



**107 वीं पीसीसी बैठक
का
कार्यवृत्त
Minutes
of
107th PCC Meeting**

दिनांक: 03.11.2021

Date: 03.11.2021

पूर्वी क्षेत्रीय विद्युत समिति

Eastern Regional Power Committee

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14, Golf Club Road, Tollygunge, Kolkata: 700 033

EASTERN REGIONAL POWER COMMITTEE

MINUTES OF 107th PROTECTION COORDINATION SUB-COMMITTEE MEETING HELD ON 22.10.2021 AT 10:30 HOURS

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

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

PART – A

ITEM NO. A.1: Confirmation of minutes of 106th Protection Coordination sub-Committee Meeting held on 16th Sep 2021 through MS Teams.

The minutes of 106th Protection Coordination sub-Committee meeting held on 16.09.2021 was circulated vide letter dated 13.10.2021.

Members may confirm.

Deliberation in the meeting

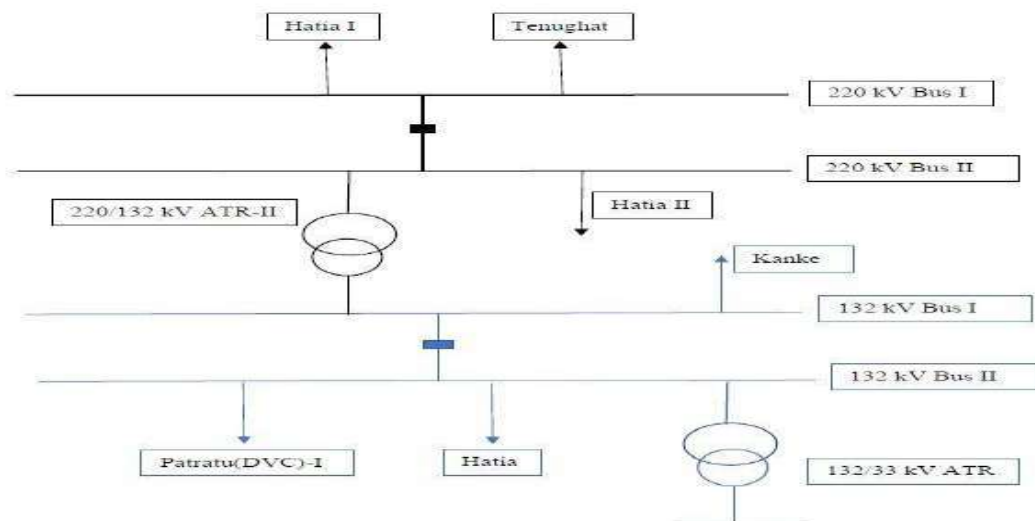
Members confirmed the minutes of 106th PCC Meeting.

PART – B

ITEM NO. B.1: Disturbance at 220/132 kV Patratu(JUSNL) S/S on 12.09.2021 at 16:01Hrs

At 16:01 hrs, all 132 kV lines at 220/132 kV Patratu S/s tripped to clear fault in 132 kV Patratu-Patratu(DVC) line. At 16:32 Hrs, 132/33 kV ATR tripped leading to 15 MW load loss at Patratu.

During restoration, while charging 132 kV Patratu-Patratu (DVC) line at 18:43 Hrs, total power failure occurred and 220 kV side also became dead at Patratu.



SLD of 220/132 kV Patratu S/s

Detailed report from ERLDC is attached at **Annexure B.1.**

Load Loss: 15 MW
Outage Duration: 03:26 Hrs.

DVC &JUSNL may explain.

Deliberation in the meeting

*JUSNL explained the event with help of a presentation which is attached at **Annexure B.1.1.***

They informed that two disturbances occurred at Patratu S/s on 12.09.2021, first one at 16:01 Hrs and second at 18:43 Hrs.

They explained as follows:

a) At 16:01 Hrs

- *At 16:01 hrs, Y-ph jumper of 132 kV Patratu- Patratu (DVC)-1 snapped and touched B-ph of the line, creating a phase-to-phase fault. Initially, fault was sensed in Zone 4 at Patratu end and after 1.2 seconds, fault came in Zone 1 and then line tripped from Patratu end.*
- *Meanwhile fault was sensed by Patratu end of 132 kV Patratu- Hatia & 132 kV Patratu- Kanke and these lines tripped after 800 msec in zone 1 from Patratu end. It was informed that relay at remote end of these lines sensed the fault in zone 3.*
- *They further informed that 220 kV Patratu-Hatia-2 tripped on overcurrent protection due to B phase VT fuse failure as VTS function was kept on and VTS O/C time settings was 200 ms.*

b) At 18:43 Hrs

The disturbance occurred while charging of 132 kV Patratu-Patratu (DVC) line at 18:43 Hr. Y phase jumper snapped at tower no -1 of 132 kV PTPS – DVC transmission line creating phase to ground fault.

JUSNL representative informed that SOTF was triggered however breaker of Patratu(DVC) line didn't open. As a result, the following 132 kV & 220 kV lines tripped to clear the fault.

Element Name	Relay indication at End 1	Relay indication at End 2	Remarks
132 kV PTPS – Hatia I S/C	YN fault, Z1, Fault Loc- 4.22 km, IR – 569.4 A, IY- 1.82 kA, IB- 659.0 A, VRN- 77.63 kV, VYN- 76.3 kV, VBN- 1.005 kV Fault Resist -26.39 Ω	Did not trip.	
132 kV PTPS – Kanke S/C	YN fault, Z1, Fault Loc- 5.956 km, IR – 146.4 A, IY- 1.553 kA, IB- 544.4 A, VRN- 77.64 kV,	Did not trip.	

	VYN- 76.33 kV, VBN- 1.011 kV Fault Resist – 39.77 Ω		
132 kV PTPS – DVC	YN fault, Fault Loc- 3.141 km, IR – 0.00 A, IY- 6.190kA, IB- 6.132kA, VRN- 36.33kV, VYN- 77.06kV, VBN- 43.53kV Fault Resist -10.10 Ω	-----	

Element Name	Relay indication at End 1	Relay indication at End 2	Remarks
220 kV PTPS – Hatia-1	Did not trip.	YN fault, E/F, IY -1.81 kA, F. Dur- 1.3 s	E/F setting (non dir) Pick up- 0.15 T. Delay – 1.25 s CT- 1200/1
220 kV PTPS – Hatia-2	YN fault, IN>1 trip (E/F 1 st stage), F. dur – 253.3 ms, IR – 110.85 A, IY- 807.4 A, IB- 262.75A, IN- 451.8A	Did not trip.	Due to B phase VT fuse failure. E/F Setting – (CT- 600/1) Pick up – 0.20 A (Fwd), TMS- 0.550 s . VTS – Non-directional, Time VTS – 200 ms
220 kV PTPS – TTPS s/c	Did not trip.	YN fault, E/F, IY- 1.003 kA F. Dur -1.268 s	
100 MVA, 220/132 kV ICT- 02	Did not trip.	Did not trip.	

Regarding tripping of 132/33 kV ICT at 16:32 Hrs, JUSNL informed that there was fault on 33 kV side due of which the ICT got tripped.

Regarding non opening of circuit breaker poles of 132 kV Patratu- Patratu(DVC) line at Patratu end, JUSNL explained that there was an issue in master trip relay contacts due to which signal was not extended to circuit breaker. They intimated that the relay contact issue had been resolved.

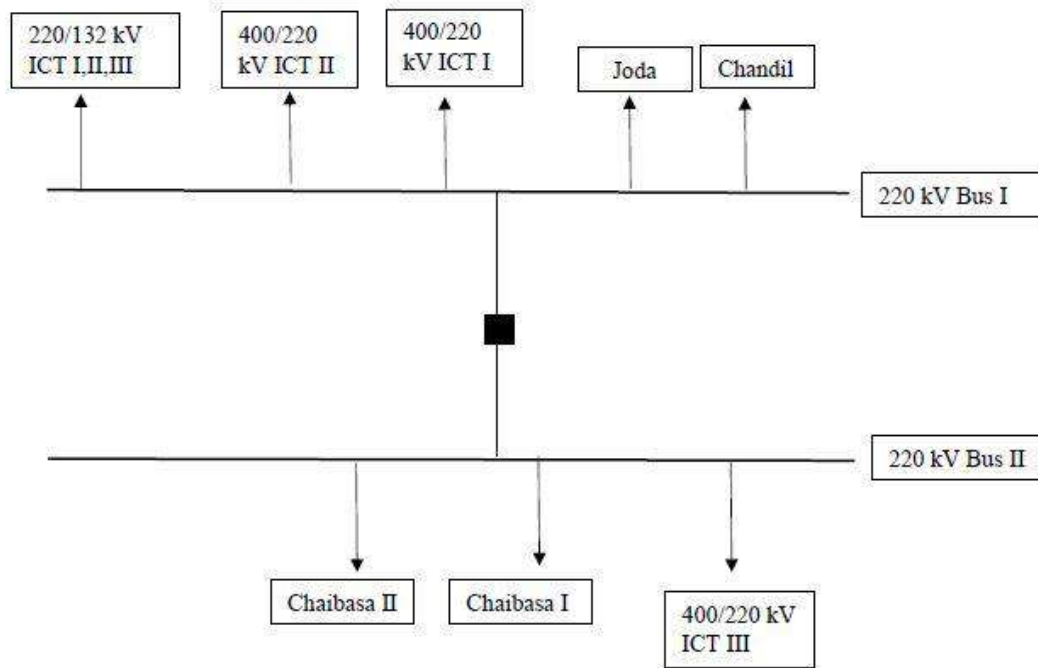
For discrepancy in zone operation in distance relays for 132 kV feeders, JUSNL clarified that PT inputs to relays for R & Y phase was swapped for all 132 kV line feeders resulting in discrepancies in zone selection by the relay. They informed that the issue has been rectified after the disturbance. PCC advised JUSNL to share the relevant test reports with ERPC/ERLDC.

Regarding 220/132 kV ICT-2, JUSNL explained that as per DR/EL of the relay, tripping command was triggered from the relay however the breaker didn't open indicating there might be issue in tripping circuit. JUSNL was advised to carry out detailed checking of the tripping circuit of the breaker for 220/132 kV ICT-2.

JUSNL representative intimated that due to dismantling work of old PTPS plant building at Patratu they are shifting relay panels from plant control room to switchyard. They added that they had already shifted relay panel for 132 kV level and the same had been relocated after thorough testing of circuitries. The shifting of panel for 220 kV level is in progress and would be completed soon.

ITEM NO. B.2: Total Power Failure at 220 kV Ramchandrapur S/S on 03.09.2021 at 21:52Hrs

At 21:52 hrs, Bus PT of 220 kV Bus-2 at Ramchandrapur got burst leading to tripping of both 220 kV buses. This resulted in total power failure at Ramchandrapur S/s.



220/132 kV Ramchandrapur Schematic Bus diagram

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

Load Loss: 200 MW

Outage Duration: 00:15 Hrs

JUSNL may explain.

Deliberation in the meeting

JUSNL representative informed that the fault occurred due to bursting of R-phase Bus PT of 220 kV Bus -2 at Ramchandrapur(RCP).

As the busbar protection is not in service, the following elements tripped to clear the fault.

Name of the Element	End 1	End 2
220 kV Bus 1 and Bus 2 at Ramchandrapur	R_ph Bus PT of 220 kV Bus 1burst. No Bus Bar protection.	
220 kV Bus Coupler	Tripped within 100 ms	
400/220kV ICT1	Differential Protection	
400/220kV ICT 2	LV: Overcurrent protection, HV: No tripping	
400/220kV ICT3	LV: Overcurrent protection, HV: No tripping	

220 kV Ramchandrapur-Chaibasa Circuit 1	Non-directional overcurrent protection within 100 ms	E/F	R phase breaker opened immediately and rest two phase opened after 1.2 seconds.
220 kV Ramchandrapur-Chaibasa Circuit 2	Zone 4		Zone 2
220 kV Ramchandrapur-Chandil	Zone 4		Zone 2
220 kV Ramchandrapur-Joda	Zone 4		Zone 2
3*150 MVA 220/132 kV ICTs	Non-directional high set O/C within 50ms		

JUSNL explained the discrepancies with following clarifications:

- Regarding restoration of busbar protection, they informed that though necessary procurement of relay parts has been made, the relay could not be restored as OEM engineers are yet to visit the site.
- Tripping of 220 kV Chaibasa-Ramchndrapur-1:

At RCP end: The line tripped instantaneously on non-directional DEF protection instead of zone-4 protection. JUSNL replied that there was setting issue in the DEF relay and the same would be resolved within a week.

At Chaibasa end: R-phase breaker pole got opened immediately and rest two phase opened after 1.2 seconds. They replied that the breakers would be tested and report would be submitted to ERPC/ERLDC.

- Regarding tripping of elements connected to 220 kV bus-2 at RCP end, they explained that during bursting of PT, heavy sparking occurred in the substation. They apprehended that due to induction effect in the switchyard, the elements of bus-2 would have sensed the fault. They added that 400/220 kV ICT-1 which was adjacent to the bus PT got tripped on differential protection during this event.

After detailed deliberation, PCC advised JUSNL following:

- To restore the busbar protection at 220 kV RCP S/s within a month.
- To review the settings in back up DEF relay for 220 kV RCP-Chaibasa-1 line at RCP end & revise the timer as well as directionality settings within a week.
- To submit a report regarding discrepancy in breaker pole openings at Chaibasa end for 220 kV RCP-Chaibasa-I line.

ITEM NO. B.3: Total Power Failure at 220 kV Garwah S/S on 26.09.2021 at 15:31Hrs

At 15:31 Hrs, 220 kV Daltonganj-Garhwa (New) D/C tripped on B-phase to earth fault leading to total power at 220/132 kV Garhwa S/s.

Relay Indications:

Time	Name	End 1	End 2	PMU Observation
15:31Hrs	220 kV Bus-1, Bus 2 at Garhwa (New)			Around 52 kV dip in B_ph at Daltonganj. A/r failed
	220 kV Daltonagnj-Garhwa(New)-1	B_N, FC-1.7 kA, FD- 56 km	B-N, FC-1.4kA, FD- 59 km	
	220 kV Daltonagnj-Garhwa(New)-2	Didn't trip	B-N, FC-1.4Ka, FD- 65 km	

Disturbance report is attached at **Annexure B.3**.

Load Loss: 34 MW

Outage Duration: 00:55 Hrs

JUSNL may explain.

Deliberation in the meeting

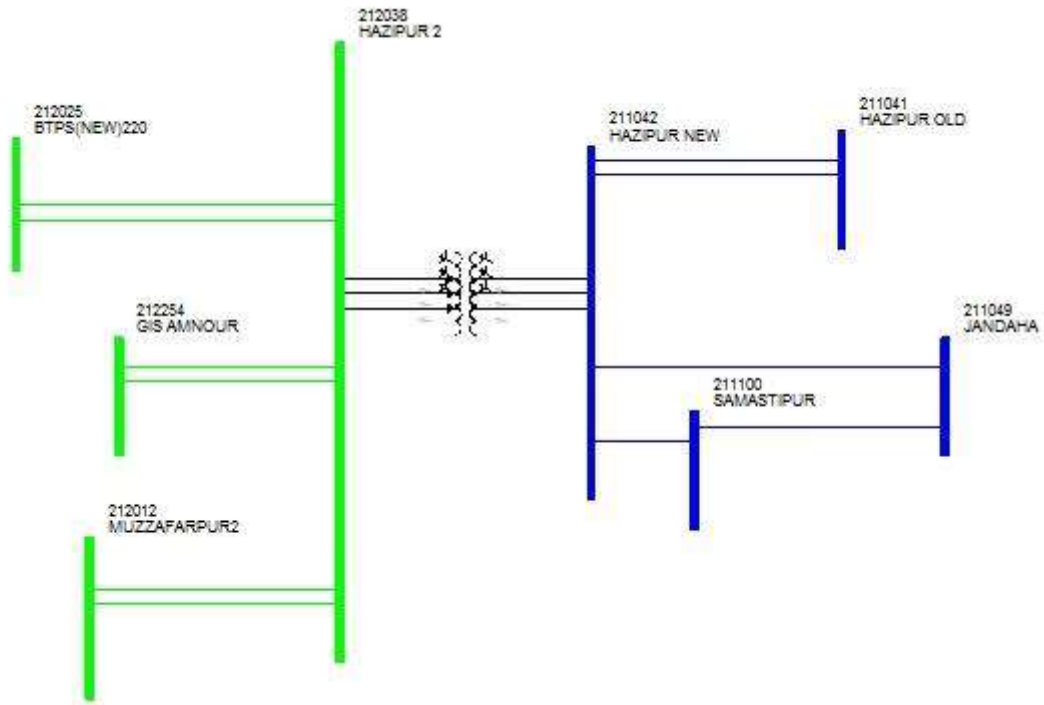
Based on the DR analysis, ERLDC explained the event as follows:

- *There was a B-phase to earth fault in 220 kV Daltonganj-Garhwa (New)-1, for which auto-reclose was attempted at both end. The fault was permanent in nature.*
- *At the autorecloser instance of circuit-1, Daltonganj end of 220 kV Daltonganj-Garhwa (New)-2 was sensing the fault of circuit-1 in Zone 2 and was sending carrier to Garhwa end. As 220 kV Daltonganj-Garhwa (New) D/C lines are radial in nature POTT scheme was implemented in the line.*
- *While reclosing, A/R attempt got failed and led to tripping of 220 kV Daltonganj-Garhwa (New)-1 from Garhwa end.*
- *After tripping of 220 kV Daltonganj-Garhwa (New)-1 from Garhwa end, suddenly current reversal took place in 220 kV Daltonganj-Garhwa (New)-2 due to which Garhwa end of circuit 2 started sensing the fault in zone 2.*
- *Since Garhwa end of circuit 2 was receiving carrier from Daltongunj end and it was also sensing the fault in zone 2 therefore tripping condition of POTT got satisfied that led to tripping of circuit 2 from Garhwa end and total power failure occurred at Garhwa.*

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.

ITEM NO. B.4: Disturbance at 220 kV Hajipur S/S on 28.09.2021 at 17:18Hrs

Both 220 kV Buses at Hazipur tripped due to operation of LBB of 220 kV Hazipur-Amnour-II line which lead to total power failure at Hazipur and Amnour.



Relay Indications:

Time	Name	End 1	End 2	PMU Observation
17:18 Hrs	220 kV Bus-I, Bus II at Hazipur	Z-1 in Amnour-2 circuit but breaker did not open. Subsequently LBB operated which caused tripping of all ckt's from Hazipur end.		23 kV dip in R phase with fault clearance time of 250ms.
	220 kV Hazipur-Muzaffarpur-I		Didn't trip	
	220 kV Hazipur-Muzaffarpur-II			
	220 kV Hazipur-Amnour I			
	220 kV Hazipur-Amnour II			
	220 kV Hazipur-Barauni (BTPS)-II		Didn't trip	
	2*100 MVA 220/132 kV ICTs at Hazipur			

Disturbance report is attached at **Annexure B.4.**

Load Loss: 230 MW
 Outage Duration: 00:12 Hrs

BSPTCL may explain.

Deliberation in the meeting

BSPTCL informed that there was a fault in 220 kV Hazipur-Amnour circuit-2 for which distance protection at Hazipur end picked up and issued trip command to circuit breaker.

However the corresponding circuit breaker did not open resulting in operation of LBB protection. Subsequently remaining feeders of 220 kV Hazipur S/s(both Bus-1 & Bus-2) got tripped on LBB protection.

They further informed that Zone-4 of remaining lines at Hazipur end also picked up during the fault but prior to that LBB issued trip command to all lines from Hazipur end.

PCC opined that with LBB initiation, only the elements which are at same bus as of 220 kV Hazipur-Amnour -2 should have tripped along with the bus coupler and all elements with other bus should have remained in service. BSPTCL representative responded that the Amnour bay was maintained by BGCL and there might be wiring issue in LBB protection relay. They submitted that the issue had been intimated to BGCL and the OEM engineer is going to visit the S/s soon to investigate and rectify the issue.

Regarding non opening of circuit breaker for Amnour bay, BSPTCL informed that there was issue in trip circuit to circuit breaker. The same would be rectified during visit of OEM Engineer.

PCC advised BSPTCL to submit action taken report for this disturbance in coordination with BGCL.

ITEM NO. B.5: Total Power Failure at 220 kV Amnour S/S on 29.09.2021 at 11:28Hrs

220 kV Hazipur-Amnour-2 was out of service prior to the disturbance. At 11:28 hrs, 220 kV Hazipur-Amnour-1 tripped due to operation of bus bar protection at Hazipur leading to total power failure at Amnour S/s.

As reported, during testing of 220 kV Hazipur-Amnour II (which was under breakdown), bus bar protection of 220 kV Bus I at Hazipur had operated.

Relay Indications:

Time	Name	End 1	End 2	PMU Observation
11:28 Hrs	220 kV Bus-I at Hazipur	Bus bar protection operated at Hazipur		No fault observed in PMU
	220 kV Hazipur-Muzaffarpur-I		Didn't trip	
	220 kV Hazipur-Barauni (BTPS)-II			
	220 kV Hazipur-Amnour I			
	220 kV Bus-I,II at Amnour	Loss of power supply		

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

Load Loss: 140 MW

Outage Duration: 00:27 Hrs

BSPTCL may explain.

Deliberation in the meeting

BSPTCL representative informed that after the disturbance on 28.09.2021, testing of 220 kV Hazipur-Amnour-2 bay was going on at Hazipur end for restoration of the said bay. During testing, bus bar protection mal-operated for 220 kV bus 1 and resulted in tripping of all elements including 220 kV Hazipur-Amnour-1 which were connected to bus 1 at Hazipur S/s.

As 220 kV Hazipur-Amnour-1 got tripped, total power failure occurred at 220 kV Amnour S/s.

PCC observed that similar type of inadvertent tripping of busbar/LBB protection relay during testing work had been observed in past in BSPTCL system and expressed serious concern on this issue.

PCC advised BSPTCL/BGCL to take utmost measure to avoid such type of tripping during testing work.

ITEM NO. B.6: Total Power Failure at 220 kV Ramgarh S/S on 29.09.2021 at 01:24Hrs

At 01:24 hrs, total power failure occurred at 220/132 kV Ramgarh, 132 kV Patratu S/s and 132 kV North Karnpura S/s.

Load Loss: 150 MW

Outage Duration: 00:06 Hrs

DVC may explain.

Deliberation in the meeting

- DVC explained that the disturbance occurred during stealing of bus PT isolator by miscreants under live condition at 220 kV Ramgarh S/s. As there was no actual fault in the substation, busbar relay did not operate during this disturbance. It was informed that all 220 kV lines at Ramgarh S/s i.e. 220 kV Ramgarh – BTPS B D/C and 220 kV Ramgarh- Ranchi got tripped on zone 4 of distance protection at Ramgarh end. There was no tripping from remote end of the 220 kV lines.*
- After tripping of all 220 kV lines at Ramgarh, the 132 kV loads of Ramgarh, Patratu & North karnapura S/s got fed by 132 kV Gola-Ramgarh D/C.*
- Subsequently there was jumper snapping in 132 kV Ramgarh-Gola-1 line resulting in tripping of this circuit in distance protection. Further, 132 kV Ramgarh-Gola-2 got tripped on overcurrent protection. This resulted in total power failure at 220/132 kV Ramgarh S/s, 132 kV Patratu(DVC) S/s, & 132 kV North Karanpura S/s.*
- Regarding tripping of 220 kV lines on zone-4 protection, DVC explained that as per the internal logic of distance protection relay ABB REL670, if all three PT voltages die down within 5 sec of sensing asymmetrical VT fuse failure, then VT fuse failure condition will get reset in the relay and distance protection will be unblocked. Due to this reason when all three PT voltages were unavailable during the disturbance, all ABB REL670 relays tripped from zone-4 distance protection as current direction of all those three 220 kV lines were*

towards Ramgarh Bus. The disturbance report received from DVC is enclosed at **Annexure B.6.**

ITEM NO. B.7: Disturbance at 220 kV Upper Kolab S/S on 18.09.2021 at 17:59Hrs

While synchronizing U#2 at UpperKolab, all three circuits emanating from 220 kV UpperKolab HEP tripped and 220 kV bus became dead.

Relay Indications:

Time	Name	End 1	End 2	PMU Observation
17:59 Hrs	220 kV Bus-I, Bus II at UpperKolab	U#2 LBB operated		No fault observed in PMU
	220 kV UpperKolab-Jaynagar-1			
	220 kV UpperKolab-Jaynagar-2			
	220 kV UpperKolab-Therubali			
	80 MW U#1 at UpperKolab			

Disturbance report is attached at **Annexure B.7.**

Gen. Loss: 73 MW

Outage Duration: 00:58 Hrs

OHPC/OPTCL may explain.

Deliberation in the meeting

- *OHPC representative informed that during synchronization of unit #2 of Upper Kolab HEP, under-voltage relay of the unit operated and issued trip command to 86 relay of generator circuit breaker.*
- *However, due to mechanical problem in the relay, the trip command did not get extended to the GCB resulting in operation of LBB protection and tripping of all the feeders at 220 kV Upper Kolab S/s. They added that all the feeders and units were connected to 220 kV bus-1 during the event.*
- *Regarding undervoltage condition of the unit during raising of the load in Unit#2, they informed that the AVR system is quite old and the same would be replaced with DAVR during next annual maintenance program of the unit.*

PCC advised OHPG to share DR/EL of the event with ERPC and ERLDC.

ITEM NO. B.8: Major grid events other than GD/GI

B.8.1: Islanding Performance and Observations during recent Islanding incidents in CESC system.

