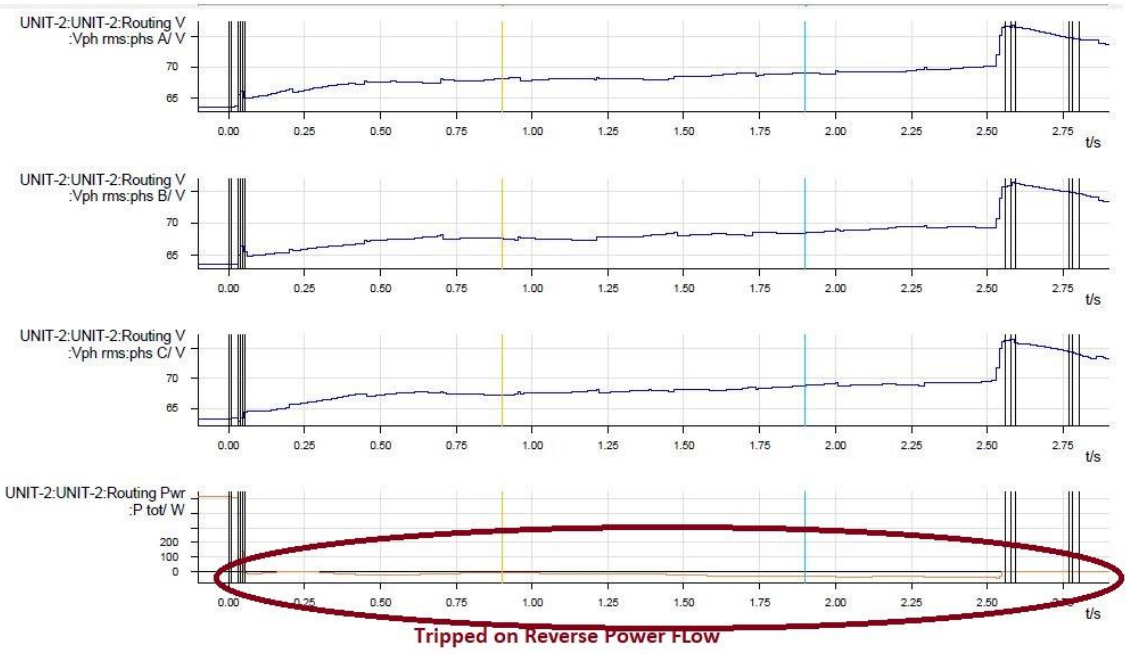
Annexure 1: Sequence of events recorded at ERLDC SCADA data at the time of the event.

Sequence of event not recorded at time of event.

Annexure 2: DR recorded at Rengali PH




Recorder:Fast-scan
:Fst-scan rec.1:UserSPS
BIBO:BINARY INPUT
:RSY-1 86R OPTD
BIBO:BINARY INPUT
:RSY-1 86Y OPTD
BIBO:BINARY INPUT
:RSY-1 86B OPTD
BIBO:BINARY INPUT
:RSY-1 86 3PH OPTD
BIBO:BINARY INPUT
:RSY-1 DIST OPTD
BIBO:BINARY INPUT
:RSY-1 O/C OPTD
BIBO:BINARY INPUT
:RSY-1 E/F OPTD
BIBO:BINARY INPUT
: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
Instanteneous trip on O/V
0.00 0.25 0.50 0.75 1.00 1.25 1.50 1.75 2.00 2.25 2.50 2.75
t/s


UNIT-2:UNIT-2:Routing V
:Vph rms:phs A/ V
70
65
0.00 0.25 0.50 0.75 1.00 1.25 1.50 1.75 2.00 2.25 2.50 2.75
t/s
UNIT-2:UNIT-2:Routing V
:Vph rms:phs B/ V
70
65
0.00 0.25 0.50 0.75 1.00 1.25 1.50 1.75 2.00 2.25 2.50 2.75
t/s
UNIT-2:UNIT-2:Routing V
:Vph rms:phs C/ V
70
65
0.00 0.25 0.50 0.75 1.00 1.25 1.50 1.75 2.00 2.25 2.50 2.75
t/s
UNIT-2:UNIT-2:Routing Pwr
:P tot/ W
200
100
0
0.00 0.25 0.50 0.75 1.00 1.25 1.50 1.75 2.00 2.25 2.50
t/s
Tripped on Reverse Power FLow

पावर सिस्टम ऑपरेशन करपोरेशन लिमिटेड
(भारत सरकार का उद्यम)
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CIN: U40105DL2009GOI188682
फ़ोन: 033- 24235755, 24174049 फैक्स : 033-24235809/5029 Website:www.erldc.org, Email ID- erldc@posoco.in

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)

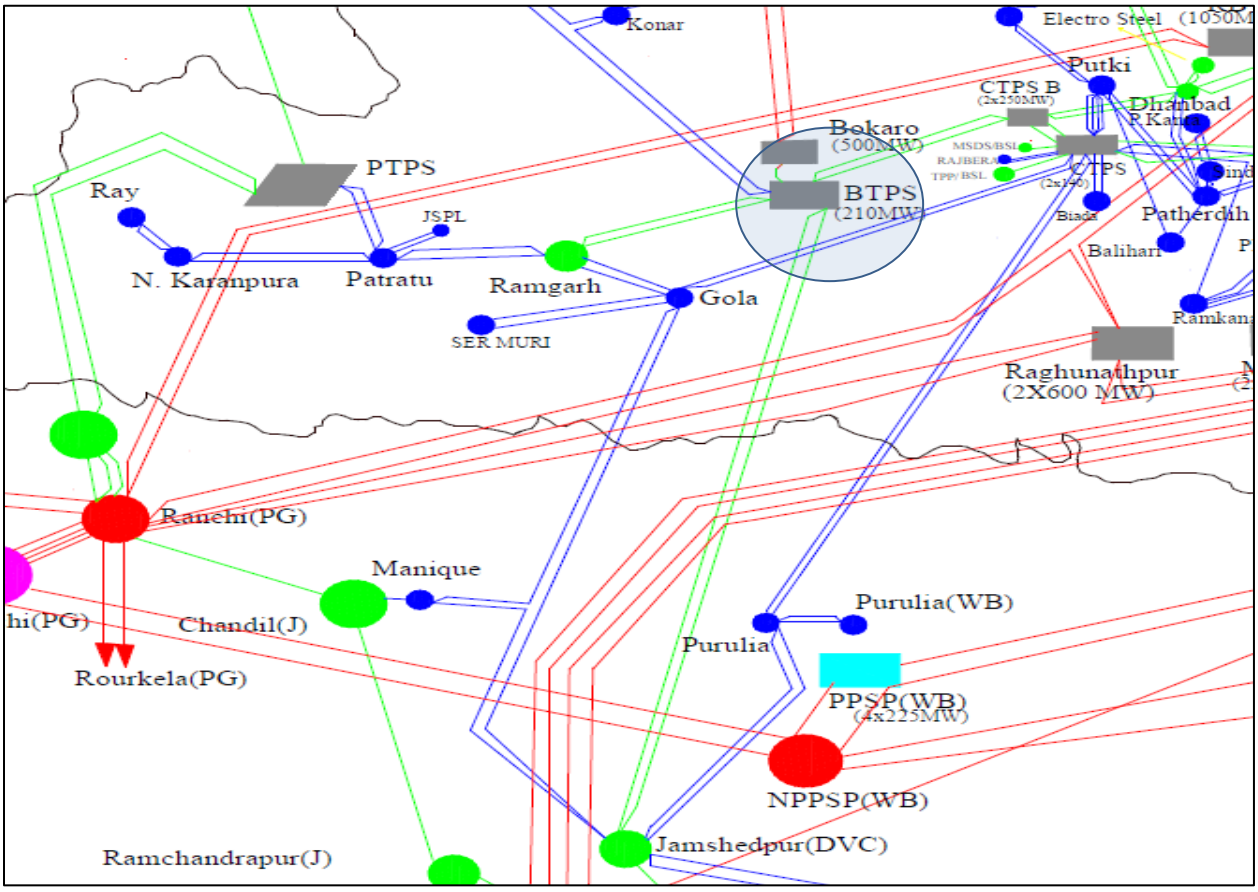


Figure 1: Network across the affected area

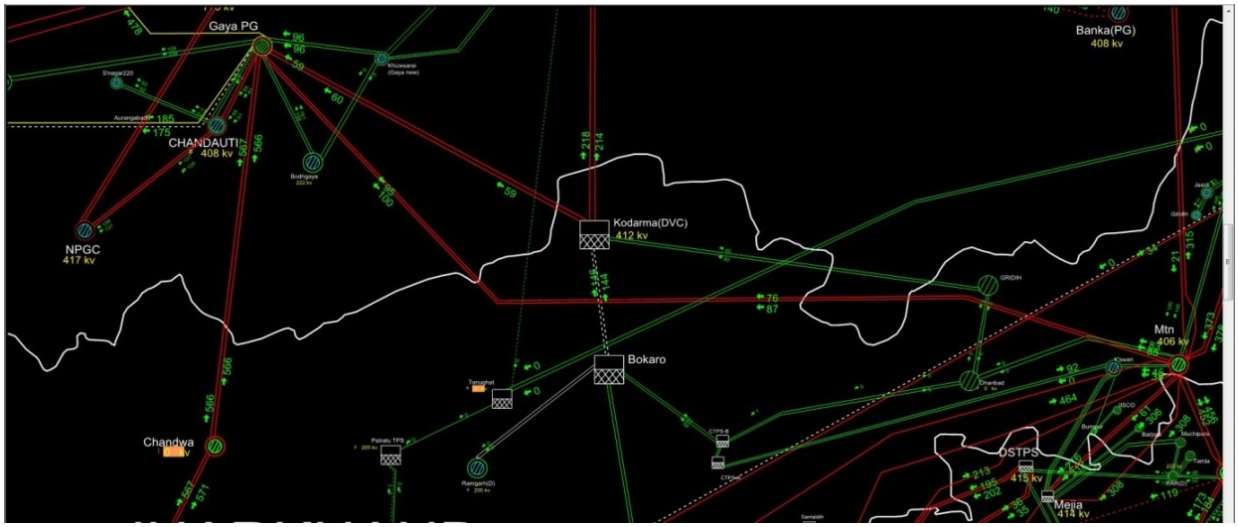


Figure 2: SCADA snapshot for of the system

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.

