Minutes of 108th PCC Meeting

Date:02.12.2021
Eastern Regional Power Committee
14, Golf Club Road, Tollygunge
Kolkata: 700 033

EASTERN REGIONAL POWER COMMITTEE

MINUTES OF 108th PROTECTION COORDINATION SUB-COMMITTEE MEETING HELD ON16.11.2021 AT 10:30 HOURS

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

PART – A

ITEM NO. A.1: Confirmation of minutes of 107th Protection Coordination sub-Committee Meeting held on22nd October2021 through MS Teams online platform.

The minutes of 107th Protection Coordination sub-Committee meeting held on 22.10.2021 was circulated vide letter dated03.11.2021.

Members may confirm.

Deliberation in the meeting

Members confirmed the minutes of 107th PCC Meeting.

PART – B

ITEM NO. B.1: Total Power Failure at 400 kV Dikchu HEP on 06.10.2021 at 12:38 Hrs

400 KV Teesta III-Dikchu& 400 kV Dikchu-Rangpo line tripped at 12:38 hrs. Subsequently one running unit at Dikchu tripped due to loss of evacuation path.

As reported, the fault was in 400 kV Dikchu-Rangpo line. Tripping of bus coupler at Teesta-V was also reported during the disturbance.

Relay Indications:

Time	Name	End 1	End 2	PMU observation
12:38	400 kV Dikchu-Rangpo		Rangpo: Y_B, Iy: 10.15 kA, Ib: 9.3 kA, 15.7 km	Around 86 kv dip in Y_ph and 91 kV dip in Y_ph at Rangpo
	400 kV Teesta III-Dikchu	DEF, B_N, 48.8 km, 2.17 kA		

Gen. Loss: 55 MW
Outage Duration: 01:04 Hrs

Dikchu HEP, Powergrid, TUL & NHPC may explain.

Deliberation in the meeting

Powergrid representative informed that a high resistive B phase fault was developed in 400 kV Dikchu-Rangpo line which was sensed by DEF relay at Rangpo end and was cleared in 2.2 second from their end. The relay operated correctly as per the settings and operating time of 2.2 sec was due to gradual increase of fault current.

Teesta III representative explained that during the incident DEF relay at their end for 400 kV Teesta III-Dikchu line picked up the fault. However due to higher resistive reach setting in the main-1 distance relay, the fault was sensed in zone-3 protection and 400 kV Teesta III-Dikchu line got tripped in 1 second. They added that the resistive settings in the relay had been reduced after the disturbance.

From DR analysis, it was observed that for 400 kV Dikchu-Rangpo line, DEF relay at Dikchu end was in picked up condition for 1 second. However, after tripping of 400 kV Teest III-Dikchu line in one second, current contribution from Dikchu HEP reduced to a very low value and hence no tripping was observed at Dikchu end.

Regarding tripping of bus coupler at Teesta V HEP, NHPC representative informed that the DEF setting of bus coupler was set to definite time and the current setting value was less than that of line which caused the tripping. They intimated that the settings have been modified to IDMT and the TMS setting of line, bus coupler & GT have been coordinated accordingly.

TPTL representative suggested to implement autorecloser function with DEF protection to reduce the outage time of their 400 kV lines as many of the times no fault was being found during the patrolling.

ERLDC representative informed that pick up for DEF relay was for zero sequence current not for individual phase current. Therefore, for any highly resistive fault, all three phases would receive tripping command and there would not be any phase segregation. Thus the implementation of single phase auto reclosing scheme is difficult with DEF relay.

NHPC representative informed that for highly resistive fault DEF relay may pick up for fault in adjacent lines too so it would not be possible to implement auto-reclose scheme for DEF.

PCC opined that the proposal of implementing autorecloser with DEF protection needs elaborate technical discussion and confirmation from the relay manufacturers regarding provision of the single phase auto reclosing functionality in DEF relay. PCC advised TPTL to furnish relevant document/information for further discussion in this regard.

PCC further advised TPTL to carry out regular patrolling of the line and clear the vegetation related issues so that frequent fault in the line may be avoided.

ITEM NO. B.2: Total Power Failure at 400 kV Teesta III HEP on 21.10.2021 at 14:32 Hrs

Prior to this disturbance 400 kV Teesta III-Kishanganj line was under tripped condition since 13:47 Hrs. At 14:32 hrs, 400 KV Teesta III-Dikchu line tripped on B phase to ground fault. This led to loss of evacuation for generation at Teesta III.

Relay Indications:

Time	Name	End 1	End 2	PMU Observation
13:47	400 kV Teesta III Kishanganj	Y_B, Z-1, Iy: 8.83 kA,	Y_B, 188.29 km, Iy=Ib=3.9 kA	Around 86 kv dip in

		Ib: 7.076 kA, 28.69 km		Y_ph and 91 kV dip in Y_ph at Rangpo
14:32	400 kV Teesta III-Dikchu	B_N, Z III, 2.1 kA		

Gen. Loss: 1086 MW
Outage Duration: 00:41 Hrs

TUL, Powergrid and Dikchu HEP may explain.

Deliberation in the meeting

TUL informed that at 13:47Hrs, Y-B phase fault was sensed by relay at Teesta -III end for 400 kV Teesta III-Kishanganj line and the line tripped from Teesta-III end in zone-1 of distance protection.

Powergrid informed that on receipt of carrier from TUL end, main bay at Kishanganj opened within 100 msec however tie CB opened in Zone-2 time after 500 msec. Regarding delayed opening of tie CB, they informed that necessary checking would be done by availing the shutdown at the earliest.

Regarding tripping of 400 kV Teesta III-Dikchu at 14:32 Hrs, it was informed that the fault(B phase to ground) was in 400 kV Dikchu-Rangpo line and of highly resistive in nature. Teesta-III end sensed the fault in zone 3 of distance protection and cleared the fault. Dikchu end cleared the fault in 1.1 second with operation of DEF relay.

ITEM NO. B.3: Total Power Failure at 220 kV Ronginchu HEP on 20.10.2021 at 12:42 Hrs

At 12:42 Hrs, 220 kV Rangpo-Rongnichu-1 tripped due to Y phase fault. At the same time, 220 kV Rangpo-Rongnichu-2 also got tripped from Rongnichu end in O/Cearth fault. Subsequently both running units at Rongnichu tripped due to loss of evacuation path.

As reported, Yphase jumper of 220 kV Rangpo-Rongnichu-1 snapped at loc. No. 6 creating Y-N fault. Following tripping is observed at both end-

- *Rongnichu end:*
  Both lines tripped within 100 msec on O/C earthfault protection. No DT signal was sent to Rangpo end.
- *Rangpo end:*
  The fault in circuit-1 was cleared by Rangpo end in Zone-2 time after 400 msec. However, the fault current sensed by the relay was to the tune of 11 kA. There was no tripping at Rangpo for Rangpo-Rongnichu-2.

Gen. Loss: 103 MW
Outage Duration: 00:36 Hrs

Ronginchu HEP and Powergrid may explain.

Deliberation in the meeting

Powergrid representative informed that the fault occurred due to jumper snapping of 220 kV Rangpo-Rongnichu-1 at loc. No. 6 from Rongnichu end. The fault was sensed by Rangpo end

relay in zone 2 and tripped the line in 400 milliseconds. They added that the fault location was near to Rongnichu end and the relay had operated correctly in zone-2 of distance protection.

Rongnichu HEP representative informed that both the circuitsof 220 kV Rongpo-Rongnichu line got tripped from Rongnichu end within 100 msec in overcurrent relay operation. They explained that after jumper snapping the fault was fed mainly from Rangpo end and the fault current contribution from Rongnichu end was very minimal compared to Rangpo end. As a result the distance protection relay at Rongnichu end did not sense the fault.

Regarding operation of overcurrent relay within 100msec, they informed that pick up for overcurrent relay for both the circuits were set at 1000A with instantaneous tripping. The fault current at Rongnichu end during the incident was 1200 A.

It was apprehended that jumper snapping of line-1 might have induces fault in line-2 too.

PCC advised Rongnichu HEP to review the overcurrent relay settings at their end. It was suggested to review the directional feature and definite time settings of the O/C relay.

ITEM NO. B.4: Total Power Failure at 220/132 kV Chatra(JUSNL) S/s on 09.10.2021 at 12:44 Hrs

At 12:44 hrs, 220 kV Daltonganj-Chatra-1 tripped on B-phase to earth fault. At the same time Daltonganj-Chatra-2 got tripped on Y phase to earth fault leading to total power failure at 220/132 kV Chatra S/s.

Relay Indications:

Name	End 1	End 2	PMU Observation
220 kV Daltonagnj-Chatra-1	B_N, Z I, 28 km	Didn't trip	22 kV dip in B_ph
220 kV Daltonagnj-Chatra-2	Y_N, 69 km, 1.3 kA	Didn't trip	31 kV dip in Y_ph

Disturbance Report from ERLDC is attached at **Annexure B.4.**

Load Loss: 15 MW
Outage Duration: 01:18 Hrs

JUSNL may explain.

Deliberation in the meeting

Powergrid informed that initially B phase to ground fault occurred in 220 kV Daltonganj-Chatra-1 line *which was cleared by Daltonganj end relay in zone 1 protection and carrier was sent to Chatra end.*

Subsequently after 800 milliseconds, another fault occurred in Y-phase of 220 kV Daltonganj-Chatra-2. The fault was cleared within 100 msec from Daltonganj end and carrier was sent to Chatra end. There was no tripping at Chatra end for both the lines.

Regarding non-receipt of carrier signal at Chatra end, JUSNL replied that investigation is being carried out to find out the root cause of the issue.

PCC advised JUSNL to resolve the carrier related issue at Chatra end and to ensure healthiness of PLCC for 220 kV Daltonganj-Chatra line.

PCC further advised JUSNL to implement weak in-feed protection at Chatra end for 220 kV Daltonganj-Chatra lines.

ITEM NO. B.5: Total Power Failure at 220/132 kV Garhwa(JUSNL) S/S on 09.10.2021 at 18:49 Hrs

220 kV Daltonganj-Garhwa(New) D/C tripped on B-phase to earth fault, leading to total power failure at 220/132 kV Garhwa(New) S/s.

Detailed Report from ERLDC is attached at **Annexure B.5.**

Load Loss: 43 MW
Outage Duration: 01:32 Hrs

JUSNL may explain.

Deliberation in the meeting

From the DR analysis the followings were emerged:

- *Initially there was a B phase to ground fault in 220 kV Daltonganj-Garhwa II. The B-phase breaker at Garwah end tripped immediately and carrier was sent to Daltonganj end. However it was informed that carrier was not received at Daltonganj end.*

- *After 200 msec, another fault occurred in Y-phase of the circuit-II, which was seen by both ends in Zone-3 of distance protection. All three phases opened from both ends after 800 msec.*

- *Relays of 220 kV Daltonganj-Chatra circuit-I also sensed the Y-phase fault and the line got tripped from both the end in 800 msec.*

JUSNL informed that the fault was due to sag issue in the line and the sag location had been identified. PCC advised JUSNL to resolve the sag issue at the earliest.

Regarding non-receipt of carrier at Daltonganj end, PCC advised Powergrid to check healthiness of PLCC at their end in coordination with JUSNL.

ITEM NO. B.6: Total Power Failure at 220/132 kV Budhipadar(OPTCL) S/S on 09.10.2021 at 11:57 Hrs

Both 220 kV Bus-1 & Bus-2 at Budhipadar S/sgot trippedleading to total power failure at 220/132 kV Budhipadar S/s, 220 kV IB Thermal and 220 kV Vedanta S/s.

A meeting was held among ERPC, ERLDC, OPTCL, SLDC Odisha, OPGC and concerned CPPs on 21.10.2021 to discuss & analyze the disturbance. The minutes of the meeting is enclosed at **Annexure B.6**

Load Loss: 115 MW, Gen. Loss: 600 MW
Outage Duration: 01:31 Hrs

OPTCL may update.

Deliberation in the meetings

The disturbance was discussed in a separate meeting held on 21.10.2021. With respect to the decision taken during the meeting, OPTCL updated as follows:

- *Regarding operation of LBB during the disturbance, it was informed that logic input error in the relay had been rectified. The issue regarding isolator discrepancy status was also resolved.*

- *Regarding PLCC and implementation of carrier aided protection, they informed that the work would be completed by 15th Dec 2021.*

- *Guideline regarding local earthing of CT during s/d of one circuit of any D/C line was included in the standard operating procedure and the same is being followed.*

- *Regarding restoration of busbar protection, it was updated that while commissioning the new bus bar bay unit of 220 kV Budhipadar-Lapanga-1, bus bar bay unit of another three number feeders got failed. The matter had been communicated to OEM to find out root cause behind failure of bus bar bay units.*

SLDC Odisha informed that all CPPs had been communicated to share the details of islanding schemes at the earliest. Upon receiving the same, they would verify the scheme and share their observation to ERPC/ERLDC.

Representative of Vedanta informed that they had already shared their islanding details to SLDC Odisha. Regarding the issue of non- survival of island during the event, they informed that the issue is being analyzed by the OEM.

ITEM NO. B.7: Bus tripping occurred in Eastern Region during October-2021

During October 2021, following incidents of bus bar tripping have been observed in Eastern Region.

Element Name	Tripping Date	Reason	Utility
400 kV Main Bus-1 at Bolangir	22-10-2021 at 13:07	Bus bar protection mal-operated	PG Odisha
400 kV Main Bus-1 at Malda	23-10-2021 at 06:22	Suspected Maloperation of TBC LBB	PG ER-2

Powergrid may explain.

Deliberation in the meeting

Powegrid odisha representative informed that the disturbance occurred due to wrong wiring in the bay unit of busbar protection for the future main bay(Bay no. 407). As a result, during tripping of corresponding tie circuit breaker, LBB initiation signal got extended to the bay unit of future bay which further initiated busbar tripping of main bus-1. The detailed report is enclosed at ***Annexure B7.1.***

They informed that as a corrective measure, LBB initiation wiring input to bay unit of future bays had been removed. Further the busbar protection was taken into service after necessary checking.

Regarding tripping of 400 kV Main Bus-1 at Malda S/S on 23-10-2021, Powergrid ER-II representative informed that the tripping occurred due to faulty 186A relay in 400 kV Malda-New Purnea Circuit-1. The same had been replaced with healthy spare and busbar protection was taken into service. The report received from Powergrid is enclosed at ***Annexure B7.2.***

ITEM NO. B.8: Tripping of 220 kV Buses at Rangpo S/s.

220 kV Bus-2 at Rangpo tripped at 16:29 Hrs on 08-11-2021 due to maloperation of Gas Density Monitor relay of 220 kV Rongnichu-2 bay.

Similar tripping of bus was observed on 11-09-2021 where 220 kV Bus-1 got tripped due to maloperation of Gas Density Monitor relay of 220 kV Rongnichu-1 bay.

Powergrid may explain.

Deliberation in the meeting

Regarding the event on 08.11.2021, Powergrid representative informed that 220 kV Bus-2 got tripped on operation of 4th stage low gas level in GD-1 of CB compartment of 220 kV Rangpo-Rongnichu circuit-2. During investigation it was found that there was loose connection at terminal of timer dedicated for 4th stage low gas level of R phase CB (GD-1).

They added that as a remedial measure, the timer was replaced and loosened wire at terminal of timer was tightened. Further they informed that to avoid the mal operation of busbar protection the following measures were taken:

- *Series connection of* ***2nd stage & 4th stage low SF6 gas level (of GD-1 CB)*** *and* ***2nd stage & 3rd stage low SF6 gas level*** *(of GD-2,3,4,10,11) were done and extended to PU for Bus bar gas zone tripping*
- *DC segregation for 1st stage & 2nd stage and 3rd stage & 4th stage of GD-1 of CB compartment was done so that falling of a single MCB would not extend Bus bar gas zone tripping signal.*

The detail report was enclosed at ***Annexure B8.***

ITEM NO. B.9: Repeated Tripping of 132 kV Lakhisarai-Jamui D/C line.

Either circuit of 132 kV Lakhisarai-Jamui D/c tripped seven times in the month of October 2021. Most of the time, fault is observed at 9-10 kmfrom Jamui end. Details of each tripping is given below:

Sr No	Element Name	Tripping Date	Tripping Time	Reason	Remarks
1	132 kV Lakhisarai-Jamui-D/c	04-10-2021	12:12	Line 1: Lakhisarai B_N, Zone-3, 79.49 km, 1.23 kA Line 2: Lakhisarai B_N, Zone-3, 77.4 km, 1.231 kA	Fault was in Zone-3.

2	132 kV Lakhisarai-Jamui-2	07-10-2021	01:19	Lakhisarai: B_N, Zone-1, 11.58 km, 5.87 kA Jamui: B_N, Zone-1, 9.3 km, 1.73 kA	Line charged within an hour suggesting transient nature of fault
3	132 kV Lakhisarai-Jamui-2	09-10-2021	09:52	Lakhisarai: R_N, Zone-1, 12.2 km, 6.6 kA Jamui: R_N, Zone-1, 9.93 km, 1.64 kA	Line was charged in the evening after patrolling. No abnormalities found.
4	132 kV Lakhisarai-Jamui-2	24-10-2021	08:22	Jamui: R_N, Zone-1, 9.9 km, 1.635 kA	Line charged within an hour suggesting transient nature of fault
5	132 kV Lakhisarai-Jamui-1	27-10-2021	10:41	Lakhisarai: R_N, Zone-1, 10.75 km, 6.34 kA Jamui: R_N, Zone-1, 10.9 km, 2.031 kA	Line charged within an hour suggesting transient nature of fault
6	132 kV Lakhisarai-Jamui-1	28-10-2021	10:05	Lakhisarai: R_N, Zone-1, 12 km, 5.9 kA Jamui: R_N, Zone-1, 10.59 km, 1.99 kA	

BSPTCL may explain.

Deliberation in the meeting

BSPTCL representative informed that patrolling was carried out in 132 kV Lakhisarai-Jamui D/C line and vegetation issues were found in the line section between 9-12 km from Jamui end. They added that the same had been attended and all the clearance related issues were addressed. After that no further tripping was observed in the line.

ITEM NO. B.10: Tripping of 400/220 kV 500 MVA ICT-1 &2 at Darbhanga(DMTCL) S/s on 25.09.2021

On 25.09.2021, both 500MVA ICT- 1&2 at Darbhanga(DMTCL) S/s tripped dueto HV directional earth fault protection. During analysis it was found that the disturbance occurred due to failure of R-phase LA in 220 kV Darbhanga(BSPTCL)-Mushari circuit-1 at Darbhnga end. The ICTs at Darbhanga got tripped within 100 msec on DEF protection. There was no tripping observed in any of the 220 kV lines.

Detailed report submitted by DMTCL is enclosed at **AnnexureB.10.**

DMTCL & BSPTCL may explain. Members may discuss.

Deliberation in the meeting

DMTCL informed that there was a fault in 220 kV Darbhanga (BSPTCL)-Musahari circuit 1 due to bursting of R Phase LA at Darbhanga end. The fault was sensed by 500MVA ICT- 1&2 at

Darbhanga(DMTCL) end and subsequently both the ICTs got tripped in HV directional earth fault protection within 100 milliseconds.

BSPTCL representative informed that relay at Darbhanga(BSPTCL) end for 220 kV Darbhanga-Musahari circuit-1 sensed the fault in zone-1 of distance protection and issues trip command to the breaker. However before tripping of the line, the 400/220 kV ICTs at DMTCL S/s got tripped within 100msec. They added that relay at Musahari end sensed the fault in zone-2 and tripped the line from remote end. Report received from BSPTCL is enclosed at ***Annexure B10.A.***

PCC observed that similar type of uncoordinated tripping of ICTs at Darbhanga(DMTCL)was discussed in 95th PCC meeting wherein DMTCL was advised to properly coordinate the overcurrent earthfault relay settings of the ICTs. However the same has not been implemented till date.

ERPC secretariat stated that a guideline for earthfault relay settings of transformers was finalized in 105th PCC meeting. PCC advised DMTCL to revise the ICT earthfault setting at Darbhanga end in line with the aforesaid guidelines at the earliest.

DMTCL requested BSPTCL to share the DR files for the above event with them.

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

1. Patna Islanding Scheme

In 106th PCC Meeting, ERLDC informed that they had received requisite information from SLDC Bihar &Nabinagar TPP. They intimated that they would require two-week time to complete the study.

In order to expedite the simulation study, it was suggested for carrying out dynamic study for Patna Islanding scheme by M/s PRDC.

PCC agreed for the same and advised PRDC to complete the simulation study by September'21.The required data would be provided by ERLDC.

MS, ERPC advised BSPTCL to prepare the DPR for implementation of Patna islanding scheme and submit it to PSDF nodal agency within 15 days.

In 44thTCC meeting, BSPTCL updated that preparation of DPR for PSDF funding is under process and the same would be completed within 15 days.

TCC stressed on the fact that this issue is being regularly monitored by MoP and advised BSPTCL for timely implementation of the Islanding Scheme.

In 107th PCC Meeting following deliberations took place –

Regarding submission of DPR, Bihar representative informed that discussions were held with vendor for preparation of DPR. The DPR would be finalized after getting required input from the vendor.

PRDC representative informed that simulation study for Patna islanding scheme would be completed soon and the report would be submitted within a week.

PCC advised PRDC to carry out the simulation study in consultation with ERLDC and submit the report at the earliest.

Members may update.

Deliberation in the meeting

Bihar representative informed that consultation with vendor is going on for preparation of the DPR and the final DPR would be submitted by first week of December 2021.

Further PRDC was advised to complete the simulation study for Patna islanding scheme and submit the report at the earliest.

2. Ranchi Islanding Scheme

In 106th PCC Meeting, ERLDC informed that they had received requisite details from JUSNL and simulation study is being carried out by them and the same would be completed within a week.

MS, ERPC advised JUSNL to prepare the DPR for implementation of Ranchi islanding scheme and submit it to PSDF nodal agency within 15 days.

ERLDC submitted the preliminary islanding study report for Ranchi Islanding Scheme. The report is enclosed at **Annexure B.11.2.**

In 44th TCC Meeting, JUSNL updated that preparation of DPR for PSDF funding is under process and the same would be completed within 15 days.

TCC stressed on the fact that this issue is being regularly monitored by MoP and advised JUSNLfor timely implementation of the Islanding Scheme.

In 107th PCC Meeting following deliberations took place –

ERLDC informed that simulation study had been carried out and preliminary study report had been shared with SLDC Jharkhand/ TVNL for their comments.

PCC advised TVNL/SLDC Jharkhand to submit their observation, if any, regarding the islanding simulation study.

Regarding submission of DPR, JUSNL informed that they were in communication with vendors for getting cost estimate with regard to implementation of the islanding scheme.DPR would be finalized after receiving the budgetary offer from the vendors.

SLDC Jharkhand& TVNL may update.

Deliberation in the meeting

Representative from SLDC Jharkhand & TVNL was not available in the meeting. It was decided to convene a separate meeting to discuss the islanding scheme and its progress.

ITEM NO. B.12: Tripping Incidence in month of October 2021

Tripping incidents in the month of October 2021 which needs explanation from constituents of either of the end is attached.

Concerned utilities may explain.

Deliberation in the meeting

Members explained the tripping incidences. The updated status is enclosed at ***Annexure B.12.***

PART- C::OTHER ITEMS

ITEM NO. C.1: Requirement of additional MiP-PSCT License key with Laptop

44thTCC advised all the utilities of ER including JUSNL to furnish their requirement, if any, for additional MiP-PSCT license to ERPC Secretariat citing proper justification.

Further in 44thERPC meeting, ERPC advised all the utilities to submit their requirement, if any, by 15th October'2021. ERPC further advised ERPC Secretariat to prepare and submit a DPR for additional MiP-PSCT licenses required for ER utilities for PSDF funding.

In 106th PCC meeting, PCC advised concerned utilitiesto submit their additional requirement of PSCT license, if any, to ERPC secretariat within fifteen (15) days.

The requirement for additional MiP-PSCT license key had been received from SLDC Odisha, JUSNL & WBSETCL.

Concerned utilities may update.

Deliberation in the meeting

ERPC informed that requirement for additional MiP-PSCT license key was received from SLDC Odisha, JUSNL & WBSETCL.

PCC advised remaining utilities to submit their additional requirement of PSCT license, if any, to ERPC secretariat within fifteen (15) days

ITEM NO. C.2: TrainingProgramme on "*Protection Tripping & DR Analysis*".

A 3 days training programme on "**Protection triping& DR/Fault Analysis**" is to be conducted by PRDC tentatively in last week of Nov-21.

Members may note.

Deliberation in the meeting

*ERPC secretariat informed that 3 days workshop on "**Protection tripping & DR/Fault Analysis**" is going to be conducted by PRDC from 6th Dec 2021 to 8th Dec 2021 at ERPC Kolkata.*

PCC advised concerned utilities to send their nominations for the training programme to ERPC secretariat by 26thNov 2021.

Members noted.

ITEM NO. C.3: Agenda by TPTL

TPTL vide letter dated 02/11/2021 suggested to take the following coordination actions to avoid tripping of 400 kV transmission lines of TPTL.

a) Resistive reach of Main I & Main II distance relays may be reviewed & increased to the extent

possible at all ends, so as to cover high impedance faults online.

b) DEF relay sensitivity may be reviewed /reduced so as to provide more time before tripping the line, as most of time fault current is much lower than the rated current.

c) Auto-reclose function for DEF tripping may be activated.

TPTL may give a detailed explanation. Members may discuss.

Deliberation in the meeting

TPTL representative explained that due to high resistive nature of fault in Sikkim region, directional earth fault gets operated most of the time and no fault was sensed by the distance protection relay from either end of their 400 kV lines. As a result, they were facing great difficulty in finding the fault location in the line which further delays the restoration of the line. They requested to increase the resistive reach of distance relays to cover high impedance faults online.

PCC opined that by increasing the resistive reach setting, the relay may overreach and may cause uncoordinated tripping in the system. Similar type of tripping was observed on 06/10/2021 where relay at Teesta-III end picked up and tripped Teesta III-Dikchu line for a fault in adjacent Dikchu-Rangpo line.

Powergrid representative suggested that for finding the accurate fault location, travelling wave fault locator may be used for the concerned lines.

PCC advised TPTL that the provision of travelling wave fault locator may be explored and the same may be implemented at the respective end of the concerned transmission lines.

ITEM NO. C.4: Follow-up of Decisions of the Previous Protection Sub-Committee Meeting(s)

The decision of previous PCC meetings is attached at Annexure.