CESSC islanding performance and frequency variation for past few Islanding events were checked for Island stability. Based on the analysis by ERLDC, possible challenges for island survival are listed below.

- Oscillating Variation of frequency after island formation in Budge-budge frequency is observed up to (0.5-1 Hz) and was varying continuously till it got synchronized with grid at Howrah point.
- In event 3, Budge-Budge Unit generation was also oscillating and its root cause needs to be looked into which is ultimately driving the frequency of island.
- Any cyclic load changes or other behavior within the island need thorough analysis as these may also be the source of observed variation. Variation of traction and Metro load may also be studied within the island as it impacts on overall frequency stability within the islanded system.
- Under frequency load shedding setting as shared within the island starts from 49.4 Hz and may cause operation of UFR relay in some cases inside the island. This would be detrimental for island survival as observed for 2 events, Frequency dipped up to 49.5 & 49.6 Hz due to these variations.
- Above observation and frequency variation pattern was also observed during event of 28th April 2020.

Following root cause analysis is required to be carried out by CESC:

1. Analysis of oscillatory variation in frequency during island mode.
2. Reason for Budge Budge unit generation oscillation during event 3.
3. Budge Budge units Governor and PSS behavior in islanded mode, issues and its tuning performance during islanded mode.
4. Load behavior within island including cyclic, metro rail/traction and its impact on island system
5. UFR system and its possible operation and impact during such variation in the island.

Detailed report from ERLDC is attached at **Annexure B.8.1**.

CESSC may explain.

Deliberation in the meeting

ERLDC explained the observations that were made during recent islanding operation of CESC system. The issue was discussed in the previous meeting and CESC was advised to carry out root cause analysis of the events.

CESSC representative informed that preliminary analysis had been done at their end however for detailed analysis, they would require a reference document regarding ideal response for a successful islanding operation. ERLDC was advised to share relevant document, if any with CESC.

PCC advised CESC to carry out the detailed analysis of the event and the report may be shared with ERPC/ERLDC.

PCC decided to refer the issue to forthcoming OCC meeting for further discussion regarding the event.

B.8.2: Low Frequency Oscillation of local mode in CESC system due to Budge-Budge Plant on 20th Sept 2021

Low Frequency Oscillation of 0.875 Hz was observed between 03:53 Hrs to 03:57 Hrs on 20th sept 2021 near Subhasgram area. The magnitude of oscillation was maximum near Subhasgram and started reducing on moving away from Subhasgram. Observed LFO was of Local mode which indicates that the oscillation initiated with hunting of any nearby unit.

It was observed that maximum variation in MW oscillation was observed for Budge-budge units, which appears to be the source of oscillation. It was also observed that as MW of units reduced at Budge Budge units, this oscillation also damped.

Detailed report from ERLDC is attached at **Annexure B.8.2**.

CESC may explain. Members may discuss.

Deliberation in the meeting

ERLDC explained that low frequency oscillation of frequency 0.8-0.9 Hz was observed near Subhasgram area. They informed that during the local mode oscillation, 140 to 160 MW variation was observed in each unit of Budge-budge of CESC and stated that hunting of Budge-budge units were source of the oscillation.

CESC representative explained following:

- *Due to prevailing overvoltage condition at Budge budge during that time, units were in under excitation mode and was absorbing reactive power from grid.*
- *After desynchronization of Unit #1 , VAR absorption in Unit # 2 and Unit # 3 increased and VAR absorption in Unit #2 reached a level which activated dynamic UEL (Under excitation Limiter or VAR Limiter).*
- *As per AVR/PSS logic, Unit #2 PSS got disabled on activation of UEL. The Unit #2 PSS got enabled after UEL got reset (after about 4 mins , once excitation was manually increased.*
- *The low frequency oscillation was started after the limiter was hit and PSS became OFF. Subsequently oscillation reduced when PSS again became active.*

Further they informed that during investigation, it was found that due to error/offset in the VAR transducer of DCS, actual VAR value was wrongly displayed in DCS. As a result the operator could not take corrective actions during the event.

They stated that following correcting actions has been planned to avoid future incidents of similar nature.

- I. Control room engineers were instructed to limit VAR absorption within the prescribed limit considering the offset in the DCS value.*
- II. Replacement of Unit #2 DCS MVAR transducer would be done during unit outage in the month of Nov -21.*
- III. Similar scenario of VAR absorption as on 20.09.21 would be simulated during upcoming Unit #1 outage in November-21 and the behavior of Unit 2 would be analyzed.*

ERLDC informed that as per their observation, when UEL was in function the damping was not adequate and oscillation was growing in nature and suggested for proper tuning of UEL.

PCC advised CESC for further analysis of the event and if required, tuning of the UEL may be carried out for Budge-budge units.

PCC decided to refer the issue to forthcoming OCC meeting for further discussion regarding the event.

B.8.3: Bus tripping occurred in Eastern Region during September 2021

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

Element Name	Tripping Date	Reason	Utility
220 kV Main bus - 1 at Rangpo	11-09-2021 at 16:37 Hrs.	Mal-Operation	PGCIL ERTS 2
400 kV MAIN BUS - 2 AT FSTPP	08/09/2021 at 15:05 Hrs.	Tripped due to mal-operation of LBB relay contacts in 400 kV Malda-2 line and Bus-2 CB	Farakka NTPC

Powergrid and NTPC Farakkamay explain.

Deliberation in the meeting

Regarding the event on 11/09/2021, Powergrid informed that the disturbance occurred due to mal-operation of gas density monitor relay of Y-phase circuit breaker of 220 kV Rangpo-Rongnichu-1 bay. During investigation it was found that due to burning of timer relay the trip contacts got shorted and DC'+ve was extended to GD trip relay resulting in tripping of 220 kV Bus-1.

They further informed that the faulty relay had been replaced with spare relay. The detail report received from Powergrid is enclosed at **Annexure B8.3**.

Regarding event on 08/09/2021, NTPC representative informed that maloperation of LBB relay was due to defective timer clock. The same had been replaced with new clock.

B.8.4: Event of Smelter Load tripping at Sterlite CPP on 20th& 28thSeptember 2021.

Smelter load tripping of 400 kV Sterlite CPP was observed on two occasions i.e., on 20 & 28th September 2021 due to electrical disturbance in the downstream side which resulted into Smelter load reduction/tripping of more than 1000 MW.

- This has caused under drawl of Odisha by more than 1000 MW, with SPS action at Sterlite injection to grid was limited upto 800 MW.
- Intimation of such events is necessary in real time as this change the grid flow pattern and also such huge load tripping /change is important for Frequency response assessment purpose.

Detailed Report as received from Sterlite is attached at **Annexure B.8.4**.

SLDC Odisha & Sterlite may explain.

Deliberation in the meeting

ERLDC explained the event with drawl pattern of Odisha during the event.

It was informed that during smelter load tripping of 400 kV Sterlite CPP on 20 & 28th September 2021, Odisha drawl from grid reduced suddenly to zero from 1500 MW. The under drawl reduced

to 1000 MW after 1 minute after SPS action at Sterlite. Further the under drawl was controlled by Odisha by backing down of its own generation (Hydro and Thermal).

ERLDC suggested to review these events in view of heavy under drawl by odisha during smelter load tripping and an action plan may be devised to control the heavy under drawl from the grid during such events in future.

SLDC Odisha representative informed that at present they are not facing any issue in controlling the under drawl from the grid. However, they submitted that they would discuss internally the issues highlighted by ERLDC.

ITEM NO. B.9: Repeated Tripping of Transmission Lines and associated issues

B.9.1: Repeated Tripping of 400 kV FSTPP-KHSTPP -4.

400 kV Farakka-Kahalgaon -4 had tripped four times in the month of Sep-21 due to DT receipt at Kahalgaon end. Details of such events are provided below.

Element Name	Tripping Date	Tripping Time	Reason	Remarks	Revival Date	Revival Time
> 400KV-FSTPP-KHSTPP-4	24/09/2021	16:10	TRIPPED FROM FARAKKA END ONLY		24/09/2021	18:23
> 400KV-FSTPP-KHSTPP-4	24/09/2021	11:53	FSTPP: DT received from KHSTPP		24/09/2021	12:55
> 400KV-FSTPP-KHSTPP-4	09/09/2021	11:43	DT received at Farakka Not tripped at KHSTPP		09/09/2021	12:37
> 400KV-FSTPP-KHSTPP-4	06/10/2021	07:21	DT Received at Kahalgaon End; Tripped from Kahalgaon end only.		06/10/2021	08:52

NTPC may explain.

Deliberation in the meeting

Regarding tripping incidents in Sep-21, NTPC representative informed that commissioning work of main circuit breaker for this line was going on at Kahalgaon end during which spurious DT signal was sent to Farakka end which caused tripping of 400 kV Farakka-Kahalgaon-4 line.

PCC advised NTPC Kahalgaon to submit a disturbance report for the aforesaid tripping in 400 kV Farakka-Kahalgaon circuit-4.

Regarding tripping on 06/10/2021, NTPC representative informed that at Farakka end there was a cable fault between relay panel and PLCC panel which resulted in transmission of DT signal to Kahalgaon end and caused tripping of the line. The issue had been rectified after the disturbance.

B.9.2: Repeated Tripping of 220KV Tie Lines of Jharkhand (JUSNL)

(A) Tripping of DALTONGANJ – GARWA D/C lines.

Following trippings were occurred during month of September.

Sr No	Element Name	Tripping Date	Tripping Time	Reason
1	220KV-DALTONGUNJ-GARWAH (NEW)-2	03-09-2021	12:22	GARWAH: Z1, YB, Iy-518A, Ib-555A, 49.59km DALTONGUNJ: YB, Iy-2.8kA, Ib-2.9kA, 27.6km

2	220KV- DALTONGUNJ- GARWAH (NEW)-2	06-09-2021	09:16	Garwah B-N, 479.9 A 60.5 km
3	220KV- DALTONGUNJ- GARWAH (NEW)-2	07-09-2021	14:43	DALTONGUNJ: - R-Y, 64.4KM, Ir=Iy=1.8KA, Z-2 GARWAH: - Z-1, 25.2KM, R-Y, Ir=Ib=1.1KA
4	220KV- DALTONGUNJ- GARWAH (NEW)-2	13-09-2021	18:38	Daltongunj: A/R successful,137.7Km,0.978Ka,b-n Garwa New: Z-I, 18.07 kM,Ia=165.9A, Ib=219.3A, Ic=916.2A
5	220KV- DALTONGUNJ- GARWAH (NEW)-2	17-09-2021	11:23	A/R SUCCESSFUL FROM DALTONGANJ; GARHWA: Z-1, B-N, Fc= 0.88 kA, Fd= 54.25km
6	220KV- DALTONGUNJ- GARWAH (NEW)-2	26-09-2021	15:31	Garwah: B-N,1.4kA, 65Km, Daltongunj- did not trip

- **Fault Nature, Sag and Clearance Issue**

It was observed from DR plots that B phase current started rising slowly and then got converted to perfect phase to phase fault (as phase currents of Y and B are 180 degrees apart) due to arc over at voltage peak instance. B phase was involved in each fault.

Same phenomenon is observed in almost all cases, which indicates that the fault is occurring due to sag and clearance issues, hence proper line patrolling and healthiness of line should be maintained.

- **Non-Operation of Auto Reclose:**

In some of the incidents, it was observed that during B-phase to ground fault, B phase opening is occurring at Garwa end but after dead time A/R is not occurring and B phase kept opened until pole discrepancy relay got operated and caused tripping of line. For all these instances A/R was successful from Daltonganj end and proper A/R operation at Garwa end could have avoided the line tripping.

Detailed report is attached at **Annexure B.9.2.A.**

JUSNL may explain.

Deliberation in the meeting

ERLDC informed that repetitive tripping of 220 kV Daltonganj-Garhwa D/C had been observed in month of September-21. They added that most of the tripping were due to phase to phase fault and involves B phase. Further unsuccessful auto recloser operation were observed at Garwah end during B phase to earth fault.

JUSNL informed that thorough patrolling was carried out in the line during last summer when all the clearance issues were resolved. They added that in view of recent line tripping in Sep-21, they would again carry out patrolling of the line to resolve any vegetation/sag related issues.

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.

(B) Repeated tripping of 220 kV Chandil–Santaldih S/C line

Details of tripping are mentioned below along with issues identified.

- Most of the Faults are R-Earth Fault.
- 3 phase tripping had occurred for single phase fault due to Non operation of A/R at Chandil end.
- Delayed tripping is observed for z-2 faults due to non-availability of PLCC

S.N O	LINE NAME	TRIP DATE	TRIP TIME	Relay Indication LOCAL END	Relay Indication REMOTE END	Remarks
1	220KV CHANDIL-SANTALDIH(STPS) -1	03-09-2021	13:54	Chandil: R_N, Z I, 1.75 kA, 101.1 km	Santaldih: R_N, 17.9 km, 4.007 kA	Three phase tripping at Chandil for single phase fault.
2	220KV CHANDIL-SANTALDIH(STPS) -1	03-09-2021	17:50	Chandil: R_N, Z I, 2.61 kA, 30.07 km	Santaldih: R_N, Z II, 93.282 km, 9.230 kA	Three phase tripping at Chandil for single phase fault after Zone-2
3	220KV CHANDIL-SANTALDIH(STPS) -1	04-09-2021	09:50		Santaldih: R_N, 18 km, 4.69 kA	3 phase tripping from chandil end for single phase fault
4	220KV CHANDIL-SANTALDIH(STPS) -1	04-09-2021	11:49	Chandil: B_N, 50.1 km, 1.5 kA	Santaldih: AR successful	3 Phase tripping from ChnadilEND, A/R successful from STPS end.
5	220KV SANTALDIH (STPS)-CHANDIL-1	17-09-2021	10:35	Santaldih: R_N, Z II, 101 km, 1.33 kA	Chandil: R_N, Z I, 24 km, 2.12 kA	Three phase tripping at Chandil for single phase fault.STPStripping after Zone-2
6	220KV CHANDIL-SANTALDIH(STPS) -1	18-09-2021	14:50	Chandil: R_N, 2.77 kA, 43 km		Three phase tripping at Chandil for single phase fault.

JUSNL & WBSETCL/WBPDCL may explain.

Deliberation in the meeting

JUSNL informed that approx. length of 220 kV Chandil–Santaldih S/C line is 100 KM and out of which approx. 15KM comes under JUSNL jurisdiction and rest comes under West Bengal jurisdiction.

WBSETCL informed that clearance/vegetation issues were found in the line. The same was taken up with the local administration to resolve the issues. They further informed that all clearance related issues in the line under their jurisdiction had been resolved.

(C) Repeated Tripping of 220 kV Joda- Ramchandrapur

Details of tripping are mentioned below along with issues identified

- 3 phase tripping had occurred for single phase fault and Non operation of A/R at Ramchandrapur end.
- Delayed tripping for z-2 faults is observed due to non-availability of PLCC

S.NO	LINE NAME	TRIP DATE	TRIP TIME	Relay Indication LOCAL END	Relay Indication REMOTE END	Fault Clearance time in msec	Remarks
1	220KV JODA-RAMCHANDRA PUR-1	01-09-2021	11:20	Joda: Y_N, 1.55 kA	Ramchandrapur: 4.4 km, 0.75 kA	700	Tripped on DEF protection from Joda in 700 msec F/c was 1.6ka. Single phase tripping within 100 msec from Ramchandrapur
2	220KV JODA-RAMCHANDRA PUR-1	02-09-2021	10:20	Joda: 41 km, 0.5 kA	Ramchandrapur: 97.4 km, 1.9 kA	100	R_ph opened from Joda within 100 msec, rest two phase opened after 500 msec.
3	220KV JODA-RAMCHANDRA PUR-1	03-09-2021	10:24	Joda: R_N, Z I, 42.37 km, 1.377 kA	Ramchandrapur: R_N, 98.4 km, 1.89 kA	150	Three phase tripping for single phase fault. PLCC seems unhealthy.
4	220KV JODA-RAMCHANDRA PUR-1	17-09-2021	11:13	Joda: A/r successful	Ramchandrapur: R_N, Z I, 58.3 km, 2.28 kA	100	A/r from Joda end only. PD time at Ramchandrapur end may be checked. Other two phase didn't open even after 2.5 seconds
5	220KV JODA-RAMCHANDRA PUR-1	25-09-2021	18:42	Joda: B_N, Z II, 128 km, 1.28 kA	Ramchandrapur: B_N, 9.6 km, 10 kA	400	Three phase tripping for single phase fault after z-2 time from joda end as no carrier received .

6	220KV JODA- RAMCHANDRA PUR-1	30-09- 2021	04: 45	Joda: B_N, Z I, 47.4 km, 2.6 kA	100	A/r attempt from Joda end failed after 1 sec
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JUSNL may explain.

Deliberation in the 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.

Regarding PLCC, JUSNL representative informed that PLCC link is not healthy at their end. They informed that OEM had visited the site and they are waiting for price quotation from the OEM.

PCC advised JUSNL to take up the issue with OEM for early restoration of the PLCC at Ramchandrapur end.

Further JUSNL informed that during OEM visit it was observed that PLCC signal from Joda end was not available at RCP end. PCC advised OPTCL to look into it and rectify PLCC issue at their end too.

(D)Repeated Tripping of Daltonganj-Chatra D/C Line:

Details of line tripping is given below:

	Element Name	Tripping Date	Tripping Time	Reason	Remarks
>	220KV-DALTONGANJ- CHATRA-1	22/09/2021	12:00	Daltonganj: Y-B Fault, FD: 31.49km, FC: Iy = 3.204 kA, Ib = 3.207 kA	
>	220KV-DALTONGANJ- CHATRA-1	21/09/2021	09:03	Daltonganj: DT received, Chatra: mistake by operator .	
>	220KV-DALTONGANJ- CHATRA-1	14/09/2021	22:57	Daltonganj: YB, 31.55km, Iy-2.1kA, Ib-2.1kA, Chatra: Not tripped	
>	220KV-DALTONGANJ- CHATRA-2	15/09/2021	12:30	Bus bar protection operated at Chatra, Dal=Z-3,239KM,R- N fault:0.96kA	
>	220KV-DALTONGANJ- CHATRA-2	13/09/2021	16:09	Daltonganj=Z- 1,81.62KM,I=57.01A,IY= 1.98KA,Ib=1.967KA	FTC of the line done
>	220KV-DALTONGANJ- CHATRA-2	10/09/2021	11:58	DIRECTIONAL EARTH FAULT RELAY OPERATED - S PH - 217 AMP , R , Y PH - 52 AMP	
>	220KV-DALTONGANJ- CHATRA-1	05/09/2021	02:15	DALTONGANJ: R_N, Z-1, FD-57.44 KM, FC-4.149 KA,	Anti theft charge from Daltonganj end.

JUSNL may explain.

Deliberation in the meeting

JUSNL informed that 220 kV Daltonganj-Chatra line passes through forest area and clearance issue are found mostly in line locations under forest area.

They further informed that they had communicated this issue to forest department and the tree pruning work would be carried out after getting approval from the concerned authority.

PCC advised JUSNL to share location details at which clearance issues were found along with time schedule for resolving issues.

ITEM NO. B.10: 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 44th TCC 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.

SLDC Bihar may update.

Deliberation in the meeting

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.

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.10.2**.

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 JUSNL for timely implementation of the Islanding Scheme.

SLDC Jharkhand & TVNL may update.

Deliberation in the meeting

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.

ITEM NO. B.11: Tripping Incidence in month of September 2021

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

Concerned utilities may explain.

Deliberation in the meeting

*Explanation from constituents related to tripping incidents in the month of September 2021 is attached at **Annexure B.11**.*

PART- C::OTHER ITEMS

ITEM NO. C.1: Schedule of Training Program on PSCT and PDMS by PRDC

As part of 4th year support period, PRDC has conducted online training program on PDMS & PSCT at Bihar & West Bengal. In continuation to same PRDC is going to conduct online training program for Jharkhand, Odisha and Sikkim as per the following schedule.

SI No.	Date	State
1	27.09.2021-28.09.2021	Jharkhand
3	04.10.2021-05.10.2021	Odisha
5	25.10.2021-26.10.2021	Sikkim

Members may note.

Deliberation in the meeting

PRDC informed that training program on PDMS/PSCT had been completed for Jharkhand and Odisha as per the schedule. Further they informed that training program for Sikkim would be conducted on 25.10.21-26.10.21.

ITEM NO. C.2: 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 44th ERPC 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.

Concerned utilities may update.

Deliberation in the meeting

ERPC Secretariat informed that requirement for additional MiP-PSCT license key had been received from SLDC Odisha and Jharkhand. PCC advised concerned utilities to submit their additional requirement of PSCT license, if any, to ERPC secretariat within fifteen(15) days.

ITEM NO. C.3: Review of guideline for over voltage setting for anti-theft charging of 765 kV, 400 kV and 220 kV Lines --ERLDC

In 67thPCCmeeting,Relay settings were finalized for anti -theft charging of lines where over voltage setting was finalized as mentioned below:

- Over voltage Stage-I - Overvoltage pick up should be minimum of all the lines connected from the charging substation with minimum grading and minimum time delay corresponding to other lines which are in service.
- Further, it was informed to utilities to keep it above 105 % but it should also be lower than any of the other lines over voltage setting.

However, many utilities keep it at 105 % itself which is leading to tripping of line during charging itself. These can be due to operational regime voltage of substation being around 416-420 kV and during charging the over voltage criteria of 105 % is already reached.

In 106th PCC Meeting,

ERLDC explained the issue they are observing with regard to overvoltage settings of anti-theft charged lines and proposed certain modification w.r.t. to the guidelines for overvoltage settings of anti-theft charge lines.

Based on the discussion in the meeting, the following guidelines are suggested.

➤ ***For anti-theft charging of 765 & 400 kV lines at charging station end:***

- *Overvoltage pick up should be below the minimum over voltage setting of all lines from that charging substation.*
- *The settings shall be more than 105% and preferably just below(say 1 or 2 % below) the minimum over voltage setting of all lines from that substation.*

➤ ***Overvoltage settings for remote end (open end) substation for anti-theft charged lines:***

- *The utility may in its discretion keep overvoltage settings at remote end of line and a trip command may be sent to charging station in order to avoid voltage stress on the equipment (LA, CVT etc.) during overvoltage condition. In such case, the settings shall be greater than*

the rated voltage of equipment e.g.: for 400 and 765 kV lines it should not be less than 110% and for 220 kV it should be at least 112%.

- *In case high voltage is observed at remote end of the line, the affected utility may request respective SLDC or ERLDC to open the circuit for safety of the equipment.*
- ***For anti-theft charging of 220 kV lines, the similar guidelines as given above may be followed.***

Members may discuss.

Deliberation in the meeting

It was informed that no comment was received from any of the utilities.

PCC advised concerned utilities to follow the above guidelines for overvoltage settings during anti-theft charging of 765/400 kV lines.

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

The decisions of previous PCC meetings are given.

Members may update the latest status.

Deliberation in the meeting

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

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

C.5.1: FTC for LILO of 220 kV Purnea-Begusarai-I at Khagaria

220 kV New Purnea (PG)-Begusarai-I is being LILOed at Khagaria. After LILO, lines will be as below:

Name	Conductor type	Length
220 kV New Purnea (PG)-Khagaria-I	ACSR Triple Zebra	102 km
220 kV Begusarai-Khagaria-I	ACSR Triple Zebra	98 km

Protection coordination may be required as per the following table:

Reason	S/S may be affected	Remarks	Utility to respond
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<p>FTC OF 220 kV New Purnea (PG)-Khagaria I & 220 kV Khagaria-Begusarai I (LILo of 220 kV New Purnea (PG)-Begusarai I at Khagaria)</p>	<p>Khagaria</p>	<p>Protection coordination to be done for all newly connected elements as per ERPC's guidelines. Busbar protection to be ensured.</p> <p>Adjacent longest line for existing lines at Khagaria was previously 220 kV New Purnea (PG)-Begusarai. Now it will change. Hence, Zone-3 settings for existing lines at Khagaria may be reviewed keeping in view it should not encroach next voltage level.</p>	<p>BSPTCL. Received</p>
	<p>New Purnea (PG)</p>	<p>Protection coordination to be done for all newly connected elements as per ERPC's guidelines.</p>	<p>PG ER-I, Received</p>
	<p>Begusarai</p>	<p>Protection coordination to be done for all newly connected elements as per ERPC's guidelines.</p>	<p>BSPTCL, Received</p>
	<p>S/S connected to New Purnea(PG): Purnea(PG), Madhepura</p>	<p>Adjacent longest line will be now 220 kV New Purnea(PG)-Khagaria,(102 km). Hence Zone-3 settings at Purnea(PG) and Madhepura end may be reviewed keeping in view it should not encroach next voltage level. Kindly check and confirm any setting revision if any change in adjacent short and long line.</p>	<p>BSPTCL, PG ER-I Received</p>
	<p>S/s connected to Begusarai: Samastipur, Barauni (BTPS)</p>	<p>Adjacent longest line for Samastipur, Barauni (BTPS) will be now 220 kV Begusarai-Khagaria (98 km). Hence Zone-3 settings at Samastipur, Barauni (BTPS) end may be reviewed keeping in view it should not encroach next voltage level. Kindly check and confirm any setting revision if any change in adjacent short and long line.</p>	<p>BSPTCL</p>

Following details needs to be shared:

- Respective Utilities may share whether revision of any existing protection setting at above mentioned S/S is required or not. In case of any revision, the revised setting may be shared with ERPC and ERLDC.
- Status of carrier protection and PLCC channel in the all above mentioned section may be shared.
- Utilities should ensure that proper protection coordination are in place after charging of these lines/elements.