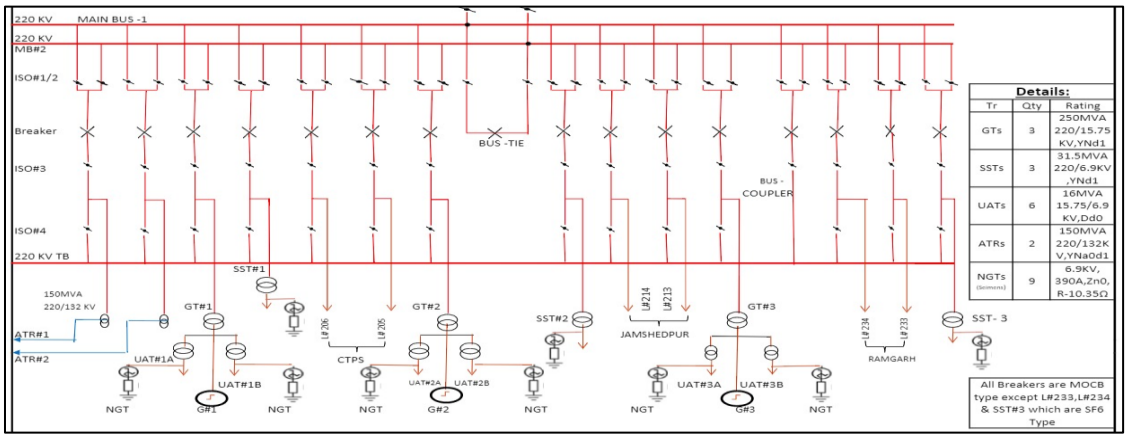


Figure 4: SLD of 220kV BTPS-B S/S

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)

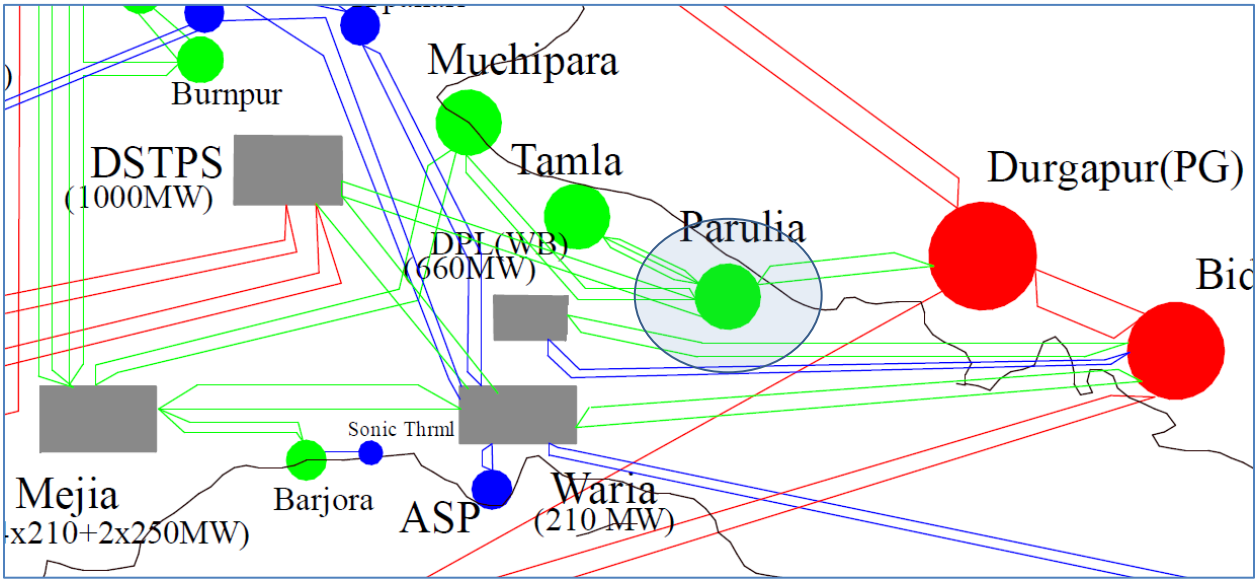


Figure 1: Network across the affected area

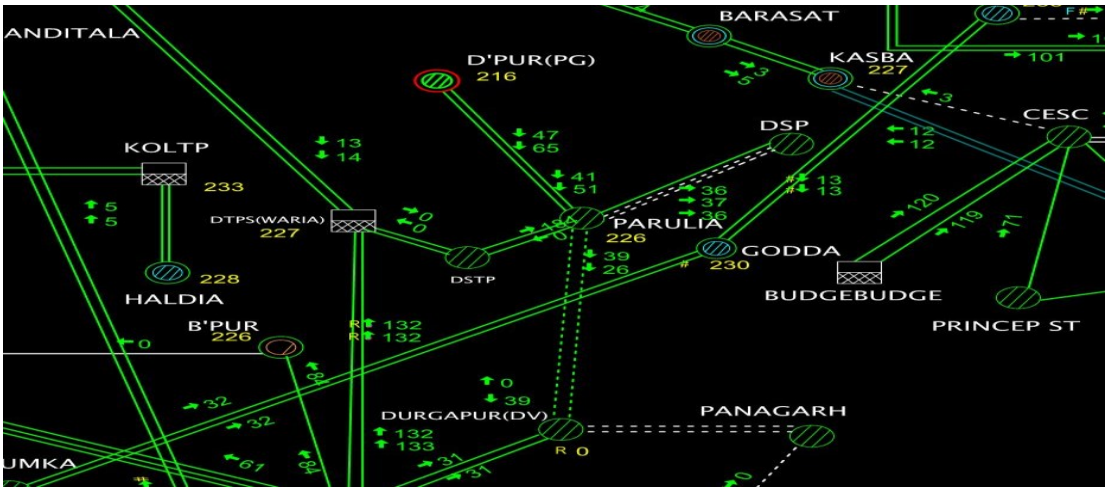


Figure 2: SCADA snapshot for of the system

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		

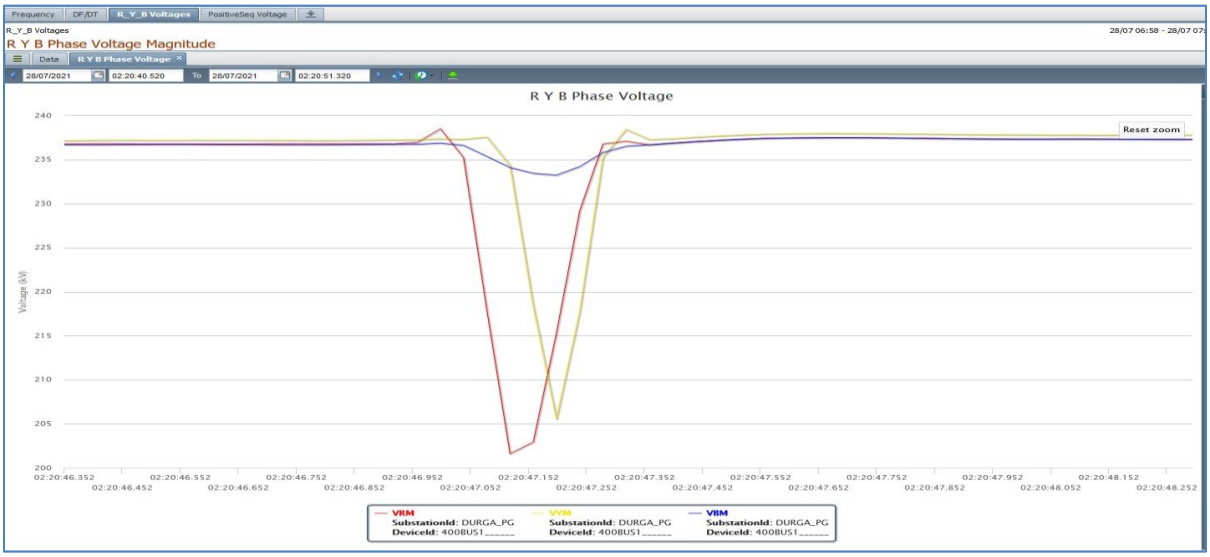


Figure 3: PMU captured at Durgapur shows R-Y-Earth fault cleared in 100ms seconds and dip of around 35 kV.

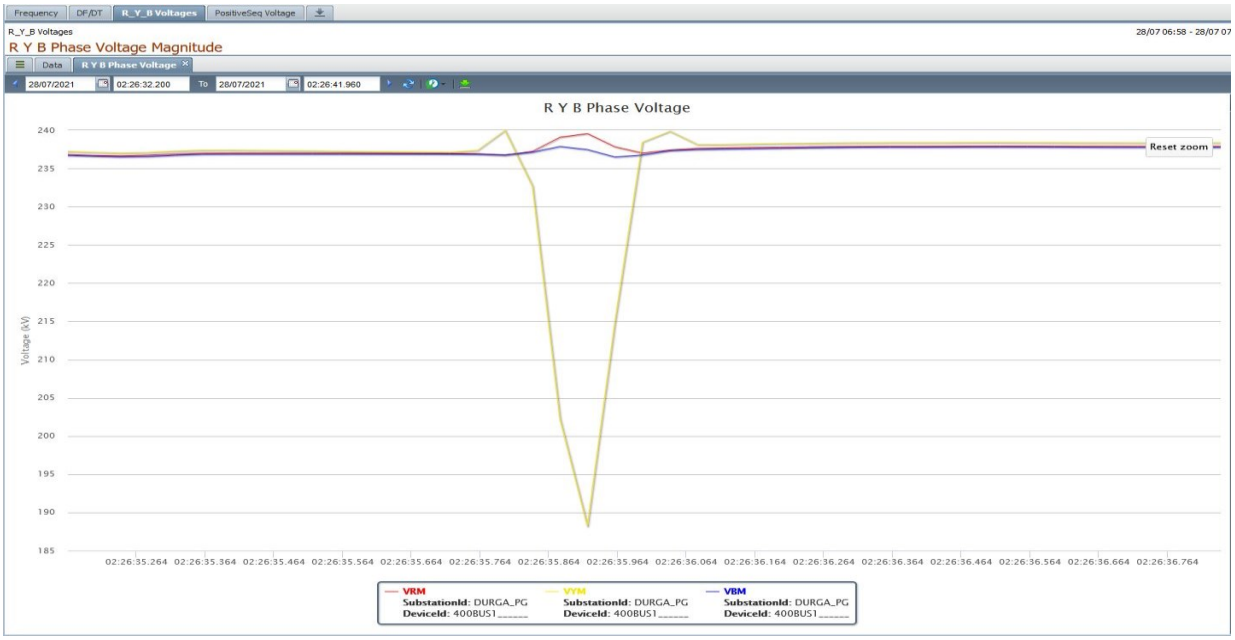


Figure 4: PMU captured at Durgapur shows Y-Earth fault cleared in 100ms seconds and dip of around 48 kV.

