Minutes
of
102nd PCC Meeting

Date: 28.05.2021
Eastern Regional Power Committee
14, Golf Club Road, Tollygunge
Kolkata: 700 033

EASTERN REGIONAL POWER COMMITTEE

MINUTES OF 102ND PROTECTION SUB-COMMITTEE MEETING HELD ON 13.05.2021 AT 10:30 HOURS

Member Secretary, ERPC welcomed all the participants to the meeting. In his opening remark he stated that in view recent Covid-19 pandemic situation and requirement of oxygen thereof, reliable power supply to oxygen generating plants is having paramount importance. He advised concerned state utilities/SLDCs in which system the Oxygen generating plants are connected, to take utmost measures for ensuring reliable power supply to these plants. He further advised utilities to ensure protection system healthiness in the substation and connected lines to the oxygen plants, for patrolling and resolving clearance/sag related issues in the respective lines on priority basis so that unwanted trippings can be avoided to great extent in transmission lines connected to oxygen plants.

The meeting was conducted through Microsoft Teams online platform. List of participants is enclosed at Annexure-A.

PART – A

ITEM NO. A.1: Confirmation of minutes of 101st Protection sub-Committee Meeting held on 13th April 2021 through MS Teams.

The minutes of 101st Protection Sub-Committee meeting held on 13.04.2021 circulated vide letter dated 27.04.2021.

Members may confirm.

Deliberation in the meeting

Members confirmed the minutes of 101st PCC Meeting.

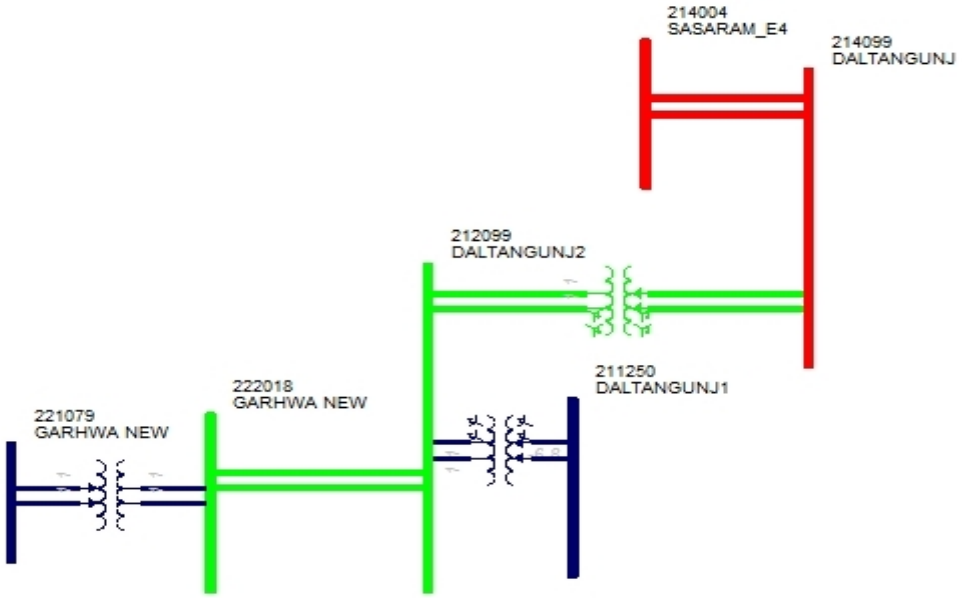
PART – B

ITEM NO. B.1: Repeated Tripping of 220 kV Daltonganj-Garwah (New) D/C in the month of April' 21.

B.1.1: On 08.04.2021 at 17:39 hrs

At 17:39 hrs, 220 kV Daltongunj-Garwah-2 tripped on B-N fault and at 17:43 Hrs 220 kV Daltongunj-Garwah-1 also tripped on B-N fault with same relay indication as of circuit-2. As a result, around 40 MW load loss occurred at Garwah.

Detailed report is enclosed at **Annexure B1.1.**



Outage Duration: 08:20 Hrs

Load Loss : 40 MW

B.1.2 : On 21.04.2021 at 15:40 hrs

At 15:40 hrs 220 kV Daltongunj – Garwah 1 & 2 tripped on B-N fault. As a result, around 40 MW load loss occurred at Garwah .

Load Loss : 40 MW

Outage Duration: 03:06 Hrs

B.1.3 : On 29.04.2021 at 13:30 hrs

At 12:34 hrs, 220kV Daltongunj-Garwah-2 tripped on B-N fault during restoration of said line after necessary checking.

220kV Daltongunj-Garwah (New)-1 also tripped on B-N fault at 13:30 hrs leading to power failure at 220kV Garwah substation. Around 20MW of traction load and 15 MW of New Garwah local load loss occurred. Traction load immediately shifted on Sonenagar (BSEB) source through Japla.

Relay Indications:

Time	Name	End 1	End 2	PMU Observation
13:30	220 kV Daltongunj-Garwah (New)-1	B-N Fault, FD 39.6 km from Daltongunj, IB= 1.18 kA. No tripping from Garwah end.	No tripping from Garwah end	Fault clearance time 120ms.
12:34	220 kV Daltongunj-Garwah (New)-2	Daltongunj: **12:33:31 Hrs**: B-N Zone-2, FD-73.72 km, FC- 1.22 kA, Later it converted to zone – 1, A/R successful **12:33:42 Hrs:** B-N, First Z-2	Garwah: B-N Fault, Z-1, FD: 38.39 km, Fc: 0.894 kA.	Fault clearance time 160ms.

		which came into zone 1 immediately after 123 ms, FD-73.72 km, FC- 1.22 kA, No Carrier received. A/R operation started but after 220 ms R and Y poles also got opened.		

Load Loss : 35 MW

Outage Duration: 06:39 Hrs

B.1.4 : On 29.04.2021 at 22:37 hrs

At 22:37 Hrs, 220 KV Daltonganj-Garwah-2 tripped on R-Y-Earth fault leading to power failure at 220/132 Garwah (New) S/s. (220 KV Daltonganj-Garwah (New)-I was already under tripped condition). Total around 20 MW load loss occurred (including 15 MW traction loss of Garwah). Inclement weather was reported around Garwah.

Detailed report by ERLDC is attached at **Annexure B 1.4 .**

Relay Indications :

Time	Name	End 1	End 2	PMU Observation
22:00	220 kV Daltongunj-Garwah (New)-1	Fault, B-N, FD - 93Km, FC - 4.8kA.	Fault B-N, FD - 0.766 km, FC - 2.01kA	Fault clearance time200 msec. A/R successful then again unsuccessful.
22:37	220 kV Daltongunj-Garwah (New)-2	Daltongunj end: B-N fault- R-Y, Fc - Ir-2.331kA, Iy-2.33kA,FD - 61km , FD: 33km, Fc: 2.26 kA	Fault R-Y, Z1. FD -6.7 km	Fault clearance time200 msec.

Load Loss: 20 MW

Outage Duration: 02:03 Hrs

JUSNL may explain.

Deliberation in the meeting

JUSNL informed that as per advice of 101th PCC, thorough patrolling was carried out in the 220 kV Daltongunj-Garwah D/C line and clearance issues/vegetation growth were found in several locations. The necessary steps for tree cutting and resolving the clearance issue due to jumpering has been taken up. The work has been started from 05/05/21 and till date 193 tower locations out of 305 towers have already been covered. All the work would be completed by May'21.

They added that the multiple trippings in April-21 is mainly due to jumper issue near to Garwah end. The same has been rectified.

PCC advised JUSNL to share a report indicating the location, reason of the fault and remedial action taken thereof for each of the disturbances mentioned above.

PCC also advised JUSNL to do line patrolling on regular basis to avoid unwanted tripping of the lines due to clearance issues.

ERLDC informed that whenever the Garwah end is connected with Daltongonj through a single circuit and any tripping occurs in that line, delayed tripping or non operation of circuit breaker at Garwah end is being observed for the line as there was no other source at Garwah end except the 220 kV Daltongonj-Garwah D/C lines. They proposed that week infeed logic/radial feeder protection logic can be implemented at Garwah end for clearing the fault in these type of cases where Garwah is connected with af single source.

PCC advised JUSNL to implement the week infeed protection in the relay at Garwah end and intimate the same to ERLDC/ERPC. PCC opined that incase of week infeed protection is being enabled at Garwah end, permissive overreach protection can be enabled at 220 kV Daltonganj end for better performance in protection coordination.

PCC further advised JUSNL to upload the DR/EL files for every disturbance/event occurred in their system in PDMS portal for analysis of the event. JUSNL was also advised to check the DR for the event occurred on 29/04/21 at 12:34 hrs to find out any carrier related issues at Garwah end.

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ITEM NO. B.2: Disturbance at 220 kV Rangpo Substation on 08.04.2021 at 15:53 hrs

400/220 kV ICT-2 at Rangpo was out for SF6 gas leakage rectification work. At 15:53 hrs, all four running ICTs 1,3,4,5 at Rangpo tripped from HV side on backup impedance protection with inter trip to LV side.

At that time only running unit of Tashiding 28 MW along with 37 MW of Gangtok load islanded and did not survived due to large imbalance. Hence 28 MW generation loss at Tashiding and 37MW load loss at Gangtok occurred. Above events led to total voltage loss in 220 KV Rangpo, Rongnichu, Tashiding, Jorethang, New Melli and 132 KV Gangtok and 132 kV Chuzachen.

Load Loss: 37 MW , Gen. Loss: 28 MW

Outage Duration: 01:07 Hrs

In 101st PCC following deliberations were made –

Powergrid informed that there was a fault in downstream side of the ICTs and all four running 400/220 kV ICTs got tripped on backup impedance protection. There was no tripping in the 220 kV lines at Rangpo end.

They added that as there was minimal generation at 220 kV level, the fault was entirely feed by the ICTs at Rangpo S/s and ICT got tripped from HV side after 800 msec.

They further informed that exact fault location has not yet been identified however they are suspecting there might have issues in recently commissioned new bays at 220 kV side.

They stated that OEM has already been communicated for detailed checking in this regard and a detail report would be shared once the fault location is identified.

Powergrid may update.

Deliberation in the meeting

Powergrid informed that there was no downstream fault at that time. Further, a thorough checking of external system outside the GIS component was also carried out by their internal team however the fault location could not be identified.

They apprehended that the fault location may pertain to busbar portion inside the GIS chamber and added that the same would be checked by the OEM personnel. They further informed that OEM personnel could not visit the substation due to ongoing Covid pandemic situation.

After detailed discussion, PCC advised Powergrid to get the GIS chamber inspected by the OEM at the earliest and share the outcome to ERPC/ERLDC.

ITEM NO. B.3: Total Power Failure at 220 kV Jorethang HEP & 220 kV Tashiding HEP on 09.04.2021 at 17:47 hrs

At 17:47 hrs 220 kV Rangpo – New Melli S/C tripped from Rangpo end in Zone-1 and same fault was sensed by 220 k V Tashding –New Melli and this line also tripped from Tashding end in zone-3 due to non-clearance of fault from New melli end. 220 kV Rangpo-Tashding S/C also tripped on the same time on R-Y phase fault encroaching the same fault from Rangpo end in Zone-3. As a result, around 36 MW generation loss occurred at Jorethang HEP due to loss of evacuation path.

There was no generation at Tashiding. Delayed clearance of fault (around 800 ms) has been observed in PMU data

Detail report is enclosed at **Annexure B.3**

Relay Indications :

Time	Name	End 1	End 2	PMU Observation
17:47	220KV-TASHIDING-RANGPO-1	Did not trip	R_Y, Z-3, FD-85.04 FC= Iy= 422.7A Iy= 407A	Delayed clearance of fault (around 800 ms) has been observed in PMU data
	220KV-New Melli-RANGPO-1	Did not trip	Z1, R-Y,59Mtr, Ir-0.73kA, Iy-10.67kA	
	220KV-New Melli-TASHIDING	Did not trip	Z-3 ,f/c-R&Y2.5Ka as per DR,f/d-160%	

Gen. Loss: 36 MW

Outage Duration: 01:19 Hrs

Powergrid and Tashiding HEP may explain.

Deliberation in the meeting

Based on disturbance recorder analysis, ERLDC explained the event as follows:

- *There was a phase to phase fault in 220 kV N.Melli-Rangpo line near to Rangpo end. Rangpo end relay cleared the fault in zone-1 of distance protection. However, New Melli end sensed the fault in zone-3 of distance protection.*

- *Due to delay in fault clearance from N. Melli end, the fault was sensed by the Tashiding end relay of 220 kV Tashiding -New Melli line and Rangpo end relay of 220 kV Rangpo-Tashiding line in zone-3. Both the relay along with relay at N.melli end got tripped simultaneously in zone-3 timing i.e. 850 msec.*

Powergrid intimated that the fault occurred due to heavy lightening near to Rangpo and was of high resistive in nature. Due to this high resistive nature of the fault and hilly terrain, it is possible that the relay at N. Melli end might not sense the fault in zone-2 of distance protection.

PCC observed that the relay at New Melli end should have picked up the fault in zone-2 protection and advised Powergrid to check the relay performance of the relay at New Melli end for 220 kV N. Melli-Rangpo line.

Regarding tripping at Tashiding and Rangpo end, PCC opined that the tripping could have been avoided had there been a proper time grading for zone-3 setting between the relays at New Melli, Tashiding and Rangpo end.

Members opined that proper time grading of zone-3 setting for the relays at 220 kV Rangpo-New Melli, 220 kV Rangpo-Tashiding and 220 kV Tashiding-N. Melli line is necessary to avoid this type of multiple trippingof the lines and advised Powergrid to carry out necessary protection simulation study for getting the required settings for proper coordination.

PCC also advised Powergrid to rectify the SOE related issues at 220 kV Rangpo end in consultation with ERLDC SCADA team.

ITEM NO. B.4: Disturbance at 220 kV Tashiding S/s on 16.04.2021 at 16:46 hrs

At 16:46, 220 KV New Melli- Tashiding tripped on 3-phase fault. At the same time, 220 KV Rangpo-Tashiding also tripped from Rangpo end on 3-phase fault isolating 220 KV Tashiding station. There was no generation loss as Tashidig had no schedule at that time.

Detailed report is enclosed at **Annexure B.4**

Relay Indications :

Time	Name	End1	End 2	PMU Observation
16:46 Hrs.	220 kV-TASHIDING-RANGPO	RYB IR 4.8 KA IB 3.9 KA IY =4.1 KA F.D 36 KM Z1 AT RANGPO	NO TRIP AT TASHIDING	Fault clearance in less than 160 ms.
16:46 Hrs.	220 kV-NEW MELLI-TASHIDING	RYB 13.5 KM Z1 IR=3.75 Ka IY =3.65 kA IB =3.92 AT NEW MELLI (19.8 KM LINE LENGTH)	Z1 B-N 5.603 KM 2.371 KA Z1 AT TASHIDING	Fault clearance in less than 160 ms.

Load loss:Nil, Generation Loss: Nil

Outage Duration: 00:26 Hrs

Frequent faults are being observed in this corridor, resulting in station blackout and generation loss, hence proper line patrolling, maintenance needs to be ensured

For 220 kV New Melli- Tashiding line, Tashiding end sensed only B phase fault, which needs to be analysed and rectified as New Melli end sensed the same fault as 3 phase fault

Tashiding HEP & Powergrid may explain.

Deliberation in the meeting

It was informed that prior to the disturbance there was no generation schedule at Tashiding as well as Jorethang HEP.

Powergrid explained the event as follows:

- *The weather was stormy with heavy thunderstorm during the disturbance.There was a three phase fault in 220 kV N.Melli-Tashiding line near to Tashiding end. New Melli end cleared the fault in zone-1 of distance protection.*

- *Rango end of 220 kV Rangpo-Tashiding line initially sensed the fault in zone-2 protection however after clearance of the fault from N. Melli end, the relay picked up the fault in zone-1 protection and subsequently got tripped. The Tashiding end relay for 220 kV Tashiding-New Melli line also tripped at the same time.*

- *As 220 kV Rangpo-Tashiding line comprises of HTLS, twin moose and zebra conductors at various spans (namely Rangpo-N.Melli-Legship-Tashiding) and due to this peculiar nature of the conductor it is difficult to configure the reach settings of distance protection relay for this line. As a result, sometimes the relay does not operate satisfactorily.*

Members opined that line differential protection may be implemented in the said line to get satisfactory response in this type of composite conductor configuration. Powergrid intimated that OPGW is not available in the line. PCC advised Powergrid to explore the possibility of implementing line differential protection using PLCC network in consultation with OEM.

Members also suggested Powergrid to implement permissive overreach protection in 220 kV Rangpo-Tashiding line for better performance.

On a query from ERPC secretariat regarding status of the commissioning of Legship S/s and the associated bays at Legship as well as New Melli S/s for Tashiding lines, it was informed that the line bays at New Melli end are ready for commissioning.

PCC opined that by connecting the 220 kV Tashiding HEP with dedicated bays at New Melli S/s, the protection related issue can be resolved and the reliability in power evacuation from 220 kV Tashiding as well as Jorethang HEP would further improve. PCC advised Powergrid to take necessary action to remove the LILO connection of 220 kV Rangpo-N.Melli line at Tashiding and to connect the 220 KV Tashiding HEP directly to New Melli S/s.

ITEM NO. B.5: Total power failure at 400 kV Teesta–III Substation on 23.04.2021 at 13:21 hrs

At 13:21 Hrs, 400 kV Teesta-3-Kishangunj tripped on B-N fault and at the same time 400 kV Teesta-3 -Dikchu also tripped on same fault . As a result, around 148 MW generation loss occurred at Teesta-Ill due to loss of evacuation path. There was no generation at Dikchu.

Based on DR/EL and PMU data analysis, It is observed that DEF tripping command at 400 kV Kishangunj- Teesta 3 circuit at Kishangunj end for the fault on 400 kV Teesta 3-Dikchu circuit is not coordinated properly. The tripping time of 400 kV Teesta 3-Dikchu at Teesta 3 should be earlier compared to the 400 kV Kishangunj -Teesta 3 circuit at Kishangunj

Detailed report is attached at **Annexure B.5.**

Relay Indications :

Time	Name	End 1	End 2	PMU Observation
13:21	400 kV Teesta-III-Kishangunj S/C	Teesta 3: DT Received	Kishangunj: B phase to earth fault, 208.4 km, 1.6 kA, Directional E/F trip, IN>1, DT sent	High resistance fault and Fault clearance time 1.5 sec
13:21	400 kV Teesta-III -Dikchu S/C.	Teesta 3- Directional E/F trip, B phase to earth fault, IN> 1, DT sent	Dikchu: B phase to earth fault, IN>1 trip, DT received.	

Gen. Loss : 148 MW

Outage Duration: 02:04 Hrs

Powergrid, Teesta – III & Dikchu HEP may explain.

Deliberation in the meeting

It was informed that there was a B- phase to earth fault of high resistive nature in 400 kV Dikchu-Teesta-III circuit. Dikchu end cleared the fault in Directional Earth fault protection after definite time settings of 1.5 sec.

After Dikchu end cleared the fault, the fault feed was increased from Teesta-III and Kishanganj end and the relay at Teesta III end for Teesta III-Dikchu line and relay at Kishanganj end for 400 kV Kishannganj-Teesta III end tripped at the same time in directional earthfault protection.

PCC observed that the fault should be cleared from Teesta III end for Teesta III-Dikchu circuit before tripping of the line at Kishanganj end and opined that DEF relays at Teesta III, Dikchu and Kishanganj end need to be coordinated properly.

ERPC secretariat informed that a study for backup earth fault relay coordination of the lines at Sikkim complex was carried out by PRDC and the proposed settings have been shared with the concerned constituents for implementation.

TUL vide e-mail has informed that the proposed DEF settings based on the study carried out by PRDC has been implemented at their end recently.

PCC advised Powergrid & Dikchu to implement the revised settings for DEF relay at their end in order to have a proper coordination among the relays.

ITEM NO. B.6: Disturbance at 220 kV Lalmatia S/S on 21.04.2021 at 17:42 hrs

On 21.04.2021, 220kV Farakka- Lalmatia, 132kV Kahalgaon (NTPC)- Lalmatia & 132kV Kahalgaon (BSPTCL)- Lalmatia tripped at 17:42 hrs. 17:52 hrs & 17:58 hrs respectively. Tower collapse was reported for 220 kV Godda- Lalmatia D/C and 220 kV Farakka Lalmatia S/C.

Relay Indications :

Time	Name	End 1	End 2	PMU Observation
17:41	220 kV Godda-Lalmatia D/C	No Data	Tripped (No Data)	Y Phase to earth fault followed by B phase to earth fault has been observed from 400 kV Farakka NTPC Bus voltage (Figure 2). Many tripping were simultaneously occurring so without DR and exact timing along with relay indication, distinguishing between fault is not possible.
17:41	132 kV Kahalgaon (NTPC)- Lalmatia	KHSTPP END: R-N FAULT, FC: 2.47KA, FD: 35.9KM	No Data	
17:41	132 kV Kahalgaon (BSPTCL)- Lalmatia	KAHALGAON(BSEB) END: Distance protection. 18.36 km, FC: 4.376 kA, E/F	No Data	
17:42	220 kV Farakka-Lalmatia	THREE TOWER COLLAPSED NEAR LALMATIA	No Data	

Load Loss: 120 MW

Outage Duration: 00:19 Hrs

JUSNL , NTPC & ECL may explain.

Deliberation in the meeting

JUSNL informed that the weather was stormy and windy during the disturbance on 21.04.21. Due to the inclement weather, there was tower collapse near to Lalmatia end in 220 kV Lalmatia-Godda S/C line at one location and in 220 kV Lalmatia-Farakka S/C line at four locations at the same time.

During tower collapse of 220 kV Lalmatia-Godda line, the conductor of the line fell on the undercrossing D/C tower of 132 kV Lalmatia-Kahalgaon(BSEB) & 132 kV Lalmatia-KhSTPP line resulting in tripping of the both 132 kV lines. As all the incoming feeders at Lalmatia got tripped, there was total power failure at 220 kV Lamatia, Godda, 132kV Sahebganj S/s.

Regarding restoration of the 220 kV Godda-Lalmatia line, JUSNL updated that the restoration work is in progress and it would be completed within a week.

Regarding 220 kV Farakka-Lalmatia S/C line, NTPC informed that 3 nos of towers of this line have also collapsed near to Farakka end on 29.04.21 due to inclement weather. They further intimated that the line is presently in de-energized condition and theft/sabotage of the healthy parts of the line had already been reported.

They stated that in view of extent of damage and ongoing Covid situation, restoration of the line is expected to take some time. They further informed that they have already approached JUSNL/JBVNL executives for anti theft charging of the healthy portion of the line from 132 kV and below level system. However, till date the issue has not been resolved.

PCC opined that as the line is lifeline for Lalmatia/Dumka area of JUSNL and considering the importance of reliable power supply requirement to ECL mines and other essential loads of Jharkhand, the FLT system should be protected from theft/sabotage by the miscreants which would further delay the restoration of the line as well as putting financial burden.

PCC advised JUSNL/JBVNL to facilitate the anti-theft charging of the healthy portion of 220 kV FLT line at the earliest to avoid any further damage due to theft/sabotage.

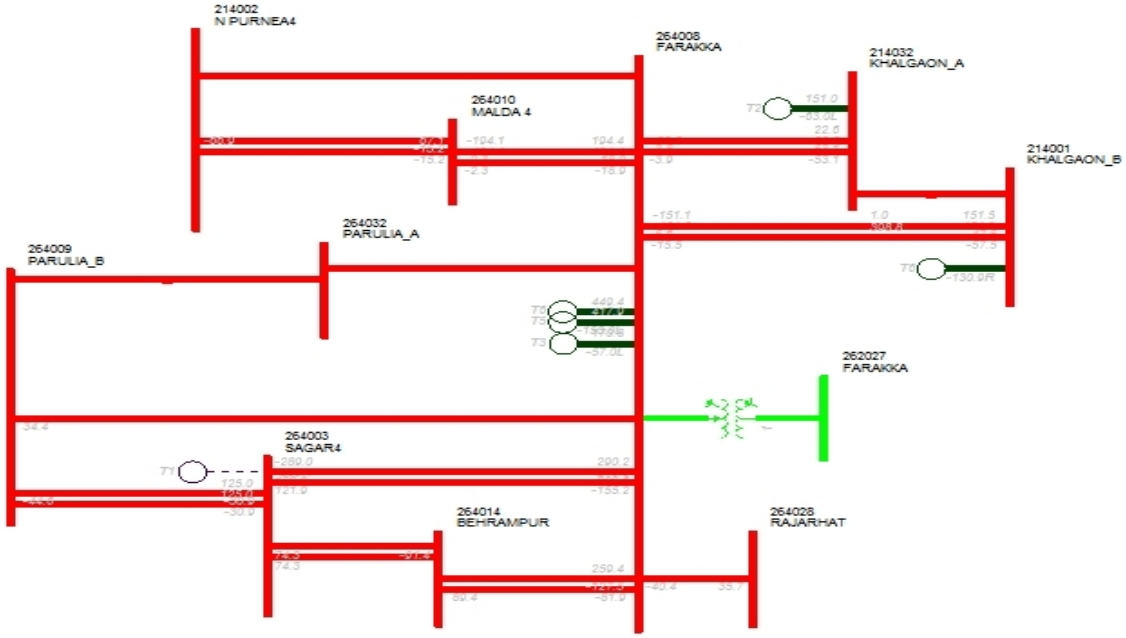
PCC also expressed concern for delay in permanent restoration of the line due to ownership issues between ECL & JUSNL and advised JUSNL to expedite the process considering the importance of the line to the ER grid in general and to JUSNL system in particular.

ERLDC enquired about implementation of revised zone settings at Kahalgaon (BSPTCL) end for 132 kV Kahalgaon-Lalmatia line to which BSPTCL replied that the same has not been implemented yet due to Covid situation and would be completed within a week.

ITEM NO. B.7: Disturbance at 400 kV Farakka S/S on 29.04.2021 at 20:40 hrs

At 20:40 Hrs, 400 KV FSTPP-Durgapur D/C, 400 KV FSTPP-New Purnea (From New Purnea end only), FSTPP U#6 tripped. Multiple faults in PMU were observed. It was reported that 220 kV Farakka-Lalmtia S/C which was out due to tower collapse since 21st april 2021 has observed another tower collpase near Farraka end and as it was passing above 220 kV Farakka-Durgapur D/C so resulted in the fault on these circuits.

Detailed report on this disturbance is attached at **Annexure B.7**



Relay Indications :

Time	Name	End 1	End 2	PMU Observation
20:41	400 kV Farakka-Durgapur -1	R-N, Zone -1, F/C 35 kA, Carrier sent A/R attempt taken. During A/R fault current was 55 kA.	R-N, Zone-2, FC 2.5 kA, Zone 1B operated, carrier received. Unsuccessful Auto reclose	PMU installed at Farakka captured one R phase to earth fault and one B phase to earth fault at the time of the event. Both the faults are cleared within 100 ms. **Auto reclose attempt was not taken for B phase to earth fault**. Auto reclose attempt was unsuccessful for R phase to
	400 kV Farakka-Durgapur -2	B-N, Zone 1 trip, Zone-4 Pickup, F/C 43.243 kA, Carrier sent (No A/R as it was in block condition as per DR so direct three phase trip)	B-N, Zone - 2, 146.2 km from Durgapur, F/C- 2.7 kA, Zone 1B operated, Carrier received. auto reclose started. After 250 ms R-Y-N, Zone-2, F/C 3.8 kA. Other two poles tripped	

			after 350 ms	earth fault
	400 kV Farakka-New Purnea -1	Did not trip	B-N, Zone-1 operated, 204.3 km from New Purnea, F/C-2.01 kA; Zone 1, 3 Phase trip, No A/R attempt observed from DR.	
	Farakka Unit - 6	High Turbine vibration		

Gen. Loss : 450 MW

Outage Duration: 04:39 Hrs

NTPC Farakka & Powergrid may explain.

Deliberation in the meeting

NTPC Farakka explained the disturbance as follows:

- *There was tower collapse at location no. 7,8 and 9 of 220 kV Farakka-Lalmtia S/C* line *near Farakka end due to bad weather.*
- *As the affected section of the line was passing over both the circuits of 400 kV Farakka-Durgapur line, during tower collapse both the circuits of Farakka-Durgapur also got tripped.*
- *400 kV Farakka-Durgapur-1 tripped from Farakka end in zone-1 of distance protection and autorecloser was attempted however due to persistent nature of the fault, A/R was not successful and all the three phases got tripped.*
- *For 400 kV Farakka-Durgapur-2 line, Farakka end sensed the fault in zone-1 however the A/R was not attempted due to issue in tie breaker A/R relay and 3-phase tripping occurred from Farakka end.*
- *Due to high fault current one wavetrap and one isolator also got damaged at Farakka end.*
- *Unit#6 also got tripped during this event due to high shaft vibration. They added that the shaft vibration settings was checked and found correct and apprehended that high fault current feeding by the generator and dynamic condition may lead to increase in shaft vibration momentarily above the set value. The issue has been referred to their corporate engineering team for further analysis.*

PCC advised NTPC to check and rectify the A/R issue of 400 kV Farakka-Durgapur-2 line at Farakka end.

Regarding A/R issue, NTPC suggested that till the time the bypassing arrangement for 400 kV Farakka-Durgapur & Farakka- KhSTPP D/C lines are being implemented to reduce fault level at Farakka S/s, autorecloser of all the connected lines at Farakka S/s may be switched off. This would prevent the substation equipments feeding high fault current during autorecloser instance and endangering the safety of the equipments.

Powergrid responded that the bypassing work is expected to be completed by June'2021.

PCC advised NTPC to place the details related to autorecloser issue at FSTPS with all the facts and the findings of their engineering wing so that it can be addressed.

Regarding overvoltage in R & B phase for Farakka-Durgapur-2 line during the disturbance, NTPC informed that the issue has been taken up with OS team. PCC advised to share the findings of the above analysis with ERLDC.

Regarding tripping of 400 kV New Purnea-Farakka line from New Purnea end during the disturbance, Powergrid informed that the tripping was due to wrong CT ratio settings in main-2 relay which caused overreaching of the zone-1 protection from New Purnea end. The same has been rectified immediately after the disturbance. They added that A/R was not attempted as it was not in service due to PLCC issue at Farakka end which would be resolved during permanent restoration of 400 kV Farakka-N. Purnea line.

ITEM NO. B.8: Disturbance at 220 kV Budhipadar S/s at 13:47 Hrs on 08.04.2021.

220 KV Budhipadar-Lapanga ckt-1&2 tripped at 13:47 and 13:49 hrs respectively, followed by tripping of Budhipadar-Raigarh on 14:03 hrs, due to B phase fault.

At increased loading of Tarkera D/C , circuit-1 also developed B phase fault at 14:06:27 Hrs and tripped .

At 14:07:24 Hrs bus fault was created at Bus-1 (with snapping of R-Ph pipe bus from isolator to Breaker of 220KV Budhipadar- Tarkera Ckt-2). All the remaining feeders with Bus -1 tripped.

With all evacuating sources out ,IBTPS and Vedanta,Bhusan formed Island with its own CPP load but due to excess generation of approx. 560 MW (Vedanta=250, IB=250 , Bhusan=50, pre event exchange with grid) over frequency occurred and also all generators tripped on Over frequency .

Detailed Report by ERLDC is attached at **Annexure B.8.**

Relay Indications :

S.No.	Name of Feeder	Budipadar end	Remote end
1	220 kV B.Padar-Lapanga-1 (13.47 Hrs)	(Siemens-7SA522) Zone-1,L2-L3, FD=6.057Km, IL2=17.03KA,IL3=16.42KA	Zone-1,L2-L3,FD=10.2km,IL2=9.2KA,IL3=9.91kA
2	220 kV B.Padar-Lapanga-2 (13.49 Hrs)	Siemens-7SA522) Zone-1,L2-L3- E, FD=7.567Km, IL2=18.48KA,IL3=8.057KA	Zone-1,L2-L3-E,FD=10km,IL2=9.69KA,IL3=7.57kA
3	220 kV Raigarh PG (14.02Hrs)	(B/U-7SJ62) O/C& E/F Trip, IL1=0.53KA, IL2=0.57KA, IL3=1.81KA	
4	220 kV Tarkera-1 (14.05Hrs)	(Siemens-7SA522) Zone-1,L3-E, FD=79.3Km, IL2=17.IL3=2.04KA	Zone-1,L3-E,FD=7.2km,IL3=6.62kA

5	220 kV Korba-3 (14.07Hrs)	PSB optd., IL3=1.76KA,In=1.76KA	No Tripping
6	220 kV Bus-1 (14.07Hrs) (korba-1,IB-1&3, Tarkera-2, B/C,Bhusan-2, SPS,AAL-1,VAL-1)	BB-SIEMENS-7SS522 Trip Bus-1 L1, Trip Bus-1 L123	NA

Generation Loss:

- Vedanta: 1120 MW (Injection to grid: 260 MW , Captive Load loss: 860 MW)
- IB TPS: 250 MW
- Bhusan:50 MW

Load Loss: 100 MW

In 101st PCC following deliberations were made –
The sequence of events as explained by OPTCL is as follows-

- The 220KV Budhipadar-Lapanga Ckt-1 &2 tripped on distance protection with Y-B phase fault. The load flow of Lapanga-1 & 2 during that period was around 320MW and total power flow at Budhipadar bus was 682MW.
- After tripping of the 220KV Lapanga-1 & 2, the power flow started to Lapanga through 132KV Budhipadar-Lapanga circuit via 160MVA ATR-1 and the loading of ATR reached to 190 MW. To prevent the overload of ATR, the 132KV Budhipadar-Lapanga and Budhipadar- Jharsuguda ckt-2 were hand tripped.
- The 220KV Budhipadar- Raigarh PG tripped on O/C & E/F protection due to unbalance power flow and 220KV Budhipadar-Korba-3 tripped on power swing protection.
- Further to evacuate the power from 220 kV Budhipadar station, power flow increased in 220 kV Budhipadar- Trakera-1 & 2 line and the lines got overloaded. Subsequently, 220 kV Tarkera-1 tripped in zone-1 of distance protection.
- After tripping of Tarkera-1, loading in 220 kV Budhipadar-Tarkera-2 further increased and R-ph pipe bus from isolator to breaker got snapped & resulted a bus fault at Budhipadar S/s.
- Therefore, all feeders/Auto TRF connected to Bus-1 tripped on Bus-bar protection and Bus-1 became dead.
- After tripping of bus-1, there was no path for evacuation of power which resulted in tripping of IB TPS units on over frequency protection and islanding of CPPs at Vedanta, Aditya Aluminium & Bhusan.
- The Aditya Aluminium and Bhusan CPP got successfully islanded however in Vedanta, the units got tripped after islanding from the grid.

Vedanta explained that the at the time of islanding they were exporting power to the tune of 260 MW and after islanding the frequency overshoots and the units got tripped. They added that if proper signal was communicated earlier to them at the start of event then they might have islanded successfully by adjusting their generation.

PCC observed that 220 kV Budhipadar S/s is an important substation of OPTCL which evacuates power from IBTPS, export power of several CPPs and connected to inter-regional grid Being a

important S/s, occurance of such type of disturbances and total power failure at substation was not desirable.
PCC opined that a suitable Special protection scheme(SPS) or scheme may be planned by OPTCL so that in case of trippings of one or multiple feeders, suitable loads can be disconnected or generation injection from CPPs can be decreased so that such cascade trippings and total power failure can be avoided. Further, it can also be explored for extension of suitable signal to CPPs for islanding to ensure successful islanding operation of CPPs.

PCC advised OPTCL to carry out a study in this regard and submit detailed plan before next PCC Meeting.

OPTCL may update.

Deliberation in the meeting

OPTCL stated that based on the decision taken in the special meeting held on 10/05/21, their planning team is carrying out the necessary study. Based on the study results the required SPS would be designed.

PCC advised OPTCL to complete the study at the earliest and share the report to ERPC secretariat and ERLDC.

Regarding unsuccessful islanding at Vedanta during the disturbance on 08/04/21, ERLDC informed that the cause of momentary over frequency which led to tripping of the units during islanding within Vedanta island is due to the poor/inadequate governor response and sluggish valve operation. The issue has been communicated to Vedanta however Vedanta is yet to submit any details in this regard.

Vedanta informed that simulation studies has been carried out to study the governor response and as per the study, tuning of the governor is required for islanding mode of operation. They informed that the issue has been taken in priority and the report will be submitted at the earliest.

ITEM NO. B.9: Disturbance at 220 kV Sonenagar S/S on 15.04.2021 at 16:08 hrs

At 16:08 hrs, 220KV Chandauti-Sonenager D/C tripped leading to total power failure at GSS Sonenagar .

As reported by SLDC Bihar, during relay testing of upcoming 160 MVA Transformer -3 at Sonenagar (GSS) by Siemens relay engineer, LBB protection operated which resulted tripping of both the lines.

Relay Indications:

Time	Name	End 1	End 2	PMU Observation
16:08	220 kV Chandauti (PMTL) - Sonenagar - 1	Line did not trip from PG end	LBB protection operated at GSS Sonenagar end	No fault was observed in PMU data.
16:08	220 kV Chandauti (PMTL) - Sonenagar - 2	Line did not trip from PG end	LBB protection operated at GSS Sonenagar end	

Outage duration : 00:25 Hrs

Load Loss: 120 MW

BSPTCL may explain.

Deliberation in the meeting

BSPTCL informed that during relay testing of upcoming 160 MVA Transformer-3 at 220 kV Sonenagar S/s by Siemens relay engineer, LBB protection operated which resulted tripping of 220 kV Chandauti (PMTL) - Sonenagar D/C lines.

PCC advised BSPTCL to take utmost precautions and measures before such type of testing of the relays to avoid mal-tripping incidences in future.

ITEM NO. B.10: Major grid events other than GD/GI

B.10.1: Grid event at 132 k V 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 bu\s-1 at Motihari tripped due to Bus extension module SF6 gas pressure low trip at 19:01 Hrs. Following feeders which were connected with 132kV Main bus – 1 at Motihari tripped:

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

After tripping of 132 kV Bus 1 and ensuring the healthiness of the remaining elements from the site, the charging attempt of all tripped feeders was taken through 132kV Main bus-2 at 400/132 kV Motihari GIS substation. During changing over, all 132 kV feeders connected to 400/132 kV Motihari S/S also got tripped at 20:19Hrs due to SF6 gas pressure low alarm of 89B of 132 kV Raxaul – 2 Bay. This caused a complete outage of 132 kV bus at Motihari substation outage.As a result, power supply got interrupted to radially connected nearby areas such as Motihari, Bettiah, Raxaul and 225 Mw load loss was reported.

Given the above event, the following issues need further discussion

- The issue and reason thereof for the incident that took place with the charging of new ICT from the 132 kV side.
- The reason for repeated SF6 low-pressure incidents at Motihari S/s. Remedial action taken after this event may also be shared by Powergrid and DMTCL.
- Restoration of one the line is still not completed which was adjacent to ICT. DMTCL may share the plan for its restoration.

PMTL & DMTCL may explain.

Deliberation in the meeting

DMTCL explained the event as follows:

- *During first time charging of 132 kV ICT-3 from IV side, 132 kV Bus-1 got tripped as a result the following elements connected to Bus-1 got tripped.*
    - *132 kV Motihari(DMTCL)-Raxaul-I*

- *132 kV Motihari(DMTCL)-Bettiah-I*
- *132 kV Motihari(DMTCL)-Motihari-I along with bus coupler.*

- *After tripping of 132 kV Bus-1, the charging attempt of all tripped feeders was taken through 132kV Main bus-2 at 400/132 kV Motihari GIS substation. During changing over, 132 kV bus-2 also got tripped which resulted in tripping of all 132 kV feeders connected to 400/132 kV Motihari S/S.*

- *After checking it was found that density monitor cable of 132 kV Raxaul-2 bay was damaged along with some of the breaker interconnection cables. Further, necessary testing was carried out for all the feeders except 132 kV Raxaul-2 bay and 132 kV Main bus-1 and the feeders were restored with Main Bus-2 one by one.*

- *Due to complete outage of 132 kV bus at Motihari(DMTCL) substation, power supply got interrupted in nearby areas such as Motihari, Bettiah, Raxaul and 225 MW load loss was reported.*

- *They informed that the details of the incident on 21/04/21 along with the findings were shared with both the OEMs for root cause analysis of the event. As two OEMs are involved in GIS system at Motihari, they were discussing with each other and the report would be submitted by them to DMTCL within a week. The same would be shared with ERPC/ERLDC once they receive the report.*
- *They mentioned that 132 kV Motihari – Raxaul circuit -2 and 132 kV Bus-1 at Motihari had not been restored yet due to non-availability of shutdown by SLDC Bihar.*

ERLDC suggested that 132 kV Motihari(BSPTCL) S/s can be connected to 132 kV Motipur S/s and the system can be run in closed loop operation. This would increase the reliability of power supply at Motihari S/s as well as overall reliability at 132 kV level.

PCC advised SLDC Bihar to consider the proposal of operating the grid in closed loop mode by connecting 132 kV Motihari(BSPTCL) to 132 kV Motihari station and submit their observation to ERLDC.

B.10.2 : Tripping of 400/220 kV Biharshariff ICT-1,2 &3 on 03-04-2021 at 19:45 hrs

On 03-04-2021 at 19:45 hrs,400/220 kV ICT 1,2 &3 tripped due to R phase CT blast of ICT-2 at 220 kV side. 220 kV Biharshariff-Khezisarai D/C also got tripped.

ICT 1&2 tripped from Powergrid side and Inter-trip sent to BSPTCL end while ICT-3 tripped from only BSPTCL side.ICT-4 was in service with loading of 350 MW. Biharshariff-Khezesarai D/C tripped from Khezesarai end on Zone -2 from Khezesarai end .There is no Bus bar scheme at Present at 220 k V Biharshariff.

Powergrid and BSPTCL may explain.

Deliberation in the meeting

Powergrid informed that the disturbance occurred due to CT blast in 220 kV side of 400/220 kV ICT-2 at Biharshariff S/s. Both HV & LV side of ICT 2 tripped on differential protection.

Further at the same time, 400/220 kV ICT-1 got tripped from HV side on receipt of intertrip signal from LV side and ICT-3 tripped from LV side only.

BSPTCL informed that for ICT-1, LV side backup protection got initiated but there was no tripping command from the relay. For ICT-3, they informed that only 86 relays are present on LV side and all the main and backup protection relays are present on 400 kV HV side.

PCC observed that the tripping of ICT-1 & 3 could not be explained based on the available details.

PCC opined that these type of spurious trippings of 400/220 kV ICTs at Biharshariff during close-in fault condition had been observed in past also and the same has been reduced to a great extent after replacement of old cables an busbar panels by BSPTCL on 220 kV side.

PCC advised BSPTCL following:

- *To carry out detail checking of the cables/wirings between HV and LV side of the 400/220 kV ICTs at Biharshariff S/s. Also to check substation DC healthiness on 220 kV side.*
- *To configure the disturbance recorder of the relays for LV side of the ICTs so that DRs can be available during tripping of the ICTs for analysis.*
- *To submit the status of busbar protection for 220 kV bus of Biharshariff S/s.*

Regarding tripping of 220 kV Biharshariff-Khezesarai D/C from Khezesarai end in Zone -2 protection, BSPTCL informed that Khizersarai S/s is maintained by BGCL and the issue has been intimated to them for necessary checking of the relay settings at their end.

PCC opined that presence of BGCL representative is necessary for analyzing the disturbances involving their substations and advised BSPTCL/SLDC Bihar to issue necessary directions to BGCL for attending the PCC meeting whenever disturbances related to BGCL substation is placed for discussion.

ITEM NO. B.11: Repeated tripping of 400 kV New Purnea Muzaffarpur-1 due to similar nature of fault

400 kV New Purnea-Muzaffarpur D/C plays important roles in the evacuation of hydropower in the North Eastern Region, Sikkim and Bhutan. During April 2021, 400 kV New Purnea-Muzaffarpur D/C had tripped repeatedly due to similar nature of faults.

Based on the available information, the following are the observations from ERLDC:

1. Fault distance is around 110-115 kM from New Purnea and 125 kM from Muzaffarpur for all four events.
2. All the faults are Y-B-N in nature.
3. Faults are first developing in one phase then converting into the Ph-Ph-Earth fault after 3 to 5 cycles, indicating possible phenomena of back flashover.

Details of tripping are attached in **Annexure B.11.**

During all tripping incidents, a single phase-to-earth fault getting converted to phase to phase to earth indicating the possibility of phenomena of black flashover.

Powerlink may explain.

Deliberation in the meeting

ERLDC informed that 400 kV New Purnea-Muzaffarpur-I is being tripped repetedily in recent times with similar nature of fault(Y-B phase to Earth) with fault distance of 110-115 kM from New Purnea end. They added that during DR analysis it was observed that there was indication of

back flashover in all the instances of tripping which may be due to high tower footing resistance value.

Powerlink responded that line patrolling was carried out in concerned area i e 110-115 Km from New Purnea end however no issue was found in the line.

PCC advised Powerlink to check tower footing resistance of the towers in the above section and submit the findings of the same to ERPC and ERLDC.

ITEM NO. B.12: Total Power failure at 220 kV Lalmatia and Godda S/S on 22.03.2021 at 11:05 hrs

220 kV Godda-Dumka D/C were not in service. On 22-03-2021 at 11:05 hrs 220 kV Farakka-Lalmatia S/C and 132 kV KhSTPP -Lalmatia S/C tripped resulting in total power failure at Lalmatia and Godda S/S.

From relay indications it was observed that there was no fault in 132kV KHSTPP-Lalmatia line. 132kV KHSTPP-Lalmatia tripped on Z3 from KHSTPP end due to non-tripping of breaker of 220kV FSTPP-Lalmatia at Lalmatia end.

In 101st PCC , NTPC informed that the fault was in 220 kV Farakka-Lalmatia line and NTPC Farakka end cleared the fault in zone-1 timing of distance protection. At 220 kV Lalmatia end, there was no tripping.

They added that relay at 132 kV KhTPP-Lalmatia circuit tripped in zone-3 of distance protection to clear the fault.

JUSNL informed that the only 220/132 kV ICT at Lalmatia S/s also got tripped from both HV and LV side on overcurrent protection.

PCC observed that as no protection system operated at 220 kV Lalmatia end, the fault should have been cleared by the 220/132 kV ICT at Lalmatia S/s. The tripping of 132 kV KhSTPP-Lalmatia line is not in order. PCC observed that there is a coordination issue between the 220 /132 kV ICT and zone-3 settings of 132 kV KhSTPP-Lalmatia line at KhSTPP end and advised JUSNL & NTPC to properly coordinate the relay settings at their respective end.

Regarding non-operation of any protection system of 220 kV Farakka-Lalmatia line at 220 kV Lalmatia end, NTPC informed that main distance relay at Lalmatia end was faulty and out of service since one year. They further informed that as installation of new relay involves capital expenditure, the issue was already communicated to ECL i.e. the owner of the 220 kV Farakka-Lalmatia transmission system. However, no response from ECL has received till date.

PCC advised NTPC to resolve the issue of protection system at 220 kV Lalmatia end in coordination with ECL.

PCC also advised JUSNL to enable directional high-set in backup overcurrent relay at LV side of 220/132 kV ICT at Lalmatia for faster fault clearance in case of non clearance of fault in 220 kV Farakka-Lalmatia line at 220 kV Lalmatia end.

JUSNL & NTPC may update.

Deliberation in the meeting

JUSNL informed that directional high-set in backup overcurrent relay had been enabled at LV side of 220/132 kV ICT at Lalmatia end.

ITEM NO. B.13: Total power failure at JSPL on 09.03.2021 at 08:02 hrs

At 07:50 hrs, 400 kV JSPL-Meramundali - 2 got tripped after unsuccessful auto-reclose attempt due to persistent Y phase to earth fault.

At 08:02 hrs, 400 kV JSPL – Meramundali-1 got tripped after unsuccessful auto-reclose attempt due to persistent Y phase to earth fault resulting in total power failure at JSPL plant. During line patrolling, it was observed that "Y" Phase Insulators of both the circuits were damaged and conductors were lying on top of Blue Phase cross arms at tower location at 111.

Load Loss : 333 MW , Gen. Loss: 373 MW

Outage Duration: 05:06 Hrs

In 101st PCC , following deliberations were made -

JSPL informed that the fault was due to insulator decapping on account of fog in the 400 kV JSPL-Meramundali line at 32 kM from JSPL which resulted in tripping of the lines.

ERLDC stated that the following two discrepancies were observed during the tripping of 400 kV Meramundali-JSPL-2 at 07:50 hrs and Meramundali-JSPL-1 at 08:02 hrs.

- ***Low Dead time of Auto Recloser*:**

ERLDC informed that there was Y-phase to earth fault in the line and Y-phase breaker got opened within 100 ms but again after 350 ms Y-phase breaker got closed and fed the fault for next 300 ms and then all 3 poles got opened.

They added that from DR as well as PMU it appeared that A/R dead time is kept only 350 ms.

JSPL informed that the deadtime settings of 350 msec was due to limitation in the relay at their end. They added that procurement of new relay has already been initiated and the revised dead time settings would be implemented in the new relay which is expected to be commissioned within two months.

- ***Delayed breaker opening at the instance of reclose:***

ERLDC informed that after reclosing of Y-pole breaker at Meramundali end, the Y-pole again got opened after 400 ms even though the fault was persisting. They opined that SOTF/TOR feature may be enabled in the distance relay to avoid the delayed opening of breaker during the autorecloser instance.

JSPL informed that SOTF had been enabled at their end.

PCC advised OPTCL to enable the Trip on reclose (TOR)/SOTF function in the distance relay at Meramundali end.

JSPL & OPTCL may update.

Deliberation in the meeting

OPTCL informed that TOR function had been enabled in the relays at Meramundali end.

JSPL informed that new relay had already been procured however the revised dead time settings could not been implemented in BCU as GE engineers could not visit the site due to ongoing lockdown in the state in view of Covid situation. The settings would be implemented once the lockdown situation gets normalized.

ITEM NO. B.14: 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.

During all instants, fault was at zone-1 from STPS and Zone – 2 from Chandil. No auto-reclose attempt was observed at STPS end. Due to non-receipt of carrier, Chandil end had cleared the faults in zone – 2 timing.

- WBSETCL may share reason for repeated short circuit faults at almost same location and remedial action taken to reduce the no of tripping.
- WBPDCL may share reason for non-auto reclose attempt at STPS end.
- WBSETCL/JUSNL/WBPDCL may share the status of carrier aided protection at both ends of the lines**.**

In 101st PCC following deliberations were made –

ERLDC informed that there are two major issues observed related to the tripping of 220 kV Chandil-STPS lines.

I. Non operation of auto- recloser at STPS end
II. Delayed tripping at Chandil end

Regarding the issue of auto-recloser at STPS end, WBPDCL informed that due to PLCC issue at Chandil end, the auto-recloser is not being initiated at their end. They further informed that PLCC issue at Chandil end persists since May,2020.