Concerned Utilities may update.

Deliberation in the meeting

BSPTCL and Powergrid were advised to share revised protection settings for their respective ends to ERPC/ ERLDC for necessary updation of the settings in PDMS database.

C.5.2: FTC for LILO of 132kV Madhepura -Sonbarsa at Saharsa (PMTL)

As per information received, 132 kV Madhepura -Sonbarsa will be liloed at 132 kV Saharsa (PMTL). Details of the line

Name	Conductor type	Length
132 kV Madepura – Saharsa New	ACSR Twin Moose	37.56 km
132 kV Saharsa New - Sonbarsa	ACSR Twin Moose	52.36 km

Protection coordination may be required as per the following table.

Reason	S/S may be affected	Remarks	Utility to respond	Response received
Lilo of 132 kV Madhepura -Sonbarsa	Madhepura	Protection coordination to be done for all newly connected elements as per ERPC's guidelines. Longest/Shortest line may change.	BSPTCL	Received
	Sonbarsa	Protection coordination to be done for all newly connected elements as per ERPC's guidelines. Longest/Shortest line may change.	BSPTCL	Received
	Saharsa New	Protection coordination to be done for all newly connected elements as per ERPC's guidelines.	PMJTL	Received

	S/S connected to Supaul ,Sahrsta ,Kusheswar,SimriBhaktiyarpur	Kindly check and confirm any setting revision for change in adjacent short line.	BSPTCL	Received
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Following Details needs to be shared:

- PMTL/BSPTCL may share whether revision of any existing protection setting at above mentioned S/S is required or not. In case of any revision, the revised setting may be shared with ERPC and ERLDC.
- The protection setting at Madhepura/Sahrsta New /Sonbarsa may be shared with ERPC and ERLDC.

Status of carrier protection and PLCC channel in the all above mentioned section may be shared.

Concerned Utilities may update.

Deliberation in the meeting

BSPTCL and PMTL were advised to share revised protection settings for their respective ends to ERPC/ ERLDC.

LIST OF PARTICIPANTS IN 107TH PCC MEETING HELD ON 22/10/2021 AT 10:30 AM

Full Name	Join Time	Email
ERPC Kolkata	10/22/2021, 10:13:04 AM	ERPC@KolkataMST.onmicrosoft.com
Ankur Kumar (Guest)	10/22/2021, 10:13:20 AM	
DEBDAS MUKHERJEE WBPDC (Guest)	10/22/2021, 10:13:21 AM	
Amaresh Mallick, ERLDC (Guest)	10/22/2021, 10:13:28 AM	
RAVIKANT KUMAR RAM	10/22/2021, 10:16:39 AM	
Raj Protim ERLDC	10/22/2021, 10:23:05 AM	
Alok Pratap Singh ,ERLDC (Guest)	10/22/2021, 10:23:05 AM	
Kurshna samntray	10/22/2021, 10:24:16 AM	krushna.samantray@opgc.co.in
Sh. Satish Kant	10/22/2021, 10:24:51 AM	SKANT@NTPC.CO.IN
TD, ADP, JUSNL (Guest)	10/22/2021, 10:25:10 AM	
eeetdhzb (Guest)	10/22/2021, 10:25:40 AM	
jitesh kumar (Guest)	10/22/2021, 10:26:06 AM	
CRITL	10/22/2021, 10:26:26 AM	
SMS SAHOO,DGM,OPTCL,BHUBANESWAR (Guest)	10/22/2021, 10:26:58 AM	
Prasanna Kumar Sahoo	10/22/2021, 10:27:11 AM	PRASANNASAHOO@NTPC.CO.IN
Dharmbeer Singh	10/22/2021, 10:30:06 AM	
EMR MRDL (Guest)	10/22/2021, 10:31:07 AM	
arindam bsptcl	10/22/2021, 10:31:17 AM	
Saugato Mondal , ERLDC" (Guest)	10/22/2021, 10:31:24 AM	
shanker	10/22/2021, 10:31:37 AM	
SANJEEV KUMAR (Guest)	10/22/2021, 10:32:28 AM	
Prachi Gupta	10/22/2021, 10:33:53 AM	
DILSHAD ALAM	10/22/2021, 10:33:54 AM	
Gopal Mitra (Guest)	10/22/2021, 10:33:55 AM	
Saurav Sahay Ch. Mgr ERLDC (Guest)	10/22/2021, 10:34:03 AM	
Rajiv Kumar Singh CESC	10/22/2021, 10:34:08 AM	
D K Singh (Guest)	10/22/2021, 10:34:30 AM	
Uma Kanta Mishra	10/22/2021, 10:35:28 AM	
Govinda Chandra Sethi (Guest)	10/22/2021, 10:35:50 AM	
GAGAN KUMAR EEE	10/22/2021, 10:36:13 AM	
Akash Modi,ERLDC (Guest)	10/22/2021, 10:36:14 AM	
Anil Krishna	10/22/2021, 10:36:14 AM	
shadab hasan	10/22/2021, 10:37:31 AM	
Sunil	10/22/2021, 10:37:40 AM	
Ch.Mohan Rao	10/22/2021, 10:38:04 AM	
Madan Prasad	10/22/2021, 10:38:27 AM	
"prabhat k (TPTL) (Guest)	10/22/2021, 10:39:01 AM	
TVNL (Ashish Kr Sharma) (Guest)	10/22/2021, 10:39:05 AM	
rajendra prasad (Guest)	10/22/2021, 10:39:11 AM	
Deepak Kr. EEE, BSPTCL	10/22/2021, 10:40:32 AM	
A Shukla	10/22/2021, 10:42:11 AM	
Teesta-V Power Station (Guest)	10/22/2021, 10:42:13 AM	
Ashish kumar	10/22/2021, 10:43:43 AM	

wasim	10/22/2021, 10:44:46 AM	
Pallavi Kansal	10/22/2021, 10:47:03 AM	pallavi.k@tvptl.com
DHARM DAS MURMU (Guest)	10/22/2021, 10:48:43 AM	
abhinaba basu	10/22/2021, 10:52:14 AM	
Chandan Kumar	10/22/2021, 10:52:46 AM	admin@POSOCO965.onmicrosoft.com
Sucharit Mondal	10/22/2021, 10:53:05 AM	
Amresh Prusti	10/22/2021, 10:58:31 AM	amresh.prusti@opgc.co.in
Sudipta Maiti DVC (Guest)	10/22/2021, 10:59:55 AM	
Gautam Nayak (Guest)	10/22/2021, 11:00:19 AM	
Sayan Sarkar	10/22/2021, 11:16:50 AM	
Madhab Mukherjee (Guest)	10/22/2021, 11:18:13 AM	
Manjesh Kumar	10/22/2021, 11:22:20 AM	MANJESHKUMAR@NTPC.CO.IN
mmp bsptcl (Guest)	10/22/2021, 11:27:09 AM	
Swarnima Singh	10/22/2021, 11:27:55 AM	
RAHUL RAJ	10/22/2021, 11:44:28 AM	
BDKumar	10/22/2021, 11:48:20 AM	
SLDC, Ranchi (Guest)	10/22/2021, 11:48:45 AM	
Nishant Kumar Shankwar	10/22/2021, 11:51:05 AM	Nishant.Kumar@SEKURA.IN
sk	10/22/2021, 12:08:17 PM	
s choudhary	10/22/2021, 12:09:48 PM	
PS	10/22/2021, 12:15:22 PM	
Prabhat	10/22/2021, 12:16:31 PM	
Veerabrahmam (PRDC) (Guest)	10/22/2021, 12:26:52 PM	
Sashank Narayan (R&D, PRDC) (Guest)	10/22/2021, 1:07:42 PM	
Dilip kant Jha Eee Bsptcl	10/22/2021, 1:23:39 PM	
Sukdev (PG) (Guest)	10/22/2021, 1:29:33 PM	
SLDC ODISHA (Guest)	10/22/2021, 1:51:48 PM	

पावर सिस्टम ऑपरेशन करपोरेशन लिमिटेड

(भारत सरकार का उद्यम)

POWER SYSTEM OPERATION CORPORATION LIMITED

(A Government of India Enterprise)



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

CIN: U40105DL2009GOI188682

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

घटना संख्या: 12-09-2021/1

दिनांक: 07-10-2021

Report on the grid event in Eastern Region (पूर्वी क्षेत्र में गिड घटना पर रिपोर्ट)**Summary of the event (घटना का सारांश):**

At 16:01 hrs, all lines at 132 kV level of 220/132 kV Patratu S/s tripped except 220/132 kV ICT 2, 132/33 kV ICT to clear fault in 132 kV Patratu-Patratu(DVC)(idle charged line). At 16:32 Hrs, 132/33 kV ATR tripped leading to 15 MW load loss at Patratu. During restoration, while charging 132 kV Patratu-Patratu (DVC) line at 18:43 Hrs, total power failure occurred and 220 kV side also became dead at Patratu.

Date / Time of disturbance: Event 1: 12-09-2021 at 16:01 hrs**Event 2:** 12-09-2021 at 18:43 hrs

- **Event type: Event 2:** GD-1
- **Systems/ Subsystems affected:** 220/132 kV Patratu (PTPS)
- **Load and Generation loss.**
 - No generation loss was reported during the event.
 - Around 15 MW load loss reported at Patratu by SLDC Jharkhand

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

Nil

Major elements tripped (प्रमुख ट्रिपिंग):**Event 1**

- 220 kV Patratu-Hatia-2
- 132 kV Patratu-Kanke
- 132 kV Patratu-Hatia
- 132 kV Patratu-Patratu (DVC)-1 (Idle-charged)

Event 2

- 220 kV Main Bus 1 & 2 at Patratu
- 220 KV Patratu-Tenughat
- 220 kV Patratu-Hatia D/c
- 150 MVA 220/132 kV ICT 2 at Patratu
- 132 kV Patratu-Hatia
- 132 kV Patratu-Kanke
- 132 kV Patratu-Patratu (DVC)-I-(idle charged)

Network across the affected area (प्रभावित क्षेत्र का नक्शा)

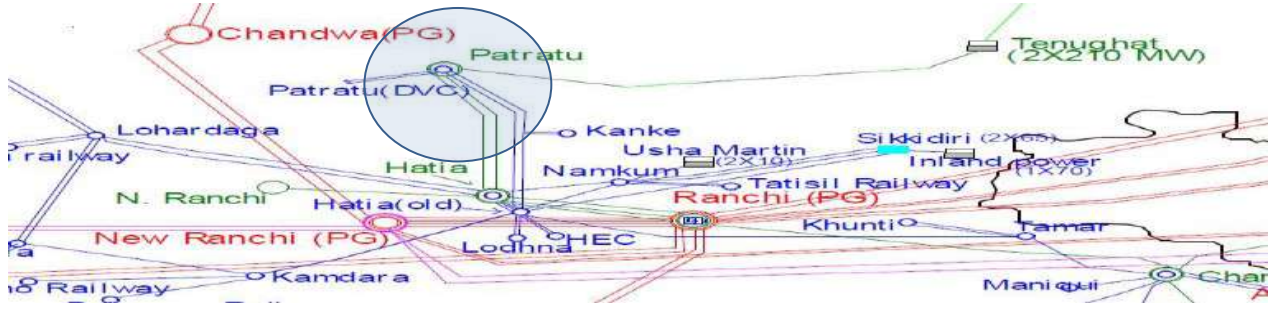


Figure 1: Network across the affected area

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
16:01	220 kV Patratu-Hatia-2	Y_B fault	-	6 kV dip in Y-ph and B-ph at Rancho. Fault clearance time: 1.3 seconds
	132 kV Patratu-Kanke	Y_B, Z I, Iy:1.337 kA, Ib: 1.388 kA	-	
	132 kV Patratu-Hatia	Y_B, Iy:2.11 kA, Ib: 2.16 kA	-	
	132 kV Patratu-Patratu (DVC)-1 (Idle charged)	Only B_ph tripped	-	
18:43	220 kV Bus-1 & 2 at Patratu	-	-	7 kV Dip in Y-ph at Rancho. Fault clearance time: 1.3 seconds
	220 kV Patratu-Hatia D/c	Didn't trip	Ckt II tripped on O/c	
	220 kV Patratu-Tenughat	Didn't trip	E/F O/C, Iy: 1.003 kA	
	150 MVA 220/132 kV ICT-2 at Patratu	O/C		
	132 kV Patratu-Hatia	B_N, Z I		
	132 kV Patratu-Kanke	B_N, Z I	-	
	132 kV Patratu-Patratu (DVC)-1 (Idle charged)	-	-	

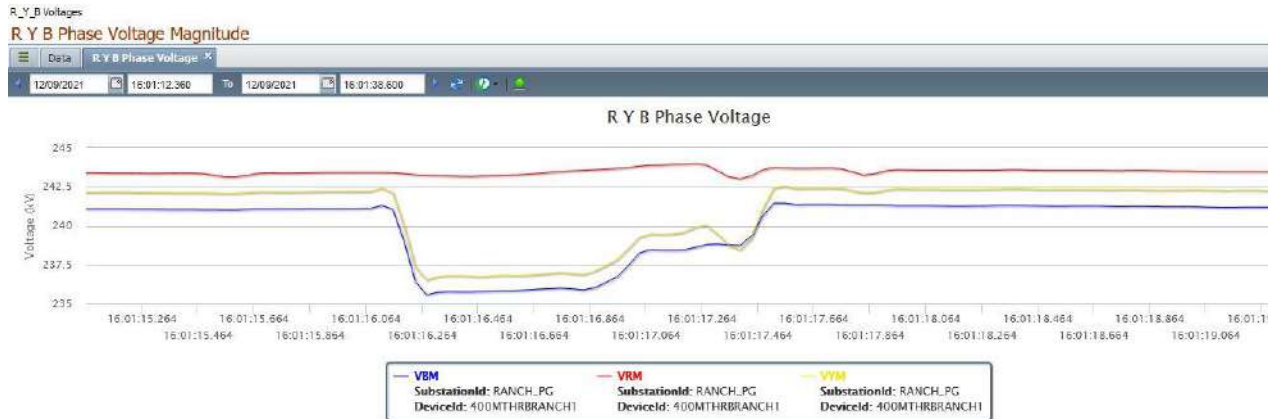


Figure 3: PMU snapshot of 400/220 kV Ranchi S/s (16:01 Hrs)

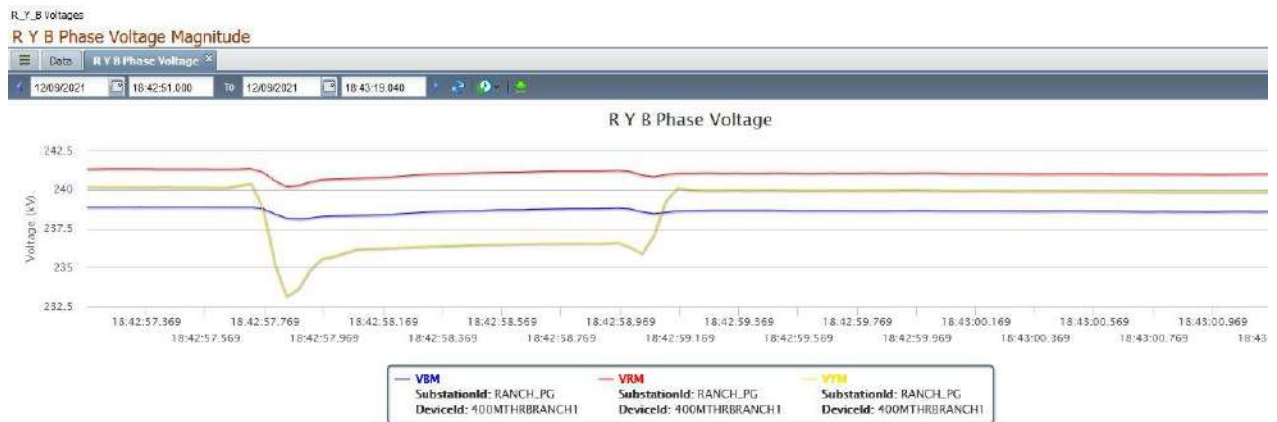
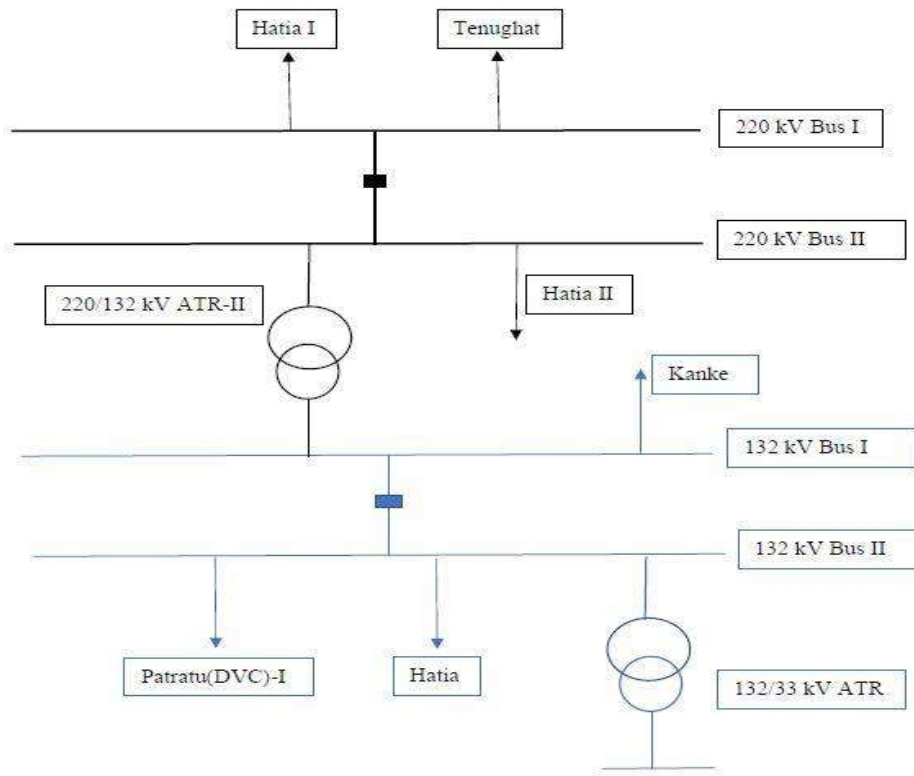


Figure 4: PMU snapshot of 400/220 kV Ranchi S/s (18:42 Hrs)

Restoration (पूर्वावस्था की प्रप्ति)

Transmission/Generation element name	Restoration time
220 kV Bus 1& Bus 2 at Patratu	19:27
220 kV Patratu-Tenughat	19:49
220 kV Patratu-Hatia-1	19:39
220 kV Patratu-Hatia-2	16:50/19:27
150 MVA 220/132 kV ICT 2 at Patratu	19:46
132 kV Patratu-Hatia-1	16:37/19:51
132 kV Patratu-Hatia-2	16:37/20:00
132 kV Patratu-Kanke	16:38/19:50
132 kV Patratu-Patratu(DVC)-1	-

Analysis of the event (घटना का विश्लेषण):



SLD of 220/132 kV Patratu S/s

Event 1 (16:01 Hrs):

- Y-ph jumper of 132 kV Patratu-Patratu (DVC)-1 (Idle charged) snapped and touched B-ph of the line, creating a phase-to-phase fault.
- DR of Patratu-Patratu(DVC) line shows tripping command triggered, though breaker didn't open of any phase. LBB also didn't operate. Fault was sensed in Z-4 which should not occur.
- After 1.2 seconds, fault came in Zone I and then line tripped.
- 132 kV Patratu-Hatia & 132 kV Patratu-Kanke tripped after 800 msec on distance protection.
- 220 kV Patratu-Hatia-2 also tripped. Reason for tripping of line may be shared.
- 220/132 kV ICT-2 & 132/33 kV ICT didn't trip and Namkum load was being fed.

At 16:32 Hrs, 132/33 kV ICT tripped. Reason may be shared.

Event 2 (18:43 Hrs):

- When breaker of 132 Kv Patratu -Patratu line closed, SOTF triggered but breaker again didn't open.
- 132 kV Patratu-Hatia and 132 kV Patratu-Kanke tripped within 150 msec on distance protection. Both lines shouldn't trip immediately as fault was in reverse direction.
- 220 kV Patratu-Hatia-2 tripped on O/c within 300 msec.
- 220 kV Patratu-Tenughat tripped after 1.3 seconds.
- 220/132 kV ICT 2 tripped on O/c after 1.3 seconds.

Protection issue (सुरक्षा समस्या):

- Breaker of 132 kV Patratu-Patratu didn't open during both instances despite tripping command triggered. LBB also didn't operate.
- B_ph breaker of Patratu-Patratu opened after 1.3 seconds on Zone-4 for a forward fault.
- 132 kV Patratu-Hatia and Patratu-Kanke tripped in Zone-1 for a reverse fault.
- Relay PT inputs for R_ph and Y_ph for all 132 kV elements seem swapped. That's why a fault in forward direction in 132 kV Patratu-Patratu is seen in Zone-4 and for other lines fault is coming in Zone-1. This aspect may be checked.
- 220 kV Patratu-Hatia 2 tripped on O/c within 300 msec for a downstream fault. Reason maybe checked.
- Reason for tripping of 220 kV Patratu-Hatia 1 in 2nd instance may be shared.
- Reason for tripping of 132/33 kV ICT at 16:32 Hrs maybe shared
- Detailed report for the event is awaited from JUSNL.

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

Status of Reporting (रिपोर्टिंग की स्थिति):

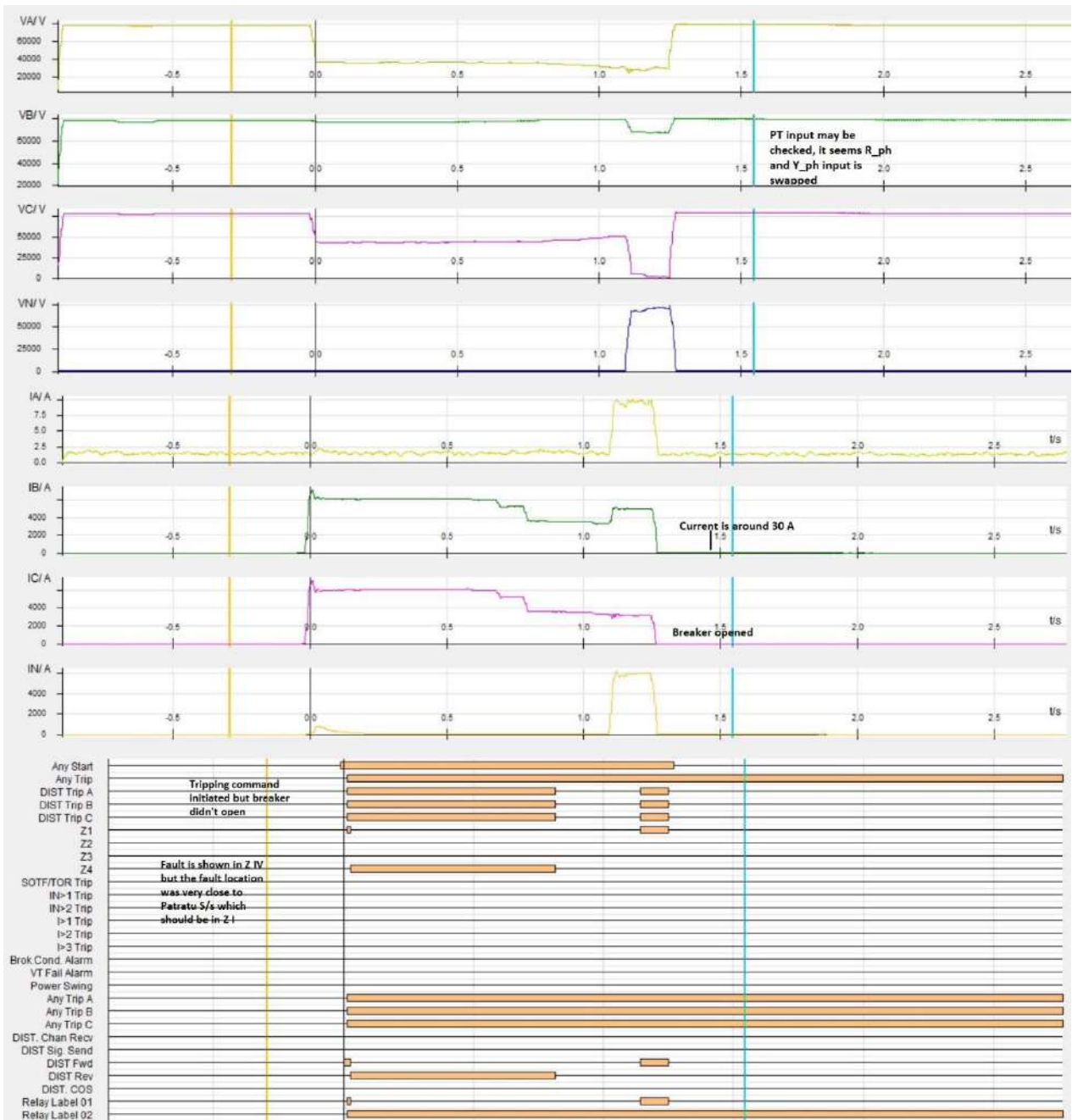
- Complete DR/EL yet to be received from JUSNL

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

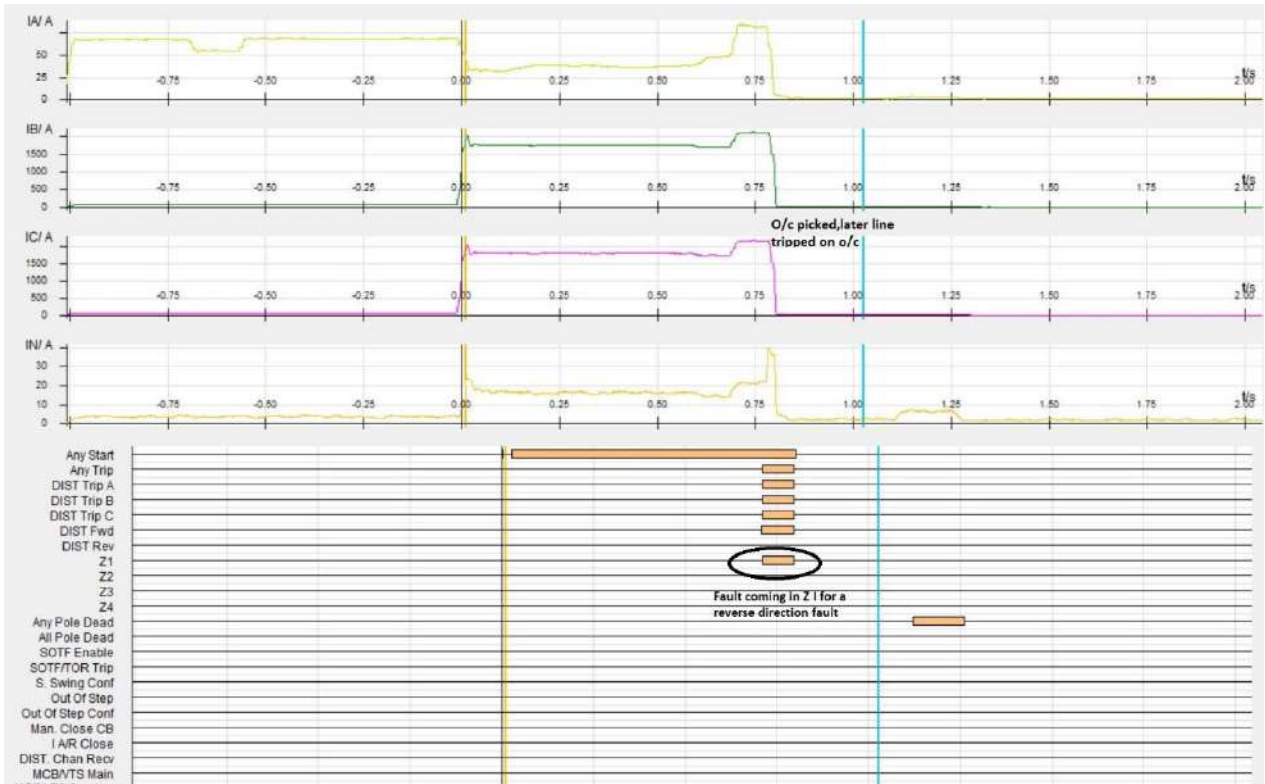
Sequence of event not recorded at the time of event.