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)

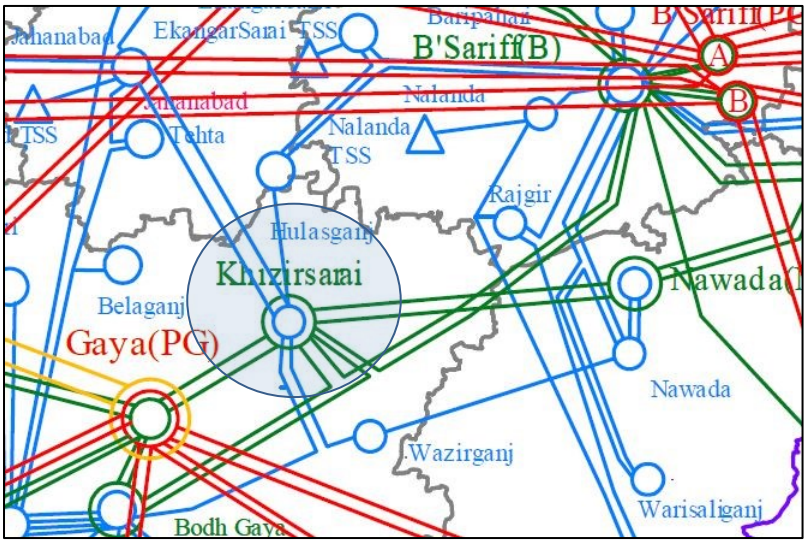


Figure 1: Network across the affected area

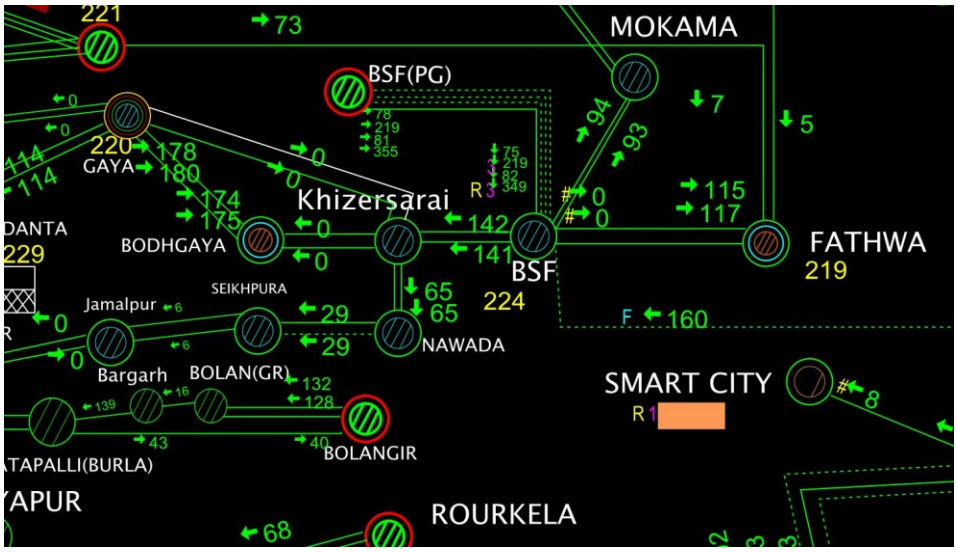


Figure 2: SCADA snapshot for of the system

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	

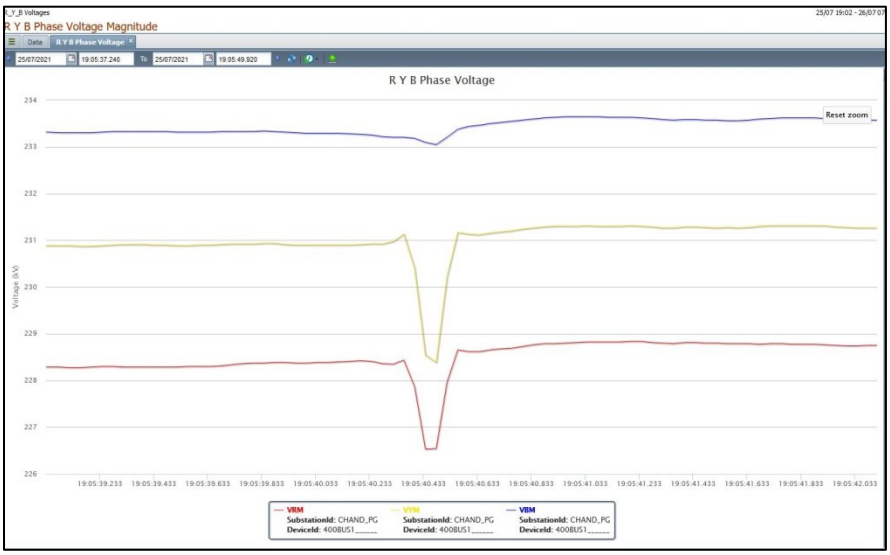


Figure 3: PMU captured at Chandauti shows 3kV dip in R and Y phases indicating fault in R-Y phases.

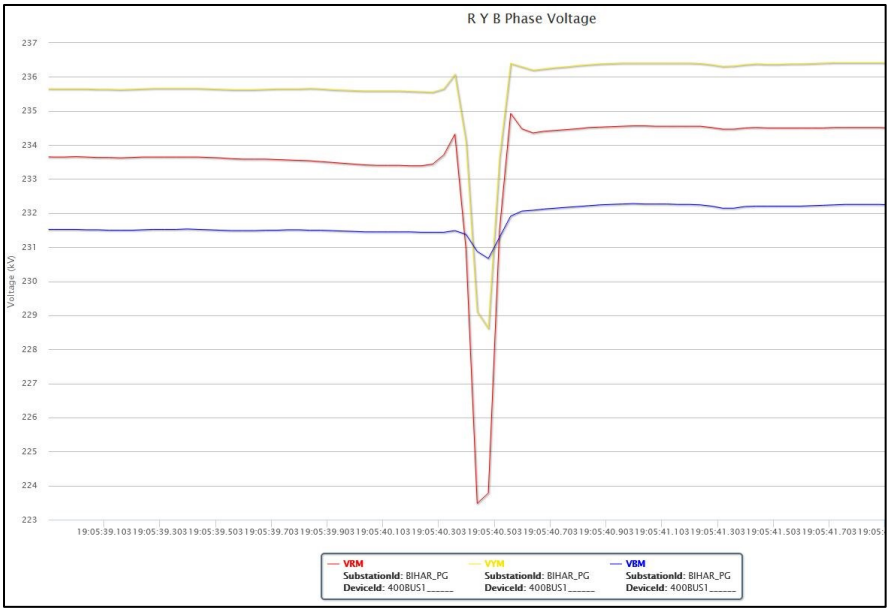


Figure 4: PMU captured at Biharshariff shows 20 kV dip in R and Y phases indicating fault in R-Y phases

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):

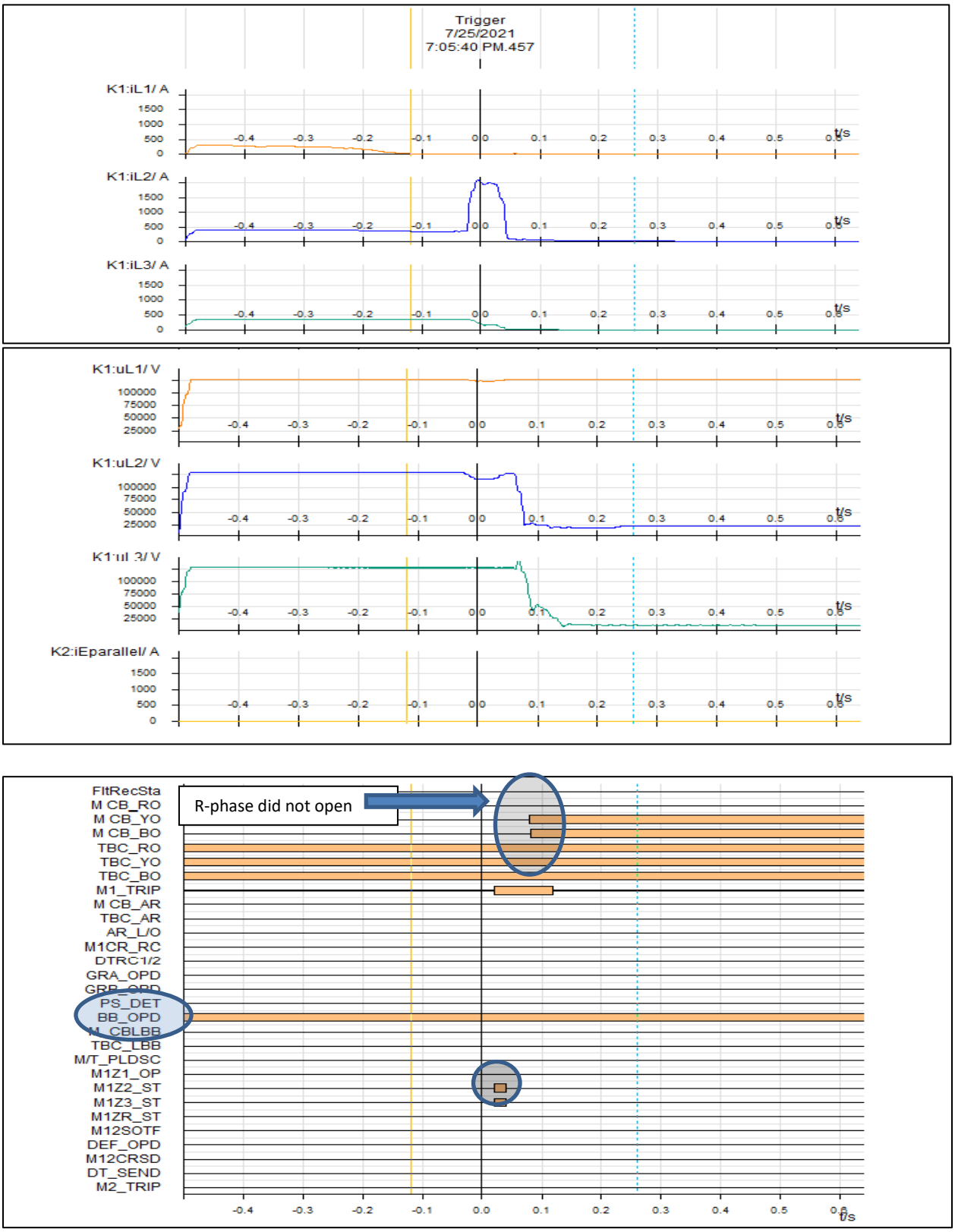
- DR/EL received from PG-ER-1&BSPTCL.
- DR/EL yet to be received from BGCL.