PCC observed that auto-recloser at Santaldih is not being operated as both the channels of PLCC are unhealthy and the delayed tripping at Chandil end is also due to non availability of carrier protection on account of PLCC issues.

JUSNL informed that the PLCC issue at Chandil was being taken up with their telecom wing.

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

Further, PCC decided that WBPDCL and JUSNL engineers would conduct a joint exercise for checking the carrier communication to both the substations after the rectification of PLCC issues at Chandil end by JUSNL.

WBSETCL informed that they had carried out the line patrolling and it was found that snapping of earth wire at one location. The same had been rectified.

After detail deliberation, PCC further advised WBPDCL to communicate the tripping/ fault details of the 220 kV STPS-Chandil line to Purulia area office of WBSETCL in addition to SLDC, West Bengal for early identification and resolution of the issues.

JUSNL & WBPDCL may update.

Deliberation in the meeting

JUSNL informed that rectification of PLCC issue is to be carried out by third party agency and the same is being taken up by their telecom wing..

PCC advised JUSNL to expedite the process and resolve the PLCC issue at Chandil end at the earliest and also advised to submit the status of the work to ERPC secretariat within a week.

ITEM NO. B.15: Repeated tripping of 220 k V Daltonganj- Garwa circuits with similar Nature of Fault

Element Name	Tripping Date	Tripping Time	Reason	Revival Date	Revival Time
220KV-DALTONGUNJ-GARWAH (NEW)-1	31/03/2021	9:49	DALTONGUNJ: B_N, Z-1, FD-47.8KM, FC-2.1KA	31/03/2021	19:07
220KV-DALTONGUNJ-GARWAH (NEW)-2	30/03/2021	11:47	DALTONGUNJ: Y-B, 61KM, 2.36KA	31/03/2021	18:22
220KV-DALTONGUNJ-GARWAH (NEW)-1	30/03/2021	9:35	Y-B Fault, Y: 1.7 KA B: 1.65 KA, Zone 2, 80.607 km from Daltongunj Garwah: Iy 0.495 KA Ib: 0.541 KA z1 23 km	30/03/2021	18:17
220KV-DALTONGUNJ-GARWAH (NEW)-2	30/03/2021	11:26	DALTONGUNJ: B-N, 18KM, 3.46KA,	30/03/2021	11:46
220KV-DALTONGUNJ-GARWAH (NEW)-1	15/03/2021	14:45	DT RECEIVED	15/03/2021	16:47

In 101st PCC following deliberations were made –

ERLDC informed that as per the disturbance recorder analysis for the tripping of 220 kV Daltonganj-Garwa-2 line on 30.03.2021, it was found that

- Initially there was a B-phase to ground fault in the line which got converted to a Y-B phase fault at the charging instance during auto-reclosing operation. The fault current in both the phases were slowly increasing and subsequently detected by the relay and initiated tripping command which indicates phase-to-phase clearance issue in the line.
- During the First time charging of this line, this same sequence of tripping was also observed.

ERLDC further informed that most of the faults are of Y-B(phase to phase) fault and there is no involvement of ground in these faults.

JUSNL stated that patrolling was done for these lines after the trippings in which various bamboo trees were found in burnt condition near conductors. They added that at one location sag issue was also found.

Regarding remedial measures, they informed that tree cuttings have been completed at the places where clearance issues were found. Further to resolve the sag issue, the same was already taken up with a third party agency for necessary rectification work.

On enquiry from ERLDC regarding frequency of conducting line patrolling by them, JUSNL informed that last patrolling was done in August 2020 and the patrolling were being carried out after the incidence of trippings.

PCC opined that periodic patrolling should be done as a measure of preventive maintenance so that such tripping incidences can be avoided and advised JUSNL to carry out periodic line patrolling for all the lines as a preventive maintenance plan.

PCC also advised JUSNL to resolve the sag issue in the line at the earliest and submit a report in this regard to ERPC secretariat and ERLDC.

JUSNL may update.

Deliberation in the meeting

JUSNL informed that the sag issue has not been resolved yet. They added that work related to tree cutting/ jumper tightening in the line is in progress and till date 193 tower locations out of 305 tower have been completed. The rest would be covered within May-21.

PCC advised JUSNL to resolve the sag issue during the above period and intimate the same to ERPC/ERLDC.

ITEM NO. B.16: Total Power Failure at 400 kV Motihari Substation on 21.01.2021 at 11:20 hrs

400 kV Motihari-Gorakhpur D/C and 400 kV Motihari Barh-1 were out of service due to tower collapse. Motihari was connected to rest of the grid through 400 kV Barh Motihari - 2.
On 21-01-2021 at 11:20 hrs, a transient Y-phase to earth fault occurred at 400 kV Barh-Motihari - 2. Successful auto reclose operation was occurred at Motihari end.

In 99th PCC, NTPC informed that there was a transient Y-phase to earth fault in 400 kV Barh-Motihari line. The auto reclosure was successful for tie bay at Barh end. However, B-pole breaker of main bay did not reclose during the autorecloser operation. They informed that after opening of

After detailed deliberation, PCC observed that the as the line reactor is switchable, the protection of line rector should not trip the master trip relay of the line. PCC advised NTPC to check and review the scheme/relay configuration for the line reactor of 400 kV Barh-Motihari-2 line.

In 100th PCC meeting, NTPC informed that the scheme/relay configuration for the line reactor of 400 kV Barh-Motihari-2 line is being reviewed by their engineering wing. The same would be shared with ERPC/ERLDC on receipt of the views of their Engineering wing.

In 101st PCC , NTPC informed that they had not received report from their engineering wing related to modification of scheme/relay configuration for the line reactor of 400 kV Barh-Motihari-2 line till date. They added that during recent shutdown of 400 kV Barh-Motihari-2 line, they had checked and simulated the scheme and the issue was not found at that time.

NTPC may update.

Deliberation in the meeting

NTPC informed that they had not received any communication from their engineering wing regarding the modification of scheme/relay configuration for the line reactor of 400 kV Barh-Motihari-2 line till date.

PCC advised NTPC to follow up with their corporate team for expediting the process.

ITEM NO. B.17: Repeated tripping of Circuits from NTPC Barh and Associated protection Issues

In January 2021, repeated tripping has been observed for the lines emanating from 400 kV NTPC Barh generating station. During the analysis of the tripping incidents, discrepancies in Auto – reclose operation, protection system operation and extension of the direct trip signal have been observed and the same has been shown in the next table.

NTPC vide mail dated 26th Feb 2021 updated as follows:

1. M/s Powergrid, Patna has been informed for resolution of carrier signal delay.
2. CVT secondary earthing has been checked at protection panel of Barh -Patna lines. For further detailed checking, shutdown is planned on 02 March 2021. The tripping after auto-reclose is due to TOR(Trip on Re-close) as in DR channel it is configured as SOTF/TOR trip.
3. The AR of both the main and tie breakers will be checked thoroughly during line shutdown.
4. The protection settings and schemes of transmission lines at Barh have been sent to our Engineering team for review and is under process.

In 100th PCC meeting, NTPC Barh informed that the CVT secondary earthing was checked and found healthy.

Regarding A/R & protection scheme, NTPC informed that the scheme has been sent to their engineering wing for review of the same.

Regarding carrier issue for 400 kV Barh –Patna line, Powergrid informed that the same would be checked during shutdown of the line planned in the month of April'2021.

In 101st PCC , Powergrid informed that carrier issue for 400 kV Barh-Patna line would be checked during shutdown of the line planned in the month of April'2021.

NTPC & Powergrid may update.

Deliberation in the meeting

Powergrid informed that the carrier related issue was checked at their end and also it was taken up with the OEM and as per OEM observation there was no delay in the carrier communication.

They stated that the carrier signal is sent whenever the zone-1 channel gets high instead of the zone-1 timer channel and mentioned that DR may be reviewed by ERLDC to clarify the same.

ITEM NO. B.18: Disturbance at 220 kV Hatia Substation on 29.01.2021 at 10:44 hrs

220 kV Ranchi - Hatia - 3 was being shifted from 220 kV bus-1 to 220 kV bus-2 at Hatia. During changeover, sparking was observed in 220 kV bus-2 isolator at Hatia of Ranchi-3 feeder. Bus bar protection was not in service at Hatia at 220 kV voltage level. All 220 kV feeders tripped from remote ends.

In 99th PCC Meeting, after detailed deliberation PCC advised followings to JUSNL:

- To review the backup overcurrent settings of 220/132 kV ICTs at 132 kV Hatia-II S/s immediately.
- To review and submit the line backup overcurrent protection settings for 132 kV Hatia 1-132 kV Hatia II circuits.
- To review the zone settings at 132 kV Kanke end as the line should not have tripped in zone-3 from Kanke end.
- To check healthiness of the relay at PTPS end for 132 kV Hatia-I-PTPS line.
- To configure the disturbance recorders as per the standard finalized in 79th PCC Meeting.

In 100th PCC Meeting, JUSNL informed that review of settings for ICTs at Hatia-II end and checking of healthiness of the relay at PTPS end could not be completed due to non-availability of shutdown. They added that same would be done within March-2021.

Regarding DR configuration, they informed that the concerned team had already been communicated to configure the disturbance recorders as per the standard finalized in 79th PCC Meeting and would be completed by two weeks.

In 101st PCC, JUSNL informed that review of settings for ICTs at Hatia-II end and checking of healthiness of the relay at PTPS end would be done during the shutdown scheduled on 24th and 25th April 2021.

JUSNL may update.

Deliberation in the meeting

JUSNL informed that shutdown was not allowed by SLDC Jharkhand due to COVID 19 pandemic situations. The shutdown would be availed once the Covid situation improves.

ITEM NO. B.19: Grid event at 220/132 kV Lalmatia S/s on 11-01-2021 at 11:57 hrs.

On 11-01-2021 at 11:57 hrs,132 KV KhSTPP - Lalmatia S/C, 132 KV Kahalgaon (Bihar)-Lalmatia S/C, 132 KV Lalmatia – Sahebgunj S/C tripped on R phase to earth fault. As a result, 40 MW load loss occurred. Power was supplied to Sahebgunj and Rajmahal areas through transfer bus at Lalmatia via 132 kV Kahalgaon – Lalmatia – Sahebgunj link. There was no power failure at 220 kV voltage level at Lalmatia.

PCC advised BSPTCL to set the relay settings at Kahalgaon(BSPTCL) end considering the line length of 132 kV Kahalgaon – Lalmatia section only.

Regarding frequent tripping of the 132 kV Kahalgaon (Bihar)-Lalmatia line and 132 kV KHSTPP-Lalmatia line, PCC advised JUSNL and BSPTCL to do a joint patrolling of the line and submit a report to PCC.

In 100th PCC Meeting, JUSNL informed that joint patrolling was conducted on 10th March 2021 and clearance issue was observed in the section under jurisdiction of Bihar.

PCC advised BSPTCL to submit corrective action plan based on the findings in joint patrolling report within one week.

In 101st PCC , BSPTCL informed that corrective actions related to clearance issue are already being taken up and regarding earth wire issue they informed that and there was a delay due to non availability of shutdown from SLDC Jharkhand.

JUSNL informed that shutdown would be facilitated after second week of April'21.

JUSNL and BSPTCL may update.

Deliberation in the meeting

BSPTCL informed that clearance issue was resolved on 19th April 2021 and regarding earth wire issue the proposal is under process.

ITEM NO. B.20: Repeated disturbances at 132/66 kV Melli S/S in March 2021

The occurrence of repeated grid events at 132/66 kV Melli S/S has been reported in March 2021

resulting in power failure at Melli and Kalimpong areas. A summary of the grid events in March 2021 is given in the following table:

Sr No	Date	Time (Hrs.)	Brief Description	Relay Indication of RangpoMelli S/C	Relay Indication of SiliguriMelli S/C	Power loss
1	11-03-2021	16:17	132 kV SiliguriMelli S/C was out of service. Kalimpong was radially fed from Melli through 66 KV Kalimpong-Melli D/C. 132 kV Rangpo – Melli S/C tripped ON R-Y phase fault leading to power failure at Melli.	R-Y, IR=1.2 kA, IY=1.1 kA, 2.1 km from Rangpo	--	Melli: 15 MW Kalimpong: 5 MW
2	24-03-2021	18:41	Both 132 kV Rangpo-Melli S/C and 132 KV Siliguri-Melli S/C tripped due to R & Y phase to earth fault resulting in total power failure at Melli and Kalimpong. Kalimpong was radially fed from Melli through 66 KV Kalimpong-Melli D/C.	R-Y, IR=1.6 kA, IY=1.5 kA, 2.1 km from Rangpo	R-Y, IR=1.4 kA, IY=1.3 kA, 104 km from Siliguri;	Melli: 12 MW Kalimpong: 6 MW
3	28-03-2021	16:42	132 kV Rangpo-Melli S/C and 132 KV Siliguri-Melli S/C tripped due to R & Y phase to earth fault resulting in total power failure at Melli and Kalimpong. Kalimpong was radially fed from Melli through 66 KV Kalimpong-Melli D/C.	R-Y, IR=1.4 kA, IY=1.4 kA, 2 km from Rangpo	R-Y, IR=1.4 kA, IY=1.3 kA, 105 km from Siliguri	Melli: 15 MW Kalimpong: 5 MW

In 101st PCC Meeting held on 13.04.2021, the agenda was placed for discussion. PCC referred the issue to OCC for discussion as Sikkim representative were not present in the meeting.

In 178th OCC Meeting the following deliberation took place:

Powergrid informed that line section of 132kV Rangpo-Melli line from 0.3 km to 3.3 km from Rangpo belongs to P&E Deptt. Sikkim and the fault location for the above trippings comes under their jurisdiction.

Sikkim representative informed that the maintenance of 132 kV Rangpo-Melli line is being carried out by Powergrid.

Powergrid clarified that there was no formal agreement between Sikkim and Powergrid for maintenance of the subjected portion of line.

OCC opined that as the line section belongs to Sikkim, the onus of the maintenance of the line lies with Sikkim and advised Sikkim to maintain the particular section of the line either by their own or by Powergrid through a formal O & M agreement.

Sikkim representative stated that the proposal of O& M agreement with Powergrid is under consideration and they would take up the issue with their higher authority for expedition of the

same.

Regarding issue of protection system at Melli S/s, Powergrid informed that the issue is in the substation DC system and needs thorough investigation.

Sikkim representative responded that the DC issue at Melli S/s has been resolved and further informed that tendering process for renovation of Melli S/s under PSDF scheme has been started.

After detailed deliberation, OCC decided that a complete review protection system of Melli S/s may be carried out by a team comprising of the technical experts from Powergrid, West Bengal and Sikkim tentatively in the last week of April'21 and the team has to submit its report to ERPC. Further, OCC advised respective utilities to nominate one representative preferably from the nearby areas.

Deliberation in the meeting

Powergrid informed that protection review of Melli S/s had been carried out on 05/05/2021. The report of the team would be submitted in forthcoming OCC meeting.

Members noted.

ITEM NO. B.21: Backup Overcurrent Relay coordination of Sikkim Complex

In 97th PCC following deliberations were made,

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

In 99th PCC, PCC advised PRDC to re-send the revised settings to all concerned utilities. It further advised all concerned utilities to go through revised settings and provide their observations within one week.

In 100th PCC, PRDC informed that comment from ERLDC was received and accordingly, revised study had been carried out and further the revised setting was sent to ERLDC for comments, if any.

ERLDC informed that observation would be submitted at the earliest.

In 101st PCC following deliberations were made –
On a query from ERLDC regarding consideration of HTLS parameters for 400 k V Rangpo-Binaguri line in the study carried out by PRDC, PRDC informed that the same has not been taken into account.

PCC advised PRDC to carry out revised study considering HTLS parameters for 400 kV Rangpo-Binaguri D/C line and share the study report to all concerned utilities.

Members may update.

Deliberation in the meeting

PCC advised PRDC to carry out revised study considering the modified CT ratio i.e. 3000A at Kishanganj end for 400 kV Kishanganj-Teesta III line and share the report among concerned utilities for implementation of the revised settings at their end.

ITEM NO. B.22: Transformer overcurrent earthfault Setting Guidelines-ERLDC

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

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

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

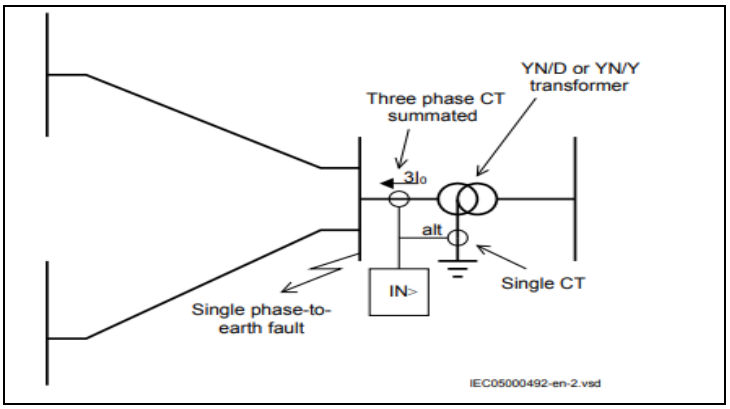


Figure 1: Step 1 fault calculation 1

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

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

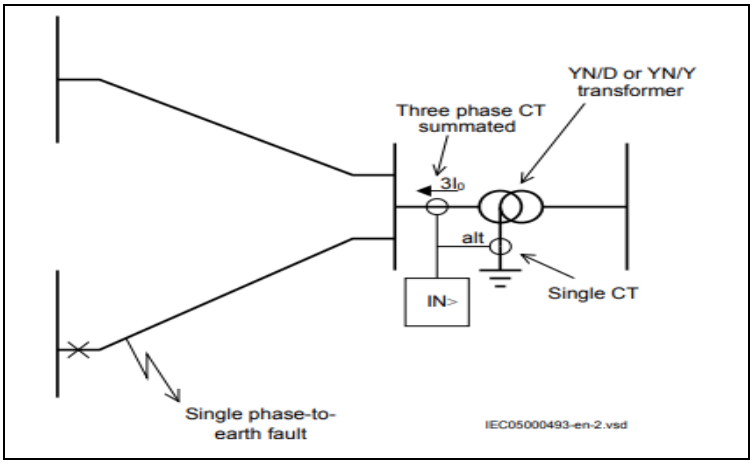


Figure 2: Step 1 fault calculation 1

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

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

Earth fault overcurrent Stage 2 setting:

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

In 100th PCC meeting,

ERLDC informed that the earth-fault overcurrent relay settings of the ICTs need to coordinated with that of the transmission lines.

PCC advised all the utilities to share their existing practice of setting the E/F overcurrent relays in transformers and also submit their comments regarding the proposed guidelines as above.

In 101st PCC following deliberations were made –

Powergrid informed that they are following the guidelines of Ramkrishna Committee for setting of the E/F overcurrent relays in transformers for 220 & 400 kV level. The settings was calculated by considering fault in remote end substation and the level of fault feeding by the connecting lines to that substation from the ICT .

CESC informed that setting of E/F overcurrent relay in transformer would depend on zero sequence current flowing through ICTs during the fault in a connected line and further value of zero sequence current would dependent on no. of ICTs connected to the bus.

DVC informed that at their substations time setting of E/F overcurrent relay in transformer is coordinated with zone 3 settings of line.

PCC advised all the utilities to share their existing practice of setting the E/F overcurrent relays in transformers through email and also submit their comments regarding the proposed guidelines as above.

Members may update.

Deliberation in the meeting

It was informed that WBSETCL has shared their protection philosophy for setting the earth fault relay in transformers. As per their practice, the earthfault relay is not being used in the transformers in their system.

PCC advised all the other utilities to share their existing practice of setting the E/F overcurrent relays in transformers through email and also submit their comments regarding the proposed guidelines as above.

ITEM NO. B.23: Keeping two sets of protection setting at Substation where bus splitting arrangement is there and at all substations connected to that substation

As per agenda point no. B.15.4 of 100th PCC meeting it was suggested that changeover of settings between multiple group can be made in case of two sets of protection setting at substation where Bus splitting arrangement is there and at all sub-stations connected to that substation. This agenda was also there in the 93rd PCC meeting wherein POWERGRID has contested this agenda mentioning that having two groups of settings will not give any additional benefit. However, if the longest line is out of service and settings revised, but the group settings change is inadvertently missed after restoration, it would leave the remote bus unprotected. Thus the risks of this proposal are more than the benefits. Subsequently, in 93rd PCC, it was recorded that “All the utilities to ensure proper setting co-ordination”.

Moreover during Bus splitting at Biharsharif SS, we have also communicated to ERPC & ERLDC vide our email dtd. 15th Sept, 2020 that "With the existing settings, the fault at all the remote buses are already covered in Z3 and as Z3 is an overreaching zone, it is subjected heavily to the infeed effect which results in under-reaching of Z3, thus it is not recommended to reduce the Z3 reach. Considering that the group settings are not providing any perceptible advantage while having a major risk of mal-operation, remote end settings may be kept as same". The Bus-splitting at Biharsharif is functional with that existing settings only and no any issue regarding protection setting co-ordination for 400 kV Lines has been observed yet. Thus the need of keeping two group settings at Sub-station where bus splitting is there doesn't seem to be beneficial. However this may be recommended based on any case study or issues observed after further experiences.

Deliberation in the meeting

It was clarified that the requirement of keeping two sets of protection settings for bus splitting arrangement is case to case basis and the same can be ascertained based on the line length of longest lines after bus splitting. In case there is no considerable change in line length of longest line after bus splitting, the existing settings may be maintained in remote end substations.

PART- C:: OTHER ITEMS

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

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

Sl No	SS Name	Data Collection	Owner	State
1	Bagmundi		WBSETCL	West Bengal
2	Dinahata		WBSETCL	West Bengal
3	Goghat		WBSETCL	West Bengal
4	Saltlake Stadium		WBSETCL	West Bengal
5	Mathabhanga		WBSETCL	West Bengal
6	Kashipur		OPTCL	Odisha
7	Betanati		OPTCL	Odisha
8	Aska New		OPTCL	Odisha
9	Udala		OPTCL	Odisha
10	Narashinghpur		OPTCL	Odisha
11	IBTPS		OPGC	Odisha
12	Mancheswar		OPTCL	Odisha
13	North Karanpura		NTPC	Jharkhand
14	TingTing		….	Sikkim
15	Lethang		….	Sikkim
16	Rongichu		……	Sikkim

In 100th PCC Meeting, PRDC informed that they had visited new substations in West Bengal and collected relevant data. They further informed that they data collection for Odisha substations would be completed by March 2021.

PCC advised all concerned utilities to facilitate the visit by PRDC personnel for collection of substation/relay data.

In 101st PCC ,PRDC informed that they had visited all new substations except few in Sikkim.

Members may update.

Deliberation in the meeting

PCC advised PRDC to submit the updated status of the substations visited by the to ERPC secretariat.

ITEM NO. C.2: Submission of protection settings in PDMS

Relay settings of many transmission elements are not available in the protection database. The list has been prepared and forwarded to all the concerned utilities.

Relay settings had been received from CESC, Haldia Energy Limited and for few Substations from Powergrid ER-1. OPTCL, WBSETCL, JUSNL, BSPTCL, WBPDCL,Powergrid ER-II ,NTPC and other constituents are required to submit relay settings at earliest.

In 100th PCC Meeting, it was informed by ERPC secretariat that an audit by PSDF audit team was carried out for protection Database project on 19.02.2021 and it was noted that around 7 percent of protection settings was not available in PDMS.

PCC advised all concerned utilities to upload the pending relay settings in PDMS or send the relay settings to erpcprotection@gmail.com.

In 101st PCC , PCC advised ERPC to share updated list of pending relay settings to all the concerned utilities. It further advised all concerned utilities to upload the pending relay settings in PDMS or send the relay settings to erpcprotection@gmail.com.

Members may update.

Deliberation in the meeting

PCC advised ERPC to share updated list of pending relay settings to all the concerned utilities. It further advised all concerned utilities to upload the pending relay settings in PDMS or send the relay settings to erpcprotection@gmail.com.

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Annexure-A

List of Attendees of 102nd PCC Meeting held on 13/05/21 through MS Teams platform

Full Name	User Action	Timestamp
ERPC Kolkata	Joined	5/13/2021, 10:16:41 AM
BD Kumar, TUL	Joined	5/13/2021, 10:16:48 AM
Pravin Ram	Joined	5/13/2021, 10:16:48 AM
Uma Kanta Mishra, OPTCL (Guest)	Joined	5/13/2021, 10:19:00 AM
Deepak, EEE, BSPTCL (Guest)	Joined	5/13/2021, 10:21:41 AM
Kumar Satyam , ERPC (Guest)	Joined	5/13/2021, 10:22:45 AM
Prabhat Kumar,CRITL,JUSNL (Guest)	Joined	5/13/2021, 10:23:05 AM
Deepak Vinnakota, PRDC (Guest)	Joined	5/13/2021, 10:33:05 AM
CRITL (Guest)	Joined	5/13/2021, 10:25:50 AM
abhinaba basu (Guest)	Joined	5/13/2021, 10:26:43 AM
Raj Protim ERLDC (Guest)	Joined	5/13/2021, 10:27:01 AM
RAHUL ANAND , NTPC (Guest)	Joined	5/13/2021, 10:27:25 AM
Saugato Mondal ERLDC (Guest)	Joined	5/13/2021, 10:27:57 AM
JAYANTA KANJILAL, WBSETCL (Guest)	Joined	5/13/2021, 10:28:14 AM
Arindam BSPTCL(Guest)	Joined	5/13/2021, 10:29:00 AM
Alok Pratap Singh ,ERLDC	Joined	5/13/2021, 10:30:33 AM
Amresh Prusti	Joined	5/13/2021, 10:30:44 AM
Ratnakar (Guest)	Joined	5/13/2021, 10:31:19 AM
Akhand Pratap, DVC (Guest)	Joined	5/13/2021, 10:31:21 AM
SE, Commercial, ERPC (Guest)	Joined	5/13/2021, 10:31:23 AM
Saibal Ghosh,ERLDC (Guest)	Joined	5/13/2021, 10:31:41 AM
D.K.JAIN ED ERLDC	Joined	5/13/2021, 10:31:51 AM
Chandan Kumar	Joined	5/13/2021, 10:32:31 AM
rajendra prasad, TVNL(Guest)	Joined	5/13/2021, 10:32:42 AM
Ankur Kumar, Powergrid (Guest)	Joined	5/13/2021, 10:32:49 AM
Sukdev, Powergrid (Guest)	Joined	5/13/2021, 10:32:53 AM
Ashish kumar (Guest)	Joined	5/13/2021, 10:32:57 AM
Pallavi Kansal, TPTL	Joined	5/13/2021, 10:32:58 AM
Prachi Gupta, SLDC Bihar	Joined	5/13/2021, 10:33:44 AM
SHASHIKANT VERMA (Guest)	Joined	5/13/2021, 10:35:02 AM
GM CRITL, JUSNL	Joined	5/13/2021, 10:35:09 AM
vibha Singh (Guest)	Joined	5/13/2021, 10:35:14 AM
DEEPAK THAKUR , AEE/BSPTCL (Guest)	Joined	5/13/2021, 10:35:29 AM
Rakesh Ranjan (Guest)	Joined	5/13/2021, 10:36:08 AM
Ch Mohan Rao,PGCIL, Odisha (Guest)	Joined	5/13/2021, 10:36:15 AM
shadab hasan (Guest)	Joined	5/13/2021, 10:36:16 AM
Rupa kumari (Guest)	Joined	5/13/2021, 10:36:50 AM
A SHUKLA,MANAGER CRITL JUSNL (Guest)	Joined	5/13/2021, 10:37:25 AM
SLDC ODISHA (Guest)	Joined	5/13/2021, 10:37:27 AM
prabhat k (TPTL)	Joined	5/13/2021, 10:37:31 AM
Saurav Kumar Sahay ERLDC (Guest)	Joined	5/13/2021, 10:37:45 AM
Yamana Ayyappa	Joined	5/13/2021, 10:38:21 AM
CRITL (Guest)	Joined	5/13/2021, 10:38:32 AM
Rajiv Ranjan (Guest)	Joined	5/13/2021, 10:38:42 AM
Dharm Das Murmu, JE, CRITL, JUSNL (Guest)	Joined	5/13/2021, 10:38:53 AM
Varun Vineet, EEE/ CRITL/BSPTCL (Guest)	Joined	5/13/2021, 10:39:43 AM
Sudeep Kumar, POWERGRID ER1 (Guest)	Joined	5/13/2021, 10:40:10 AM
Debdas Mukherjee Manager WBPDCL (Guest)	Joined	5/13/2021, 10:40:32 AM
Deepak Kumar Singh (Guest)	Joined	5/13/2021, 10:40:52 AM
MS ERPC (Guest)	Joined	5/13/2021, 10:41:00 AM
Dilip kant Jha (Guest)	Joined	5/13/2021, 10:41:03 AM
Godda GSS (Guest)	Joined	5/13/2021, 10:41:45 AM
ele.cpkpatra@optcl.co.in (Guest)	Joined	5/13/2021, 10:42:35 AM
\D K Singh (Guest)\""	Joined	5/13/2021, 10:42:50 AM
SANJEEV KUMAR (Guest)	Joined	5/13/2021, 10:43:02 AM
kundan Kumar (Guest)	Joined	5/13/2021, 10:43:34 AM

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: 08-04-2021/1 **दिनांक: 08-04-2021**

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

Summary of the event (घटना का सारांश):

On 8th April 2021 at 17:39 hrs, 220 kV Daltongunj – Garwah circuit 2 tripped on B phase to earth fault. At 17:43 Hrs, 220 kV Daltongunj – Garwah circuit 1 also got tripped on B phase to earth fault with same relay indication as of ckt-2. As a result, the 220/132 kV Garwah substation (JUSNL) got blackout as it was being radially fed from the 400/220/132 kV Daltongunj (PG) substation through this D/C transmission line. This had led to around 40 MW load loss occurred at Garwah (Traction load of 15 MW and Domestic load of 25 MW).

- **Date / Time of disturbance:** 08-04-2021 at 17:43 hrs.
- **Event type:** GD - 1
- **Systems/ Subsystems affected:** 220/132 kV Garwah S/S
- **Load and Generation loss**.
  - 45 MW load loss occurred event (Traction load of 15 MW and Domestic load of 25 MW)
  - No generation loss occurred during the event.

Major elements tripped (प्रमुख ट्रिपिंग):

- 220 kV Daltongunj – Garwah - 1
- 220 kV Daltongunj – Garwah - 2

Network across the affected area (प्रभावित क्षेत्र का नक्शा)

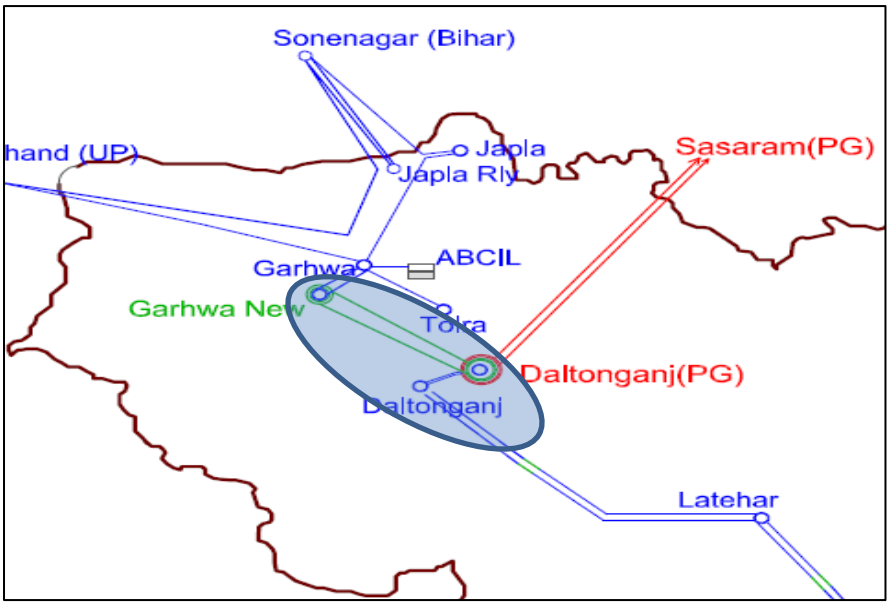


Figure 1: Network across the affected area

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

समय	नाम	उप केंद्र 1 रिले संकेत	उप केंद्र 2 रिले संकेत	पीएमयू पर्यवेक्षण
17:39 Hrs	220 kV Daltongunj – Garwah - 2	B-N , FD: 12.7 Km, FC: 3.8KA. Zone 1, Fault clearance 800 ms, DEF trip, DT sent	Yet to be received	B phase high resistive earth fault with delayed clearance of more than 1 second.
17:43 Hrs	220 kV Daltongunj – Garwah - 1	DALTONGUNJ END: B-N FAULT, FD: 13.2KM, FC: 2.26 KA	GARWAH END: Z-1, B-N FAULT, FC:- 1.4kA, FD:- 83.710km	A/R successful after 1 second again fault appeared in reclaim time and line got tripped.

Figure 2: Three phase 400 kV bus voltage captured at 765/400 kV Sasaram S/S for both events.

Restoration (पूर्वावस्था की प्रप्ति)

- 220 kV Daltongunj – Garwah – 1 was restored at 19:59 hrs.
- 220 kV Daltongunj – Garwah – 2 was restored at 19:57 hrs.
- Traction load and 33 kV supply load were normalised at 19:57 hrs and 15:48 hrs respectively through another source.

Analysis of the event (घटना का विश्लेषण):

- At 17:39 hrs 220 kV Daltongunj – Garwah circuit 2 observed a high resistive nature of B-Earth fault. During the fault, increasing nature of current was observed for 800 ms which was sensed as DEF fault first. The relay at the Daltongunj end for the circuit issued the tripping command through directional earth fault (DEF) protection causing 3 phase tripping. Before clearance, it was also sensed by the distance protection at the Daltongunj end relay in zone 1 when the current increased to a sufficiently higher value.
- The line voltage of circuit 2 observed from the Daltongunj end relay indicates that the circuit has tripped from both ends at the same time. With DEF operation, the Daltongunj end relay has also sent a direct trip (DT) command to Garwah end which may have caused the tripping. Garwah' s end relay indication is not shared by JUSNL.
- At 17:43 Hrs, 220 kV Daltongunj – Garwah circuit 1 also observed the B phase to earth fault.
    - **Daltongunj Relay:** The fault was resistive in nature however voltage drop was significantly high. Due to this, the fault had immediately got detected under distance protection zone 1. With this, from the Daltongunj end relay, the B phase got tripped and the A/R cycle started in the relay. After 1 second, Daltongunj end attempted A/R which was successful however fault appeared in the next 500 ms in reclaim time. This then led to the issuance of three phase trip by the relay in distance protection zone 1. The circuit during the A/R cycle had not tripped from Garwah's end so, the voltage in the B phase has not become zero due to persistent nature fault. This is evident from DRs attached to the annexure.
    - **Garwah End:** While at Garwah end as there was no source to feed the fault and the current observed in the faulty phase was basically due to system imbalance and ground path formation from the fault causing the contribution from the healthy phase current. Being far away location from the fault (fault located away from Garwah 86 km and near to Daltongunj 13 km) the imbalance current in faulty phase was low and thus fault was not being detected in any of distance zones and DEF range. So, the circuit did not trip from Garwah's end.
- As a result of both circuits tripping one after another, the 220/132 kV Garwah substation (JUSNL) got blackout at 17:43 hrs as it was being radially fed from the 400/220/132 kV Daltongunj (PG) substation through these circuits. This had led to around 40 MW load loss occurred at Garwah (Traction load of 15 MW and Domestic load of 25 MW).
- Fault signature analysis as per past event records and this event are indicating the issue of ROW clearance and sag issues for these circuits.

Operational issues Observed (प्रचालन समस्या):

- 220 kV Daltonganj -Garwa D/C have been tripping frequently with the same nature of fault. The outage of one of these circuits reduces the reliability of 220/132 kV Garwa substation. While the outage of double circuits results in grid disturbance (GD event as per CEA Standards 2010) causing a load loss at 220/132 kV Garwa substation as it is being fed radially via D/C.
- In 101st PCC held in March 2021, trippings of these circuits were discussed in detail. In the meeting, it was explained by ERLDC that fault signatures obtained from DR are indicating clearance and sag

issues in these circuits. During the meeting, the JUSNL representative stated that at multiple locations bamboo trees are coming in the induction zone of lines causing faults and burnt bamboo trees were found as evidence. In addition, it was informed by JUSNL that at one location sag issue has also been identified.

- **Because of the above, JUSNL is advised to take all corrective actions to reduce such repeated tripping incidents to ensure a reliable power supply. JUSNL may advise concerned officials in the field and substations to take prompt preventive measures after the identification of issues for improving the availability of the lines. Timely actions from the JUSNL end are desired for ensuring the reliability and security of the grid.**

Protection issues observed (सुरक्षा समस्या):

- At 17:39 Hrs ckt-2 had already tripped due to fault. At 17:43 Hrs for the fault in ckt-1, the Garwa end relay did not pick any protection as it was being radially fed via a single circuit. This is evident from DR. Thus the fault was not completely isolated from the system. So for such cases in case of single line tripping and with the availability of only one radial source**, Week infeed protection needs to be enabled at Garwa end to avoid non-opening or delayed opening of breakers. Kindly confirm regarding week infeed protection with circuit breaker logic for the other parallel circuit**. Please refer to DR as attached in the annexure**. (JUSNL to update).**
- A/R operating and becoming unsuccessful at each tripping indicating the permanent nature of fault occurring due to tree encroachments, clearance issues and sag issues.

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

Issues	Regulation Non-Compliance	Utility
SCADA data Non-Availability for the station	1. IEGC 4.6.2 Data and Communication Facilities 2. IEGC 5.2.q	JUSNL

Status of Reporting (रिपोर्टिंग की स्थिति):

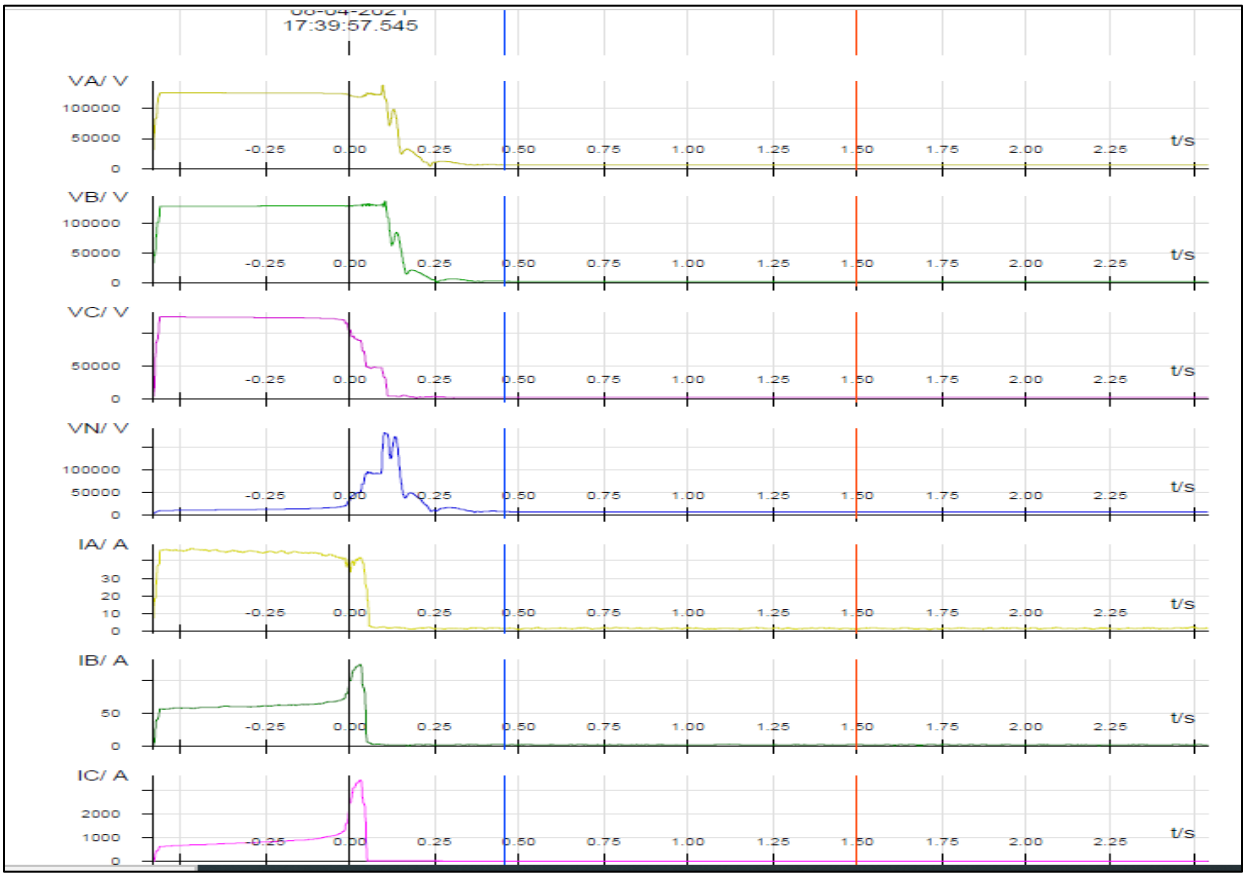
- DR/EL received from POWERGRID-ER-1 (Daltonganj end)
- DR/EL for Circuit 2 which tripped at 17:39 Hrs has not been received from JUSNL end

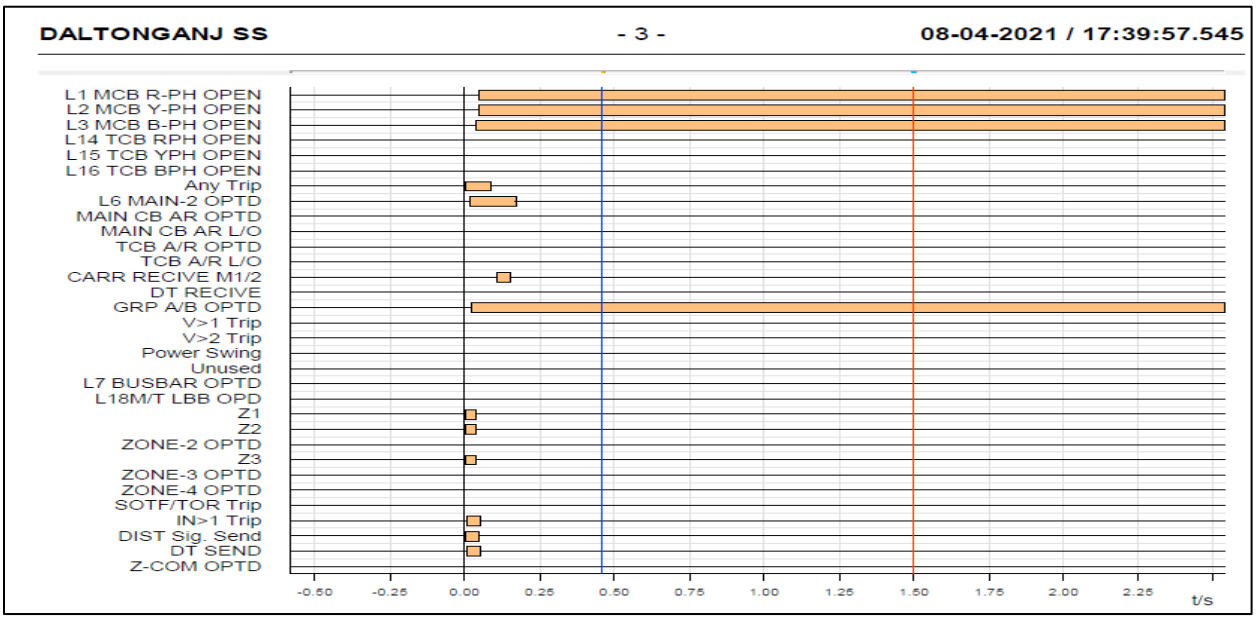
Annexure 1: Sequence of events recorded at ERLDC SCADA data at the time of both the events.