Members may update the latest status.

Deliberation in the meeting

Updated status for decisions of previous PCC meetings is given at ***Annexure C.4.***

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घटना संख्या: **09-10-2021/1** दिनांक: **05-11-2021**

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

Summary of the event (घटना का सारांश):

At 12:44 Hrs, 220 kV Daltonganj-Chatra D/c tripped on B-phase to earth fault, leading to total power failure at 220/132 kV Chatra S/s. There was total load loss of 15 MW during the event.

Date / Time of disturbance: 09-10-2021 at 12:44 hrs

- **Event type:** GD-1
- **Systems/ Subsystems affected:** 220/132 kV Chatra
- **Load and Generation loss**.
    - No generation loss was reported during the event.
    - Around 15 MW load loss reported during the event at Chatra by Jharkhand SLDC.

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

- NIL

Major elements tripped (प्रमुख ट्रिपिंग):

- 220 kV Daltonganj-Chatra D/c

Network across the affected area (प्रभावित क्षेत्र का नक्शा)

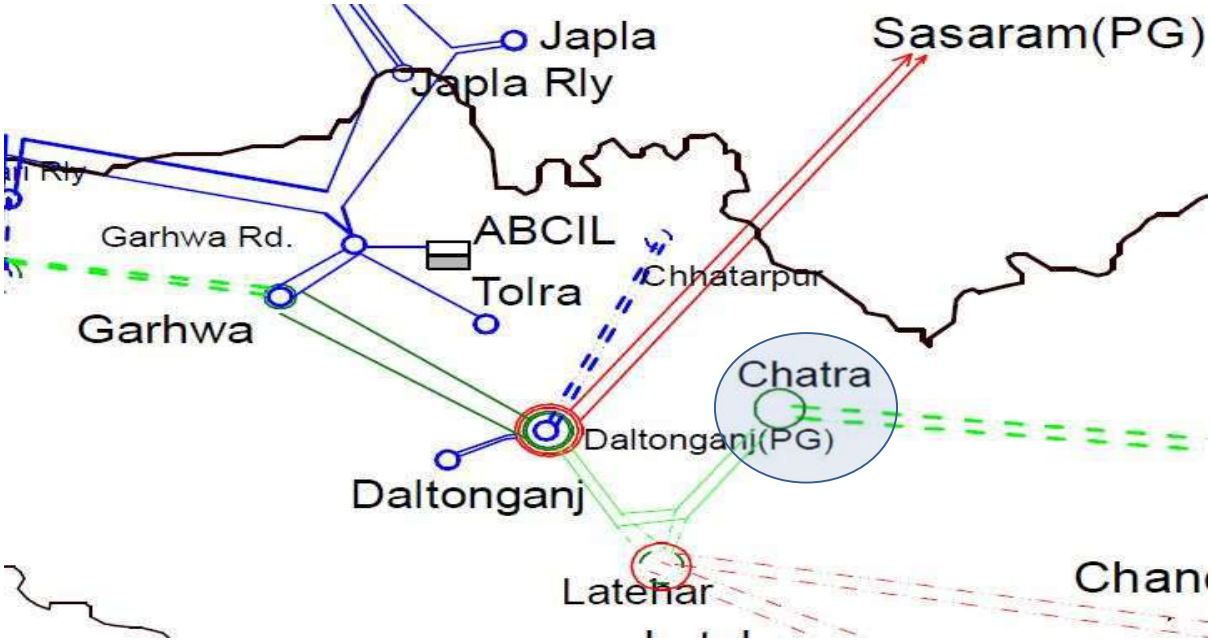


Figure 1: Network across the affected area

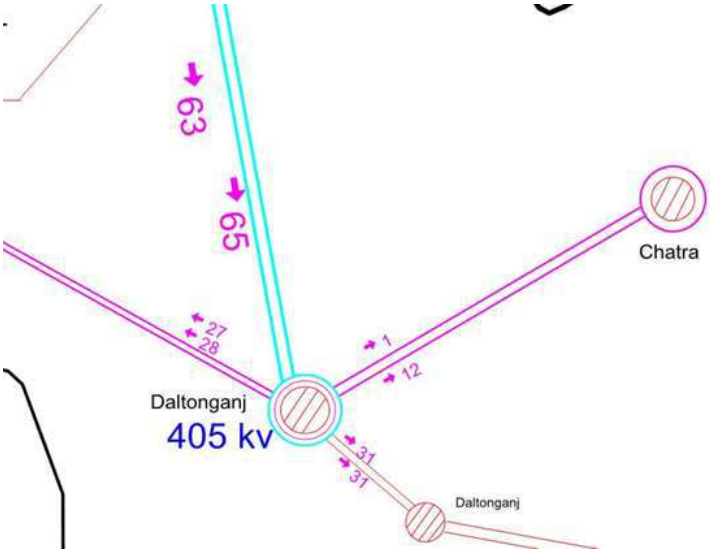


Figure 2: SCADA snapshot of the system

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

समय	नाम	उप केंद्र 1 रिले संकेत	उप केंद्र 2 रिले संकेत	पीएमयू पर्यवेक्षण
12:44	220 kV Daltonagnj-Chatra-1	B_N, Z I, 28 km	Didn't trip	22 kV dip in B_ph
	220 kV Daltonagnj-Chatra-2	Y_N, 69 km, 1.3 kA	Didn't trip	31 kV dip in Y_ph

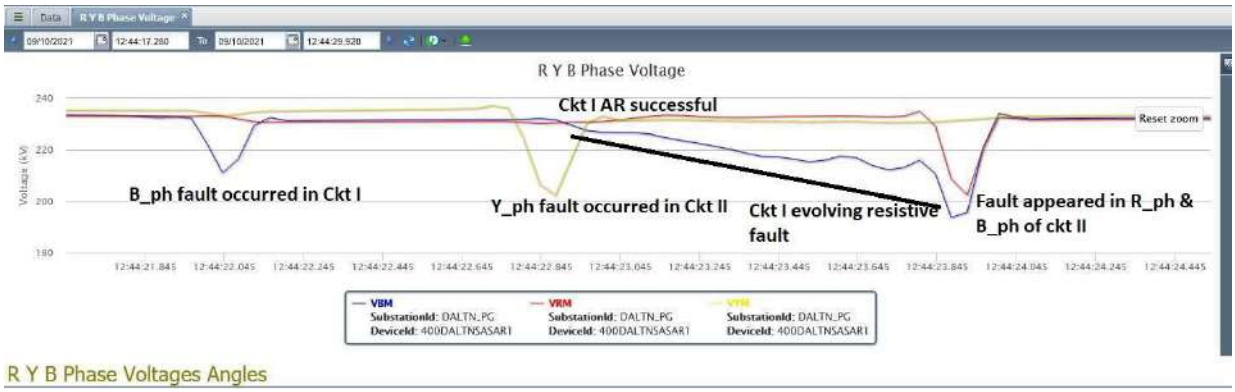


Figure 3: PMU snapshot of 400/220 kV Daltonganj S/s

Restoration (पूर्वावस्था की प्रप्ति)

Transmission/Generation element name	Restoration time
220 kV Daltonganj-Chatra-1	14:13
220 kV Daltonganj-Chatra-2	14:02

Analysis of the event (घटना का विश्लेषण) & Protection issue (सुरक्षा समस्या):

- **Ckt 1:**
  - A resistive fault occurred in B_ph of Ckt I which was cleared by Daltonganj when fault came in Z I.
  - A/r was successful after 1 second. High resistive fault appeared again and current started increasing gradually, which was cleared after 800 msec.
- **Ckt 2:**
  - After 800 msec of fault in Ckt I, another fault occurred in Y_ph of ckt II, which was cleared within 100 msec by Daltonganj. After 800 msec, fault appeared in other two phases and breakers got opened at Daltonganj.

- As informed, both lines didn't trip from Chatra. PLCC status maybe checked.

- Voltage induced in both lines after fault clearance is indicative of arcing which persisted till all three phases opened. Root cause of the fault maybe analysed and findings may be shared.

- As informed, both lines are kept on separate bus with bus coupler kept open. Entire load of Chatra is fed through one circuit only. Reason for keeping bus coupler open may be shared. This is further reducing reliability of these radial loads and asset also remains unutilized.

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

Issues	Regulation Non-Compliance	Utility
DR/EL not provided within 24 Hours	1. IEGC 5.2 (r) 2. CEA grid Standard 15.3	**JUSNL, PG ER-I**

Status of Reporting (रिपोर्टिंग की स्थिति):

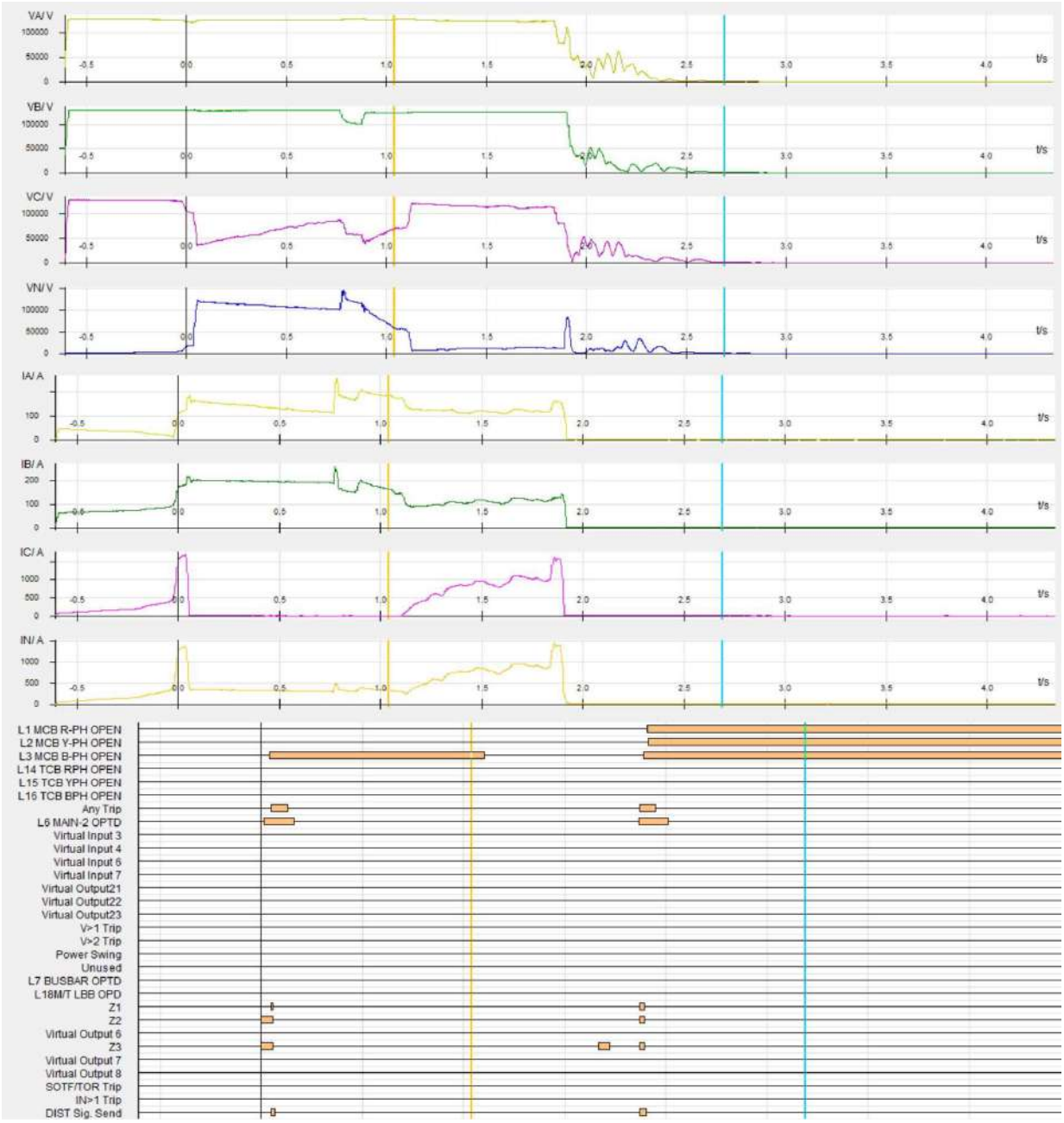
- DR/EL yet to be received from JUSNL
- DR/EL received from PG ER-I

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

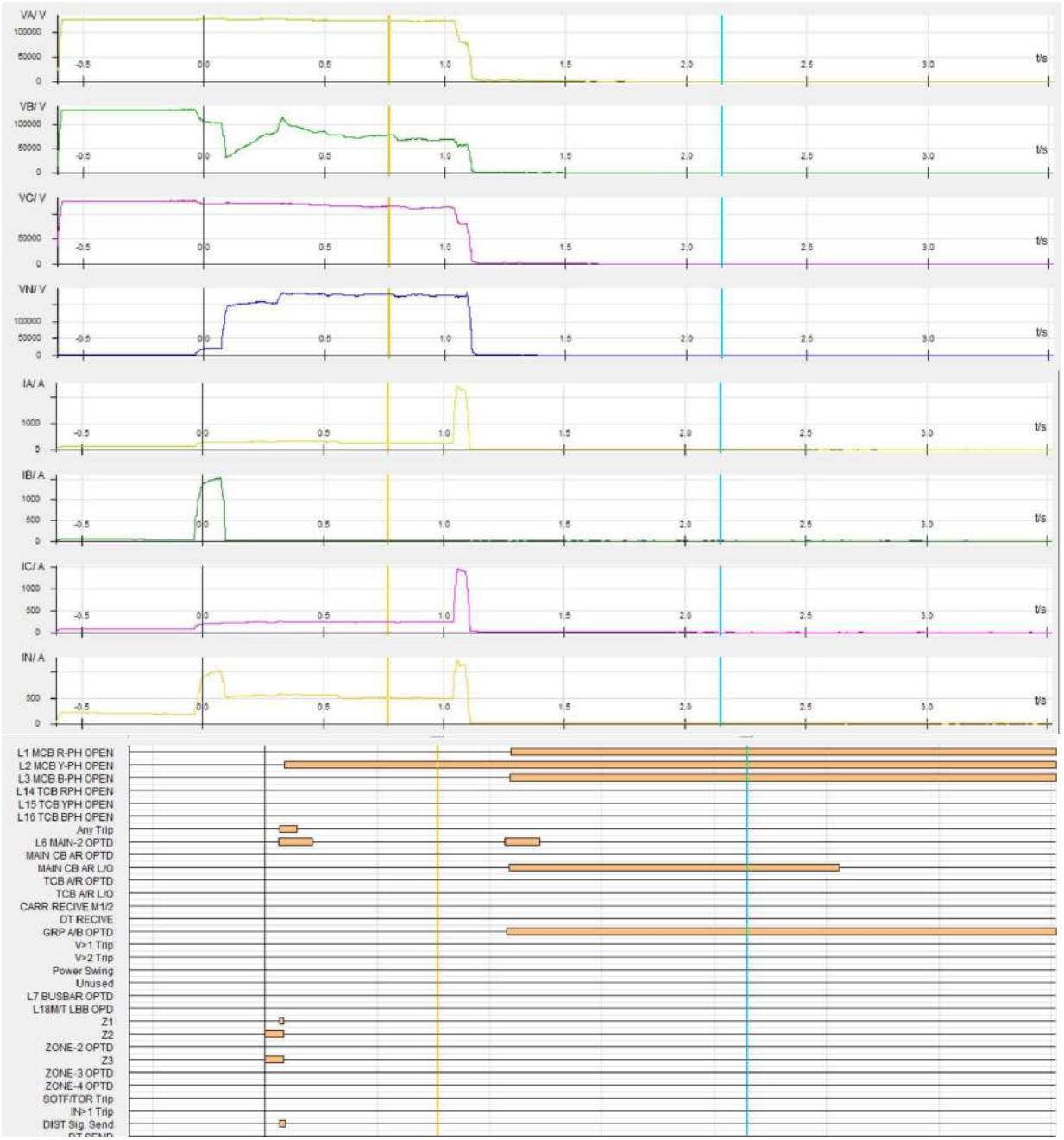
Sequence of event not recorded at time of event.

Annexure 2: DR recorded

DR of 220 kV Daltonganj-Chatra-I (Daltonganj end)



DR of 220 kV Daltonganj-Chatra-II (Daltonganj 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: **09-10-2021/1** दिनांक:**06-11-2021**

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

Summary of the event (घटना का सारांश):

At 18:49 Hrs, 220 kV Daltonganj-Garhwa(New) D/c tripped on B-phase to earth fault, leading to total power failure at 220/132 kV Garhwa(New) S/s. There was total load loss of 43 MW during the event (including traction load loss of 10 MW at Garhwa).

Date / Time of disturbance: 09-10-2021 at 18:49 hrs

- **Event type:** GD-1
- **Systems/ Subsystems affected:** 220/132 kV Garhwa (New)
- **Load and Generation loss**.
    - No generation loss was reported during the event.
    - Around 43 MW load loss reported during the event at Garhwa.

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

- NIL

Major elements tripped (प्रमुख ट्रिपिंग):

- 220 kV Daltonganj-Garhwa (New) D/c
- 220 kV Bus 1 & Bus 2 at Garhwa (New)

Network across the affected area (प्रभावित क्षेत्र का नक्शा)

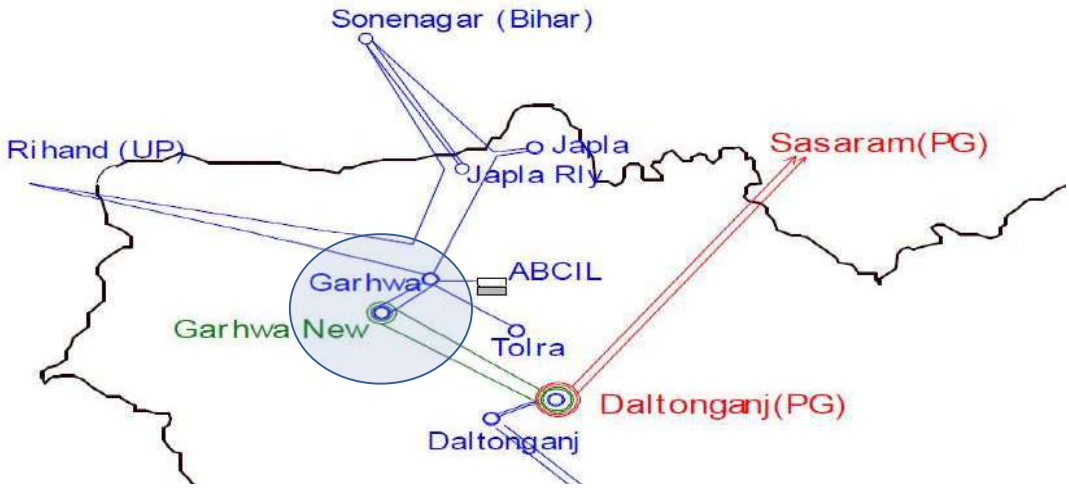


Figure 1: Network across the affected area

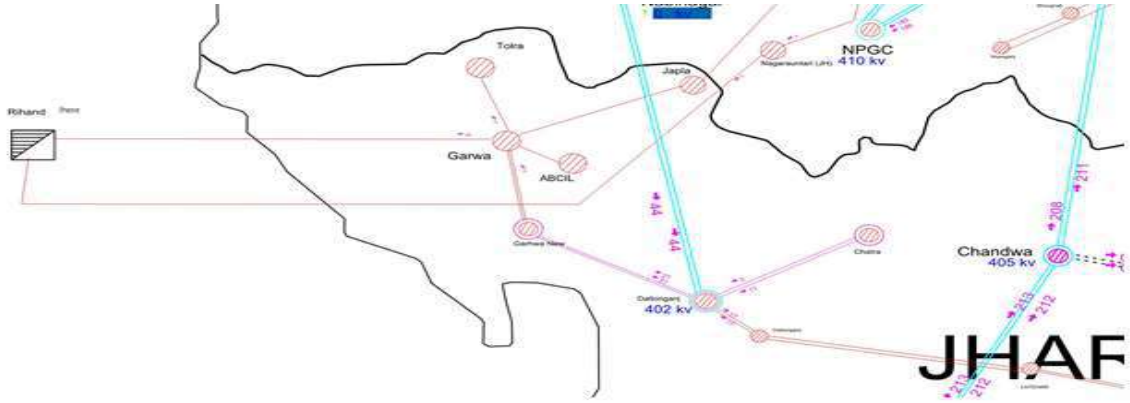


Figure 2: SCADA snapshot of the system

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

समय	नाम	उप केंद्र 1 रिले संकेत	उप केंद्र 2 रिले संकेत	पीएमयू पर्यवेक्षण
18:49	220 kV Bus-1, Bus 2 at Garhwa (New)	-	-	25 kV dip in R_ph, 40 kV dip in Y_ph and 42 kV dip in B_ph
	220 kV Daltonagnj-Garhwa(New)-1	B_N, 1.16 kA	-	
	220 kV Daltonagnj-Garhwa(New)-2	B_N, 24.5 km, 1.91 kA	-	

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

Restoration (पूर्वावस्था की प्रप्ति)

Transmission/Generation element name	Restoration time
220 kV Bus 1 at Garhwa (New)	16:26
220 kV Bus 2 at Garhwa (New)	16:26

220 kV Daltonganj-Garhwa (New)-1	16:26
220 kV Daltonganj-Garhwa (New)-2	17:11

Analysis of the event (घटना का विश्लेषण) & Protection issue (सुरक्षा समस्या):

- There was a B_ph fault in Zone-1 from Garhwa of 220 kV Daltonganj-Garhwa II. Garhwa end breaker got opened within 180 msec. However, breaker at Daltonganj didn't open. After that voltage at Garhwa (open end) became around 268 kV, which persisted till the time breaker at Daltonganj opened. Carrier signal wasn't sent from Garhwa. JUSNL may explain.
- After 200 msec, another fault occurred in Y_ph of Ckt-2, which was seen by both ends in Z III. All three phases opened from both ends after 800 msec. Why fault was seen in Z III from both ends. JUSNL may explain.
- Whether Ckt-2 tripped from Garhwa in Zone-3 by distance protection or it tripped on O/V. O/V setting maybe shared. JUSNL may explain.
- Ckt-1 also saw the Y-ph fault in Z III and all three phases tripped after 800 msec from Daltonganj. Whether Ckt-1 tripped from Garhwa or not. JUSNL may explain.

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

Issues	Regulation Non-Compliance	Utility
DR/EL not provided within 24 Hours	1. IEGC 5.2 (r) 2. CEA grid Standard 15.3	**JUSNL, PG ER-I**

Status of Reporting (रिपोर्टिंग की स्थिति):

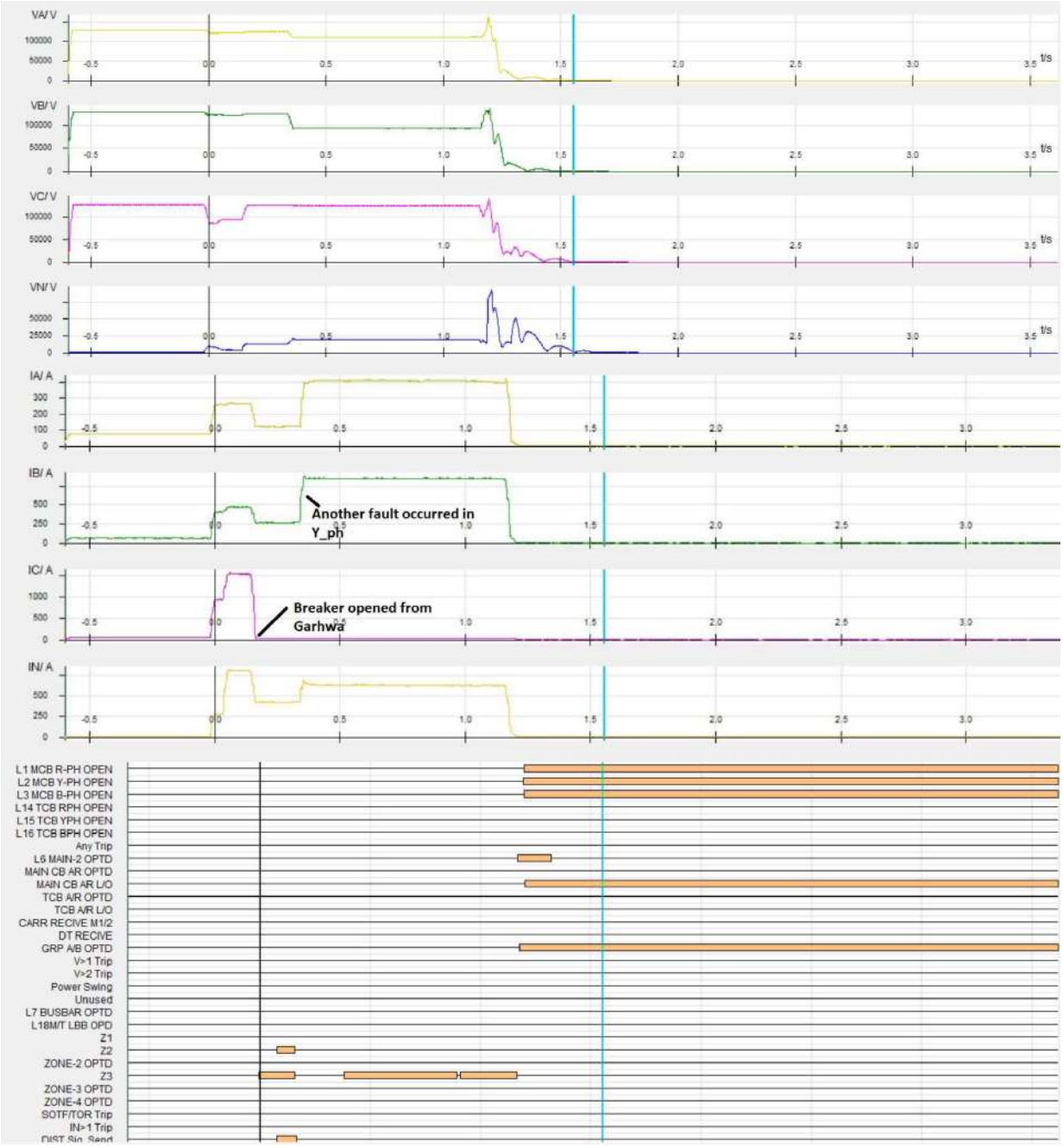
- Complete DR/EL yet to be received from JUSNL
- DR/EL received from PG ER-I

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

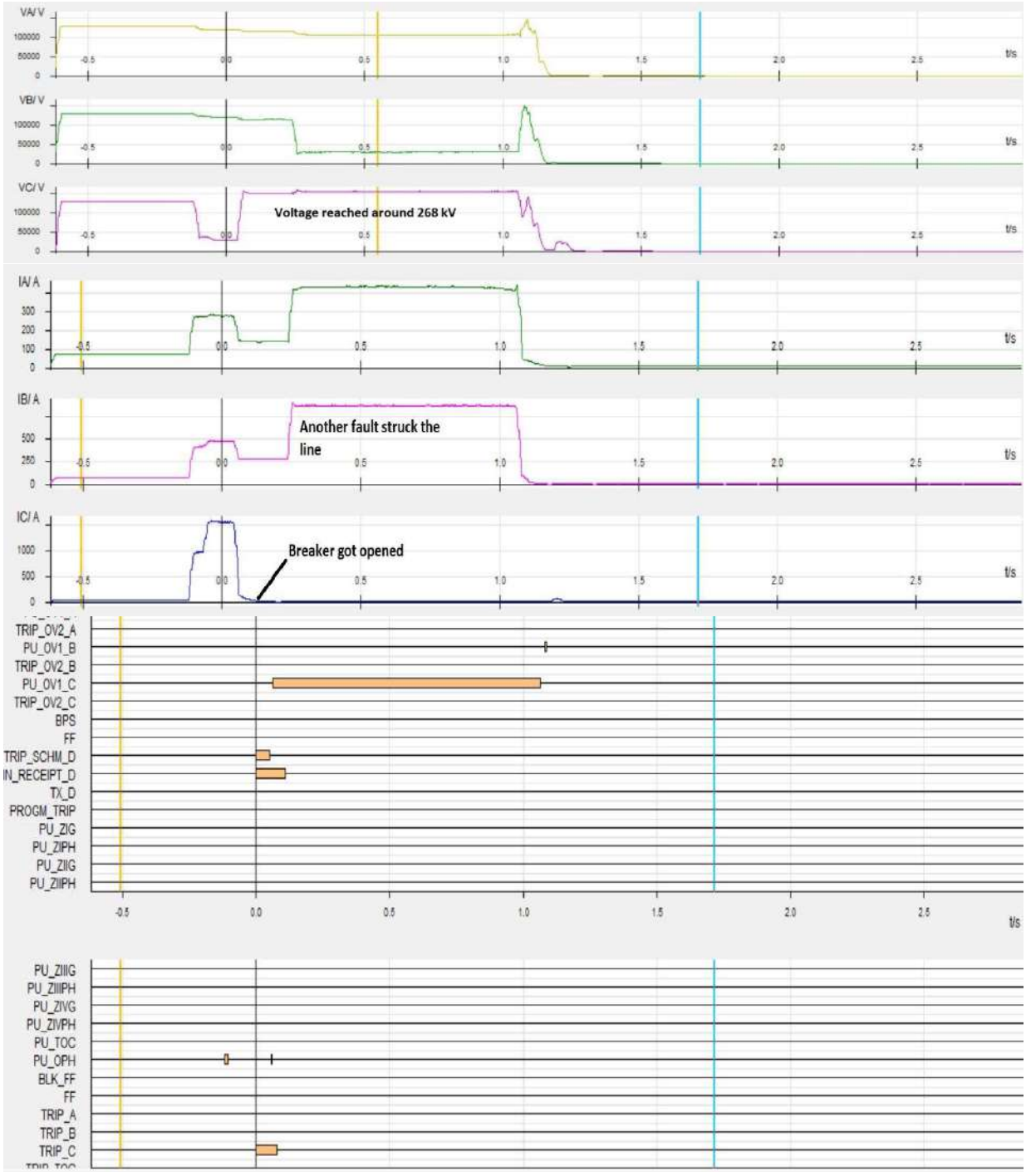
Sequence of event not recorded at time of event.