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

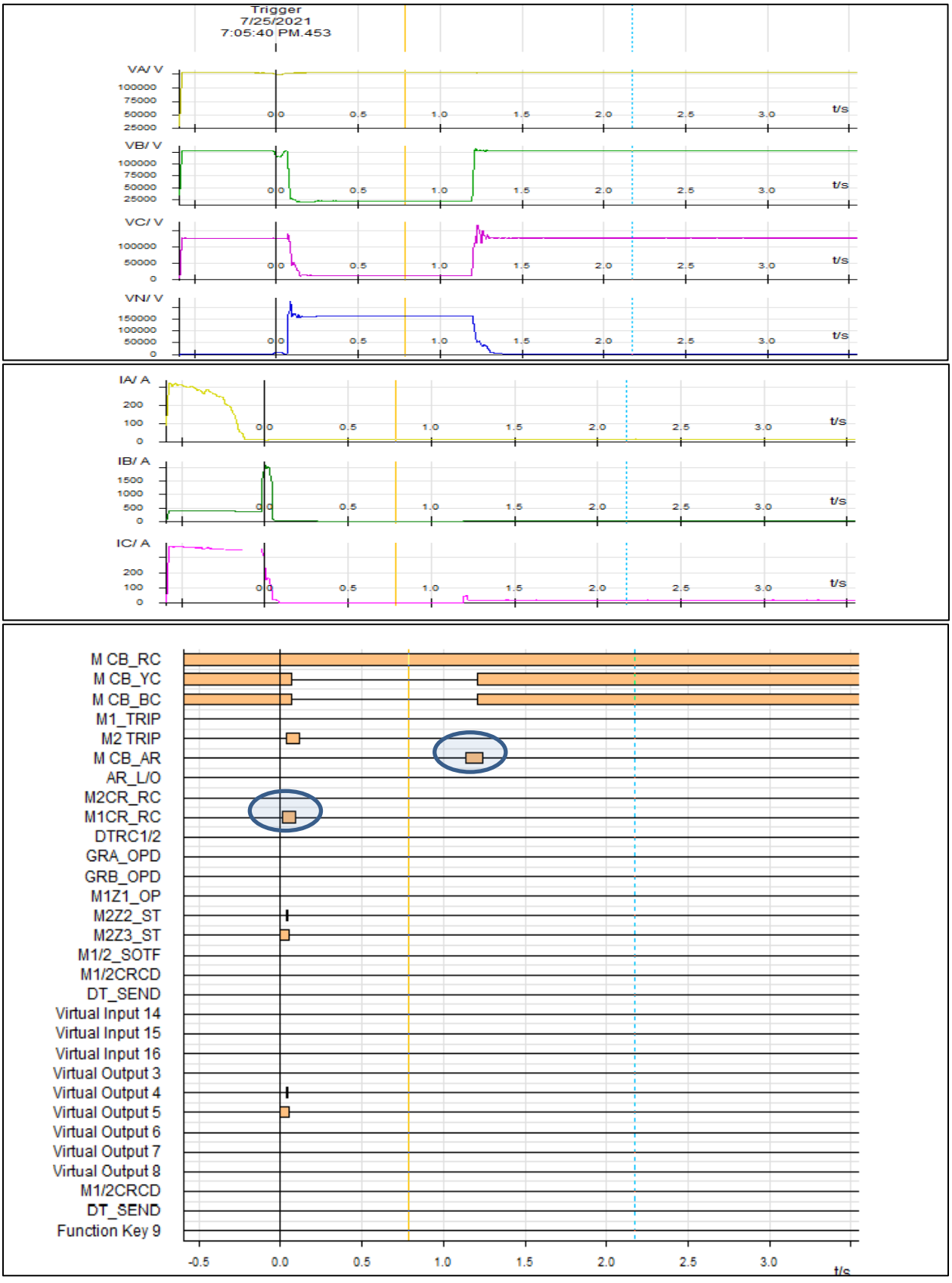
Sequence of event not recorded at time of event.