TIME	MILLI_SEC	STATION	DESCRIPTION	STATUS
04-08-2021 17:39	563	DALTN_PG	220_GARHWA_1_MP2	Operated
04-08-2021 17:39	583	DALTN_PG	220_GARHWA_1_CB	Open
04-08-2021 17:39	714	DALTN_PG	220_GARHWA_1_MP2	Normal
04-08-2021 17:42	365	DALTN_PG	220_GARHWA_2_CB	Travel
04-08-2021 17:43	444	DALTN_PG	220_GARHWA_2_CB	Closed
04-08-2021 17:43	902	DALTN_PG	220_GARHWA_2_CB	Open

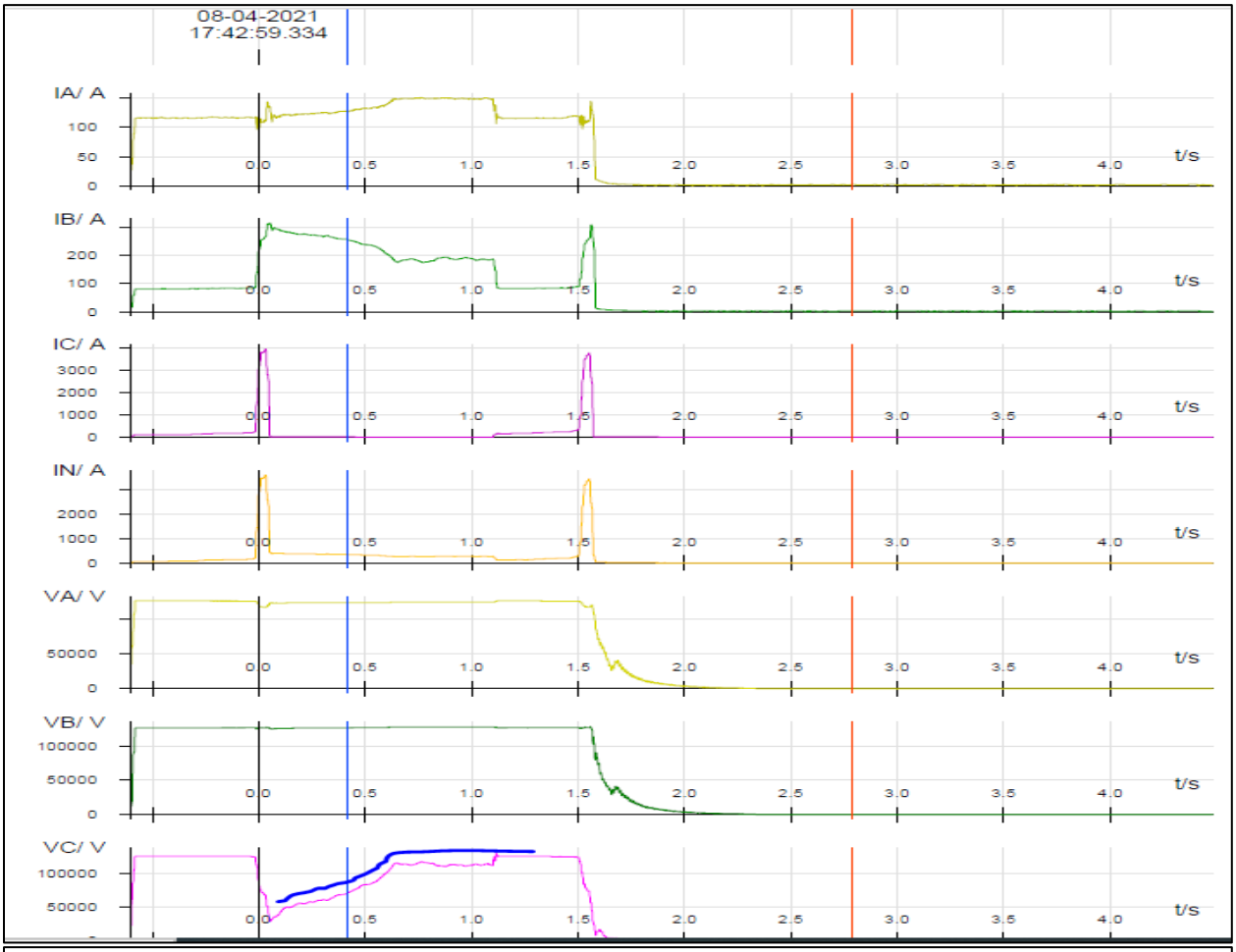
Annexure 2:

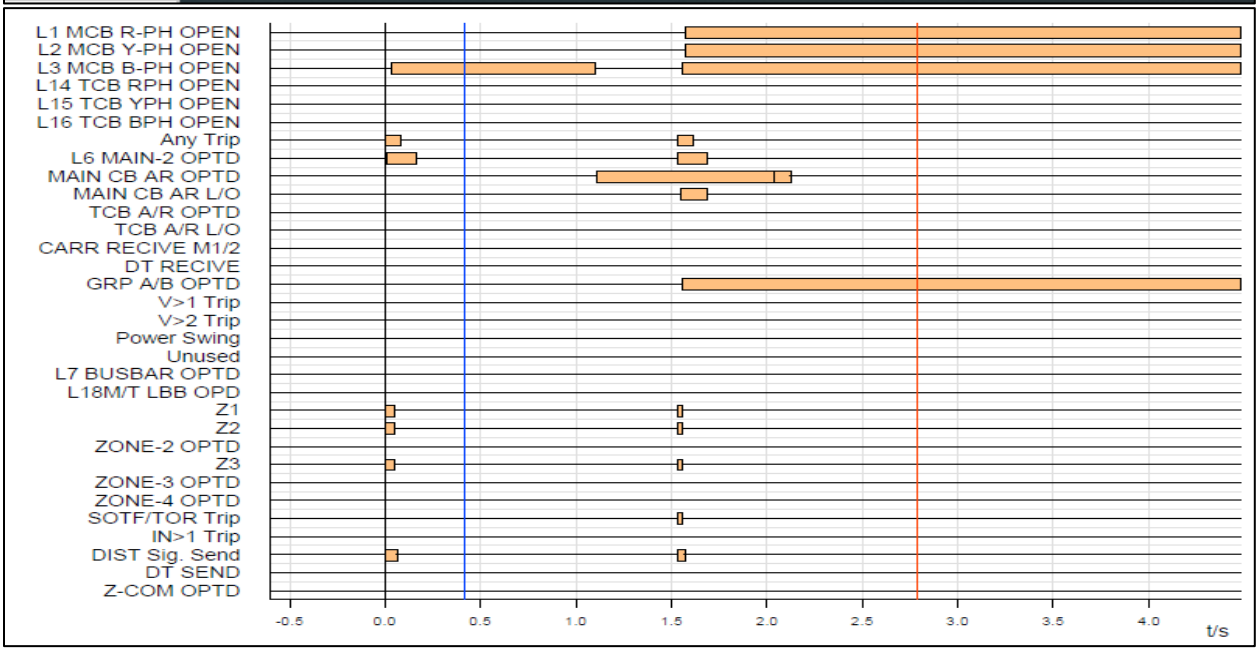
1. **DR received at Daltongunj end for tripping of Daltongunj-Garwah -2 at 17:39 Hrs.**



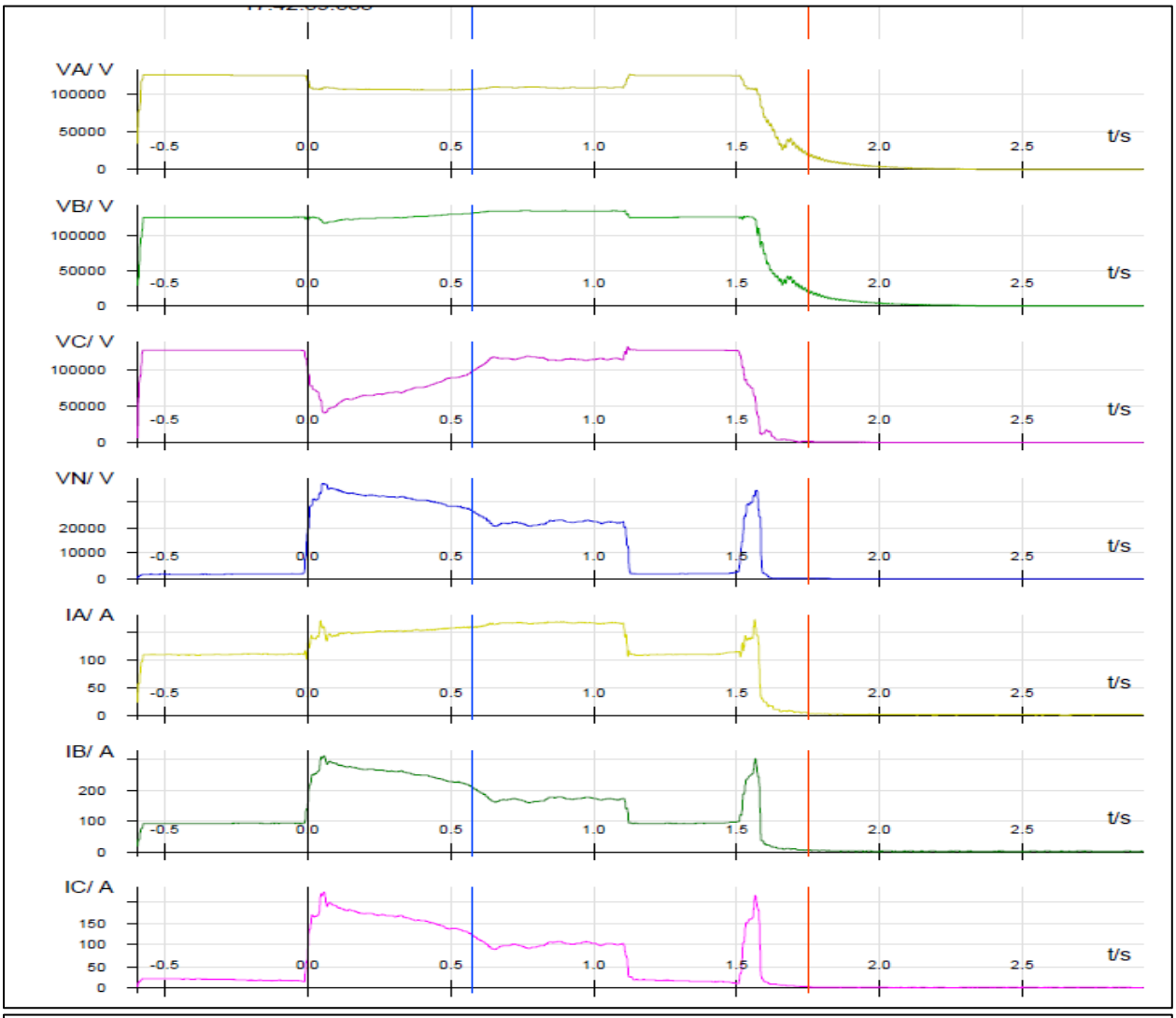


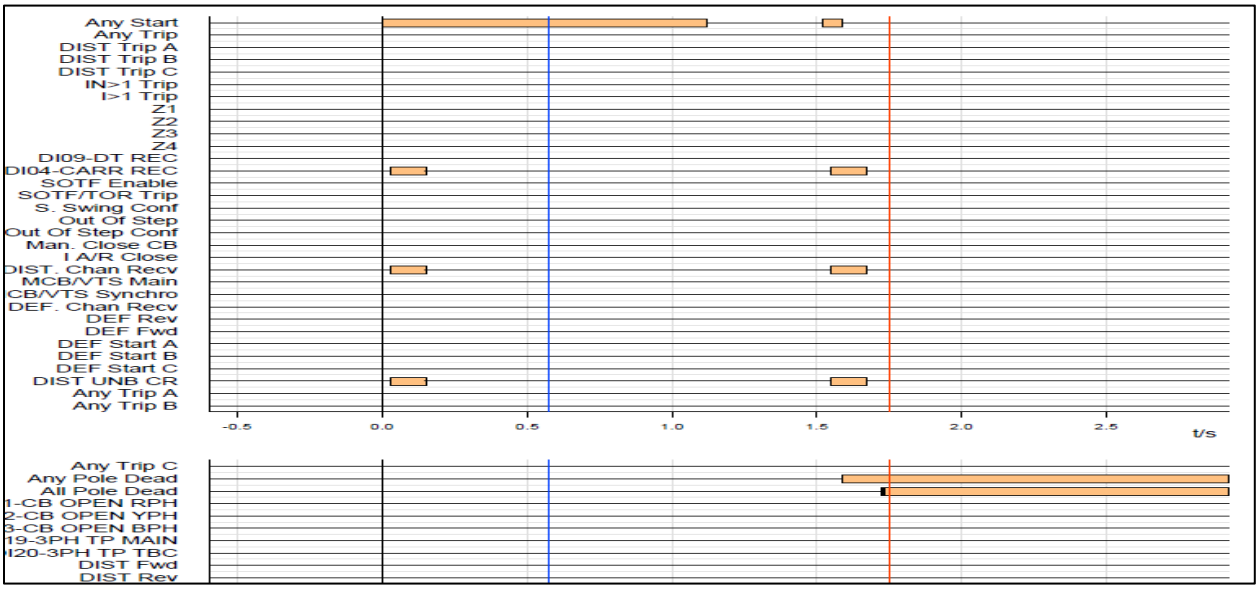
2. **DR received at Daltongunj end for tripping of Daltongunj-Garwah -1 at 17:43 Hrs.**





3. DR received at Garwah end for tripping of Daltongunj-Garwah -1 at 17:43 Hrs.





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: **29-04-2021/1** दिनांक: **29-04-2021**

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

Summary of the event (घटना का सारांश):

On 29th April 2021 at 22:00 Hrs, 220 kV Daltonganj-Garwah (New)-2 tripped on B phase to earth fault while at 22:37 Hrs, 220 KV Daltonganj-Garwah (New)-2 tripped on R-Y-Earth fault. This led to total power failure at 220/132 Garwah at around 22:37 Hrs and around 20 MW load loss occurred (including 15 MW traction loss of Garwah). During the event, Inclement weather was reported around Garwah (New) S/s.

- **Event type:** GD - 1
- **Systems/ Subsystems affected:** 220 kV Garwah S/S
- **Load and Generation loss**.
  - No generation loss occurred during the event.
  - 20MW load loss occurred event(Traction load of 15 MW)

Major elements tripped (प्रमुख ट्रिपिंग):

- 220 kV Daltongunj – Garwah (New) 1
- 220 kV Daltongunj – Garwah (New) 2

Network across the affected area (प्रभावित क्षेत्र का नक्शा)

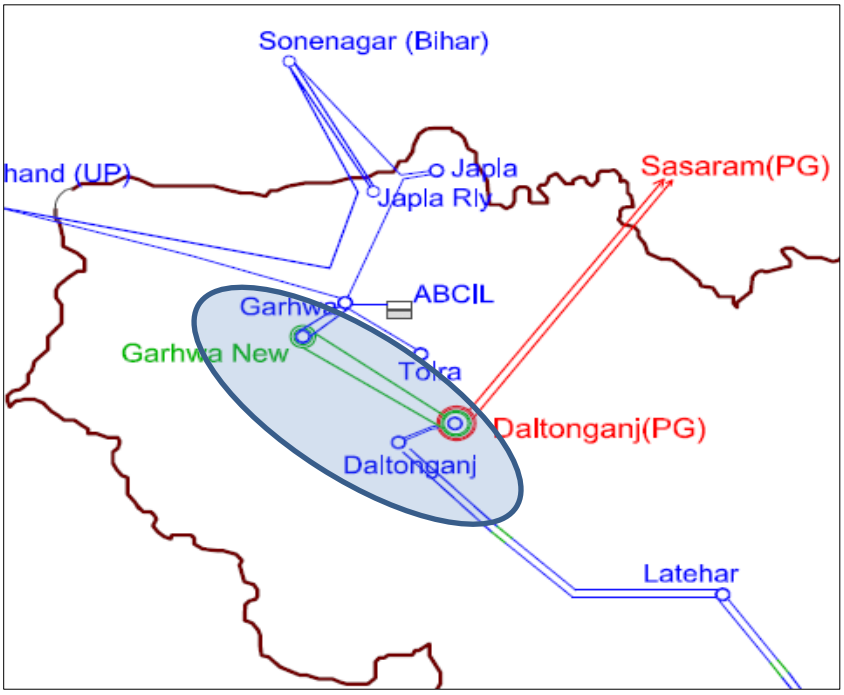


Figure 1: Network across the affected area

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

समय	नाम	उप केंद्र 1 रिले संकेत	उप केंद्र 2 रिले संकेत	पीएमयू पर्यवेक्षण
22:00	220 kV Daltongunj-Garwah (New)-1	Fault, B-N, FD -93Km, FC - 4.8kA.	Fault B-N, FD - 0.766 km, FC - 2.01kA	Fault clearance time200 msec. A/R successful then again unsuccessful.
22:37	220 kV-Daltongunj-Garwah (New)2	Daltongunj end: B-N fault- R-Y, Fc - Ir-2.331kA, Iy-2.33kA,FD - 61km , FD: 33km, Fc: 2.26 kA	Fault R-Y, Z1. FD - 6.7 km	Fault clearance time200 msec.

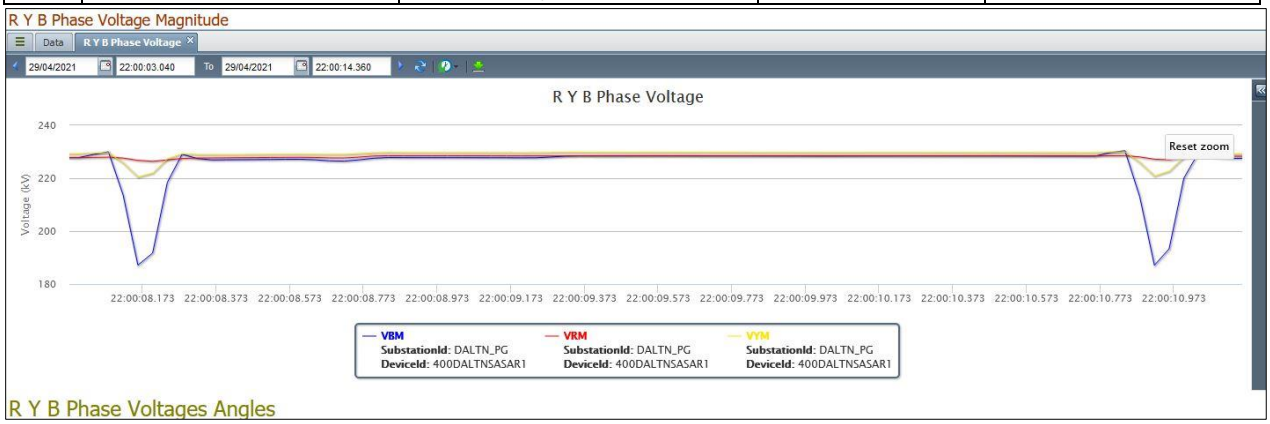


Figure 2: Three phase bus voltage captured at 400 kV Daltongunj S/S at 22:00 hrs during tripping of 220 kV Daltongunj-Garwah (New) 1

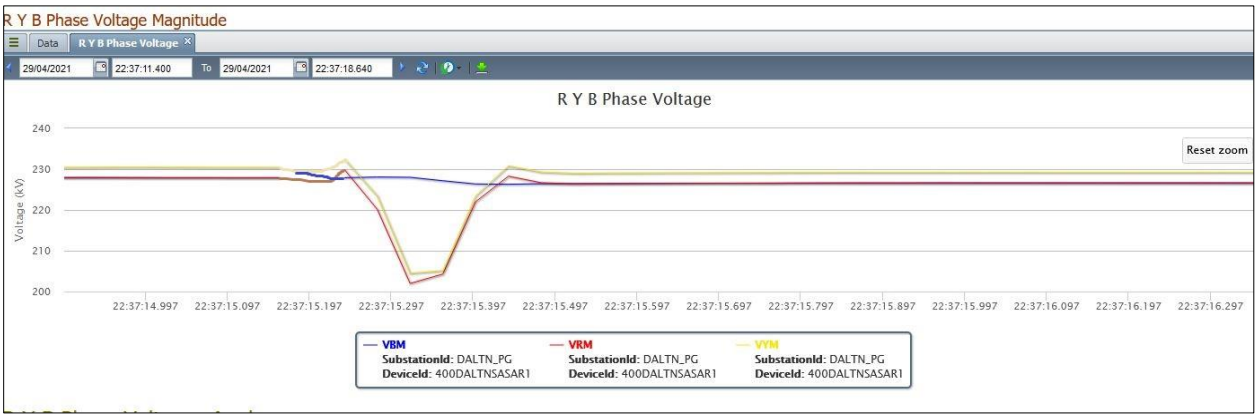


Figure 3: Three phase bus voltage captured at 400 kV Daltongunj S/S at 22:37 hrs during tripping of 220 kV Daltongunj-Garwah (New) 2

Restoration (पूर्वावस्था की प्रप्ति)

- 220 kV-Daltongunj-Garwah (New)-1 was restored at 23:49 hrs and loads were restored immediately.
- 220 kV- Daltongunj-Garwah (NEW)-2 was restored at 00:10 hrs on 30/4/2021.

Analysis of the event (घटना का विश्लेषण):

- Due to bad weather conditions, at 22:00 hrs 220 kV Daltongunj-Garwah (New) 1 circuit got tripped on B-Earth fault. The circuit first successfully reclosed however within reclaim time fault reappeared.
- At 22:37 Hrs, 220 kV Daltonganj-Garwah (New) 2 also got tripped on R-Y-Earth fault leading to power failure at 220/132 Garwah (New) S/s and blackout.
- During the event, a total of around 20 MW load loss had occurred (including 15 MW traction loss of Garwah).
- Fault signature analysis as per records and this incident also indicating clearance and sag issues in these circuits.

Operational issues Observed (प्रचालन समस्या):

- 220 kV Daltonganj -Garwah D/C is tripping frequently with the same nature of the fault. The outage of one of the circuits reduces the reliability of 220/132 kV Garwah substation and the outage of double circuits results in grid disturbance (GD event as per CEA Standards 2010) causing a load loss at 220/132 kV Garwah substation as it is being fed radially via D/C.
- In 101st PCC meeting held in March 2021, tripping of these circuits was discussed in detail. In the meeting, it was explained by ERLDC that fault signatures obtained from DR are indicating clearance and sag issues in these circuits. During the meeting, JUSNL representative stated that at multiple locations bamboo trees are coming in the induction zone of lines causing faults and burnt bamboo trees were found. In addition, it was informed that at one location sag issue has also been identified.
- Given the above, JUSNL is advised to take all corrective actions to reduce such repeated tripping incidents to ensure a reliable power supply. JUSNL may advise concerned officials in the field and substations to take prompt preventive measures after the identification of issues for improving the availability of the lines. The timely actions from your end are desired for ensuring the reliability and security of the grid.

Protection issues observed (सुरक्षा समस्या):

- A/R operating and becoming unsuccessful at each event also showing the permanent nature of fault occurring due to tree encroachments, clearance issues and sag issues.

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

Issues	Regulation Non-Compliance	Utility
SCADA data Non-Availability for the station	1. IEGC 4.6.2 Data and Communication Facilities 2. IEGC 5.2.q	JUSNL (Garwa SOE)

Status of Reporting (रिपोर्टिंग की स्थिति):

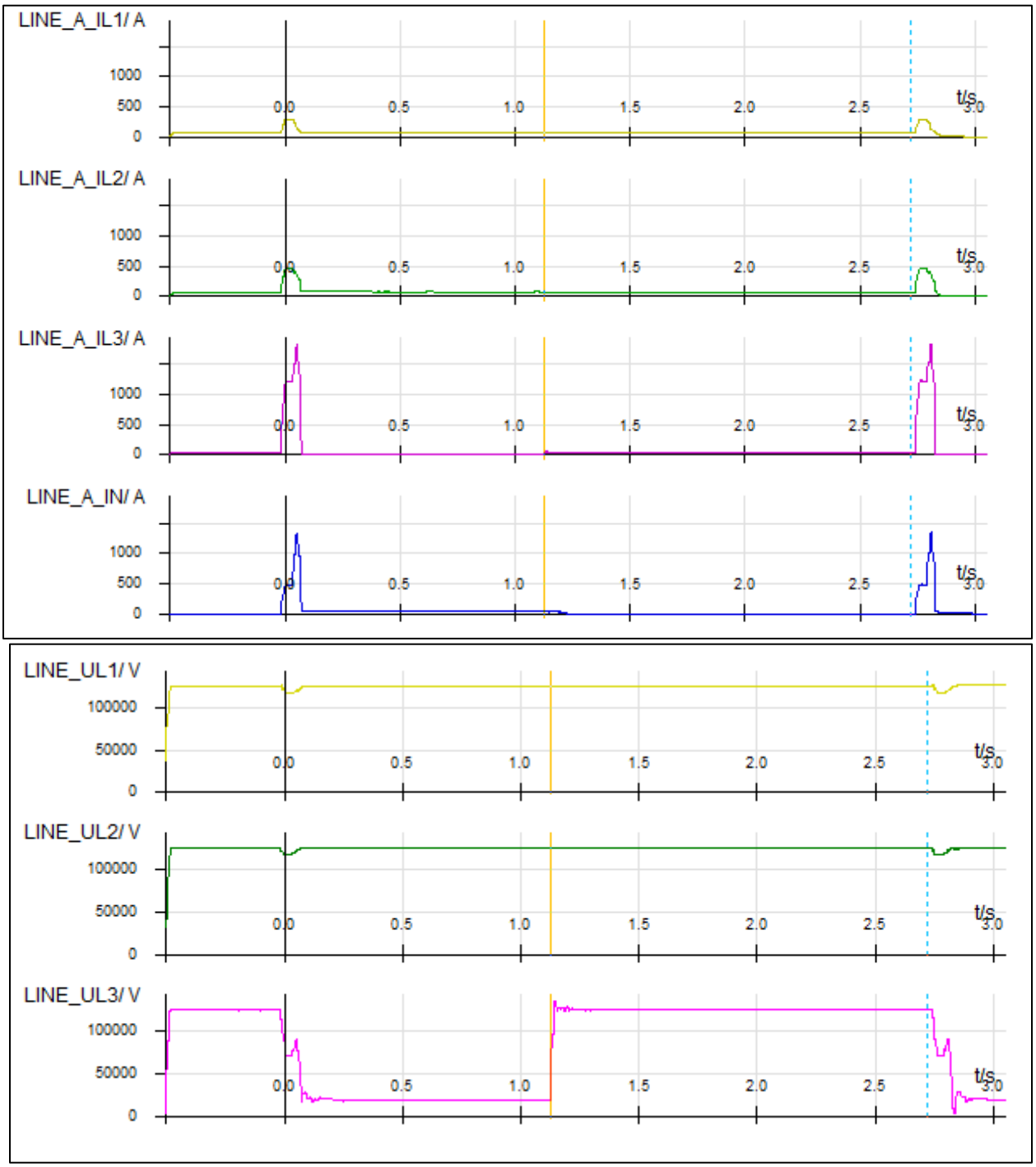
- DR/EL received from POWERGRID-ER-1 (Daltonganj end).
- DR/ER not yet received from JUSNL end for 22:37 hrs event i.e. 220 kV Daltonganj-Garwah (New) 2

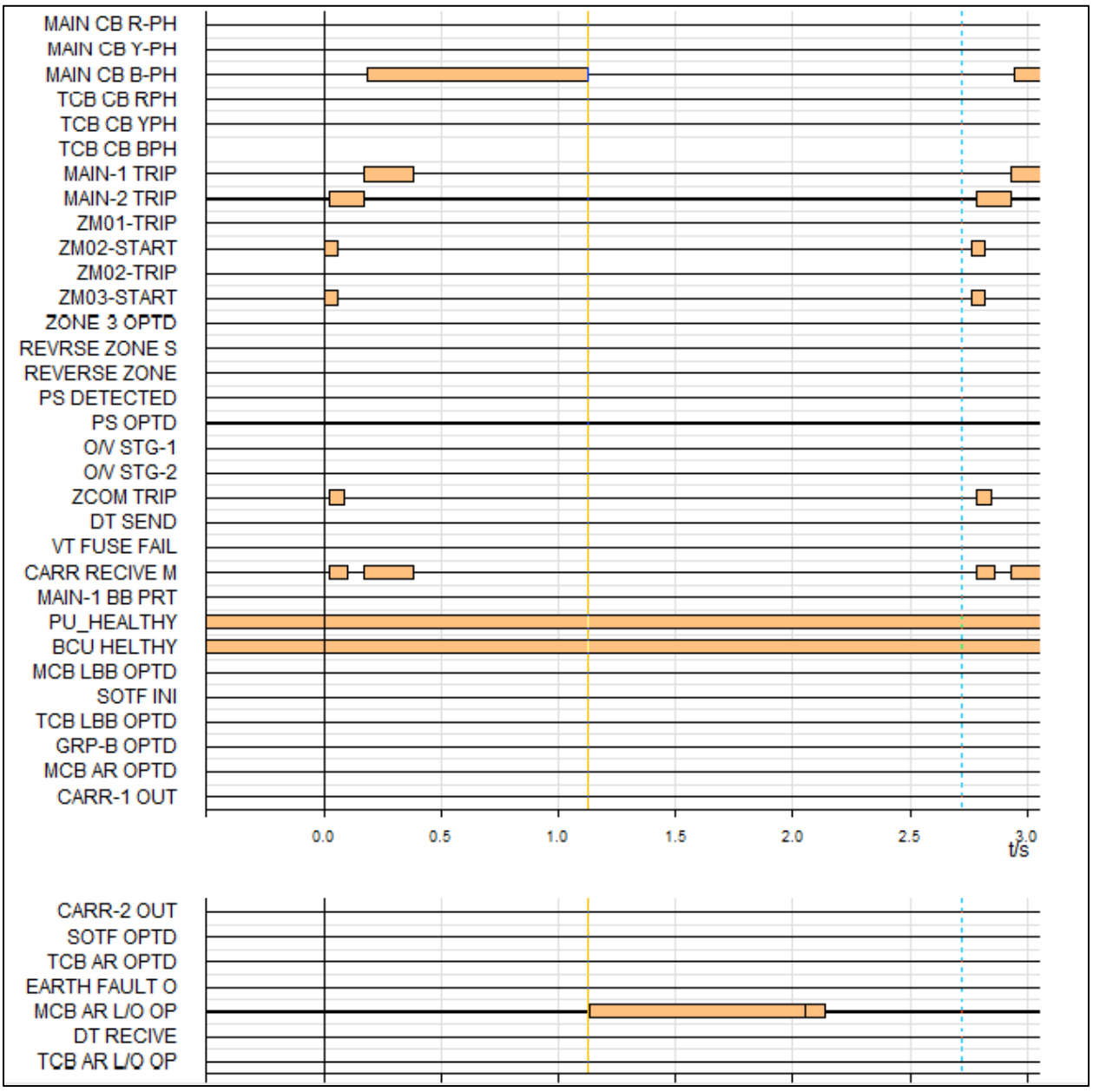
Annexure 1: Sequence of events recorded at ERLDC SCADA data at the time of the event.

TIME	MILLI_SEC	STATION	DESCRIPTION	STATUS
22:00:08	195	DALTN_PG	220_GARHWA_1_MP2	Operated
22:00:08	212	DALTN_PG	220_GARHWA_1_CB	Travel
22:00:08	345	DALTN_PG	220_GARHWA_1_MP2	Normal
22:00:09	289	DALTN_PG	220_GARHWA_1_CB	Closed
22:00:10	955	DALTN_PG	220_GARHWA_1_MP2	Operated
22:00:10	990	DALTN_PG	220_GARHWA_1_CB	Open
22:00:11	105	DALTN_PG	220_GARHWA_1_MP2	Normal
22:37:15	361	DALTN_PG	220_GARHWA_2_CB	Open
23:49:37	978	DALTN_PG	220_GARHWA_1_CB	Closed

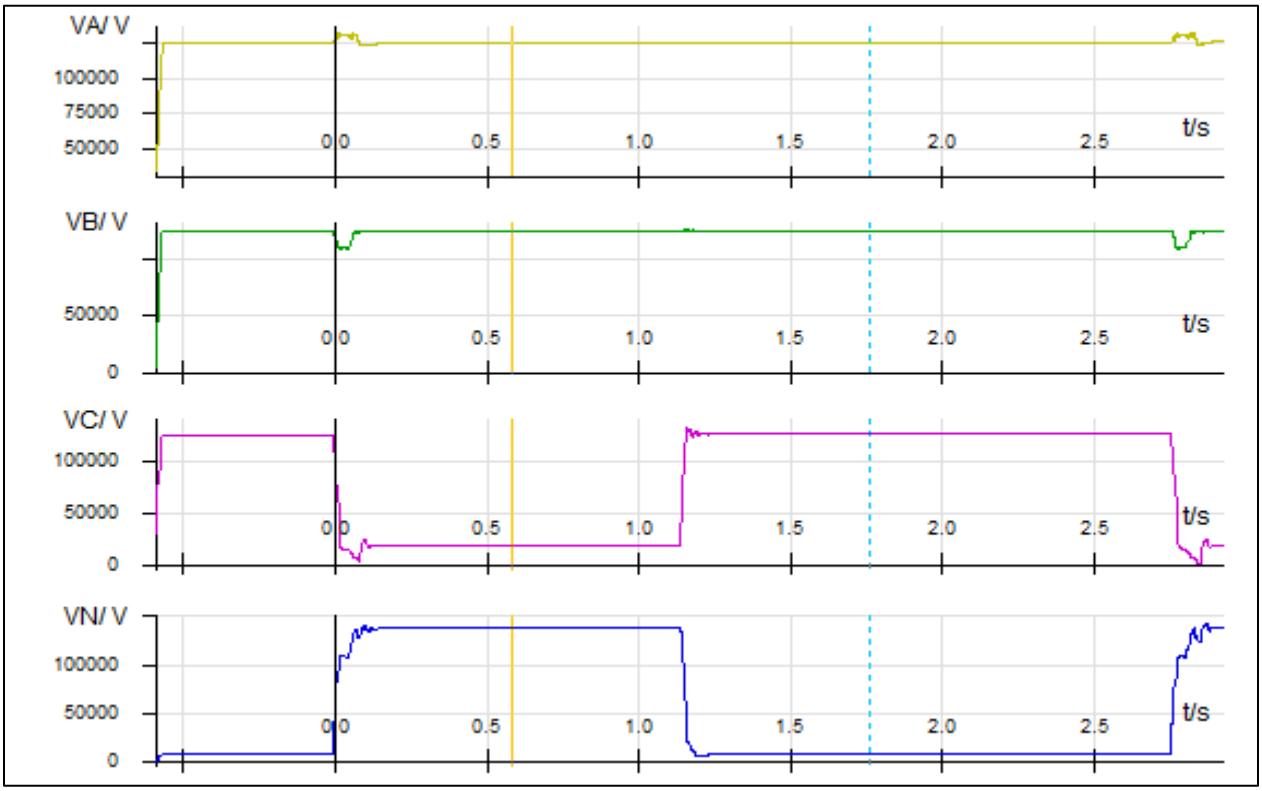
Annexure 2:

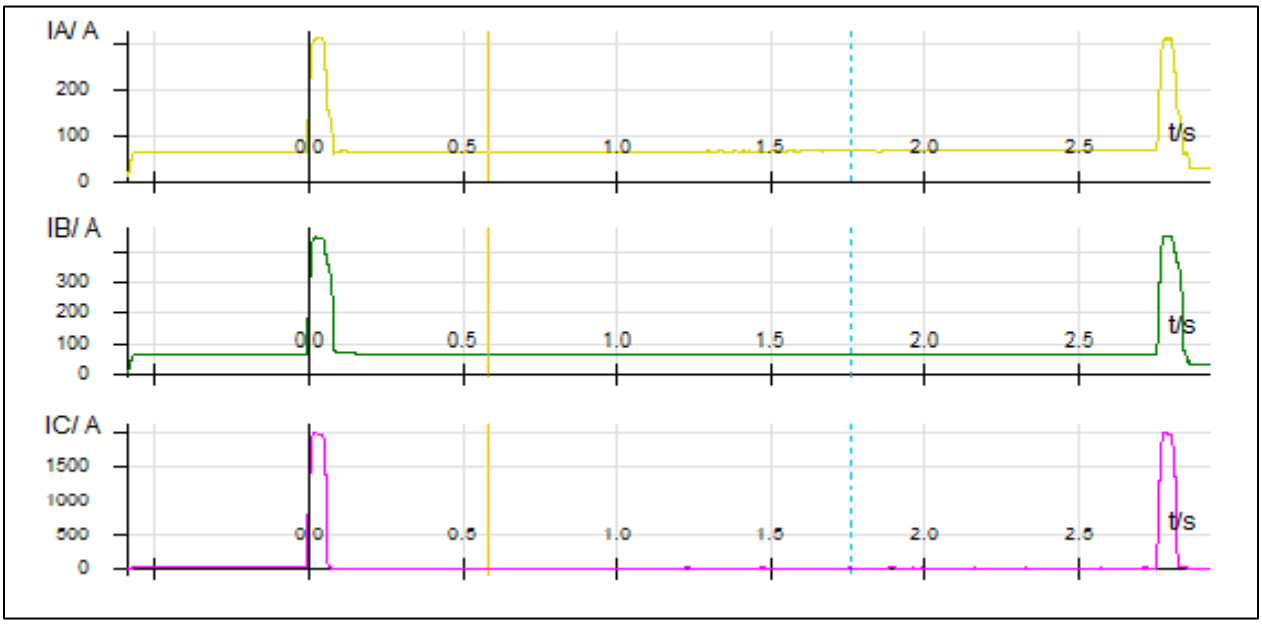
1. **DR received at Daltongunj end for tripping of Daltongunj-Garwah ckt-1 at 22:00Hrs.**

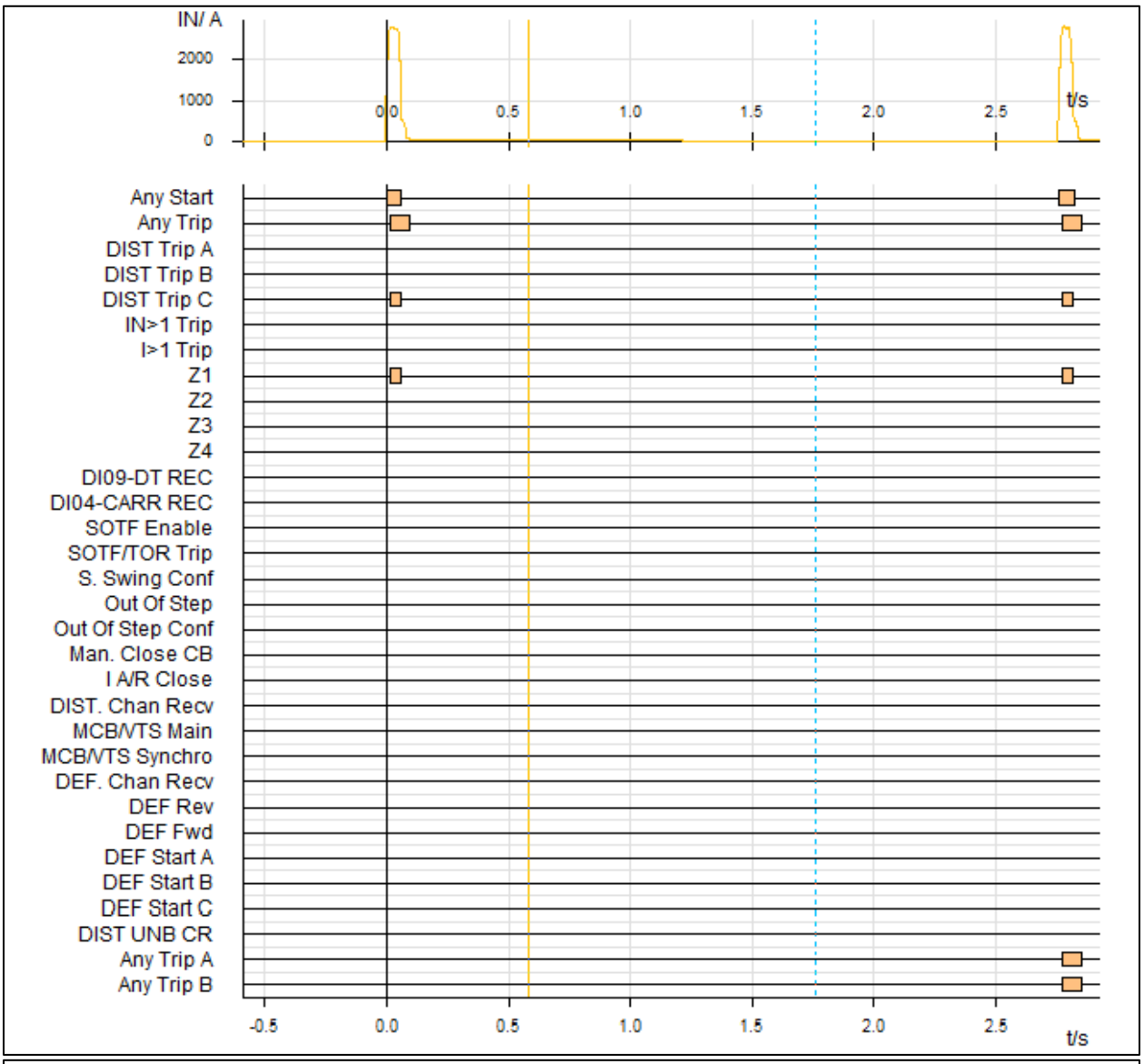


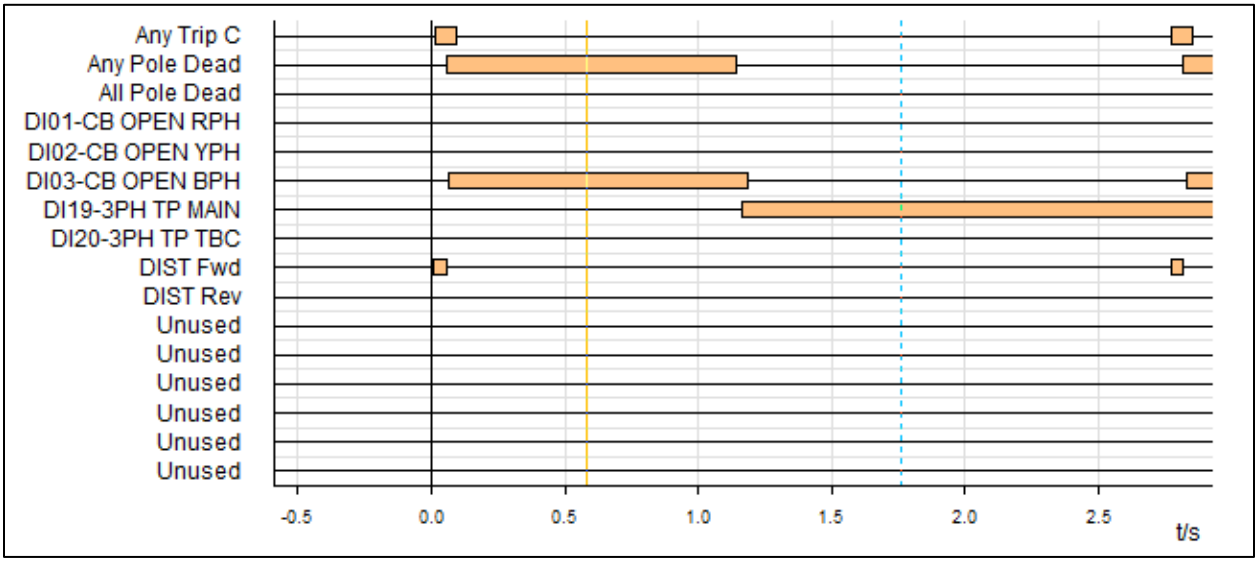

MAIN CB R-PH
MAIN CB Y-PH
MAIN CB B-PH
TCB CB RPH
TCB CB YPH
TCB CB BPH
MAIN-1 TRIP
MAIN-2 TRIP
ZM01-TRIP
ZM02-START
ZM02-TRIP
ZM03-START
ZONE 3 OPTD
REVRSE ZONE S
REVERSE ZONE
PS DETECTED
PS OPTD
O/V STG-1
O/V STG-2
ZCOM TRIP
DT SEND
VT FUSE FAIL
CARR RECIVE M
MAIN-1 BB PRT
PU_HEALTHY
BCU HELTHY
MCB LBB OPTD
SOTF INI
TCB LBB OPTD
GRP-B OPTD
MCB AR OPTD
CARR-1 OUT
0.0
0.5
1.0
1.5
2.0
2.5
3.0
t/s
CARR-2 OUT
SOTF OPTD
TCB AR OPTD
EARTH FAULT O
MCB AR L/O OP
DT RECIVE
TCB AR L/O OP

2. **DR received at Garwah end for tripping of Daltongunj-Garwah ckt-1 at 22:00Hrs.**

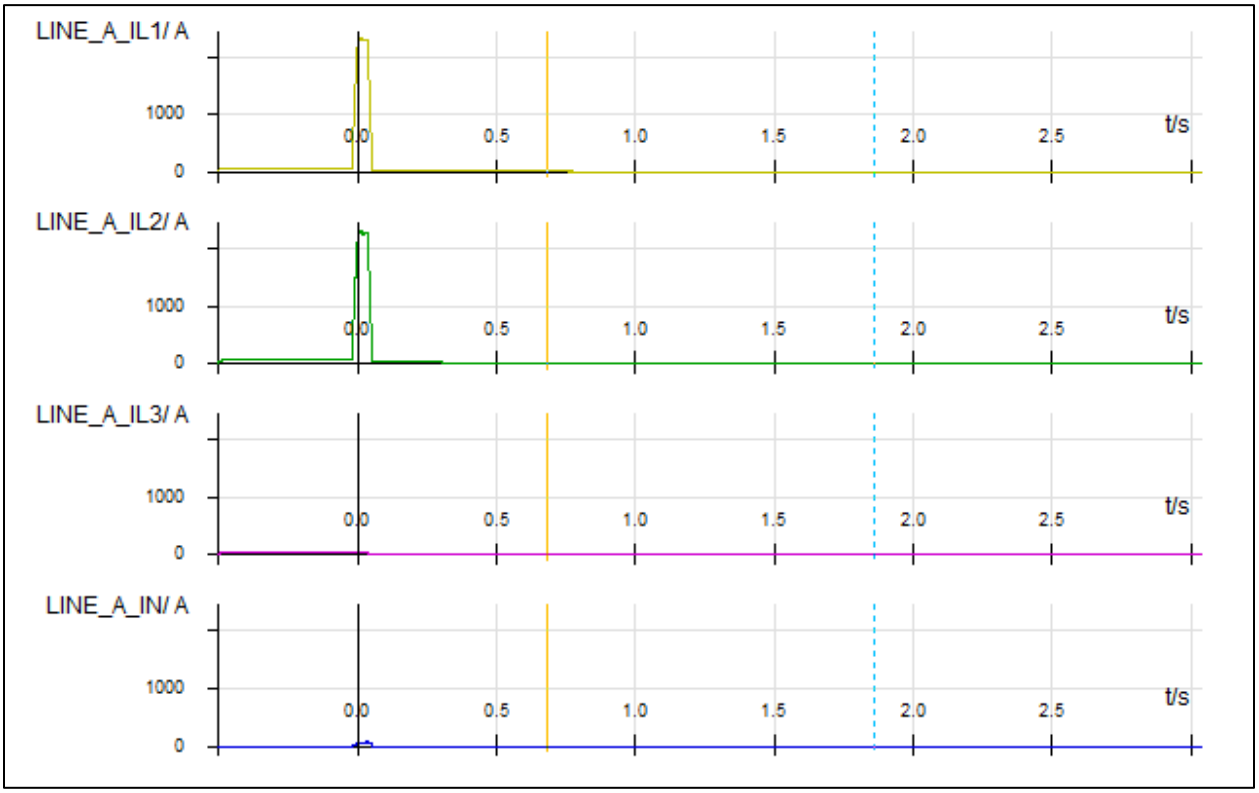


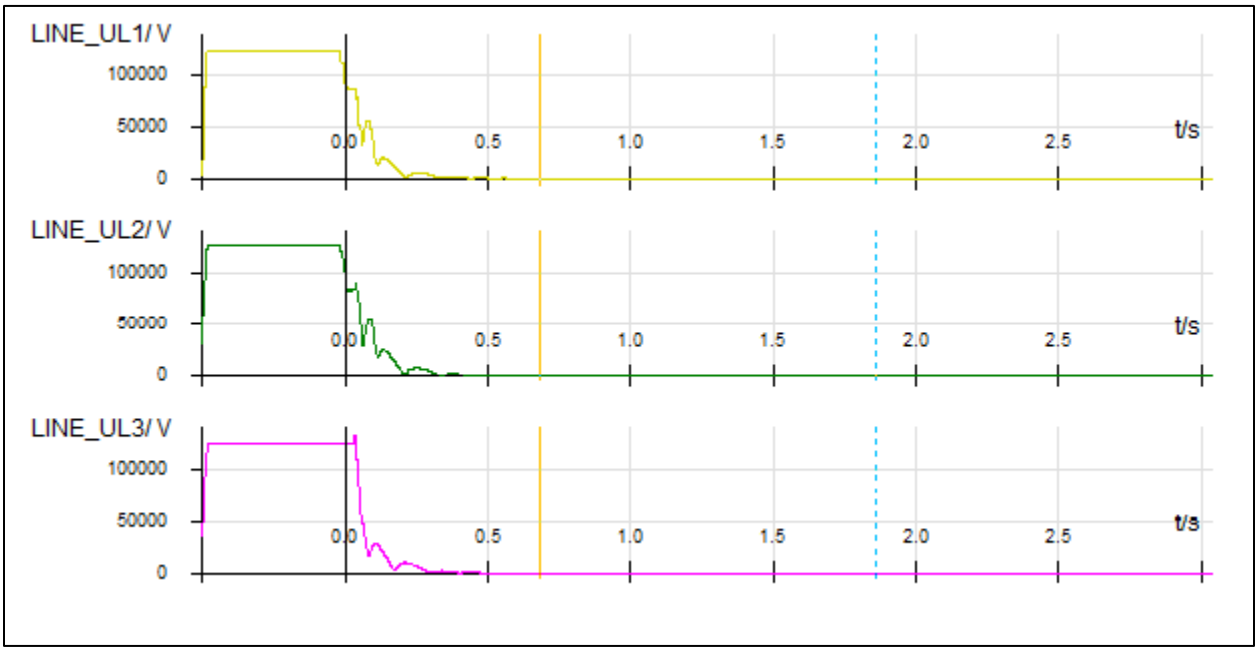


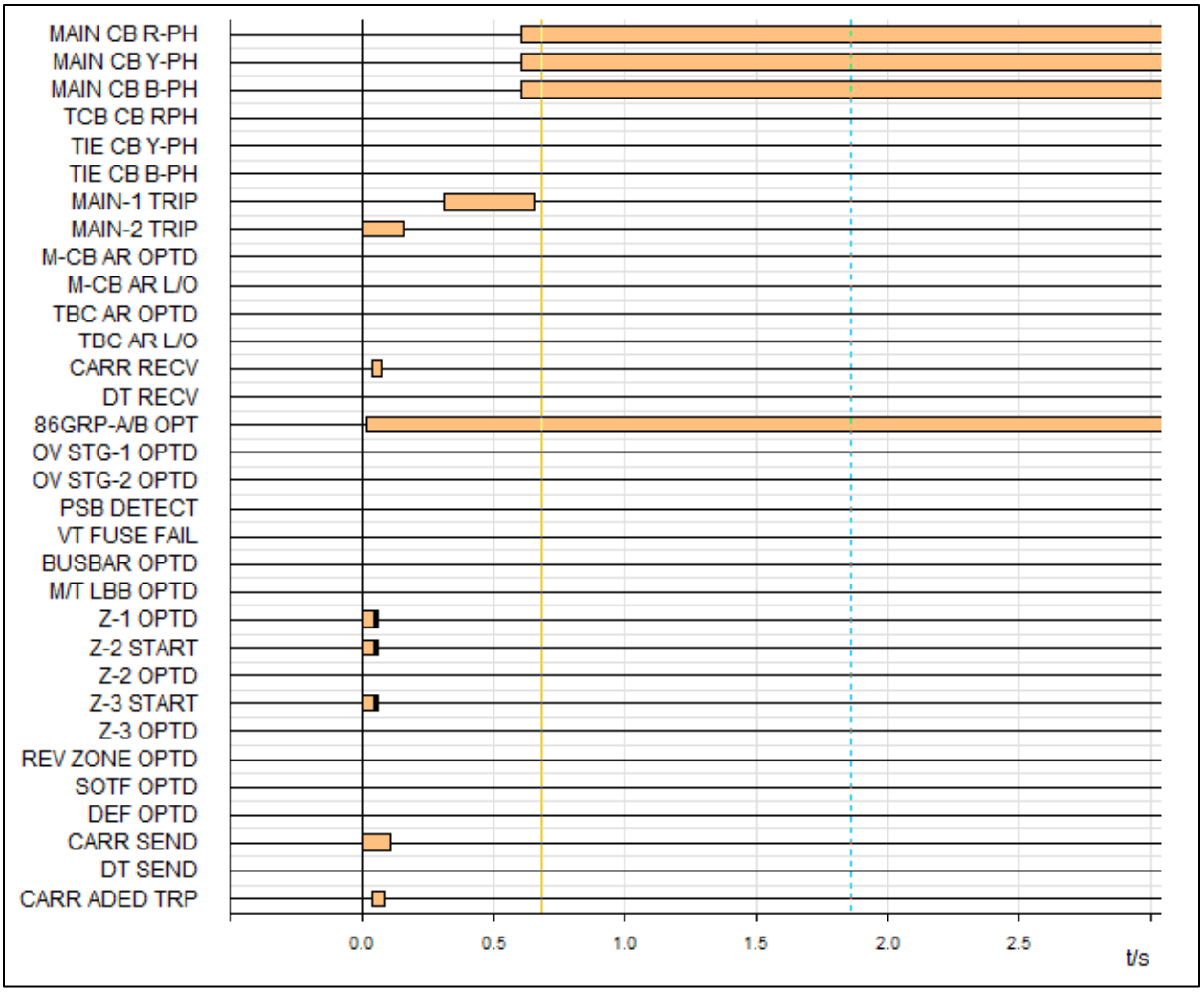

IN/ A
2000
1000
0
0.0
0.5
1.0
1.5
2.0
2.5
t/s
Any Start
Any Trip
DIST Trip A
DIST Trip B
DIST Trip C
IN>1 Trip
I>1 Trip
Z1
Z2
Z3
Z4
DI09-DT REC
DI04-CARR REC
SOTF Enable
SOTF/TOR Trip
S. Swing Conf
Out Of Step
Out Of Step Conf
Man. Close CB
I A/R Close
DIST. Chan Recv
MCB/VTS Main
MCB/VTS Synchro
DEF. Chan Recv
DEF Rev
DEF Fwd
DEF Start A
DEF Start B
DEF Start C
DIST UNB CR
Any Trip A
Any Trip B
-0.5
0.0
0.5
1.0
1.5
2.0
2.5
t/s


Any Trip C
Any Pole Dead
All Pole Dead
DI01-CB OPEN RPH
DI02-CB OPEN YPH
DI03-CB OPEN BPH
DI19-3PH TP MAIN
DI20-3PH TP TBC
DIST Fwd
DIST Rev
Unused
Unused
Unused
Unused
Unused
Unused
-0.5
0.0
0.5
1.0
1.5
2.0
2.5
t/s

3. **DR received at Daltongunj end for tripping of Daltongunj-Garwah ckt-2 at 22:37Hrs.**






MAIN CB R-PH
MAIN CB Y-PH
MAIN CB B-PH
TCB CB RPH
TIE CB Y-PH
TIE CB B-PH
MAIN-1 TRIP
MAIN-2 TRIP
M-CB AR OPTD
M-CB AR L/O
TBC AR OPTD
TDC AR L/O
CARR RECV
DT RECV
86GRP-A/B OPT
OV STG-1 OPTD
OV STG-2 OPTD
PSB DETECT
VT FUSE FAIL
BUSBAR OPTD
M/T LBB OPTD
Z-1 OPTD
Z-2 START
Z-2 OPTD
Z-3 START
Z-3 OPTD
REV ZONE OPTD
SOTF OPTD
DEF OPTD
CARR SEND
DT SEND
CARR ADED TRP
0.0
0.5
1.0
1.5
2.0
2.5
t/s

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: 09-04-2021/1 **दिनांक: 09-04-2021**

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

Summary of the event (घटना का सारांश):

0n 9th April 2021 at 17:47 hrs, 220 kV Rangpo – New Melli circuit S/C tripped from Rangpo end in Zone-1. The fault was not cleared from the New-Melli end. Thus, this same fault was sensed by 220 kV Tashiding –New Melli circuit and this line also got tripped from Tashiding end in zone-3 due to non-clearance of fault from New Melli end. In addition to this circuit, 220 kV Rangpo-Tashiding circuit also had tripped at the same time on R-Y phase fault encroaching for the same fault from Rangpo end in Zone-3. This led to total evacuation system loss for 220 kV Tashiding and Jorethang hydropower stations and their blackout along with 220 kV New Melli substation. As a result, around 36 MW generation loss occurred at Jorethang HEP due to loss of evacuation path. There was no generation at Tashiding during this event. The total delayed clearance of fault was around 800 ms as observed in PMU data. During the event,

- **Date / Time of disturbance:** 09-04-2021 at 17:47 hrs.
- **Event type:** GD - 1
- **Systems/ Subsystems affected:** 220 kV Jorethang S/S, 220 kV Tashiding and New Melli hydropower stations.
- **Load and Generation loss**.
    - Around 36 MW generation loss was reported at Jorethang HEP.
    - No load loss occurred.