Annexure 2: DR recorded

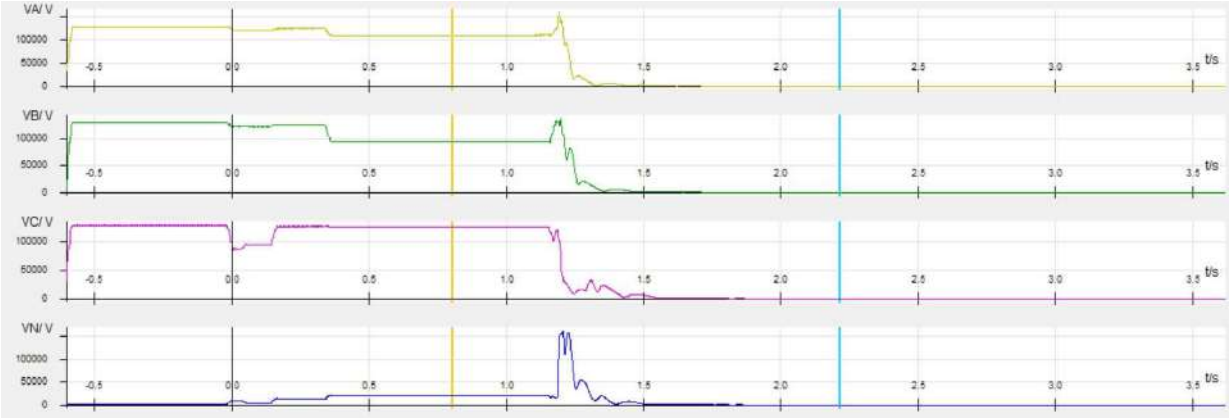
DR of 220 kV Daltonganj-Garhwa II (Daltonganj end)

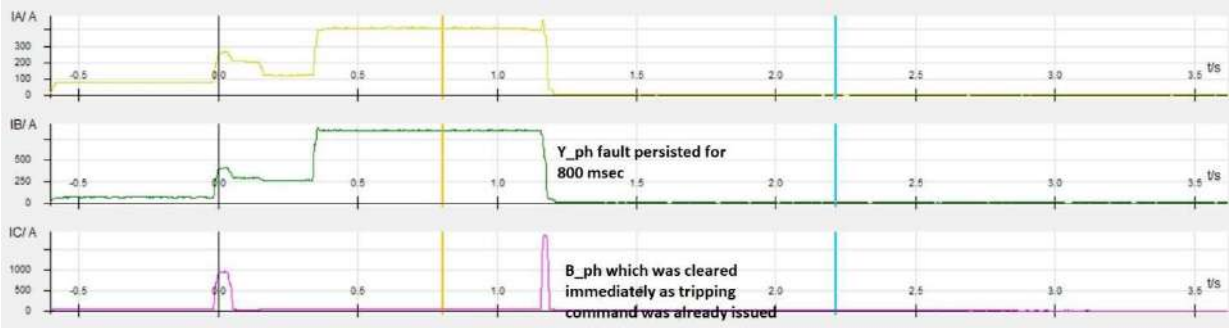


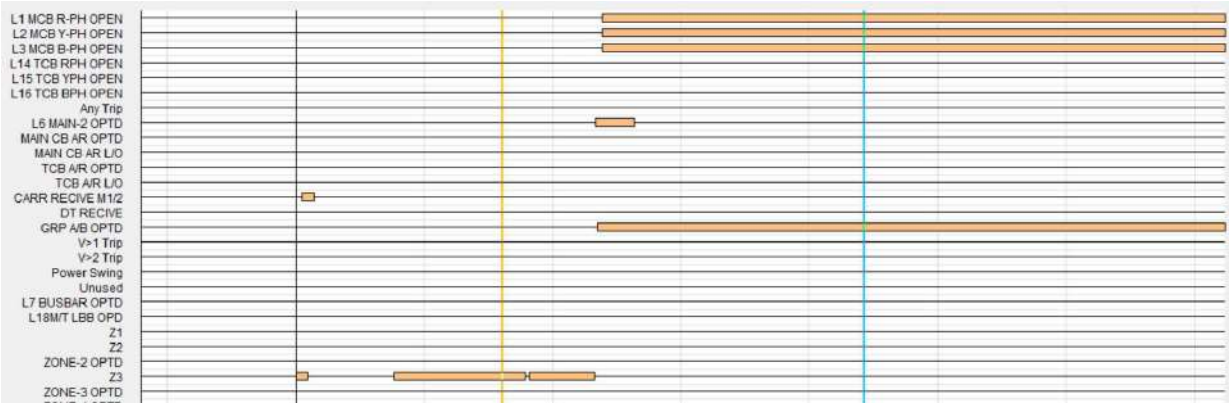
DR of 220 kV Daltonganj-Garhwa II (Garhwa end)



DR of 220 kV Daltonganj-Garhwa I (Daltonganj end)







Minutes of meeting held on 21st Oct 2021 for the discussion of event on 9th Oct 2021 at 11:57 Hrs leading to 220/132 kV Budhipadar S/S blackout and non-survival of Vedanta Island

Venue: Held through Online Webex platform (3 PM-5:30 PM)

Event Description: There was a complete blackout event at 220/132 kV Budhipadar substation on 9h Oct 2021 at 11:57 Hrs. The event has resulted in significant load loss and generation loss including a blackout of 220 kV IBTPS power plant. In addition associated, captive power plants which include 220 kV Vedanta, Aditya Alumina, Bhushan Steel and SNC got islanded. Out of these, 220 kV Vedanta Island could not survive with a significant load generation mismatch. At Bhushan steel out of 5 units (130 X 3 + 60+ 40 MW), only one 130 MW unit and one 60 MW survived in islanded mode. There was no issue observed at Aditya alumina and its 650 MW load survived with 650 MW generation (630 MW Thermal gen+ 20 MW solar gen).

During the event, there was generation and load loss which are summarized below :

- IBTPS: 300 MW generation loss
- Budhipadar load loss: 115 MW loss in local loads of Budhipadar.
- Vedanta CPP: 1120 MW generation loss + 880 MW captive load loss= 240 MW net injection loss to Orissa grid
- Bhushan Steel CPP: 300 MW generation loss (130 X 2 MW + 40 MW) and 300 MW captive load loss for Load generation balance as per CILMS scheme. There was no injection/drawal loss.

Overall Loss for Indian grid : 240 Injection (Vedanta)+300 MW (IBTPS Gen) -115 MW load loss =425 MW Generation loss

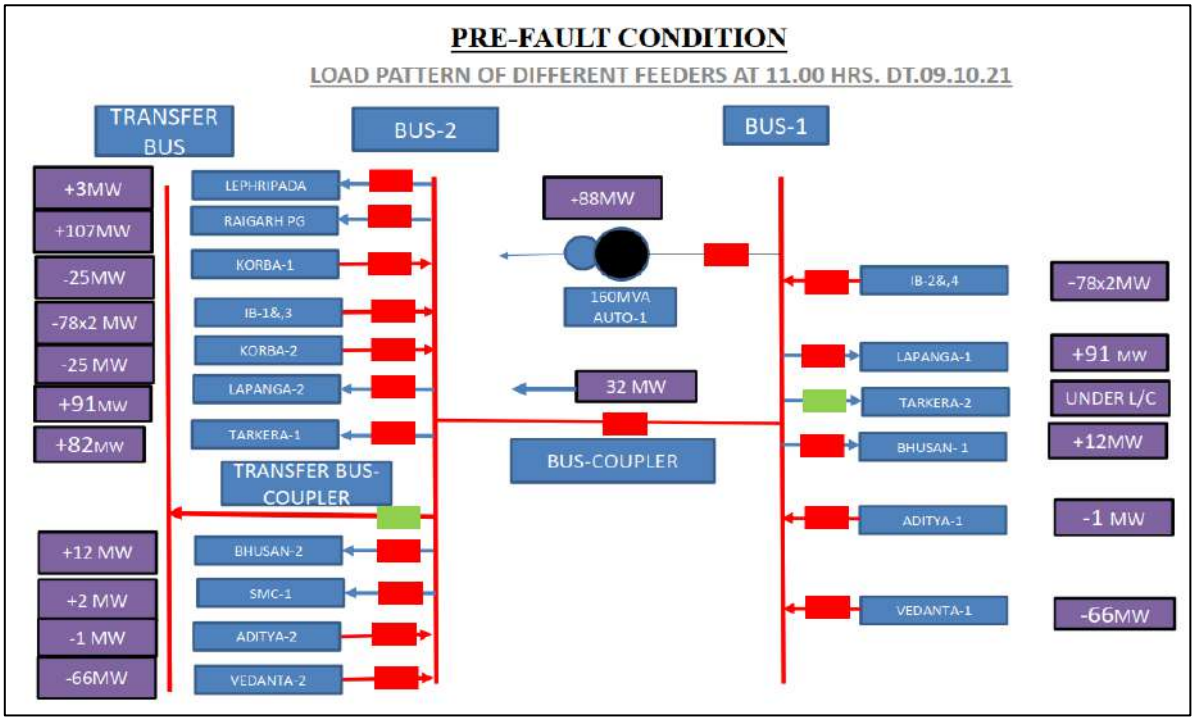


Fig: Power flow pattern at 220 kV Budhipadar substation before event (Source : OPTCL)

Summary of Meeting Discussion

The event was analyzed and discussed in detail during the meeting and associated presentations and analysis are attached. **Major issues and action points that have been discussed during the event are as follows :**

Issue 1: Local earthing was not done for the line CT when the line was taken out for maintenance activity.

Discussion and Recommendation: In 104th PCC, PCC recommended that for the shutdown of one circuit of any D/C line which is emanating from substations having DMT/DM bus configuration with CT positioned towards line side isolators, the bus side isolator of the circuit may be opened before closing the line earth switch. In addition to this, local earthing of the CT may also be carried out as an additional precautionary measure to avoid any unwanted tripping in the substation during a fault in the other healthy circuit as well as for safety measures.

Action points for OPTCL and Orissa SLDC:

- OPTCL has been advised to include this guideline strictly as a part of the standard operating procedure (SOPR) at substation switching instruction to avoid such kind of event in the future.
- This guideline should also be shared with the outage coordination team of Orissa SLDC for proper sharing with other utilities in Orissa. (SLDC Orissa)

Issue 2 : Bus Bar protections Scheme healthiness at Budhipadar

Discussion and Recommendation: OPTCL should take up the issue with M/s Siemens and appropriately resolve the issue related to the bus bar protection scheme at Budhipadar substation and associated issues related to isolator status. In addition, the defective bus bar bay unit of 220 kV Budhipadar-Lapanga 1 should also be rectified at the earliest. Any further delay may result in any similar event and associated tripping at the substation causing a widespread event. This issue was discussed in an earlier meeting which was held by ERPC on 4th August 2021 related to the complete blackout of Budhipadar on 8th April 2021. In MoM of the meeting, it was apprised to OPTCL to accelerate the process of bus bar protection rectification and Auto-reclosure of transmission lines. It was discussed in the present meeting that such delays in correction of the protection scheme for 220 kV Budhipadar substation are detrimental to system security.

Action Points for OPTCL:

1. OPTCL to update SLDC Orissa/ERPC/ERLDC on the bus bar protection scheme healthiness and rectification work regarding the scheme in consultation with Siemens at the earliest.
2. OPTCL should resolve the 220 kV Budhipadar-Lapanga 1 bus bar bay unit which is defective at the earliest and inform SLDC Orissa/ERPC/ERLDC

Issue 3: Issue of carrier protection scheme and healthiness from 220 kV Budhipadar substation

Discussion and Recommendation: During the meeting, it has been advised to OPTCL to carry out thorough testing of the auto-reclosure scheme for lines where it has been installed with OPGW. In addition, OPTCL may accelerate the process of implementation of the A/R scheme with OPGW on other lines from the Budhipadar substation. This would avoid any delayed fault clearance of line fault in the system.

Action Points for OPTCL :

1. Completion of testing of 220 kV Budhipadar-Tarkera D/C carrier-based protection scheme thorough testing by end of Nov 2021.
2. Update the status of implementation of carrier-based A/R scheme on other lines from Budhipadar substation and healthiness of existing implemented A/R schemes.

Issue 4: Installation of CVTs on 220 kV Lines at Budhipadar for protection purpose

Discussion and Recommendation: During the meeting, OPTCL informed that they do not have line CVTss for old lines and are in process of installation. It was advised to OPTCL to implement the line CVTs for the protection of transmission lines at Budhipadar being a critical station with inter-regional lines, multiple CPPs and IBTPS connectivity. In addition, it was advised to check the healthiness of the Bus PT selection relay to ensure that similar issues as observed in this event are not being faced. In the meeting, OPTCL confirmed that the defective Bus PT selection relay has been replaced.

Action Points for OPTCL :

1. OPTCL to share the status of all lines which are utilizing Bus PT at 220/132 kV Budhipadar substation
2. OPTCL to install line PT on 220 kV lines to ensure protections schemes are redundant and do not depend on Bus PT.
3. OPTCL to check the healthiness of Bus PT selection relay for 220 kV lines at Budhipadar which are using BUS PT input for voltage.

Issue 5: Aging infrastructure at 220 kV Budhipadar substation

Discussion and Recommendation: During the meeting, the physical healthiness of 220/132 kV Budhipadar substation and its equipment were discussed in detail. OPTCL informed that the old isolator/CT/CVT/Breaker and other equipment are being replaced in a phase-wise manner at the substation to improve physical health. OPTCL informed that bus bar conductors also need to be replaced and these have been procured however other materials are also required. This issue was reviewed seriously during the meeting based on substation criticality, fault level. It was recommended that bus conductor replacement and associated outage program need to be finalized in one month period from this meeting and should be submitted to SLDC Orissa/ERPC/ERLDC. The issue should be apprised to senior management of OPTCL and work should be started at the earliest.

Action Points for OPTCL :

1. OPTCL to submit bus conductor replacement plan and outage plan to SLDC Orissa/ERPC/ERLDC.
2. OPTCL to initiate the conductor replacement activity in a stage-wise manner at the earliest to ensure system reliability and security

Issue 6: 220 kV Vedanta CPP Islanding non-survival

Discussion and Recommendation: During the meeting non-survival of 220 kV Vedanta CPP islanding has been deliberated in detail. Vedanta explained that due to sluggish response from their unit's boiler-turbine system (Shanghai Electric make), the island is not able to survive. ERLDC and ERPC observed that there had been consecutive failures of the islanding scheme at Vedanta in the recent past when high injection/drawal is being done by 220 kV CCP with Orissa grid. Vedanta informed that they have taken a lot of measures at the plant in terms of governor tuning and AVR replacement (ABB make) and change in islanding scheme with M/s ABB however issues are persisting. They have earlier appointed M/s Solvina to analyze the issue and share the recommendation for improving the system stability during the islanded condition. Vedanta agreed to share various data, islanding schemes details, associated reports and analysis with SLDC Orissa, ERLDC and ERPC so that it can be jointly reviewed.

Action points for Vedanta CPP

1. Vedanta to share data for islanding events, islanding schemes details, details of the simulation model for the plant, analysis/findings of instability and root cause reports with SLDC Orissa, ERLDC and ERPC

Issue 6: Disconnection of 220 kV Vedanta CPP and its connection with 400 kV system

Discussion and Recommendation: In the previous meeting organized by ERPC on 4th August 2021, OPTCL and Orissa SLDC informed that the Vedanta CPP will be connected to the 400 kV system and disconnected from the 220 kV system after installation of the second 220/132 kV 160 MVA ICT at Budhipadar and necessary clearance from GRIDCO. This has been decided given that high injection from CPP was leading to Vedanta CPP Island collapse as well as high loading issue.

Vedanta during the meeting shared that when it was connected with the 400 kV system through its IPP in the past, the island used to survive as the 600 MW unit was able to provide a fast governer response to the islanded system. While the present 135 X 9 MW units with captive load under Composite islanding and load management system (CILMS) are not able to cope up with frequency rise in the islanded mode. The islanding action is leading to over frequency and under frequency causing generation and load loss in a staged manner and collapse of the island in 2-3 minutes.

In response to the shifting query, Orissa SLDC informed that during a meeting taken by senior management with Vedanta, it has been decided not to connect Vedanta with the

400 kV system. This is in view that if the 220/132 kV ICT is commissioned at Budhipadar and Vedanta injection is removed then 220 kV Rourkela-Tarkera D/C will get overloaded. It was informed that Vedanta will be connected to the 220 kV system only after the commissioning of 220 kV Rourkela-Tarkera 2nd D/C which is under the planning discussion stage. ERPC informed SLDC Orissa that as this was one action plan of 4th august 2021 meeting so Orissa SLDC should share the MoM of the meeting, decisions taken and case study based on which decision has been taken with ERPC and ERLDC.

Based on these it was recommended that Vedanta in coordination with SLDC Orissa should explore reducing injection and drawal with the Budhipadar system to enhance chances of islanding survival.

Action points for SLDC Orissa and Vedanta CPP

1. Orissa SLDC should share the MoM of meeting with Vedanta where the decision was taken and case study based on which decision has been taken with ERPC and ERLDC urgently before 185th OCC meeting
2. Vedanta and SLDC Orissa should explore reducing injection and drawal with the Budhipadar system to enhance the islanding survival chance.

Issue 7: High fault level of 220 kV Budhipadar substation and bus splitting scheme

Discussion and Recommendation: In the past 183rd OCC meeting, OPTCL informed that they conducted a study for 220 kV Meramundali and Budhipadar bus splitting scheme. OCC advised OPTCL to carry out the revised study in consultation with OPGC & SLDC Odisha for different scenarios and submit the report to ERPC/ERLDC for further discussion in this regard. One email was communicated by ERLDC on 23rd September 2021 to OPTCL and SLDC Orissa for convening the internal discussion meeting, discussing the ERLDC shared points and proposing the outcome to ERLDC and ERPC based.

It was enquired whether the meeting has been conducted for which SLDC Orissa and OPTCL informed that this meeting is yet to be conducted. ERLDC and ERPC advised that this meeting should be convened shortly and its MoM and outcome may be placed in OCC to be held in Nov 2021.

Action point by SLDC Orissa and OPTCL:

1. To convene the internal meeting at the earliest and its MoM and outcome may be placed in OCC to be held in Nov 2021

Issue 8: Bhushan steel islanding scheme and other CPPs concerns

Discussion and Recommendation: During the meeting, Bhushan steel explained that their system got islanded with captive loads with generation (two stages: 130 X 3 MW Units) + (60 X 1 + 40 X 1 MW Units). They were importing 24 MW from Budhipdar before the event. Their one 130 MW unit got immediately tripped after islanding while the other two 130 MW units survived however out of it one 130 MW unit got tripped on under frequency. Further in another stage (60 +40 MW Units), the island survived with both units however in the next

5 minutes 40 MW unit got tripped and the island survived with 60 MW unit. Thus total 130 X 2 + 60 MW islands survived after the event.

During the meeting, it was discussed that such islanding event reports and analysis should be shared with SLDC Orissa as well as ERLDC and ERPC by all captive plants. This is required for proper discussion and finding the root cause and appropriate remedial measures suggestion.

Aditya alumina stated that their system successfully islanded with line tripping from Budhipadar end. However, their islanding scheme did not detect islanded as their exchange with grid was nil and their end breaker did not trip. They have a 560 MW captive load which survived with 530 MW thermal and 20 MW solar generation. They had managed the variation of solar plant generation which was varying during islanded conditions impacting the stability of the islanded system. It was desired that islanded system operation with load, generation and frequency variation plots to be shared with SLDC Orissa and ERLDC/ERPC also.

One issue of event sharing was raised by CPPs during the meeting. It was informed that as per grid code SLDC Orissa and ERLDC have to prepare a flash report of the event as per their jurisdiction on the same day and share it with respective stakeholders and concerned utility. After restoration activity, OPTCL and SLDC Orissa should inform connected utilities on the event as the captive plant may trip after islanding if not restored for a longer duration of time. ERLDC and ERPC desired that SLDC Orissa and OPTCL may see this aspect on information sharing in line with relevant regulations and discussion with their stakeholders.

Action Points for CPP (Bhushan Steel, Aditya alumina CPP and other CPP) and SLDC Orissa and OPTCL:

1. Bhushan Steel and Aditya alumina CPP to share the present event analysis and islanding operation, load generation balance, frequency variation plots with SLDC Orissa and ERLDC and ERPC.
2. SLDC Orissa and OPTCL to coordinate with CPPs on information exchange during such events given islanded system operation at CPPs.
3. All CPPs to share islanding information detail or any major smelter or generation tripping impacting grid (inform of high drawal/injection) to SLDC Orissa and later share report and analysis and action taken to resolve the issues.

Issue 9: Islanding scheme implementation of IBTPS

Discussion and Recommendation: IBTPS informed that they have completed the islanding arrangement and OPTCL has to implement the scheme for the load provision for islanding. OPTCL informed that the scheme should be soon operational in coordination with OPGC. ERPC informed OPTCL to provide the necessary arrangement as per the islanding scheme and complete the implementation.

Action Point for OPTCL and OPGC:

1. OPTCL in coordination with OPGC to ensure implementation of islanding scheme for IBTPS at earliest.

Based on the above discussion and backdrop on 220 kV Budhipadar substation importance and associated issues and CPP islanding issues, **ERLDC would convene a meeting for discussing the islanding scheme of CPP in Orissa in coordination with SLDC Orissa and captive power plants.**

In the end, ERLDC and ERPC advised all involved utilities to address the various issues and take actions as per action points in a time-bound fashion. This will help in avoiding any repetition of such events and help in the improvement of the system reliability.