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

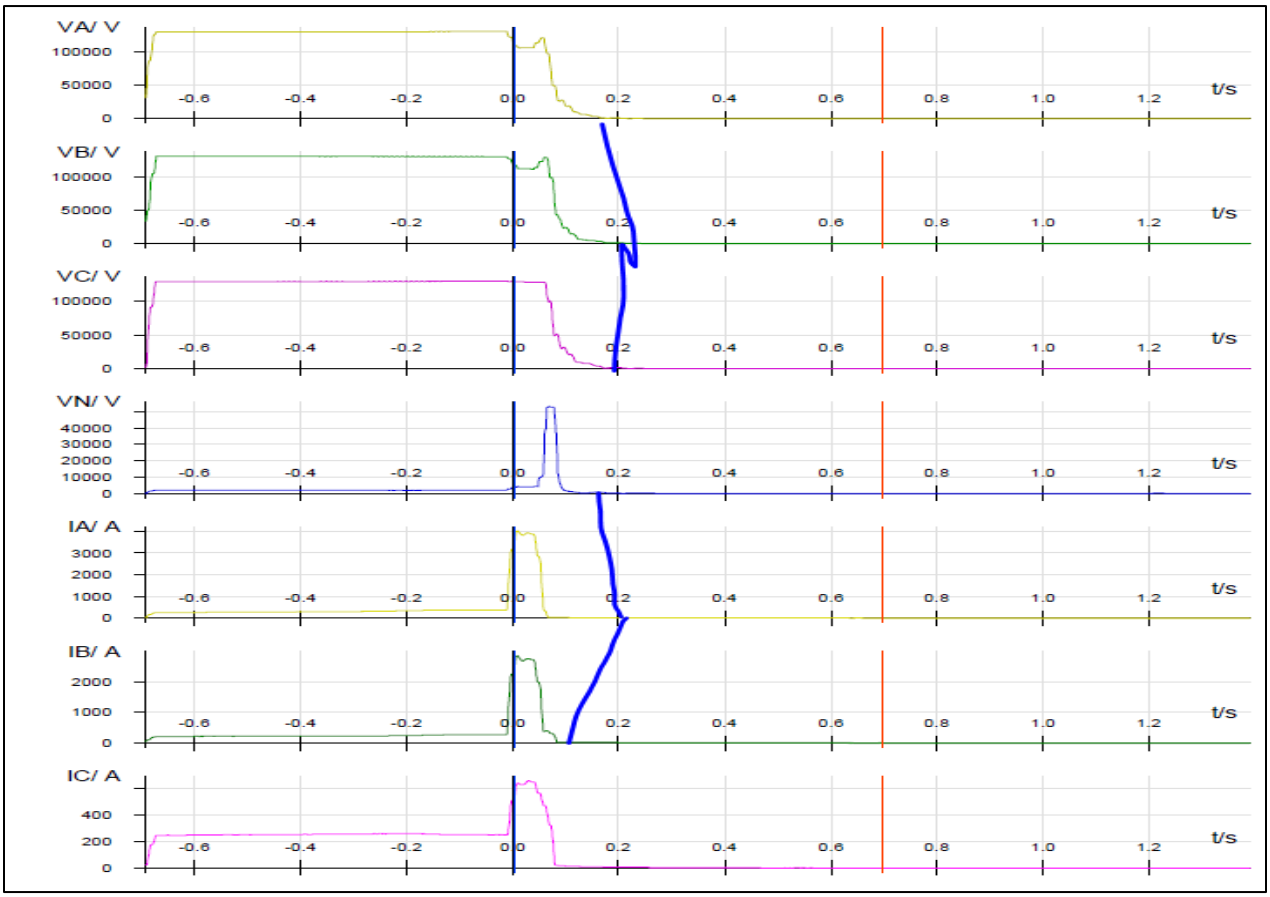
Main 1

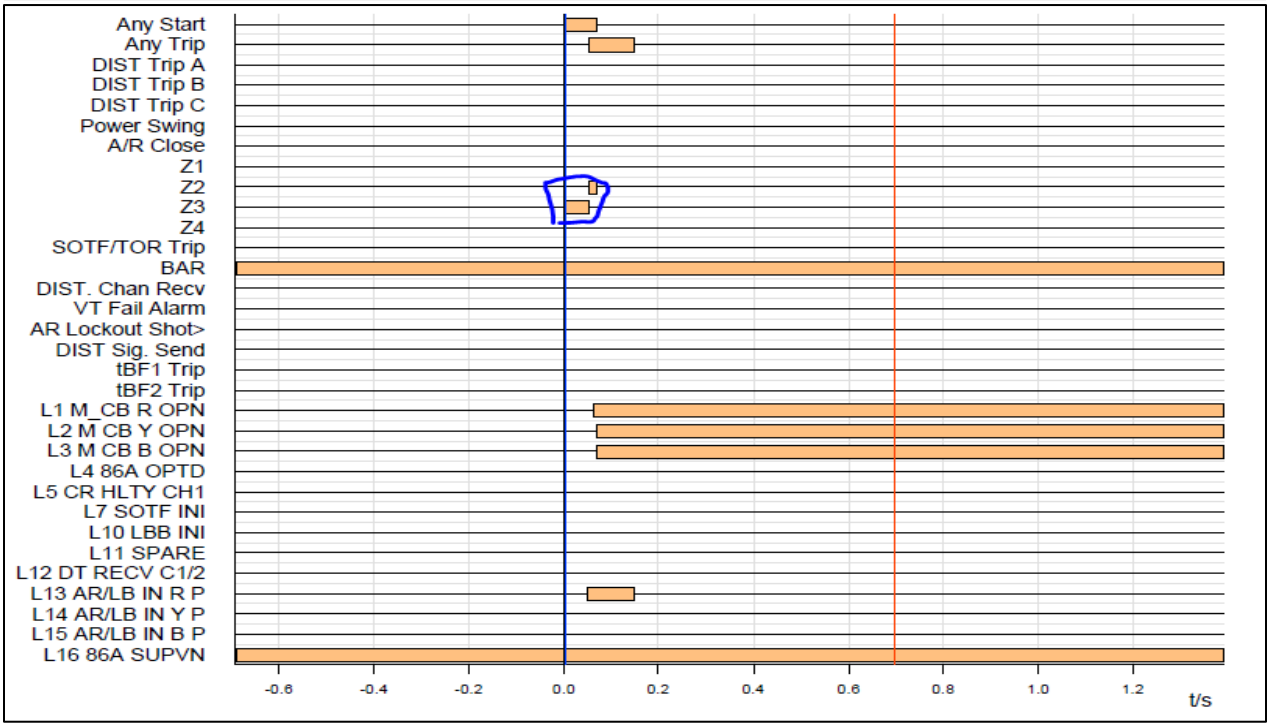


Main-2

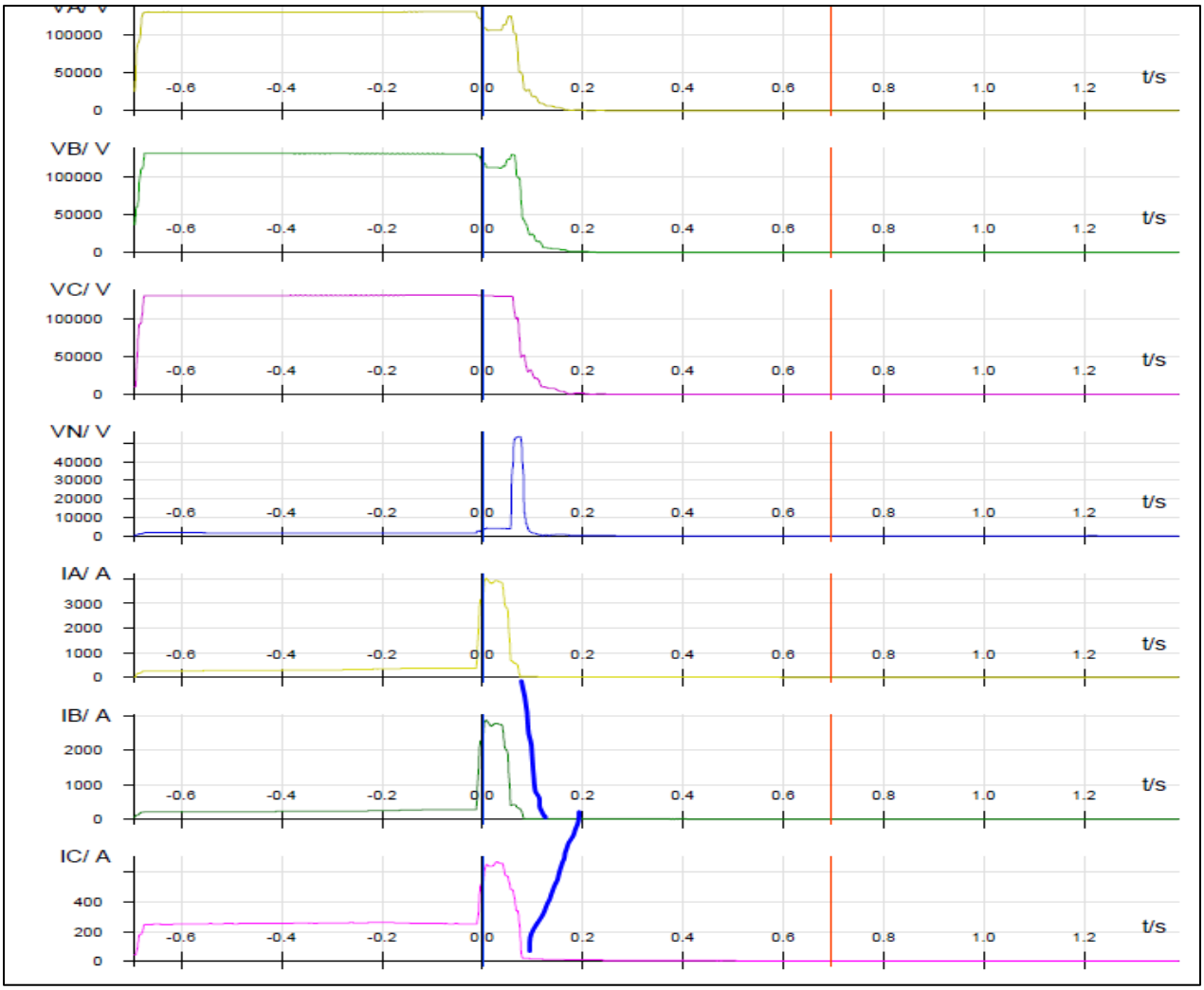

Trigger
7/25/2021
7:05:40 PM.453
VA/ V
VB/ V
VC/ V
VN/ V
IA/ A
IB/ A
IC/ A
t/s
M CB_RC
M CB_YC
M CB_BC
M1_TRIP
M2 TRIP
M CB_AR
AR_L/O
M2CR_RC
M1CR_RC
DTRC1/2
GRA_OPD
GRB_OPD
M1Z1_OP
M2Z2_ST
M2Z3_ST
M1/2_SOTF
M1/2CRCD
DT_SEND
Virtual Input 14
Virtual Input 15
Virtual Input 16
Virtual Output 3
Virtual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

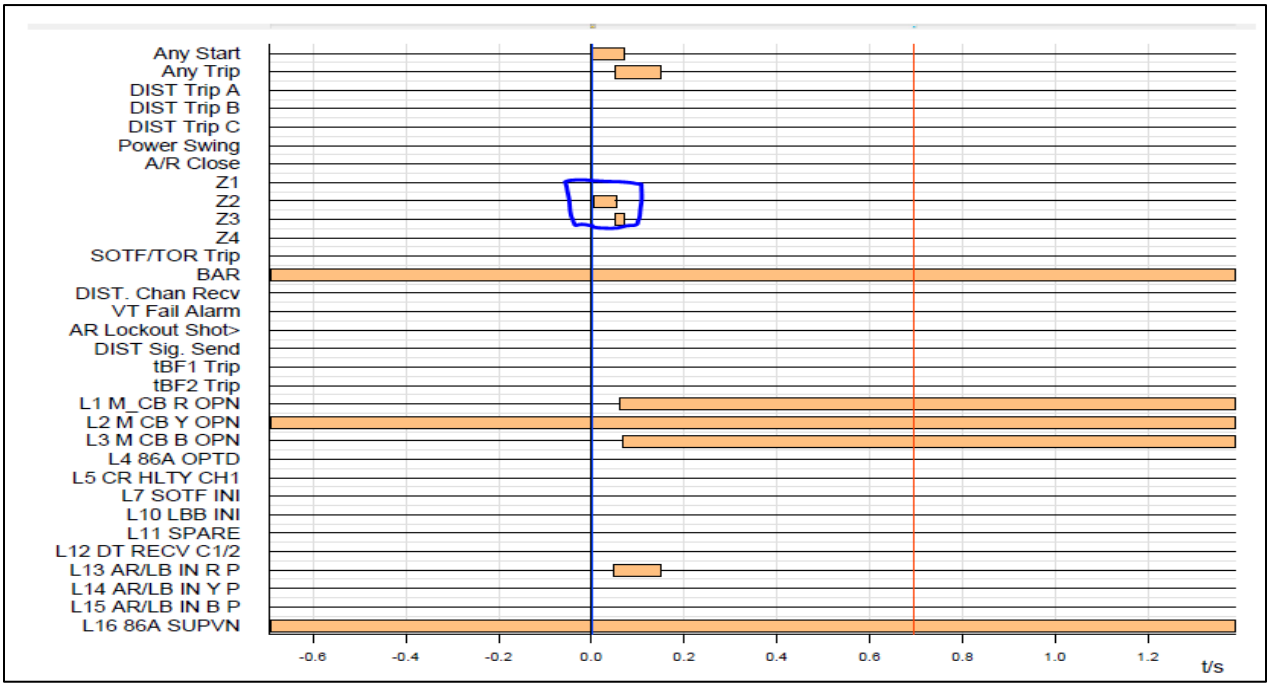
DR recorded at Biharshariff end for 220Kv Biharshariff-Khezesarai-1





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





Annexure B.9

Incidence Report – Tripping of 220kv Bus-2

02.07.2021 at 15:23:15Hrs

Time(Hrs)	Disturbance	Reason
15:23:15Hrs	220kv bus-2 tripped and hence assosciated feedrers ICT-2 220kv meramundali-2 tripped.	LBB Local breaker Backup protection of 220kv rengali line which was under shutdown acted .

Protection setting values(220kV rengali line) :

Sl No	Protection	Setting value	Value at time of fault
1	Local Breaker Back up(LBB)	200A/0.2Sec delay	300A approx for 1.02 Sec
2	Switch ON Trip Fault(SOTF)	V<154Kv & I>50A/ instantaneous	V=0.3kV&I=300A approx for 1.02 Sec

Relays Operated:

Sl No	Panel	Relays operated
1	220kV rengali	Master trip 86 ,Distance Start R,Y,B,Dist gentrip/SOTF,LBB trip Above operated in both main-1 P437 and Main-2 P444 and auxillary flag relays
2	220kv Busbar protection panel	496 ,1496 relays
3	ICT-2	Master trip relay 86,TC healthy indication went off
4	220kv Meramundali	TC healthy indication went off

Pre-Incident Status:

On 02.07.2021 220kv Rengali line was under shutdown for relay replacement and Bay PM works . Relay replacement was completed by 13:10 hrs all relays,Master trip relay 86 reset and PTW cancelled and PTW for bay PM works was in hold for work completion.