Annexure 2: DR recorded

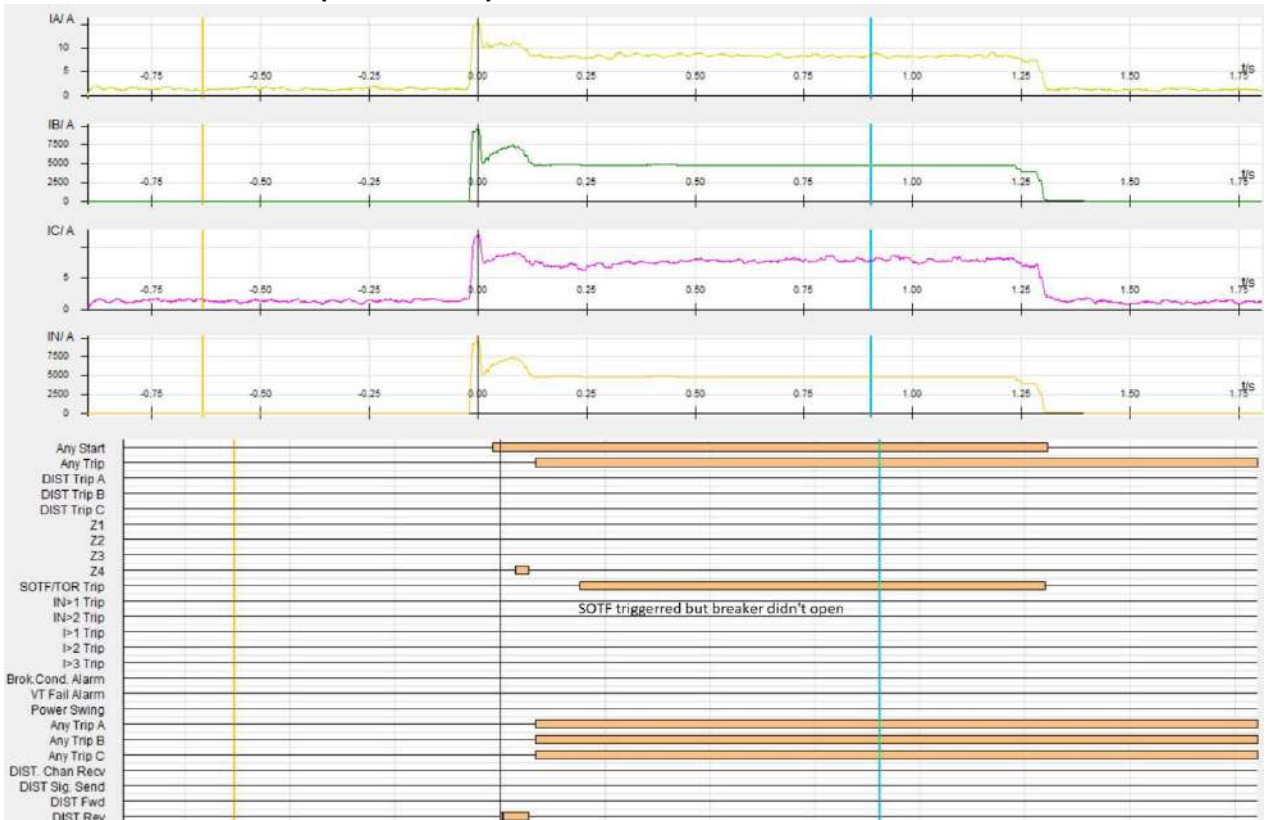
132 kV Patratu-Patratu (DVC)-1st instance



132 kV Patratu-Hatia



132 kV Patratu-Patratu (2nd instance)



Grid Disturbance at 220/132 kV PTPS on 12.09.2021 at 16:03 and 18:43hrs.



Overview of Incident : -

- **At 16:01 hrs, all 132 kV level lines of 220/132 kV Patratu S/s tripped except 220/132 kV ICT 2, 132/33 kV ICT to clear fault in 132 kV Patratu-Patratu(DVC)(idle charged line).**

During restoration, while charging 132 kV Patratu-Patratu (DVC) line at 18:43 Hrs, total power failure occurred and 220 kV side also became dead at Patratu.

- **Y phase jumper snapped at tower no – 1 of 132 kV PTPS – DVC (5C) transmission line, which was identified on 13.09.21.**
- **Load Loss – 15 MW**
- **Weather – Normal**
- **Major elements tripped:**
 - i. 220 kV PTPS – Hatia -II ckt -02
 - ii. 132 kV PTPS- Kanke (8C), 132 kV PTPS - Hatia -I (9C) and 132 kV PTPS – DVC (5C)

Pre-fault Condition :-

220 kV PTPS

220 kV TTPS

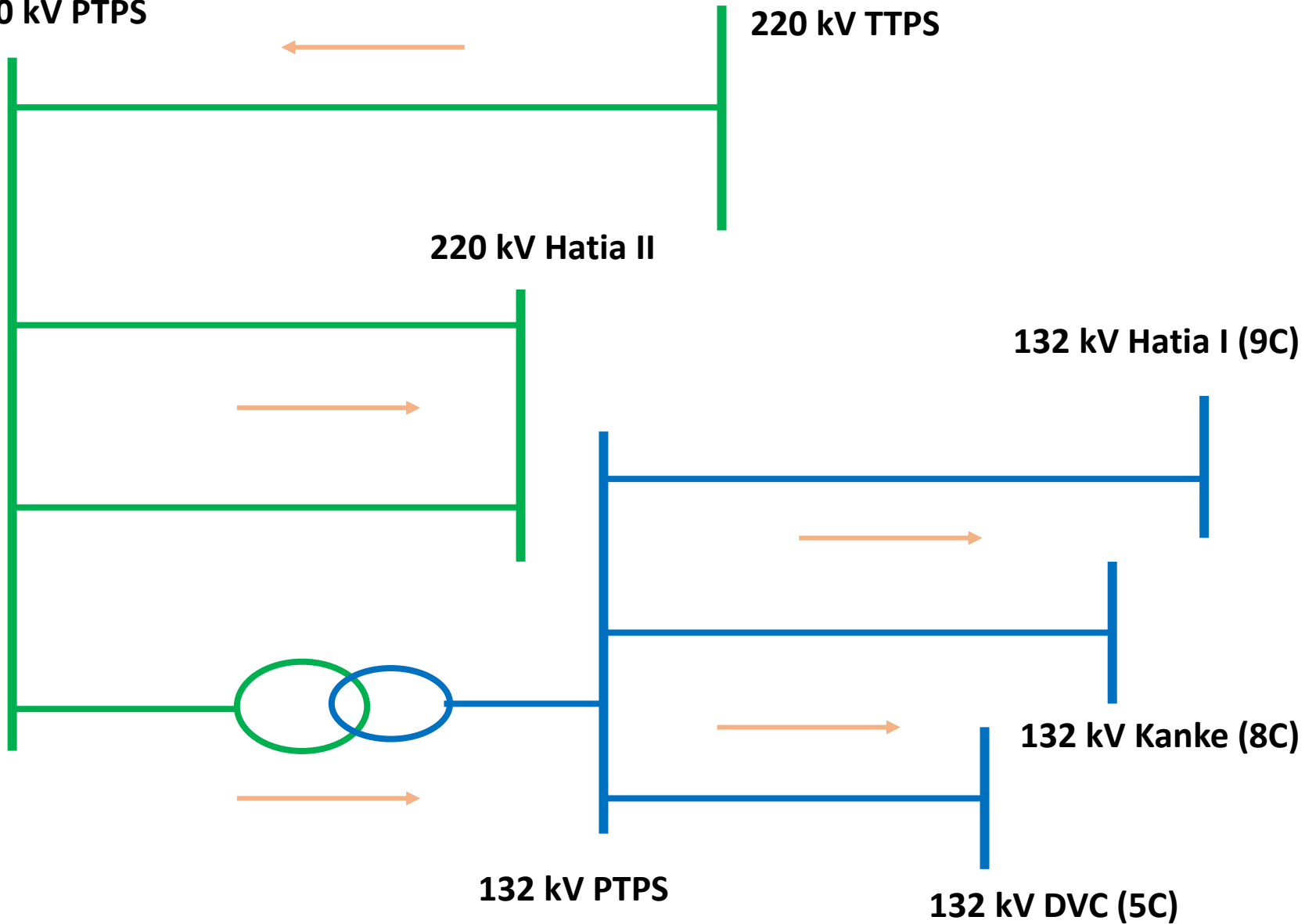
220 kV Hatia II

132 kV Hatia I (9C)

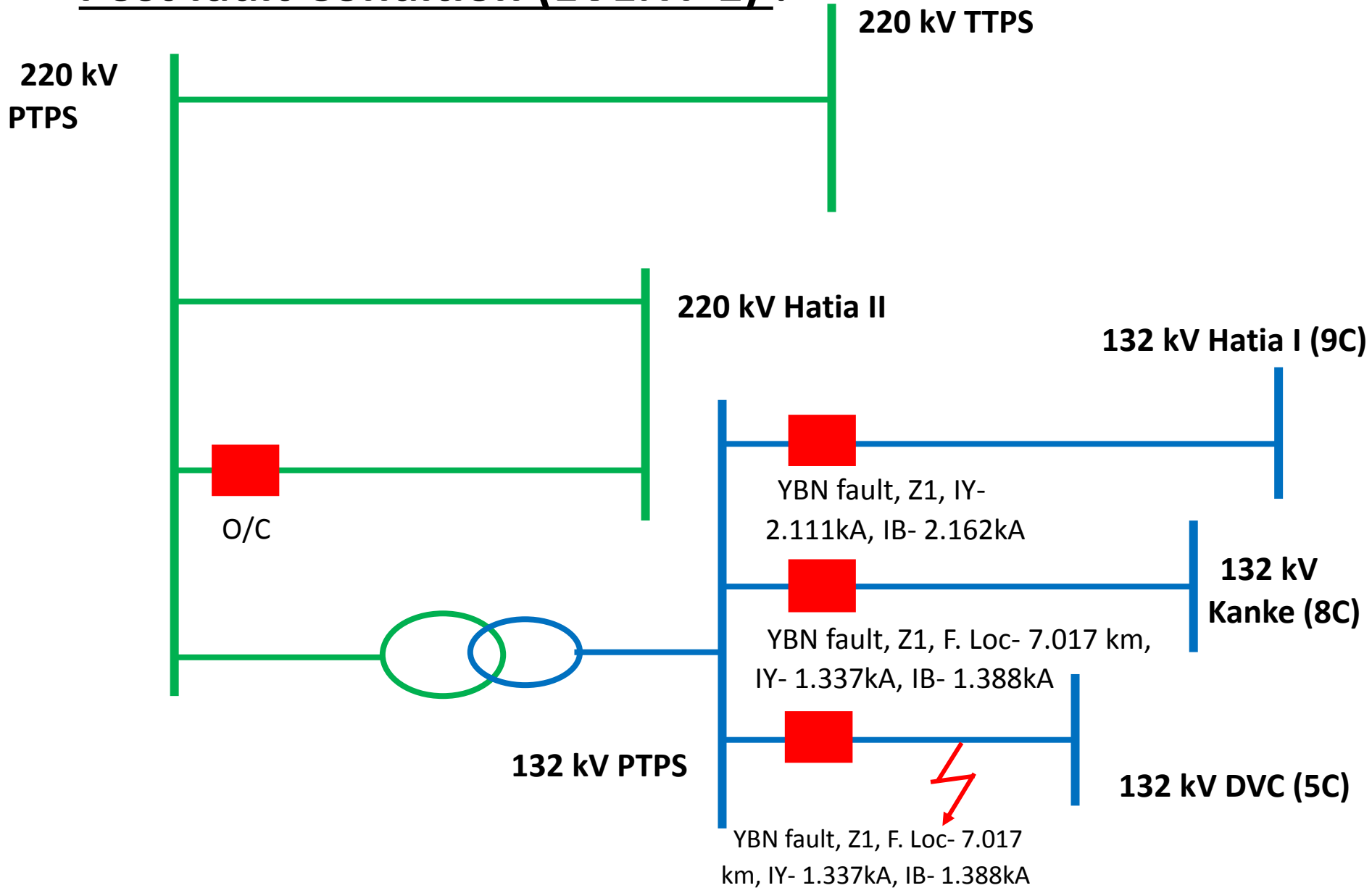
132 kV Kanke (8C)

132 kV PTPS

132 kV DVC (5C)

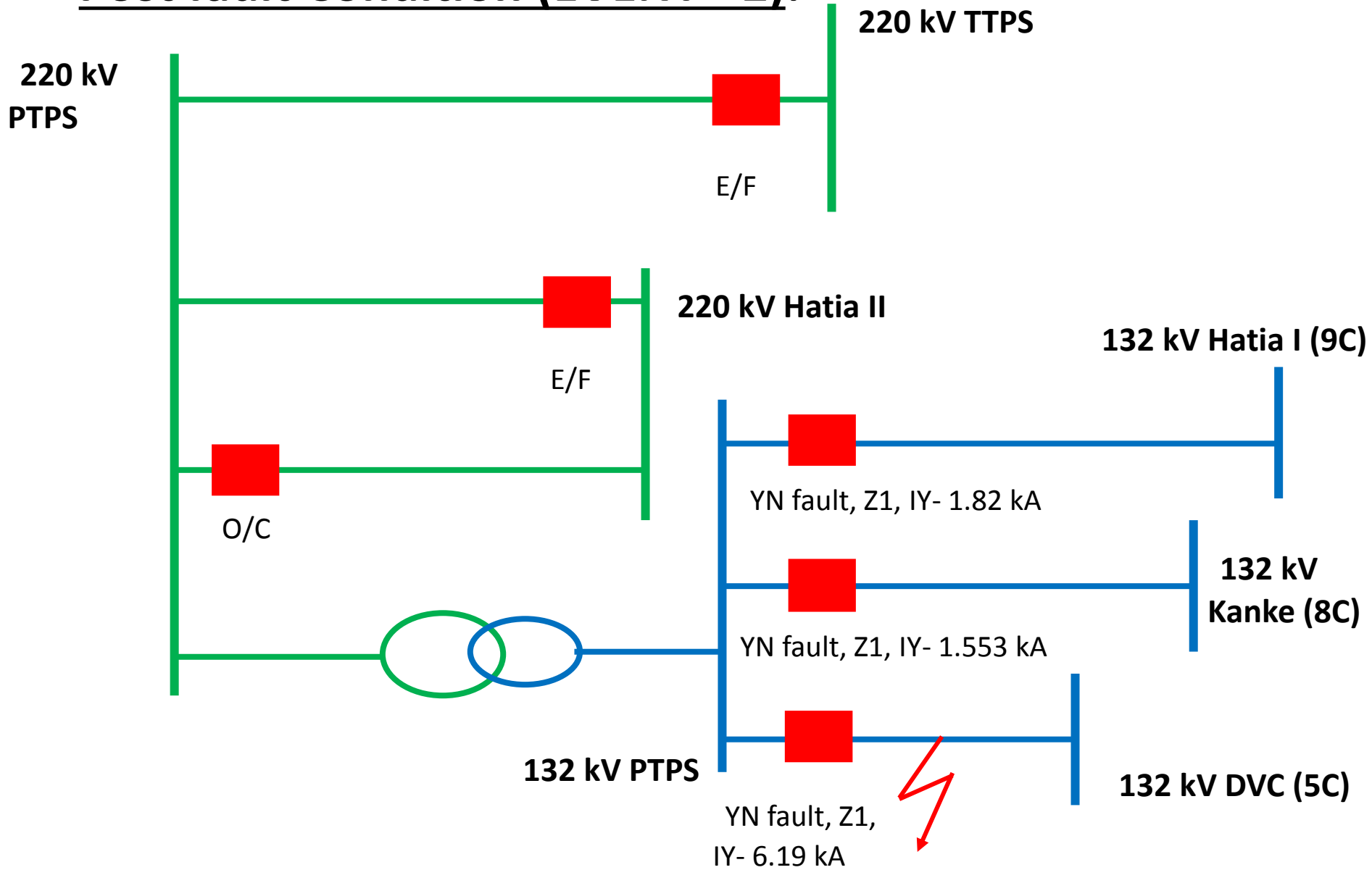


Post fault Condition (EVENT-1) :-



Y phase jumper snapped at tower no -1

Post fault Condition (EVENT - 2):-



Y phase jumper snapped at tower no -1

• Relay Indications (EVENT -1) :-

Element Name	Relay indication at End 1	Relay indication at End 2	Remarks
220 kV PTPS – Hatia II ckt – 01	Did not tripped.	Did not tripped.	
220 kV PTPS – Hatia II ckt - 02	YB fault, I>1 trip (O/C 1 st stage), F. dur – 246.7 ms	Did not tripped.	Due to B phase VT fuse failure <u>O/C Setting</u> – (CT- 600/1) Pick up – 1.0 A (Fwd), TMS- 0.600 s . VTS – Non-directional, Time VTS – 200 ms
220 kV PTPS – TTPS s/c	Did not tripped.	-----	
100 MVA, 220/132 kV ICT- 02	Did not tripped.	Did not tripped.	

• **Relay Indications (EVENT -1) :-**

Element Name	Relay indication at End 1	Relay indication at End 2	Remarks
132 kV PTPS – Hatia I (9C) S/C	YBN fault, Z1, Fault Loc- 0.000m, IR - 83.12 A, IY- 2.111kA, IB- 2.162kA, VRN- 35.83kV, VYN- 78.04kV, VBN- 44.72kV Fault Resist -30.57 Ω	Did not tripped.	
132 kV PTPS – Kanke (8C) S/C	YBN fault, Z1, Fault Loc- 7.017 km, IR – 63.16 A, IY- 1.337kA, IB- 1.388kA, VRN- 36.04kV, VYN- 77.56kV, VBN- 44.68kV Fault Resist – 3.79 Ω	Did not tripped.	
132 kV PTPS – DVC (5C)	YBN fault, Z1, Fault Loc- 3.141 km, IR – 0.00 A, IY- 6.190kA, IB- 6.132kA, VRN- 36.33kV, VYN- 77.06kV, VBN- 43.53kV Fault Resist -10.10 Ω	-----	

• Relay Indications (EVENT -2) :-

Element Name	Relay indication at End 1	Relay indication at End 2	Remarks
220 kV PTPS – Hatia II ckt – 01	Did not tripped.	YN fault, E/F, IY -1.81 kA, F. Dur- 1.3 s	E/F setting (non dir) Pick up- 0.15 T. Delay – 1.25 s CT- 1200/1
220 kV PTPS – Hatia II ckt - 02	YN fault, IN>1 trip (E/F 1 st stage), F. dur – 253.3 ms, IR – 110.85 A, IY- 807.4 A, IB- 262.75A, IN- 451.8A	Did not tripped.	Due to B phase VT fuse failure. E/F Setting – (CT- 600/1) Pick up – 0.20 A (Fwd), TMS- 0.550 s . VTS – Non-directional, Time VTS – 200 ms
220 kV PTPS – TTPS s/c	Did not tripped.	YN fault, E/F, IY- 1.003 kA F. Dur -1.268 s	
100 MVA, 220/132 kV ICT- 02	Did not tripped.	Did not tripped.	

• Relay Indications (EVENT- 2) :-

Element Name	Relay indication at End 1	Relay indication at End 2	Remarks
132 kV PTPS – Hatia I (9C) S/C	YN fault, Z1, Fault Loc- 4.22 km, IR – 569.4 A, IY- 1.82 kA, IB- 659.0 A, VRN- 77.63 kV, VYN- 76.3 kV, VBN- 1.005 kV Fault Resist -26.39 Ω	Did not tripped.	
132 kV PTPS – Kanke (8C) S/C	YN fault, Z1, Fault Loc- 5.956 km, IR – 146.4 A, IY- 1.553 kA, IB- 544.4 A, VRN- 77.64 kV, VYN- 76.33 kV, VBN- 1.011 kV Fault Resist – 39.77 Ω	Did not tripped.	
132 kV PTPS – DVC (5C)	YN fault, Z1, Fault Loc- 3.141 km, IR – 0.00 A, IY- 6.190kA, IB- 6.132kA, VRN- 36.33kV, VYN- 77.06kV, VBN- 43.53kV Fault Resist -10.10 Ω	-----	

• Tripping Analysis :-

Event 1 (16:01 Hrs):

- At 16:01 hrs, all 132 kV level lines of 220/132 kV Patratu S/s tripped except 220/132 kV ICT 2, 132/33 kV ICT to clear fault in 132 kV Patratu-Patratu(DVC) (idle charged line).
- Y-ph jumper of 132 kV Patratu- Patratu (DVC)-1 (Idle charged) snapped and touched B-ph of the line, creating a phase-to-phase fault (which was identified on 13.09.21)

Initially, Fault was sensed in Z-4 and after 1.2 seconds, fault came in Zone- I and then line tripped.

- 132 kV Patratu- Hatia & 132 kV Patratu- Kanke tripped after 800 msec on Z1 distance protection.
- As the fault was in 132 kV Patratu- Patratu (DVC)-1 but fault was sensed in Z4 and 132 kV PTPS – Hatia I (9C) S/C and 132 kV PTPS – Kanke (8C) S/C sensed in Z1. It seems that Relay PT inputs for R_ph and Y_ph for all 132 kV elements swapped. Also, from DR it was evident that fault was in Y ph and B ph but voltage dip occurred in R ph and B ph.
- 220 kV Patratu-Hatia-2 tripped on O/C within 300 ms due to the B phase VT fuse failure. As VTS function is kept on Non-directional and VTS time is 200 ms in O/C setting.
- In DR and EL of 220/132 kV ICT-2 showed tripping command triggered, though breaker didn't open in any of the event. It seems there is any issue in tripping circuit.

• Tripping Analysis :-

Event 2 (16:43 Hrs):

- After 16:01 hrs event during restoration, while charging of 132 kV Patratu-Patratu (DVC) line at 18:43 Hrs, total power failure occurred and 220 kV side also became dead at Patratu.
- Y phase jumper snapped at tower no – 1 of 132 kV PTPS – DVC (5C) transmission line, which was identified on 13.09.21.
- When breaker of 132 Kv Patratu -Patratu line closed, SOTF triggered but breaker didn't tripped.
- 132 kV Patratu- Hatia and 132 kV Patratu- Kanke tripped within 150 msec on Z1 distance protection.
- As the fault was in 132 kV Patratu- Patratu (DVC)-1 but fault was sensed SOTF in Z4 and 132 kV PTPS – Hatia I (9C) S/C and 132 kV PTPS – Kanke (8C) S/C sensed in Z1. It seems that Relay PT inputs for all 132 kV elements swapped. Also, from DR it was evident that fault was in Y ph but voltage dip occurred in B ph.
- 220 kV Patratu-Hatia-2 tripped on E/F within 300 msec due to the B phase VT fuse failure. As VTS function is kept on Non-directional and VTS time is 200 ms in E/F setting.
- 220 kV Patratu - Tenughat and 220 kV Patratu-Hatia-1 tripped on E/F after 1.3 seconds from remote end.
- In DR and EL of 220/132 kV ICT-2 showed tripping command triggered, though breaker didn't open in any of the event. It seems there is any issue in tripping circuit.
- Eventually the fault was cleared after tripping of 220 kV Patratu - Tenughat and 220 kV Patratu-Hatia-1.