Email Ids of ERLDC Protection team

1. **Protection Department: erldcprotection@posoco.in**
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3. Alok P Singh: apsingh@posoco.in
4. Akash Modi: akmodi@posoco.in

Email Ids of ERPC Protection team

1. **Protection wing: erpc-protection@gov.in ; erpcprotection@gmail.com**
2. Pranay P.Jena: pranayapiyusha@gmail.com

Meeting Participants

ERLDC

1. Gopal Mitra, CGM (I/C), ERLDC
2. Saugato Mondal, DGM, ERLDC
3. Saurav Kumar Sahay, Chief Manager, ERLDC
4. Chandan Kumar, Manager, ERLDC
5. Raj Protim Kundu, Manager, ERLDC
6. Chandan Mallick, Manager, ERLDC
7. Alok P singh, Manager, ERLDC
8. Akash Modi, Dy Manager, ERLDC

ERPC

1. Shyam Kejriwal, SE, ERPC
2. Pranay P Jena, EE, ERPC

SLDC Orissa

1. P.K.Satapathy, Sr.G.M (SLDC)
2. S.K.Mohanty,G.M (OP)
3. S.C.Dash, G.M (O.S)
4. S.K.Mishra, DGM
5. D.P.Kar, DGM

OPTCL

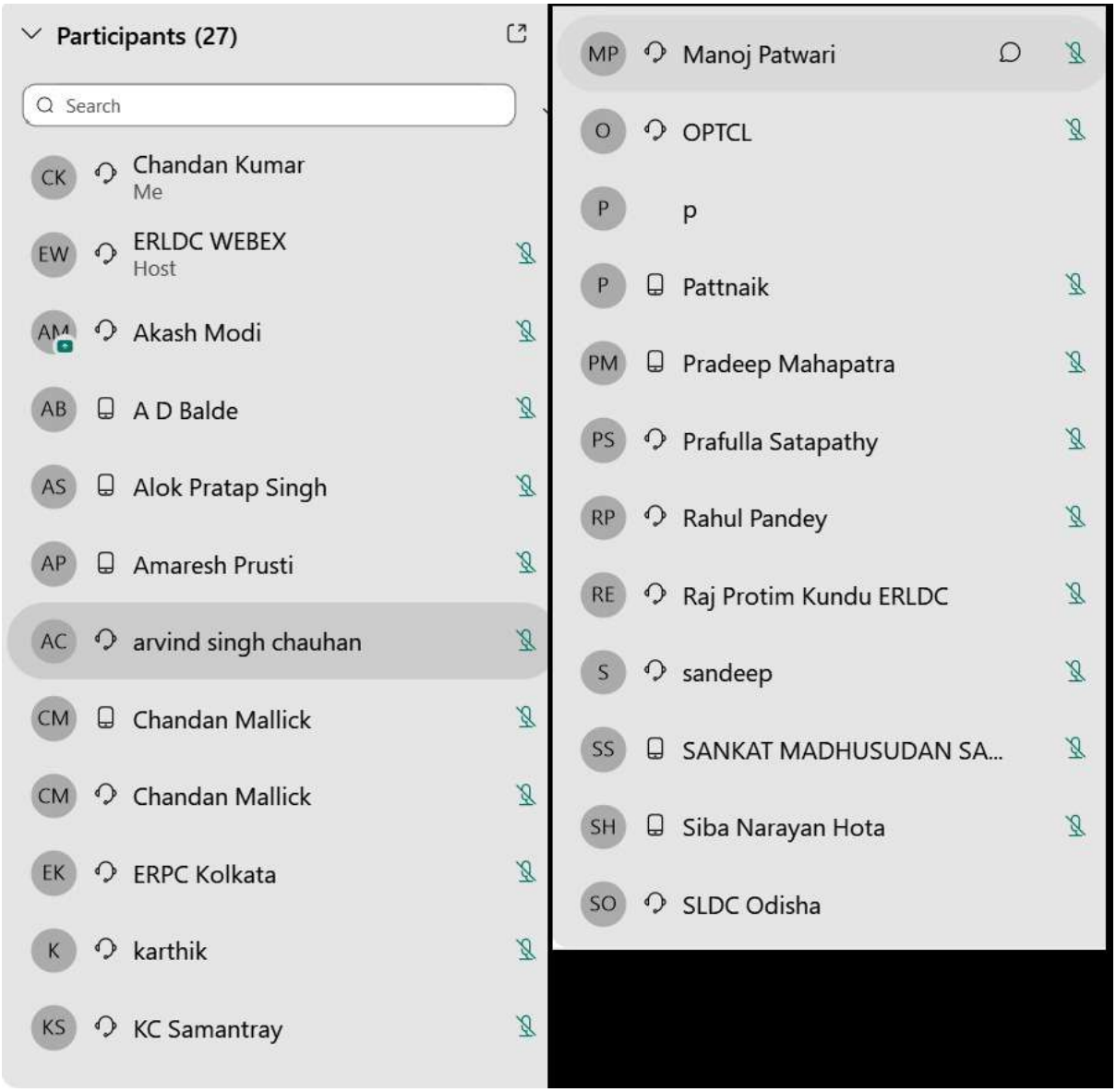
1. U.K.Misra, DGM Burla
2. S M S Sahoo, DGM
3. P.K. Patnaik, OPTCL
4. Amaresh Prusti,OPTCL

OPGC

1. Pradeep Mohapatra, OPGC
2. K.C.Samantha, OPGC

CPP

1. Mangu Srinivas, Vedanta CPP
2. Prafulla Satapathy, Aditya Alumina CPP
3. A.D.Balde, Bhushan Steel CPP
4. Arvind singh Chauhan, Bhushan steel CPP
5. Manoj Patwari, Bhushan steel CPP

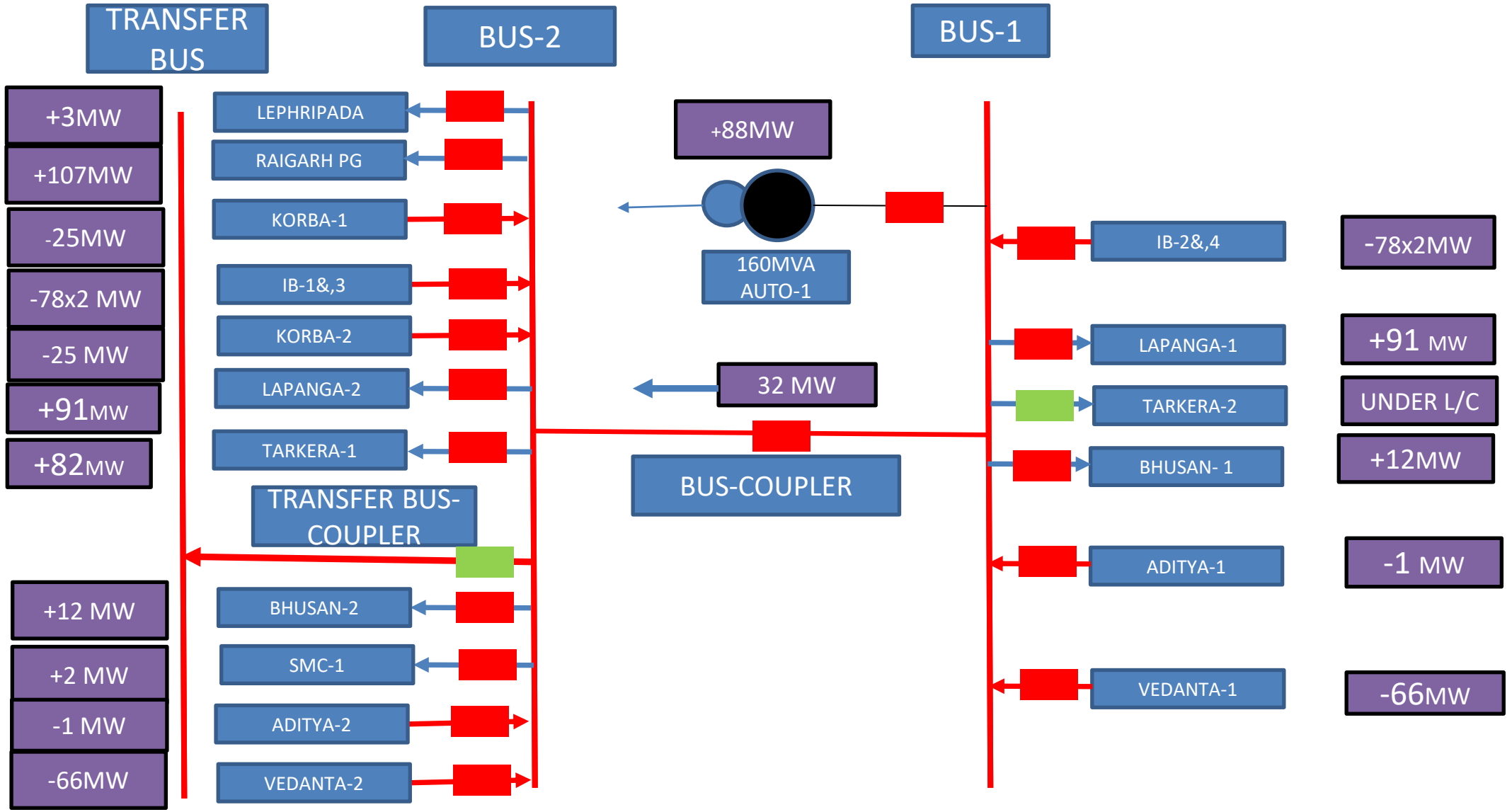

Participants (27)
Search
CK Chandan Kumar
Me
EW ERLDC WEBEX
Host
AM Akash Modi
AB A D Balde
AS Alok Pratap Singh
AP Amaresh Prusti
AC arvind singh chauhan
CM Chandan Mallick
CM Chandan Mallick
EK ERPC Kolkata
K karthik
KS KC Samantray
MP Manoj Patwari
O OPTCL
P p
P Pattnaik
PM Pradeep Mahapatra
PS Prafulla Satapathy
RP Rahul Pandey
RE Raj Protim Kundu ERLDC
S sandeep
SS SANKAT MADHUSUDAN SA...
SH Siba Narayan Hota
SO SLDC Odisha

Outage of 220KV Bus-1 & 2 system at Budhipadar Grid S/s on dt 09.10.2021.

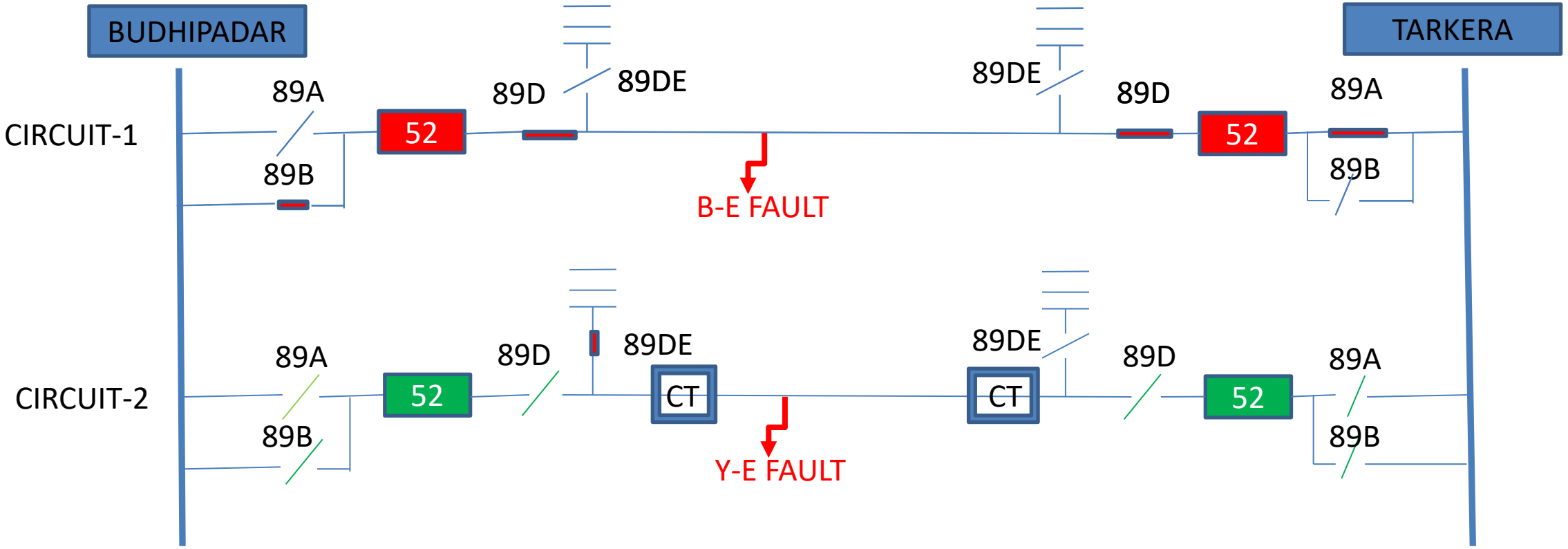
- Date 09.10.2021 ,Time- 11:57 Hrs.
- Station : Budhipadar 220/132/33kV GSS
- Weather : Sunny.
- 220KV Budhipadar-Tarkera ckt-2 was in shutdown condition. Earth switch of Tarkera ckt-2 was in closed position at Budhipadar end but open position at Tarkera end.
- At 11.57hrs fault occurs in 220KV Tarkera ckt-1(B-E fault) & ckt-2(Y-E fault) and the same time outage of 220KV Bus-1 & 2 system occurred due to breaker failure protection of Bus bar protection.
- 220KV B/C was in closed condition and TBC was free.
- Bus bar bay unit of 220KV Lapanga-1 is defective.

PRE-FAULT CONDITION

LOAD PATTERN OF DIFFERENT FEEDERS AT 11.00 HRS. DT.09.10.21

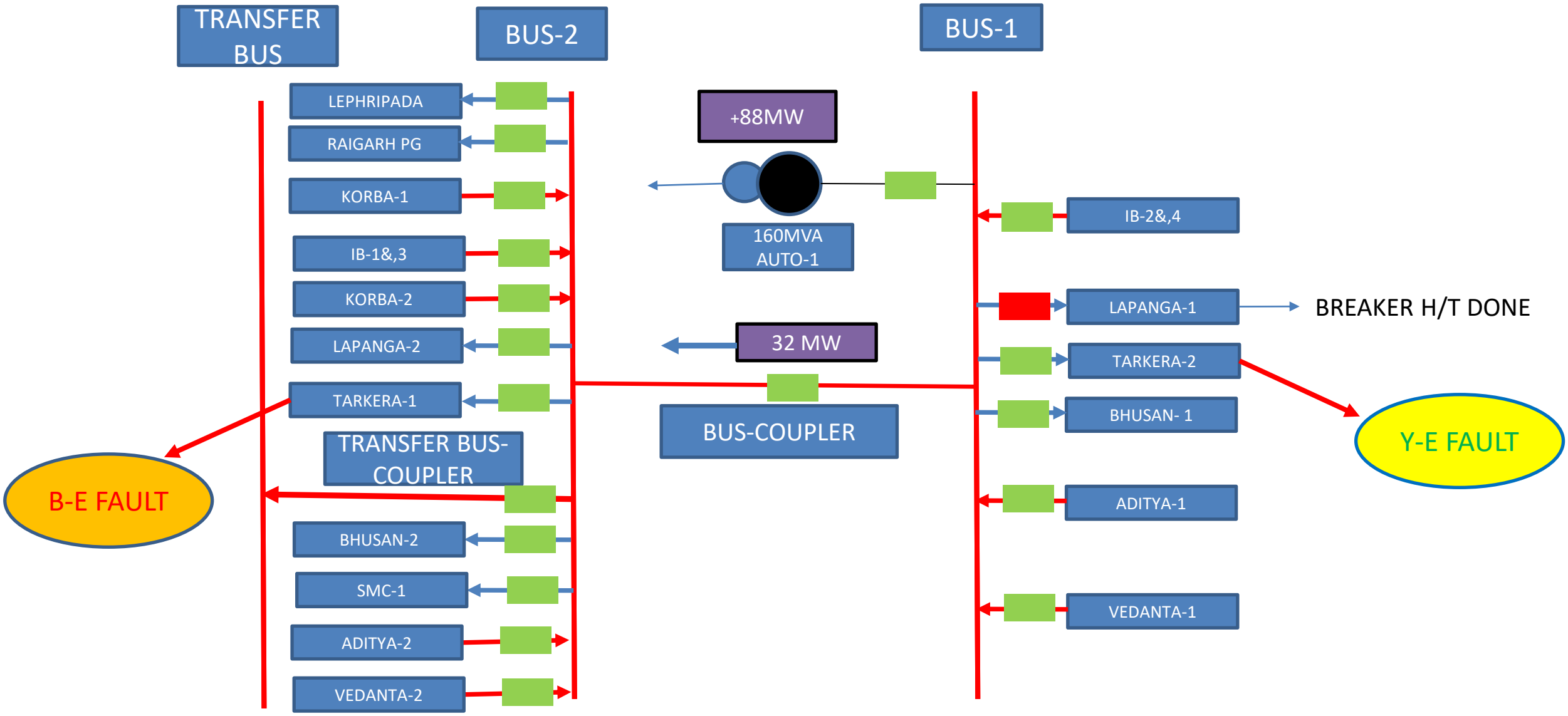


SLD FOR THE TARKERA CKT DURING THE EVENT



POST-FAULT CONDITION

ALL FEEDERS/TRF IN BUS-1 & BUS-2 TRIPPED, Bus-1(AT-1,IB-2 &4,Lapanga-1, Tarkera-2, Bhusan-1, Aditya-1,Vedanta-1) Bus-2(Lephripada,Raigarh PG,Korba-1, IB-1 & 3,Korba-2Lapanga-2, Tarkera-1, Bhusan-2, SMC-1, Aditya-2, Vedanta-2)



Date & Time of Occurrence:09.10.21, 11.57 Hrs

Sl.No.	Name of feeder	Relay Indication	
		B.Padar End	Remote End
1	220 kV Budhipadar-TarkeraCkt-1	SIEMENS-7SA522 Zone-1, L3-E, FD=25.8Km IL3=5.83KA	SIEMENS-7SA522 Zone-2, L3-E, FD=105.9Km IL3=1.5KA
2	220 kV Budhipadar-TarkeraCkt-2	SIEMENS-7SA522 Zone-1, L2-E, FD=23.2Km IL2= 6.04KA	NA
3	220KV IB-2	ABB, REL-670 Zone-1, L1-E, FD=15.786Km IL1= 3.7KA	Zone-1, L1-E
4	220KV Bus-1 & 2	BB-SIEMENS-7SS522 Trip BF BB1- L1, Trip BF BB1- L2, Trip BF BB1- L3 Trip Rep BU@11-L1 Trip Rep BU@11-L2 Trip Rep BU@11-L3	NA

Analysis:-

1. **The 220KV Budhipadar-Tarkera ckt-2 was charged earlier through 220KV Bus-1. The said feeder was taken shut down at 09.42hrs. At the time of Shutdown the Bus-1 PT selection relay suppose to be reset condition automatically . Due to defect in reset coil of PT selection relay , it was in pickup condition even though the feeder was Shutdown. The Bus PT supply is being used for protection purpose in this feeder due non-availability of line PT so PT was available in the relay.**
2. **At 11.57 hrs. the fault occurs in 220KV Budhipadar- Tarkera Ckt-1 (B-E fault) and 220KV Budhipadar-Tarkera Ckt-2(Y-E fault). The fault in 220KV Budhipadar-Tarkera Ckt-1 was cleared in zone-1 from Budhipadar end and Zone-2 from Tarkera end.**
3. **The earth switch of 220KV Budhipadar-Tarkera Ckt-2 was in closed condition at Budhipadar end but open condition at Tarkera end . When fault occurs in Ckt-2, the CT at Budhipadr end sensed the fault current as the earth switch was closed. The DP relay of the Budhipadar-Tarkera Ckt-2 actuated due to availability current and voltage. The relay issued a trip command in delayed time due to high resistance nature of fault and master trip relay(86) operated.**
4. **As the master trip relay (86) was in operated condition and current was persisted the LBB relay actuated and the breaker failure protection in Bus bar relay operated for 220KV Bus-1.**
5. **During the time, the status of 89A isolator was missing & 89B was close& open both in the Bus bar bay unit relay of Tarkera Ckt-2. Due to improper status of bay unit relay, the same tripping was also transferred to 220KV Bus-2 alongwith Bus-1 and resulted a tripping of all the feeders/ Transformer connected in Bus-1 & Bus-2(Except Lapanga-1).**

REMEDIAL MEASURES:

1. **Replacement of the defective PT selection relay of 220KV Budhipadar-Tarkera Ckt-2.**
2. **During S/D of any 220KV feeder bay having Bus PT for protection purpose, the PT fuses are to be removed for getting additional protection in such type incident.**

Investigation Report on Busbar-1 Trip at Balangir SS on 22.10.2021

Rohan Prakash(60003472) Dy. Mgr Balangir

Introduction/Event/scenario:

400KV Busbar-1 of Balangir tripped on 22.10.2021 at 13:06:58 Hrs with the indication of Breaker failure protection. Before proceeding please refer to the 400KV SLD of Balangir ss at ***Fig-1***.

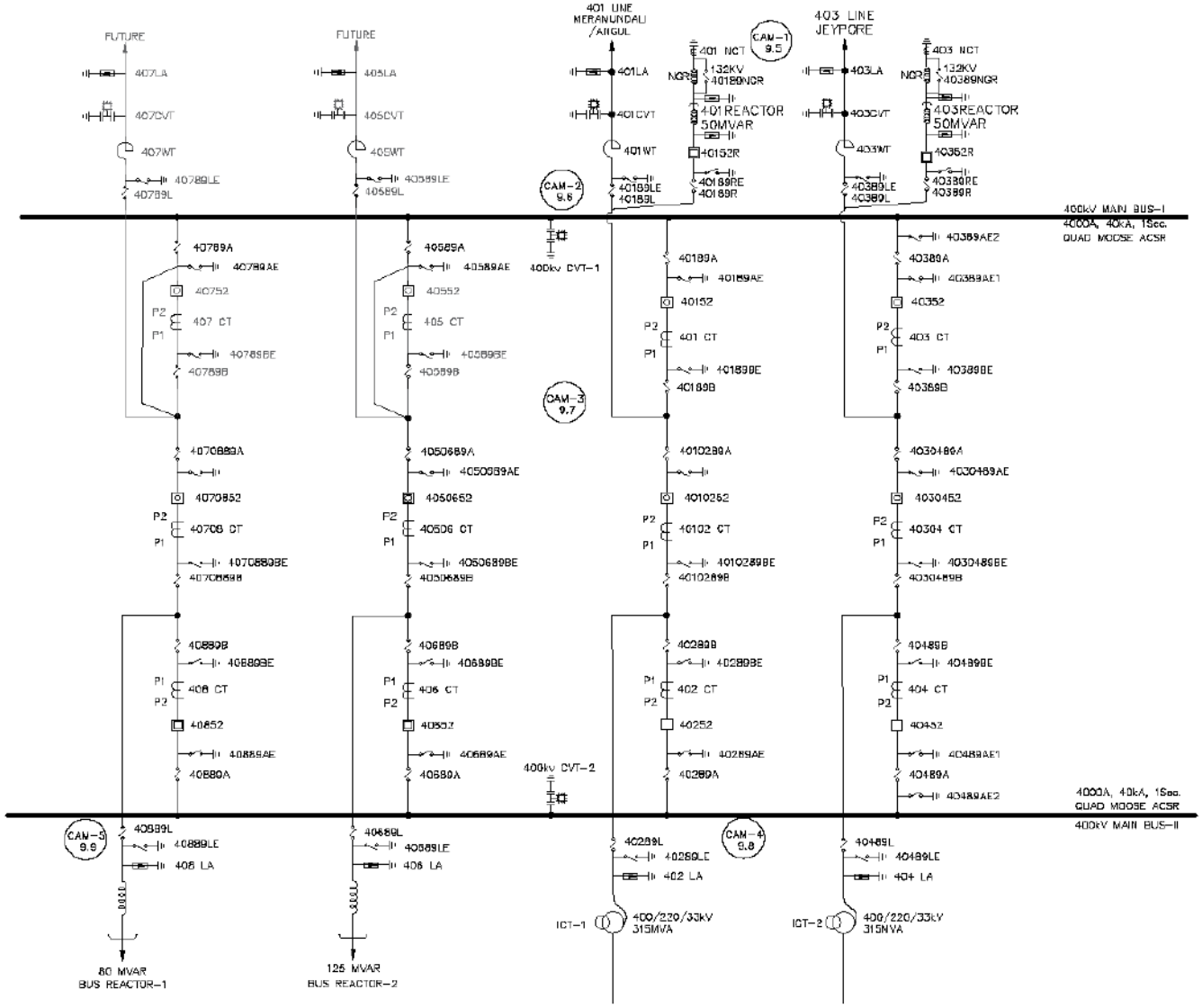


Fig-1

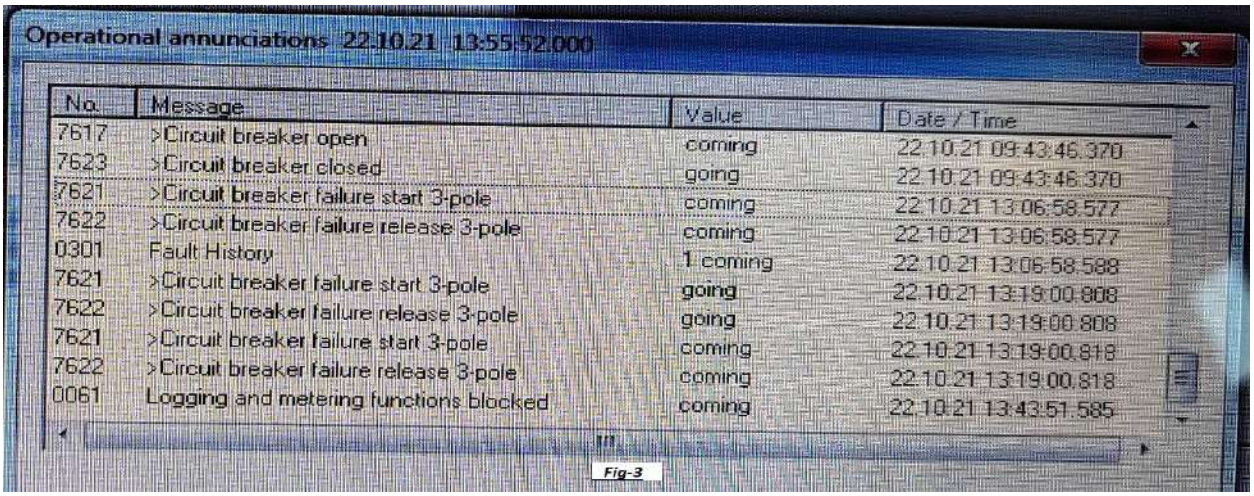
The 80MVAR Bus Reactor-1 was in shutdown for maintenance (408 and 40708 CB were OFF). As a part of maintenance, PRV trip was given from PRV of BR-1 for checking group trip relay 86 operation of Main and Tie CB. Tie Bay 86 relays operated and instantaneously Busbar-1 got tripped (refer to Event log at ***Fig-2***). The Breaker failure signals were persisting from Future bay 407 and future bay 405 in Both MCU (BB protection system is centralized MCU and Bay unit system of Siemens). So the **BB-1 Trip command was persisting**.