Incident:

On 02.07.2021 @15.23:15 It was informed by operation that ICT-2 and 220KV Meramundali lines got tripped.

Immediate action:

1.On analysis of Relay indications and SOE it was observed that SOTF of the 220KV rengali line had acted first.

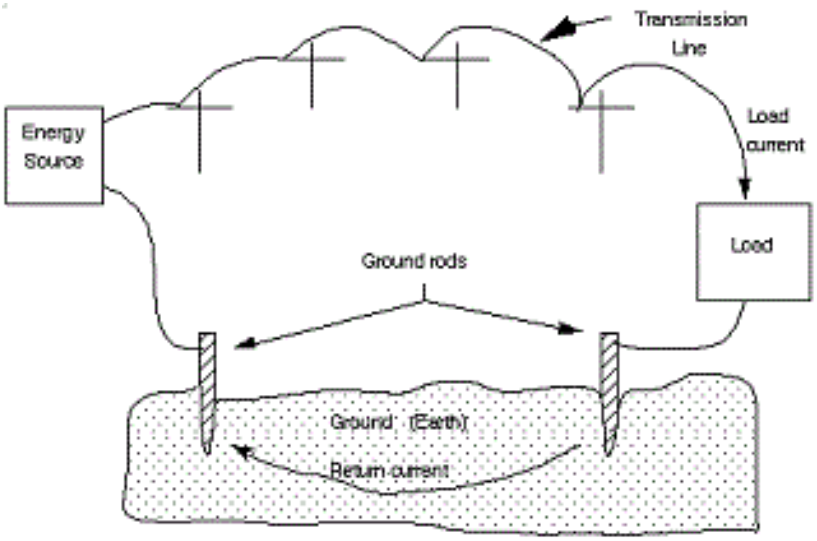
2.SOTF of 220kV rengali had tripped master trip relay 86 which has initiated LBB and after 200mS delay LBB had tripped 200kV Bus-2

2.Disturbance recorder of the 220KV rengali Distance protection relay was analysed and it was observed that current of magnitude 438A/367A/315A had flown in R/Y/B phases of the line for more than 1 sec.

Problem of having current flow in a isolated line under shutdown:

It is to be noted that 220KV rengali line was under shutdown and breaker was in open condition at both ends and hence there should not be any current flowing in circuit.It was concluded that the same has occurred because the line was earthed at both ends as part standard isolation procedure of safe isolation for field /Bay PM works.

Transmission Line earthed at both ends explanation:
The 220Kv Rengali line was earthed with line earth switches closed at TSTPS end and Rengali end as part of PTW isolation.This has effectively created a parallel path to ground return path.The figure below is shown to illustrate and help visulaise the concept of ground return .



Root Cause Analysis:

1.IN 220KV Rengali line Current of magnitude 438A/367A/315A had flown in R/Y/B phases of the line and voltages of < 0.1kV for more than 1 sec (Due to line earthed at both end phenomena explained above)Which has lead to Operation of SOTF of the line .SOTF is set to operate if V<70%(154kV) of noiminal value and I>5%(50A) of Nominal value.

2.SOTF tripped master trip 86 which has in turn has imitated the LBB timer.

3.Since the current was persisting >200mS which is the set value for LBB timer it has Operated the 220KV Bus-2 effectively tripping the associated feeders i.e ICT-2 and 220kv meramundali-2

Restoration

1.LBB of 220kv rengali feeder was disabled to avoid recurrence.It was concluded that 220kV ICT-2 and Meramundali -2 was healthy as RCA was established hence PTW canclled and ERLDC Codes were taken .
2.ICT-2 was charged first and 220kV Bus-2 was charged through ICT-2
3.400KV meramundali line was Normalsied.
4.220kV Rengali both ends earth was removed after return of LC
5.LBB of 220kV rengali normalized
6.220kV Rengali line Normalsied after taking ERLDC code.

Suggested Modification to avoid recurrence:

1. LBB protection link of the concerned line under outage to be kept out of service during line maintenance. After opening of line and bay earth switch , LBB protection to be given in service before line charging.

Attachments

1.220KV SLD

2.SOE

3.DR record 220kV Rengali

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

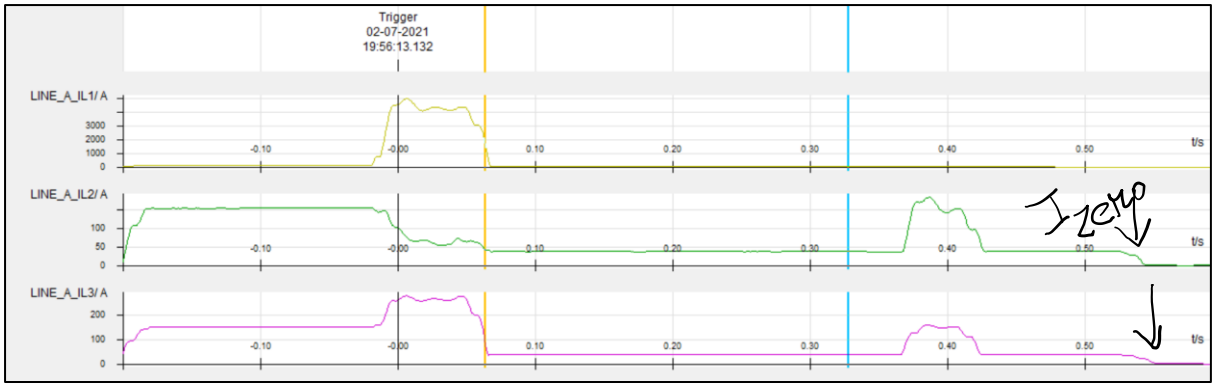
Issues are mentioned below in details

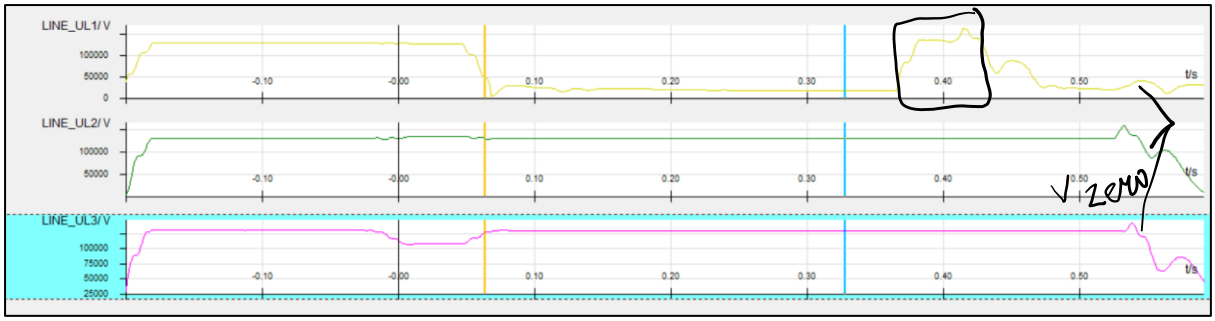
Protection Issue:

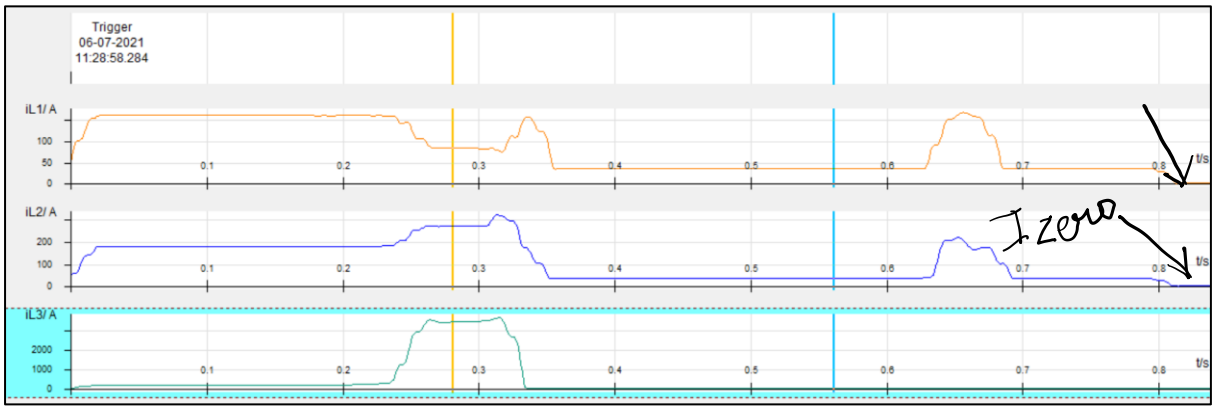
It has been observed that for all cases whenever there is fault in any phase , that phase is being opened immediately but after 500ms of that other rest two phases are also being opened as observed from Purnea end DR .

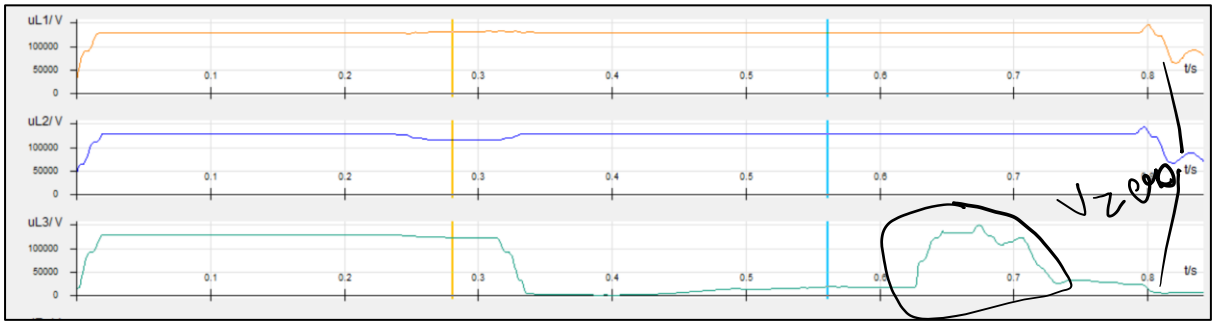
Line current of rest 2 phases are becoming zero which can be observed from below attached DRs for all cases.