Major elements tripped (प्रमुख ट्रिपिंग):

- 220 kV-RANGPO-NEW MELLI-S/C.
- 220 kV-RANGPO-TASHIDING-S/C
- 220 kV- NEW MELLI—TASHIDING S/C.

Network across the affected area (प्रभावित क्षेत्र का नक्शा)

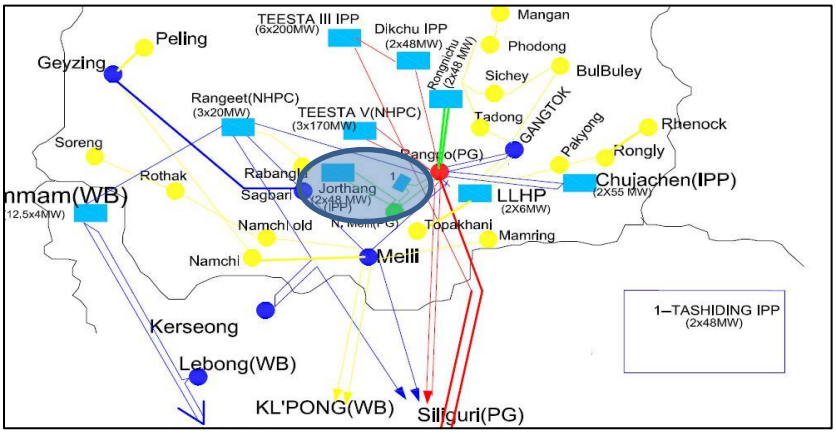


Figure 1: Network across the affected area

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

समय	नाम	उप केंद्र 1 रिले संकेत	उप केंद्र 2 रिले संकेत	पीएमयू पर्यवेक्षण
17:47	220KV-TASHIDING-RANGPO-1	Did not trip	R_Y, Z-3, FD- 85.04 FC= Iy= 422.7A Iy= 407A	Delayed clearance of fault (around 800 ms) has been observed in PMU data
17:47	220KV-New Melli-RANGPO-1	Did not trip	Z1, R-Y,59Mtr, Ir-0.73kA, Iy-10.67kA	Delayed clearance of fault (around 800 ms) has been observed in PMU data
17:47	220KV-New Melli- TASHIDING	Did not trip	Z-3 ,f/c-R&Y2.5Ka as per DR,f/d-160%	Delayed clearance of fault (around 800 ms) has been observed in PMU data

Figure 2: Three phase bus voltage captured at 400 kV Rangpo S/S indicating the fault and its delayed clearance.

Restoration (पूर्वावस्था की प्रप्ति)

- 220 kV-NEW MELLI-TASHIDING-1 restored at 19:06 hrs.
- 220 kV-RANGPO-NEW MELLI-1 restored at 18:57 hrs.

Analysis of the event (घटना का विश्लेषण):

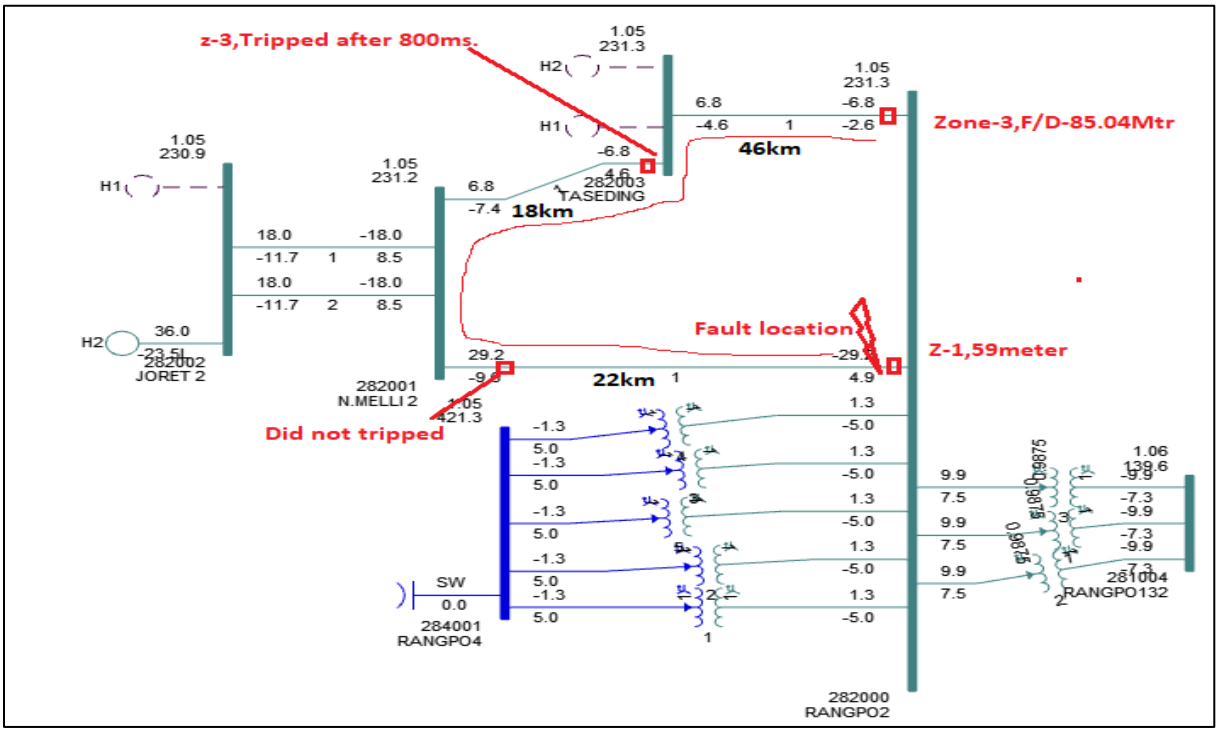


Figure 3: SLD of Affected area

- Before the event, there was no generation at Tashiding and Unit 2 at Jorethang hydropower plant was generating 36 MW.
- There was an R-Y phase to phase fault in the 220 kV Rangpo –New Melli section at a distance of 59 meters from the Rangpo end as shown in the above figure (3). This fault was sensed in Zone-1 from the Rangpo end and the line got tripped from the Rangpo end.
- But the above fault did not get cleared in Zone-1 time from the New Melli end as it sensed the fault in Zone-3 causing line tripping after 850 ms from the New Melli end and isolation of the above fault from the system.
- Due to this delayed fault clearance from the New Melli end, the same fault was also sensed by the Tashiding end relay of 220 kV Tashiding -New Melli line and Rangpo end relay of 220 kV Rangpo-Tashiding line in zone-3. Both these circuits also got tripped in zone 3 operations of distance protection from the respective end as mentioned.
- As the Tashiding end relay of 220 kV Tashiding -New Melli line caused the tripping of line in Zone-3 after 800 ms, this led to disconnection of 220 kV Tashiding, New Melli and Jorethang substation from the grid. With this, there was no evacuating path for 220 kV Jorethang and hence its unit also tripped on over frequency due to load-generation imbalance in the formed island. As a result, around 36 MW generation loss occurred at Jorethang HEP due to loss of evacuation path. There was no generation at Tashiding.
- The Rangpo end relay of 220 kV Rangpo –Tashiding line also sensed this fault in zone-3 at 85.04km from Rangpo end which is the same distance of fault in 220 kV Rangpo –New Melli line as shown in the above figure (46+18+21.4=85.4 Km) causing its tripping after 800 ms.

- It seems that the Rangpo end relay for the 220 kV Rangpo-Tashiding circuit has over encroached on zone 3 as the fault was beyond its Zone 3. This aspect needs further detailed analysis. As zone-3 of both lines i.e., 220 kV Tashiding -New Melli line and 220 kV Rangpo-Tashiding line are picking up so their distance parameters need to checked and there can be time grading so that simultaneous tripping of Rangpo-Tashiding can be avoided.

Operational issues Observed (प्रचालन समस्या):

- Frequent faults are being observed in this corridor, resulting in station blackout and generation loss, hence proper line patrolling, maintenance needs to be ensured.
- Delayed clearance observed which is detrimental for the system as generators are feeding the fault directly also needs to be avoided.
- No sequence of events recorded at Rangpo end at the time of the event.

Protection issues observed (सुरक्षा समस्या):

- Reason for fault sensing in Zone-3 from New Melli end instead of zone-2, for the fault in Rangpo-New Melli s/c may be shared**. (Powergrid-ER-2 to update).**
- Proper coordination of relays needs to be ensured as the zone-3 of both lines i.e., 220 kV Tashiding -New Melli line and 220 kV Rangpo-Tashiding line are overlapping. It may be required that zone 3 should be time graded to avoid simultaneous tripping of circuits. It was desired that after 800 ms only the 220 kV Tashiding –New Melli should have tripped from the Tashiding end and there should not have been any tripping of 220 kV Rangpo-Tashiding line from the Rangpo end.
- Why the fault of 220 kV Rangpo – New Melli near to Rangpo end was sensed in Zone-3 by the Rangpo end relay of the 220 kV Rangpo – Tashiding line? It has crossed almost 3 lines from the Rangpo end indicating overreaching in zone 3 and this needs to be checked for the relay at the Rangpo end.
- **At the instant of fault, no units were running at Tashiding and only one unit running at Jorethnag at 36 Mw, it seems variable infeed causing the under reaching of fault, which needs to be reviewed and coordinated**.

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

Issues	Regulation Non-Compliance	Utility
Incorrect/ mis-operation / unwanted operation of Protection system	1. CEA Technical Standard for Construction of Electrical Plants and Electric Lines: 43.4 .A. 2. CEA (Technical standards for connectivity to the Grid) Regulation, 2007: Schedule Part 1. (6.1, 6.2, 6.3)	ER-2
SCADA data Non-Availability for the station	1. IEGC 4.6.2 Data and Communication Facilities 2. IEGC 5.2.q	PGCIL ERTS-2

Status of Reporting (रिपोर्टिंग की स्थिति):

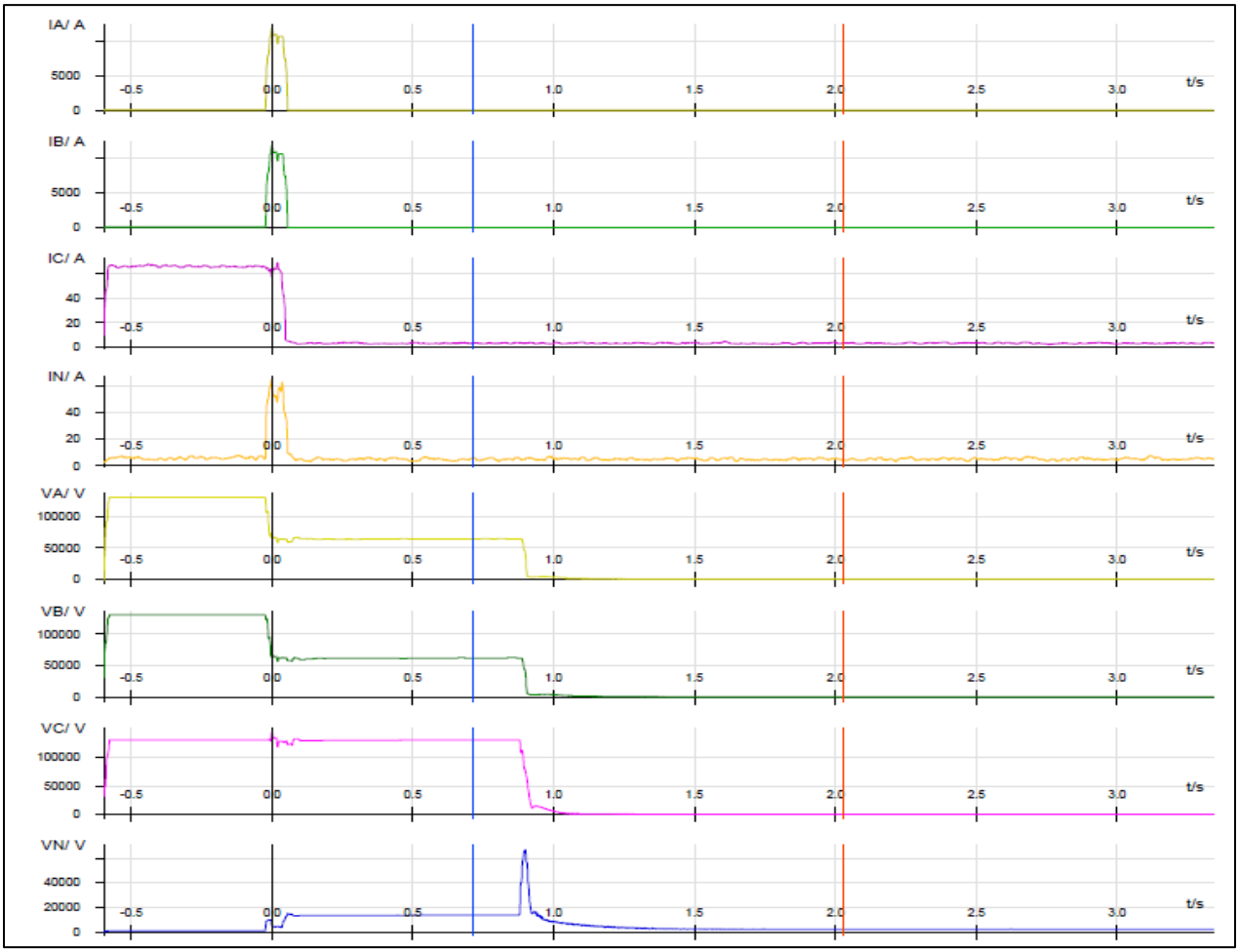
- DR/EL yet not received for 220kV Rangpo-Tashiding and 220 kV Rangpo-New Melli (Powergrid-ER-2 to submit.
- DR/EL received for 220kV Tashiding-New Melli from Tashding end.

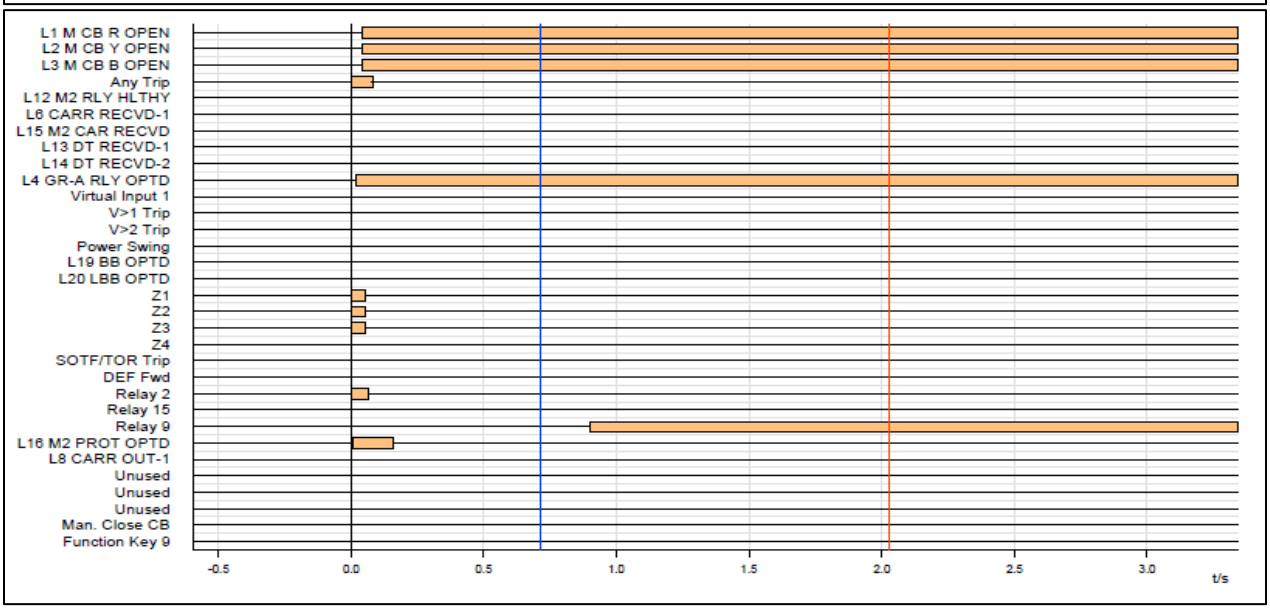
Annexure 1: Sequence of events recorded at ERLDC SCADA data at the time of the event.

TIME	MILLI_SEC	STATION	DESCRIPTION	STATUS
17:46:58	974	MELNW_PG	220_RANGP_PG_1_CB	Open
18:49:03	619	MELNW_PG	220_Main_Bus_R2_CB	Open
18:52:24	958	MELNW_PG	220_RANGP_PG_2_L_ISO	Open
18:54:33	12	MELNW_PG	220_JORET_PG_1_CB	Open
18:55:09	653	MELNW_PG	220_JORET_PG_2_CB	Open
18:56:46	115	MELNW_PG	220_RANGP_PG_2_CB	Open
18:58:19	540	MELNW_PG	220_RANGP_PG_1_CB	Closed
18:58:49	470	MELNW_PG	220_Main_Bus_R2_CB	Closed
18:59:25	285	MELNW_PG	220_RANGP_PG_2_L_ISO	Closed
19:00:31	184	MELNW_PG	220_JORET_PG_1_CB	Closed
19:00:57	415	MELNW_PG	220_JORET_PG_2_CB	Closed
19:04:22	801	MELNW_PG	220_RANGP_PG_2_CB	Closed
17:47:00	518	TASHI_PG	220_MELNW_PG_CB	Invalid
17:47:00	518	TASHI_PG	220_MELNW_PG_CB	Open
19:06:48	621	TASHI_PG	220_MELNW_PG_CB	Travel
19:06:48	621	TASHI_PG	220_MELNW_PG_CB	Closed

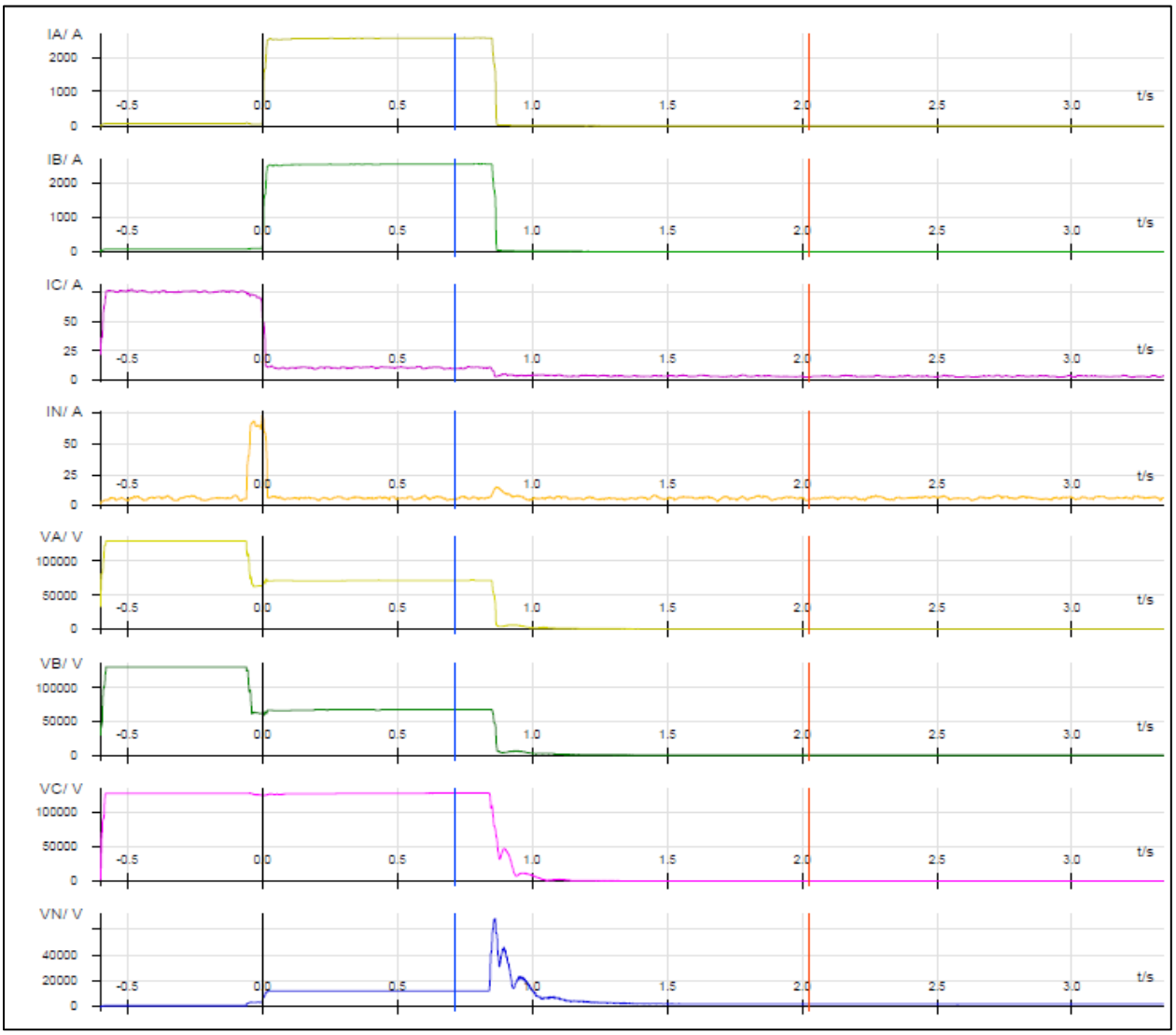
Annexure 2:

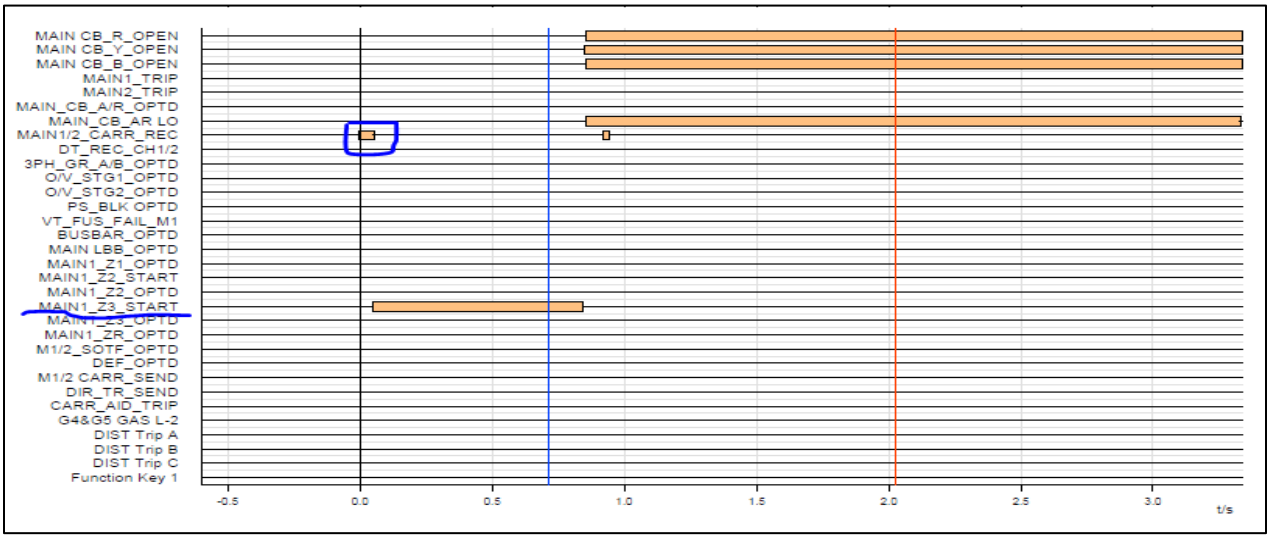
1. DR output at 220 kV Rangpo-New Melli (RANGPO END).



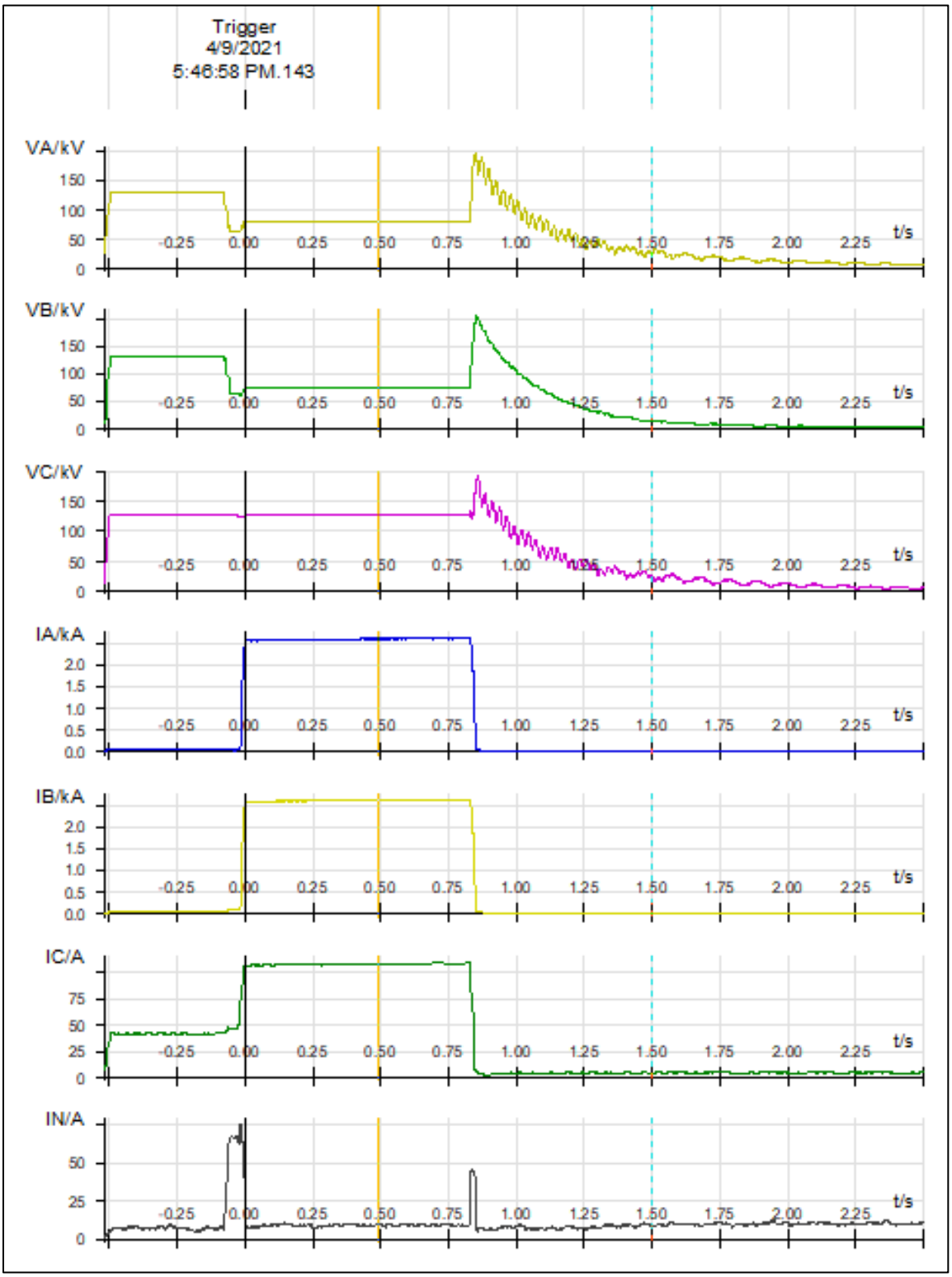


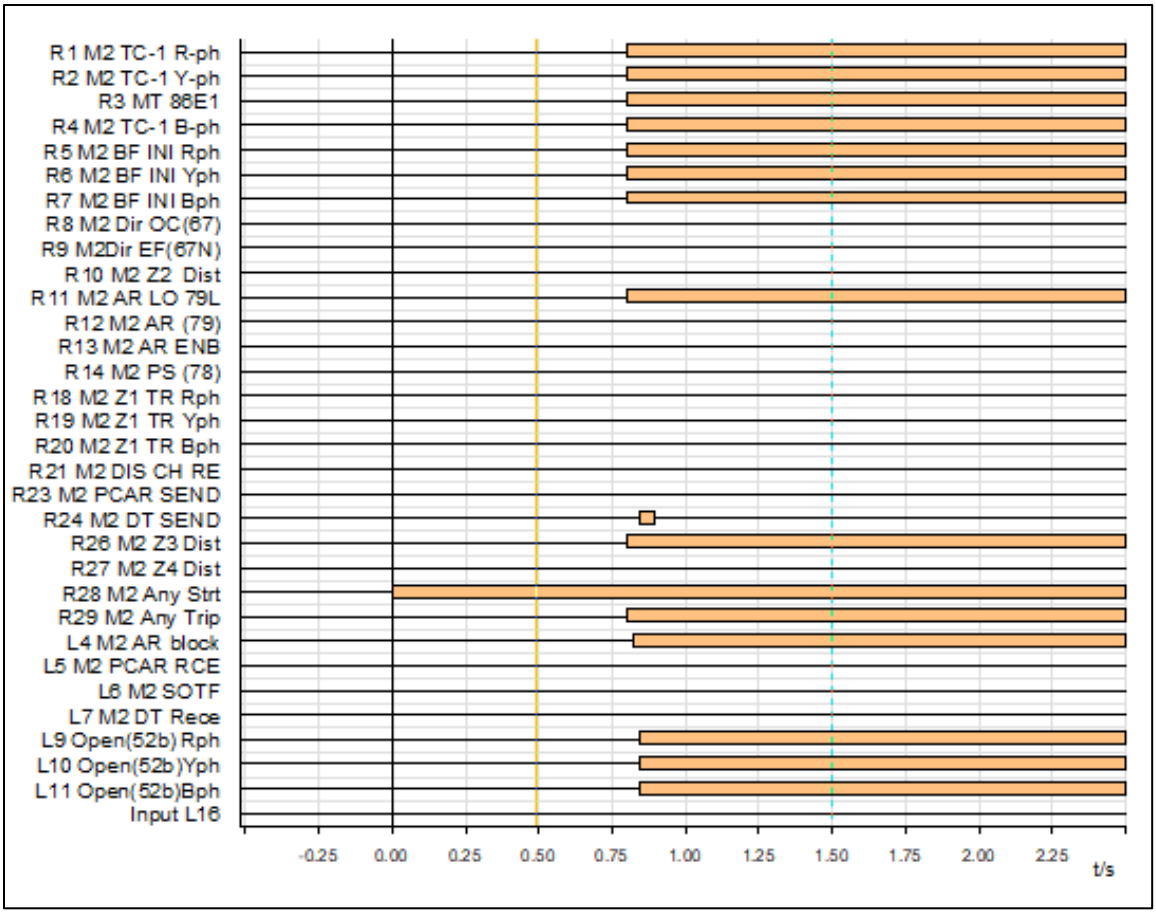
2. **DR output at 220 kV Rangpo-New Melli (New Melli END).**



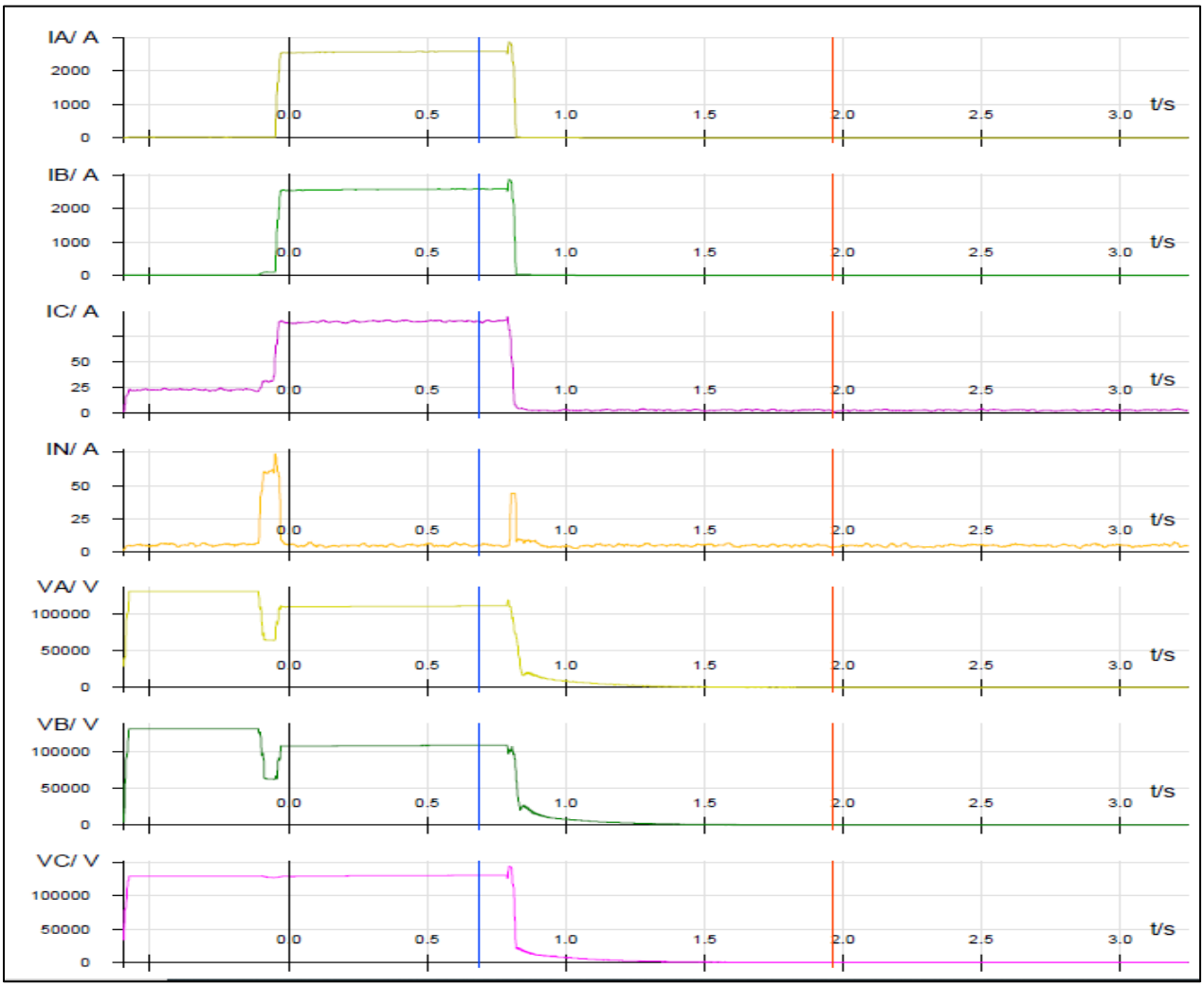


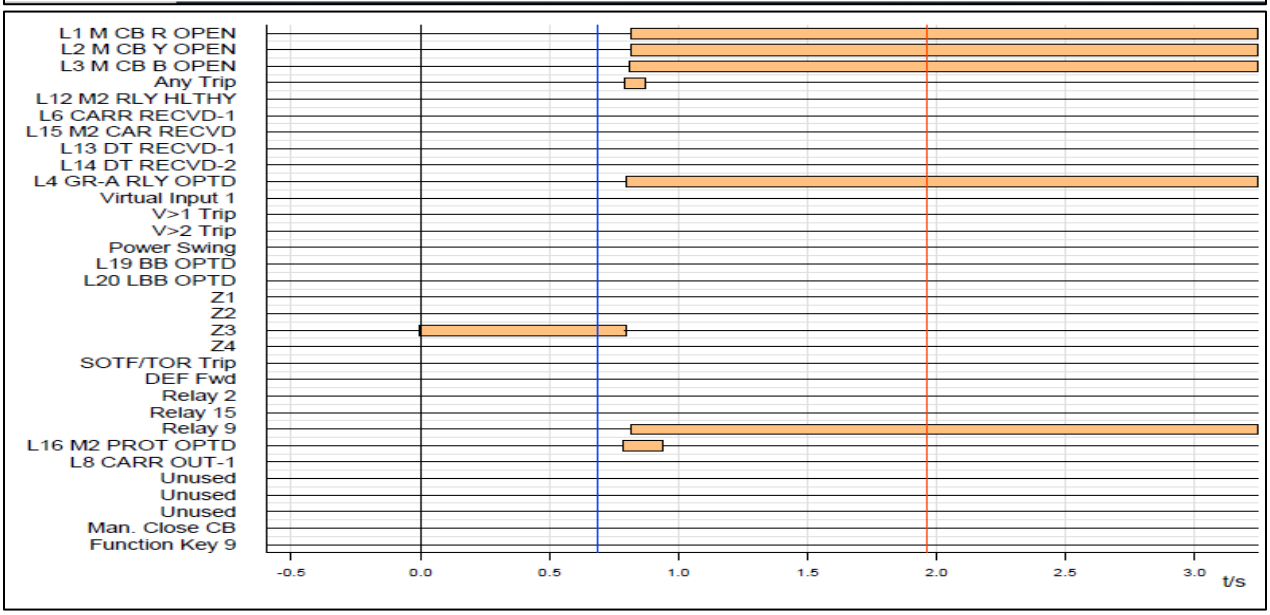
3. DR output at 220 kV Tashiding-New Melli (Tashiding end).




R1 M2 TC-1 R-ph
R2 M2 TC-1 Y-ph
R3 MT 86E1
R4 M2 TC-1 B-ph
R5 M2 BF INI Rph
R6 M2 BF INI Yph
R7 M2 BF INI Bph
R8 M2 Dir OC(67)
R9 M2Dir EF(67N)
R10 M2 Z2 Dist
R11 M2 AR LO 79L
R12 M2 AR (79)
R13 M2 AR ENB
R14 M2 PS (78)
R18 M2 Z1 TR Rph
R19 M2 Z1 TR Yph
R20 M2 Z1 TR Bph
R21 M2 DIS CH RE
R23 M2 PCAR SEND
R24 M2 DT SEND
R26 M2 Z3 Dist
R27 M2 Z4 Dist
R28 M2 Any Strt
R29 M2 Any Trip
L4 M2 AR block
L5 M2 PCAR RCE
L6 M2 SOTF
L7 M2 DT Rece
L9 Open(52b) Rph
L10 Open(52b)Yph
L11 Open(52b)Bph
Input L16
-0.25
0.00
0.25
0.50
0.75
1.00
1.25
1.50
1.75
2.00
2.25
t/s

4. DR output of 220 kV Rangpo-Tashiding (RANGPO END).





पावर सिस्टम ऑपरेशन करपोरेशन लिमिटेड
(भारत सरकार का उद्यम)
POWER SYSTEM OPERATION CORPORATION LIMITED
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Eastern Regional Load Despatch Centre: 14, Golf Club Road, Tollygunge, Kolkata-700 033.
CIN: U40105DL2009GOI188682
फ़ोन: 033- 24235755, 24174049 फैक्स : 033-24235809/5029 Website:www.erldc.org, Email ID- erldc@posoco.in

घटना संख्या: **16-04-2021/1** दिनांक: **16-04-2021**

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

Summary of the event (घटना का सारांश):

220 kV Tashiding substation is having only two interconnections, 220 kV Tashiding-New Melli S/C and 220 kV Tashiding -Rangpo S/C. At 16:46 Hrs, 220 KV New Melli- Tashiding circuit tripped on 3 phase fault. At the same time, 220 kV Rangpo-Tashiding also got tripped from Rangpo end only on the same 3 phase fault isolating 220 kV Tashiding station, though there was no generation loss as it had no schedule.

- **Date / Time of disturbance:** 16-04-2021 at 16:46 hrs.
- **Event type:** GD - 1
- **Systems/ Subsystems affected:** 220 kV Tashiding S/S.
- **Load and Generation loss**: Nil

Major elements tripped (प्रमुख ट्रिपिंग):

- 220 kV-TASHIDING-RANGPO-1
- 220 kV-NEW MELLI-TASHIDING-1

Network across the affected area (प्रभावित क्षेत्र का नक्शा)

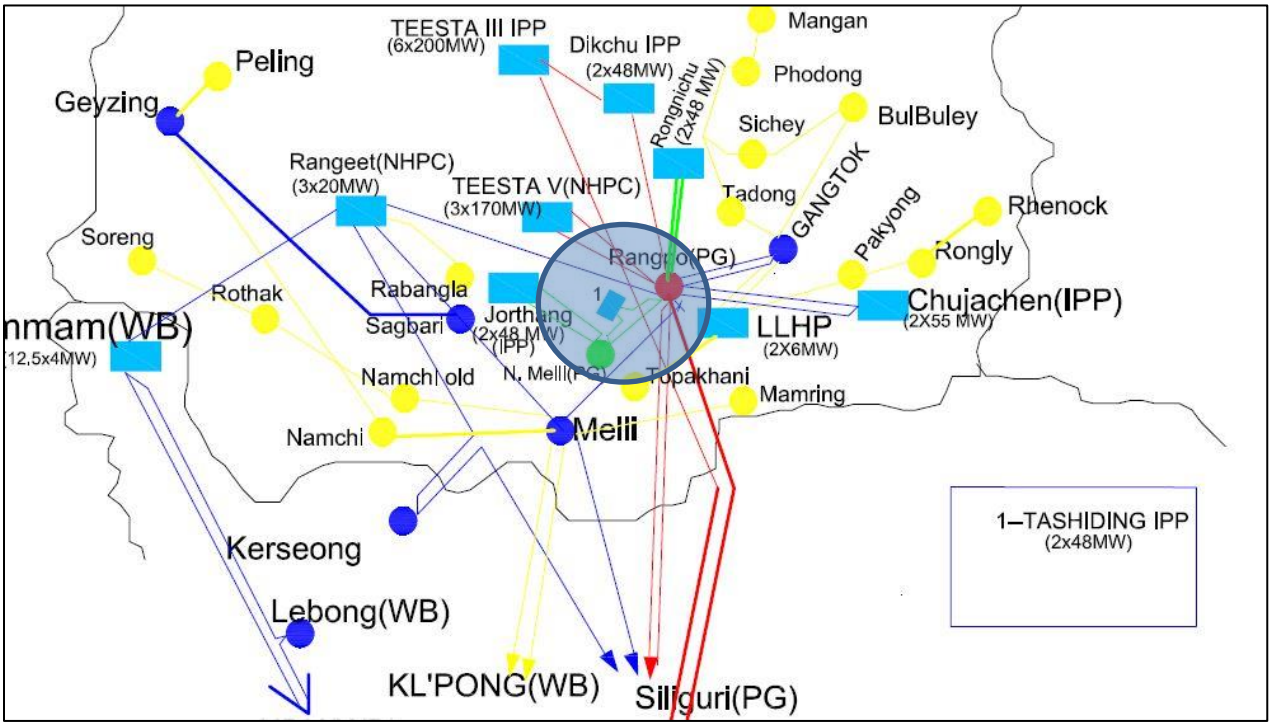


Figure 1: Network across the affected area

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

समय	नाम	उप केंद्र 1 रिले संकेत	उप केंद्र 2 रिले संकेत	पीएमयू पर्यवेक्षण
16:46 Hrs.	220 kV-TASHIDING-RANGPO	RYB IR 4.8 KA IB 3.9 KA IY =4.1 KA F.D 36 KM Z1 AT RANGPO	NO TRIP AT TASHIDING	Fault clearance in less than 160 ms.
16:46 Hrs	220 kV-NEW MELLI-TASHIDING	RYB 13.5 KM Z1 IR=3.75 Ka IY =3.65 kA IB =3.92 AT NEW MELLI (19.8 KM LINE LENGTH)	Z1 B-N 5.603 KM 2.371 KA Z1 AT TASHIDING	Fault clearance in less than 160 ms.

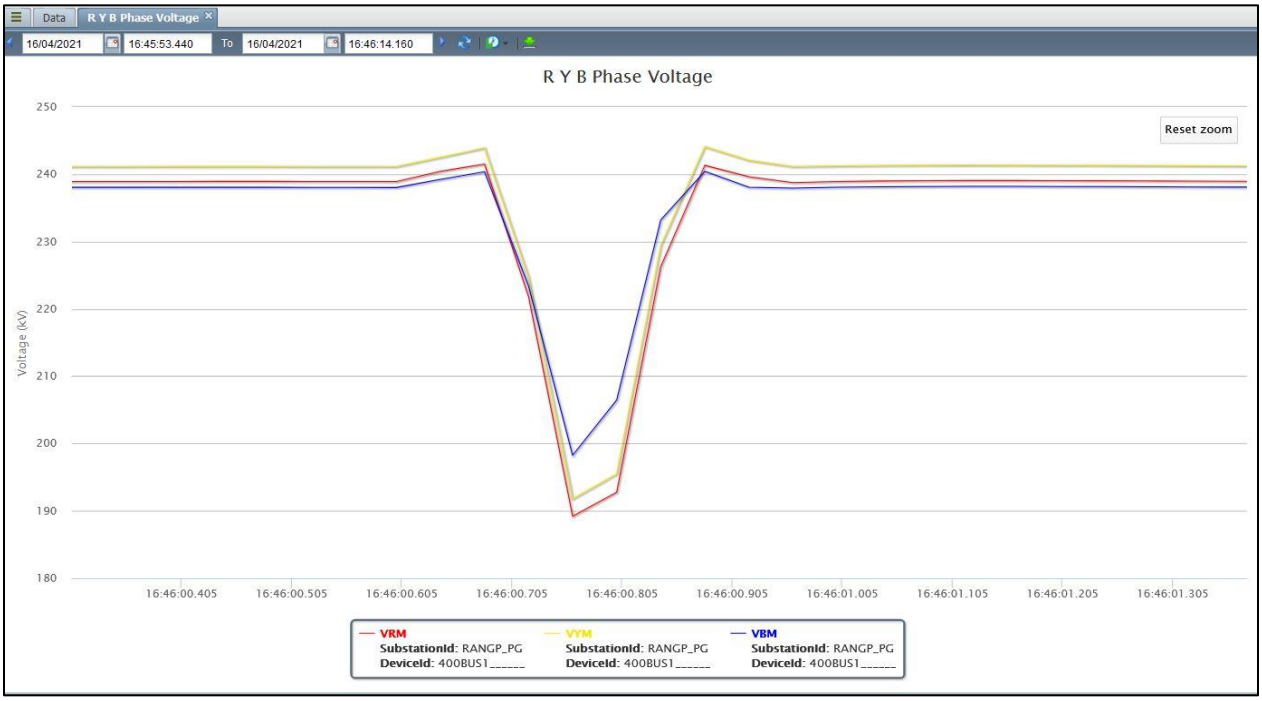


Figure 2: Three phase fault captured through 400 kV Rangpo bus voltage through PMU.

Restoration (पूर्वावस्था की प्रप्ति)

- 220 kV-TASHIDING-RANGPO circuit was restored at 17:02 hrs.
- 220 kV-NEW MELLI-TASHIDING circuit was restored at 17:12 hrs.

Analysis of the event (घटना का विश्लेषण):

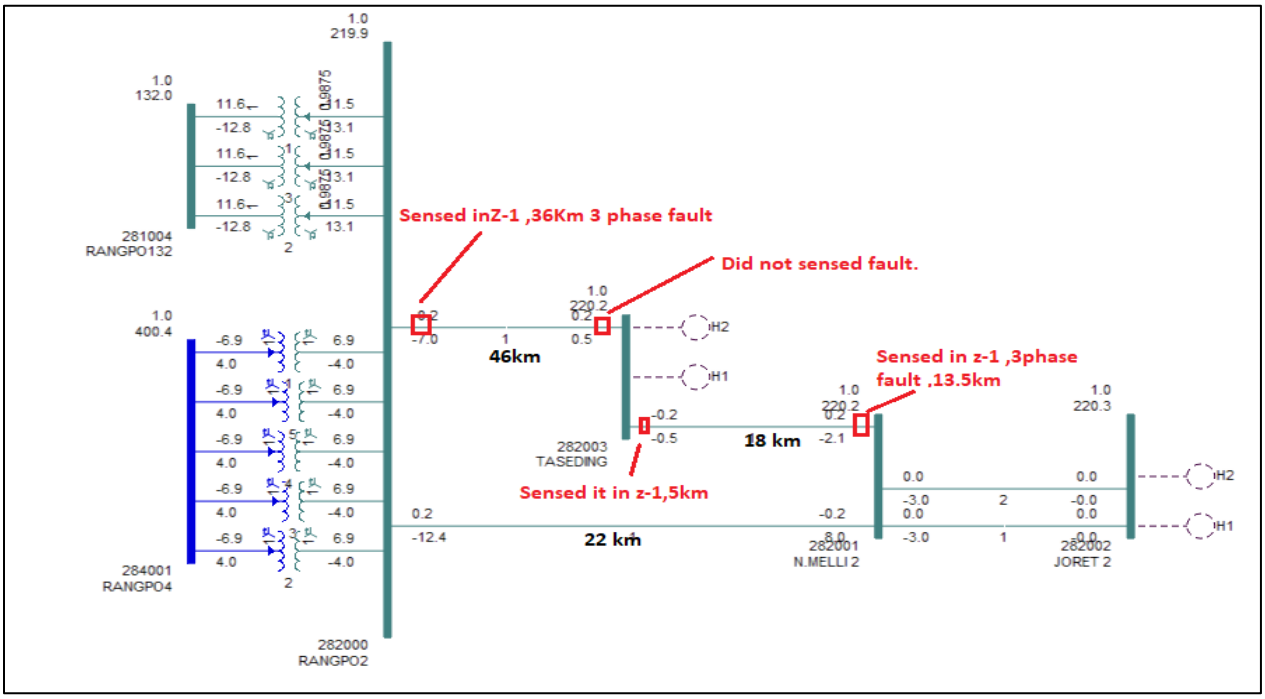


Figure 3: SLD of the affected area.

- Prior to the tripping, there was no generation at Tashiding and Jorethang hydro power plant. Thus, any fault feeding at Tashiding has to come from Rangpo substation either directly via 220 kV Rangpo-Tashiding circuit or via longer path of 220 kV Rangpo-New Melli-Tashiding.
- At 16:46, 220 kV New Melli- Tashiding tripped on 3 phase fault from New Melli end and in B phase to earth fault from Tashiding end . Both ends have sensed the fault in Zone 1.
- At the same time, 220 kV Tashiding-Rangpo line also tripped from the Rangpo end sensing 3 phase fault in Zone-1. While at the Tashiding end no relay had picked up for this circuit and there was no tripping.
- After tripping of both lines 220 kV Tashiding substation became dead. However, there was no generation loss as no units were in service as provided above.
- It appears from submitted details that 3-phase fault was there only in the 220 kV New Melli-Tashiding line at a distance of approx. 6 km from Tashiding end.
- This same fault was also sensed by Rangpo end relay of 220 kV Tashiding-Rangpo line. Initially, this fault was sensed in Zone-2 from the Rangpo end for 220 kV Tashiding-Rangpo line. However, as the 3-phase tripping occurred from the New Melli end in Zone 1 for 220 kV New Melli- Tashiding ckt, the only source to feed the fault was the 220 kV Tashiding-Rangpo ckt from Rangpo end. Hence the current increased from Rangpo end in this circuit while feeding the fault on 220 kV Tashiding-New melli through Tashiding substation. Due to this, the fault got sensed in zone-1 from the Rangpo end which caused issuance of tripping command by the relay and tripping of the circuit. This aspect is also clear from the DR plot of the Rangpo end for 220 kV Tashiding-Rangpo ckt which is attached below for reference in Figure (4).