6	22/10/2021	13:04:05.458	BOLANGIR\400KV\408\BCU	CB B-PH POSITION	Open	spontaneous	1002269
7	22/10/2021	13:04:05.458	BOLANGIR\400KV\408\BCU	CB 52 POSITION	Open	feed back	1002269
8	22/10/2021	13:06:58.274	BOLANGIR\400KV\401\BCU	A/R in process	Simulatec	spontaneous	1004201
9	22/10/2021	13:06:58.274	BOLANGIR\400KV\401\BCU	A/R in process	Cleared	spontaneous	1004201
10	22/10/2021	13:06:58.274	BOLANGIR\400KV\401\BCU	A/R ON	Cleared	spontaneous	1004201
11	22/10/2021	13:06:58.274	BOLANGIR\400KV\401\BCU	A/R ON	Simulatec	spontaneous	1004201
12	22/10/2021	13:06:58.274	BOLANGIR\400KV\401\BCU	A/R Ready	Simulatec	spontaneous	1004323
13	22/10/2021	13:06:58.274	BOLANGIR\400KV\401\BCU	A/R Ready	Raised	spontaneous	1004323
14	22/10/2021	13:06:58.274	BOLANGIR\400KV\401\BCU	A/R Successful	Cleared	spontaneous	1004323
15	22/10/2021	13:06:58.274	BOLANGIR\400KV\401\BCU	A/R Successful	Simulatec	spontaneous	1004323
16	22/10/2021	13:06:58.336	BOLANGIR\400KV\403\BCU	A/R Ready	Raised	spontaneous	1004323
17	22/10/2021	13:06:58.336	BOLANGIR\400KV\403\BCU	A/R Ready	Simulatec	spontaneous	1004323
18	22/10/2021	13:06:58.336	BOLANGIR\400KV\403\BCU	A/R Successful	Cleared	spontaneous	1004323
19	22/10/2021	13:06:58.336	BOLANGIR\400KV\403\BCU	A/R Successful	Simulatec	spontaneous	1004323
20	22/10/2021	13:06:58.534	BOLANGIR\400KV\408\64.2R	PRV TRIP	Raised	spontaneous	1002295
21	22/10/2021	13:06:58.547	BOLANGIR\400KV\408\87.1R	WTI_PRV_BUCH_OTI TRIP	Raised	spontaneous	1002301
22	22/10/2021	13:06:58.568	BOLANGIR\400KV\40708T\BCU	86.2 Trip Relay Operated	Raised	spontaneous	1002258
23	22/10/2021	13:06:58.568	BOLANGIR\400KV\408\BCU	86.2 Trip Relay Operated	Raised	spontaneous	1002274
24	22/10/2021	13:06:58.569	BOLANGIR\400KV\408\BCU	86.1 OPTD	Raised	spontaneous	1002274
25	22/10/2021	13:06:58.570	BOLANGIR\400KV\40708T\BCU	86.1 OPTD	Raised	spontaneous	1002258
26	22/10/2021	13:06:58.578	BOLANGIR\400KV\400R\MCU-2	Trip BB1 G	Raised	spontaneous	1002076
27	22/10/2021	13:06:58.578	BOLANGIR\400KV\400R\MCU-2	BB1TRPGGIO1 Trip BF BB1 L1	Raised	spontaneous	1002076
28	22/10/2021	13:06:58.578	BOLANGIR\400KV\400R\MCU-2	BB1TRPGGIO1 Trip BF BB1 L2	Raised	spontaneous	1002077
29	22/10/2021	13:06:58.578	BOLANGIR\400KV\400R\MCU-2	BB1TRPGGIO1 Trip BF BB1 L3	Raised	spontaneous	1002077
30	22/10/2021	13:06:58.578	BOLANGIR\400KV\400R\MCU-2	GENERAL TRIP.phsA	Raised	spontaneous	1002080
31	22/10/2021	13:06:58.578	BOLANGIR\400KV\400R\MCU-2	GENERAL TRIP.phsB	Raised	spontaneous	1002081
32	22/10/2021	13:06:58.578	BOLANGIR\400KV\400R\MCU-2	GENERAL TRIP.phsC	Raised	spontaneous	1002081
33	22/10/2021	13:06:58.578	BOLANGIR\400KV\400R\MCU-2	IRest BF TRIP T1	Raised	spontaneous	1004237
34	22/10/2021	13:06:58.579	BOLANGIR\400KV\400R\MCU-1	Trip BB1 G	Raised	spontaneous	1002068
35	22/10/2021	13:06:58.579	BOLANGIR\400KV\400R\MCU-1	Trip BF BB1 L1	Raised	spontaneous	1002069
36	22/10/2021	13:06:58.579	BOLANGIR\400KV\400R\MCU-1	Trip BF BB1 L2	Raised	spontaneous	1002069
37	22/10/2021	13:06:58.579	BOLANGIR\400KV\400R\MCU-1	Trip BF BB1 L3	Raised	spontaneous	1002069
38	22/10/2021	13:06:58.579	BOLANGIR\400KV\400R\MCU-1	GENERAL TRIP.phsA	Raised	spontaneous	1002072
39	22/10/2021	13:06:58.579	BOLANGIR\400KV\400R\MCU-1	GENERAL TRIP.phsB	Raised	spontaneous	1002072
40	22/10/2021	13:06:58.579	BOLANGIR\400KV\400R\MCU-1	GENERAL TRIP.phsC	Raised	spontaneous	1002073

Fig-2

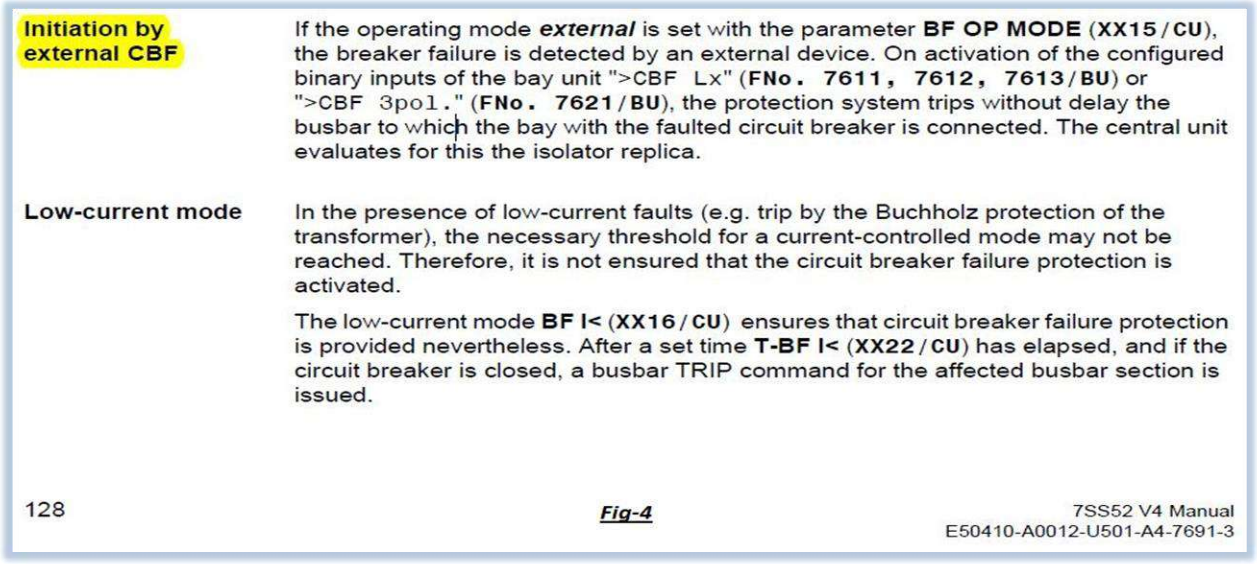
Investigation:

The BB-1 Trip command was persisting and hence the 86 relays of all Main bays were not able to reset. BF failure signal from 407 Bay-Unit was coming, so the event log of 407 87.1 Bay unit was checked and it was found that the Signal ***'7621 >Circuit breaker failure start 3-pole'*** was persisting (refer ***Fig-3***). It was inferred that as soon as 86 of 40708 Tie operated, it gave 3-pole LBB initiation to adjacent Future Bay unit 407.



But mere LBB initiation receipt at Bay Unit should not cause instantaneous tripping. Current query was also required to be done for tripping and currents in the bays 408, 40708 and 407 was zero since BR-2

was OFF for maintenance. Then the setting of Bay unit in MCU was checked and it was found that in setting no. ***xx15/CU Operation Mode BF*** the setting option was chosen as ***Trip from External CBF Protection***. As per the relay Manual (***Fig-4***) this setting means 'On activation of the configured binary inputs of the bay unit ">CBF Lx" (FNo. 7611, 7612, 7613/BU) or ">CBF 3pol." (FNo. 7621/BU),the protection system trips without delay the busbar to which the bay with the faulted circuit breaker is connected'.



Initiation by external CBF

If the operating mode ***external*** is set with the parameter **BF OP MODE** (**XX15/CU**), the breaker failure is detected by an external device. On activation of the configured binary inputs of the bay unit ">CBF Lx" (**FNo. 7611, 7612, 7613/BU**) or ">CBF 3pol." (**FNo. 7621/BU**), the protection system trips without delay the busbar to which the bay with the faulted circuit breaker is connected. The central unit evaluates for this the isolator replica.

Low-current mode

In the presence of low-current faults (e.g. trip by the Buchholz protection of the transformer), the necessary threshold for a current-controlled mode may not be reached. Therefore, it is not ensured that the circuit breaker failure protection is activated.

The low-current mode **BF I<** (**XX16/CU**) ensures that circuit breaker failure protection is provided nevertheless. After a set time **T-BF I<** (**XX22/CU**) has elapsed, and if the circuit breaker is closed, a busbar TRIP command for the affected busbar section is issued.

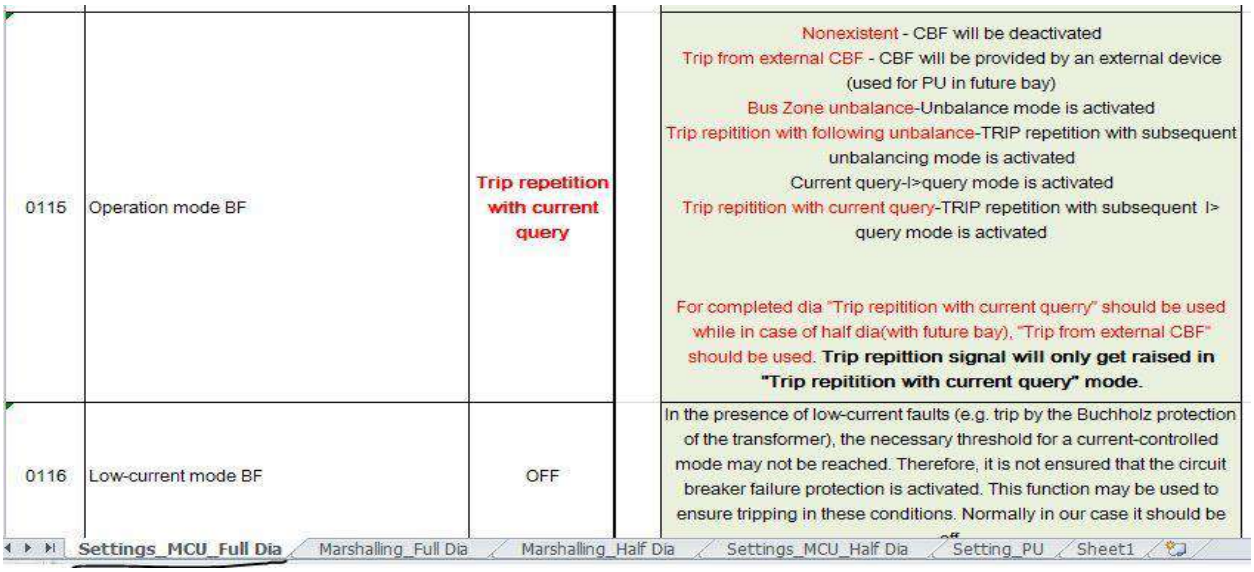
128 ***Fig-4*** 7SS52 V4 Manual E50410-A0012-U501-A4-7691-3

Analysis:

The setting value in setting no. ***xx15/CU Operation Mode BF*** as ***Trip from External CBF Protection*** is the recommended setting for Half Dia Bay MCU (see template at ***Fig-5***) in Busbar protection setting template available at Intranet. Hence due to this setting, as soon as MCU received the LBB initiation in 407 future bay unit the MCU did not checked current in the Bay 40708 (which was zero) and gave CBF Trip command to the Busbar-1.

0115	Operation mode BF	TRIP from external CBF protection	Nonexistent - CBF will be deactivated Trip from external CBF - CBF will be provided by an external device (used for PU in future bay) Bus Zone unbalance-Unbalance mode is activated Trip repitition with following unbalance-TRIP repetition with subsequent unbalancing mode is activated Current query-I>query mode is activated Trip repitition with current query-TRIP repetition with subsequent I> query mode is activated For completed dia "Trip repitition with current querry" should be used while in case of half dia(with future bay), "Trip from external CBF" should be used. **Trip repittion signal will only get raised in "Trip repitition with current query" mode.**
0116	Low-current mode BF	OFF	In the presence of low-current faults (e.g. trip by the Buchholz protection of the transformer), the necessary threshold for a current-controlled mode may not be reached. Therefore, it is not ensured that the circuit breaker failure protection is activated. This function may be used to ensure tripping in these conditions. Normally in our case it should be off.
0117	TRIP repeat mode	3pole	1pole-Single-pole TRIP repetition will be generated in the case of a single-pole start 3pole-Three-pole TRIP repetition will be generated in the case of a single-pole start

Settings_MCU_Full Dia | Marshalling_Full Dia | Marshalling_Half Dia | Settings_MCU_Half Dia | Setting_PU | Sheet1



0115	Operation mode BF	**Trip repetition with current query**	Nonexistent - CBF will be deactivated Trip from external CBF - CBF will be provided by an external device (used for PU in future bay) Bus Zone unbalance-Unbalance mode is activated Trip repitition with following unbalance-TRIP repetition with subsequent unbalancing mode is activated Current query-I>query mode is activated Trip repitition with current query-TRIP repetition with subsequent I> query mode is activated For completed dia "Trip repitition with current querry" should be used while in case of half dia(with future bay), "Trip from external CBF" should be used. **Trip repittion signal will only get raised in "Trip repitition with current query" mode.**
0116	Low-current mode BF	OFF	In the presence of low-current faults (e.g. trip by the Buchholz protection of the transformer), the necessary threshold for a current-controlled mode may not be reached. Therefore, it is not ensured that the circuit breaker failure protection is activated. This function may be used to ensure tripping in these conditions. Normally in our case it should be

Settings_MCU_Full Dia | Marshalling_Full Dia | Marshalling_Half Dia | Settings_MCU_Half Dia | Setting_PU | Sheet1

Fig-5

The tripping could be avoided if one of the following was done:

1> The tripping could be avoided if the setting in setting no. ***xx15/CU Operation Mode BF*** were ***Trip repetition with current query***.

2> If the Future Bay units are not wired/configured for receipt of LBB initiation from Tie bay. The Tie Bay has standalone LBB Relay 50Z which can take care of the LBB situation in Tie Bay. If actual LBB occurs in Tie Bay, scheme is there in place for tripping of BusBar-1 along with other side Main Bay CB. A wire is taken from LBB optd signal in Tie 50Z to Fure Bay unit input for direct tripping of Busbar-1.

So from the point 2 above it is evident that if we remove the LBB initiation input wiring from Future Bay unit, the issue can be resolved without affecting any other protect scenario.

Action taken:

The single pole as well as 3-pole LBB initiation wiring and BI input configuration for this are removed now from both Future Bay units in Both Bays 405 and 407. Subsequently, 86 relay of Tie 40708 was manually operated and if was found that the busbar-1 didn't trip. After this the Busbar was taken into service at 17:50Hr on 22.10.2021.

SUB: REPORT ON TRIPPING OF 400 KV Bus-1 AT 400/220/132KV Malda SS AT 06:22 HRS ON DATED 23.10.2021.

1.0 BACKGROUND

400/220/132KV Malda substation having **Double Main Single Breaker Scheme**. All 400, 220 & 132 KV feeders were in service at Malda substation during the incident. 400KV Malda-New Purnea line-1 was in service via TBC (Due to failure of Main CB in New Purnea bay).

Feeders connection details to 400KV Bus-I & II:

400KV Bus-I: 400KV Malda-New Purnea Ckt.-I, 400KV Malda-Farakka Ckt.-I, 315 MVA ICT- V.

400KV Bus-II: 400KV Malda-New Purnea Ckt.-II, 400KV Malda-Farakka Ckt.-II, 315 MVA ICT- II.

2.0 Brief History

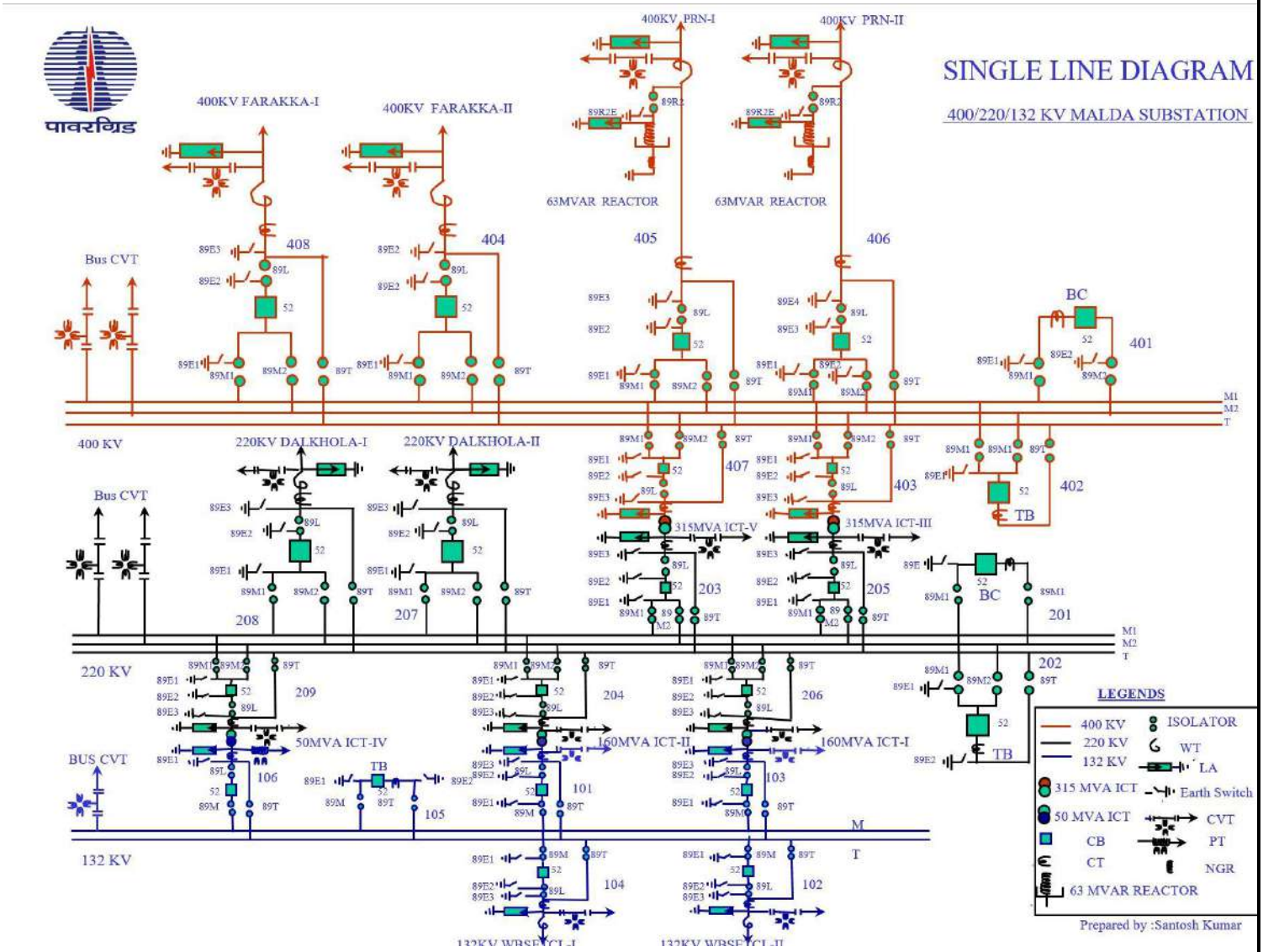
1) On 23rd Oct 2021 at 06:22 hrs.400KV Bus-1 tripped due to LBB relay operation of 400KV TBC.

3.0 Root Cause Analysis of Tripping of 400KV Bus-1

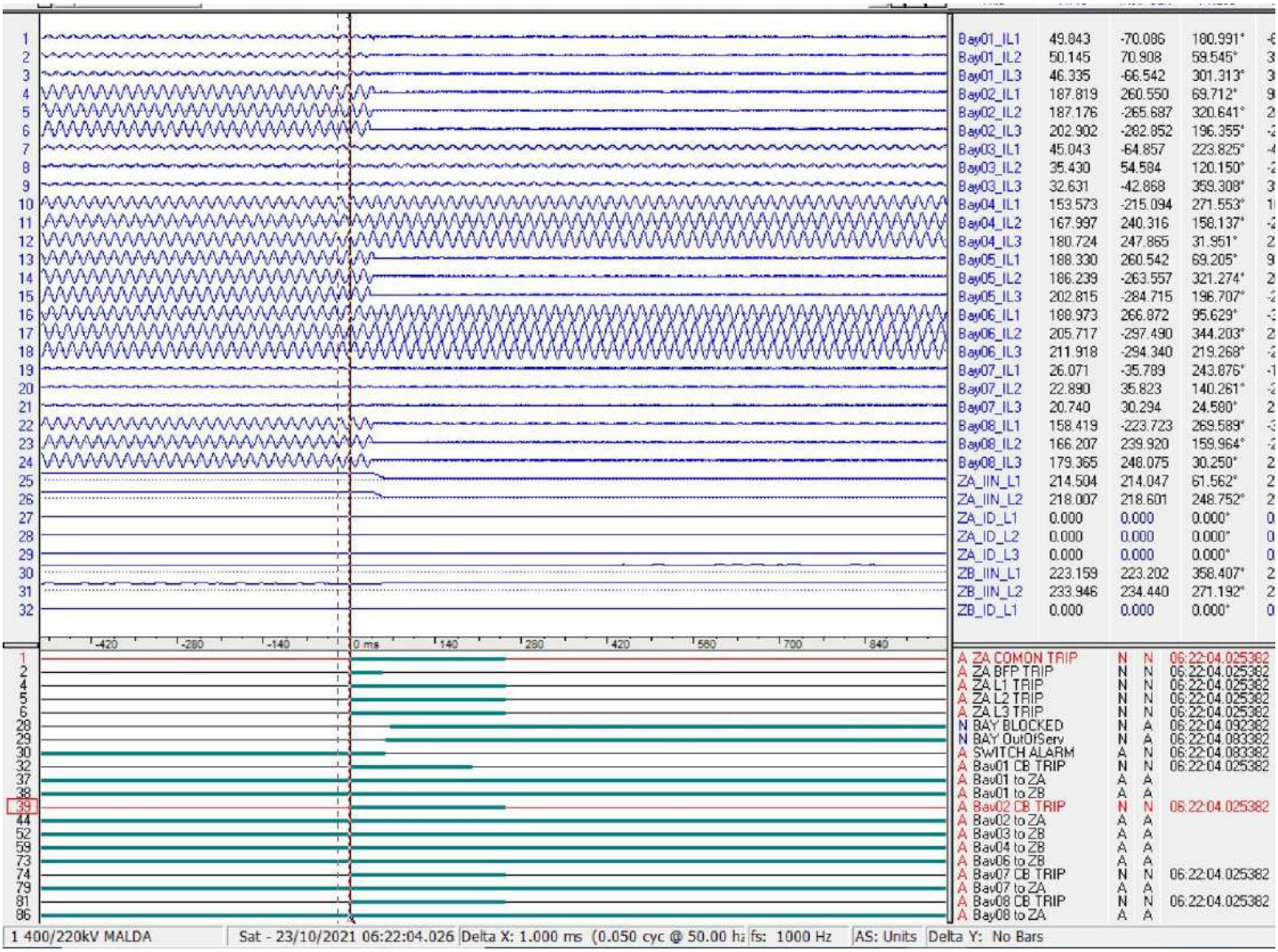
1) 186A relay (MVAJSM, make: EE) found faulty in 400KV Malda-New Purnea Ckt.-I which initiate the tripping command to TBC LBB relay.