Remedial Measures to be taken :-

- Breaker and tripping circuit of 132 kV Patratu- Patratu_DVC (8C) need to be checked and tested.
- Relay PT inputs for R_ph and Y_ph for all 132 kV elements seem swapped. This aspect need to be checked.
- Breaker and Tripping circuit of 220/132 kV ICT-2 need to be checked and tested.
- PT fuse for distance protection relay of 220 kV Patratu – Hatia II ckt -2 need to be checked.

THANK YOU

पावर सिस्टम ऑपरेशन करपोरेशन लिमिटेड

(भारत सरकार का उद्यम)

POWER SYSTEM OPERATION CORPORATION LIMITED

(A Government of India Enterprise)



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CIN: U40105DL2009GOI188682

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घटना संख्या: 03-09-2021/1

दिनांक: 01-10-2021

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

Summary of the event (घटना का सारांश):

At 21:52 hrs, R_ph Bus PT of 220 kV Bus-2 at Ramchandrapur burst, leading to tripping of both 220 kV buses at Ramchandrapur. This led to total power failure at Ramchandrapur. Around 200 MW load loss occurred in Adityapur, Rajkharaswan and Jadugoda.

Date / Time of disturbance: 03-09-2021 at 21:52 hrs

- **Event type:** GD-1
- **Systems/ Subsystems affected:** 220/132 kV Ramchandrapur
- **Load and Generation loss.**
 - No generation loss was reported during the event.
 - Around 200 MW load loss reported during the event at Adityapur, Chandil, Jadugoda

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

- NIL

Major elements tripped (प्रमुख ट्रिपिंग):

- 220 kV Main Bus I & II at Ramchandrapur
- 220 KV Jamshedpur-Ramchandrapur I, II & III (400/220 kV ICT I, ICT II & ICT III at Jamshedpur)
- 220 kV Joda-Ramchandrapur
- 220 kV Chandil-Ramchandrapur
- 220 kV Chaibasa-Ramchandrapur D/c
- 3*150 MVA 220/132 kV ICT I, ICT II, ICT III at Ramchandrapur

Network across the affected area (प्रभावित क्षेत्र का नक्शा)

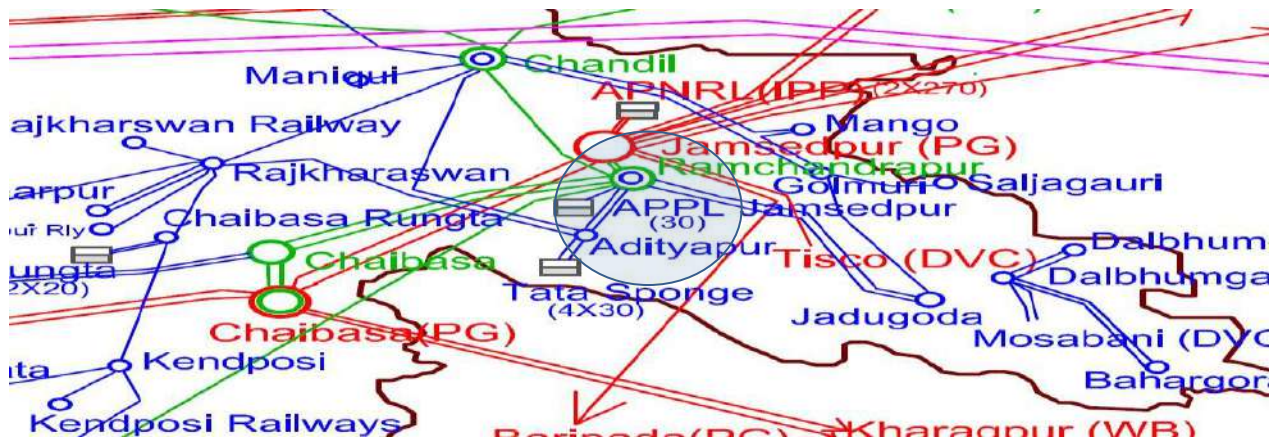


Figure 1: Network across the affected area

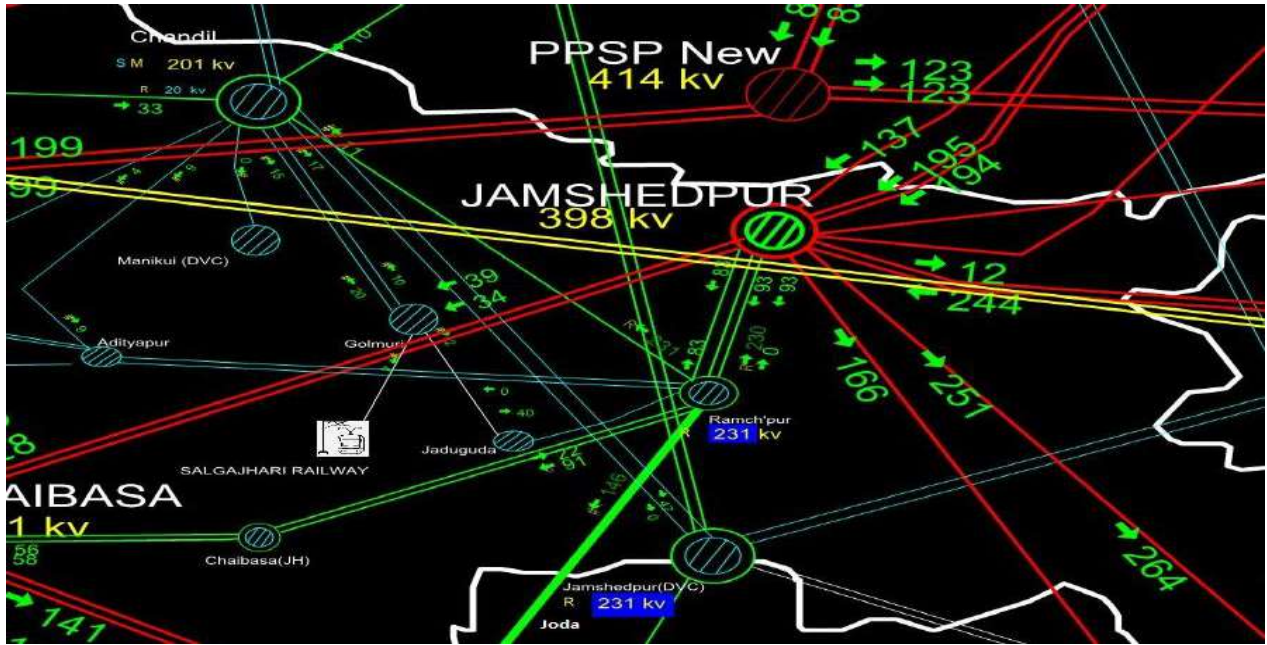


Figure 2: SCADA snapshot of the system

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

समय	नाम	उप केंद्र 1 रिले संकेत	उप केंद्र 2 रिले संकेत	पीएमयू पर्यवेक्षण
21:52	220 kV Bus-I, Bus II at Ramchandrapur	R_ph Bus PT of 220 kV Bus I burst	-	Around 50 kV dip in R_ph, 28 kV dip in Y_ph at Jamshedpur
	220 kV Ramchandrapur-Jamshedpur I, II, III		Didn't trip from 400kV side	
	220 kV Ramchandrapur-Chaibasa D/c		-	
	220 kV Ramchandrapur-Chandil		-	
	220 kV Ramchandrapur-Joda		-	
	3*150 MVA 220/132 kV ICTs at Ramchandrapur		-	



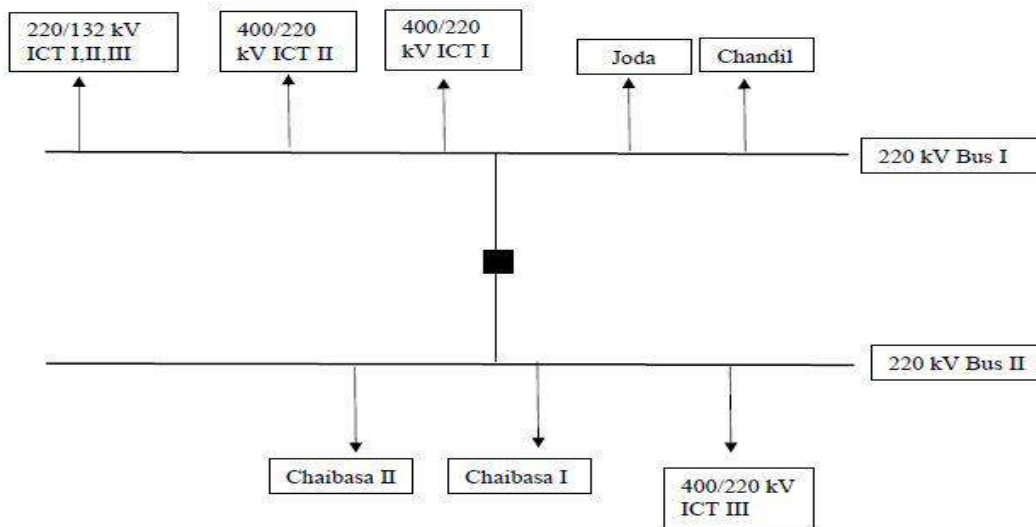
Figure 3: PMU snapshot of 400/220 kV Jamshedpur S/s

Restoration (पूर्वावस्था की प्रप्ति)

Transmission/Generation element name	Restoration time
220 kV Bus 1 at Ramchandrapur	01:28
220 kV Bus 2 at Ramchandrapur	02:56
220 kV Jamshedpur-Ramchandrapur I	01:39
220 kV Jamshedpur-Ramchandrapur II	01:47
220 kV Jamshedpur-Ramchandrapur III	02:56
220 kV Ramchandrapur-Chandil	01:43
220 kV Joda-Ramchandrapur	02:48
220 kV Ramchandrapur-Chaibasa I	01:28
220 kV Ramchandrapur-Chaibasa II	14:31 (04.09.2021)
150 MVA 220/132 kV ICT I at Ramchandrapur	01:39
150 MVA 220/132 kV ICT II at Ramchandrapur	01:47
150 MVA 220/132 kV ICT III at Ramchandrapur	02:56

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

- Schematic Bus diagram of Ramchandrapur is as below:



220/132 kV Ramchandrapur Schematic Bus diagram

- R_ph Bus PT of 220 kV Bus II burst. As there was no busbar protection, the fault should be cleared either by Zone-4 of local end or Z-2 of remote end.
- Chaibasa Ckt-2 tripped in Zone-2 from Chaibasa end, and in Zone-4 from Ramchandrapur end.
- Chaibasa ckt-1 tripped in E/F (Non directional within 100 ms) from Ramchandrapur end, While from Chaibasa end R_phase breaker opened immediately and rest two phase opened after 1.2 seconds. **(Same was also observed in previous disturbance, needs to be rectified).**
- Bus coupler tripped within 100 ms, still Remote ends connected to BUS-1 (Chnadil, Joda) were seeing the fault and tripped in Zone-2, this shows that PT burst of BUS-2 may also have caused fault in Bus 1. Local end RCP for both the lines sensed fault in zone-4.
- 220/132 Kv ICT 1&2 &3 tripped on non-directional high set O/C within 50ms. **(This needs to be reviewed and some delay of 100-150 ms may be provided with proper study).** As for close end line fault clearance within z-1 may also cause tripping of ICT.
- 400/220 kV ICT I tripped on differential protection (R_ph). Fault was on 220 kV bus then why differential protection operated for external fault.
- Root cause analysis for PT burst to be done.

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):

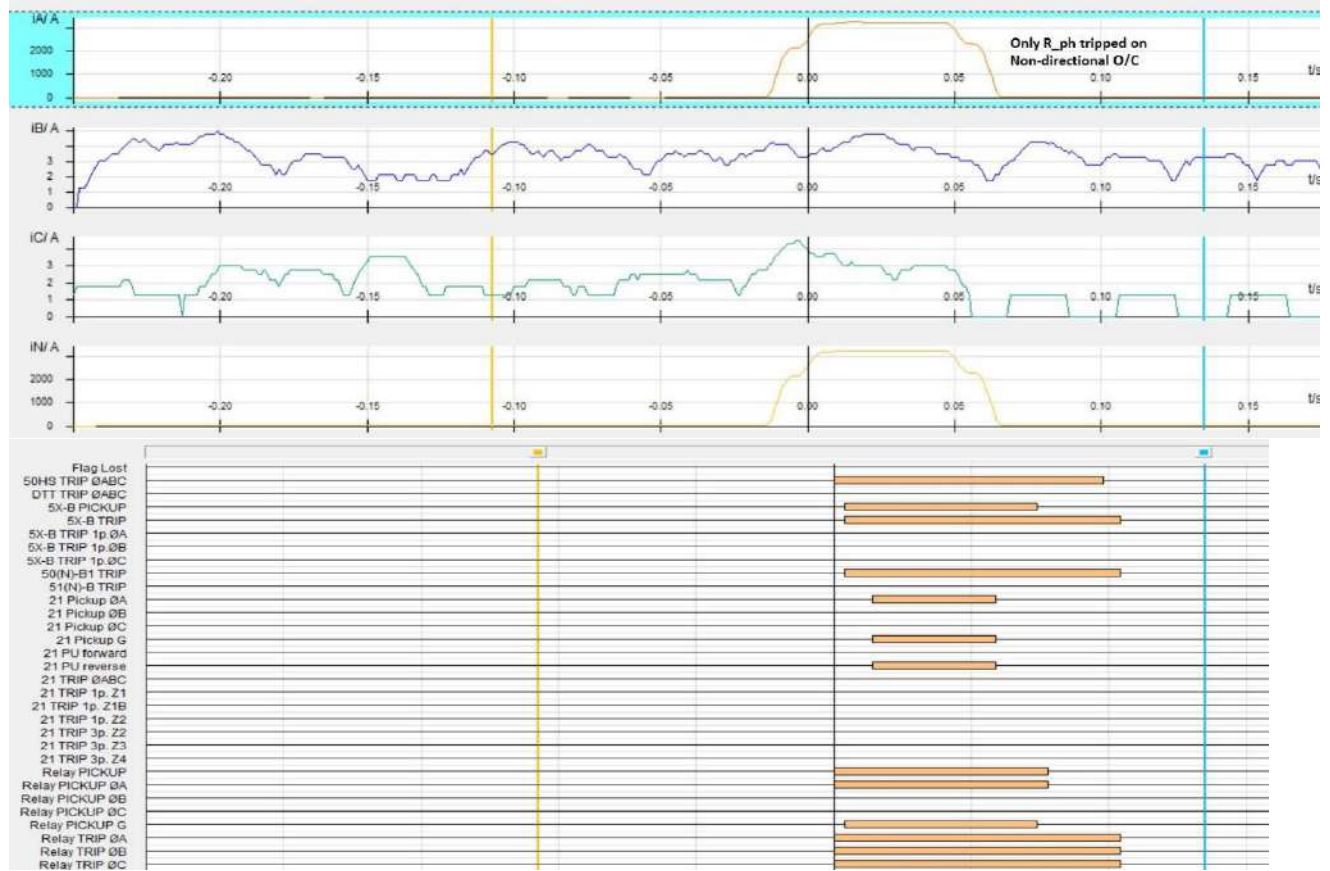
- DR/EL received from JUSNL
- DR/EL received from PG ER-I

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

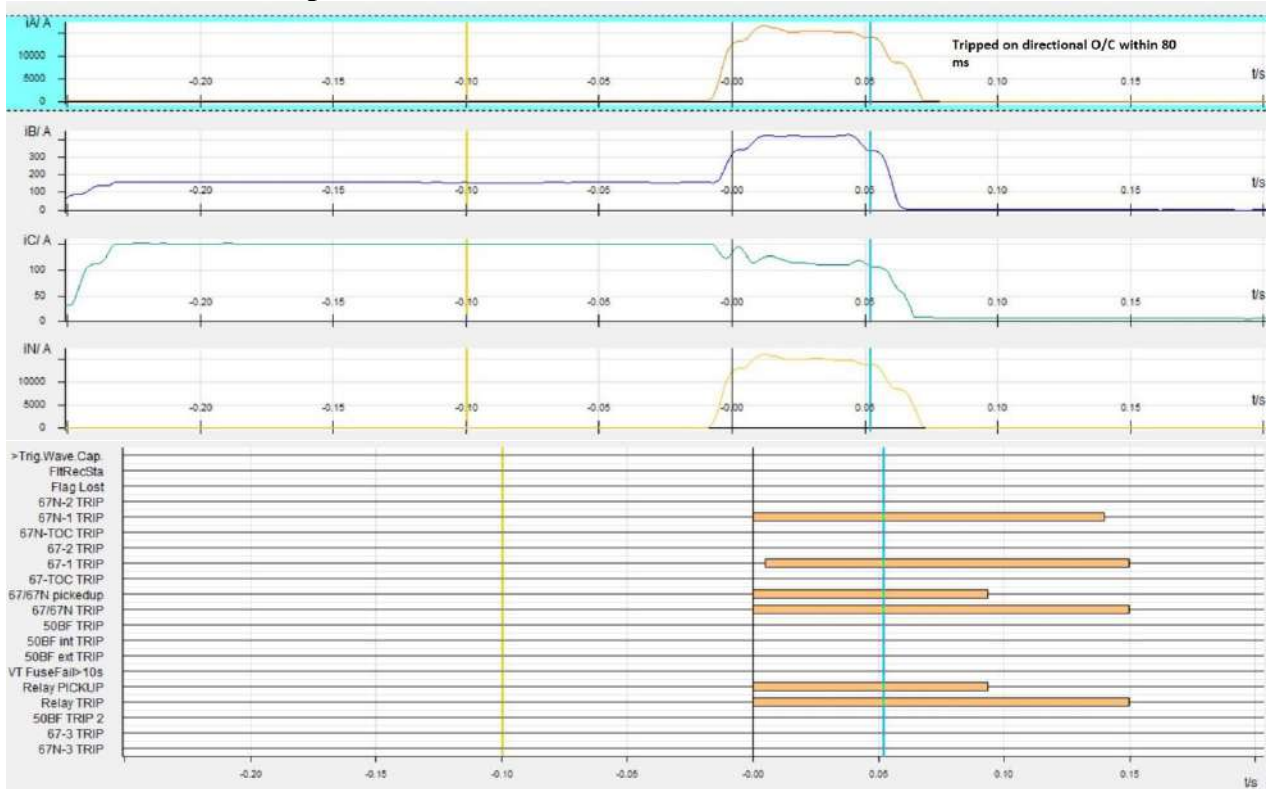
Sequence of event not recorded at time of event.

Annexure 2: DR recorded

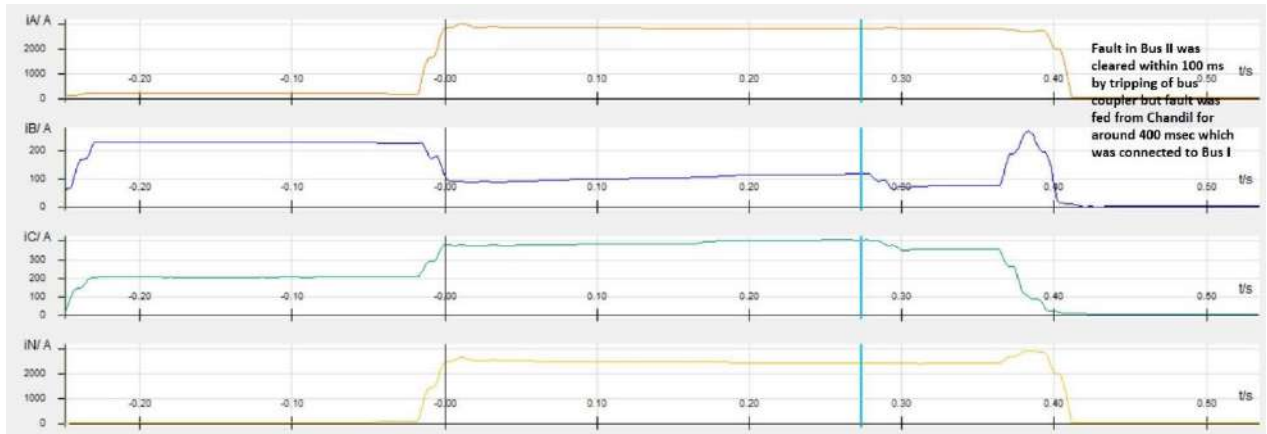
DR of 220 kV Ramchandrapur-Chaibasa I



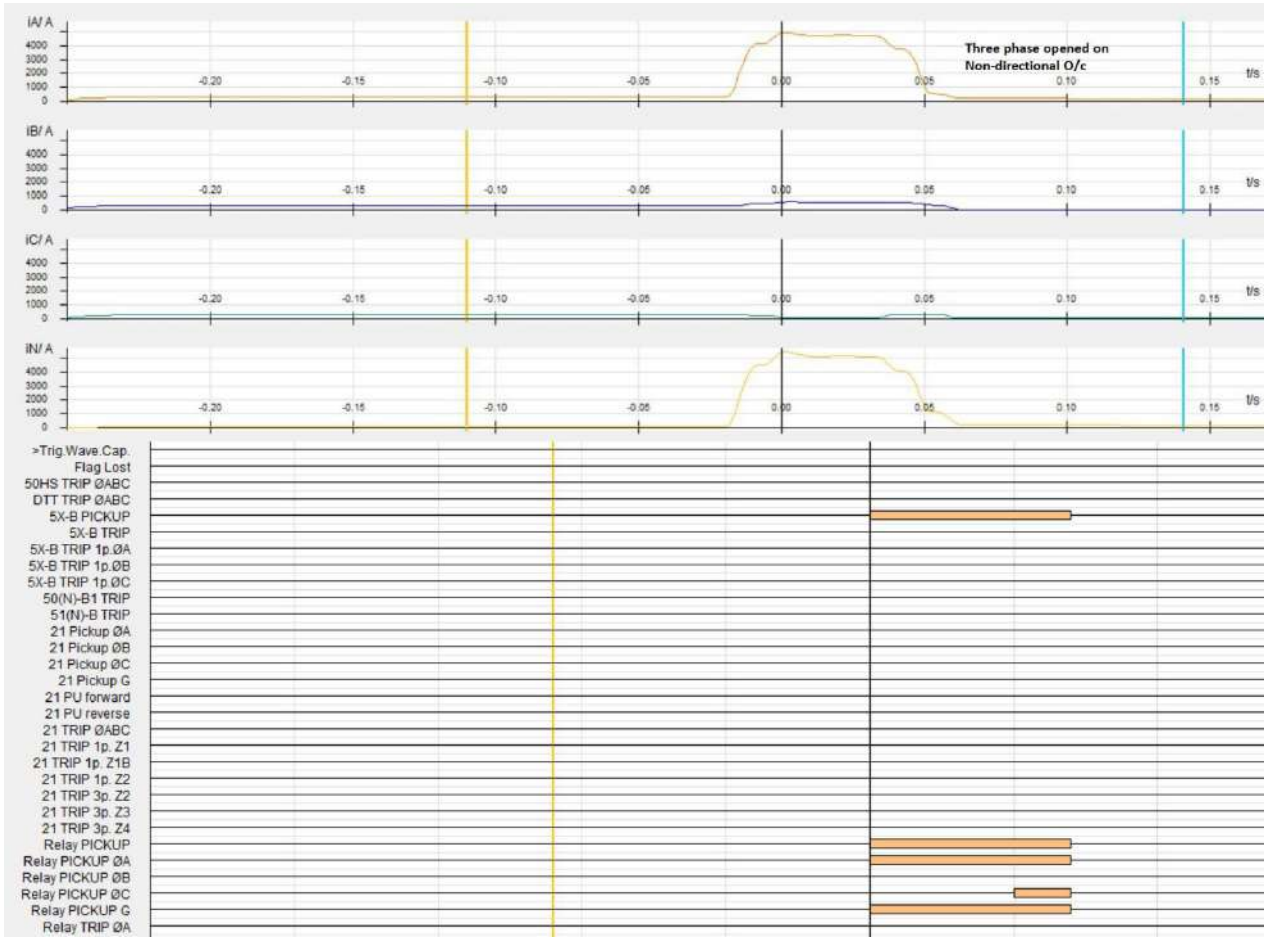
DR of 220 kV Bus coupler



DR of 220 kV Ramchandrapur-Chandil at Chandil



DR of 220/132 kV ICT I



पावर सिस्टम ऑपरेशन करपोरेशन लिमिटेड

(भारत सरकार का उद्यम)

POWER SYSTEM OPERATION CORPORATION LIMITED

(A Government of India Enterprise)



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

CIN: U40105DL2009GOI188682

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

घटना संख्या: 26-09-2021/1

दिनांक: 07-10-2021

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

Summary of the event (घटना का सारांश):

At 15:31 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 34 MW during the event (including traction load loss of 11 MW at Garhwa).

Date / Time of disturbance: 26-09-2021 at 15:31 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 34 MW load loss reported during the event at Garhwa by Jharkhand SLDC.