- As the fault was in reverse direction of Tashiding end for Rangpo-Tashiding line hence no relay picked-up.
- Double ended fault algorithm was also used to identify the location of fault by using DR of Rangpo end of Rangpo-Tashiding line and, New Melli end of New Melli-Tashiding line. This is due to the fact that these two ends were the only source to feed the fault as there were no units at Tashiding and Jorethnag. (Considering there was fault in only one line).

  Results obtained from the calculation also shows that the fault location at a distance of 54 Km from Rangpo end which lies in Tashiding-New Melli section line, and also matched with relay details of Tashiding -new Melli line, at a distance of 6 km from Tashiding (46+6=52 km). Result is shown in below figure (5).

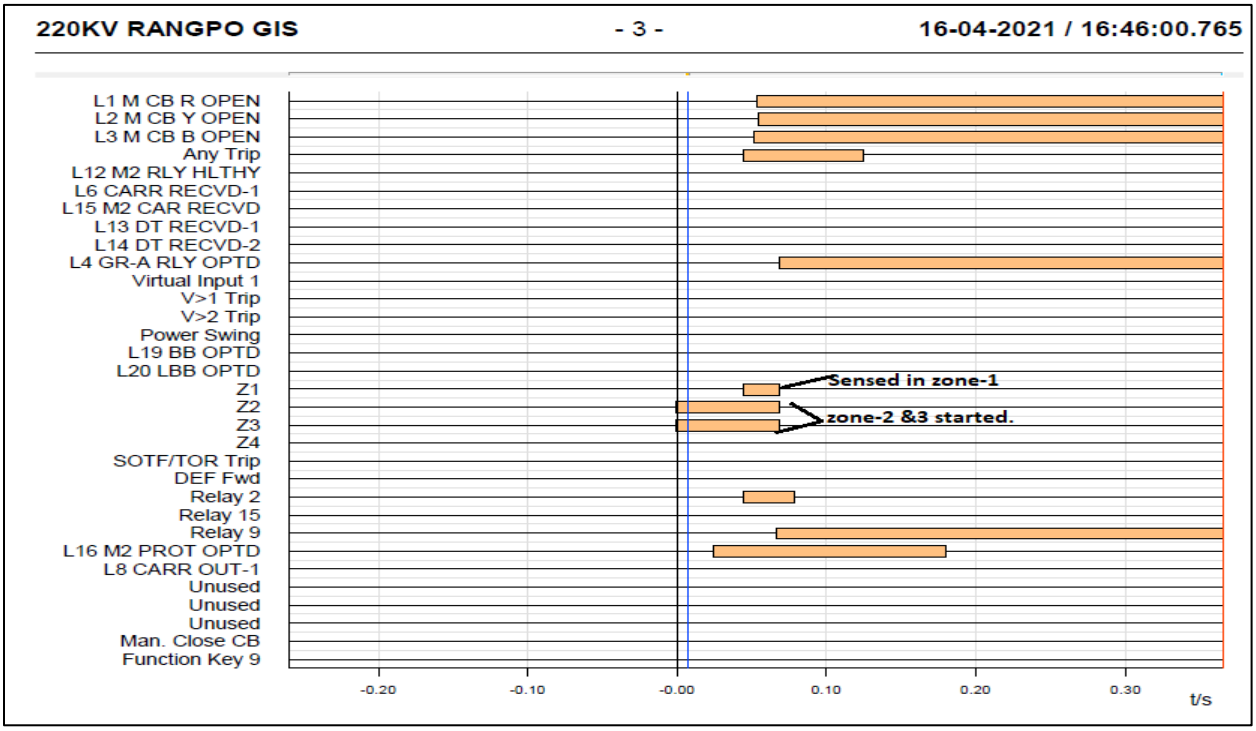


Figure 4: DR digital status of 220 kV Tashiding-Rangpo Rangpo end.

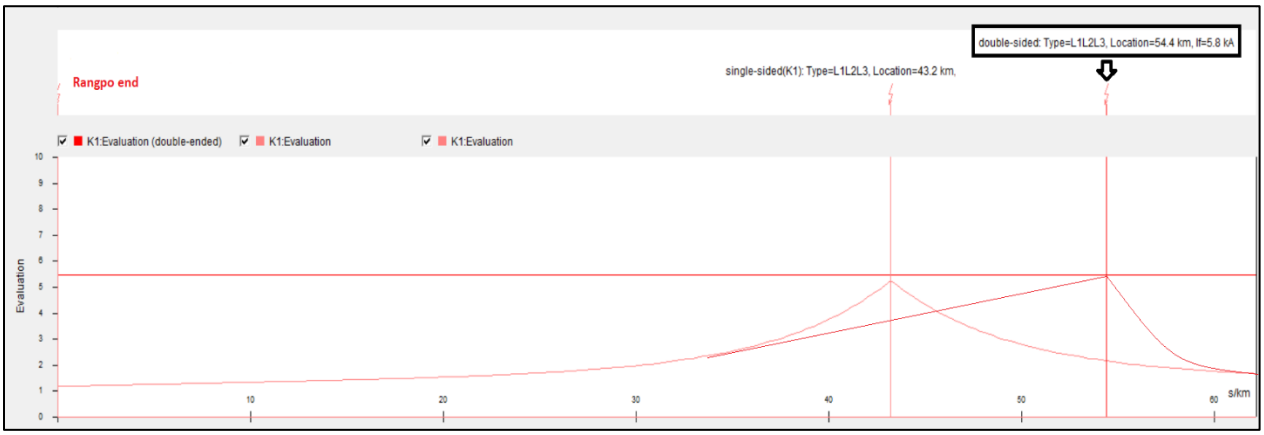


Figure 5: Double ended fault location.

Operational issues Observed (प्रचालन समस्या):

- Frequent faults are being observed in this corridor, resulting in station blackout and generation loss, hence proper line patrolling, maintenance needs to be ensured. **(PGCIL ERTS 2 and Tashiding)**
- Actual Fault location needs to be identified, whether fault was in both the lines at same time at some common portion also needs to be identified. **(PGCIL ERTS 2 and Tashiding)**

Protection issues observed (सुरक्षा समस्या):

- For, 220 kV New Melli- Tashiding line, Tashiding end sensed only B phase fault, which needs to be analysed and rectified as New Melli end sensed the same fault as 3 phase fault. **(Tashiding to check)**
- Out zone fault should not be sensed in zone-1 for 220 kV Tashiding-Rangpo line at Rangpo end even in case of radial infeed as mentioned in the analysis. This aspect also needs to be looked into. **(PGCIL-ERTS 2 May please check)**

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

Issues	Regulation Non-Compliance	Utility
Incorrect/ mis-operation / unwanted operation of Protection system	1. CEA Technical Standard for Construction of Electrical Plants and Electric Lines: 43.4 .A. 2. CEA (Technical standards for connectivity to the Grid) Regulation, 2007: Schedule Part 1. (6.1, 6.2, 6.3)	ER-2,THEP
SCADA data Non-Availability for the station	1. IEGC 4.6.2 Data and Communication Facilities 2. IEGC 5.2.q	ER-2,THEP

Status of Reporting (रिपोर्टिंग की स्थिति):

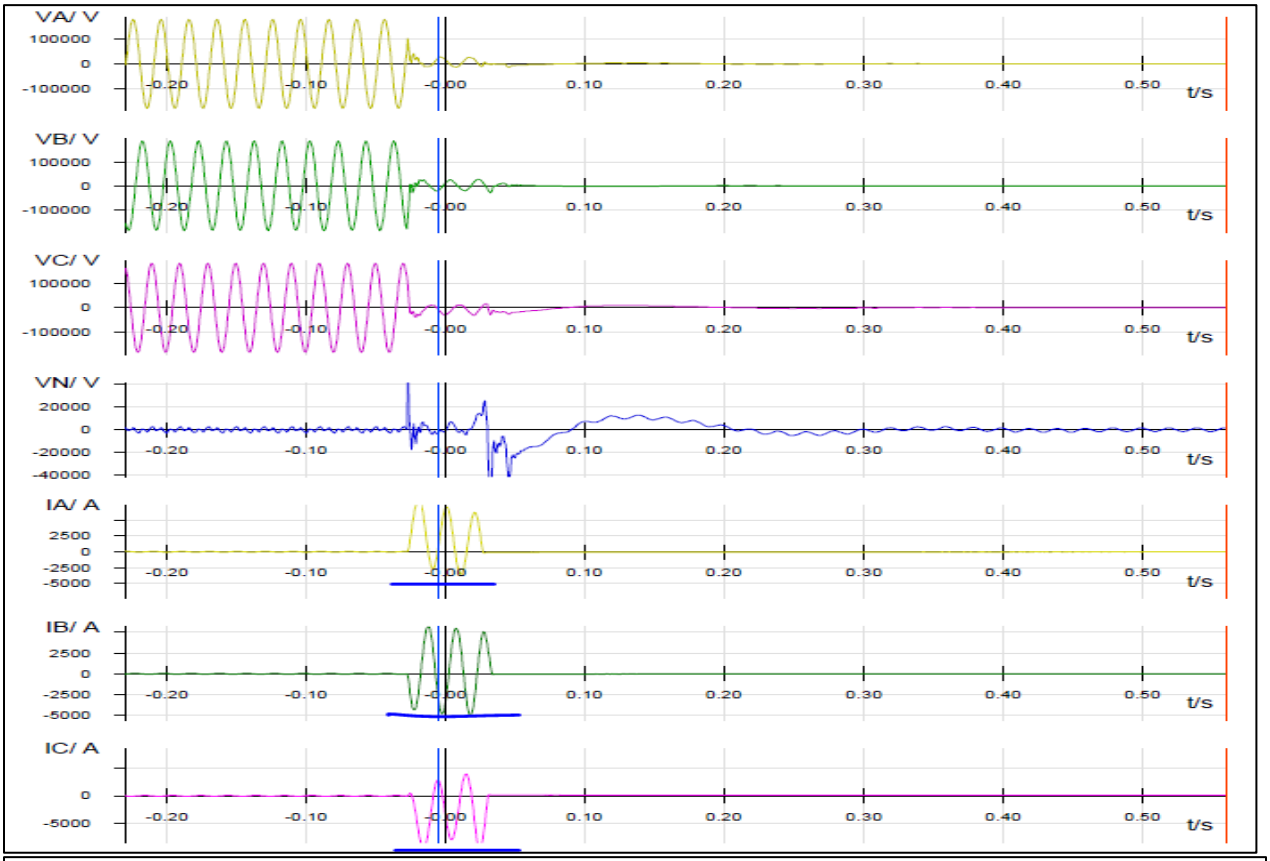
- DR/EL for 220 kV New Melli- Tashiding received from both ends.
- DR/EL for 220 kV Tashiding-Rangpo also received from Rangpo end.

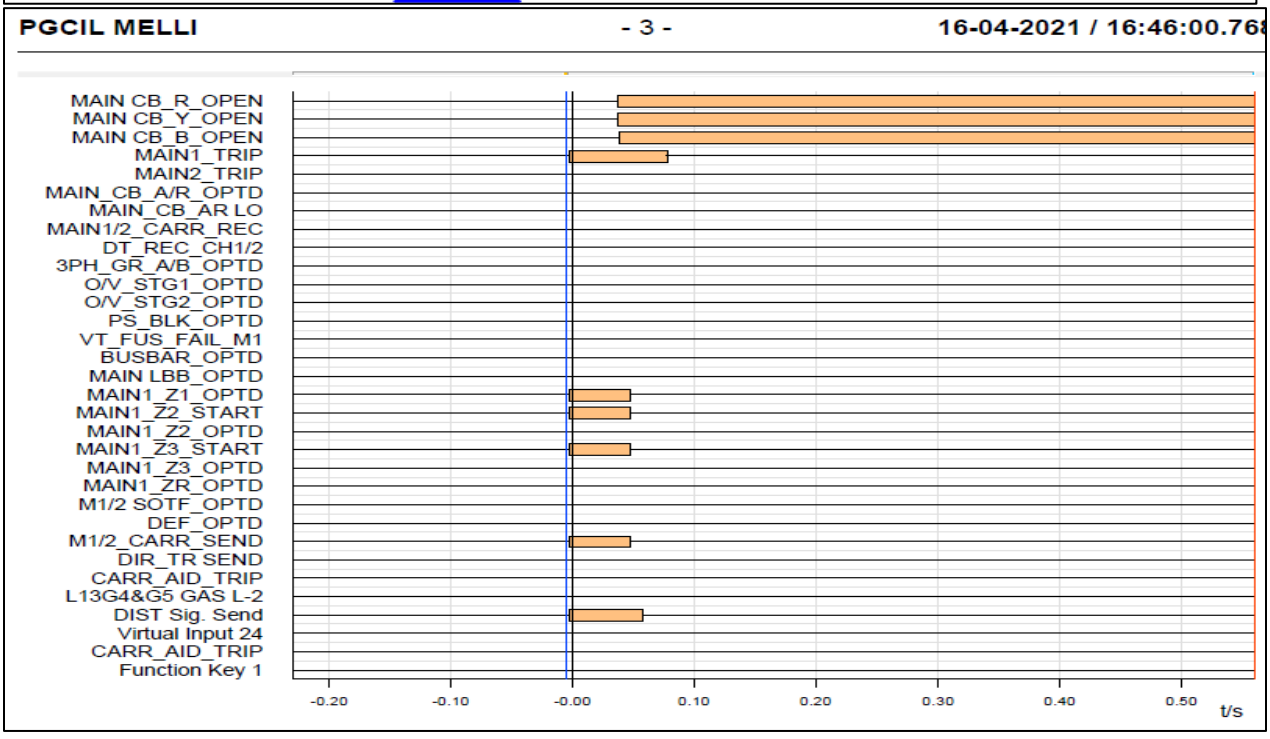
Annexure 1: Sequence of events recorded at ERLDC SCADA data at the time of the event.

TIME	MILLI_SEC	STATION	DESCRIPTION	STATUS
16:46:00	820	RANGP_PG	220_MELNW_PG_1_CB	Open
17:06:41	962	RANGP_PG	220_MELNW_PG_1_CB	Closed
16:46:01	602	TASHI_PG	220_MELNW_PG_CB	Open
16:46:01	602	TASHI_PG	220_MELNW_PG_CB	Invalid
17:12:29	184	TASHI_PG	220_MELNW_PG_CB	Invalid
17:12:29	184	TASHI_PG	220_MELNW_PG_CB	Closed
19:45:21	695	TASHI_PG	220_UNIT_H_1_CB	Closed
16:46:00	799	MELNW_PG	220_RANGP_PG_2_CB	Open
17:12:09	832	MELNW_PG	220_RANGP_PG_2_CB	Closed

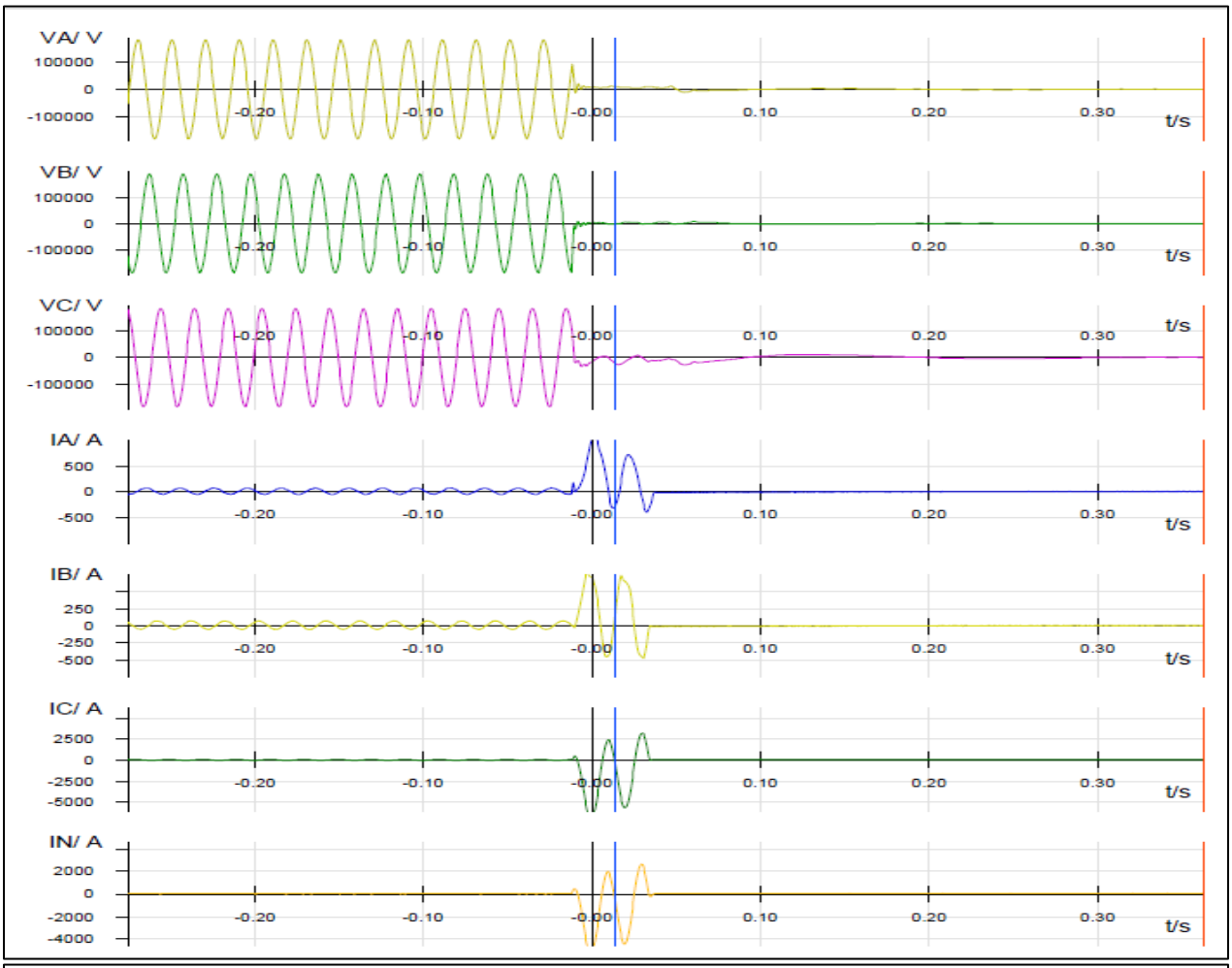
Annexure 2:

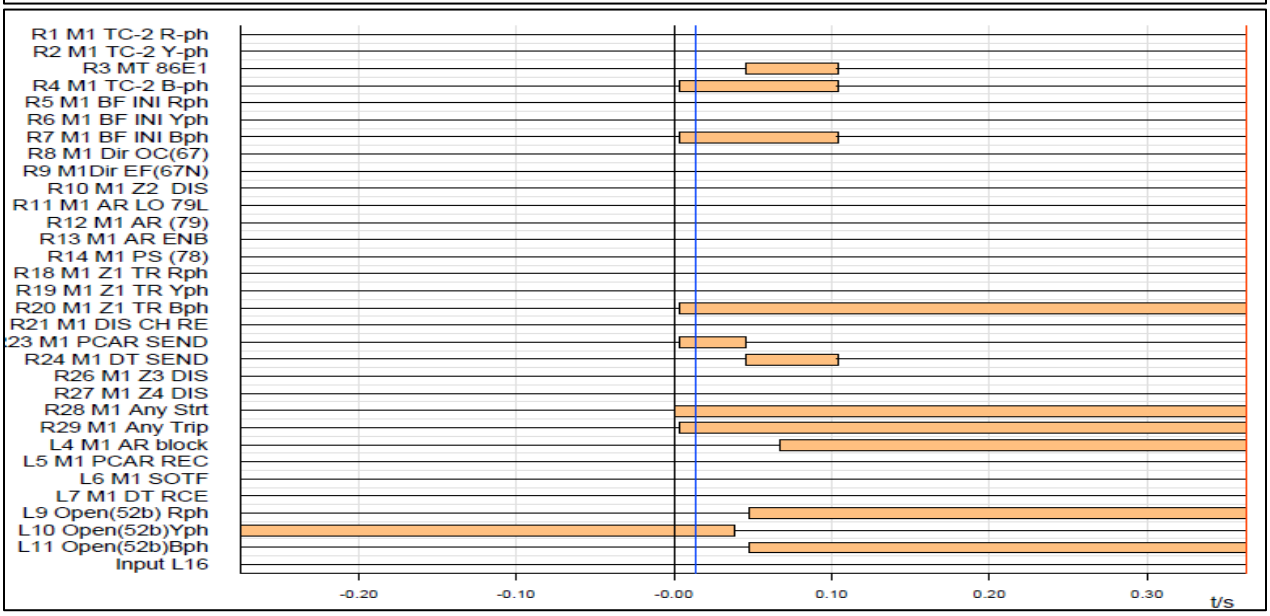
1. DR output of 220 kV New Melli- Tashiding (New Melli end)



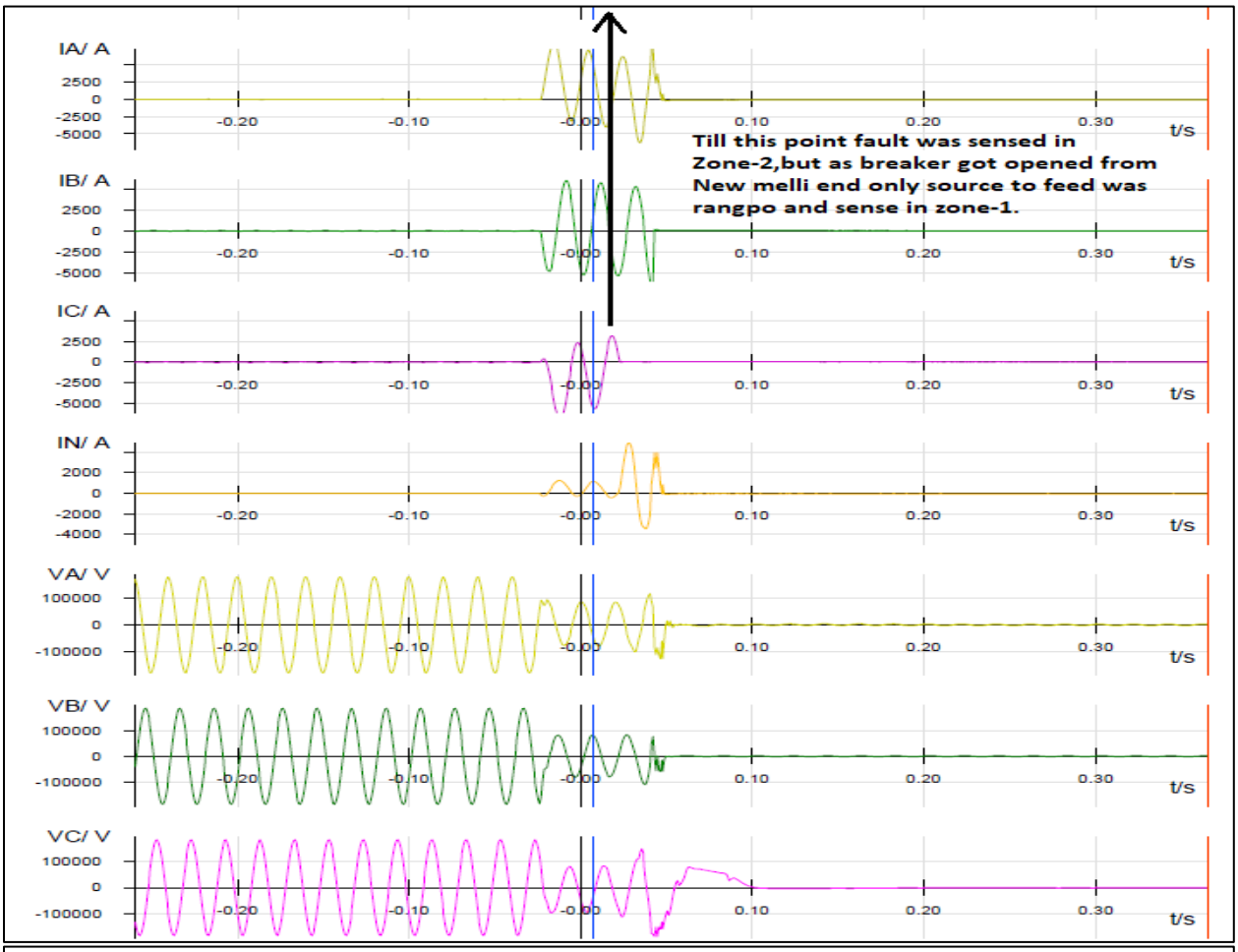


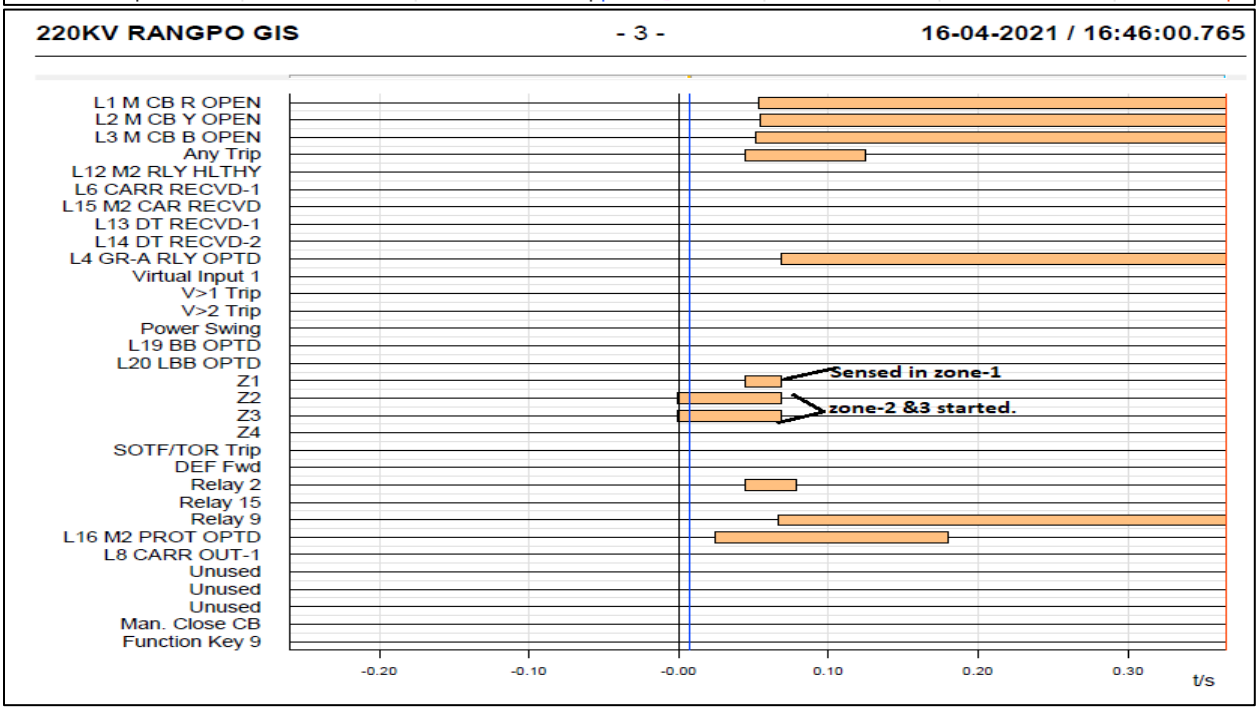
2. DR output of 220 kV New Melli- Tashiding (Tashiding end)





3. DR output of Tashiding-Rangpo (Rangpo end)





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: **23-04-2021/1** दिनांक: **23-04-2021**

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

Summary of the event (घटना का सारांश):

400 kV Teesta-III hydropower station is having only two interconnections, 400 kV Teesta-III-Kishangunj S/C and 400 kV Teesta-III -Dikchu S/C. On 23 April 2021 at 13:21 Hrs, 400 kV Teesta-III-Dikchu S/C tripped on B-phase fault from both ends with direction earth fault (DEF) protection operation. At the same time, 400 kV Teesta-III -Kishangunj s/c also got tripped sensing the same fault from Kishangunj end and sending direct trip to Teesta III end. Based on voltage dip and fault current rise, it was observed that the fault was highly resistive in nature and there was a delay in its clearance by around 1.5 seconds. With tripping of both these circuits, Teesta III hydropower station got blackout due to loss of evacuation path leading to 148 MW generation loss.

- **Date / Time of disturbance:** 23-04-2021 at 13:21 hrs.
- **Event type:** GD - 1
- **Systems/ Subsystems affected:** 400kV Teesta-III S/S.
- **Load and Generation loss**.
    - 148 MW generation loss occurred.
    - No load loss occurred.

Major elements tripped (प्रमुख ट्रिपिंग):

- 400 kV Teesta-III -Dikchu S/C.
- 400 kV Teesta-III-Kishangunj S/C

Network across the affected area (प्रभावित क्षेत्र का नक्शा)

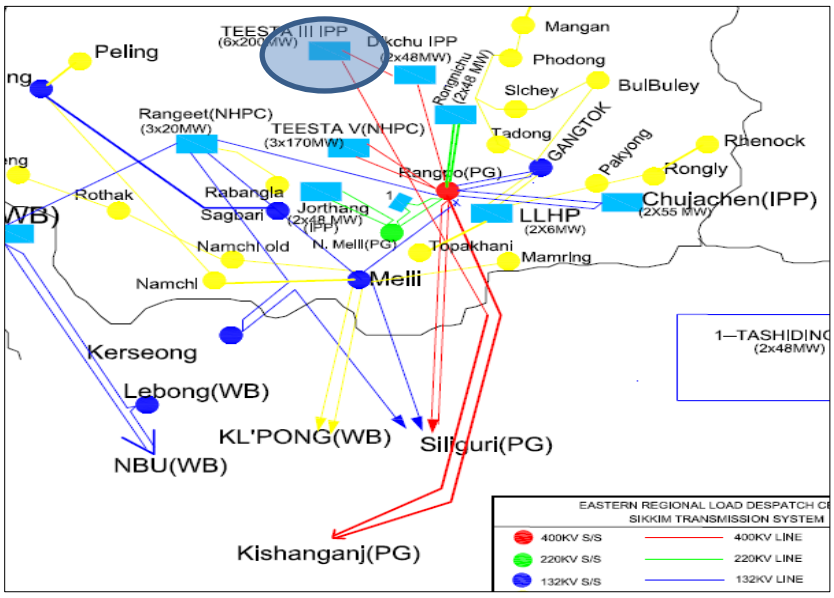


Figure 1: Network across the affected area

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

समय	नाम	उप केंद्र 1 रिले संकेत	उप केंद्र 2 रिले संकेत	पीएमयू पर्यवेक्षण
13:21	400 kV Teesta-III-Kishangunj S/C	Teesta 3: DT Received	Kishangunj: B phase to earth fault, 208.4 km, 1.6 kA, Directional E/F trip, IN>1, DT sent	High resistance fault and Fault clearance time 1.5 sec
13:21	400 kV Teesta-III - Dikchu S/C.	Teesta 3-Directional E/F trip, B phase to earth fault, IN> 1, DT sent	Dikchu: B phase to earth fault, IN>1 trip, DT received.	

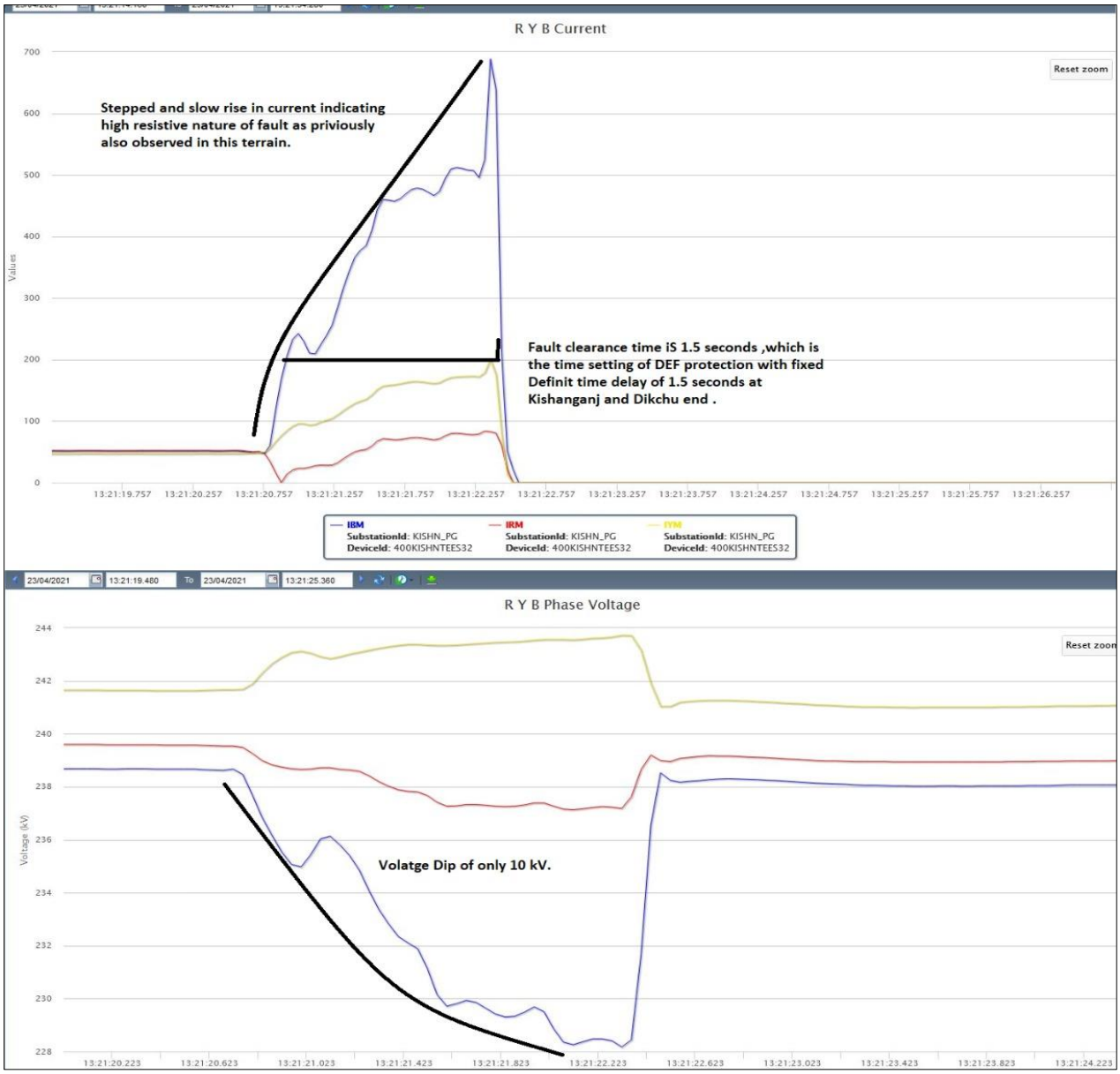


Figure 2: Three phase current of 400 kV Kishangunj-Teesta 3 and 400 kV Kishangunj bus voltage captured at Kishangunj S/S indicating the event.

Restoration (पूर्वावस्था की प्रप्ति)

- 400 kV Kishangunj-Teesta 3 circuit was restored at 14:30 hrs
- 400 kV Teesta-III -Dikchu circuit was restored at 15:25 hrs

Analysis of the event (घटना का विश्लेषण):

- 400 kV Teesta 3 hydropower station (6 X 200 MW) is connected with the Indian grid through two 400 kV Quad moose lines i.e., 400 kV Teesta 3-Kishangunj and 400 kV Teesta 3-Dikchu circuit. From the 400 kV Dikhcu hydropower station, there is a 400 kV Dikchu-Rangpo (PG) circuit.
- At 13:21 Hrs, 400 kV Dikchu-Teesta 3 circuit developed a high resistive fault. This fault was being sensed by both in their direction earth fault protection. At both ends, DEF protection (IN>1) operated after around 1.5 seconds to clear this fault by tripping command to respective breakers.
- At the same time, 400 kV Teesta-III-Kishangunj circuit also tripped on DEF protection from the Kishangunj end by sensing the same fault. The Teesta 3 end line DR does not show any pickup of DEF and the fault is observed to be in the reverse direction. This further clarified the fact that the fault was in the 400 kV Teesta 3-Dikchu circuit only.
- This has resulted in the loss of evacuation path from 400 kV Teesta 3 hydropower station which was generating 148 MW with only one unit in service. With this, GD-1 category event occurred with the blackout of 400 kV Teesta 3 HPS leading to 148 MW generation loss.

Table: DR analysis

Time	Station	Relay indication for ckts
13:21:20.777	Dikchu	Teesta 3-Dikchu fault started
13:21:20.777	Teesta 3	Teesta 3-Dikchu fault started
13:21:20.834	Teesta 3	Teesta 3-Dikchu IN>1 pickup, B phase fault (IB=0.207 kA)
13:21:20.838	Dikchu	Teesta 3-Dikchu IN>1 pickup, B phase fault (IB=0.49 kA)
13:21:21.296	Kishangunj	Teesta 3-Kishangunj IN>1 Pickup, B Phase fault (IB=0.434 kA)
13:21:21.337	Teesta 3	Teesta 3-Kishangunj, Any pickup (IB=0.54 kA)
13:21:22.337	**Dikchu**	**Teesta 3-Dikchu IN>1 trip, B phase fault (IB=2.1 kA)**
13:21:22.405	**Teesta 3**	**Teesta 3-Dikchu IN>1 trip, (IB=1.541 kA)**
13:21:22.405	**Kishangunj**	**Teesta 3-Kishangunj IN>1 trip, DT sent to Teesta 3 (IB=1.56 kA)**
13:21:22.440	Teesta 3	Teesta 3-Kishangunj,DT Received

- During the analysis of DR (annexure) as well PMU data (figure 2), stepped and the slow rise of current is observed. This is indicative of the high resistance nature of the fault in 400 kV Teesta—Dikchu. Such events are also observed during previous trippings in this corridor.
- Total fault clearance time is around 1.5 sec based on the above table prepared using DR analysis (DR is attached at annexure). It is observed that 400 kV Dikchu end breaker of 400 kV Teesta 3-Dikchu circuit tripped first in DEF. This has led to an increase in fault current feed from 400 kV Teesta 3 and Kishangunj before the fault clearance (refer DR). Based on the above table, it can be seen that tripping of breakers at 400 kV Teesta 3 S/s for 400 kV Teesta 3-Dikchu and 400 kV Kishangunj S/s for 400 kV Kishangunj-Tessta 3 occurred at the same time. This is indicative to check

the DEF operational timing and coordination at 400 kV Teesta 3 for 400 kV Teesta 3-Dikchu and 400 kV Kishangunj for 400 kV Teesta-III-Kishangunj circuit.

Operational issues Observed (प्रचालन समस्या):

- Frequent resistive nature faults are being observed in this corridor, resulting in station blackout and generation loss, hence proper line patrolling, maintenance needs to be ensured. **TVTPL may kindly share the root cause analysis of the fault.**
- Based on analysis of DR/PMU, it is observed that fault was in 400 kV Dikchu-Teesta 3 section. Actual Fault location needs to be identified on the circuit.

Protection issues observed (सुरक्षा समस्या):

- Based on DR/EL and PMU data analysis, It is observed that DEF tripping command at 400 kV Kishangunj- Teesta 3 circuit at Kishangunj end for the fault on 400 kV Teesta 3-Dikchu circuit is not coordinated properly. The tripping time of 400 kV Teesta 3-Dikchu at Teesta 3 should be earlier compared to the 400 kV Kishangunj -Teesta 3 circuit at Kishangunj.
- The fault indicates the very need to coordinate the directional earth fault protection at all substations. The fault level calculation and setting criteria for DEF used should be uniform for all power plants and stations in Sikkim Complex to ensure there is no such tripping. This will ensure that the line on which fault is there will be tripping first. **PGCIL ERTS 1 and Teesta may kindly heck and coordinate the setting. One setting guidelines has already been issued by ERPC.**

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

Issues	Regulation Non-Compliance	Utility
Incorrect/ mis-operation / unwanted operation of Protection system	1. CEA Technical Standard for Construction of Electrical Plants and Electric Lines: 43.4. A. 2. CEA (Technical standards for connectivity to the Grid) Regulation, 2007: Schedule Part 1. (6.1, 6.2, 6.3)	PGCIL ERTS 1, Teesta-III
SCADA data Non-Availability for the station	1. IEGC 4.6.2 Data and Communication Facilities 2. IEGC 5.2.q	Teesta-III (SOE is not captured)

Status of Reporting (रिपोर्टिंग की स्थिति):

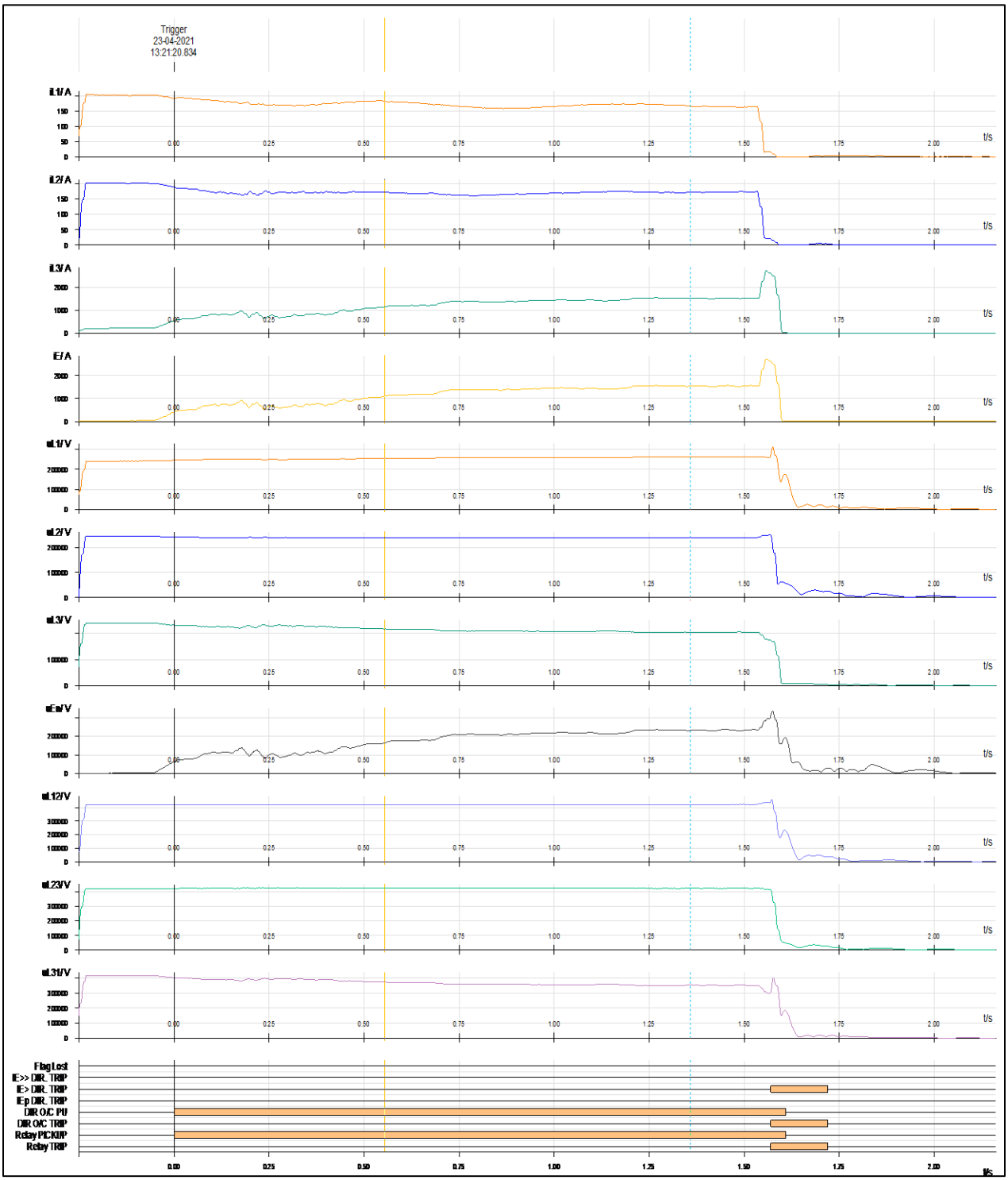
- DR/EL for 400 kV Teesta-III-Kishangunj received from both ends.
- DR/EL for 400 kV Teesta-III-Dikchu received from both ends.