186 A relay replaced.

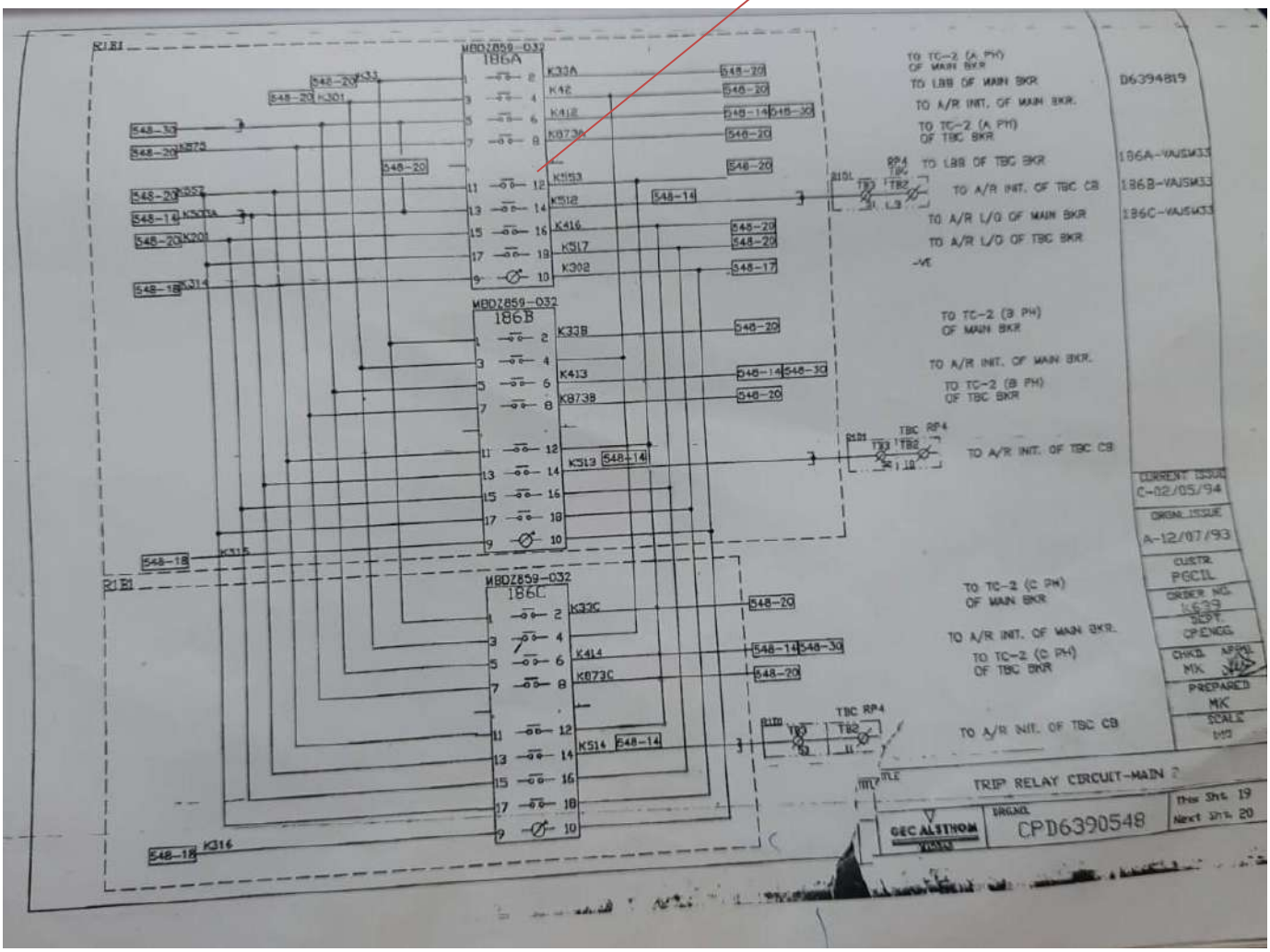
4.0 SLD of 220KV at Malda substation:



TRIP DR:


Bay01_IL1 49.843 -70.086 180.991°
Bay01_IL2 50.145 70.908 59.545°
Bay01_IL3 46.335 -66.542 301.313°
Bay02_IL1 187.819 260.550 69.712°
Bay02_IL2 187.176 -265.687 320.641°
Bay02_IL3 202.902 -262.852 196.355°
Bay03_IL1 45.043 -64.857 223.825°
Bay03_IL2 35.430 54.584 120.150°
Bay03_IL3 32.631 -42.868 359.308°
Bay04_IL1 153.573 -215.094 271.553°
Bay04_IL2 167.997 240.316 158.137°
Bay04_IL3 180.724 247.865 31.951°
Bay05_IL1 188.330 260.542 69.205°
Bay05_IL2 186.239 -263.557 321.274°
Bay05_IL3 202.815 -284.715 196.707°
Bay06_IL1 188.973 266.872 95.629°
Bay06_IL2 205.717 -297.490 344.203°
Bay06_IL3 211.918 -294.340 219.268°
Bay07_IL1 26.071 -35.789 243.676°
Bay07_IL2 22.890 35.823 140.261°
Bay07_IL3 20.740 30.294 24.580°
Bay08_IL1 158.419 -223.723 269.589°
Bay08_IL2 166.207 239.920 159.964°
Bay08_IL3 179.365 248.075 30.250°
ZA_IIN_L1 214.504 214.047 61.562°
ZA_IIN_L2 218.007 218.601 248.752°
ZA_ID_L1 0.000 0.000 0.000°
ZA_ID_L2 0.000 0.000 0.000°
ZA_ID_L3 0.000 0.000 0.000°
ZB_IIN_L1 223.159 223.202 358.407°
ZB_IIN_L2 233.946 234.440 271.192°
ZB_ID_L1 0.000 0.000 0.000°
-420 -280 -140 0 ms 140 280 420 560 700 840
A ZA COMON TRIP N N 06:22:04.025382
A ZA BFP TRIP N N 06:22:04.025382
A ZA L1 TRIP N N 06:22:04.025382
A ZA L2 TRIP N N 06:22:04.025382
A ZA L3 TRIP N N 06:22:04.025382
N BAY BLOCKED N A 06:22:04.092382
N BAY OutOfServ N A 06:22:04.083382
A SWITCH ALARM A N 06:22:04.083382
A Bay01 CB TRIP N N 06:22:04.025382
A Bay01 to ZA A A
A Bay01 to ZB A A
A Bay02 CB TRIP N N 06:22:04.025382
A Bay02 to ZA A A
A Bay03 to ZB A A
A Bay04 to ZB A A
A Bay06 to ZB A A
A Bay07 CB TRIP N N 06:22:04.025382
A Bay07 to ZA A A
A Bay08 CB TRIP N N 06:22:04.025382
A Bay08 to ZA A A
1 400/220kV MALDA
Sat - 23/10/2021 06:22:04.026
Delta X: 1.000 ms (0.050 cyc @ 50.00 hz
fs: 1000 Hz
AS: Units
Delta Y: No Bars

Scheme drawing:



Remedial action taken:

1. 186A relay replaced with healthy spare.
2. All feeders are normalized accordingly.

SUB: REPORT ON TRIPPING OF 220 KV Bus-2 AT 400/220/132KV RANGPO SS AT 16:29 HRS ON DATED 08.11.2021.

1.0 BACKGROUND

400/220/132KV Rangpo substation having **Double Main Single Breaker Scheme**. All 400, 220 & 132 KV feeders were in service at Rangpo substation during the incident except 220KV Rangpo-Rongnchu line-2 for which s/d was taken by M/s MBPCL for jumper tightening work & 100MVA 220/132KV ICT-4.

SLD of Rangpo SS attached as **Annex.-I**

Feeders connection details to 220KV Bus-I & II:

220KV Bus-I: 220KV Rangpo-Tashiding line, 315 MVA ICT- I & IV, 100 MVA ICT-II, 220KV Rangpo-Rongnchu line-1.

220KV Bus-II: 220KV Rangpo-New Melli line, 315MVA ICT-II,III,V, 100MVA ICT-I & III

2.0 Brief History

1) On 11th Sept 2021 220KV Bus-1 tripped due to burning of timer (KGD1-T4Y) dedicated for 4th stage low gas level of Y ph CB (GD-1) of 220KV Rangpo-Rongnchu line-1(Bay-212). This timer continuously extends DC supply to Y ph CB GD-1 contactor (KGD1-4Y). This contactor (which continuously remains in picked up condition during normal gas level) further extends signal for Gas zone tripping to PU if low gas level observed or DC disturbance to this contactor occurs. Due to burning of this contactor, DC supply for Y ph CB GD-1 contactor (KGD1-4Y) got disturbed & gas zone tripping signal was extended to PU. As this line i.e 220KV Rangpo-Rongnchu line-1(Bay-212) was connected to 220KV bus-1, all the elements connected to 220KV Bus-1 got tripped.

3.0 Root Cause Analysis of Tripping of 220KV Bus-2

1) On 08.11.2021 s/d of **220KV Rangpo-Rongnchu line-2(Bay-213)** was taken by M/s MBPCL for jumper tightening work**.** After receiving of ERLDC code for same line, all the isolators (89C & 89B) were closed at 16:26 hrs on 08.11.2021.

2) At 16:29 hrs 4th stage low gas level in GD-1 (of CB compartment) of 220KV Rangpo-Rongnchu line-2(Bay-213) observed on local SCADA & 220KV Bus-2 got tripped with all the lines/ICTs connected to it.

3**)** However at site, SF6 gas pressure of CB compartments (GD-1) of 220KV Rangpo-Rongnchu line-2(Bay-213) was found normal**.**

3) During checking in LCC panel it was found that +ve DC supply to 4th stage of GD-1 contactor (KGD1-4R) is fluctuating b/w zero volt & +113 V. Hence this contactor got released & picked up continuously whenever DC disturbance occurs.

4) NC contact (61-62 for Bus-1, 71-72 for Bus-2) of this contactor has been used gas zone tripping. Upon release of contactor (KGD1-4R) positive supply was extended to PU relay for

gas zone tripping logic via NC contacts 61-62 & 71-72. As this feeder was connected to 220KV Bus-2, as per gas zone logic 220KV Bus-2 got tripped.

5) After tracing it was found that this +ve DC supply for contactor (KGD1-4R) is coming from a timer (KGD1-T4R) dedicated for 4th stage low gas level of R ph CB (GD-1) via terminal no-18 of this timer. Loose connector was found at terminal-18 this timer which disturbs DC supply for the contactor (KGD1-4R).

6) Above findings concludes that 220KV busbar zone-2 tripping occurred due to loose connection at terminal-18 of timer (KGD1-T4R) dedicated for 4th stage low gas level of R ph CB (GD-1).

7) Also the corresponding timer (KGD1-T4R) is replaced with new one.

5.0 Corrective action taken:

1) Now this loosed wire at **terminal-18 of timer (KGD1-T4R) dedicated for 4th stage low gas level of R ph CB (GD-1) tightened & now it is working properly.**

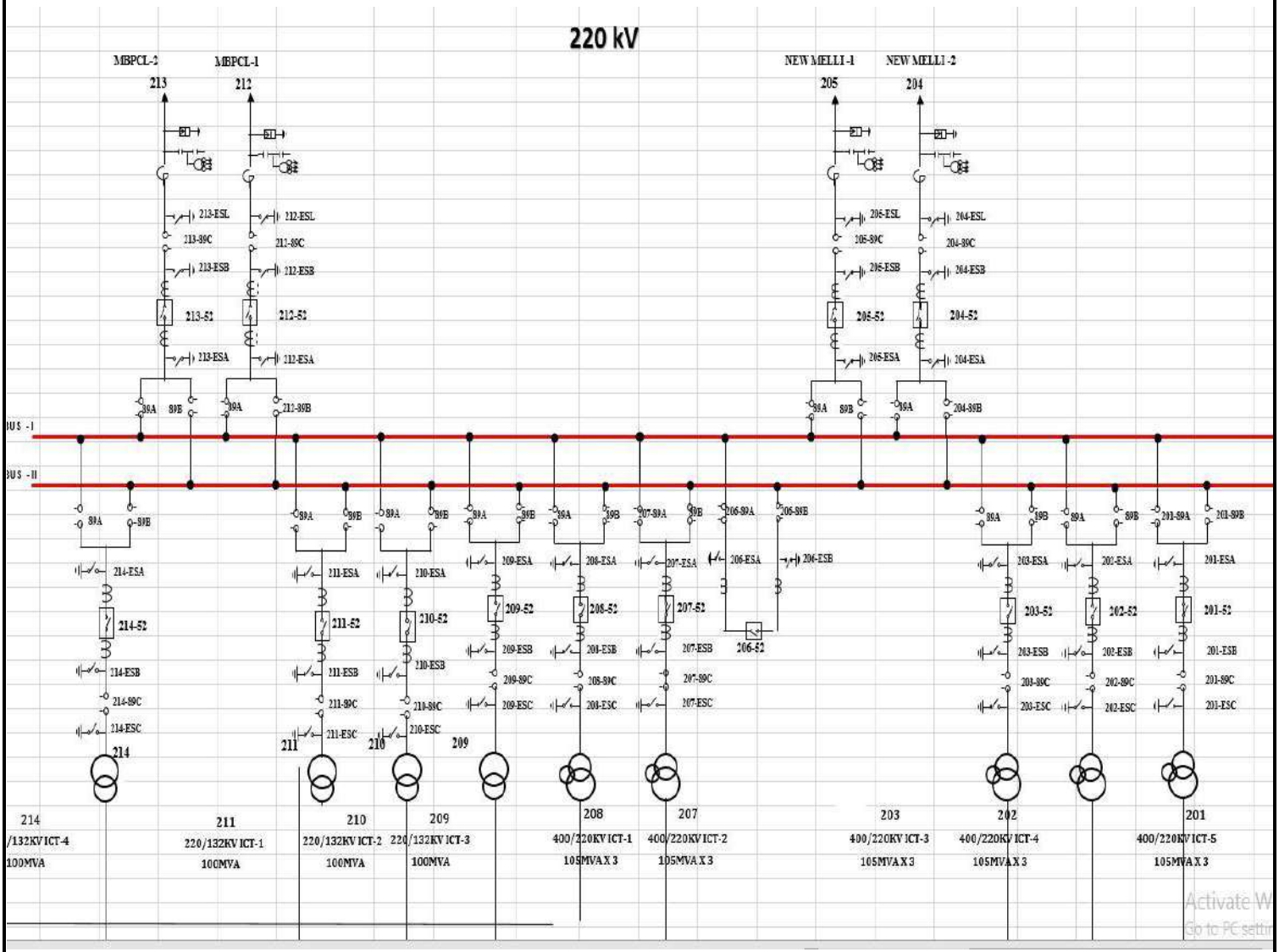
2) Previously it was already intimated to M/s MBPCL for series connection of alarm & trip signal (In 220KV Rangpo-Rongnchu line-2 Bay-213) of GDs which extends gas zone tripping signal for BB. However M/s MBPCL was saying the same would be done during low hydro period.

3) Later on 09.11.2021, series of 2nd stage & 4th stage low SF6 gas level (of GD-1 CB) and 2nd stage & 3rd stage low SF6 gas level (of GD-2,3,4,10,11) done and was extended to PU for Bub bar gas zone tripping. So that this type of mal operation can be avoided in future.

4) Also DC segregation for 1st stage & 2nd stage (through MCB-12) and 3rd stage & 4th stage (through MCB-10) of GD-1 of CB compartment done so that falling of a single MCB would not extend Bus bar gas zone tripping signal.

Annex.-I

4.0 SLD of 220KV at GIS Rangpo substation:



Event List

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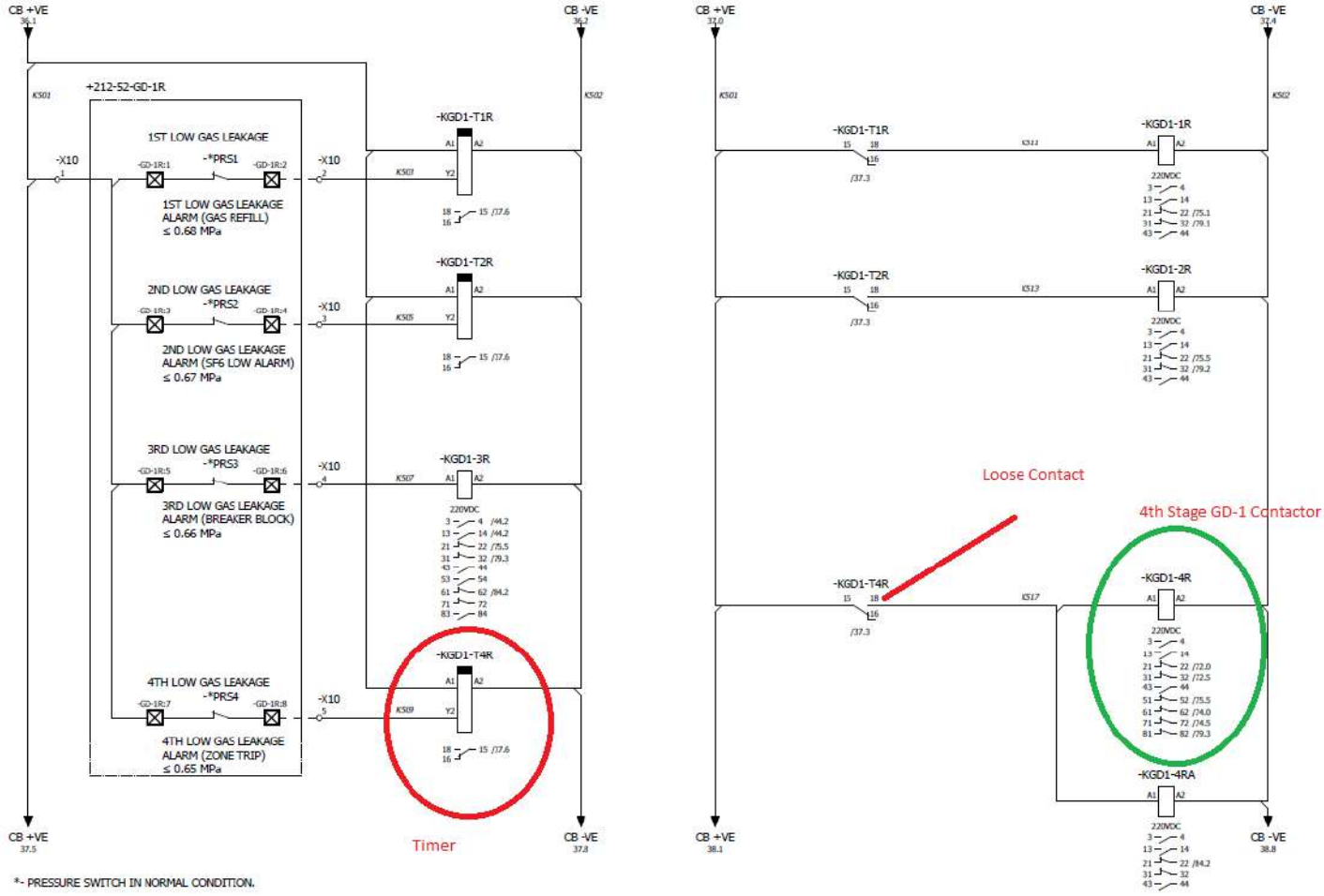
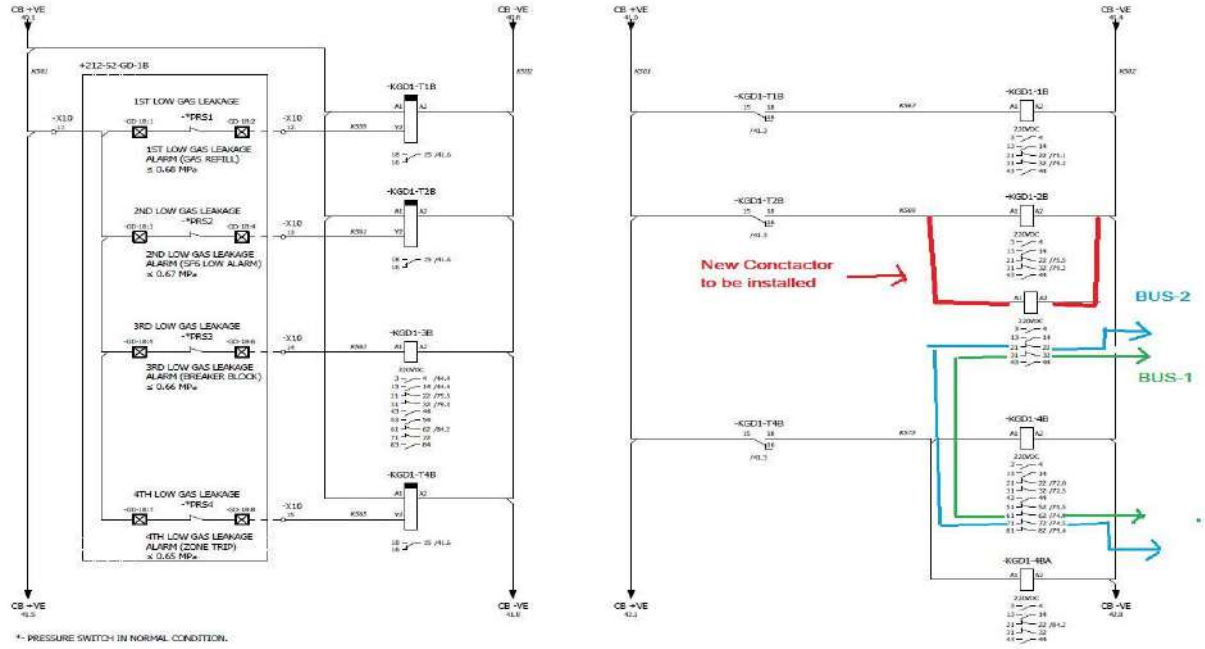
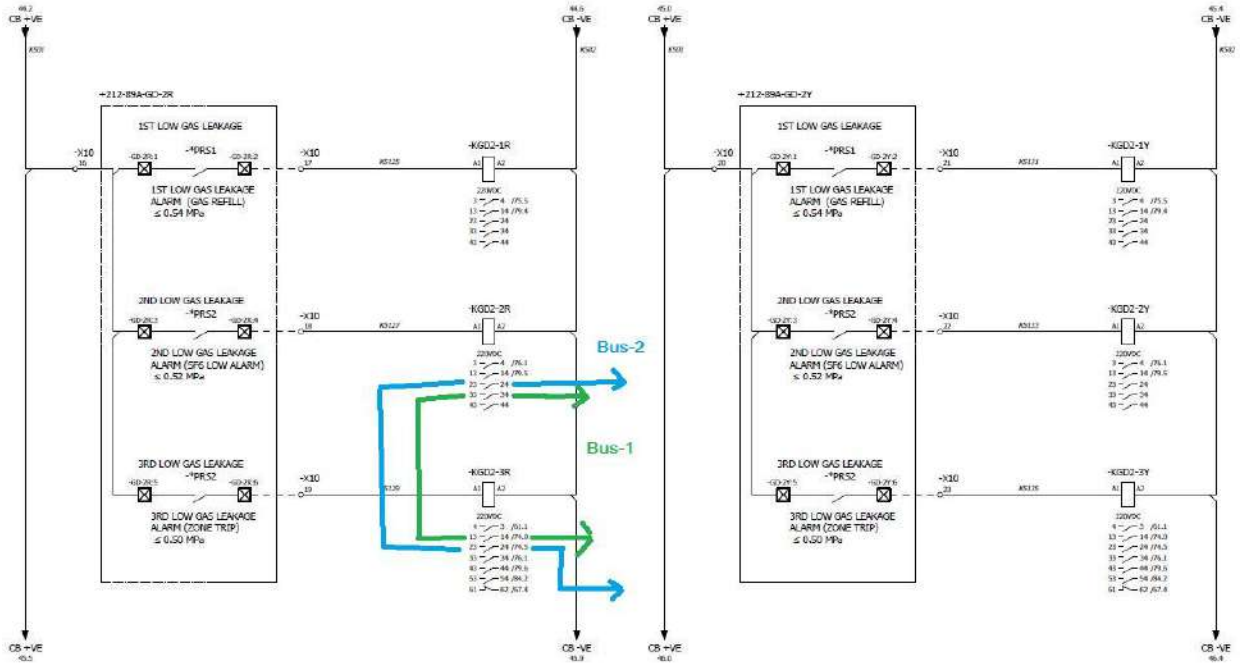
Date	Origin	Description	Message	Command Origin
2021-11-08 16:29:15.732	RANGPO / 220 KV / 211 220/132ICT-1 / CB 211-52	Y PHASE POSITION	OPEN	
2021-11-08 16:29:15.731	RANGPO / 220 KV / 201 400/220ICT-5 / CB 201-52	R PHASE POSITION	OPEN	
2021-11-08 16:29:15.731	RANGPO / 220 KV / 201 400/220ICT-5 / CB 201-52	B PHASE POSITION	OPEN	
2021-11-08 16:29:15.730	RANGPO / 400 KV / 411 ICT-3 / REF-RELAY_SYSTEM	86-B	TRIP	
2021-11-08 16:29:15.730	RANGPO / 400 KV / 413 ICT-5 / P643-RELAY_SYST	86-A	TRIP	
2021-11-08 16:29:15.730	RANGPO / 400 KV / 411 ICT-3 / P643-RELAY_SYST	86-A	TRIP	
2021-11-08 16:29:15.728	RANGPO / 400 KV / 410 ICT-2 / REF-RELAY_SYSTEM	86-B	TRIP	
2021-11-08 16:29:15.728	RANGPO / 220 KV / 211 220/132ICT-1 / P141LV-REL_PROT	GROUP RELAY 86B	TRIP	
2021-11-08 16:29:15.727	RANGPO / 220 KV / 209 220/132ICT-3 / P141LV-REL_PROT	GROUP RELAY 86B	TRIP	
2021-11-08 16:29:15.727	RANGPO / 400 KV / 410 ICT-2 / P643-RELAY_SYST	86-A	TRIP	
2021-11-08 16:29:15.726	RANGPO / 400 KV / TERITARY BAY / PROTECTION	GROUP RELAY 86	TRIP	
2021-11-08 16:29:15.724	RANGPO / 400 KV / 413 ICT-5 / REF-RELAY_SYSTEM	86-B	TRIP	
2021-11-08 16:29:15.718	RANGPO / 220 KV / 205 NEW MELLI-1 / 21-MAIN-1_SYST	GROUP RELAY-A	TRIP	
2021-11-08 16:29:15.718	RANGPO / 220 KV / 205 NEW MELLI-1 / 21-MAIN-1_SYST	GRP RELAY 86A GOOSE	TRIP	
2021-11-08 16:29:15.717	RANGPO / 220 KV / RONGNICHU-2 / P546-RELAY_SYST	LBB PROTN. OPTD	OPERATED	
2021-11-08 16:29:15.717	RANGPO / 220 KV / 211 220/132ICT-1 / P141HV-RELAY_SYS	GRP RELAY 86A	TRIP	
2021-11-08 16:29:15.716	RANGPO / 220 KV / 209 220/132ICT-3 / P141HV-RELAY_SYS	GRP RELAY 86A	TRIP	
2021-11-08 16:29:15.710	RANGPO / 220 KV / RONGNICHU-2 / GOOSE	LBB OPT	RUN	
2021-11-08 16:29:15.711	RANGPO / 220 KV / 205 NEW MELLI-1 / 21-MAIN-2_SYST	GRP RELAY 86B	TRIP	
2021-11-08 16:29:15.706	RANGPO / 220 KV / 205 NEW MELLI-1 / 21-MAIN-1_SYST	LBB PROTECTION	TRIP	
2021-11-08 16:29:15.701	RANGPO / 220 KV / 205 NEW MELLI-1 / PROTECTION PANEL	DIRECT TRIP CHANNEL-2	SEND	
2021-11-08 16:29:15.701	RANGPO / 220 KV / 205 NEW MELLI-1 / PROTECTION PANEL	DIRECT TRIP CHANNEL-1	SEND	
2021-11-08 16:29:15.701	RANGPO / 220 KV / 205 NEW MELLI-1 / AUTORECLOSE-PROT	BLOCK CONTACTS	ALARM	
2021-11-08 16:29:15.687	RANGPO / 220 KV / P741-87CU / SYSTEM	BUSBAR ZONE-2 TRIP	TRIP	
2021-11-08 16:29:15.654	RANGPO / 220 KV / RONGNICHU-2 / P546-RELAY_SYST	BUSBAR PROTN. OPTD	OPERATED	
2021-11-08 16:29:15.654	RANGPO / 220 KV / RONGNICHU-2 / PROTECTION PANEL	BB PROTN	SET	
2021-11-08 16:29:15.637	RANGPO / 220 KV / RONGNICHU-2 / PROTECTION PANEL	AR BLOCK	ALARM	
2021-11-08 16:29:15.637	RANGPO / 220 KV / RONGNICHU-2 / PROTECTION PANEL	DIRECT TRIP CH-2	SEND	
2021-11-08 16:29:15.636	RANGPO / 220 KV / RONGNICHU-2 / PROTECTION PANEL	DIRECT TRIP CH-1	SEND	
2021-11-08 16:29:15.624	RANGPO / 220 KV / RONGNICHU-2 / CB-52	4TH STAGE GAS PRESSURE LOW GD-1	ALARM	
2021-11-08 16:26:11.487	RANGPO / 220 KV / RONGNICHU-2 / PROTECTION PANEL	LR SWITCH STATUS	REMOTE	
2021-11-08 16:25:50.362	RANGPO / 220 KV / RONGNICHU-2 / ISO-89B-DS	ISO 89B-DS POSITION	CLOSE	PROCESS /
2021-11-08 16:25:35.828	RANGPO / 220 KV / RONGNICHU-2 / ISO 89C-DS	ISO 89C-DS POSITION	CLOSE	PROCESS /
2021-11-08 16:24:23.154	SBUS / BCL213 / Device link	Device link	CONNECTED	
2021-11-08 16:24:21.049	SBUS / BCL213 / Device link	Device link	CONNECTED	
2021-11-08 16:23:42.443 (*)	RANGPO / 220 KV / RONGNICHU-2 / PROTECTION PANEL	N/M SWITCH POSITION	SERVICE	
2021-11-08 16:22:23.407 (*)	RANGPO / 220 KV / RONGNICHU-2 / ES-89ESL	ES-89ESL POSITION	OPEN	