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

- 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)

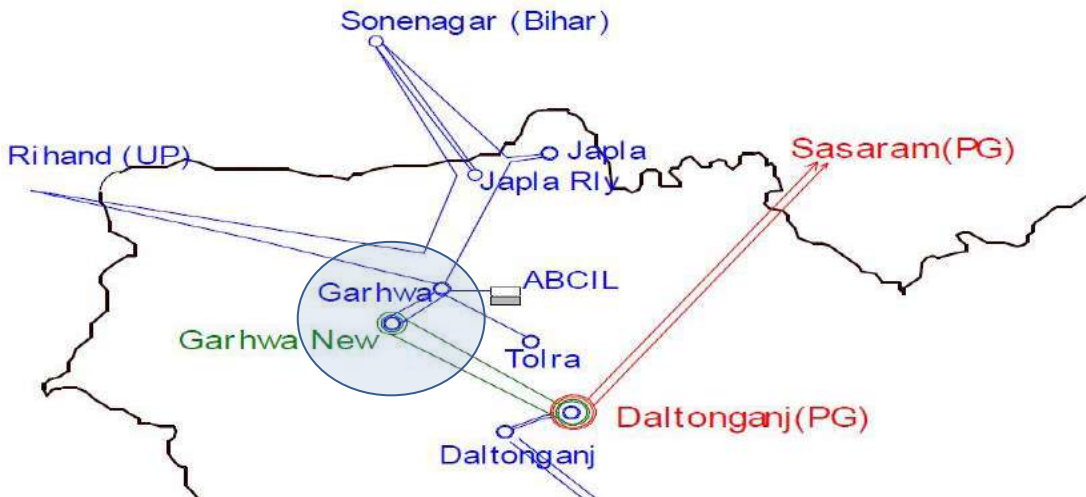


Figure 1: Network across the affected area



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
15:31	220 kV Bus-1, Bus 2 at Garhwa (New)	-	-	Around 52 kV dip in B_ph at Daltonagnj. A/r failed
	220 kV Daltonagnj-Garhwa(New)-1	B_N, FC-1.7 kA, FD- 56 km	B-N, FC-1.4kA, FD- 59 km	
	220 kV Daltonagnj-Garhwa(New)-2	Didn't trip	B-N, FC-1.4Ka, FD- 65 km	

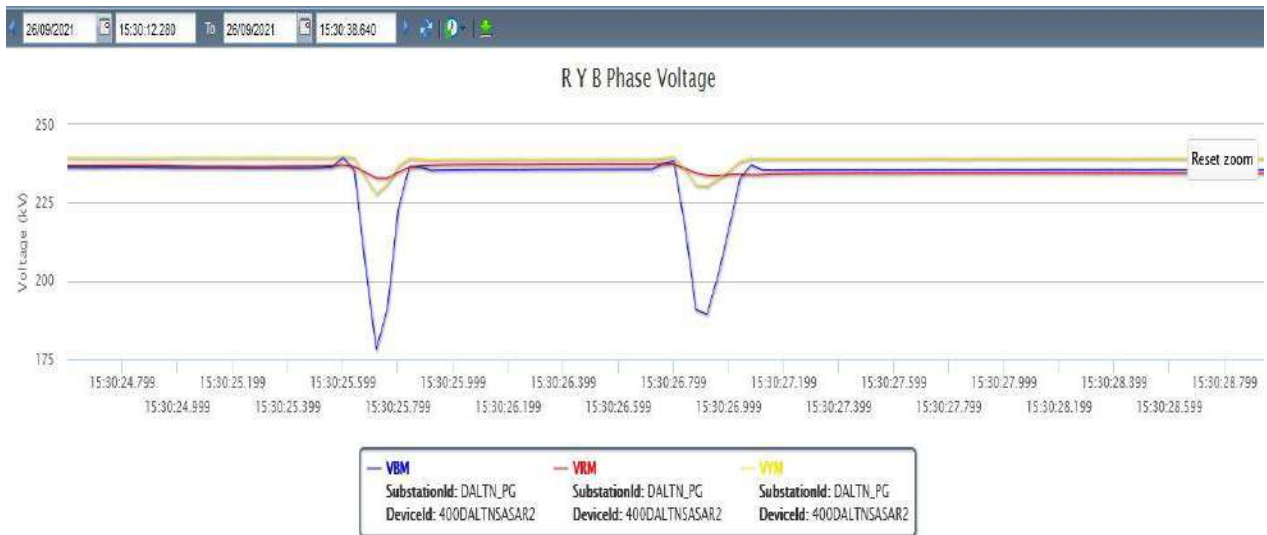


Figure 3: PMU snapshot of 400/220 kV Daltonagnj S/s

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-phase to earth fault in 220 kV Daltonganj-Garhwa (New)-1 which was cleared within 100 msec. After 1 second, A/r attempt failed.
- As 220 kV Daltonganj-Garhwa (New) D/C lines are radial in nature therefore POTT scheme has been implemented.
- At the A/R instance of ckt-1, Daltonganj end of ckt-2 was sensing the fault of ckt-1 in Zone-II and was sending carrier to Garhwa end.
- Thereafter A/R of Ckt-1 got failed leading to its tripping from Garhwa end. With this, suddenly current reversal took place in ckt-2 and Garhwa end of ckt-2 started sensing the same fault in zone-2, and it was receiving the carrier also so tripping condition for ckt-2 at Garhwa end got satisfied and caused tripping of Ckt-2 from Garhwa only. This also caused the load loss at Garhwa.
- Proper implementation of Current reversal guard needs to be ensured to avoid such tripping.

Nature of the Fault & Frequent Tripping of 220 kV Daltonganj-Garhwa

220 kV Daltonganj-Garhwa-2 tripped frequently in the month of September'21. Details of all tripping are given as below:

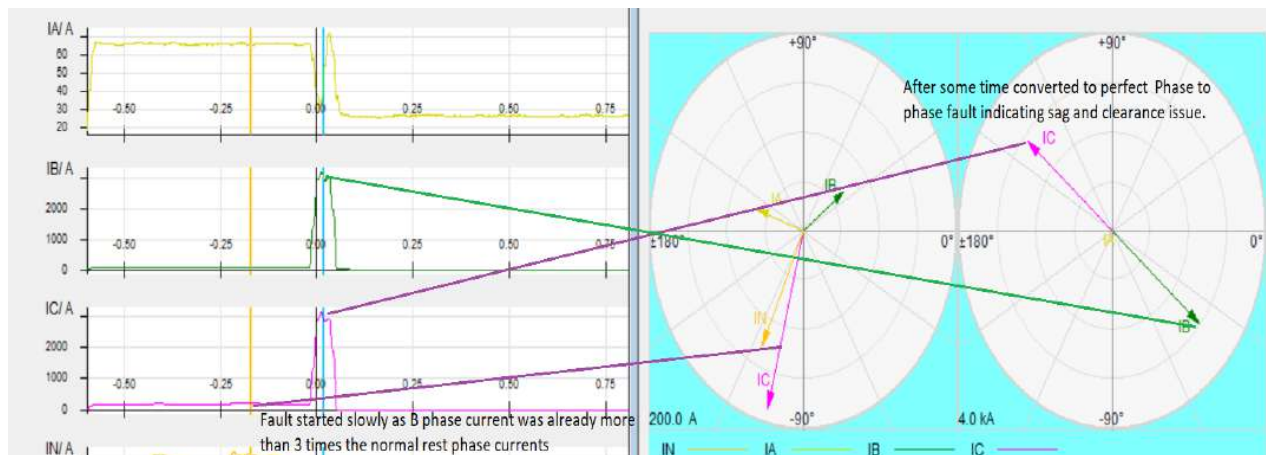
Sr No	Element Name	Tripping Date	Tripping Time	Reason	Remarks
1	220KV-DALTONGANJ-GARHWA (NEW)-2	03-09-2021	12:22	GARHWA: Z1, YB, Iy=518A, Ib=555A, 49.59km DALTONGANJ: YB, Iy=2.8kA, Ib=2.9kA, 27.6km	B-phase fault started first and after some time converted to perfect phase to phase fault indicating, sag and clearance issue. For Phase-to-phase fault at Daltonganj end R phase did not open and was holding, only Y&B phase opened.
2	220KV-DALTONGANJ-GARHWA (NEW)-2	06-09-2021	09:16	Garhwa B-N, 479.9 A 60.5 km	B phase fault but at Garhwa end ,No A/R occurred and breaker was open for some time after that tripped in PD ,while at Daltonganj A/R was successful. Arc over occurring at Peak voltage.
3	220KV-DALTONGANJ-GARHWA (NEW)-2	07-09-2021	14:43	Daltonganj:- R-Y, 64.4KM, Ir=Iy=1.8KA, Z-2 GARHWA:- Z-1, 25.2KM, R-Y, Ir=Ib=1.1KA	Y phase fault converted to perfect R-Y phase to phase fault , with fault occurring at Voltage peak.

4	220KV-DALTONGANJ-GARHWA (NEW)-2	13-09-2021	18:38	Daltonganj: A/R successful,137.7Km,0.978Ka,b-n Garhwa New: Z-I, 18.07 km,Ia=165.9A, Ib=219.3A, Ic=916.2A	B phase fault but at Garhwa end ,No A/R occurred and breaker was open for some time after that tripped in PD ,while at Daltonganj A/R successful. Arc over occurring at Peak voltage.
5	220KV-DALTONGANJ-GARHWA (NEW)-2	17-09-2021	11:23	A/R SUCCESSFUL FROM DALTONGANJ; GARHWA: Z-1, B-N, Fc= 0.88 kA, Fd= 54.25km	B phase fault but at Garhwa end, No A/R occurred and breaker was open for some time after that tripped in PD, while at Daltonganj A/R successful. Arc over occurring at Peak voltage.
6	220KV-DALTONGANJ-GARHWA (NEW)-2	26-09-2021	15:31	Garhwa: B-N,1.4kA, 65Km, Daltonganj - did not trip	B phase fault , A/R unsuccessful at both end in ckt-1 while ckt-2 tripped from only Garhwa end .Current reversal guard implementations to be checked as racing has caused tripping of ckt-1.

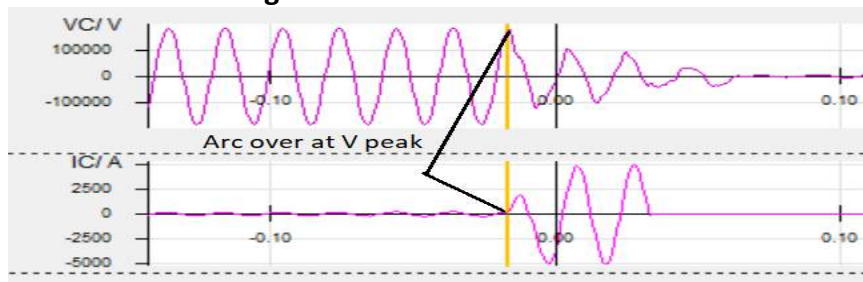
Fault Nature, Sag and Clearance Issue:

It can be observed from below plots that B phase current started rising slowly and then got converted to perfect phase to phase fault (as phase currents of Y and B are 180 degrees apart) due to arc over at voltage peak instance. B phase was involved in each fault.

Same phenomenon as mentioned above is observed in almost all cases, which indicates that the fault is **occurring due to sag and clearance issues**, hence proper line patrolling and healthiness of line should be maintained, same kind of fault nature was also observed in this line few months ago which was resolved by, jumper tightening and tree pruning at some locations. This needs to be looked into again and taken care.



ARC OVER AT Volatge Peak:



Non-Operation of Auto Reclose:

In 3 instances, it was observed that for B-Earth single phase fault Single(B) phase opening is occurring at Garhwa end but, after dead time A/R is not occurring and B phase kept opened until Pole discrepancy operated and caused tripping of line .For all these instances A/R was successful from Daltonganj end proper A/R operation at Garhwa end could have avoided tripping .

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):

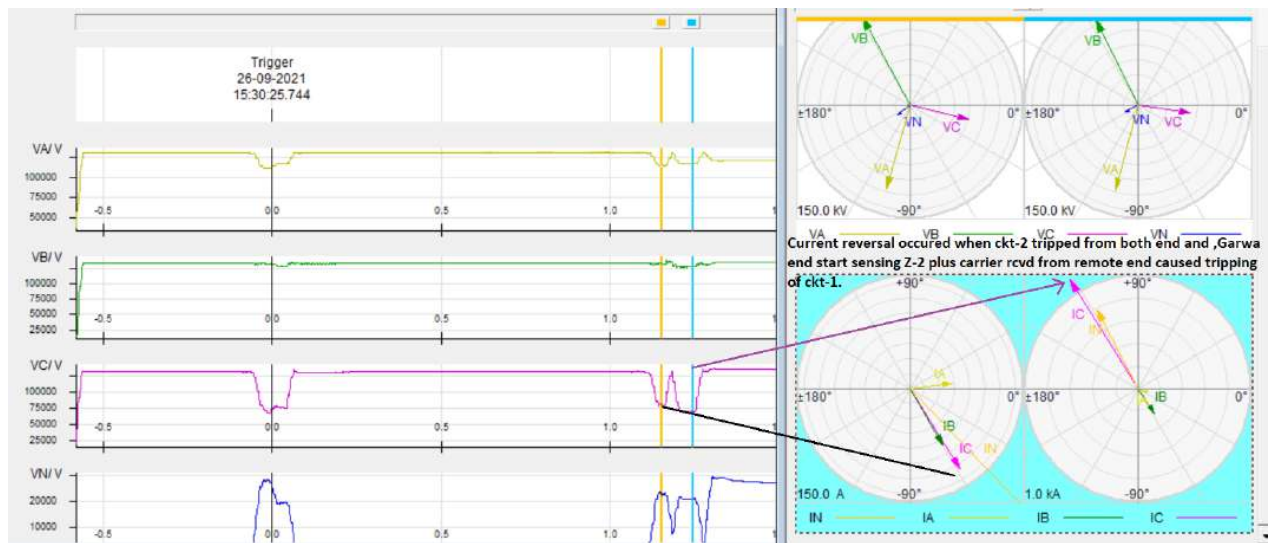
- DR/EL received from JUSNL
- DR/EL received from PG ER-I

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 (Garhwa end)





पावर सिस्टम ऑपरेशन करपोरेशन लिमिटेड

(भारत सरकार का उद्यम)

POWER SYSTEM OPERATION CORPORATION LIMITED

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CIN: U40105DL2009GOI188682

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

घटना संख्या: 28-09-2021/1

दिनांक: 01-10-2021

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

Summary of the event (घटना का सारांश):

At 17:18 hrs, all 220 kV lines emanating from Hazipur tripped. Consequently total power failure occurred at Hzaipur and Amnour. Around 230 MW load loss occurred at Hazipur, Siwan, Chhapra, Amnour and Sithalpur.

Date / Time of disturbance: 28-09-2021 at 17:18 hrs

- **Event type:** GD-1
- **Systems/ Subsystems affected:** 220/132 kV Hazipur, 220/132 kV Amnour
- **Load and Generation loss.**
 - No generation loss was reported during the event.
 - Around 230 MW load loss reported during the event at Hazipur, Siwan, Chhapra, Amnour, Sithalpur

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

- 220kV Hazipur-Barauni (BTPS)-1

Major elements tripped (प्रमुख ट्रिपिंग):

- 220 kV Main Bus I & II at Hazipur
- 220 kV Hazipur-Muzaffarpur D/c
- 220 kV Hazipur-Amnour D/c
- 220 kV Hazipur-Barauni (BTPS)-2
- 1*200 MVA 220/132 kV ICT I at Hazipur
- 2*100 MVA 220/132 kV ICT I, ICT II at Hazipur

Network across the affected area (प्रभावित क्षेत्र का नक्शा)

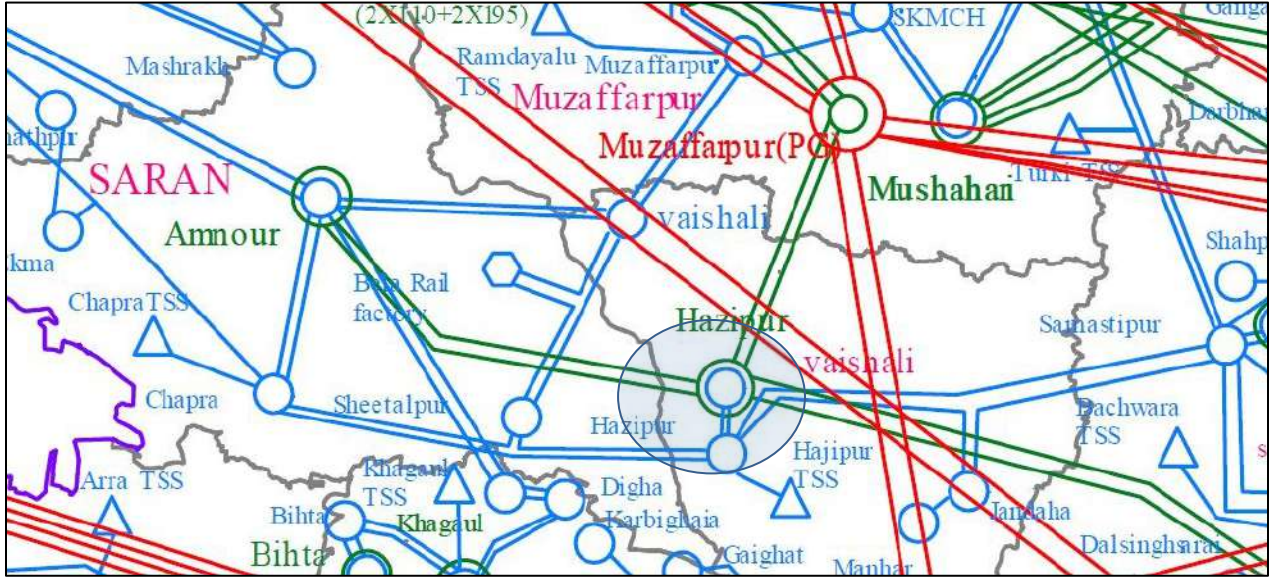


Figure 1: Network across the affected area

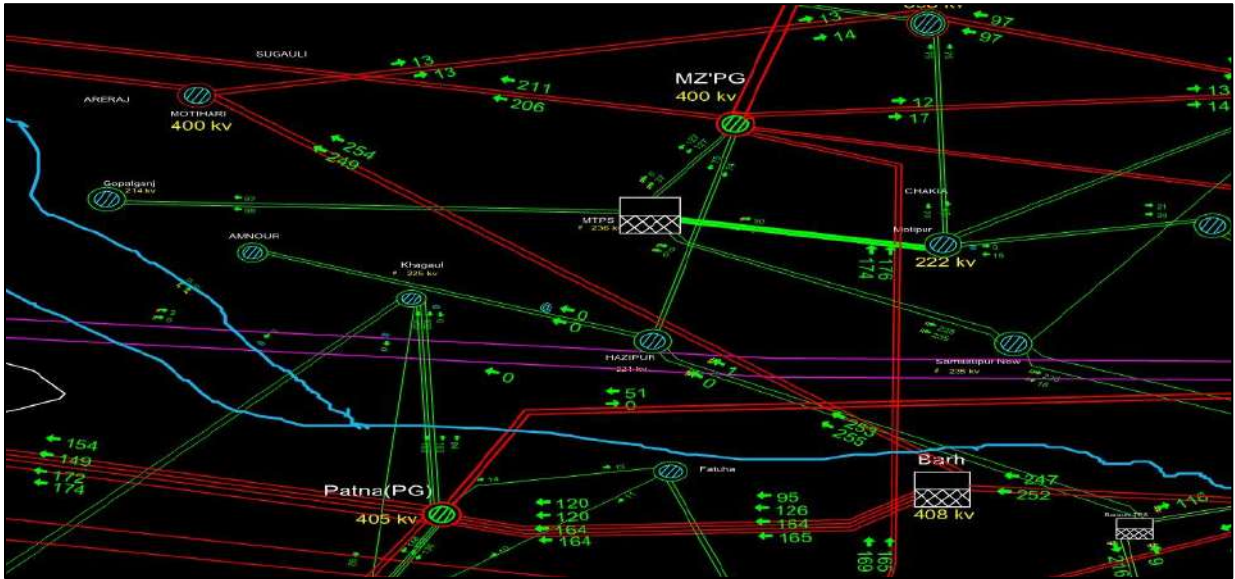


Figure 2: SCADA snapshot of the system

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

समय	नाम	उप केंद्र 1 रिले संकेत	उप केंद्र 2 रिले संकेत	पीएमयू पर्यवेक्षण
17:18	220 kV Bus-I, Bus II at Hazipur	Z-1 in Amnour-2 but breaker did not opened initiated LBB which caused tripping of all ckt's from Hazipur end.	Didn't trip	23 kV dip in R phase with fault clearance time of 250ms.
	220 kV Hazipur-Muzaffarpur-I			
	220 kV Hazipur-Muzaffarpur-II			
	220 kV Hazipur-Amnour I			
	220 kV Hazipur-Amnour II			

220 kV Hazipur-Barauni (BTPS)-II 2*100 MVA 220/132 kV ICTs at Hazipur		Didn't trip	

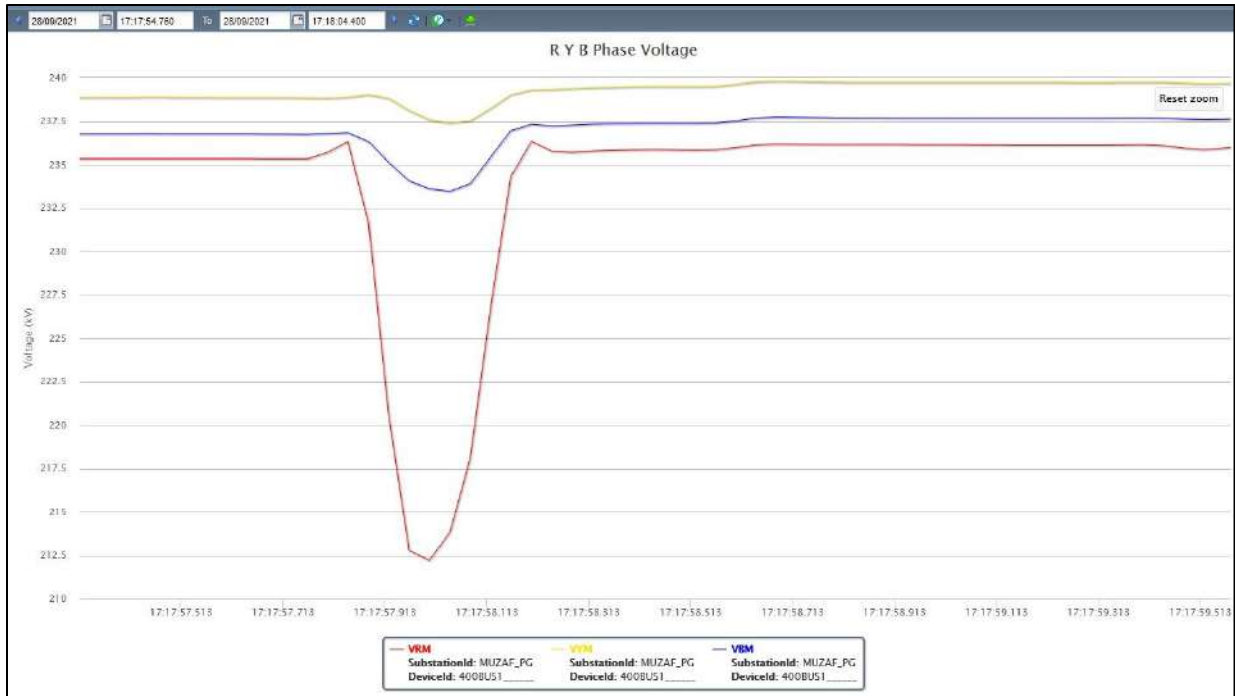


Figure 3: PMU snapshot of 400/220 kV Muzaffarpur S/s

Restoration (पूर्वावस्था की प्रप्ति)

Transmission/Generation element name	Restoration time
220 kV Bus 1 at Hazipur	17:30
220 kV Bus 2 at Hazipur	17:30
220 kV Muzaffarpur-Hazipur I	17:34
220 kV Muzaffarpur-Hazipur II	18:11
220 kV Hazipur-Amnour I	17:34
220 kV Hazipur-Amnour II	
220 kV Hazipur-Barauni (BTPS)-II	17:30
100 MVA 220/132 kV ICT I at Hazipur	
100 MVA 220/132 kV ICT II at Hazipur	

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

- Fault was in 220 kv Hazipur-Amnour -II ,Distance protection picked and gave trip command but Breaker did not opened hence LBB initiated.
- Further LBB gave tripping command after 250ms to all the elements from Hazipur substation and all elements tripped and fault was isolated. Zone-4 of all lines at Hazipur end also picked but prior to that LBB gave trip command to all lines.
- Ideally With LBB initiation only the elements which are at same bus as of Amnour -2 should have tripped along with the bus coupler and all elements with other bus should have remained in service this needs to be checked (**BSPTCL to reply**). With proper LBB operation Load loss could have been avoided.
- As the Hazipur is GIS reason for non-opening of breaker also needs to be checked and resolved. (**BSPTCL to reply**).