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

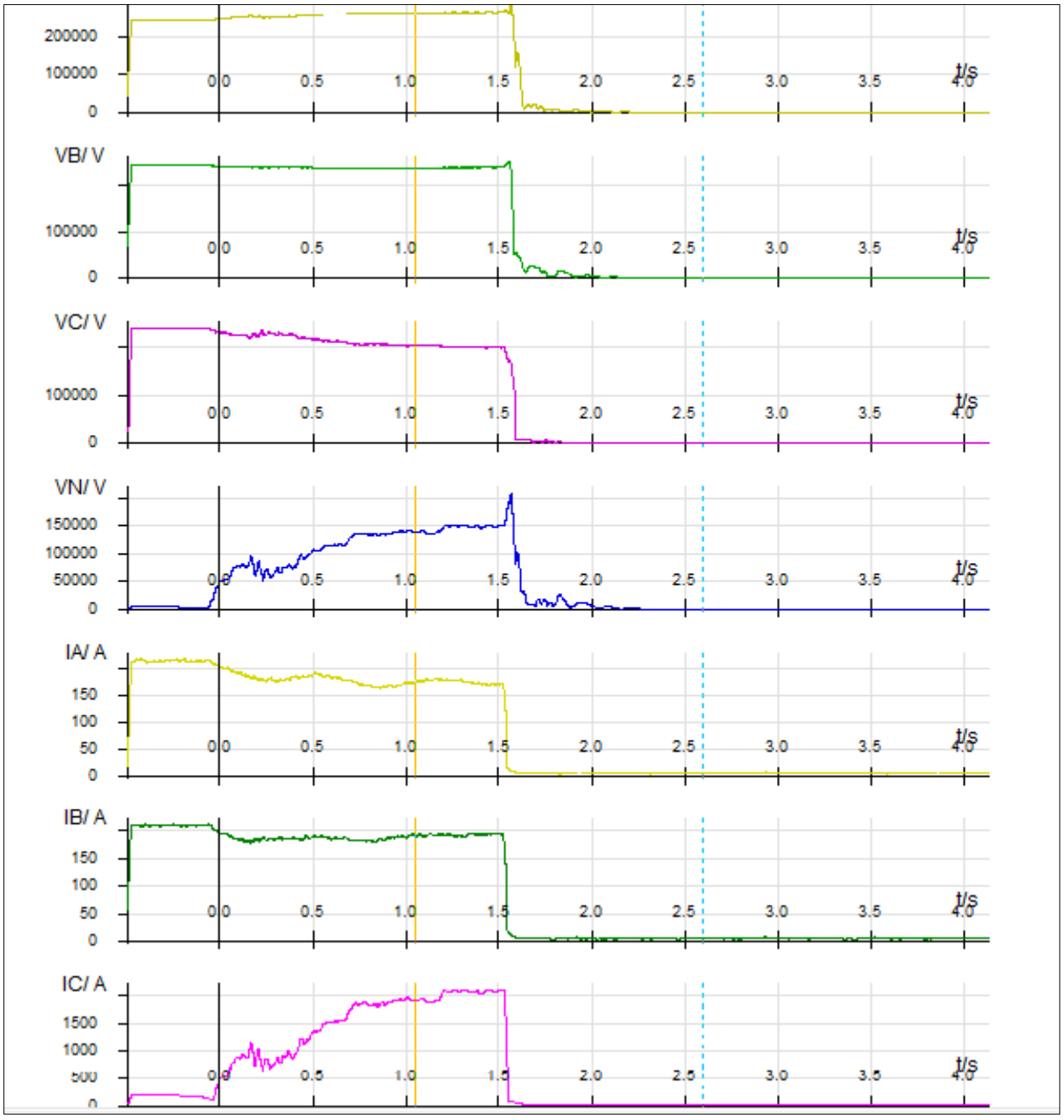
TIME	MILLI_SEC	STATION	DESCRIPTION	STATUS
23-04-2021 13:21:22	351	DKCHU_PG	400_TEES3_PG_MP2	Operated
23-04-2021 13:21:22	356	DKCHU_PG	400_TEES3_PG_MP1	Operated
23-04-2021 13:21:22	368	DKCHU_PG	400_TEES3_PG_RANGP_PG_Tie	Open
23-04-2021 13:21:22	370	DKCHU_PG	400_TEES3_PG_Main_CB	Open
23-04-2021 13:21:22	453	KISHN_PG	400_STATCOM_TEES3_PG_2_Tie	Travel
23-04-2021 13:21:22	454	KISHN_PG	400_TEES3_MAIN_CB	Travel
23-04-2021 13:21:22	459	KISHN_PG	400_STATCOM_TEES3_PG_2_Tie	Open
23-04-2021 13:21:22	461	KISHN_PG	400_TEES3_MAIN_CB	Open
23-04-2021 13:21:22	655	KISHN_PG	400_TEES3_PG_2_R_CB	Travel
23-04-2021 13:21:22	661	KISHN_PG	400_TEES3_PG_2_R_CB	Open

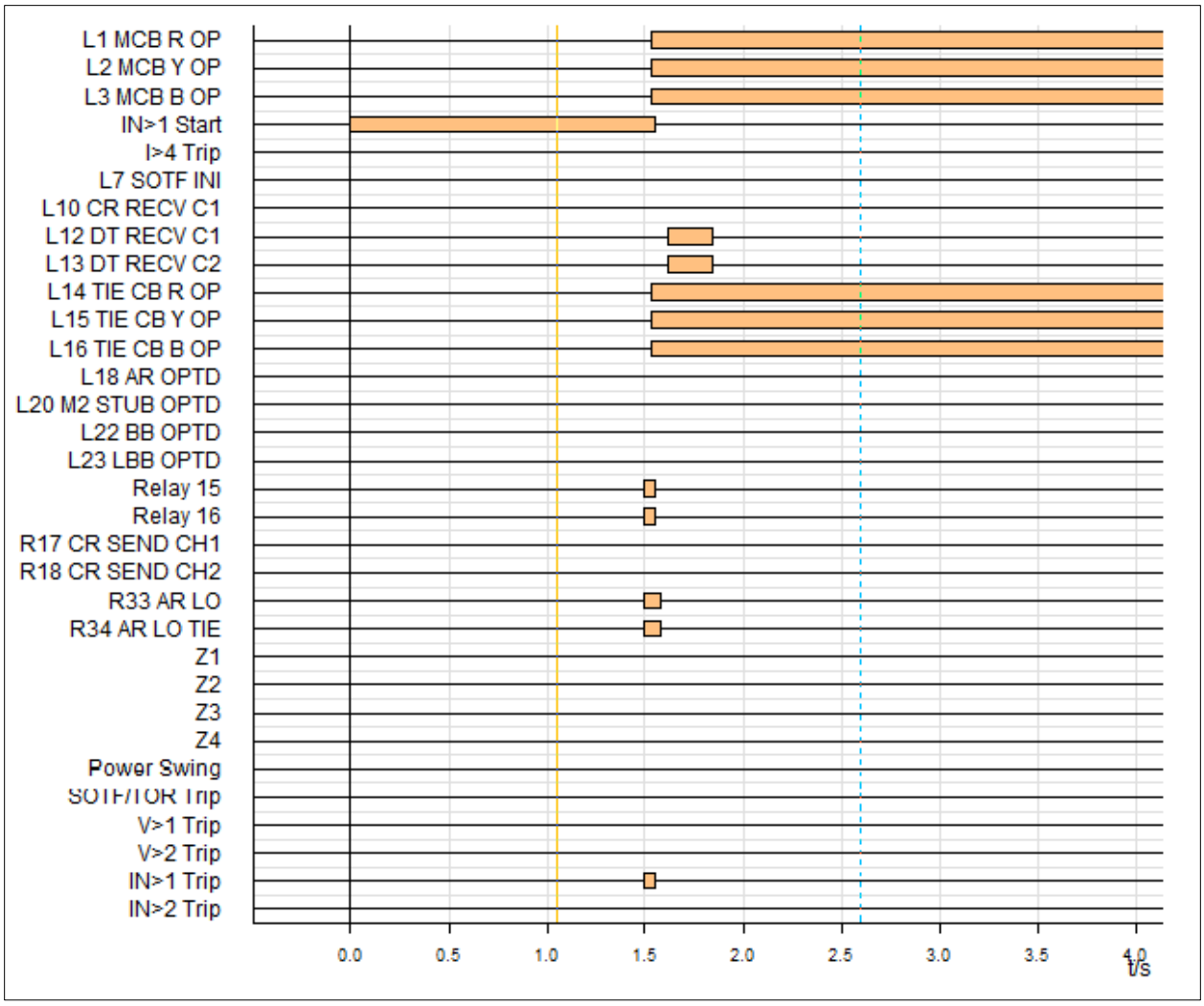
Annexure 2:

1. DR output of 400 kV Teesta-III – Dikchu (Teesta end).

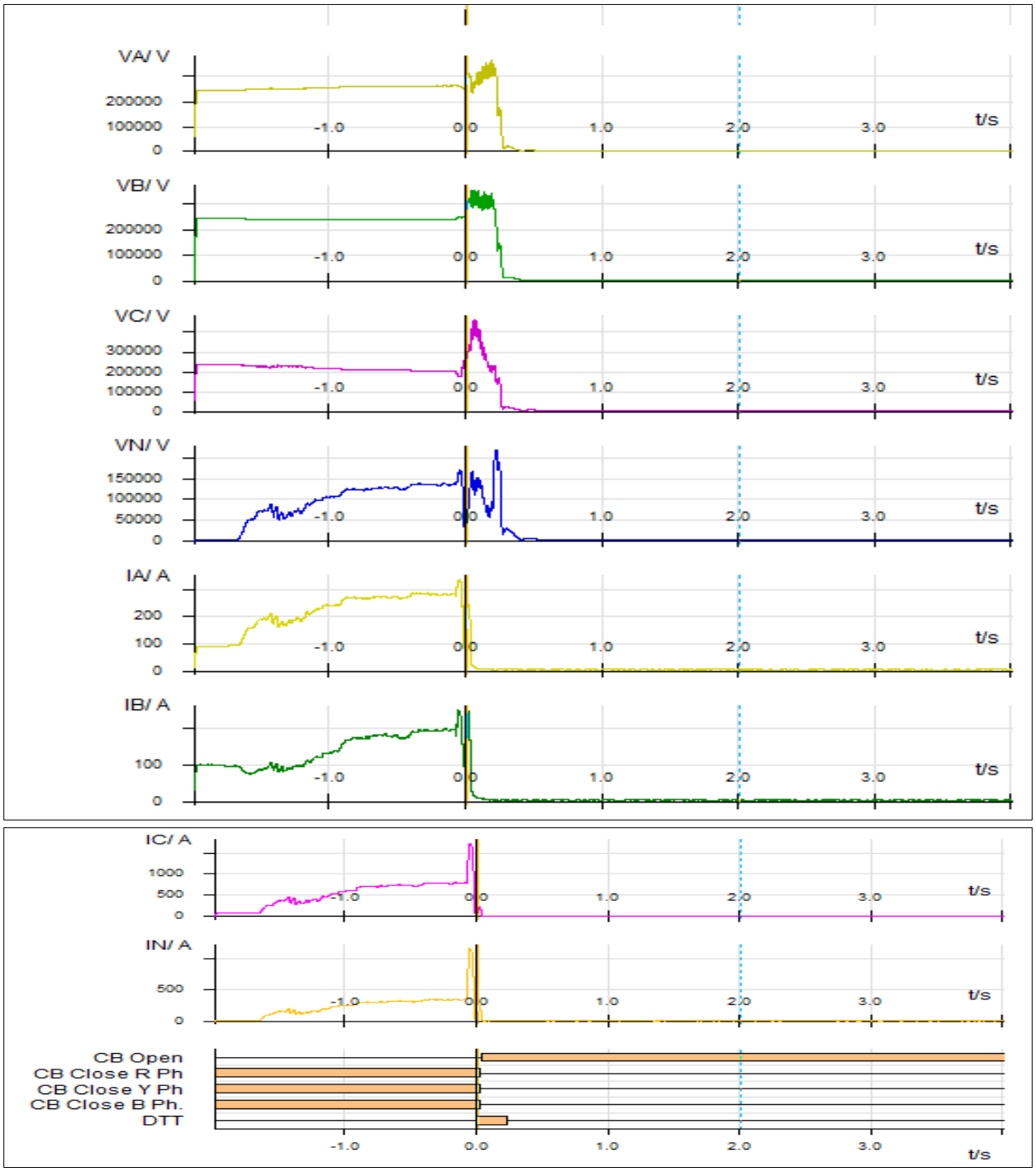


2. DR output of 400 kV Teesta-III – Dikchu (Dikchu end).

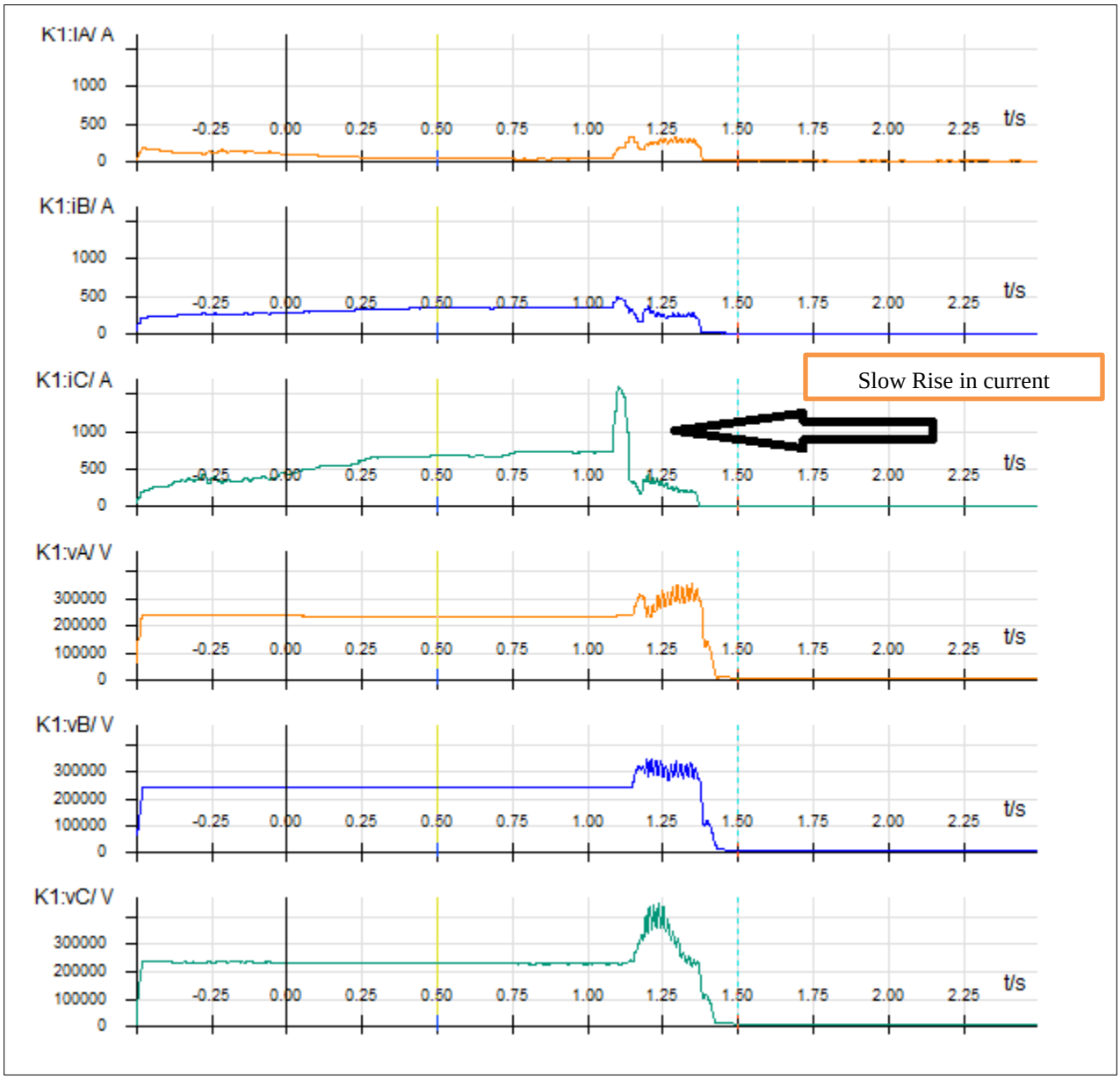


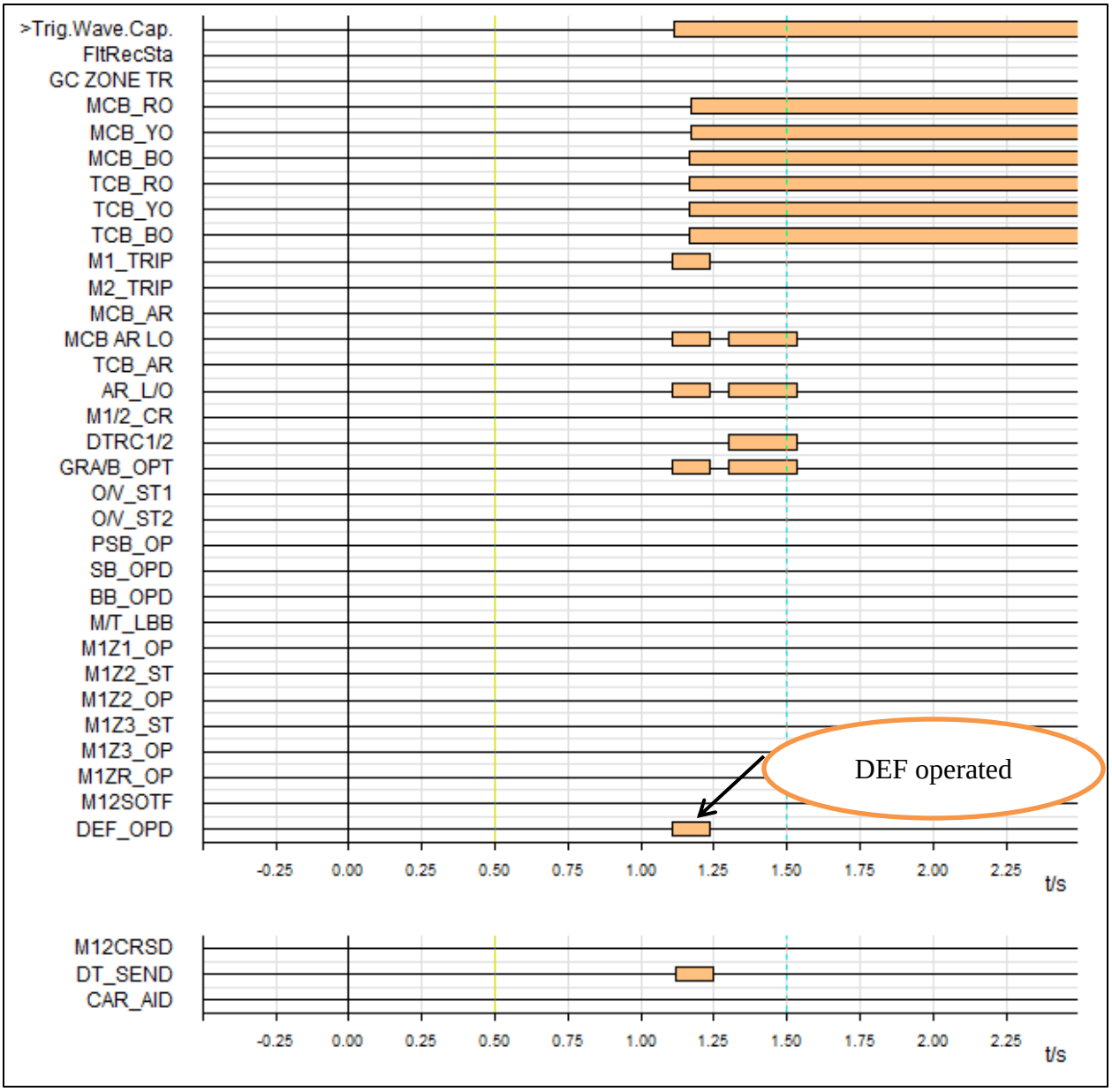

L1 MCB R OP
L2 MCB Y OP
L3 MCB B OP
IN>1 Start
I>4 Trip
L7 SOTF INI
L10 CR RECV C1
L12 DT RECV C1
L13 DT RECV C2
L14 TIE CB R OP
L15 TIE CB Y OP
L16 TIE CB B OP
L18 AR OPTD
L20 M2 STUB OPTD
L22 BB OPTD
L23 LBB OPTD
Relay 15
Relay 16
R17 CR SEND CH1
R18 CR SEND CH2
R33 AR LO
R34 AR LO TIE
Z1
Z2
Z3
Z4
Power Swing
SOTF/TOR Trip
V>1 Trip
V>2 Trip
IN>1 Trip
IN>2 Trip
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
t/s

3. DR output of 400 kV Teesta-III – Kishangunj (Teesta-III end).



4. DR output of 400 kVTeesta-III – Kishangunj (Kishangunj end).




>Trig.Wave.Cap.
FltRecSta
GC ZONE TR
MCB_RO
MCB_YO
MCB_BO
TCB_RO
TCB_YO
TCB_BO
M1_TRIP
M2_TRIP
MCB_AR
MCB AR LO
TCB_AR
AR_L/O
M1/2_CR
DTRC1/2
GRA/B_OPT
O/V_ST1
O/V_ST2
PSB_OP
SB_OPD
BB_OPD
M/T_LBB
M1Z1_OP
M1Z2_ST
M1Z2_OP
M1Z3_ST
M1Z3_OP
M1ZR_OP
M12SOTF
DEF_OPD
DEF operated
-0.25
0.00
0.25
0.50
0.75
1.00
1.25
1.50
1.75
2.00
2.25
t/s
M12CRSD
DT_SEND
CAR_AID
-0.25
0.00
0.25
0.50
0.75
1.00
1.25
1.50
1.75
2.00
2.25
t/s

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:29-04-2021/1 **दिनांक: 04-05-2021**

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

Summary of the event (घटना का सारांश):

220 kV Farakka-Lalmatia S/C was under breakdown since 21-04-2021 due to tower collapse near Lalmatia S/s end. On 29-04-2021 at 20:41 hrs, its tower no. 7, 8 & 9 near 400 kV Farakka switchyard (within 1 km distance) also got collapsed during inclement weather. As 400 kV Farakka – Durgapur D/C conductors are crossing under 220 kV Farakka-Lalmatia S/C between tower no 6 & 7, its conductor fell on these circuits leading to single phase to earth faults on these circuits. This has resulted in severe fault current feeding to the fault by Farakka thermal power plant along with significant voltage dip due to nearness of fault and high fault of Farakka. Both the circuits tripped from their respective ends. At the same time sensing this fault 400 kV Farakka-New Purnea also got tripped in zone 1 from New Purnea end only. Along with this Unit 6 at Farakka tripped due to high turbine vibration and generation rescheduling was done for the same. Prior to the tripping, the schedule to Farakka stage III (unit 6) was 450 MW. Inclement weather condition was reported at the time of the event.

- **Date / Time of disturbance:** 29-04-2021 at 20:41 hrs.
- **Event type:** GI-2
- **Systems/ Subsystems affected:** 400 kV Farakka Super Thermal Power Station
- **Gen Loss:** Around 450 MW due to tripping of Farakka Unit 6.

Major elements tripped (प्रमुख ट्रिपिंग):

- 400 kV Farakka Durgapur D/C
- 400 kV Farakka New Purnea - 1
- Farakka Unit 6

Network across the affected area (प्रभावित क्षेत्र का नक्शा)

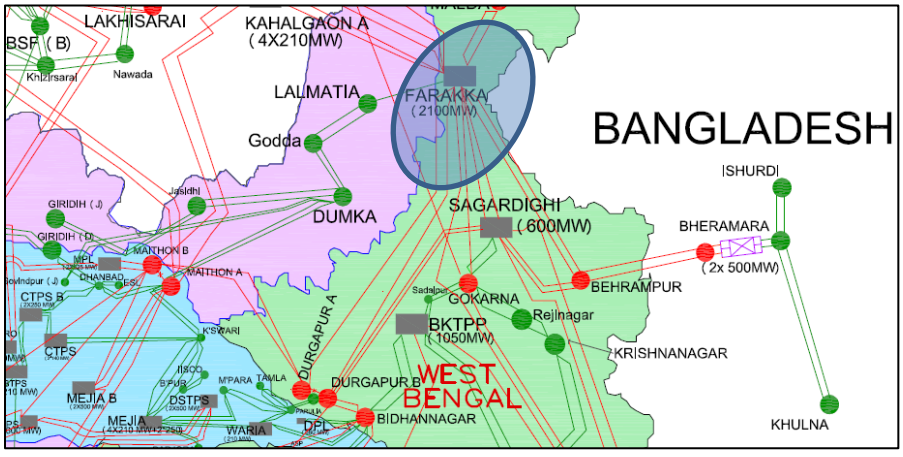


Figure 1: Network across the affected area

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

समय	नाम	उप केंद्र 1 रिले संकेत	उप केंद्र 2 रिले संकेत	पीएमयू पर्यवेक्षण
20:41	400 kV Farakka Durgapur -1	R-N, Zone -1, F/C 35 kA, Carrier sent A/R attempt taken. During A/R fault current was 55 kA.	R-N, Zone-2, FC 2.5 kA, Zone 1B operated, carrier received. Unsuccessful Auto reclose.	PMU installed at Farakka captured one R phase to earth fault and one B phase to earth fault at the time of the event. Both the faults are cleared within 100 ms. **Auto reclose attempt was not taken for B phase to earth fault**. Auto reclose attempt was unsuccessful for R phase to earth fault.
20:41	400 kV Farakka Durgapur -2	B-N, Zone 1 trip, Zone-4 Pickup, F/C 43.243 kA, Carrier sent (No A/R as it was in block condition as per DR so direct three phase trip)	B-N, Zone - 2, 146.2 km from Durgapur, F/C- 2.7 kA, Zone 1B operated, Carrier received. auto reclose started. After 250 ms R-Y-N, Zone – 2, F/C 3.8 kA. Other two poles tripped after 350 ms	
20:41	400 kV Farakka New Purnea -1	Did not trip	B-N, Zone – 1 operated, 204.3 km from New Purnea, F/C- 2.01 kA; Zone 1, 3 Phase trip, No A/R attempt observed from DR.	
20:41	Farakka Unit - 6	High Turbine vibration		

Figure 2: Three phase voltage measured by Farakka PMU shows the existence of one B phase to earth fault and one persistent R phase to earth fault at the time of the event.

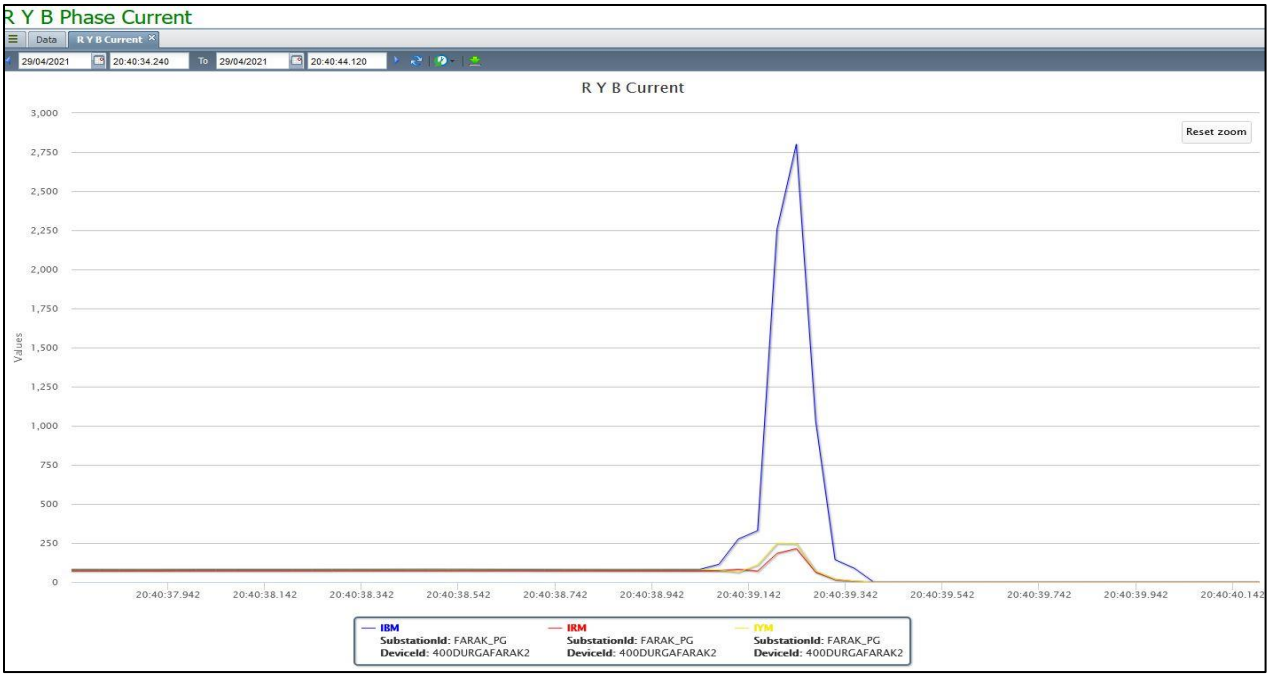


Figure 3: Three phase current measured at Farakka for 400 kV Durgapur 2 feeder shows the existence of B phase to earth fault current at the time of the fault. No auto-reclose attempt was taken place as it was in block condition. Fault clearing time was less than 100 ms.

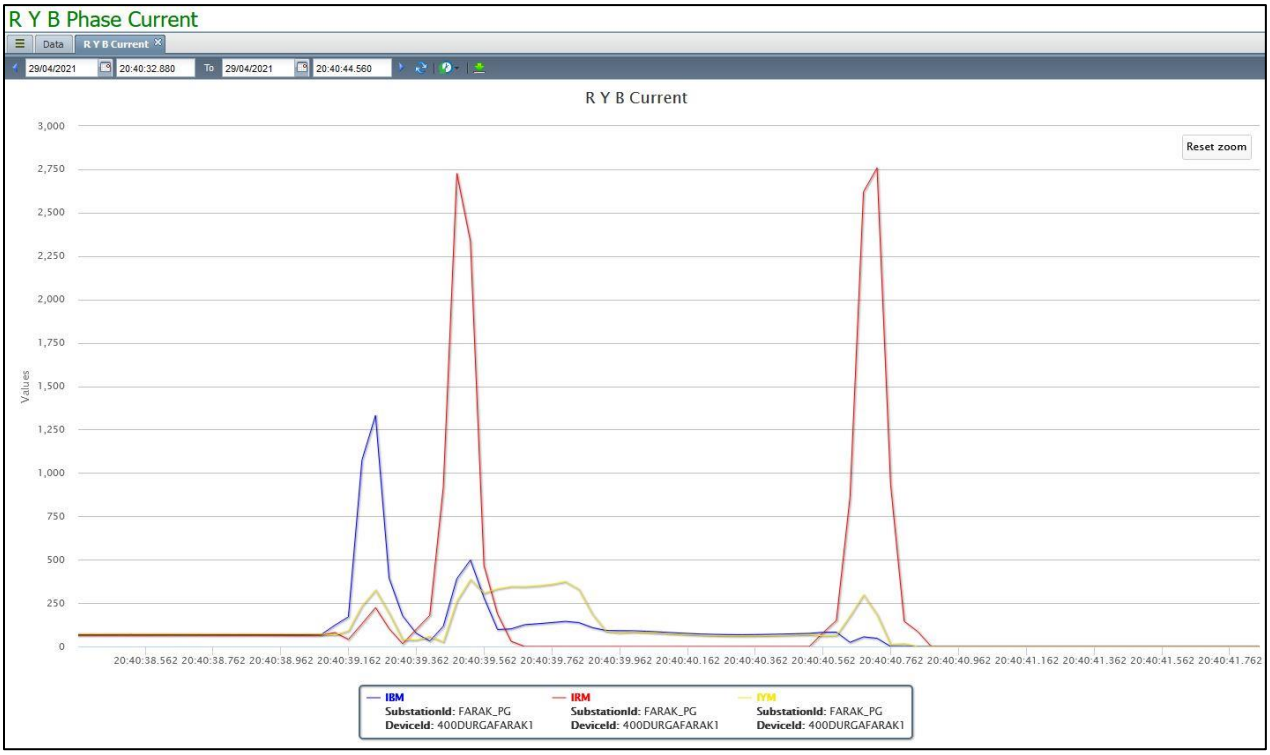


Figure 4: Three phase current measured at Farakka for 400 kV Durgapur 1 feeder shows the existence of R phase to earth fault current at the time of the fault. As fault was persistent in nature auto-reclose was unsuccessful. Fault clearing time was less than 100 ms.

Restoration (पूर्वावस्था की प्रप्ति)

- 400 kV New Purnea Farakka - 1 was restored at 21:05 hrs on same day.
- 400 kV Farakka Durgapur – 1 was restored at 20:41 hrs on 01-05-2021.
- 400 kV Farakka Durgapur – 2 was restored at 18:19 hrs on 04-05-2021.
- Unit 6 at Farakka was revived at 01:19 hrs on 30-04-2021

Analysis of the event (घटना का विश्लेषण):

- On 29-04-2021 at 20:41 hrs 400 kV Farakka Durgapur D/C tripped on short circuit fault. At the same time, 400 kV Farakka New Purnea – 1 tripped from New Purnea end only. Around 8 seconds after, Unit 6 at Farakka got tripped due to unit vibration.
- After the preliminary field investigation was carried out by NTPC, it was observed that 220 kV Farakka Lalmatia S/C (under breakdown since 21-04-2021 due to tower collapse near Lalmatia) had tower collapsed at No 7, 8 & 9 of near Farakka switchyard (within 1 km distance) due to inclement weather. The 220 kV conductor of the already out transmission line fell on 400 kV Farakka – Durgapur D/C which is under crossing 220 kV Farakka-Lalmatia S/C between tower no 6 & 7. This has resulted in a single phase-to-earth fault on both circuits near to NTPC Farakka substation at a close distance to the plant.
- The initial fault appeared in 400 kV Farakka Durgapur – 2 which tripped from Farakka end due to B phase to earth fault in zone – 1. The fault current was around 42.3 kA. All three poles of the breaker at Farakka end opened instantly as single-phase A/R was in block condition(**Refer to Annexure 3**). NTPC Farakka informed voltage in R&B phase increased to 495 kV & 370 kV respectively and voltage in Y phase dropped to 100 kV during the event. Blackmark and damage of element in the wave trap of B-phase were observed along with chipping in one of the BPI stacks. Relay also pick up the zone 4 fault when the similar fault appeared also in the Durgapur 1 circuit in the R phase due to conductor earthing.

  At Durgapur end also, the B phase fault was first sensed in zone 2 however, with the carrier from Farakka end it tripped the B phase pole to clear the fault in Zone-1 B protection. Auto reclose operation of 400 kV Durgapur – Farakka - 2 started at Durgapur end after sensing first B phase to earth fault. Around 200 ms after the first fault, another fault in R and Y phase has been sensed by the Durgapur end relay in zone -2. Around 350 ms after R and Y poles also opened at Durgapur end and 400 kV Farakka Durgapur – 2 tripped from both ends. (**Refer to Annexure 3A**)
- Immediately within 166 ms of B phase fault on 400 kV Farakka-Durgapur 2 circuit, R phase fault occurred on 400 kV Farakka-Durgapur 1 circuit as conductor of 220 kV Farkka-Lalmatia also fell on this circuit. The fault was sensed in zone 1 from farakka and Zone 2 from Durgapur. Farakka end sent the carrier to Durgapur end. Both ends tripped the R phase pole and A/R cycle got started. Due to the permanent nature of the fault, unsuccessful auto reclose attempt had been observed at Farakka and Durgapur end for 400 kV Farakka Durgapur – 1 on R phase to earth fault. The fault current at Farakka was around 55 kA during the A/R attempt. One of the conductors of Wave Trap and Isolator interconnection was found snapped due to breaking of Wave Trap side connector. No arc/flashover marking was observed on the structure and WT.

- In addition to these, 400 kV New Purnea – Farakka – 1 tripped from New Purnea end only after sensing one B phase to earth fault in zone – 1. It was observed that all three phases got tripped in zone 1 rather than single-phase tripping. (**Refer to Annexure 4**).
- Around 8 seconds after the line tripping, 500 MW Unit 6 at Farakka tripped on high turbine vibration causing loss of 450 MW generation.

Operational issues Observed (प्रचालन समस्या) :

- 220 kV Farakka-Lalmatia S/C has tower collapse at two locations (one near Farakka during this event) and one near Lalmatia (on 21st April event). Due to ownership/maintenance/court litigation issue restoration of 220 kV Farakka-Lalmatia S/C is not taking place. This 220 /132/33 kV Lalmatia substation is relying on only 132 kV lines. In addition, the non-availability of 220 kV Farakka-Lalmatia S/C is also leading to islanding of Farakka Super thermal power plant out of scope. Hence NTPC Farakka, ECL and JUSNL/Jharkhand SLDC may share the restoration plan of 220 kV Farakka Lalmatia S/C. (**NTPC Farakka, ECL and JUSNL/Jharkhand SLDC to update**).
  It may kindly be noted that the Lalmatia Mines which is being supplied through this substation is the source of coal supply to 400 kV Kahalgaon NTPC and 400 kV Kahalgaon NTPC substation. Any loss of supply to mines for a longer period will result in the outage of these two power plants due to the coal supply issue from the affected mines.
- The sequence of event data at Durgapur end is not recorded at ERLDC SCADA data during this event. **POWERGRID ER-2 to update.**
- Severe fault current has been observed to the tune of 55 kA during the event which is basically due to nearness of solid fault near to Farakka generating plant having high fault level (tune of 55 kA three phase fault current). The high fault current seems to have impacted the end equipment of the circuits (Wave trap, isolator, conductor). **PGCIL ERTS 2 may kindly update on the status of bypassing of circuits from Farakka NTPC for fault reduction as per ERPCTP forum decisions.**
- Tripping of Unit 6 just after the fault needs further analysis by NTPC Farakka. **NTPC Farakka to update**

Protection issues observed (सुरक्षा समस्या):

- Based on DR from the New Purnea end and no tripping at the Farakka end, it is observed that there was no fault on the 400 kV New Purnea-Farakka circuit. It seems that the New Purnea end relay has observed the fault of 400 kV Farakka-Durgapur 2 (B phaser fault) and tripped in zone 1. It is also observed that the circuit has given the three phase trip command in place of a single-phase trip during the single-phase fault. (**POWERGRID ER – 1 to explain**)
- There was no three-phase tripping on B phase-to-earth fault during the 400 kV Farakka-Durapur 2 circuit from the Farakka end. NTPC may explain why the A/R was in block condition before the fault. (**NTPC Farakka to update**)
- The event logger for the entire substation was not made available for the event. All DRs received from NTPC Farakka are not time-synchronized. This created a difficulty during the analysis. The observed drift in DR is quite high. NTPC Farakka should check the DR synchronization at regular intervals. Time synchronization of DR may be done at priority by NTPC Farakka. A substation level

event logger is recommended for such a critical powerplant to ensure detailed analysis.(**NTPC Farakka to update**)

- NTPC Farakka informed line voltage of 400 kV Farakka Durgapur – 2 increased to 495 kV & 370 kV in R&B phase respectively and dropped to 100 kV in Y phase during the event. This was also observed at DR. Around 39 kA fault current has been observed in the B phase. The reason for voltage rise in faulted phase and drop in voltage in healthy phase may be investigated. (**NTPC Farakka to update**)

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

Issues	Regulation Non-Compliance	Utility
DR/EL are not time-synchronized	1. Indian Electricity Grid Code 4.6.3 2. CEA Technical Standard for Construction of Electrical Plants and Electric Lines: 43.4 .D. 3. CEA (Technical standards for connectivity to the Grid) Regulation, 2007: Schedule Part 1.7.	NTPC Farakka
SCADA data Non-Availability for the station	1. IEGC 4.6.2 Data and Communication Facilities 2. IEGC 5.2.q	PGCIL ERTS-2

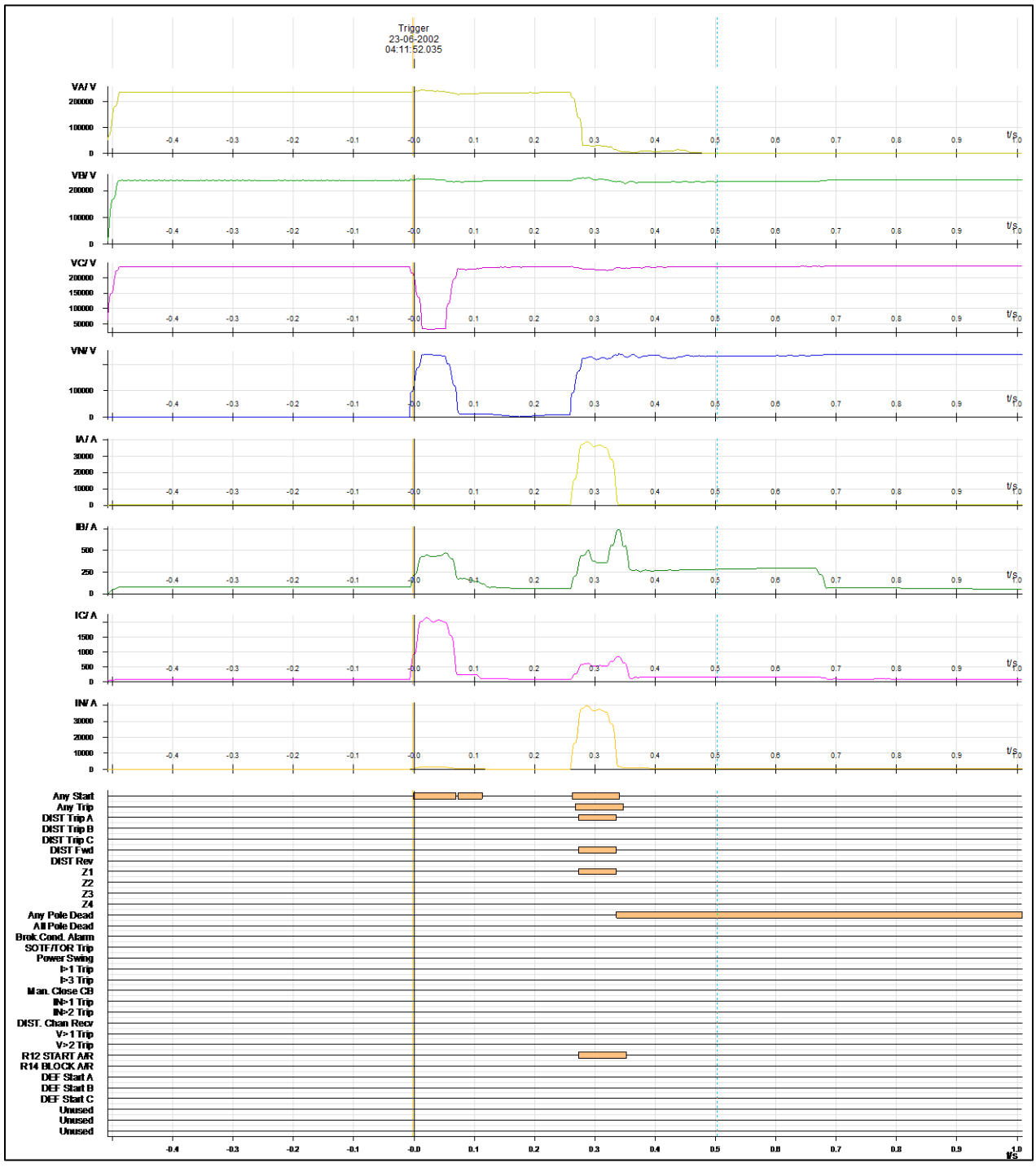
Status of Reporting (रिपोर्टिंग की स्थिति):

- DR received from POWERGRID ERTS 1 & 2.
- DR and detail report received from NTPC Farakka.

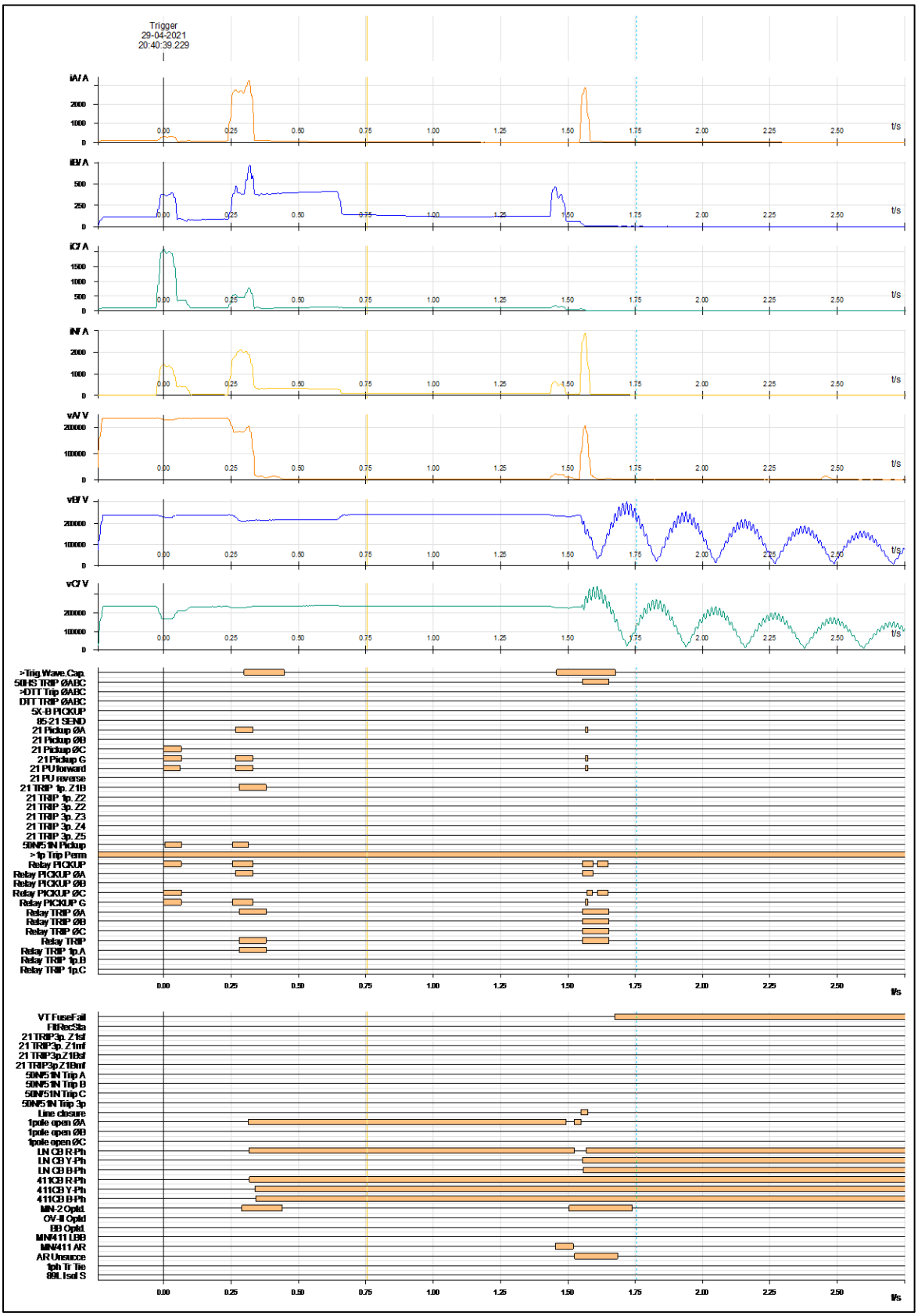
Annexure 1: Sequence of events recorded at ERLDC SCADA data at the time of the event.

TIME	MILLI_SEC	STATION	DESCRIPTION	STATUS
20:40:39	250	NFARA_PG	400_DURGA_PG_2_KAHAL_PG_2_Tie	Open
20:40:39	250	NFARA_PG	400_DURGA_PG_2_Main_CB	Open
20:40:39	282	PURNW_PG	400_FARAK_PG_Main_CB	Open
20:40:39	291	PURNW_PG	400_BIHAR_PG_2_FARAK_PG_Tie	Open
20:40:39	528	NFARA_PG	400_DURGA_PG_1_Main_CB	Open
20:40:40	675	NFARA_PG	400_DURGA_PG_1_Main_CB	Closed
20:40:40	713	NFARA_PG	400_DURGA_PG_1_Main_CB	Open
20:40:48	610	NFARA_PG	400_Unit6_CB	Open
20:40:48	612	NFARA_PG	400_Unit6_Main_CB	Open
20:54:56	426	BHVDC_PG	220_ACFBank4_Reactor6_CB	Closed
20:56:25	672	BARH__PG	400_PATNA_PG_3_MP2	Open
20:56:26	27	BARH__PG	400_PATNA_PG_3_MP2	Open
20:59:22	890	BHVDC_PG	220_ACFBank2_Reactor3_CB	Closed

Annexure 2: DR recorded at Farakka for 400 kV Farakka Durgapur – 1

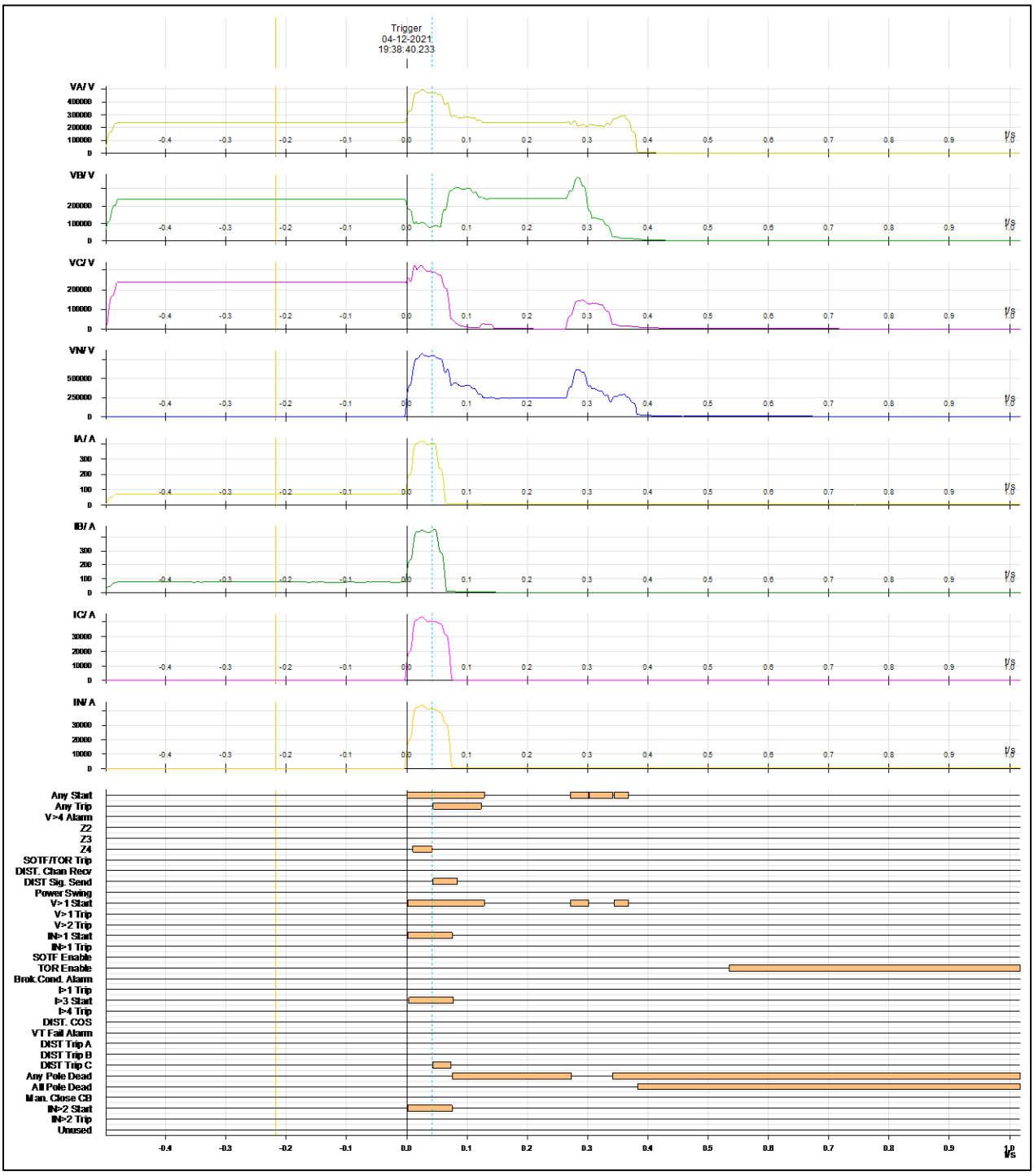


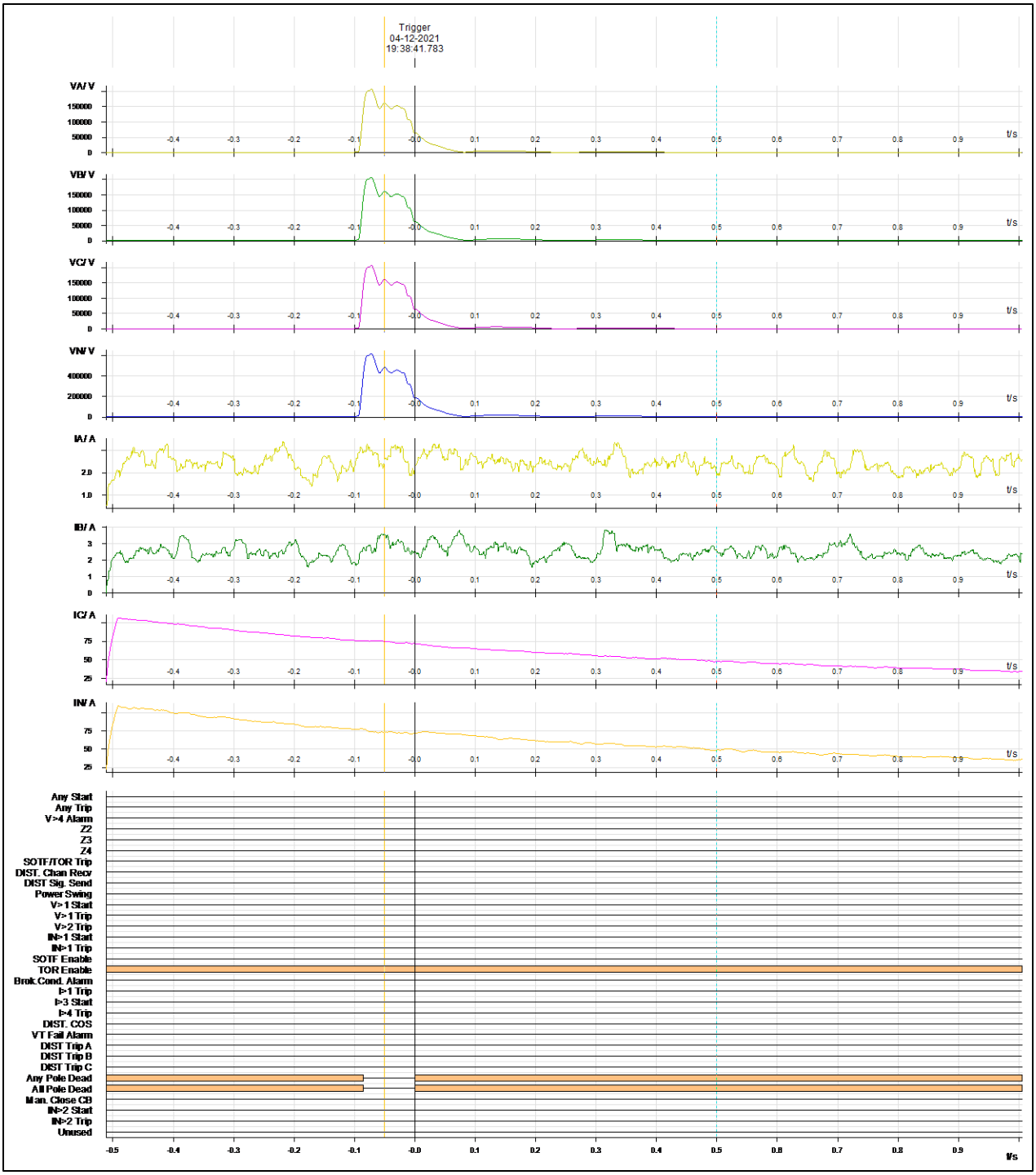
Annexure 2A: DR recorded at Durgapur for 400 kV Farakka Durgapur – 1



Why 411 breakers did not auto reclose?