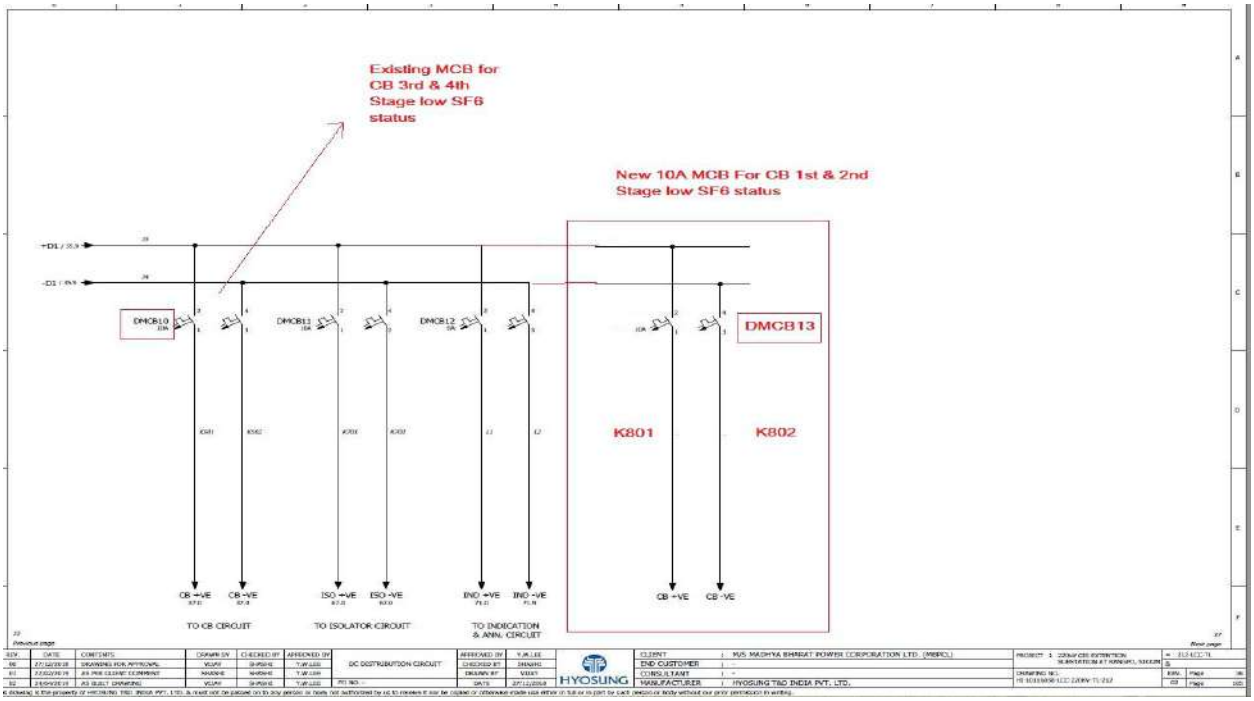
*- PRESSURE SWITCH IN NORMAL CONDITION.

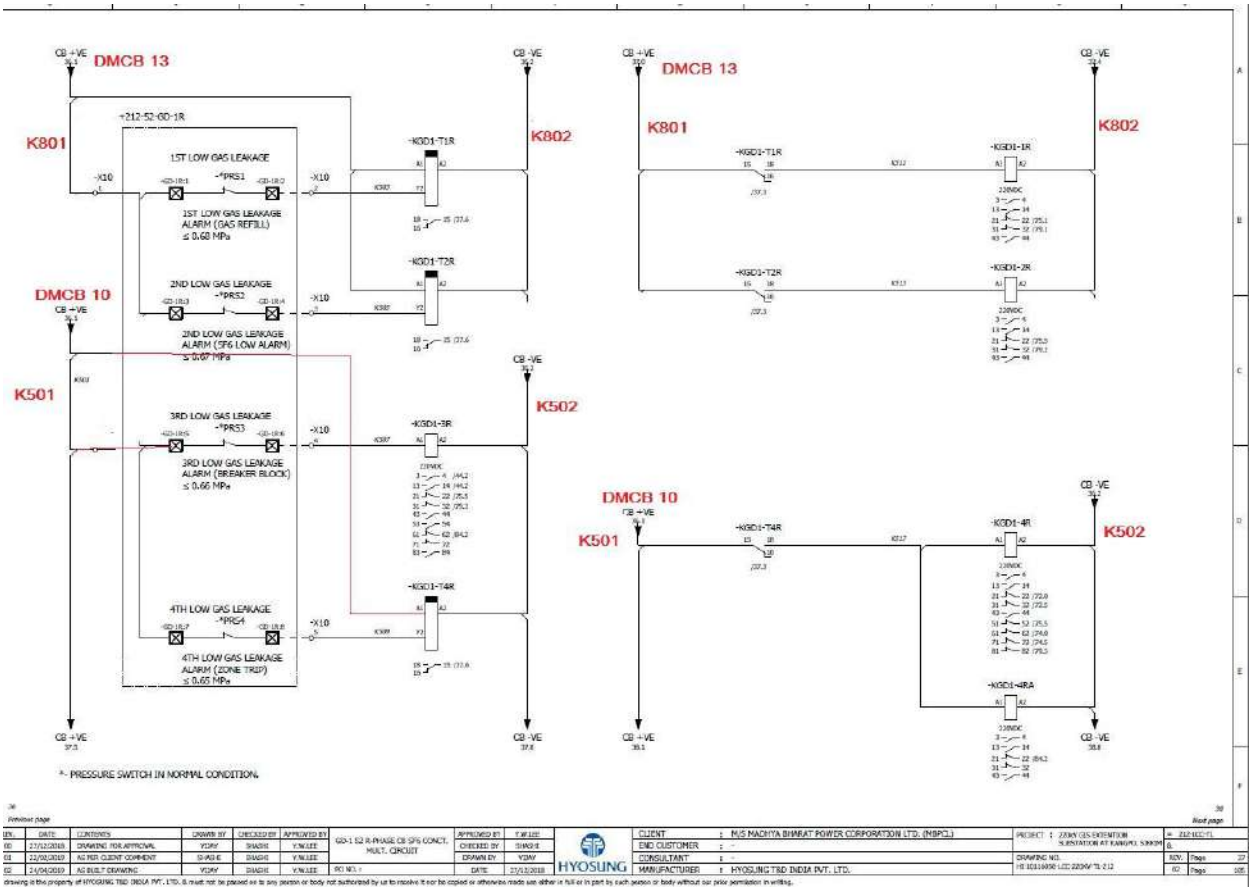
Series Connection of 2nd & 4th Stage alarm





DC Segregation for GD-1 of CB Compartment





Annexure B.10

Darbhanga-Motihari Transmission Co. Ltd.

TRIPPING REPORT FOR 500MVA ICT-1&2 AT DARBHANGA SUB-STATION

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Incident Report for 500MVA ICT-1 & 2 Tripping at Darbhanga Substation

1. **Date and time of the Event**:

   25/09/2021 at 13:18hrs for 500MVA ICT 1&2.

2. **Event details:**

On 25.09.2021, 13:18 hrs. at DMTCL Darbhanga Substation both 500MVA ICT- 1&2 (400/220/33 kV) tripped due to HV directional earth fault protection.

3. **Trip details of the Elements during Event:**

- 500MVA ICT-1 — Tripped at 13.18hrs on 25.09.2021.

  Fault current- 2.07KA

  Trip Time- 97msec

- 500MVA ICT-2 — Tripped at 13.18hrs on 25.09.2021.

  Fault current- 2.06KA

  Trip Time- 92msec

Incident Report for 500MVA ICT-1 & 2 Tripping at Darbhanga Substation

4. Action Taken :

After due coordination with Darbhanga (BSPTCL), ERLDC and SLDC Bihar and Darbhanga (BSPTCL), **failure (Blast & Fire) of R Phase LA** in 220kV Darbhanga-Musahari circuit 1 (owned by BSPTCL) was confirmed.

Pl Note: 220kv Darbhanga (Ramnager) is connected to 220kv DMTCL

5. Restoration details:

- 500MVA ICT-1 restored at 13.56hrs on 25.09.2021 (Total Outage Time- 00:38hrs)
- 500MVA ICT-2 restored at 13.59hrs on 25.09.2021 (Total Outage Time- 00:41hrs)

6. Causal Factor Analysis:

- Failure (Blast & Fire) of R Phase LA in 220kV Darbhanga-Musahari circuit 1 (owned by BSPTCL) created fault in 220kV BSPTCL substation.
- **None of the 220kV CB's at BSPTCL substation end tripped**
- 220kV CB at DMTCL end also did not trip since fault was sensed as Zone 2 (fault clearing time- 350ms)
- ICT 1 & 2 cleared the fault **as through fault -External fault** (fault clearing time- 100ms) and both the ICT's tripped.

7. ROOT CAUSE:

- Due to malfunction of 220kV CB tripping mechanism / protection relay coordination at BSPTCL substation end, 220kV CB's at BSPTCL substation end did not trip during failure (Blast & Fire) of R Phase LA in 220kV Darbhanga-Musahari circuit 1 (Owned by BSPTCL) and fault was fed in DMTCL 220kV and 400kV ICT elements resulting in tripping of ICT 1&2.

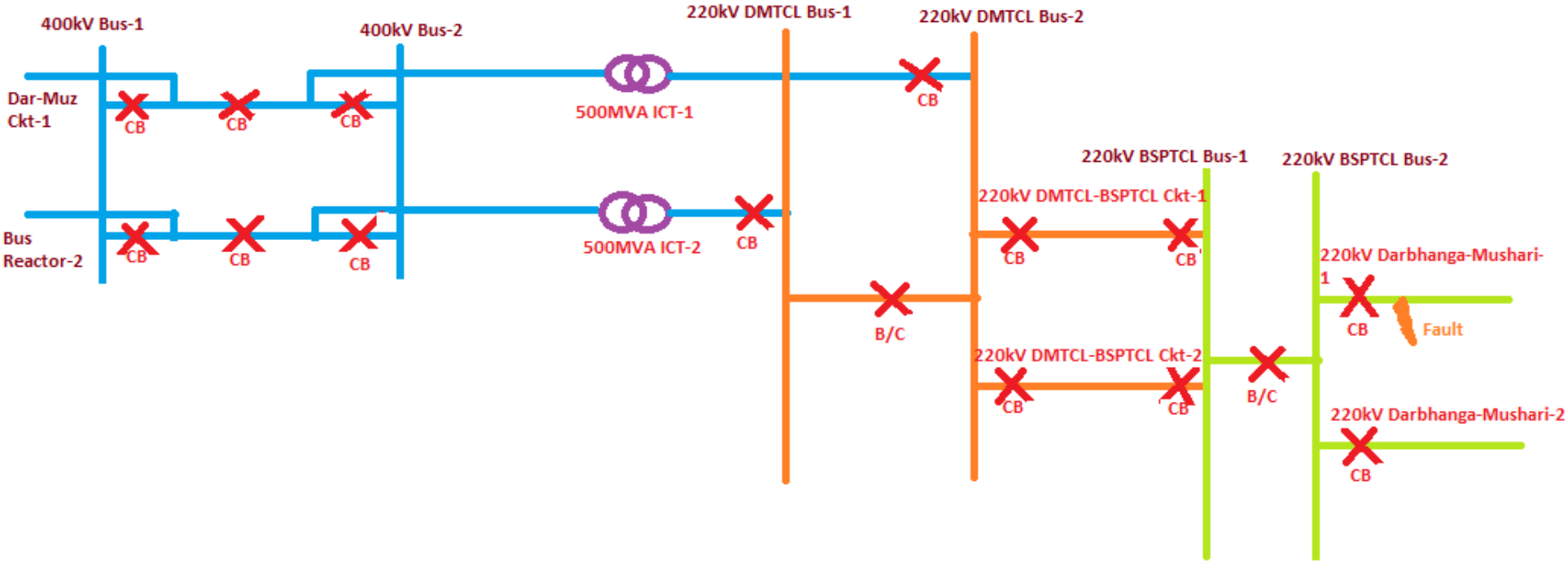
Incident Report for 500MVA ICT-1 & 2 Tripping at Darbhanga Substation

Way forward- Our proposal to ERLDC in upcoming PCC meeting:-

- Since the DMTCL ICT's have tripped due to malfunction of 220kV CB tripping mechanism / protection relay coordination at BSPTCL substation end, ERLDC is requested to not consider outage time of ICT 1 & 2 in DMTCL's account.
- ERLDC to instruct BSPTCL to check healthiness of all 220kV CB and protection relay coordination.
- For 220 kV Darbhanga (DMTCL) Darbhanga (BSPTCL) circuit 1 & 2 , allow DMTCL to change Zone 2 protection settings as instantaneous. This will allow 220kV CB at DMTCL end to clear fault before tripping of ICT 1 & 2, in case fault is not cleared at BSPTCL end.
- Requesting BSPTCL/ERLDC to share relay settings at BSPTCL end for better coordination and fault analysis.

Incident Report for 500MVA ICT-1 & 2 Tripping at Darbhanga Substation

Reference SLD:



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Darbhanga-Motihari Transmission Co. Ltd. (DMTCL) is a subsidiary of Sekura Energy Ltd.

The Management System of DMTCL has been certified to: ISO 14001:2015, ISO 450001:2018

Detailed report regarding tripping of 220 kv Darbhanga-Musahari ckt-1 on date- 25/09/2021 at 13:19 hrs. (Item No. B10 of Part B in Agenda for 108th PCC meeting to be held on 16/11/2021)

- On date- 25/09/2021 at 13:19 hrs, R-Phase L.A. of 220 kv Darbhanga (BSPTCL) - Musahari ckt-1 got bursted at Darbhanga end. Fault was cleared from both ends. Relay details are as follows:

  @ 220 kv Darbhanga (BSPTCL) end:
  Distance Relay operated, R-N, Zone-1, Fault Location- 3 km, Fault current- 1.875 KA

  @ 220 kv Musahari end:
  Distance Relay operated, Zone-2, Instantaneous DEF

  - ckt-2 was on no load, charged from Darbhanga (BSPTCL) end.
    Hence Observation of DMTCL (Darbhanga) regarding this tripping that "none of the 220 kv CB's at BSPTCL substation tripped" is totally incorrect.
- For 220 kv DMTCL-Darbhanga (BSPTCL) ckt-1 & 2, Zone-4 settings are as follows. These settings have been done as per telephonic conversations and discussion in 95th PCC meeting with ERPC.

	Zone-4 Time Delay
Ckt-1	500 ms
Ckt-2	500 ms

- In 95th PCC meeting on date- 15/10/2020 (minutes attached) detailed discussion was made regarding relay settings at 220 kv DMTCL & Darbhanga (BSPTCL) GSS. Following instructions were given by ERPC.

  - TMS for both ICTs (400/220 kv) at DMTCL (Darbhanga) were configured for 100 ms. As discussed, this setting was found to be very conservative and DMTCL was requested to increase TMS for both ICTs. But as per DMTCL till it has not been increased. So due to this poor relay co-ordination both ICTs at DMTCL got tripped. This may kindly be taken into consideration.
  - As per instruction of ERPC, TMS for backup protection (DEF) for both 220 kv Darbhanga (BSPTCL)-DMTCL ckt-1 & 2 was increased to 500 ms.

Action taken:

Breaker timer test for all bays at 220 kv Darbhanga (BSPTCL) was done last year in the month of September and shared with ERPC also. This test is to be performed again in our winter maintenance programme but if required earlier, we will do it before and will share test report with ERPC also.

TENUGHAT ISLANDING STUDY

1. Introduction:

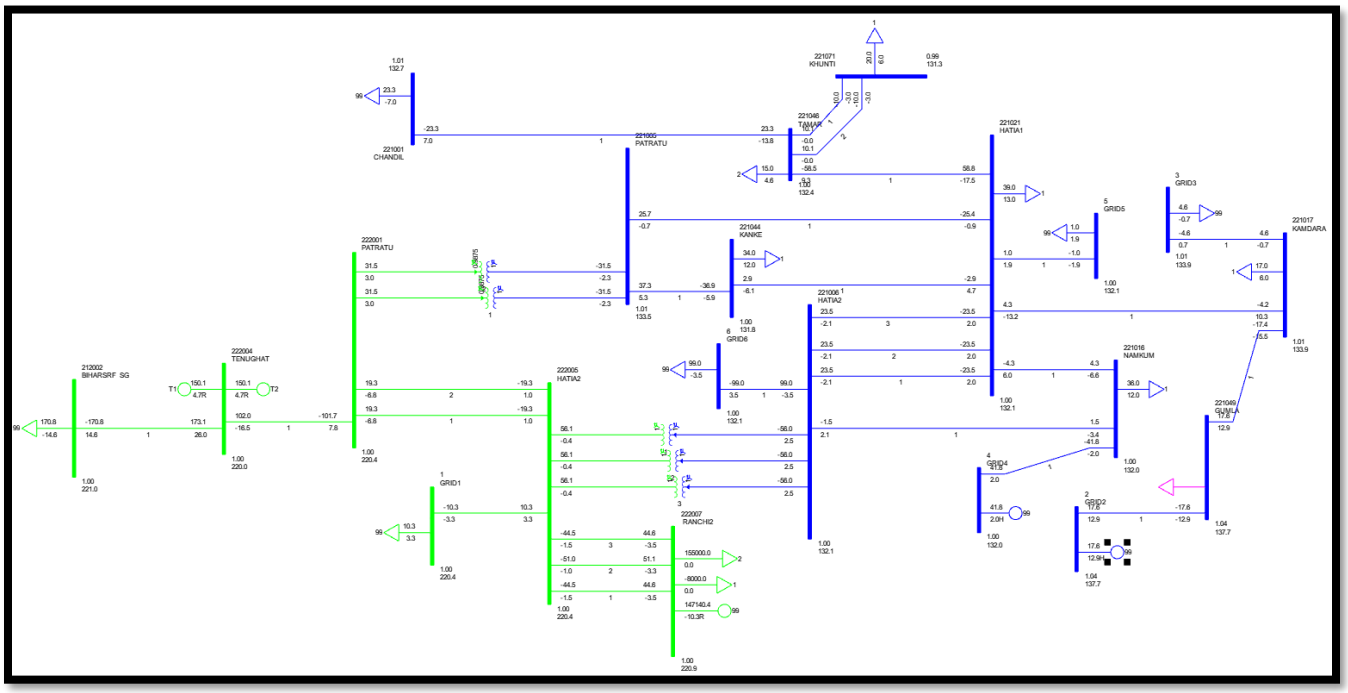
One of the key features of a resilient power system is robust islanding scheme. Success of an islanding scheme depends on the design as well as implementation of the logic. Logic needs to be robust as well as simple. Extensive study is required to design an effective islanding scheme. For TENUGHAT islanding scheme design various preliminary studies are done and the results are discussed below. However these studies are done based on certain assumption (which will be discussed below) and its purpose is to check the broader feasibility of an islanding scheme. Hence the final islanding logic must be finalized by the respective generating plants in consultation with their OEM.

2. Modeling:

A. Network:

Network modeling data is taken from latest PSSE base case as shared by Jharkhand SLDC. Only the part of Jharkhand network which corresponds to the Island to be formed, is taken into consideration. Rest of the grid is modeled as an equivalent generator or load.

In one of the equivalent generator bus(Ranchi Bus 222007) two loads are added: 1) Load 1 is a negative load and used for creating the frequency disturbance during the dynamic simulation. 2) Load 2 is All India load



B. Generator:

TENUGHAT generators are modeled as “GENROU” (cylindrical rotor synchronous machine) based on the OCC magnetization curve. The parameters of “GENROU” are populated based on the similar machine data:

Model GENROU for machine at bus 222004 'T1'

Model CONS | Model ICONS | Model VARS

	Con Value	Con Description
1	8.5000	T'do (> 0)
2	0.0400	T"do (> 0)
3	2.5000	T'qo (> 0)
4	0.1500	T"qo (> 0)
5	3.7340	H, Inertia
6	0.0000	D, Speed Damping
7	1.8280	Xd
8	1.7360	Xq
9	0.2290	X'd
10	0.4810	X'q
11	0.1790	X"d = X"q
12	0.1570	Xl
13	0.1201	S(1.0)
14	0.5981	S(1.2)

Figure 1: TENUGHAT generator parameters.

The equivalent generator representing the All-India grid is modeled by a simple classical cylindrical rotor “GENCLS” model and its Inertia value is used as per the inertia calculated during real frequency excursion event in the grid.

A. Exciter and PSS:

The BHEL brushless excitation system of TENUGHAT is represented by ST1C model of PSSE library :

Model ST1C for machine at bus 222004 'T1'

Model CONS | Model ICONS | Model VARS

	Con Value	Con Description
1	0.0200	TR (sec)
2	99.0000	VI MAX
3	-99.0000	VI MIN
4	1.0000	TC (sec)
5	3.6364	TB (sec)
6	0.0200	TC1 (sec)
7	0.0138	TB1 (sec)
8	200.0000	KA
9	0.2000	TA (sec)
10	6.0000	VA MAX
11	-6.0000	VA MIN
12	6.0000	VR MAX
13	-6.0000	VR MIN
14	0.0696	KC
15	0.0000	KF
16	1.0000	TF > 0 (sec)
17	0.0000	KLR
18	1.0000	ILR

Figure 2: TENUGHAT exciter model AC6C

C. Governor model:

BHEL governor model and parameters not received from Tenughat. Therefore, model from similar capacity machine and make is used and following parameters are considered in simulation:

Model IEEEG1SDU for machine at bus 222004 'T1'

Model CONS | Model ICONS | Model VARS

	Con Value	Con Description
1	17.0000	K
2	0.1000	T1
3	0.0300	T2
4	0.1500	T3 (> 0)
5	0.1300	Uo
6	-1.0000	Uc (< 0.)
7	0.4700	PMAX
8	0.4000	PMIN
9	0.1700	T4
10	0.2660	K1
11	0.0000	K2
12	8.2500	T5
13	0.3295	K3
14	0.0000	K4
15	0.4200	T6
16	0.4045	K5
17	0.0000	K6
18	0.0000	T7
19	0.0000	K7
20	0.0000	K8
21	0.0000	DBH (pu freq. deviation), deadband for overspeed, (>=0)
22	0.0000	DBL (pu freq. deviation), deadband for underspeed, (<=0)
23	0.0000	Trate (MW), Turbine rating, if zero, then MBASE used

Figure 3: TENUGHAT Turbine and governor Model

However, the above model doesn't take for the RGMO and maximum output limit. 5% of MCR value is used for maximum governor output.

During few simulation the lower limit of the governor is not restricted to 5% of MCR , the reason is as follows:

We know that there is a speed controller in generator, which starts unloading the unit even beyond the 5% limit of RGMO when speed crosses some value and speed controller takes over the load controller. Also HP-LP bypass system is there for quick load reduction.

C. Load modeling:

Loads are modeled as below:

Real Power: 100% Constant Current

Reactive Power: 100% Constant Admittance

Frequency dependency of the load is not modeled.

3. Design logic:

Following points are considered in designing the islanding logic:

i. Frequency setting for last stage of the existing All-India UFLS scheme is 48.8 HZ; therefore island formation should happen below this frequency with sufficient margin.

ii. Inside the Island it is assumed that there is no UFLS relays as per grid side requirement.

iii. However, during few scenarios after the formation of the island, island may be generation deficit. To tackle such some UFLS scheme is designed for island. But this UFLS scheme starts much below the grid side UFLS scheme.

iii. Present frequency protection setting for TENUGHAT units is as follows:

UNIT1:
Under Frequency: 47.3 Hz,1.5sec
Over frequency: 52 .7Hz, 1 sec

UNIT2:
Under Frequency: 47.5 Hz, 1.5 sec
Over frequency: 53.13 Hz, 1 sec

However, over speed setting as per C&I are: STAGE1-3180 rpm and STAGE2-3250 rpm.

Based on the above inputs following islanding logic is proposed:

i. Islanding should commence before pick up of any of the under-frequency protection stage of TENUGHAT units and that's why island formation will start at 48.4 Hz with a delay of 1 sec. (however it would be better to keep it 500 ms, TENUGHAT may suggest)

ii. Under frequency inside the island is proposed to trigger at 48.2 Hz. The details is as follows

48.2 HZ 500msec 30 % of island load

48 Hz 500 msec 10% of Island load

47.8 Hz 500 msec 10 % of Island load

iii. The island is generation excess for all the scenario and therefore one unit tripping is proposed based on the generation excess. If generation inside the island is 50 MW more than the generation then one unit should be tripped immediately at the time of island formation.