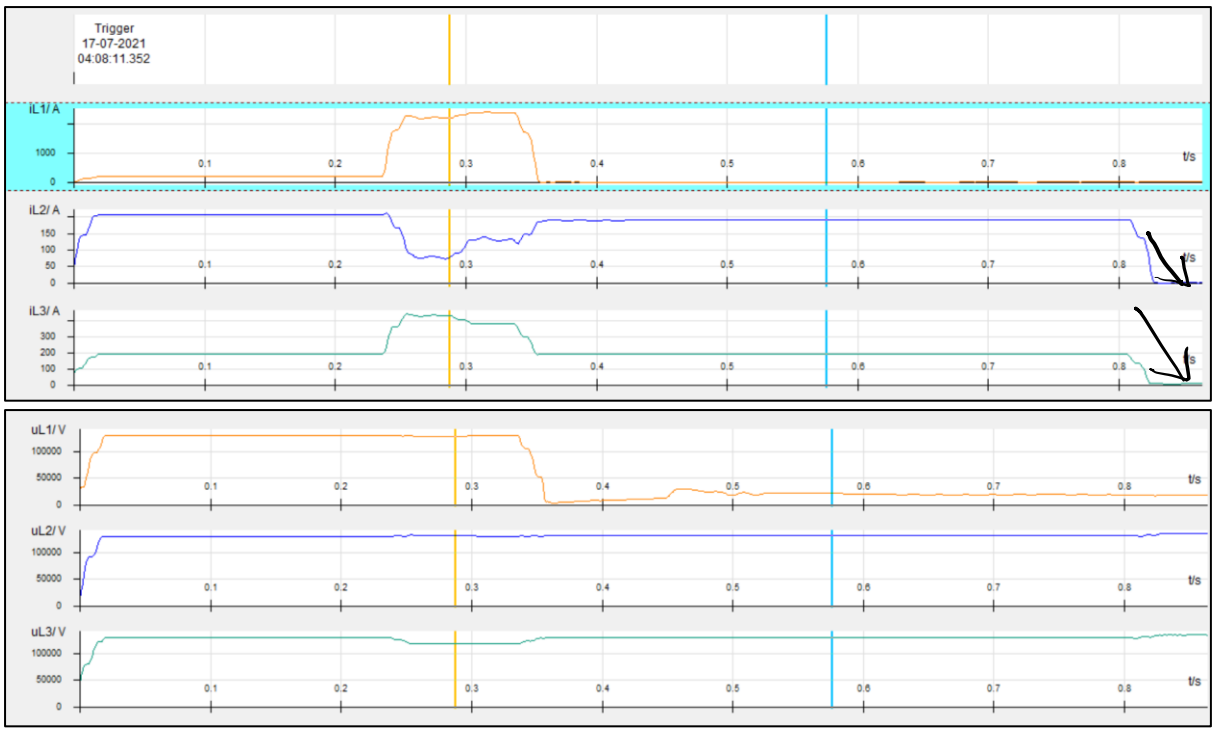
Issue of Auto reclose can also be seen in below attached DR that ,A/r is not occurring as rest 2 phases are being opened, this can be properly analysed for root cause identification and mitigation.


Trigger
02-07-2021
19:56:13.132
LINE_A_IL1/ A
LINE_A_IL2/ A
LINE_A_IL3/ A
I zero
t/s


LINE_UL1/ V
LINE_UL2/ V
LINE_UL3/ V
V zero
t/s

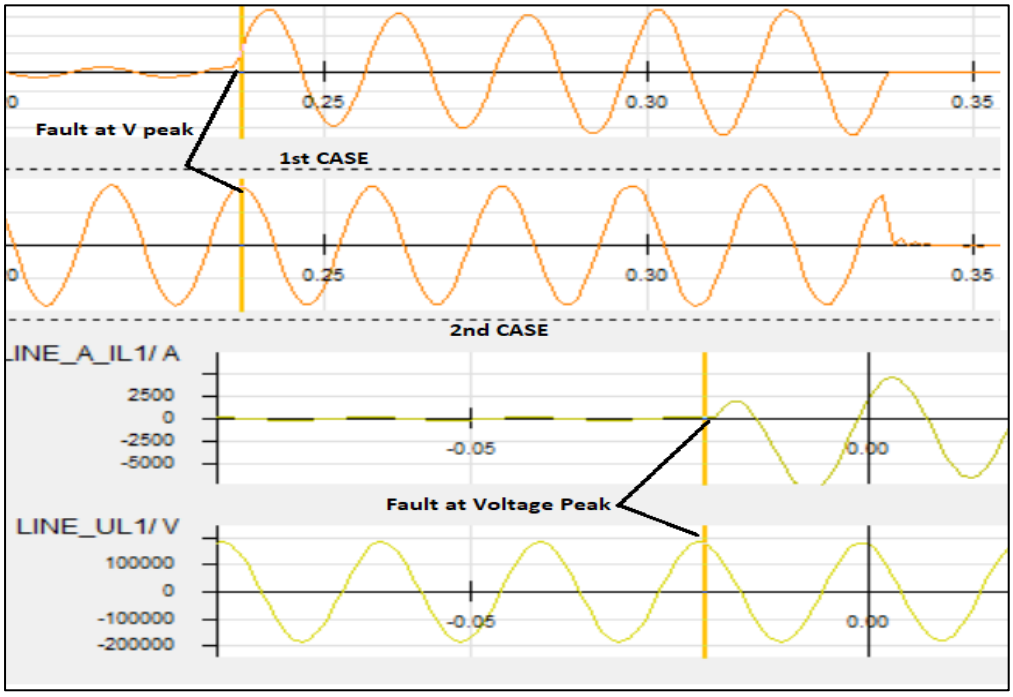

Trigger
06-07-2021
11:28:58.284
iL1/ A
iL2/ A
iL3/ A
I zero
t/s


uL1/ V
uL2/ V
uL3/ V
V zero
t/s



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:

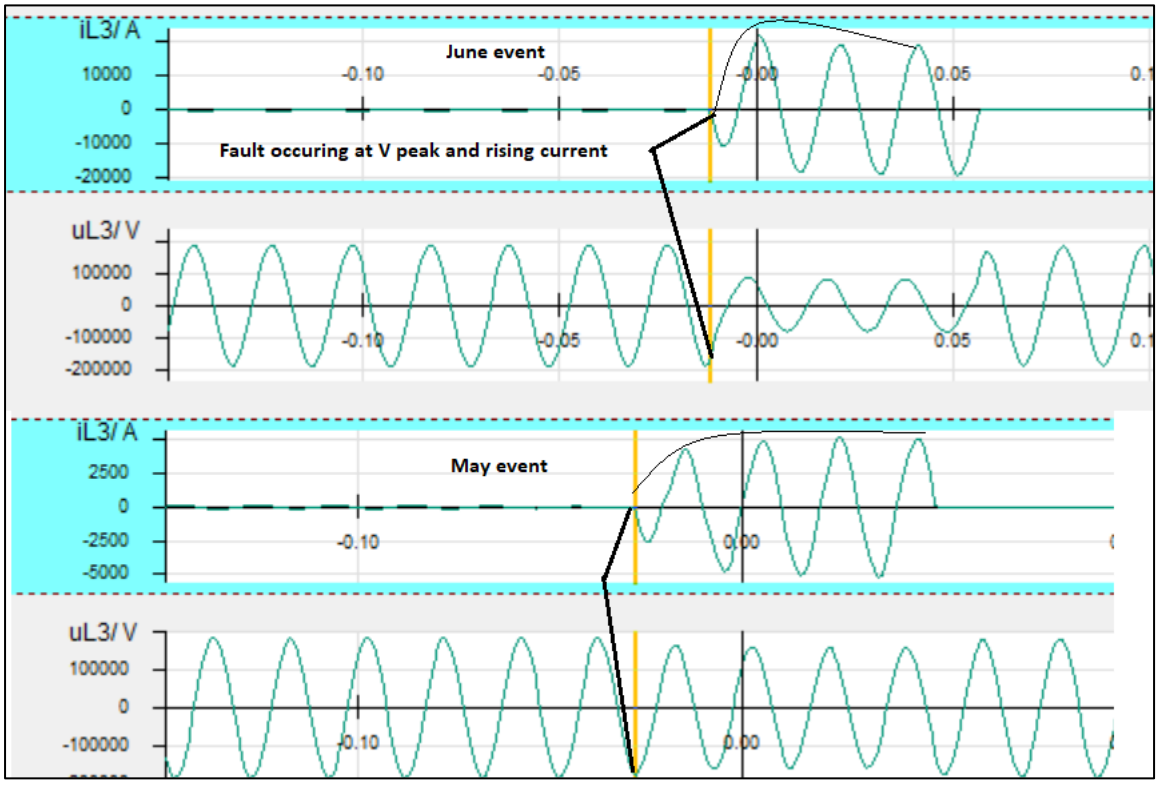
(1)Fault due to Arc over / Tree Fault (Vegetation Fault) and Fault Distance:

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.