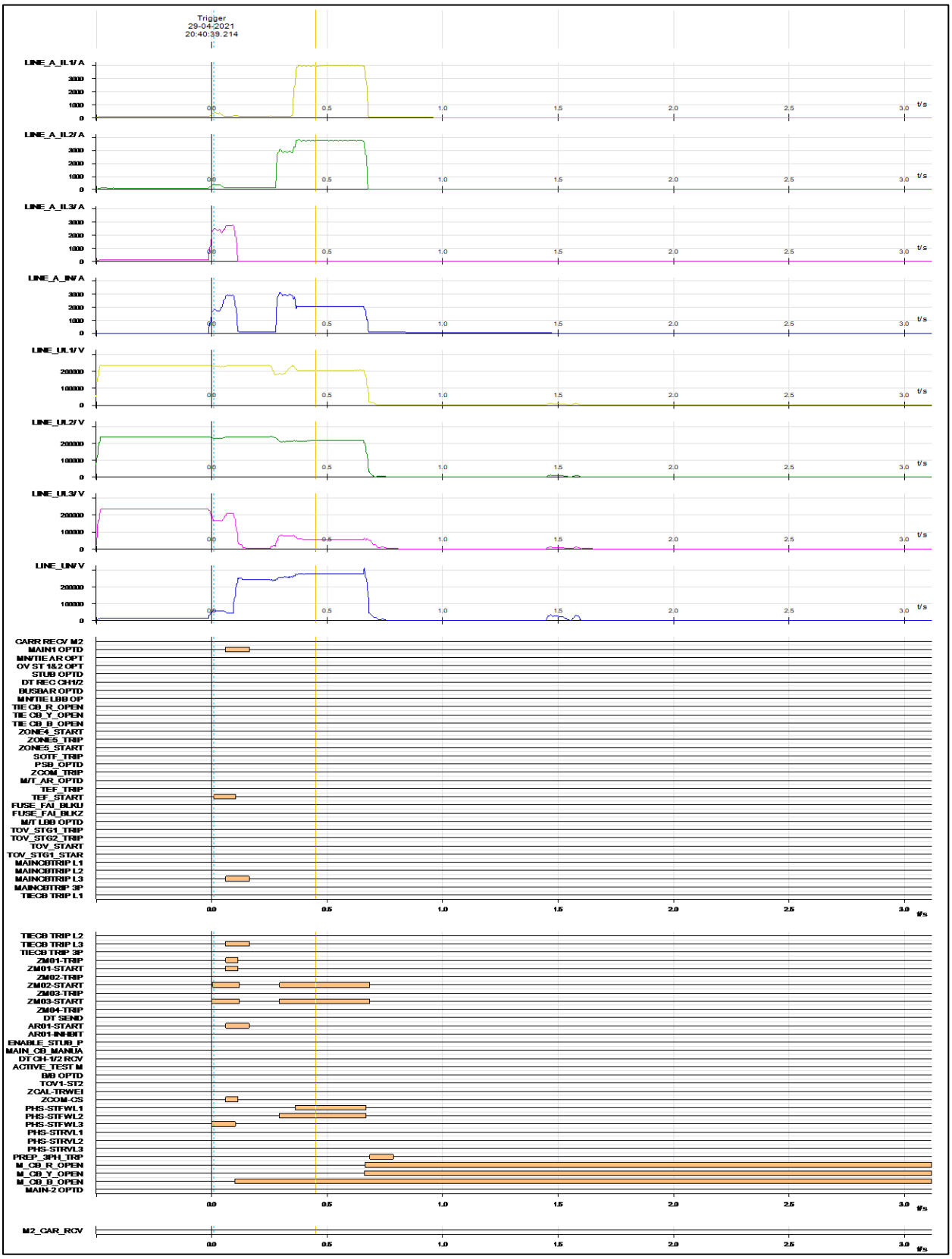
Annexure 3: DR recorded at Farakka for 400 kV Farakka Durgapur – 2



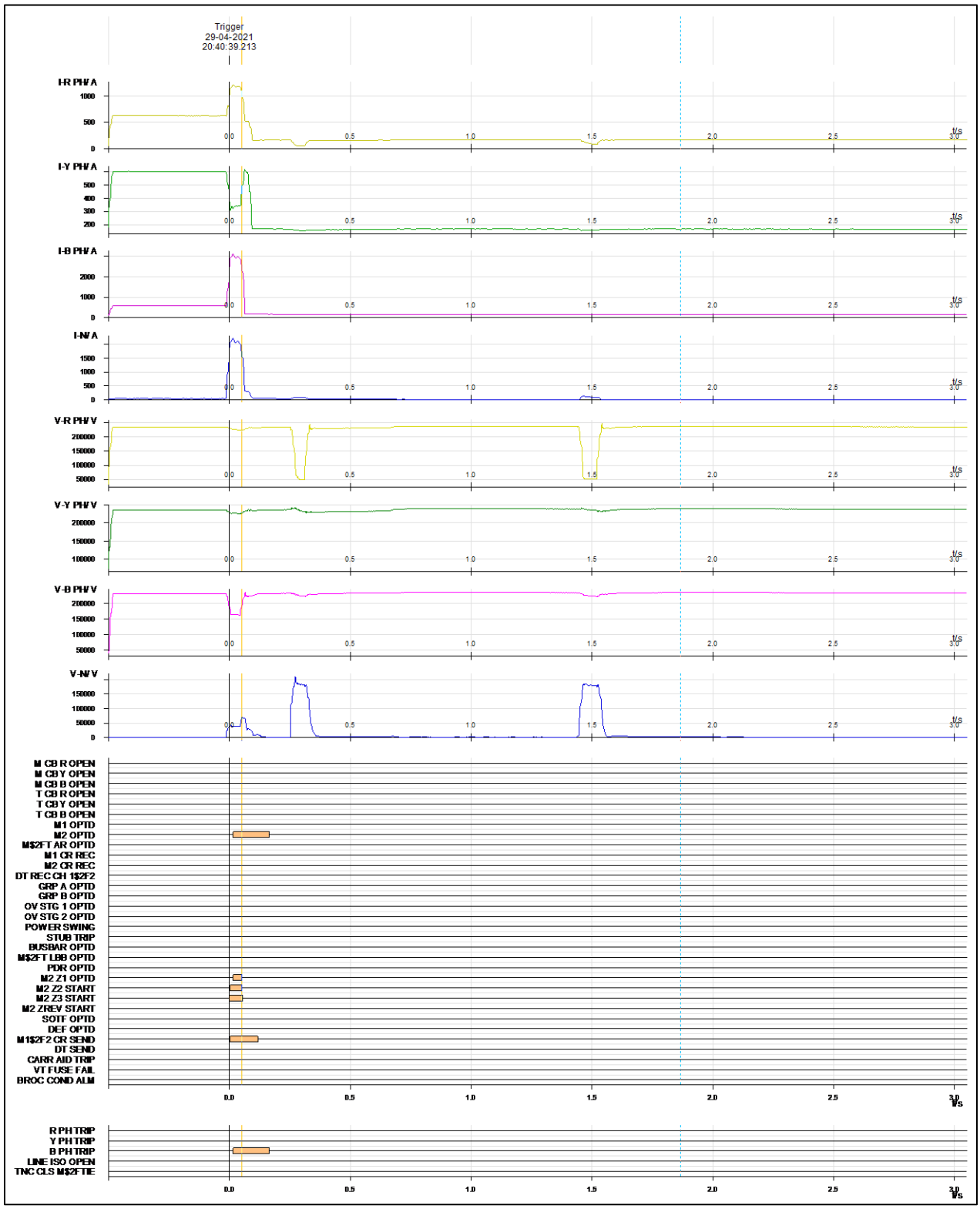


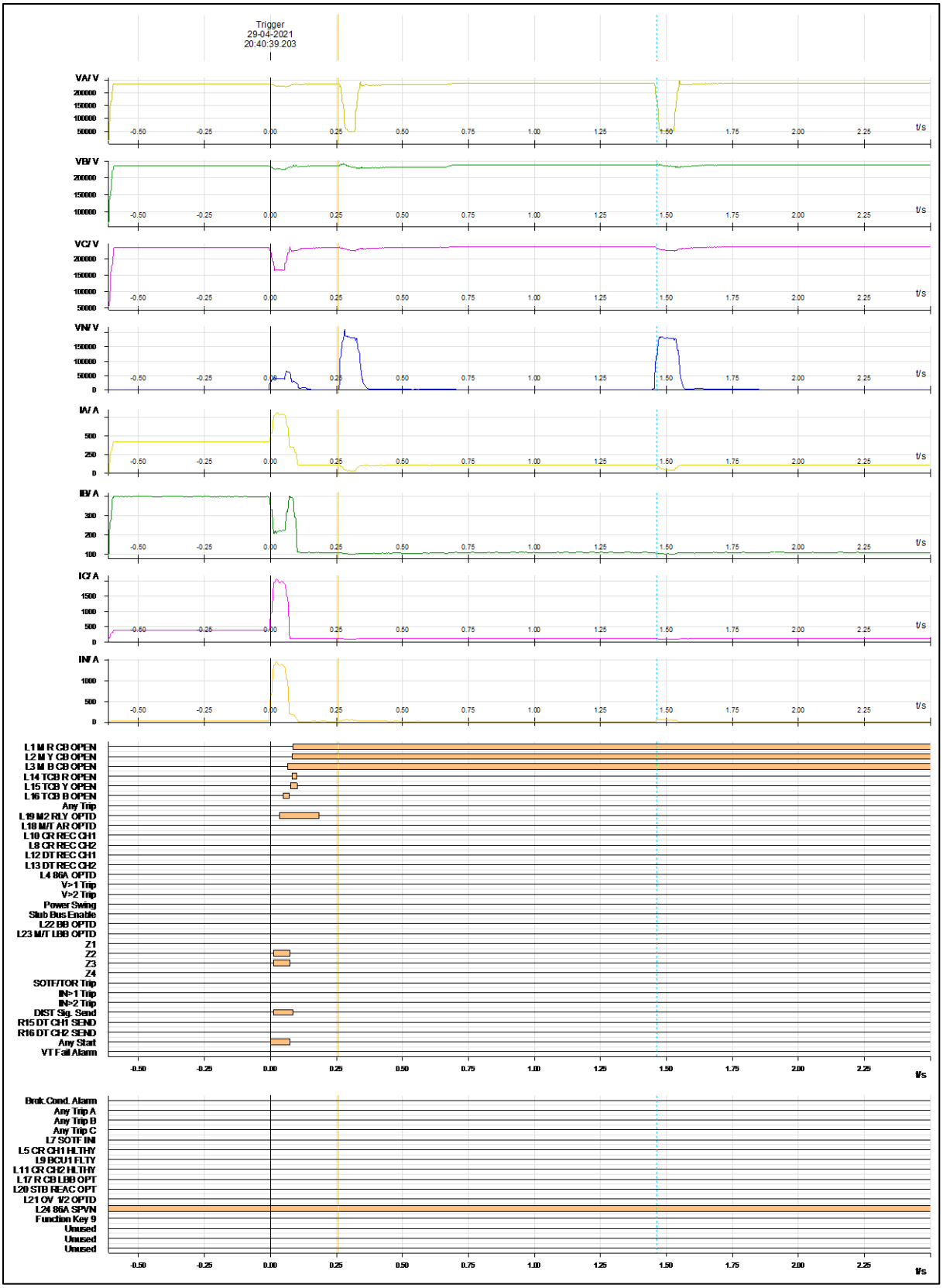
Line voltage in all three phases reappears for around 100 ms around 1.5 seconds after the three poles tripping at Farakka on zone - 4. Current was zero at that time at Farakka end. DR is not time synchronized.

Annexure 3A: DR recorded at Durgapur for 400 kV Farakka Durgapur – 2



Annexure 4: DR recorded at Purnea end for 400 kV Farakka New Purnea – 1





Fault was sensed in zone – 1; Unsuccessful auto-reclose operation.

Annexure 5: Report shared by NTPC Farakka

Brief Incident Report of Line Tripping on 29.04.2021

On 29.04.2021 at 20.41HRS Durgapur Line#1&2 tripped during inclement weather condition at Farakka. Following are the observations on tripping incident:

Durgapur Line#1:

1) Fault in R phase (Zone#1) appeared with fault current of 38kA approx and AR was initiated.
2) After Auto reclose, fault was persisting with fault current of 53kA approx with DC component which was subsequently cleared by protection system.
3) One of the conductors of Wave Trap and Isolator interconnection was found snapped due to breaking of Wave Trap side connector. No arc/flashover marking observed on the structure and WT.
4) During line patrolling by PGCIL, it was gathered that Farakka-Lalmatia line tower conductor has fallen over Farakka-Durgapur#1&2 lines due to FLT line tower collapse.

Durgapur Line#2:

1) Voltage dip in Y-ph (up to 100kV approx) is observed with rise in voltage of R&B phase to the value of 495 kV &370kV respectively.
2) Fault current was gone up to 43kA approx in B phase before line tripping from Farakka end with minor increase in current of other two phases (approx. 400A).
3) Fault was cleared by the protection system.
4) Black mark and damage of element in Wave Trap of B-phase is observed along with chipping in one of the BPI stack.

220kV FLT Line:

1) Tower no. 7, 8 & 9 of 220kV Farakka-Lalmatia line near Farakka switchyard (within 1km distance) was collapsed during inclement weather condition on 29.04.2021 at approx 20:40 HRS. FD#1&2 line of PGCIL are undercrossing FLT line between tower no. 6&7 and due to collapse of tower no.7, conductor of FLT line fallen on Fd#1&2 circuit.

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: 08-04-2021/1 **दिनांक: 08-04-2021**

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

Summary of the event (घटना का सारांश):

220/132 kV Budhipadar is an important grid substation in the Odisha system. It is having 3 captive power plants (Vedanta, Bhushan steel, Aditya Alumina) connected through D/C lines each and one thermal power plant (IBTPS) connected at 220 kV level with 2 X D/C lines. Apart from these it is having 220 kV Budhipadar Tarkera D/C, 220 kV Budhipadar -Lapanga D/C, 220 kV Budhipadar-Korba East D/C and 220 kV Budhipadar-Raigarh S/C. It has one 220/132 kV ICT (ICT 2 was out as damaged since 05-02-2021) and 132 kV Budhipadar-Lapanga S/C which act as an incomer. Radial substations meeting load are connected at 132 kV levels.

On 08 April 2021, at 220 kV Budhipadar-Lapanga ckt-1 & 2 got tripped at 13:47 and 13:49 hrs respectively. This resulted in higher loading of 220/132 kV ICT 1 160 MVA ICT Budhipadar as 132 kV Budhipadar-Lapanga S/C acted as the path. Due to this, at 13:55 hrs., this 132 kV circuit was made out. With the outage of the Lapanga source, the Loading of other circuits increased. With this, 220 kV Budhipadar-Raigarh S/C got tripped on 14:02 hrs on B phase fault which got cleared with a delay of 1 second. With tripping of these circuits, now all the generation of that 220 kV Budhipadar complex was being evacuated via Tarkera D/C and Korba D/C. At increased loading of 220 kV Budhipadar-Tarkera D/C, Ckt 1 also developed a B phase fault as its jumper melting 14:06:27 Hrs and tripped.

As 220 kV Budhipadar-Tarkera Ckt-1 tripped, circuit 2 power flow increased beyond its thermal rating and at 14:07:24 Hrs, this circuit also developed a fault due to snapping of R-Ph pipe bus from isolator to Breaker. This resulted in a bus fault on 220 kV Bus 1 at Budhipadar due to which all connected elements got tripped. As bus bar protection operated So, with Bus bar operation, 220 kV Budhipadar-Korba East 2 circuit and 160 MVA 220/132 kV ICT 1 also got tripped as these were connected on 220 kV bus 1 at Budhipadar S/s. Now as only 220 kV -Budhipadar-Korba 3 was the only outgoing feeder through this 220 kV Budhipadar substation with so much excess generation, it also tripped on power swing immediately.

With all evacuating sources out, IBTPS and Vedanta, Bhushan formed Island with its own CPP load. However, due to excess generation of approx. 560 MW (Vedanta=250, IBTPS=250, Bhushan=50, pre-event exchange with grid), over frequency occurred leading to tripping of IBTPS generation on over frequency. 220 kV Bhushan steel and Aditya alumina after this got disconnected from the system and their island survived however 220 kV Vedanta island collapsed during the event. The above events had finally led to total voltage loss in 220/132 KV Budhipadar, 220 kV IB thermal and 220 kV Vedanta s/s. This finally also led to a blackout of connected 132 kV radial substations.

There was 1120 MW generation loss in 220 kV Vedanta station (all 9 units of 135MW each) with 860 MW captive load loss, thus causing 260 MW injection loss to GRIDCO. In addition, 250 MW generation loss occurred in 220 KV IB thermal station and 50 MW injection loss from Bhushan Power and steel. Due to 220/132 kV Budhipadar S/s blackout, 100 MW loss in local loads of 132 kV Budhipadar, Jharsuguda and Sundargarh also took place.

- **Date / Time of disturbance:** 08-04-2021 at 14:07 hrs.
- **Event type:** GD - 1
- **Systems/ Subsystems affected:** 220 kV Budhipadar, IB thermal, Vedanta.
- **Load and Generation loss**.
    - 1120 MW generation loss in Vedanta 220 KV station (all 9 units of 135MW each) with 860 MW captive load loss.
    - 250 MW generation loss at IBTPS and 50 MW Injection loss at Bhushan Steel.
    - Total injection loss to the grid was 560 MW (Vedanta=250, IB=250, Bhushan=50).
    - Around 100 MW load loss was reported at Budhipadar, Jharsuguda, Sundargarh.
    - So, Over Generation loss to the grid was around 460 MW.

Major elements tripped (प्रमुख ट्रिपिंग):

- 220 kV-Budhipadar-Lapanga-1.
- 220 kV-Budhipadar-Lapanga-2.
- 220 kV-Budhipadar-Raigarh.
- 220 kV-Budhipadar-Tarkera-1.
- 220 kV-Budhipadar-Tarkera-2.
- 220 kV-Budhipadar-Korba-2.
- 220 kV-Budhipadar-Korba-3.
- IBTPS Units (Details not received)

Network across the affected area (प्रभावित क्षेत्र का नक्शा)

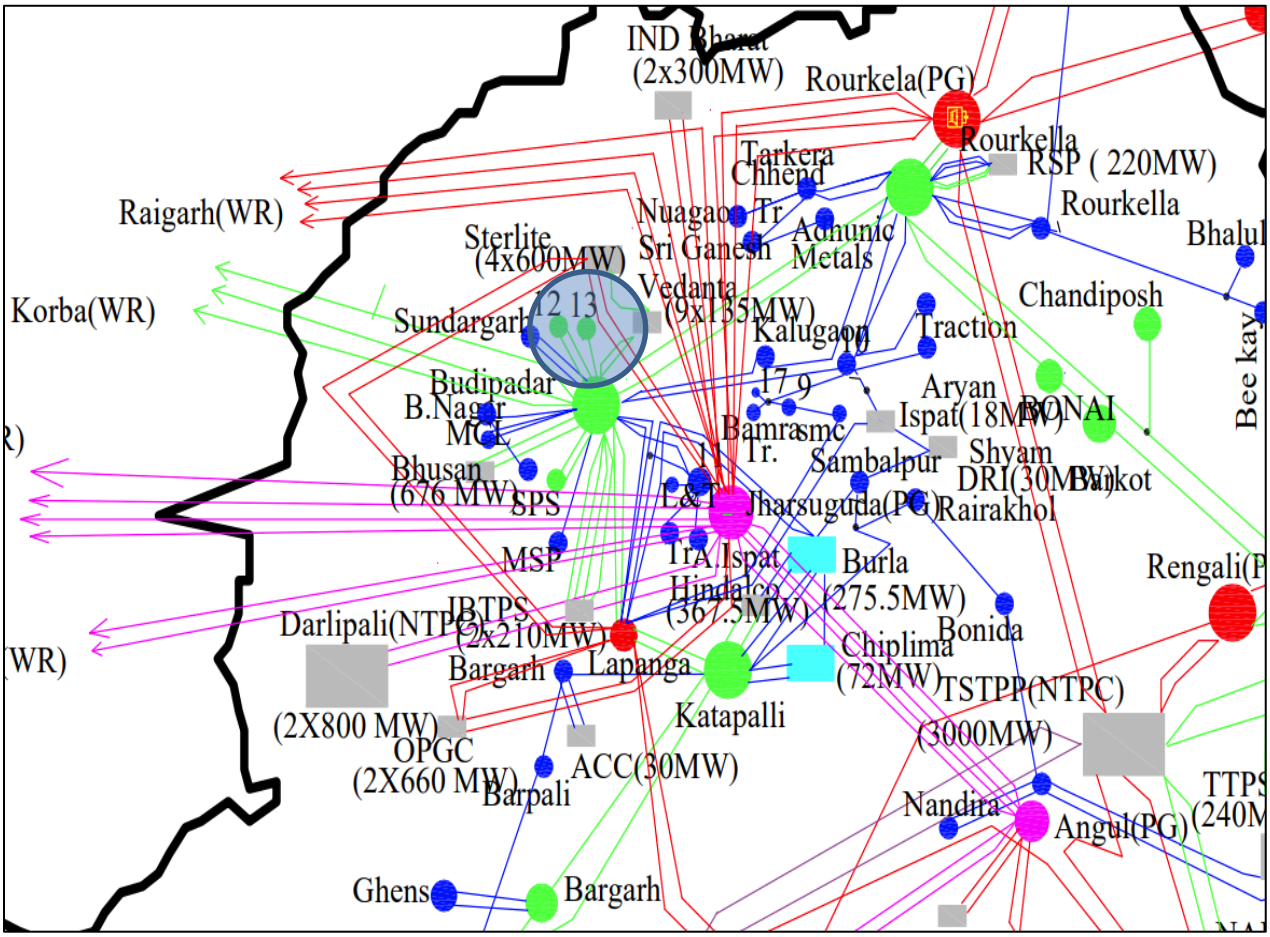


Figure 1: Network across the affected area

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

Sl.No.	Name of feeder	Relay Indication	
		B.Padar End	Remote End
1	220 kV B.Padar-Lapanga-1 (13.47 Hrs)	(Siemens-7SA522) Zone-1,L2-L3, FD=6.057Km, IL2=17.03KA,IL3=16.42KA	Zone-1,L2-L3,FD=10.2km,IL2=9.2KA,IL3=9.91kA
2	220 kV B.Padar-Lapanga-2 (13.49 Hrs)	(Siemens-7SA522) Zone-1,L2-L3-E, FD=7.567Km, IL2=18.48KA,IL3=8.057KA	Zone-1,L2-L3-E,FD=10km,IL2=9.69KA,IL3=7.57kA
3	220 kV Raigarh PG (14.02Hrs)	(B/U-7SJ62) O/C& E/F Trip, IL1=0.53KA, IL2=0.57KA, IL3=1.81KA	
4	220 kV Tarkera-1 (14.05Hrs)	(Siemens-7SA522) Zone-1,L3-E, FD=79.3Km, IL2=17.IL3=2.04KA	Zone-1,L3-E,FD=7.2km,IL3=6.62kA
5	220 kV Korba-3 (14.07Hrs)	PSB optd., IL3=1.76KA,In=1.76KA	No Tripping
6	220 kV Bus-1 (14.07Hrs) (korba-1,IB-1&3, Tarkera-2, B/C,Bhusan-2, SPS,AAL-1,VAL-1)	BB-SIEMENS-7SS522 Trip Bus-1 L1, Trip Bus-1 L123	NA

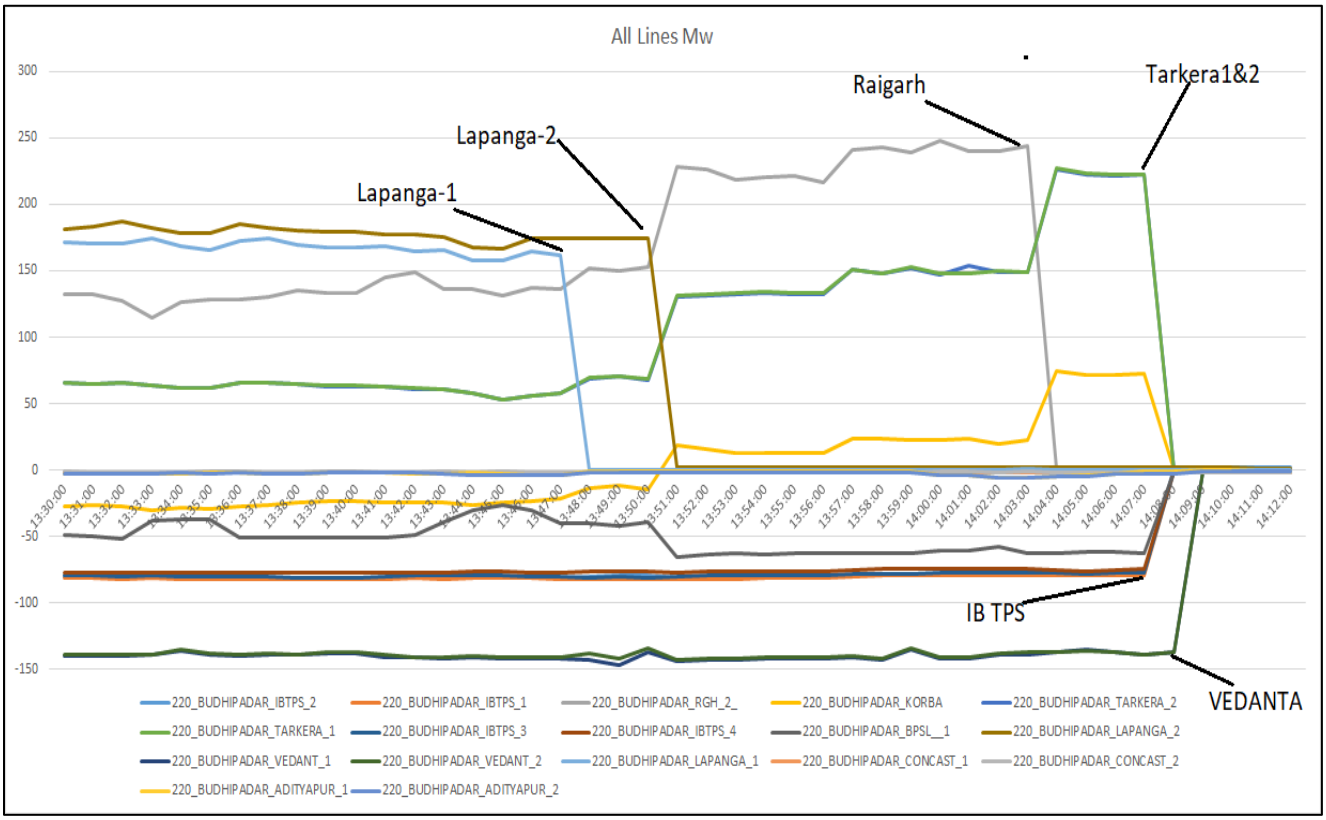


Figure 2: SCADA plot of line loading of 220 kV circuit from Budhipadar S/s during the entire event.

Restoration (पूर्वावस्था की प्रप्ति)

- 220 kV Budhipadar-IBTPS all 4 ckts and 220 kV Budhipadar-Vedanta D/C were restored by 18:00 hrs.
- 220 kV Budhipadar-Raigarh and 220 kV Budhipadar-Korba east d/c were restored at 15:31.
- 220 kV Budhipadar-Tarkera-1 was restored at 17:43hrs.
- 220 kV Budhipadar-Tarkera-II is under B/D

Analysis of the event (घटना का विश्लेषण):

On 08 April 2021 at 14:07 hrs. complete Budhipadar 220 kV substation became dead. There was 1120 MW generation loss in 220 kV Vedanta station (all 9 units of 135 MW each) with 860 MW captive load loss, thus causing 260 MW injection loss to GRIDCO. In addition, 250 MW generation loss occurred in 220 kV IB thermal station and 50 MW injection loss from Bhushan Power and steel. Due to 220/132 kV Budhipadar S/s blackout, 100 MW loss in local loads of 132 kV Budhipadar, Jharsuguda and Sundargarh also took place.

This blackout was the result of series of events including several fault-related tripping events and cascading. The overall chronology of the entire event is being tried to find out based on SCADA and PMU plot and is mentioned as below. SCADA Pre-Event power flow pattern is shown below for the area.

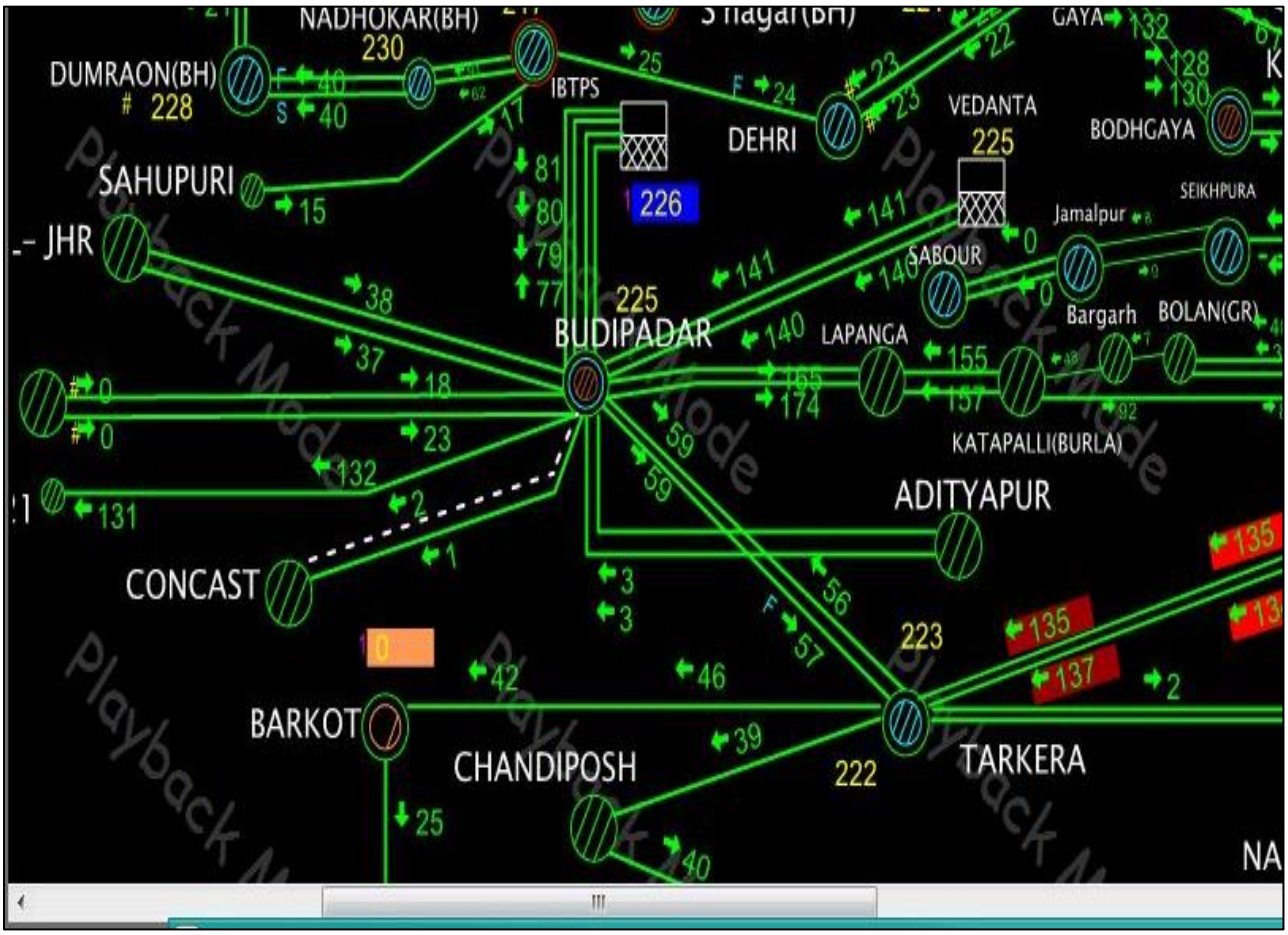


Figure 3: SCADA Snapshot just before the event (13:45 Hrs)

Bus Bar Arrangement at 220 kV and 132 kV Budhipadar

Load flow at 13:00 Hrs. at Budhipadar GSS on dated 08/04/2021

220 KV			
Bay No	Bay	Bus-1(MW)	Bus-2(MW)
1	Basundhara-1	NA	
2	Basundhara-2		2
3	Raigarh	130	
4	Korba- 2	-27	
5	AT-1	112	
6	BC	120 from 2 to 1	
7	TBC		2
8	AT-2		Faulty
9	IB- 1	-80	
10	IB- 2		-80
11	Korba- 3		-27
12	IB- 3	-80	
13	IB- 4		-80
14	Tarkera- 1		56
15	Tarkera- 2	56	
16	Lapanga- 1		162
17	Lapanga- 2	162	
18	Bhusan- 1		-18
19	Bhusan- 2	-18	
20	SPS- 1	0	
21	SPS- 2	NA	
22	AAL- 1	1	
23	AAL- 2		1
24	VAL- 1	-136	
25	VAL- 2		-136

Total Import = 682MW
Total Export = 682MW
Total on Bus-1 = 120MW
Total on Bus-2 = -120MW

132 KV	
Bay	Load(MW)
SNG- 1	11
SNG- 2	11
Kalunga	
Rajgangpur	
20MVA TFR- 1	6
AT- 1	-112
AT- 2	
Lapanga	-10
JSG- 2	24
JSG-1	20
Remja	32
MCL- 1	15
MCL- 2	I/C
MSP	PS disconnected
12.5MVA TFR- 2	3
TFR- 3	U/C

Total Import = 122MW
Total Export = 122MW

- **EVENT 1:**

Tripping of Budhipadar Lapanga D/C on 13:47 & 13:49 Hrs.

- Prior to the event, 220 kV Budhipadar-Lapanga D/C loading were 170 MW each, 220 kV Vedanta-Budhipadar D/C 140 MW each and 220 kV Rourkela-Tarkera D/C was 135 MW each.
- 220 kV Budhipadar Lapanga -1 tripped due to fault at 13:46:59 Hrs with Y-B fault. This is clear from the PMU plot shown here. Before tripping, 220 kV Budhipadar- Lapanga D/C flow was around 170 MW each.
- Tripping of 220 kV Budhipadar-Lapanga circuit 1 had led to further higher loading of 220 kV Budhipadar-Lapanga circuit 2 by more than its thermal rating i.e., 300 MW. Within 3 minutes, this circuit also developed one Y-B fault and tripped with delayed clearance of 500 ms at 13:49:37 Hrs. There is a possibility of sagging in this line due to loading beyond thermal rating.

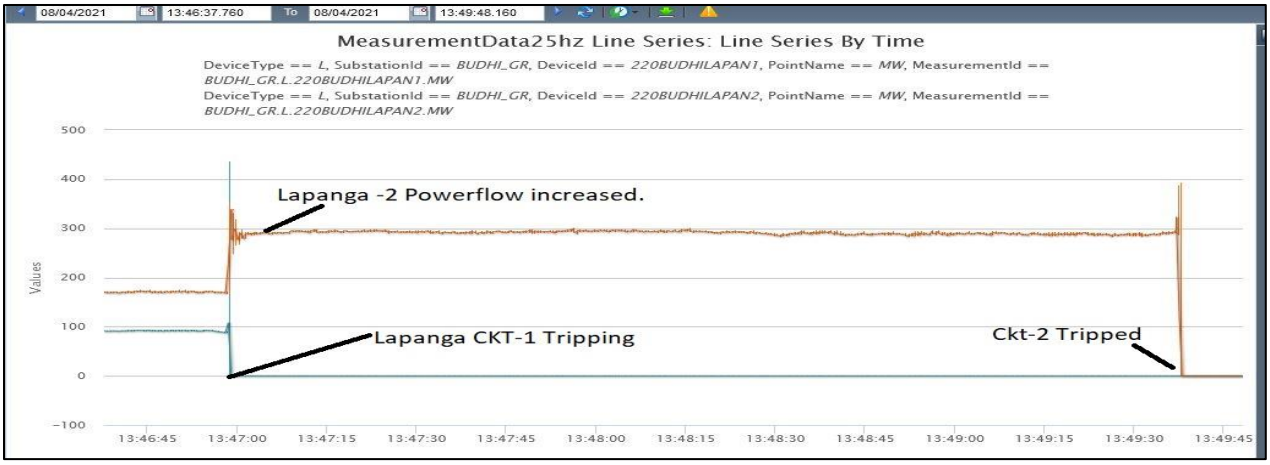


Figure 4: 220 kV Budhipadar-Lapanga D/C active power plot by PMU. (Magnitude of MW in PMU for circuit 1 is not accurate due to CT ratio or other problem while circuit 2 is correct. However, the dynamic behaviour is showing correctly. In addition, circuit loading should be almost equal)

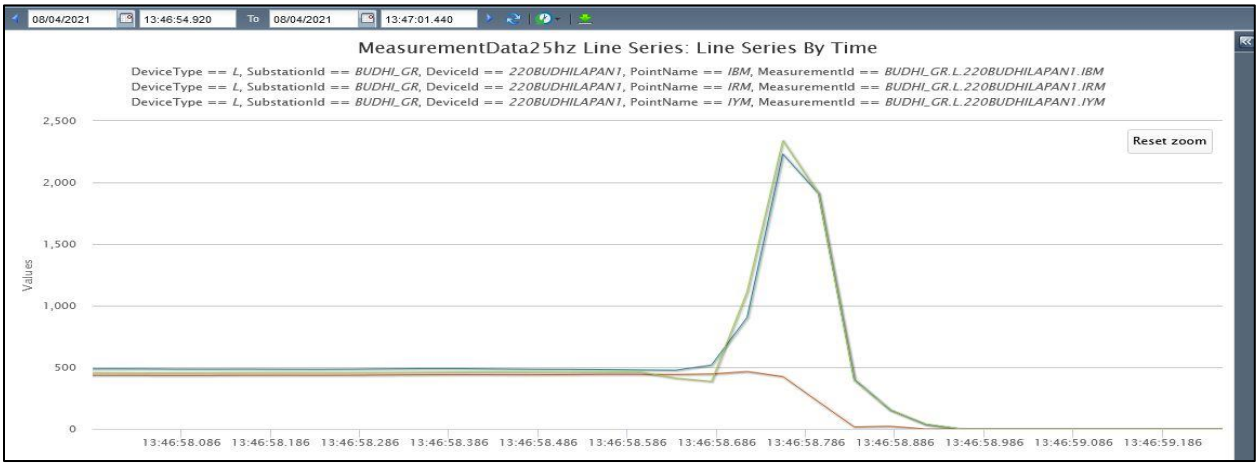


Figure 5: 220 kV Budhipadar-Lapanga-1 current Indicating Ckt-1 Y-B Phase to phase fault.

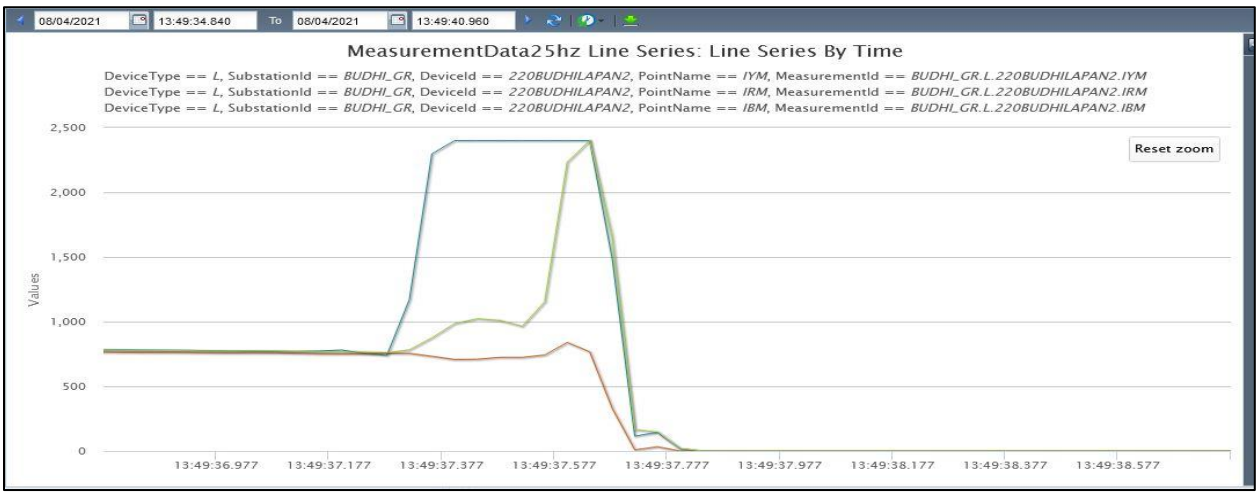


Figure 6: 220 kV Budhipadar-Lapanga-2 current indicating Ckt-2 Y-B Phase to phase fault with delayed clearance

Figure 7: Network loading after 220 kV Budhipadar-Lapanga D/C tripping is shown below in the SCADA snapshot

EVENT -2:

Tripping of Budhipadar-Raigarh on 14:03 Hrs. due to B phase fault with delayed clearance of 1 sec.

- Now with the tripping of 220 kV Budhipadar-Lapanga D/C, the available evacuating path for all power coming from IBTPS, Vedanta injection and 220 kV Korba- East 2 &3 ckts were through 220 kV Budhipadar-Tarkera D/C and 220 k Budhipadar-Raigarh circuit. All other 132 kV S/S connected to Budhipadar such as Concast, BPSL, Adityapur are CPP with minimal exchange with the grid.
- In addition, there was 132 kV Budhipadar-Lapanga circuit whose loading increased with 220 kv Budhipadar-Lapanga D/C causing higher loading on 160 MVA 220/132 kV Budhipadar ICT 1. Thus, it was manually hand tripped at 13:52 Hrs.
- Thus, tripping of 220 kV Budhipadar-Lapanga D/C and 132 kV Budhipadar-Lapanga had resulted in higher loading of 220 kV Budhipadar-Raigarh S/C and 220 kV Budhipadar-Tarkera D/C. This can be seen from the above Scada plot (Figure 7).
- 220 kV Budhipadar-Tarkera D/C power flow increased from 70 MW to 120 MW each and 220 kV Budhipadar- Raigarh increased from 150 to 242 MW.
- Due to the increased loading of the 220 kV Budhipadar-Raigarh line (Above 220 MW), it has slowly developed a B phase fault (may have developed some sag) as shown below in the PMU plot. The circuit got tripped at 14:02 Hrs., with clearance of 1 second. For this circuit, directional overcurrent operated hence delayed clearance of the fault was observed.

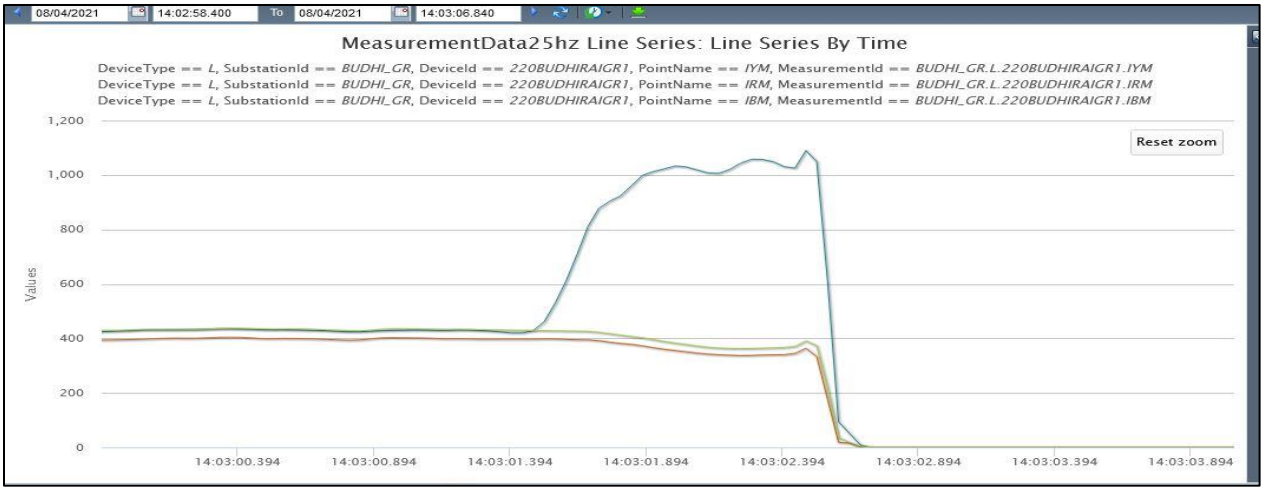


Figure 8: 220 kV Budhipadar-Raigarh Current indicating slowly developing B phase to earth fault.

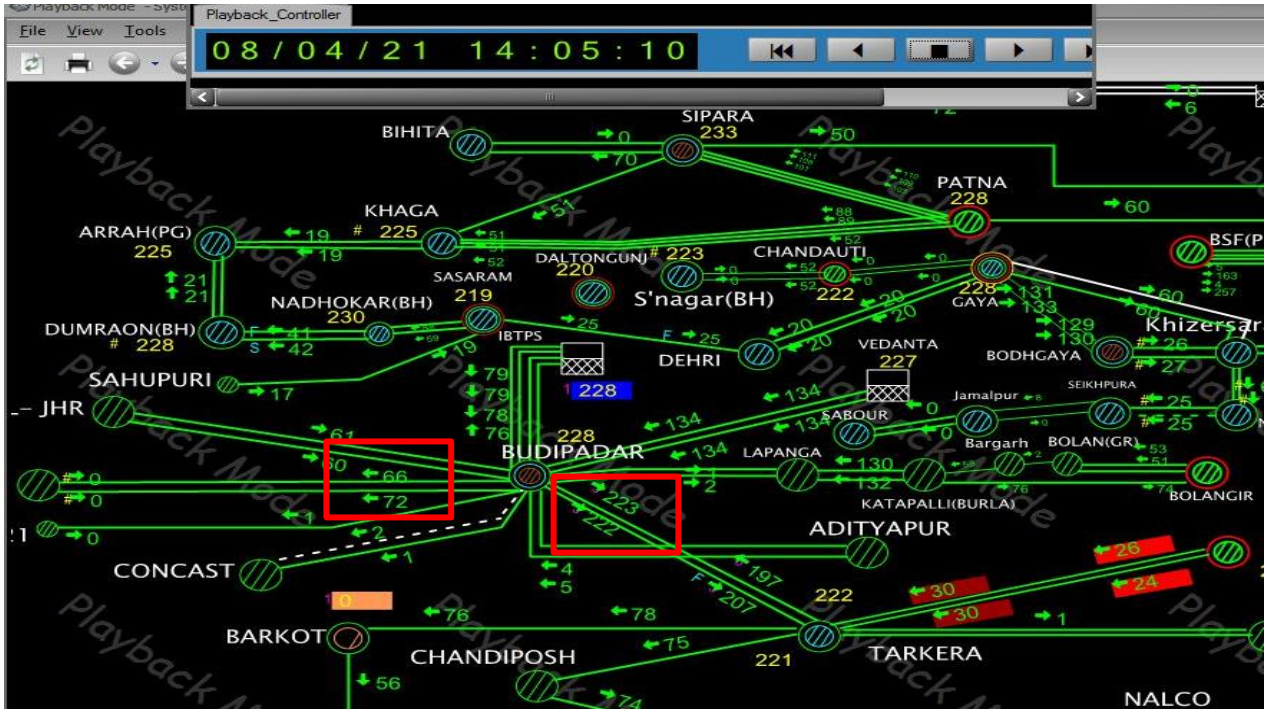


Figure 9: Network loading after 220 kV Budhipadar-Raigarh tripping is shown below in the SCADA snapshot

EVENT 3: Tripping of Budhipadar Tarkera -1 and 2 at 14:06:27 & 14:07:24 Hrs

- With the tripping of 220 kV Budhipadar -Raigarh circuit, now all the generation was being evacuated via 220 kV Budhipadar-Tarkera D/C and 220 kV Budhipadar- Korba East D/C.
- From the above SCADA plot, it can be observed that with the tripping of Raigarh line, 220 kV Budhipadar-Tarkera ckts flow had increased from 150 MW each to 230 MW each and Korba East D/C which was previously injecting power to Budhipadar also got reversed and 80 MW each is flowing towards Korba East from Budhipadar.
- Due to increased loading of 220 kV Budhipadar-Tarkera D/C nearing its thermal limit, Ckt 1 developed B phase fault, (Jumper melting as per preliminary information) at 14:06:27 Hrs. PMU plot is attached here.

- As Ckt-1 got tripped, 220 kV Budhipadar-Tarkera ckt-2 flow further increased to 350 MW (Way above thermal loading limit) and at 14:07:24 Hrs Ckt-2 also developed a fault **with snapping of R-Ph pipe bus from isolator to Breaker of 220 kV Budhipadar- Tarkera Ckt-2-as reported. The fault led to 220 kV Bus 1 fault at Budhipadar and** all the remaining feeders with that bus tripped with Busbar protection operation.
- So, with Bus bar operation 220 kV Budhipadar-Korba East circuit 2 which was on 220 kV Bus 1 got tripped. (Another circuit is referred to as Korba East 3) . In addition, now Aditya Alumina, Bhushan Steel, Vedanta CPP were connected to 220 kV Bus 2 of Budhipadar through only one circuit each while 220 kV IBTPS through 220 kV ckts 2 & 4.
- Further, all the 132 kV Radial connected loads got blacked out as 200/132 kV ICT 1 also got tripped which was on 220 kV Bus 1 leading to 100 MW load loss. This caused blackout of all 132 kV connected radial substations including 132 kV Jharsuguda and Sundargarh/

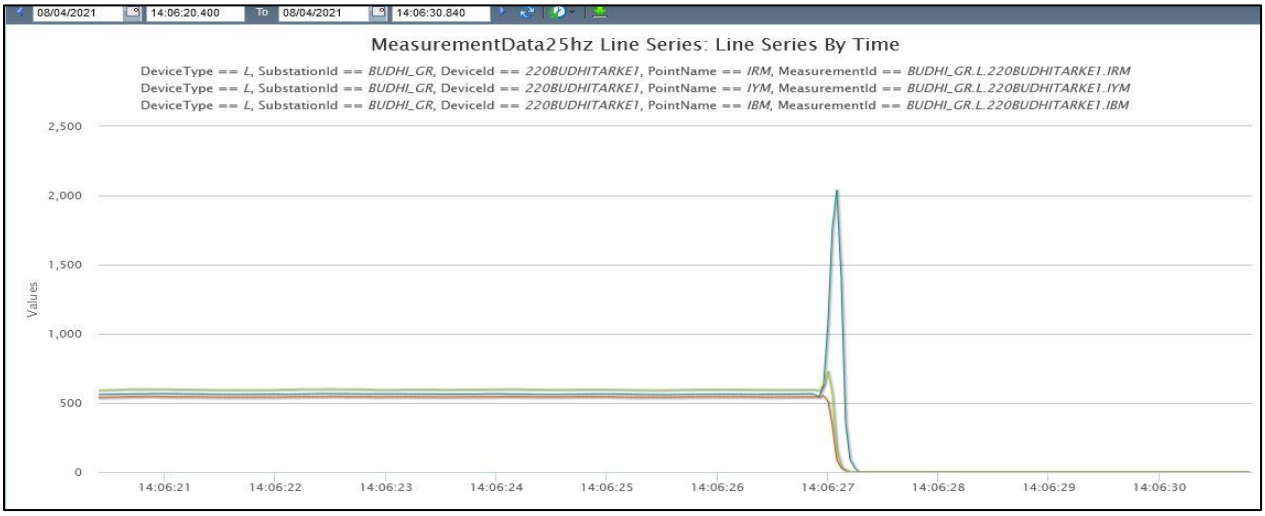


Figure 10: 220 kV Budhipadar-Tarkera-1 current indicating R phase to E/F.