4. Simulation:

Different LGB scenario is studied in the simulation for checking the robustness of the proposed scheme. Details of different scenario are summarized as follows:

Scenario	Generation	Load	Surplus(+)/Deficit(-)
Scenario-1	300 MW	161+25 MW	114 MW
Scenario-2	300MW	84+25 MW	190 MW
Scenario-3	220 MW	161+25 MW	34 MW
Scenario-4	220 MW	84+25 MW	111MW

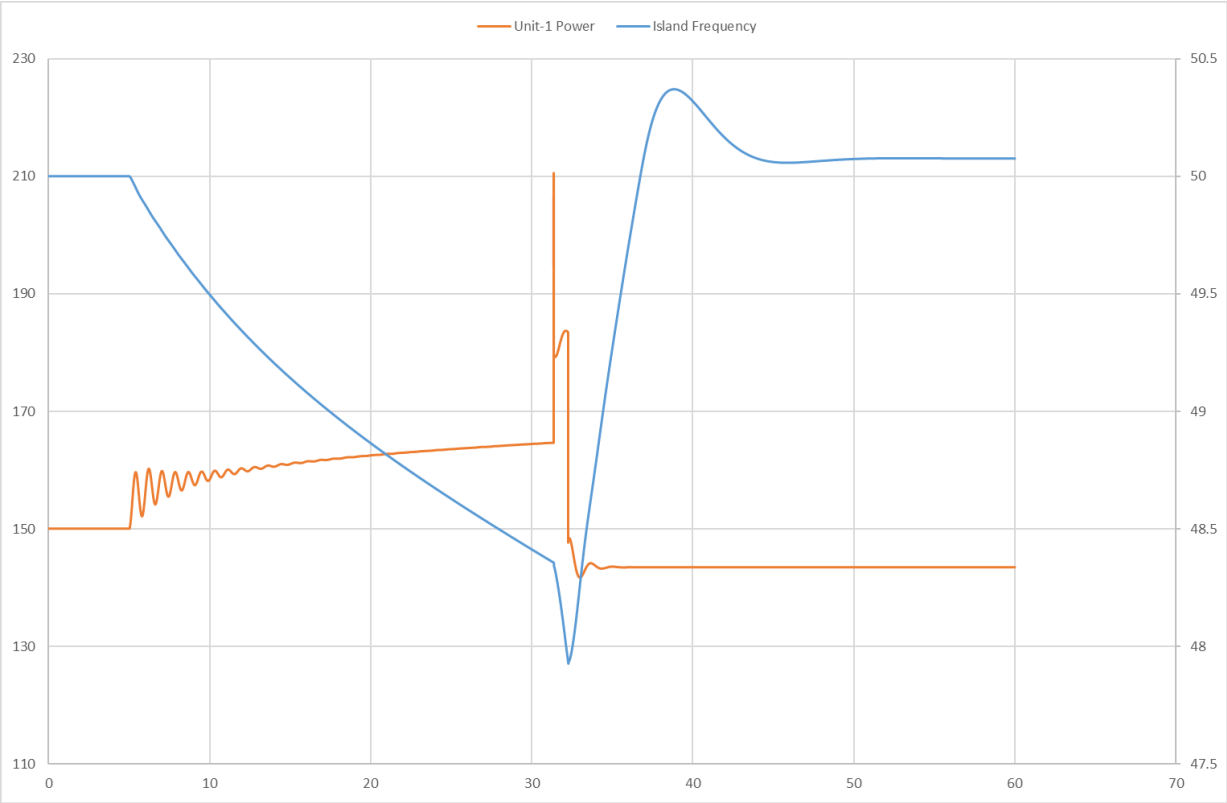
The above LGB is prepared based on input from SLDC.

With above islanding logic following steps are followed:

Step-1. First a grid disturbance is created by tripping 8000 MW generation (i.e. the negative load). This triggers the island formation logic in which the equivalent generator or load buses are tripped, 1 sec after the frequency drops to 48.6 Hz. And island is formed

Step-2. After formation of island the simulation is further carried out for 60 sec to check stabilization of the island frequency with all generator protection and island UFLS in action.

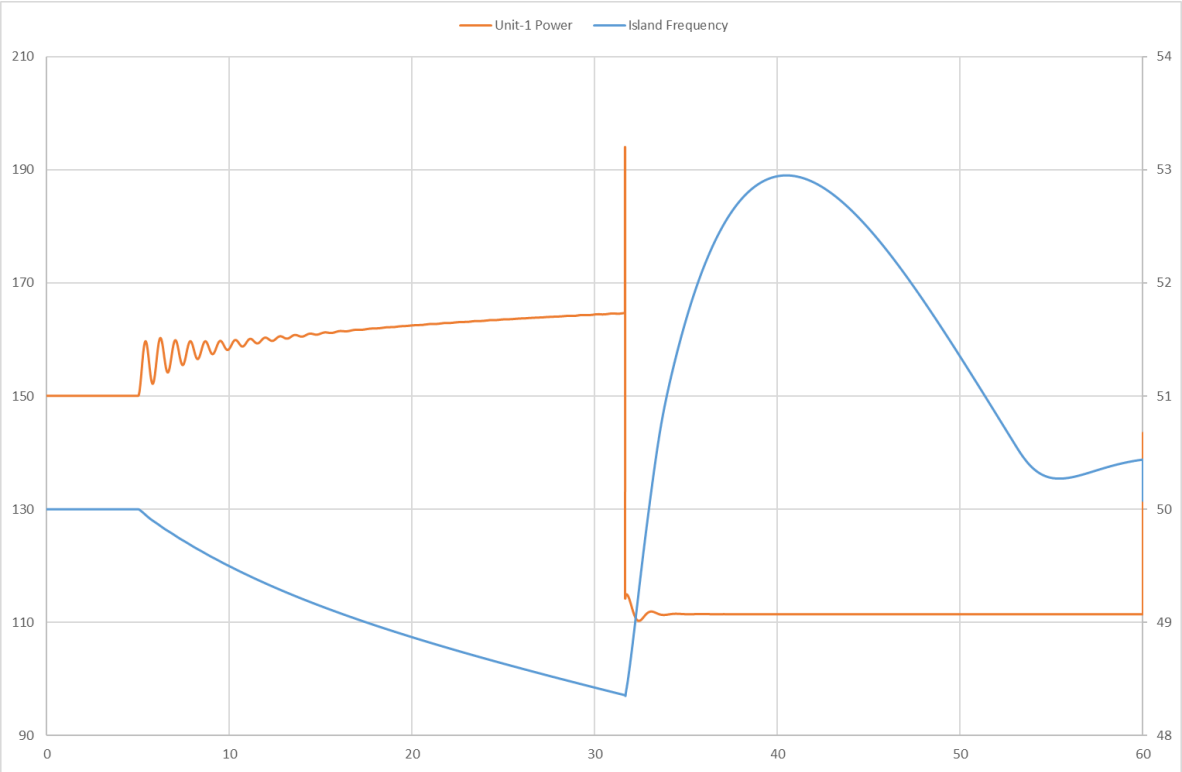
Scenario-1: Maximum generation & Maximum load



Discussion:

1. In max generation max load scenario there is 114 MW surplus generation inside the Island if both unit is considered. However if one unit is considered then the island is 35 Mw deficit.
2. Here one unit inside the island is tripped immediately after island is formed.
3. With this setting island frequency stabilizes around 50.07 Hz

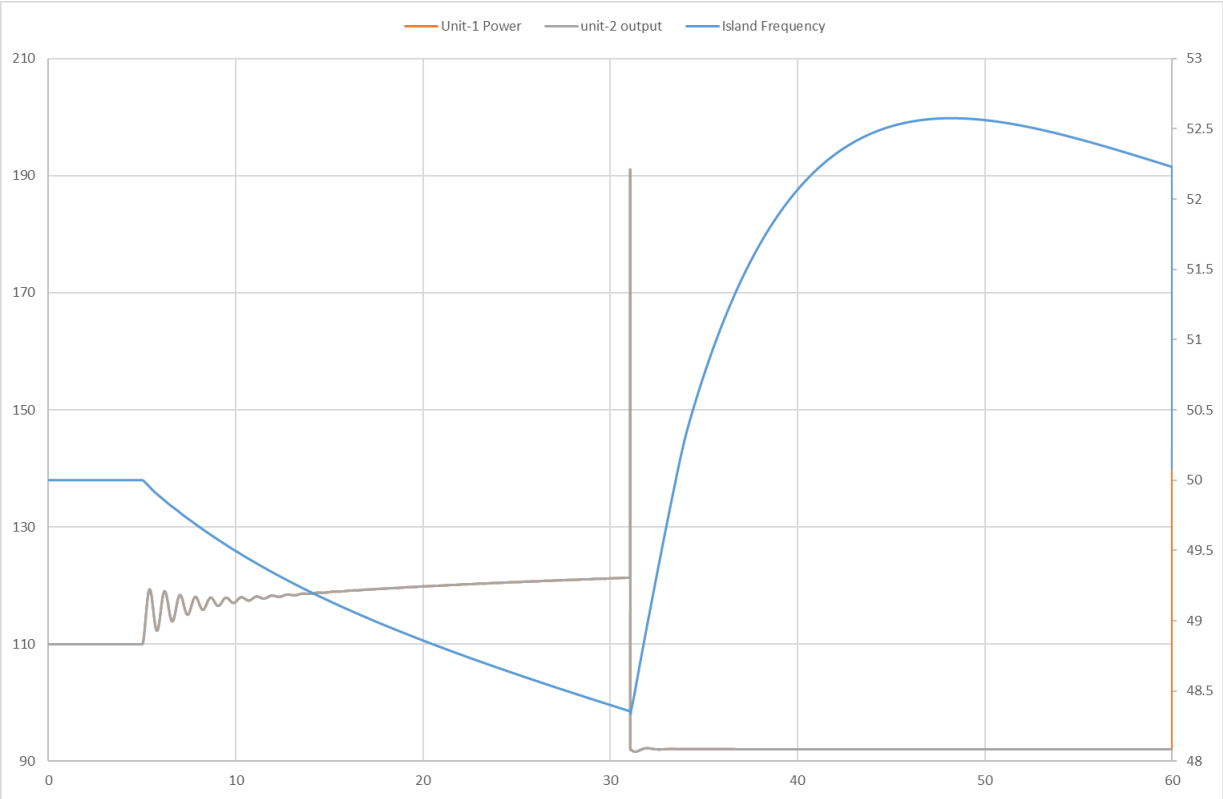
Scenario-2 : Maximum generation & Minimum load



Discussion:

1. In max generation min load scenario there is 190 MW generation surplus inside the Island
2. Therefore after island formation frequency start raising at faster rate, as the inertia of the island is low.
3. One unit is therefore tripped immediately
4. The island is survived with 50.43 Hz frequency.

Scenario-3: Minimum generation & Maximum load

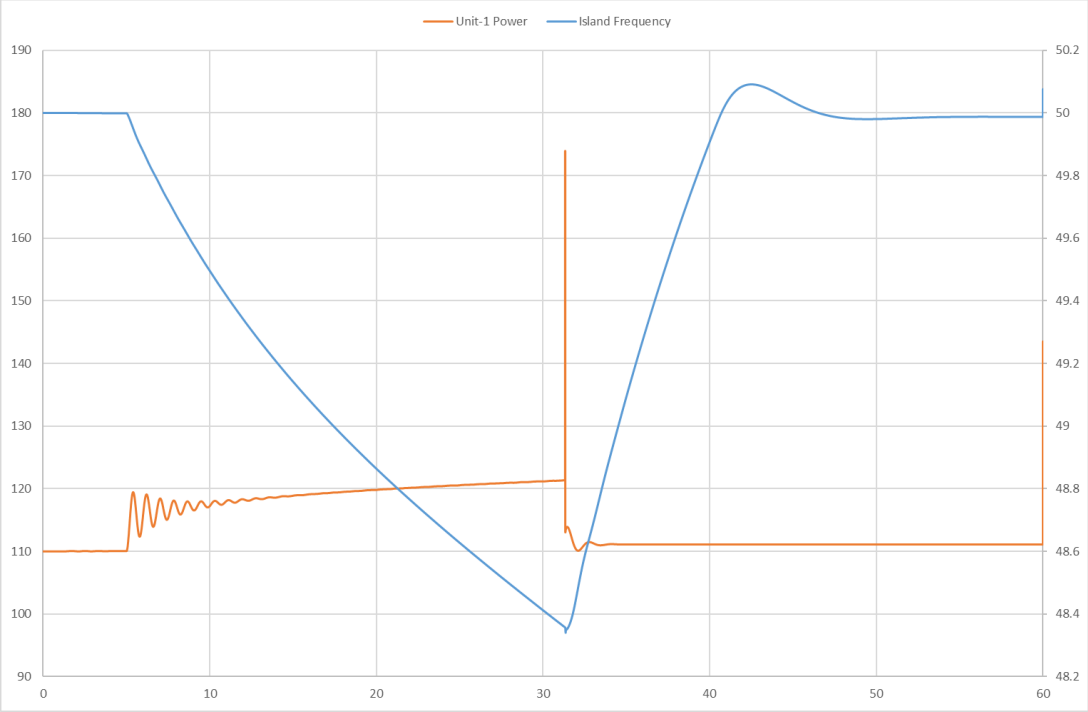


Discussion:

1. In min generation max load scenario there is 34 MW generation surplus inside the Island
2. Therefore after island formation frequency start rising fast, as the inertia of the island is low.
3. With this setting finally island frequency stabilizes around 52 Hz.
4. Here Both the unit survived

Scenario-4: Minimum generation & Minimum load

In scenario fourth the island is 111 MW generation surplus.



Discussion:

1. In min generation max load scenario there is 111 MW generation surplus
2. Therefore, one unit is tripped and the island is stabilized at 49.98 HZ.

5. Summary:

Logic	Islanding at 48.4 HZ and 1 sec, UFLS(Inside island): 48.2 Hz, 500ms 30% of Island load 48.0 Hz 500 ms 10 % of Island load 47.8 Hz 500 ms 10 % of Island load				
	Generation	**Load**	**Surplus/Deficit**	**Number of unit survived**	**Remarks**
Scenario-1	300 MW	186 MW	114 MW	1 unit	In this scenario, island can be survive with two unit also. However change in logic will be required.
Scenario-2	300MW	110 MW	190 MW	1 unit	
Scenario-3	220 MW	186 MW	36 MW	2 unit	
Scenario-4	220MW	110 MW	111 MW	1 unit	

Based on the above study following islanding logic is proposed:

i. Islanding should happen before pick up of any of the frequency protection stage and that's why island formation will start at 48.4 Hz with a delay of 1 sec.

ii. Under frequency inside the island is proposed to trigger at 48.2 Hz. The details is as follows

48.2 HZ 500 ms 30 % of island load
48.0 Hz 500 ms 10% of Island load
47.8 Hz 500 ms 10 % of Island load

iii. However the over frequency trip setting of unit -1 may be changed from 52.7 to 53 Hz . Tenughat have to confirm it.

Limitation of the study:

1. In absence of any guideline for islanding study, we have applied a frequency disturbance in the grid and grid is simulated with closely matching inertia and Governor Response. However it is well known that during such large disturbance lot of other protective control features of various generators, other equipment may come into picture. Also UFLS of grid side impacts the frequency dynamics and the ROCOF. Those phenomena are difficult to consider in the study. Therefore not considered here.
2. The exact governing behavior of the units has high impact on the island study, however those detailed model of a plant considering influences from speed and pressure control loop is not modeled here. Plants may consult OEM for the detailed study considering those control action.
3. Initial ROCOF has also has huge impact of island stability after separation, however this ROCOF depends on lot of things and very difficult to predict. Also there is no guideline in Indian context what ROCOF should be considered during such study.
4. Therefor the above study is only showing a tentative frequency excursion of the island and helping in arriving at a suitable starting logic.

Annexure B12

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

S.NO	LINE NAME	TRIP DATE	TRIP TIME	RESTORATION DATE	RESTORATION TIME	Relay Indication LOCAL END	Relay Indication REMOTE END	Reason	Fault Clearance time in msec	Remarks	LOCAL END UTILITY	REMOTE END UTILITY	Utility Response
1	220 KV MUZAFFARPUR-HAZIPUR-1	01-10-2021	21:44	01-10-2021	22:19	Didn't trip	Y_ph O/c	Y-Earth	100		PG ER-1	BSPTCL	PLCC card issue. S/d to be taken to resolve the same
2	220 KV MUZAFFARPUR-HAZIPUR-2	01-10-2021	21:44	02-10-2021	10:04	Y_N, 0.6 km, 21 kA		Y-Earth	100	A/r can't be ascertained. DR timelength is less	PG ER-1	BSPTCL	PLCC card issue. S/d to be taken to resolve the same
8	220 KV KHAGARIA-NEW PURNEA-2	03-10-2021	12:17	03-10-2021	17:38		Didn't trip	NA	NA	No fault observed in PMU. Reason for tripping maaybe shared by BSPTCL	BSPTCL	PG ER-1	Due to loose connection DT sent.

9	220 KV PATNA-FATUAH-1	03-10-2021	12:23	03-10-2021	13:13	Patna: R_N, Z I, 14.4 km, 8.4 kA	Fatuah: R_N, Z I, 7.86 km, 7.56 kA	R-Earth	100	Three phase tripping for single phase fault from Patna end .While from Fatuah end also 3 phase tripping occurred but R and B phase reclosed after 800 ms .A/R scheme to be reveiwed at Fatuah.	PG ER-1	BSPTCL	Three phase A/r has been implemented. Issue in spring charge mechanism of Y_ph at Fatuah. PLCC not healthy. A/r implemented at Fatuah without PLCC
10	400 KV PATNA-BALIA-2	03-10-2021	16:50	03-10-2021	17:31	Patna: Y_N, 126.53 km, 3.6 kA	Balia: A/r successful	Y-Earth	100	No A/r attempt at Patna. Other two phase tripped after 2.5 seconds on PD.Seems Y phase reclosed at balia end but after 2.5 seconds also needs to be checked.	PG ER-1	NR	CB status was not healthy at Patna

11	220 KV DALTONGANJ-CHATRA-2	04-10-2021	19:25	04-10-2021	19:43	Spurious DT sent from Daltonganj while changeover from Bus-1 to Bus-2 through TBC		NA	NA	Reason maybe shared by PG	PG ER-1	JUSNL	Wiring issue at Daltonganj
21	400 KV KISHANGANJ-RANGPO-1	13-10-2021	10:53	13-10-2021	17:22	Kishanganj: B_N, 2.09 kA, DEF	Rangpo: B_N, 2.5 kA	B-Earth	1500	DEF setting at Rangpo need to be checked. Fault current was around 2 kA for more than 1.5 seconds. DT sent to Kishanganj	PG ER-1	PG ER-2	Less current for pickup.
29	400 KV MEDINIPUR-NEW CHANDITALA-1	17-10-2021	15:32	17-10-2021	15:58	Medinipur: Didn't trip	New Chanditala : DT received		NA	DR not uploaded. Tripping reason maybe explained by WBSETCL	PMJTL	WBSETCL	Supervision relay changed
35	400 KV RANCHI-RAGHUNATHPUR (RTPS)-3	19-10-2021	16:33	19-10-2021	17:22	Ranchi: B_N, Z I, 55.95 km, 5.292 kA	Raghunathpur: B_N, Z I, 151.2 km, 2.542 kA	B-Earth	100	A/r successful from Ranchi	PG ER-1	DVC	Raghunathpur end sensed phase-to-phase fault

39	400 KV MALDA-NEW PURNEA-1	21-10-2021	00:16	21-10-2021	18:22	Malda: R_N, 3.828 km, 14.91 kA	New Purnea: R_N, 156 km, 1.85 kA	R-Earth	150	No A/r attempt at Malda. Other two phases tripped in PD time. A/r failed after 1 second from New Purnea. Tie CB at New Purnea took another attempt after 1 second of A/r failure	PG ER-2	PG ER-1	186A A/r relay not working properly. S/d was taken to replace it
47	220 KV KHAGARIA-NEW PURNEA-2	23-10-2021	21:18	23-10-2021	21:44	Khagaria: R_N, 3.04 kA, 24.2 km	New Purnea: R_N, 82.7 km, 2.1 kA	R-Earth	100	No A/r at New Purnea. A/r operated at Khagaria after 300 msec and breaker agin got opened after 200 msec	BSPTCL	PG ER-1	B_ph Breaker status was not available in Main-I. Dead time changed
49	400 KV BINAGURI-RANGPO-2	26-10-2021	13:29	26-10-2021	13:56	Binaguri: DT received	Rangpo: Y_N, 2 kA	Y-Earth	1700	DEF setting at both ends need to be checked. Current in neutral is around 2.2 kA at Rangpo and 1.4 kA at Binaguri for more than 1.7 seconds.	PG ER-2	PG ER-2	PickUp current less

ANNEXURE-C.4

Sl No.	Name of the incidence	PCC Recommendation	Latest status
106th PCC Meeting			
1.	Tripping of Bus-1 at 220 kV Ramchandrapur on 20/08/2021 at 20:24 Hrs.	In 106th PCC Meeting, PCC advised JUSNL following: ➢ To restore the busbar protection at 220 kV Ramchandrapur S/s within a month. ➢ To check the settings as well as directionality of earth fault relay for 220 kV RCP-Chaibasa line at RCP end. ➢ Regarding tripping of ICT-4 at Chandil, PCC advised JUSNL to check the stabilizing resistor value for REF relay in addition to the wiring issue. The relay shall be checked and tested before putting it into service.	*Regarding Bus Bar Protection, JUSNL informed that the same could not be restored as the visit of OEM engineers get delayed.PCC advised to take up the issue with higher authority for early restoration of the busbar protection.* *Regarding settings of earth fault relay, they updated that the same had been reviewed.*
2.	Repeated Tripping of 132 kV Sultanganj- Deogarh D/C	In 106th PCC Meeting, PCC advised BSPTCL to resolve all clearance issues in the line and complete the insulator replacement work at the earliest.	
3.	Total Power Failure at 220 kV Rengali HEP on 27/07/2021 at 08:57 Hrs	In 106th PCC Meeting, PCC advised OHPC to check CVT secondary earthing circuits for any double earthing/grounding as double earthing leads to high voltage during fault.	*OHPC informed that no double earthing/grounding was found in CVT secondary circuit wiring.* *OHPC was advised to share the report on earthing resistance measurement carried out by them for the substation.*
4.	Total Power Failure at Dumka S/s on 15/05/2021 at 12:01 Hrs	Regarding 220 kV Maithon-Dumka-1, JUSNL intimated that there was card issue in PLCC panel. The OEM (M/s ABB) had been communicated regarding the issue and the same would be resolved by September' 21.	*JUSNL informed that work order would be placed after receiving the cost estimate from OEM. They stated that the PLCC link would be restored by December 2021.*
5.	Grid event at 132 kV Motihari (DMTCL) S/S on 21-04-2021 at 20:19 hrs	In 106th PCC Meeting, PMTL informed that offers received from	*PMTL representative informed that an internal committee of*

		OEM i.e., M/s TBEA regarding restoration of the damaged GIS section is under examination. Regarding timeline to complete the work, PMTL informed that since all materials required for restoration work are to be imported from China, it would take 40-50 days for restoration after placing the supply order.	*Powergrid had visited site on 12th Nov 2021. PCC advised to submit the restoration plan of the damaged bus extension module.*
6..	Repeated delayed clearance of faults at 220 kV Chandil STPS S/C	In 106th PCC Meeting, JUSNL informed that cost estimate was received from OEM and work order for rectification work of PLCC panel would be placed after getting approval from higher authority. They added that the PLCC issue would be resolved within Nov-21.	*JUSNL representative informed that approval from higher authority was not received till date hence work order for rectification work of PLCC panel could not been placed with OEM.* *PCC expressed serious concern for delay in restoration of PLCC in 220 kV Chandil-Santaldih line and decided to refer the issue to forthcoming OCC meeting.*
7.	Backup Overcurrent Relay coordination for Sikkim Complex.	In 107th PCC Meeting, PRDC informed that they require fault level of the substations at Sikkim complex corresponding to minimum hydro generation in order to carry out the revised study. PRDC was advised to coordinate with ERLDC for getting required information for the study.	*PRDC was advised to coordinate with ERLDC for getting required information for the study and complete study at the earliest.* *ERLDC informed that requisite details would be shared to PRDC.*
107th PCC Meeting			
8.	Total Power Failure at 220 kV Garwah S/S on 26.09.2021 at 15:31Hrs	In 107th PCC Meeting, PCC advised JUSNL to implement current reversal guard feature along with POTT Scheme in the relay at Garwah end in order to avoid similar type of disturbances.	*JUSNL informed that current reversal guard feature along with POTT scheme has been successfully implemented in the relay for both the 220kVDaltongunj- Garwah circuits.*

9.	Disturbance at 220 kV Hajipur S/S on 28.09.2021 at 17:18Hrs	In 107th PCC Meeting, PCC advised BSPTCL to submit action taken report for this disturbance in coordination with BGCL.	
10.	Islanding Performance and Observations during recent Islanding incidents in CESC system.	In 107th PCC Meeting, PCC advised CESC to carry out the detailed analysis of the event and the report may be shared with ERPC/ERLDC.	*CESC informed that a preliminary meeting was held with ERLDC. Based on the feedback, islanding events are being analyzed and the report would be submitted after completion of the analysis.*
11.	Tripping of DALTONGANJ – GARWA D/C lines.	In 107th PCC Meeting, PCC advised JUSNL to resolve all the clearance related issues in 220 kV Daltonganj-Garwah line within two weeks. PCC further advised JUSNL to check the auto recloser scheme at Garwah end and rectify the issue at their end.	*JUSNL informed that patrolling was carried out and vegetation issues were found at location no. 89, 90, 91. The same would be cleared within two weeks.* *Regarding auto-recloser scheme at Garwah end, they updated that scheme is being reviewed by the CRITL wing.*
12.	Repeated Tripping of 220 kV Joda- Ramchandrapur	In 107th PCC Meeting,PCC advised JUSNL to carry out line patrolling under their jurisdiction for 220 kV Joda-Ramchandrapur line and resolve vegetation or clearance issues in the line at the earliest. PCC advised JUSNL to take up the issue with OEM for early restoration of the PLCC at Ramchandrapur end.	*JUSNL informed that* line *patrolling was carried out for however no vegetation or clearance issues were found in the line.* *Regarding PLCC, they updated that issue had been communicated to OEM but they were facing difficulty in getting the availability of service engineers at site.*