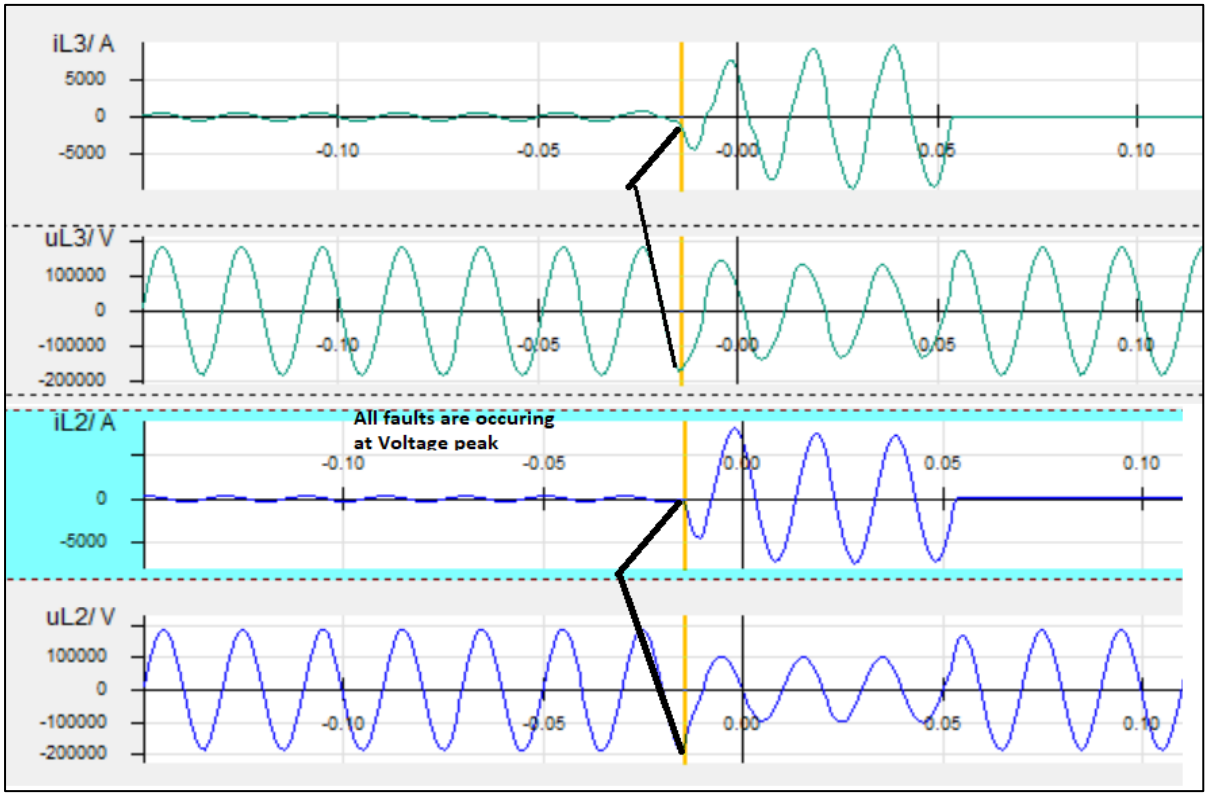
(2) Fault Distance as can be Observed for both the lines is most of the times in Zone-2 from RAIGARH and Korba end hence near to Budhipadar ,hence OPTCL is requested to to do proper

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 :

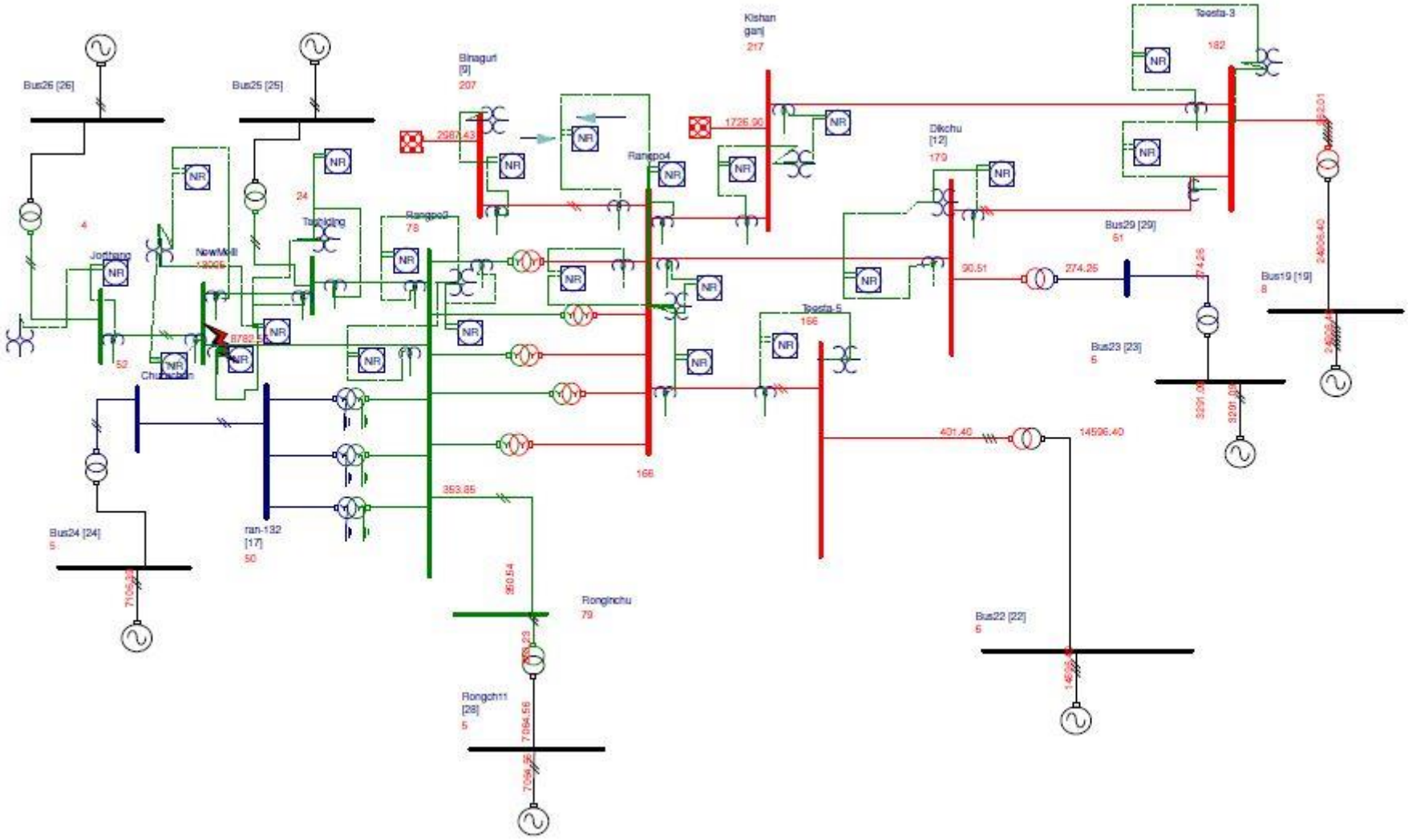
As per information available PLCC is not available at Budhipadar end due to which A/R is not implemented for these lines. Hence lines are tripping for transient Single line to ground faults also interrupting the power flow and hampering the reliability of inter-regional link .

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.

S. No.	LINE NAME	TRIP DATE	TRIP TIME	Relay Indication LOCAL END	Relay Indication REMOTE END	Reason	Fault Clearance time in msec	Remarks	LOCAL END UTILITY	REMOTE END UTILITY	Utility to update	Utility Response
1	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	Y pole TCB stuck atRTPS end, problem resolved at RTPS End.At Ranchi end TCB A/r not operating properly reffered to OEM
2	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	Y pole TCB stuck atRTPS end, problem resolved at RTPS End.At Ranchi end TCB A/r not operating properly reffered to OEM
3	400KV-MEERAMUNDALI-MENDHASAL-II	7-1-21	17:25	RELAY INDICATION: Meramundali end:-R-E, IR-10.35 KA, DIST= 20.1 KM,Z1,SOTF,A/R Unsuccessful Mendhasal End: R-E, IR-2.19 KA, DIST= 107.8 KM,Z1,A/R Unsuccessful		R-Earth	<100	A/R unsuccessful at Mendhasal	NO	YES		
4	220KV-BIHARSARIFF-TTPS-1	7-6-21	12:35		126.8 kM, Ia 254 A IB 280.5 A IC 370.7 A	B-Earth	<100	NO A/R attempted	YES	NO	JUSNL	
5	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	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	Auxilary relay failed which has been replaced.
6	400KV-TSTPP-ROURKELA-1	7-7-21	17:03	TSTPP-Z1 Y-N FC-5 kA FD-69.97 km;	successful, Y-N, Z1, 3.60kA, 97.595 km	Y-Earth	<100	A/R successful at ROURKELA end only.	NO	YES	NTPC TALCHER	

7	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	Electromechnical A/R relay not working to be replaced by Numerical relay.
8	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	
9	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	
10	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	
11	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	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	

Network:


Bus26 [26]
Bus25 [25]
Binaguri
[9]
207
Kishan
ganj
217
Teesta-3
182
Dikchu
[12]
179
Rangpo4
Rangpo2
78
Jorthang
NewMelli
Tadong
Chuzachen
Teesta-5
156
Bus29 [29]
51
Bus19 [19]
8
Bus23 [23]
5
Bus24 [24]
5
ran-132
[17]
50
Rongnichu
79
Rongch11
[28]
5
Bus22 [22]
5
2687.43
1726.90
90.51
274.25
401.40
14596.40
353.85
350.54
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	200	IEC NI	0.514	1.6	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	400	IEC NI	0.11	0.8

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

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

$$0.14$$

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 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.-- $= (110\ to\ 130) * \frac{MVA\ rating}{\%\ impedance * volatge * 1.732}$

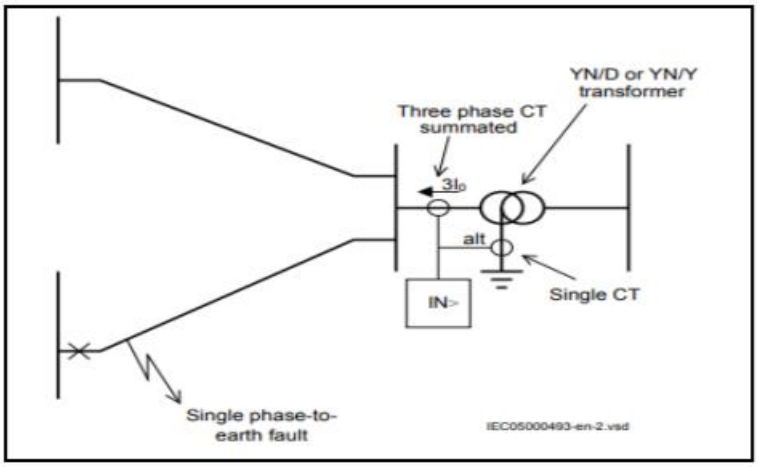
Characteristics- Definite time 50-100 ms

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