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

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

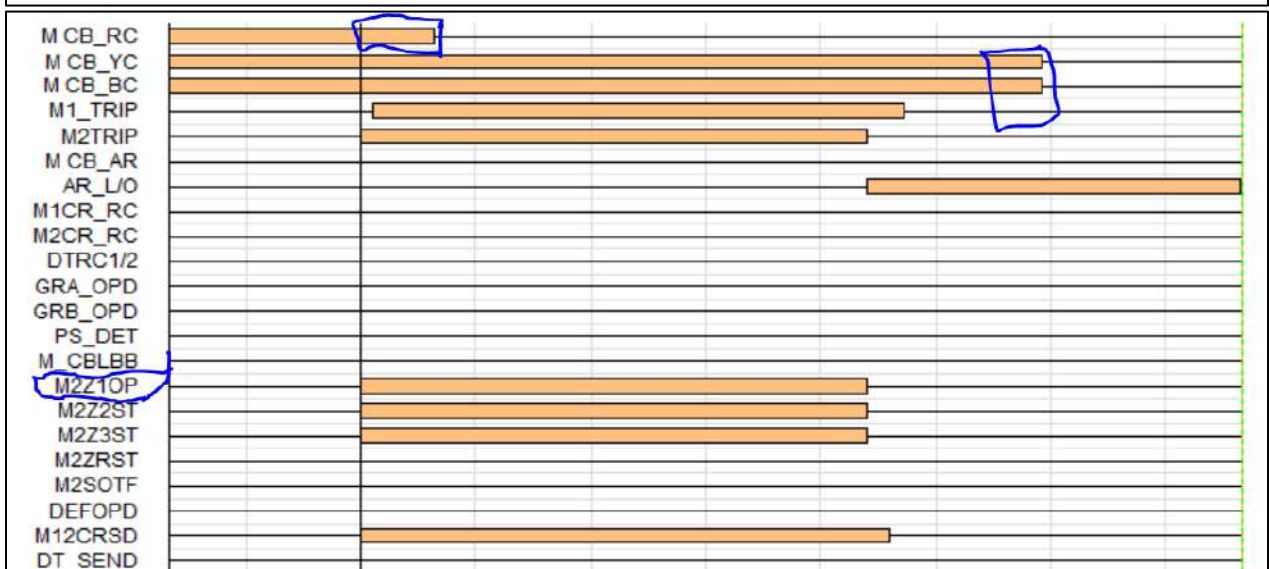
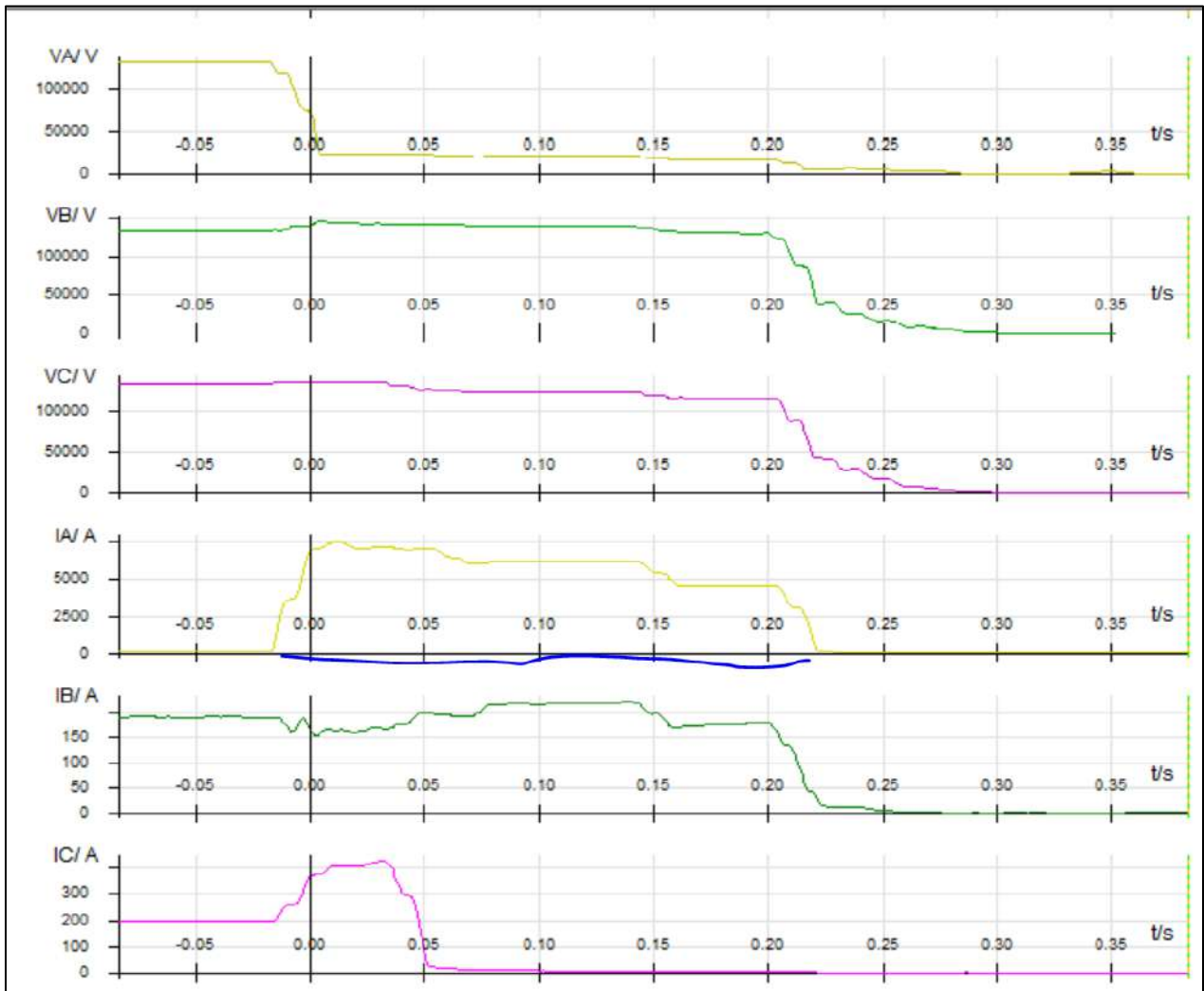
Status of Reporting (रिपोर्टिंग की स्थिति):

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

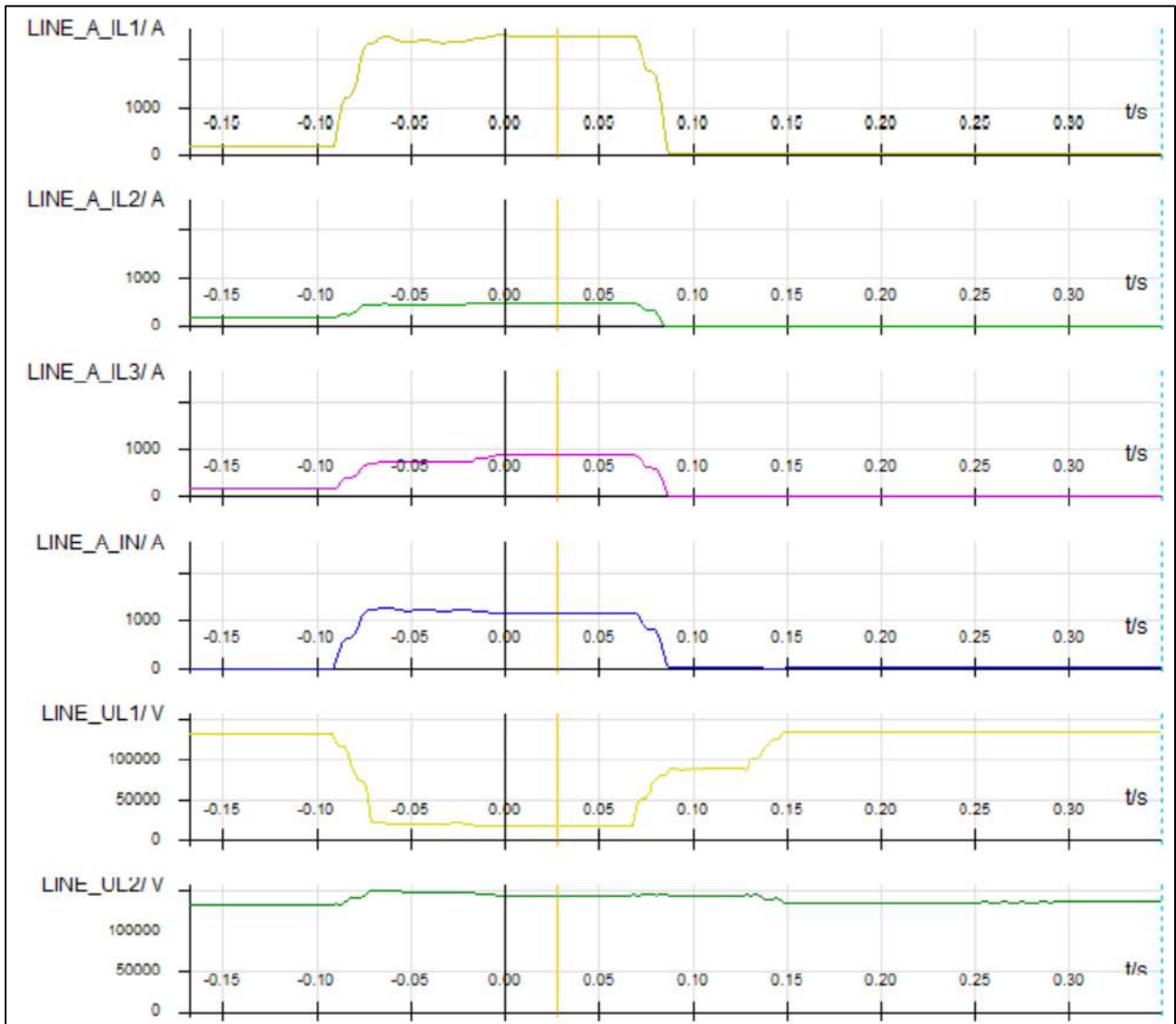
Annexure 1: Sequence of events recorded at ERLDC SCADA data at the time of the event.

Sequence of event not recorded at time of event.

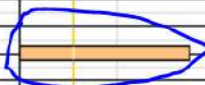
Annexure 2: DR recorded at Hazipur end for Amnour-II

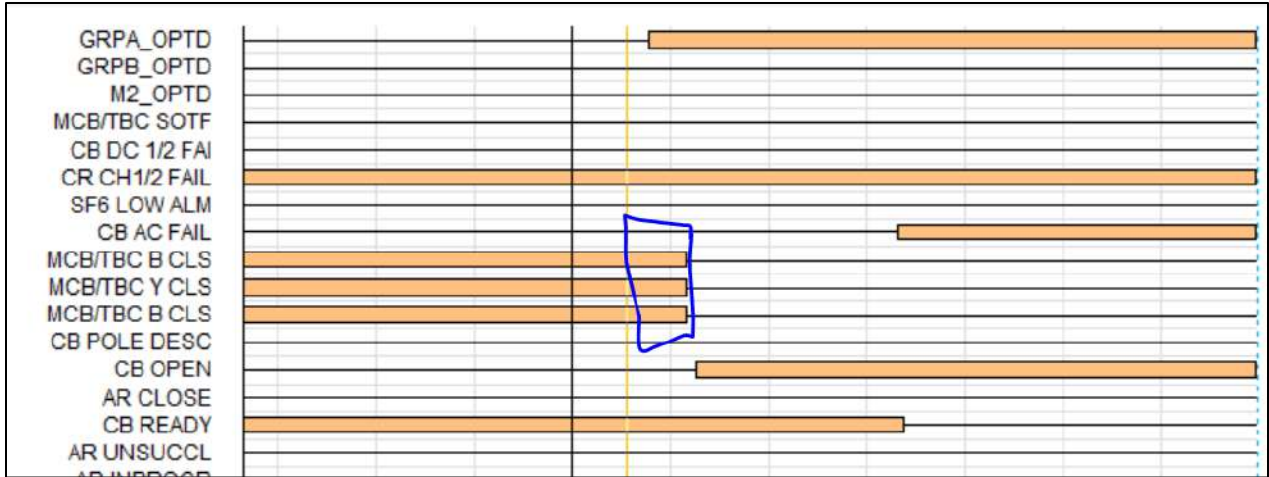


DR recorded at Hazipur end for Muzzafferpur-I



AR01-SETON	
AR01-ACTIVE	
ZM01-TRIP	
ZM01-START	
ZM02-TRIP	
ZM02-START	
ZM03-TRIP	
ZM03-START	
ZM04-TRIP	
ZM04-START	
ZM05-TRIP	
ZM05-START	
SOTF-TRIP	
ZCOM-TRIP	
AR_BLOCK	
ZCAL-TRWEI	





पावर सिस्टम ऑपरेशन करपोरेशन लिमिटेड

(भारत सरकार का उद्यम)

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CIN: U40105DL2009GOI188682

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

घटना संख्या: 29-09-2021/2

दिनांक: 07-10-2021

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

Summary of the event (घटना का सारांश):

At 11:28 hrs, 220 kV Hazipur-Amnour-1 tripped due to operation of bus bar protection at Hazipur. Total power failure occurred at Amnour as it was being through 220 kV Hazipur-Amnour-1, Ckt-2 was under breakdown. Around 140 MW load loss occurred at Siwan, Chhapra and Amnour.1

Date / Time of disturbance: 29-09-2021 at 11:28 hrs

- **Event type:** GD-1
- **Systems/ Subsystems affected:** 220/132 kV Amnour
- **Load and Generation loss.**
 - No generation loss was reported during the event.
 - Around 140 MW load loss reported during the event at Siwan, Chhapra, Amnour

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

- 220kV Hazipur-Amnour-2

Major elements tripped (प्रमुख ट्रिपिंग):

- 220 kV Main Bus I & II at Amnour
- 220 kV Hazipur-Muzaffarpur I
- 220 kV Hazipur-Amnour I
- 220 kV Hazipur-Barauni (BTPS)-2
- 220 kV Bus I at Hazipur

Network across the affected area (प्रभावित क्षेत्र का नक्शा)

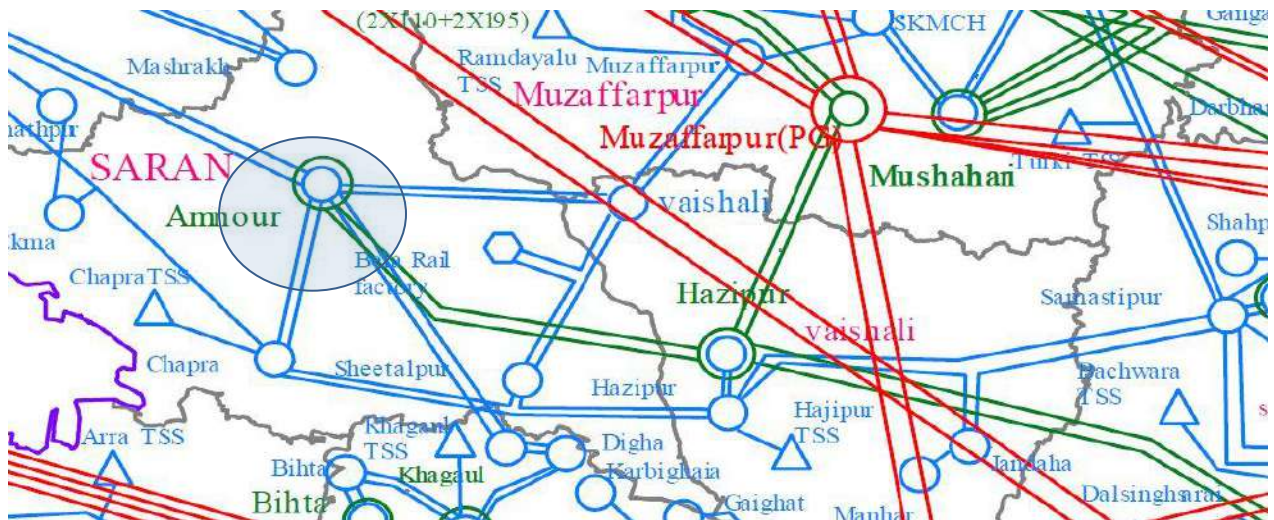


Figure 1: Network across the affected area

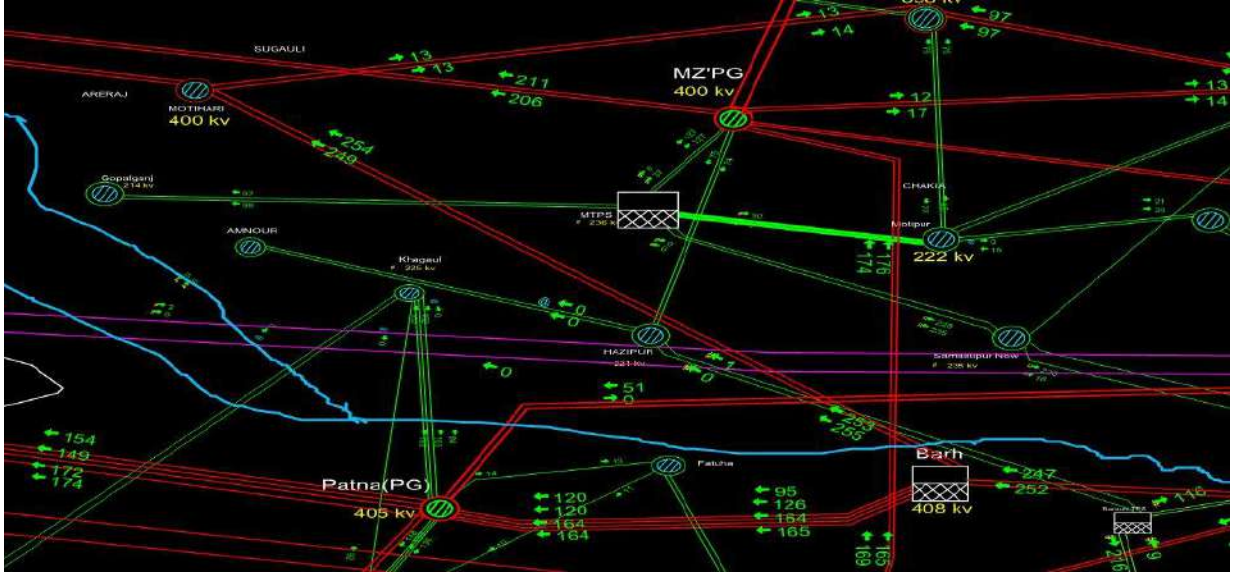


Figure 2: SCADA snapshot of the system

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

समय	नाम	उप केंद्र 1 रिले संकेत	उप केंद्र 2 रिले संकेत	पीएमयू पर्यवेक्षण
11:28	220 kV Bus-I at Hazipur	Bus bar protection operated at Hazipur	Didn't trip	No fault observed in PMU
	220 kV Hazipur-Muzaffarpur-I			
	220 kV Hazipur-Barauni (BTPS)-II			
	220 kV Hazipur-Amnour I			
	220 kV Bus-I,II at Amnour	Loss of power supply		



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

Restoration (पूर्वावस्था की प्रप्ति)

Transmission/Generation element name	Restoration time
220 kV Bus 1 at Hazipur	11:37
220 kV Muzaffarpur-Hazipur I	11:55
220 kV Hazipur-Amnour I	11:55
220 kV Hazipur-Barauni (BTPS)-II	11:37

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

- No fault observed in PMU.
- As reported, during testing of 220 kV Hazipur-Amnour II (which was under breakdown), bus bar protection of 220 kV Bus I operated. Proper precaution should be taken during any testing to avoid such kind of tripping which resulted in load loss.

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

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

Status of Reporting (रिपोर्टिंग की स्थिति):

- DR/EL yet to be received from BSPTCL
- DR/EL yet to be 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 yet to be received.

पावर सिस्टम ऑपरेशन करपोरेशन लिमिटेड

(भारत सरकार का उद्यम)

POWER SYSTEM OPERATION CORPORATION LIMITED

(A Government of India Enterprise)



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

CIN: U40105DL2009GOI188682

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

घटना संख्या: 29-09-2021/1

दिनांक: 11-10-2021

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

Summary of the event (घटना का सारांश):

At 01:24 hrs, total power failure occurred at 220/132 kV Ramgarh, 132 kV Patratu S/s and 132 kV North Karnpura S/s. Around 150 MW load loss occurred in Ramgarh, Patratu and North Karnpura. Power supply was extended to the affected areas by 01:30 Hrs through 132 kV Ramgarh-Gola.

Date / Time of disturbance: 29-09-2021 at 01:24 hrs

- **Event type:** GD-1
- **Systems/ Subsystems affected:** 220/132 kV Ramgarh
- **Load and Generation loss.**
 - No generation loss was reported during the event.
 - Around 150 MW load loss reported during the event at Ramgarh, Patratu and North Karnpura by DVC SLDC

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

- NIL

Major elements tripped (प्रमुख ट्रिपिंग):

- 220 kV Main Bus I & II at Ramgarh
- 220 KV Ranchi-Ramgarh
- 220 kV Ramgarh-BTPS B D/c
- 2*150 MVA 220/132 kV ICT I, ICT II at Ramgarh

Network across the affected area (प्रभावित क्षेत्र का नक्शा)

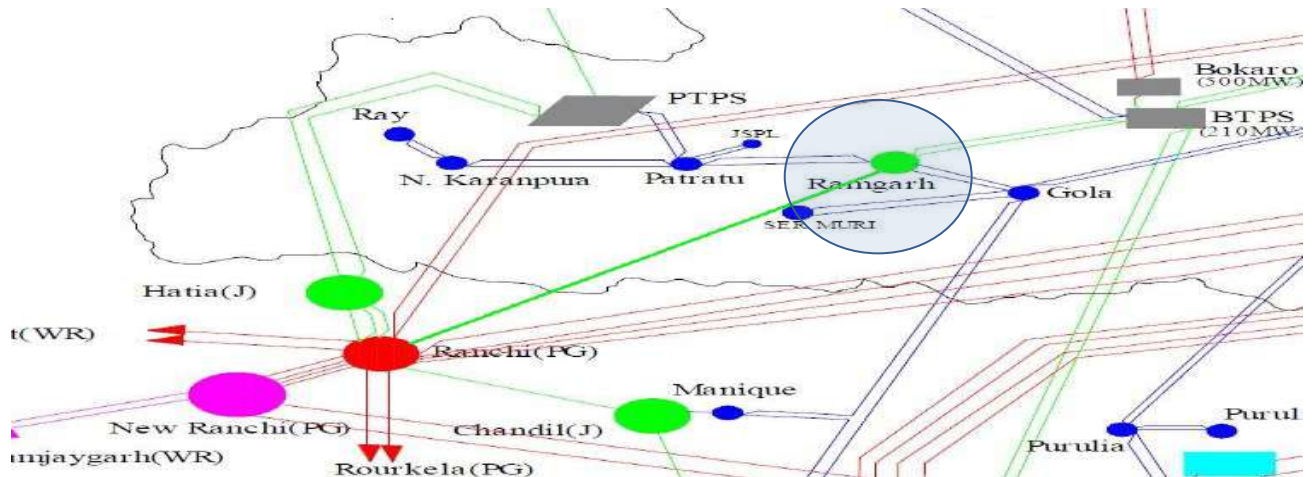


Figure 1: Network across the affected area

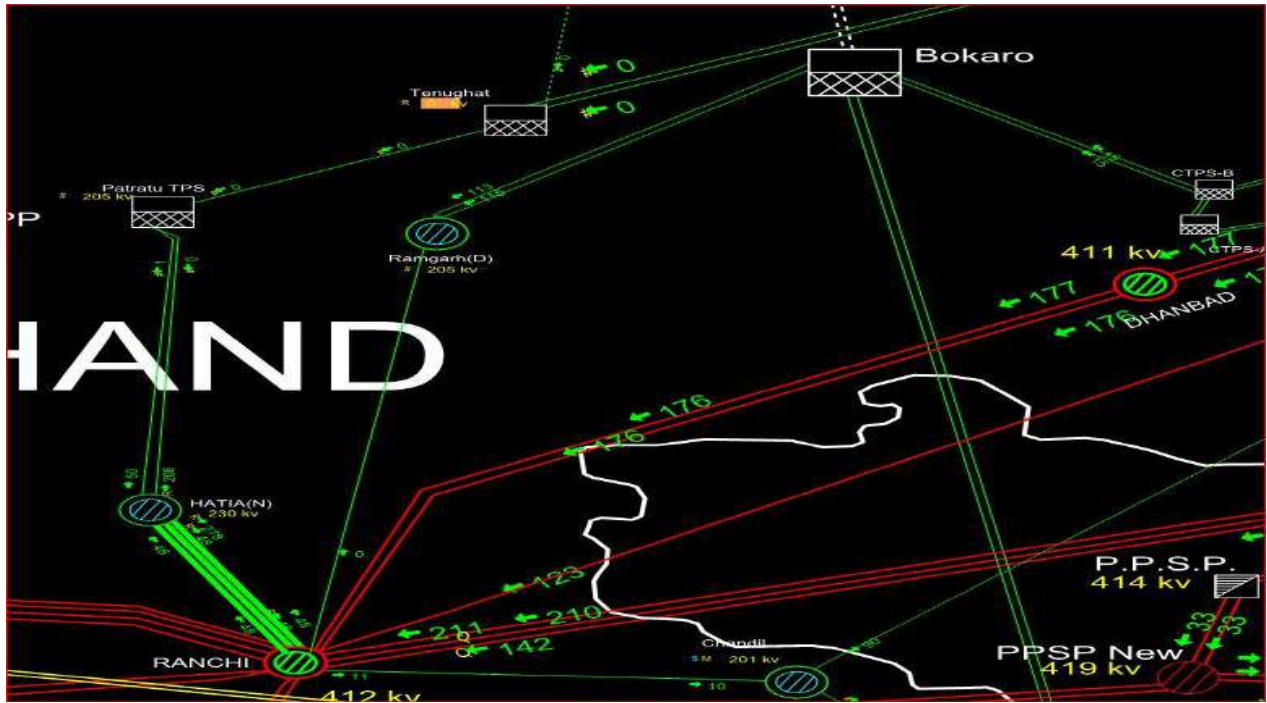


Figure 2: SCADA snapshot of the system

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

समय	नाम	उप केंद्र 1 रिले संकेत	उप केंद्र 2 रिले संकेत	पीएमयू पर्यवेक्षण
01:24	220 kV Bus-I, Bus II at Ramgarh	-	-	No fault observed in PMU at Ranchi
	220 kV Ramgarh-Ranchi-I	Z IV	Didn't trip	
	220 kV Ramgarh-BTPS B D/c	Z IV	-	
	2*100 MVA 220/132 kV ICTs at Ramgarh	-	-	

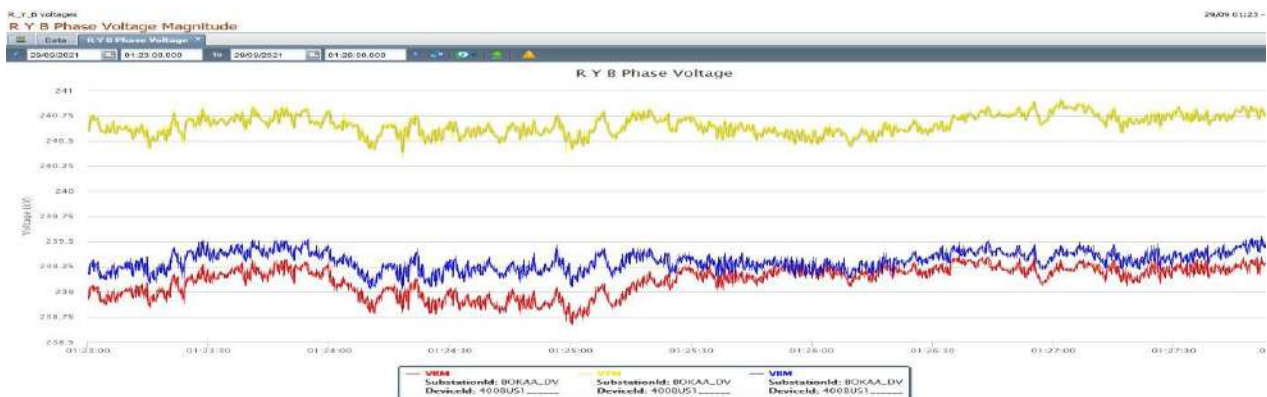


Figure 3: PMU snapshot of 400/220 kV Bokaro S/s

Restoration (पूर्वावस्था की प्रप्ति)

Transmission/Generation element name	Restoration time
220 kV Bus 1 at Ramgarh	01:42
220 kV Bus 2 at Ramgarh	01:42
220 kV Ramgarh-Ranchi-I	11:50(04.10.2021)
220 kV Ramgarh-BTPS B-I	01:42
220 kV Ramgarh-BTPS B-II	01:42

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

- As reported by DVC SLDC, bus PT isolator was stolen in live condition and there was no sparking. Bus bar protection also didn't operate. DVC may explain.
- At first B_ph voltage disappeared then after 350 msec voltage of other two phase also disappeared. One of the relays of each line then sensed the fault in Z IV. Report from DVC is attached in annexure.
- Incident maybe elucidated by DVC.