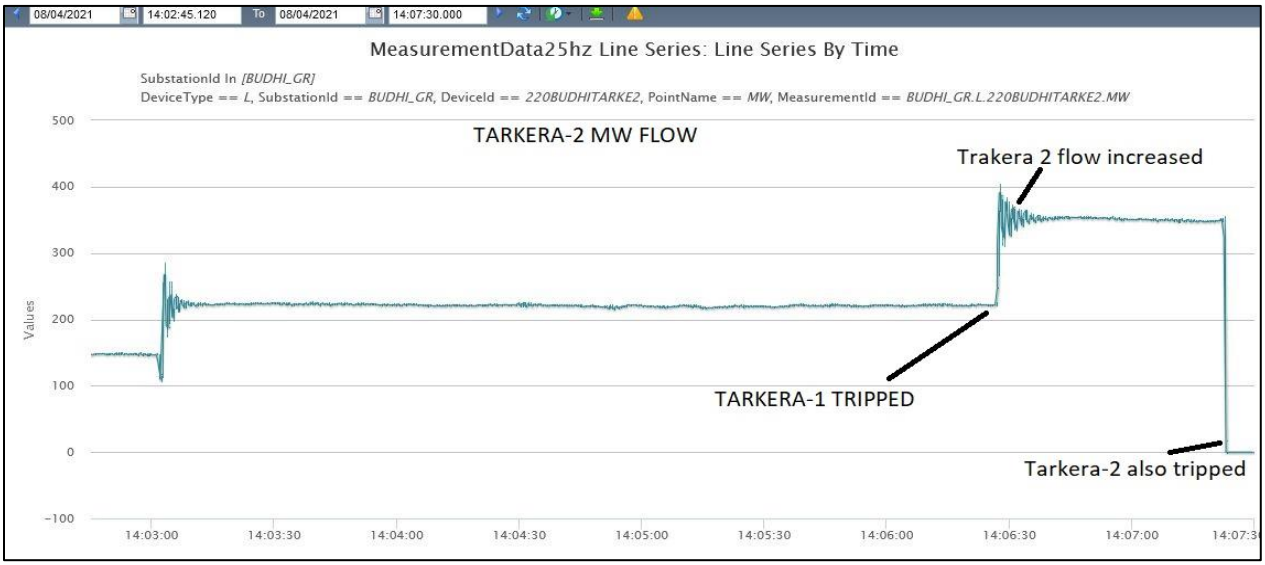


Figure 11: 220 kV Budhipadar-Tarkera-2 active power plot indicating flow reaching 350 MW after circuit 1 tripping.

Figure 12: 220 kV Budhipadar-Tarkera-2 current after tripping of circuit 1.

Figure 13: 220 kV Budhipadar-Korba East 2 Line current indicating R phase fault and its tripping on bus bar protection for 220 kV Bus 1 on which it was connected.

EVENT 4: Tripping of Budhipadar Korba -3 at 14:07:24 Hrs:

Now as only 220 kV Budhipadar-Korba East 3 was the available path for evacuation of all generation plant and CPPs excess injection hence it also tripped on Power swing as the excess injection was in the tune of 560 MW.

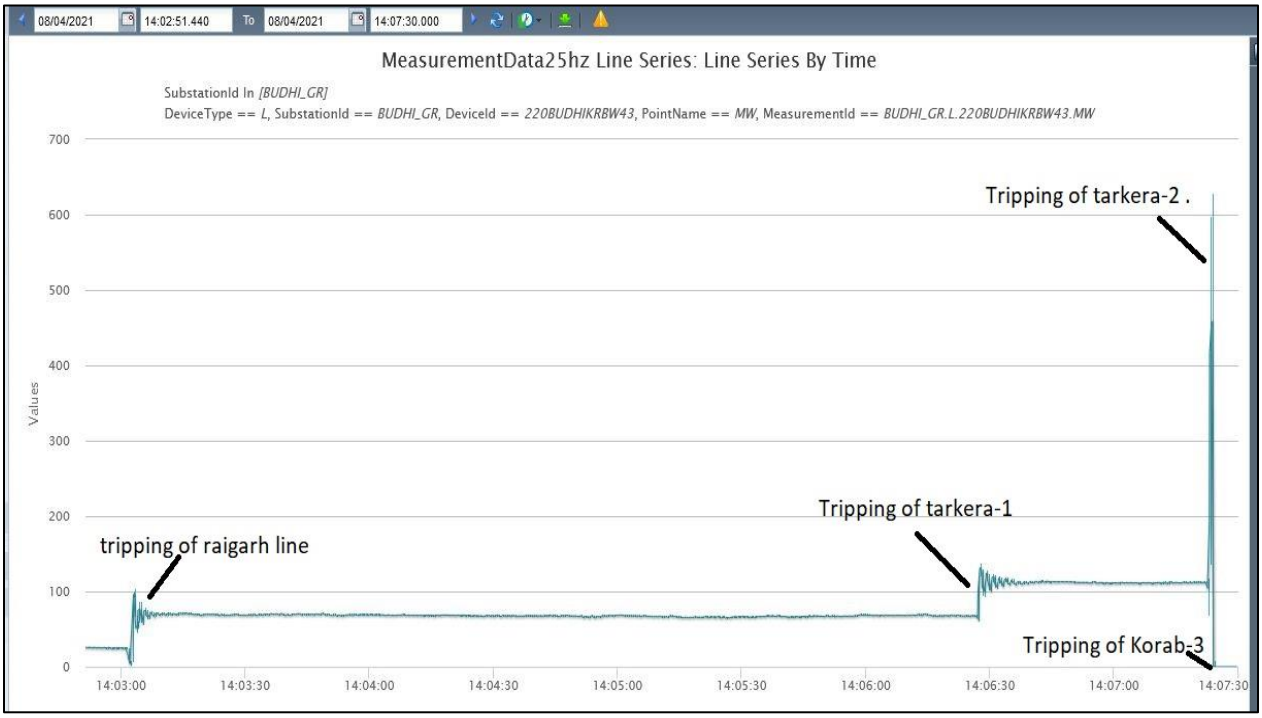


Figure 14: 220 kV Budhipadar-Korba East 3 Power flow

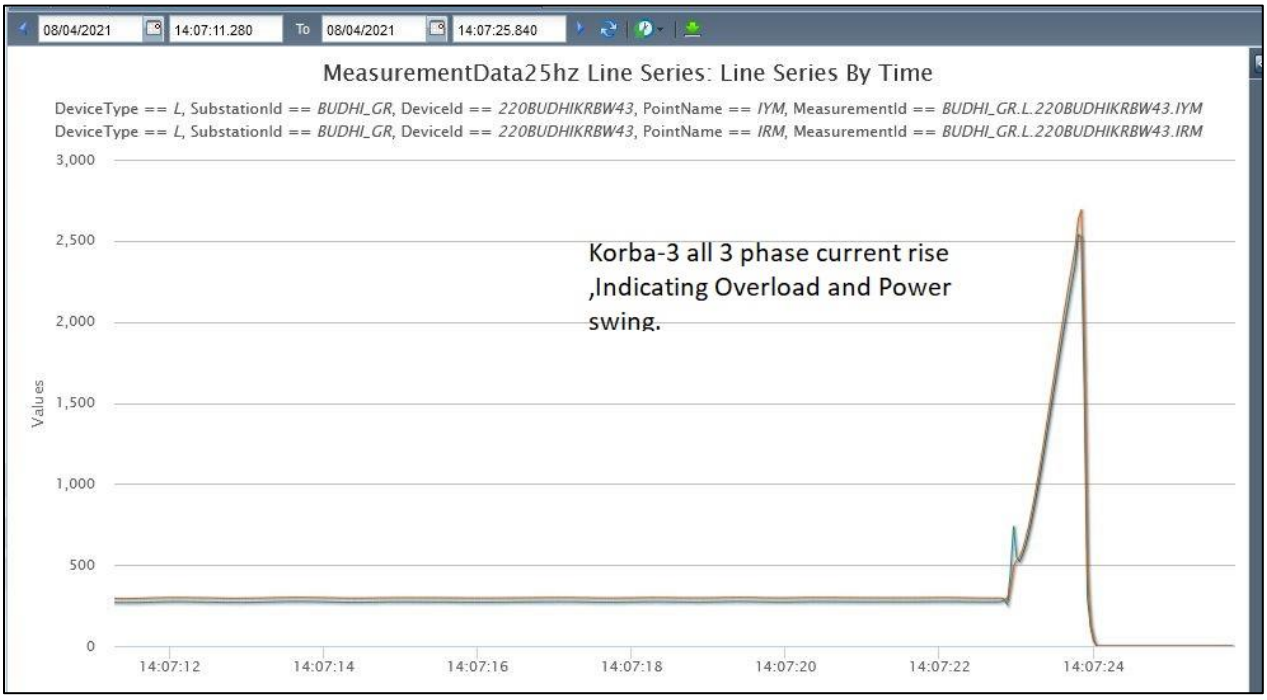
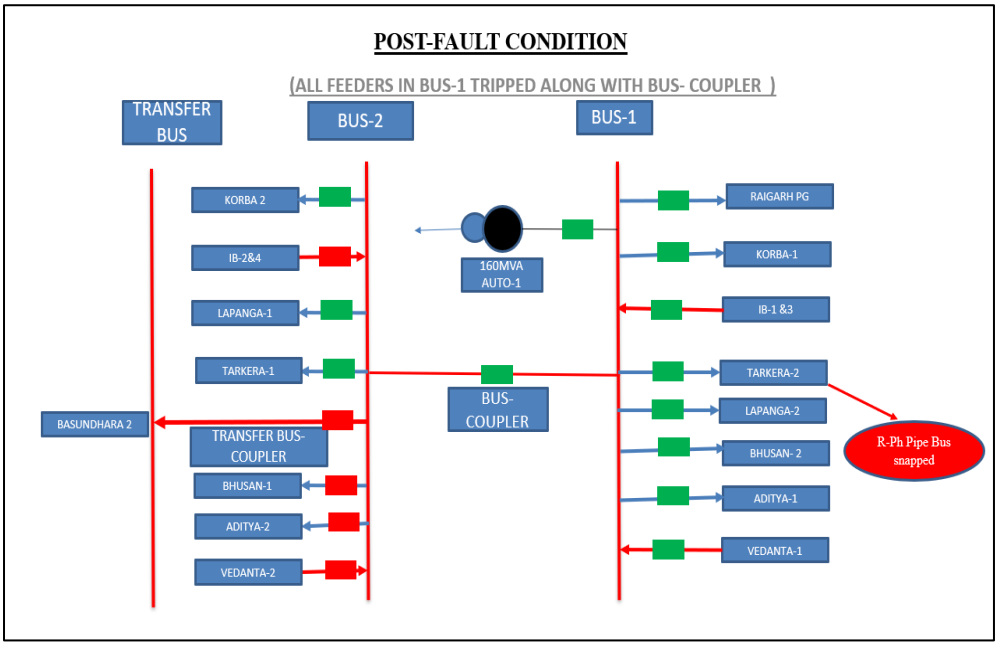


Figure 15: 220 kV Budhipadar-Korba East 3 line current

EVENT 5:

After this tripping, the 220 kV Bus arrangement at Budhipadar can be seen in the below bus arrangement (Green indicates open breaker, red closed breaker). This resulted in an island having 3 captive generation plants and one IBTPS plant. The island had 560 MW excess generation causing over frequency. Bhushan and Aditya Alumina formed their separate islands as per their scheme and survived. IBTPS is not having its islanding scheme so, could not survive the event. Vedanta formed Island with its own CPP load but did not survive.

220 kV Bus arrangement



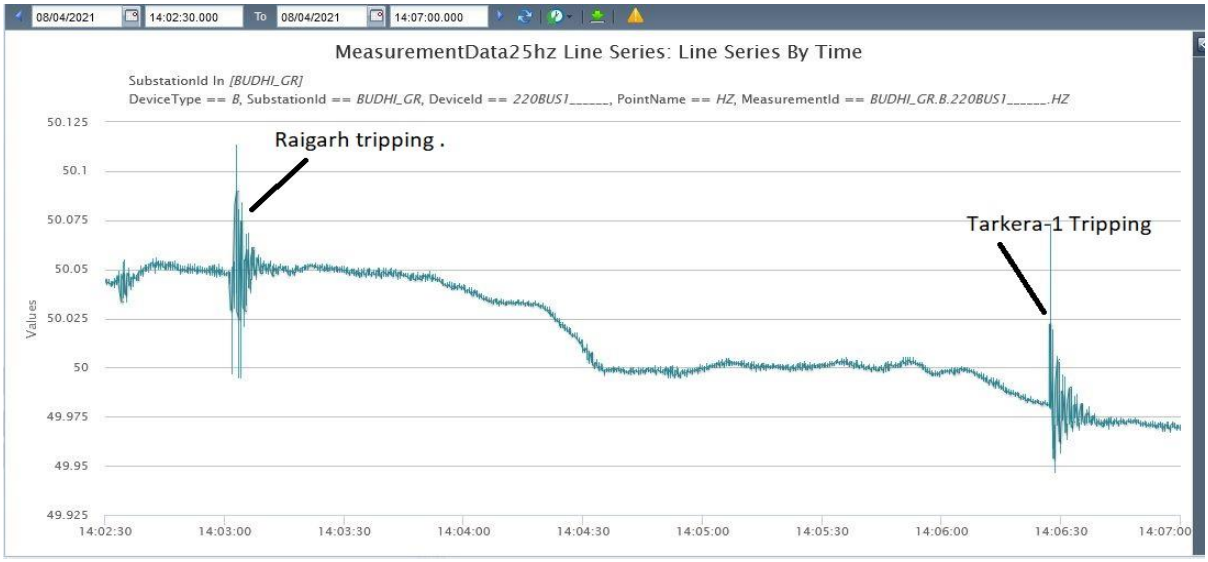


Figure 16: Frequency during 220 kV Budhipadar-Raigarh and 220 kV Budhipadar -Tarkera 1 tripping showing oscillations.

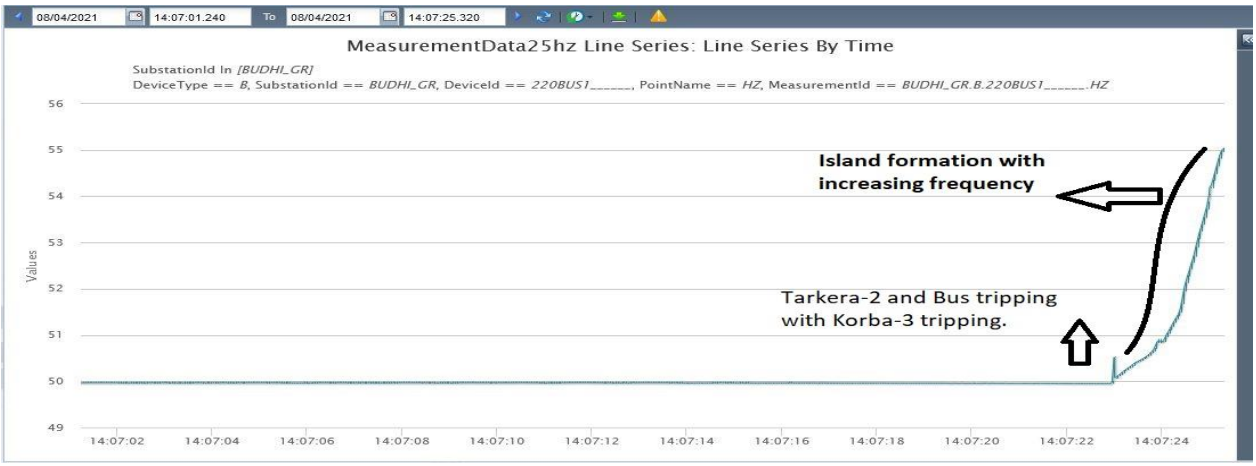


Figure 17: Frequency during island formation and excess frequency (Budhipadar bus frequency)

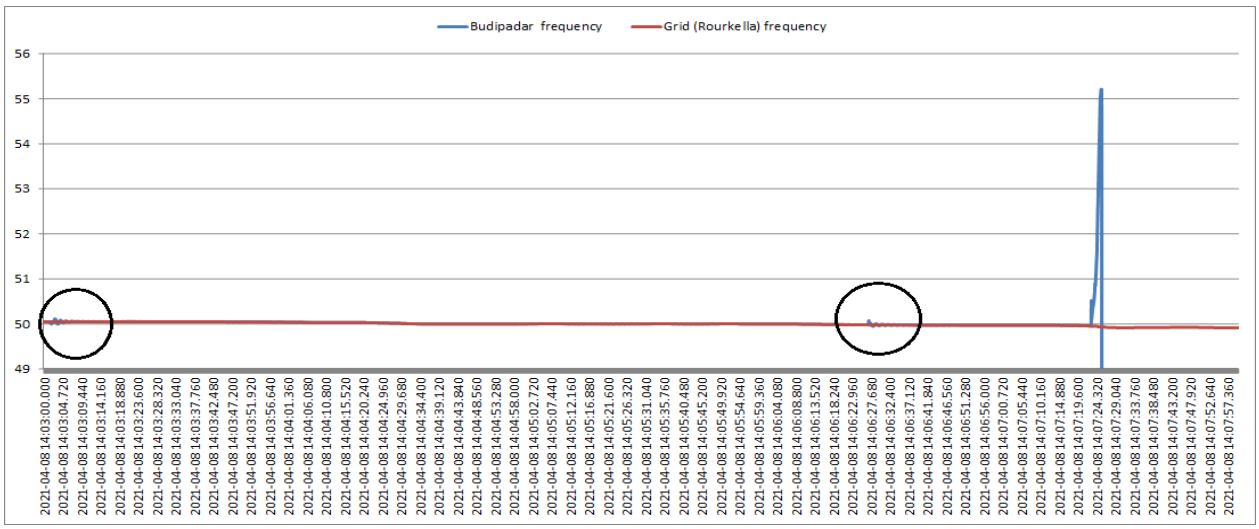


Figure 17: Frequency during island formation and excess frequency (Budhipadar and Grid frequency)

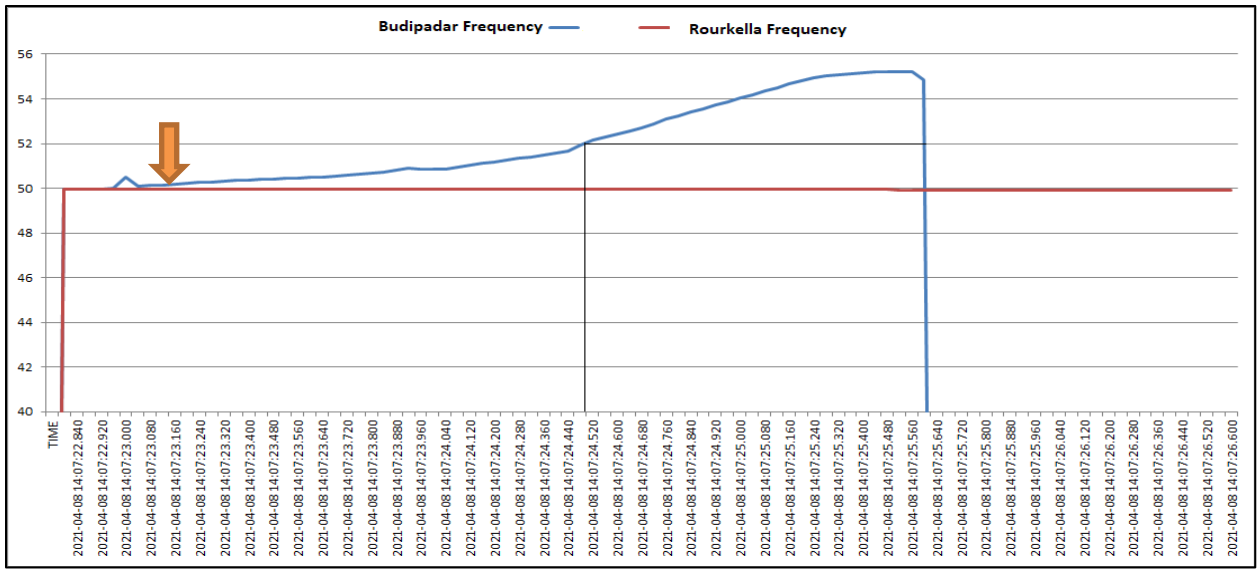


Figure 18: Over Frequency with islanding operation

Non-survival of 220 kv Vedanta Island (As per collected information):

- Vedanta is having its Islanding scheme, and as per the logic, island was formed after Event 5. However, before islanding, its exchange with the grid was approx. 260 MW and to balance the load generation in the island its tripped 270 MW generation (2*135 MW).
- With the 2 units tripping, Load –generation should have been balanced, but with the units tripping sudden under-frequency came and reached 48 Hz. This led to automatic Under frequency load shedding as per the islanding scheme. This further led to over-frequency as the island was already balanced. Due to over frequency, its units tripped and the island collapsed.
- Suspected cause for this under-frequency and over-frequency within the island after LGBR balance can be the sluggish response of the governor which was unable to cope-up with load–generation imbalance instantaneously. Units steam valve opening was found to be sluggish (approx. 200 ms) which may have caused under frequency and over-frequency. These need to be attended and rectified for successful islanding in future events.

Operational issues Observed (प्रचालन समस्या):

- N-1 security of the 220 kV Budhipadar complex is not being met with higher loading of 220 kV Budhipadar-Lapanga D/C, 220 kV Budhipadar-Vedanta D/C and 220 kV Rourkela-Tarkera D/C. This aspect has been highlighted by ERLDC for the last 6 months in the OCC meeting however Orissa SLDC/STU has not provided any response. This ultimately has come out in form of this GD-1 category event as predicted by ERLDC. The event had caused much damage to the 220 kV lines on cascaded tripping with permanent nature fault and sag. These will have an overall long-term impact on lines healthiness. **(Odisha SLDC/STU/Transmission wing to respond)**
- Huge injection from CPP was also one of the reasons for overloading under the N-1 scenario, so proper measures need to be ensured for limiting the excess injection to that complex. **(Odisha SLDC/STU/Transmission wing to respond)**
- Multiple faults occurred due to sag issue, which occurred due to overloading and high ambient temperature hence proper line maintenance, clearance needs to be ensured to avoid such faults. **(Odisha SLDC/STU/Transmission wing to respond)**
- As the complete blackout event occurred within 20 minutes so proper measures should have been taken during that time to avoid the blackout event. SLDC should operate the system with N-1 security compliance. Short-term measures like load trimming scheme should have been deployed earlier based on ERLDC intimation during the OCC meeting held in Sept-Oct 2020. **(Odisha SLDC/STU/Transmission wing to respond)**
- In case of the next such event how cascading event to be avoided needs to be envisaged and detailed planning has to be carried out.
- Vedanta is having an Islanding scheme, reason for non-survival may be shared along with detailed reports and action taken after the event **(SLDC may collect the same from Vedanta).**

Protection issues observed (सुरक्षा समस्या):

- 220 kV Budhipadar-Lapanga –II tripped on a phase-to-phase fault with delayed clearance of 500 ms. **The reason for delayed clearance needs to be checked by OPTCL**.

- 220 kV Budhipadar-Raigarh tripped on directional O/C with 1-second delayed clearance with high resistive nature of the fault.

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

Issues	Regulation Non-Compliance	Utility
N-1 Non-Compliance during Grid Operation	1. CEA Grid standard 3.1.e 2. CEA planning Criteria 6.2.1 3. IEGC 3.5.a.i (only applicable for ISTS)	**Orissa SLDC, Vedanta CPP, OPTCL**
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)	OPTCL
SCADA data Non-Availability for the station	1. IEGC 4.6.2 Data and Communication Facilities 2. IEGC 5.2.q	OPTCL

Status of Reporting (रिपोर्टिंग की स्थिति):

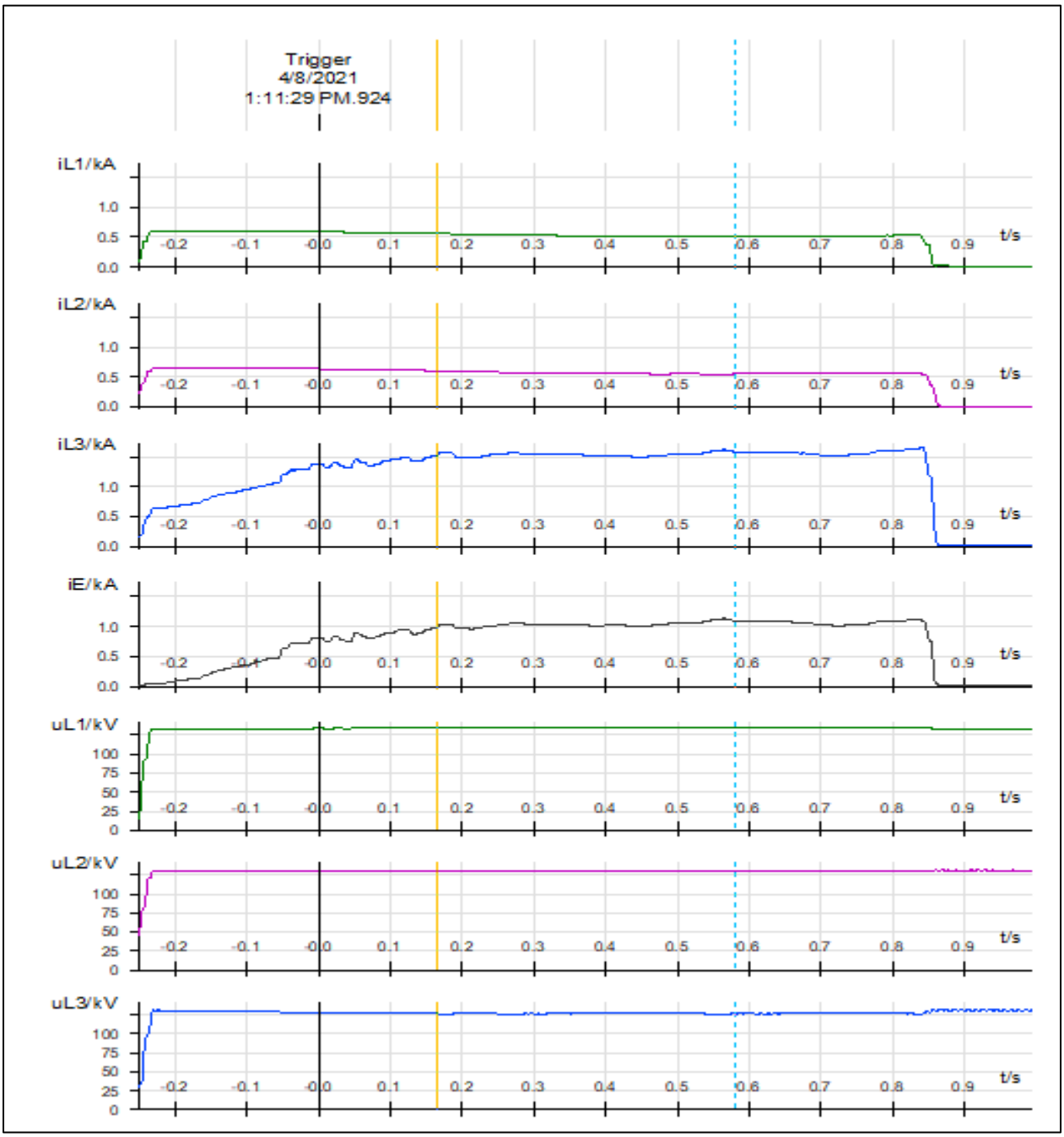
- DR/EL for Raigarh, Busbar, Adityapur received.
- DR for Lapanga D/C, Korba-3, Tarkera-1 not received.
- **DR/EL received are not as per ERPC philosophy.**

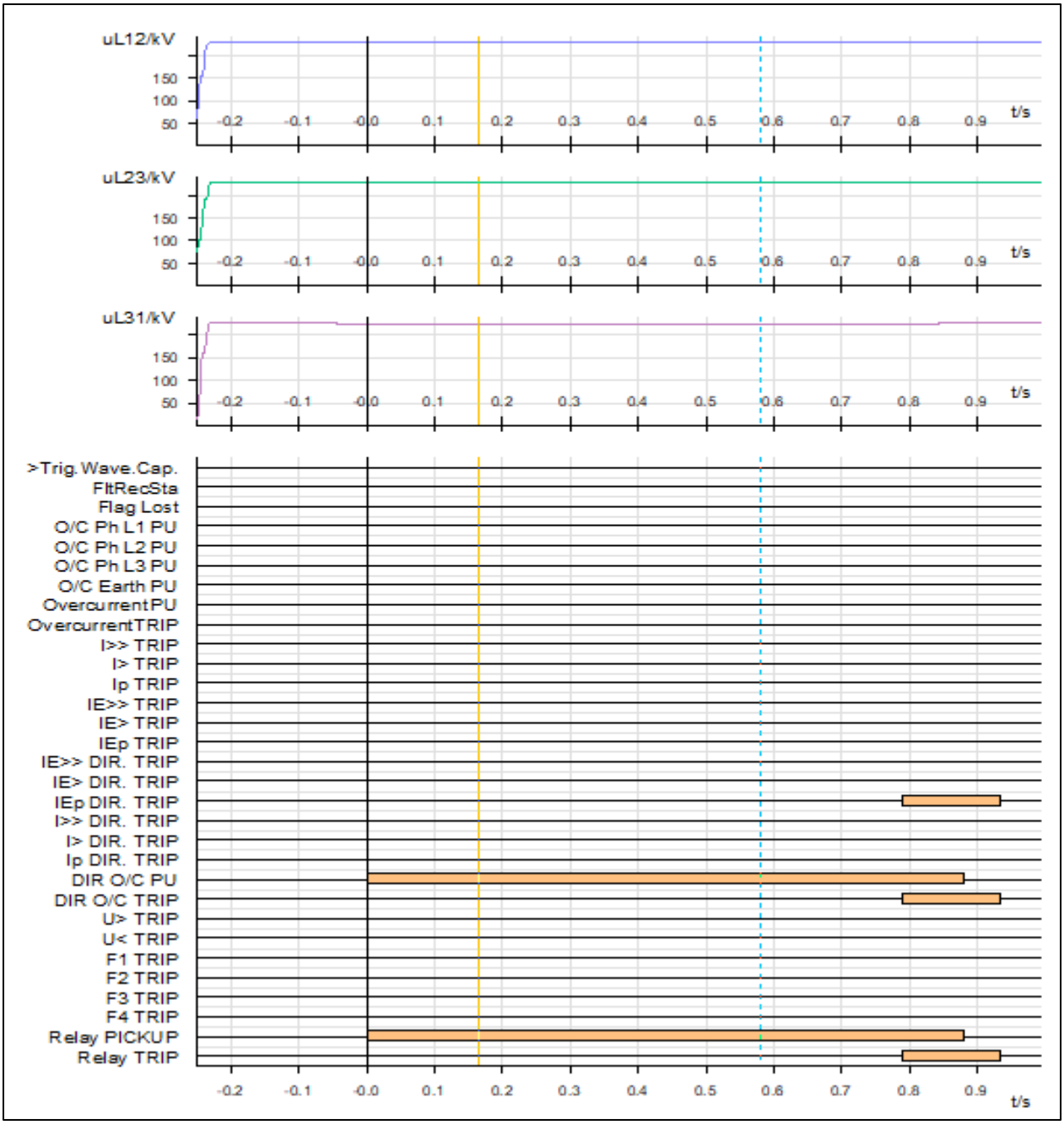
Annexure 1: Sequence of events recorded at ERLDC SCADA data at the time of the event.

TIME	MILLI_SEC	STATION	DESCRIPTION	STATUS
13:54:21	493	BUDHI_GR	D_10(BURLA1-1)	Open
13:55:16	385	BUDHI_GR	D_09(BURLA1-2)	Open
14:03:02	858	BUDHI_GR	E_03(RGH22-1)	Open
14:06:27	429	BUDHI_GR	E_11(TARKE-1)	Open
14:07:23	270	BUDHI_GR	E_05(T1)	Open
14:07:23	272	BUDHI_GR	E_04(KORBA-1)	Open
14:07:23	273	BUDHI_GR	E_06	Open
14:07:23	276	BUDHI_GR	E_10(TARKE-2)	Open
14:07:23	276	BUDHI_GR	E_12(IBTPS-3)	Open
14:07:23	280	BUDHI_GR	E_20(BPSL-2)	Open
14:07:23	284	BUDHI_GR	E_19(CONCA-1)	Travel
14:07:23	284	BUDHI_GR	E_23	Open
14:07:23	313	BUDHI_GR	E_16(VEDAN-1)	Open
14:07:24	184	BUDHI_GR	E_09(KORBA-2)	Open
14:14:09	139	BUDHI_GR	E_07	Open
14:14:33	752	BUDHI_GR	E_18(BPSL-1)	Open
14:14:33	754	BUDHI_GR	E_14(BURLA-1)	Open
14:14:57	214	BUDHI_GR	E_22(ADITY-2)	Open
14:15:00	506	BUDHI_GR	E_17(VEDAN-2)	Open
14:15:45	923	BUDHI_GR	D_04(T1)	Open
14:23:01	97	BUDHI_GR	D_06(REMJA)	Open
14:23:04	233	BUDHI_GR	D_02(MCL__-1)	Open
14:23:08	781	BUDHI_GR	D_03(SUNDA-1)	Open
14:23:17	295	BUDHI_GR	D_05	Open
14:24:45	261	BUDHI_GR	D_09(BURLA1-2)	Closed
14:29:13	373	BUDHI_GR	D_10(BURLA1-1)	Closed
14:38:13	828	BUDHI_GR	D_03(SUNDA-1)	Closed
14:42:26	252	BUDHI_GR	D_06(REMJA)	Closed
15:08:48	245	BUDHI_GR	D_03(SUNDA-1)	Open
15:09:51	250	BUDHI_GR	D_10(BURLA1-1)	Open
15:09:54	700	BUDHI_GR	D_07(JHARS)	Open
15:09:57	85	BUDHI_GR	D_06(REMJA)	Open
15:15:45	848	BUDHI_GR	D_07(JHARS)	Closed
15:16:25	28	BUDHI_GR	D_03(SUNDA-1)	Closed
15:18:03	807	BUDHI_GR	D_10(BURLA1-1)	Closed
15:31:04	829	BUDHI_GR	E_03(RGH22-1)	Closed
15:33:47	472	BUDHI_GR	E_04(KORBA-1)	Closed

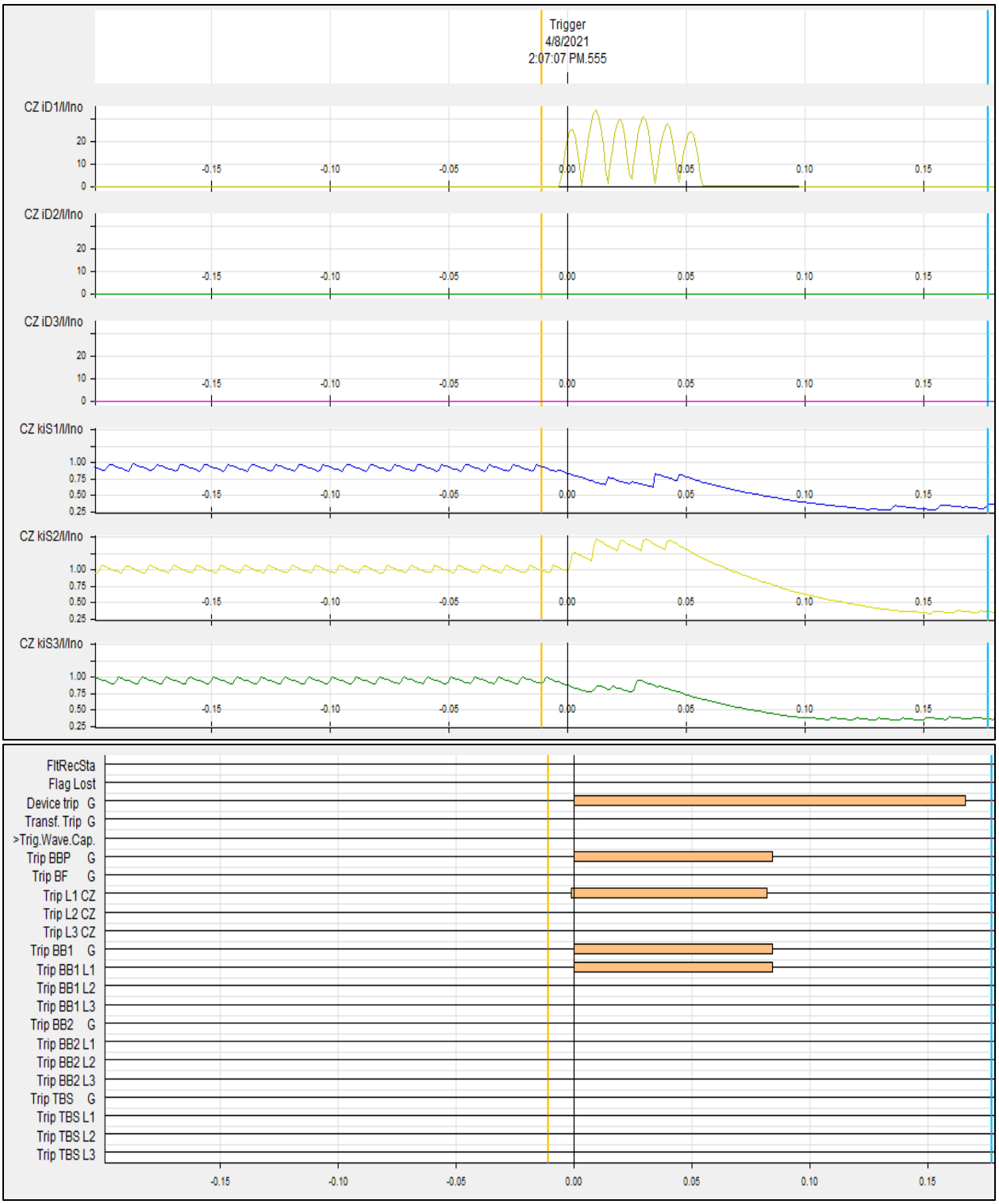
15:35:04	434	BUDHI_GR	E_06	Closed
15:37:18	719	BUDHI_GR	E_05(T1)	Closed
15:37:41	727	BUDHI_GR	D_04(T1)	Closed
15:38:37	640	BUDHI_GR	E_11(TARKE-1)	Closed
15:39:53	497	BUDHI_GR	E_11(TARKE-1)	Open
15:41:06	406	BUDHI_GR	D_06(REMJA)	Closed
15:43:00	962	BUDHI_GR	D_05	Closed
15:45:39	10	BUDHI_GR	E_14(BURLA-1)	Travel
15:45:39	18	BUDHI_GR	E_18(BPSL-1)	Closed
15:47:03	234	BUDHI_GR	E_20(BPSL-2)	Closed
15:47:52	102	BUDHI_GR	D_02(MCL__-1)	Closed
15:48:16	693	BUDHI_GR	E_07	Closed
15:49:46	114	BUDHI_GR	E_23	Closed
15:49:56	798	BUDHI_GR	E_22(ADITY-2)	Closed
15:51:04	633	BUDHI_GR	E_19(CONCA-1)	Closed
15:54:22	228	BUDHI_GR	E_12(IBTPS-3)	Closed
16:01:51	796	BUDHI_GR	E_16(VEDAN-1)	Closed
16:02:00	963	BUDHI_GR	E_17(VEDAN-2)	Invalid
16:05:42	784	BUDHI_GR	E_09(KORBA-2)	Closed
17:43:15	92	BUDHI_GR	E_11(TARKE-1)	Closed

Annexure 2: DR output at Budhipadar end for Raigarh line.




uL12/kV
150
100
50
-0.2
-0.1
-0.0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
t/s
uL23/kV
150
100
50
-0.2
-0.1
-0.0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
t/s
uL31/kV
150
100
50
-0.2
-0.1
-0.0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
t/s
>Trig.Wave.Cap.
FltRecSta
Flag Lost
O/C Ph L1 PU
O/C Ph L2 PU
O/C Ph L3 PU
O/C Earth PU
OvercurrentPU
OvercurrentTRIP
I>> TRIP
I> TRIP
Ip TRIP
IE>> TRIP
IE> TRIP
IEp TRIP
IE>> DIR. TRIP
IE> DIR. TRIP
IEp DIR. TRIP
I>> DIR. TRIP
I> DIR. TRIP
Ip DIR. TRIP
DIR O/C PU
DIR O/C TRIP
U> TRIP
U< TRIP
F1 TRIP
F2 TRIP
F3 TRIP
F4 TRIP
Relay PICKUP
Relay TRIP
-0.2
-0.1
-0.0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
t/s

DR output at Budhipadar end for Bus Bar Protection:



Annexure 3: Relay Indication from the Budhipadar Substation

sl	Lines / Equipments / Generating Units tripped	Date	From (Hrs)	To (Hrs)	Duration (Min)	Relay Indication / Cause	Remarks
1	220 KV Budhipadar-Lapanga Ckt-I	08.04.2021	13:47Hrs	02:22Hrs Dt. 09.04.2021	12Hrs 45Min	Distance protection (Y,B Ph Trip,Zone 1 Trip,Dist-6.057 Km Ib= 17.03kA, Ic= 16.42KA)	
2	220 KV Budhipadar-Lapanga Ckt-II	08.04.2021	13:50Hrs	09:31Hrs Dt. 09.04.2021	19Hrs 41Min	Distance protection (Y,B Ph Trip,Zone 1 Trip,Dist-7.56 Km, Ib= 18.48KA, Ic= 8.04KA)	
3	132 KV Budhipadar-Jharsuguda Ckt-II	08.04.2021	13:52Hrs	15:18Hrs	01Hr 26 min	H/T	As per instruction of SDO Jharsuguda GSS
4	132 KV Budhipadar-Lapanga Ckt	08.04.2021	13:55Hrs	14:25Hrs	30Min	H/T	To avoid overloading of 160MVA Auto-I. At 1425Hrs station supply availed from 132kV Lapanga.
5	220 KV Budhipadar-Raigarh Ckt	08.04.2021	14:02Hrs	15:31Hrs	01hr 29 min	B/U protection (E/F Trip IL1= 0.53KA, IL2= 0.57KA, IL3= 1.81KA)	220 KV Main Bus -I charged at 15:31 Hrs
6	220 KV Budhipadar-Tarkera Ckt I	08.04.2021	14:05	15:38Hrs	01Hr33 min	Distance protection I (TRZ1,ZM,ZM2,ZM3,PST,PSN,CSZ,SUP) Distance protection II (L3-E,Dist Trip,Dist-79.3 Km, IL3= 2.04KA)	
7	220 KV Budhipadar-Korba Ckt II (Previously Korba III)	08.04.2021	14:07	16:05Hrs	01Hr 58 min	Distance protection (PSB OP,M CB B0,M CB Y0,M1 Trip,86 BU OPTD,M2Z1 OPTD Ib= 1.76KA, In=1.76KA)	
8	220 KV B/C	08.04.2021	14:07	15:35Hrs	01Hr 28min	Bus Bar Protection operated on Bus-I, SIEMENS 7SS52(Main Bus bar Panel relay) 1) Trip Bus 1 L1, 2) Trip Bus 1 L123,3)Trip L2 L123 4)Device Trip	220 KV Main Bus-I&II Became dead
9	220 KV Budhipadar-Tarkera Ckt-II	08.04.2021	14:07	22:47Hrs Dt. 09.04.2021	32Hrs 40Min	Bus Bar Protection operated on Bus-II	R ph pipe Bus conductor connecting Breaker to Main Bus isolator snapped at Budhipadar switchyard. GRID BlACK OUT
10	220 KV Budhipadar-Bhushan Ckt-II	08.04.2021	14:07	15:42Hrs	01Hr 35min	Bus Bar Protection operated on Bus-II	
11	220 KV Budhipadar-IBTPS Ckt-I	08.04.2021	14:07	15:57Hrs	01hr50min	Bus Bar Protection operated on Bus-II	
12	220 KV Budhipadar-IBTPS Ckt-III	08.04.2021	14:07	16:07Hrs	02 hr	Bus Bar Protection operated on Bus-II	
13	220 KV Budhipadar-AAL Ckt-I	08.04.2021	14:07	15:49Hrs	01Hr 42 min	Bus Bar Protection operated on Bus-II	
14	220 KV Budhipadar-Korba Ckt-I (Previously Korba II)	08.04.2021	14:07	15:33Hrs	01Hr 26 min	Bus Bar Protection operated on Bus-II	
15	220/132KV sides of 160MVA AT-I	08.04.2021	14:07	15:37Hrs	01hr30min	Bus Bar Protection operated on Bus-II	
16	220 KV Budhipadar-VAL Ckt-I	08.04.2021	14:07	16:01Hrs	01hr 52min	Bus Bar Protection operated on Bus-II	
17	220 KV Budhipadar-SPS Ckt-I	08.04.2021	14:07	15:51Hrs	01hr 44min	Bus Bar Protection operated on Bus-II	
18	220 KV Budhipadar-Basundhara Ckt-II (Charged through TBC)	08.04.2021	14:14Hrs	15:48Hrs	01hr34min	H/T	GRID was in BLACK OUT condition. CB was intact at Budhipadar end.
19	220 KV Budhipadar-Bhusan Ckt-I	08.04.2021	14:14Hrs	15:42Hrs	01hr28min	H/T	GRID was in BLACK OUT condition. CB was intact at Budhipadar end.
20	220 KV Budhipadar-AAL Ckt-II	08.04.2021	14:14Hrs	15:50Hrs	01hr36min	H/T	GRID was in BLACK OUT condition. CB was intact at Budhipadar end.
21	220 KV Budhipadar-VAL Ckt-II	08.04.2021	14:14Hrs	16:02Hrs	01hr48min	H/T	GRID was in BLACK OUT condition. CB was intact at Budhipadar end.
22	220 KV Budhipadar-IBTPS Ckt-II	08.04.2021	14:14Hrs	15:36Hrs	01hr22min	H/T	GRID was in BLACK OUT condition. CB was intact at Budhipadar end.
23	220 KV Budhipadar-IBTPS Ckt-IV	08.04.2021	14:14Hrs	15:37Hrs	01hr23min	H/T	GRID was in BLACK OUT condition. CB was intact at Budhipadar end.
24	132 KV Budhipadar-Remja Ckt	08.04.2021	14:23Hrs	14:42Hrs	01hr19min	H/T	GRID was in BLACK OUT condition. CB was intact at Budhipadar end.
25	132 KV Budhipadar-MCL Ckt-I	08.04.2021	14:23Hrs	15:47Hrs	01hr24min	H/T	GRID was in BLACK OUT condition. CB was intact at Budhipadar end.
26	132 KV Budhipadar-Sundergarh Ckt I	08.04.2021	14:23Hrs	14:38Hrs	01hr15min	H/T	GRID was in BLACK OUT condition. CB was intact at Budhipadar end.
27	132 KV Budhipadar-Sundergarh Ckt II (Charged through TBC)	08.04.2021	14:23Hrs	15:42Hrs	01hr19min	H/T	GRID was in BLACK OUT condition. CB was intact at Budhipadar end.
28	132 KV Budhipadar-Jharsuguda Ckt I	08.04.2021	14:23Hrs	15:15Hrs	52min	H/T	GRID was in BLACK OUT condition. CB was intact at Budhipadar end.
29	132KV Budhipadar Lapanga	08.04.2021	15:08Hrs	15:11Hrs	03min	Tripped from Lapanga end due to overloading resulting in failure of station supply.	At 15:11Hrs station supply availed.
30	132 KV Budhipadar-Sundergarh Ckt I	08.04.2021	15:10	15:16Hrs	06min	H/T after 132 KV Budhipadar-Lapanga Ckt tripped at Lapanga end due to overloading resulting in station failure.	
31	132 KV Budhipadar-Remja Ckt	08.04.2021	15:10	15:41Hrs	31min	H/T after 132 KV Budhipadar-Lapanga Ckt tripped at Lapanga end due to overloading resulting in station failure.	
32	220 KV Budhipadar-Tarkera Ckt I	08.04.2021	15:39Hrs	17:43Hrs	02hr4min	H/T	Due to overloading of PGCIL at Tarkera end Loading= 230MW

Annexure B.11

Tripping details of 400 kV New Purnea Muzaffarpur – 1

S.NO	LINE NAME	TRIP DATE	TRIP TIME	Reason
1	400KV-NEW PURNEA-MUZAFFARPUR-1	04-03-21	2:18	NEW PURNEA: R_Y, Z-1, FD-112.5KM, FC= Ir-5.612 KA, Iy-5.36KA ;MUZAFFARPUR: R_Y, FD-125KM, FC=Ir-4.96KA, Iy-4.73
2	400KV-NEW PURNEA-MUZAFFARPUR-1	04-04-21	16:56	Purnea-R-Y FD-113.5km FC-Ir-5.58kA Iy-5.3kA ;Muzzaffarpur-R-Y FD-125km FC-Ir-4.85kA Iy-4.66kA
3	400KV-NEW PURNEA-MUZAFFARPUR-1	04-11-21	1:56	NEW PURNEA: R_Y, Z-1, FD-113.5KM, FC= Ir-5.612 KA, Iy-5.36KA ;MUZAFFARPUR: R_Y, FD-125KM, FC=Ir-4.96KA, Iy-4.73
4	400KV-NEW PURNEA-MUZAFFARPUR-1	19/04/2021	15:29	Muzaffarpur: R-Y, Ir-4.87kA, Iy-4.82kA, 125.1Km; N. Purnea: R-Y fault, Ir-5.5kA, Iy-5.26kA, 112.6Km