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

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

Status of Reporting (रिपोर्टिंग की स्थिति):

- DR/EL yet to be received from DVC

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

Sequence of event not recorded at time of event.

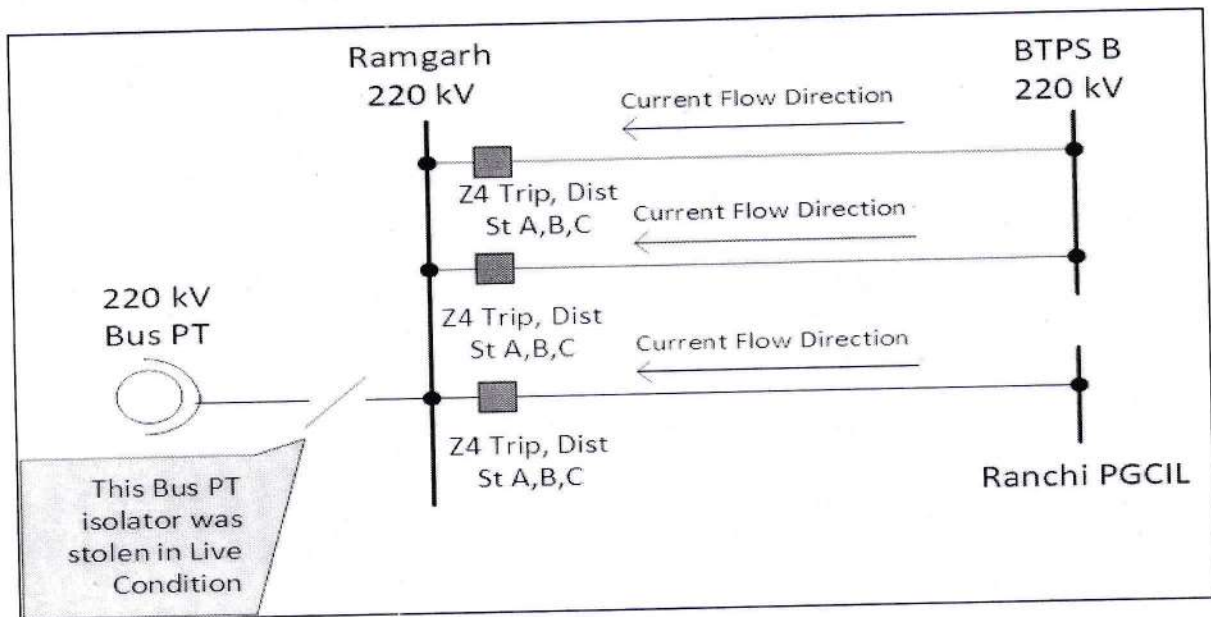
Annexure 2: DR recorded

DR yet to be received.

Investigation Report on Total power failure of Ramgarh 220 kV system on 29/09/21

Brief History:

At around 1:24 Hrs on 29/09/21, 220 kV Bus PT isolator was stolen online 220 kV bus of at Ramgarh S/S resulting in tripping of all 220 kV lines i.e. L#233, L#234 & L#249 from Z4 distance protection.



Relevant SLD:

Analysis of Trippings:

- i) Stealing of Bus PT isolator in live condition did not cause any sparking and did not result in any kind of bus fault. Busbar protection was in service, no operation of this protection occurred. Due to the same reason, there was no Z2 distance protection operation of 220 kV Lines from remote end.
- ii) 220 kV Lines at Ramgarh S/S end have two distance protection relays i.e. GE D60 & ABB REL670 Relay. Operating principle of fuse failure function of these two relays are different. It was observed from relevant DR files, that all three PT voltages did not disappear simultaneously during this incident. At first B phase PT voltage went away. This time both the relays sensed VT fuse failure and blocked distance protection. But after around 350ms of this occurrence, when all three PT voltages disappeared, VT Fuse failure condition remained in latched condition in D60 relay. But the same did not happened in ABB REL670 Relay. It has been observed from ABB REL670 logic diagram, that minimum 5 sec is needed to seal in three phase VT fuse failure condition. If all three PT voltages die down within 5 sec of sensing asymmetrical VT fuse failure, then VT fuse failure condition will get reset in ABB REL670 and distance protection will be unblocked. Due to this reason when all three PT voltages were unavailable, all ABB REL670 relays tripped from Z4 distance protection as current direction of all those three 220 kV lines were towards Ramgarh Bus.

Remarks: No maloperation of protection relays occurred as per logic of internal protection functions of these relays.

Adhuary
FE, CRITL

पावर सिस्टम ऑपरेशन करपोरेशन लिमिटेड

(भारत सरकार का उद्यम)

POWER SYSTEM OPERATION CORPORATION LIMITED

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

CIN: U40105DL2009GOI188682

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

घटना संख्या: 18-09-2021/1

दिनांक: 01-10-2021

Report on the grid event in Eastern Region (पूर्वी क्षेत्र में ग्रिड घटना पर रिपोर्ट)**Summary of the event (घटना का सारांश):**

At 17:59 hrs, all three circuits emanating from 220 kV UpperKolab HEP tripped and 220 kV bus became dead while synchronizing U#2 at UpperKolab. 73 MW generation loss occurred due to tripping of running U#1.

Date / Time of disturbance: 18-09-2021 at 17:59 hrs

- **Event type:** GD-1
- **Systems/ Subsystems affected:** 220 kV UpperKolab
- **Load and Generation loss.**
 - 73 MW generation loss occurred
 - No load loss occurred during the event

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

- NIL

Major elements tripped (प्रमुख ट्रिपिंग):

- 220 kV Main Bus I & II at UpperKolab
- 220 kV UpperKolab-Jaynagar-1
- 220 kV UpperKolab-Jaynagar-2
- 220 kV UpperKolab-Therubali-1
- 80 MW U#1 at UpperKolab

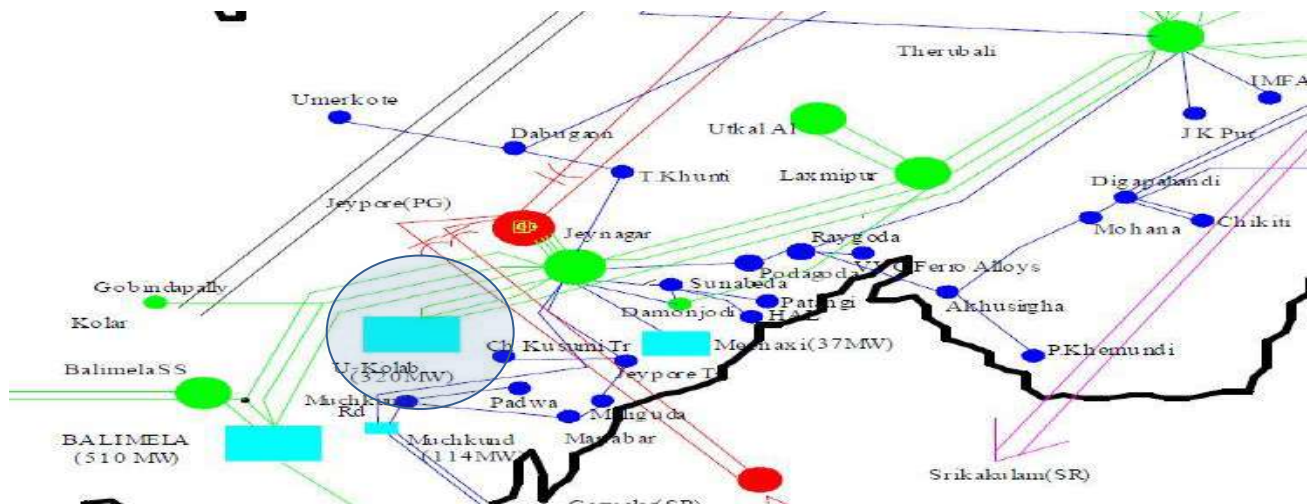
Network across the affected area (प्रभावित क्षेत्र का नक्शा)

Figure 1: Network across the affected area

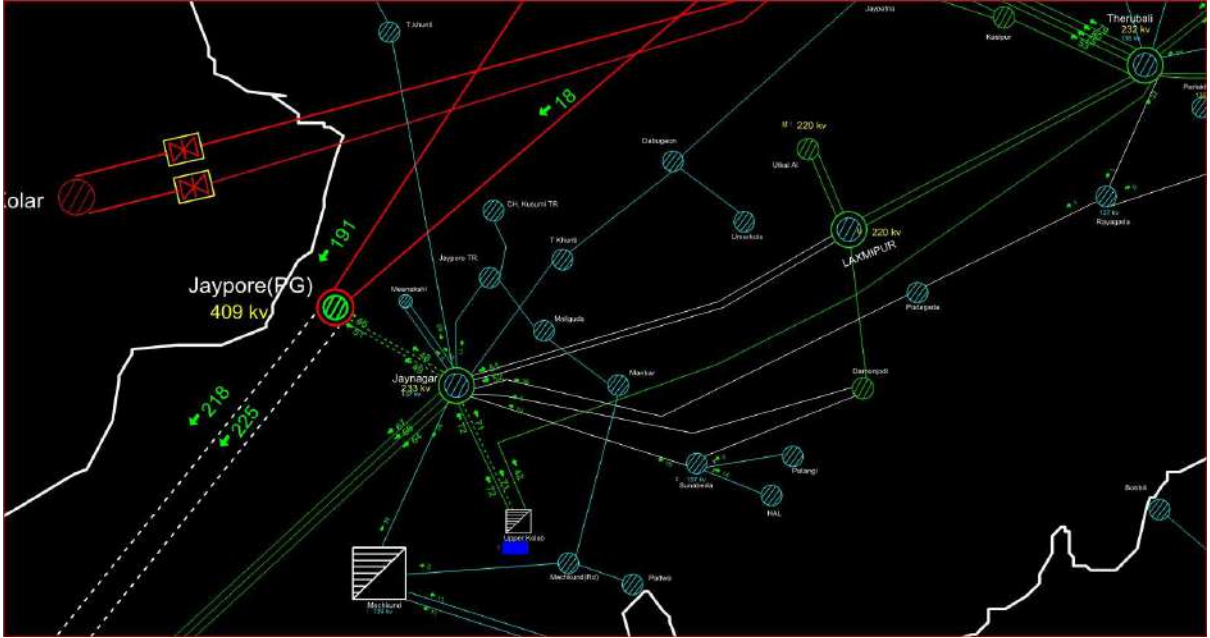


Figure 2: SCADA snapshot of the system

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

समय	नाम	उप केंद्र 1 रिले संकेत	उप केंद्र 2 रिले संकेत	पीएमयू पर्यवेक्षण
21:52	220 kV Bus-I, Bus II at UpperKolab	U#2 LBB operated	-	No fault observed in PMU
	220 kV UpperKolab-Jaynagar-1		-	
	220 kV UpperKolab-Jaynagar-2		-	
	220 kV UpperKolab-Therubali		-	
	80 MW U#1 at UpperKolab		-	

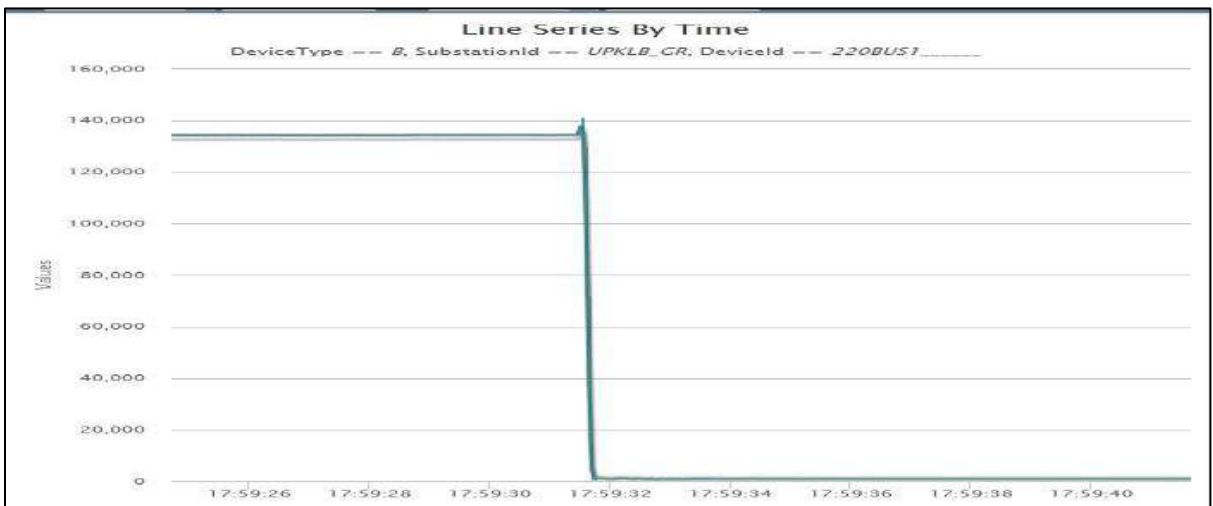


Figure 3: PMU snapshot of 220 kV UpperKolab S/s

Restoration (पूर्वावस्था की प्रप्ति)

Transmission/Generation element name	Restoration time
220 kV Bus 1 at UpperKolab	18:47
220 kV Bus 2 at UpperKolab	18:47
220 kV UpperKolab-Jaynagar-1	18:47
220 kV UpperKolab-Jaynagar-2	18:47
220 kV UpperKolab-Therubali-1	20:02

Analysis of the event (घटना का विश्लेषण):

- As per PMU plot at UpperKolab, no fault was observed. The reason of operation of LBB of U#2 may be analysed.

Protection issue (सुरक्षा समस्या):

- Both 220kV buses tripped on LBB. OHPC to 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	OPTCL, OHPC

Status of Reporting (रिपोर्टिंग की स्थिति):

- DR/EL yet to be received from OHPC & OPTCL

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

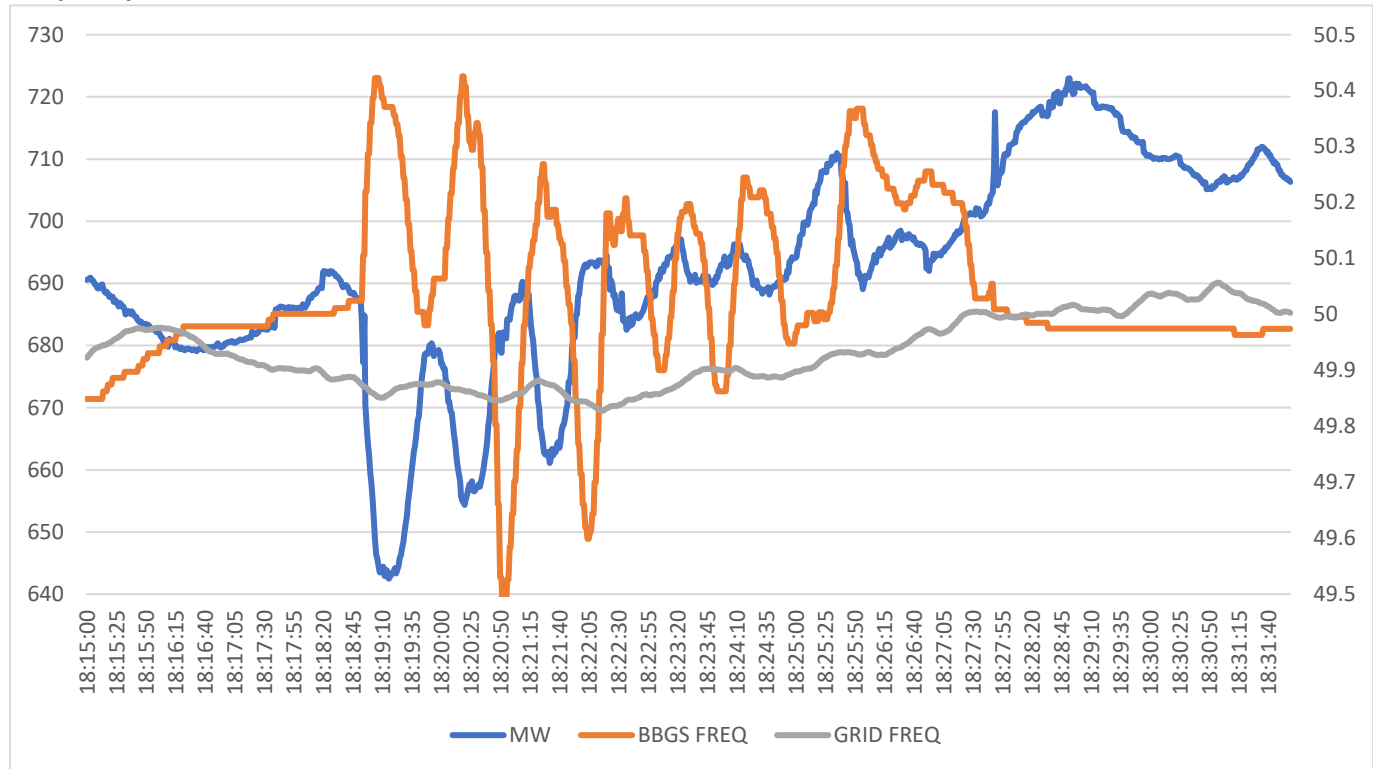
DR yet to be received.

Islanding Performance and Observations During Past Islanding of CESC

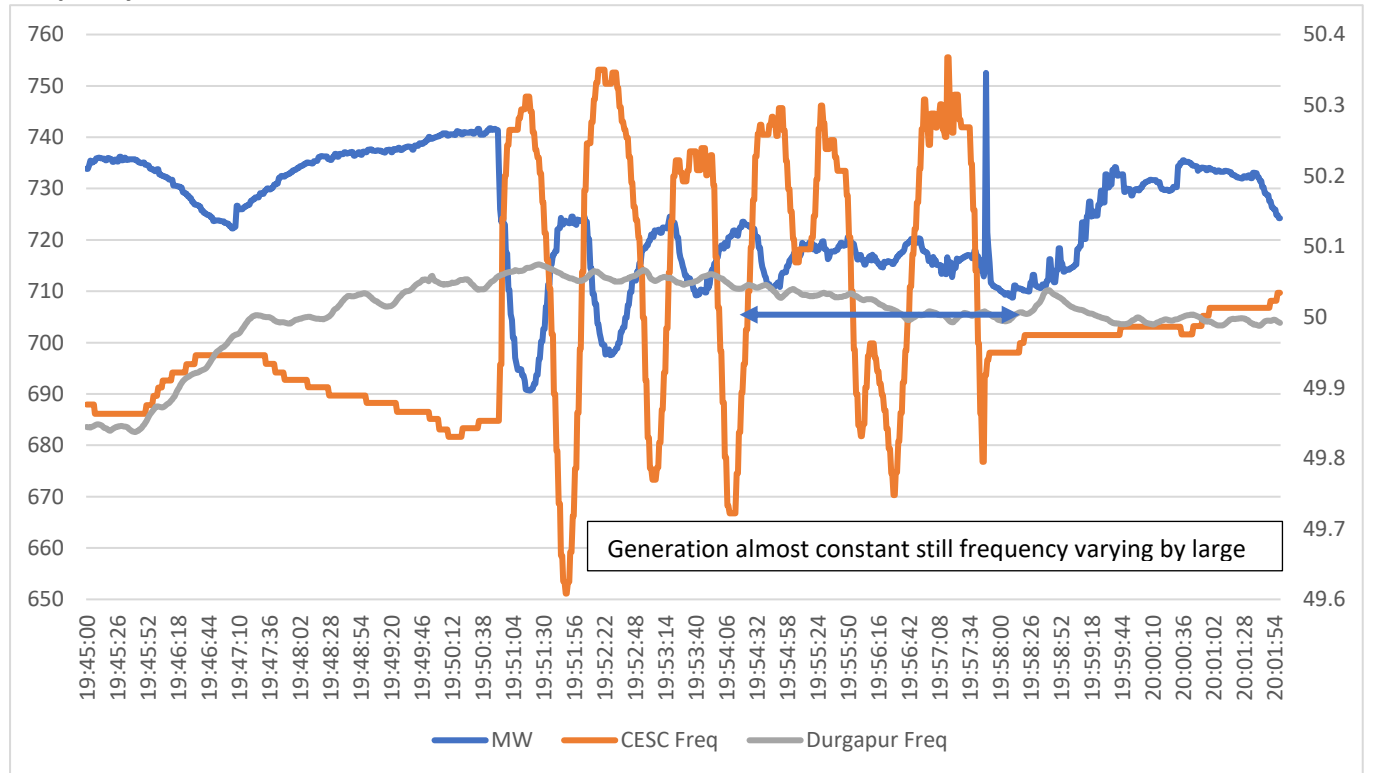
Islanding Performance and Frequency variation for past few Islanding events were checked for Island stability evaluation and following observations are listed in regard to this, (Plots for each event in attached)

- Oscillating Variation of frequency after island formation in Budge-budge frequency is observed upto (0.5-1Hz) and was varying continuously till it got synchronised with grid at Howrah point, this may also be checked.
- Such prolonged variation of frequency during whole islanded mode may be checked.
- In event 3 Budge-Budge Unit generation was also oscillating, root cause for which needs to be looked into which is ultimately driving the frequency of island.(Plot attached)
- Any cyclic load changes or other behaviour may also be analysed. Variation of traction and Metro load may also be studied.
- **Governor parameter tuning during islanded mode may also be checked along with PSS for stability during islanded mode.**
- **Reason for such continuous high oscillating variation in frequency may be analysed and possible consequences may also be looked.**
- **Frequency of oscillation was very slow 1 cycle in a minute so approx. 0.014Hz. So mechanical parameters associated with Machines may be checked for root cause analysis .**
- **Under frequency load shedding setting as shared within the island starts from 49.4Hz and may cause operation of UFR relay in some cases inside the island. Which is detrimental for island survival.**
- **As observed in below cases for 2 events, Frequency dipped upto 49.5 & 49.6Hz due to these variations. Chakmir -47Mw is under UFR shedding at 49.4Hz, tripping of which may further cause stability problem within island. (Setting attached)**
- **Same variation pattern was also observed during past events also one such event of 28April 2020 was checked and same observation found (Plot attached).**

SCADA plot for EVENT 1: 01st August 18:18Hrs, Budge-Budge generation Vs CESC frequency vs Grid Frequency

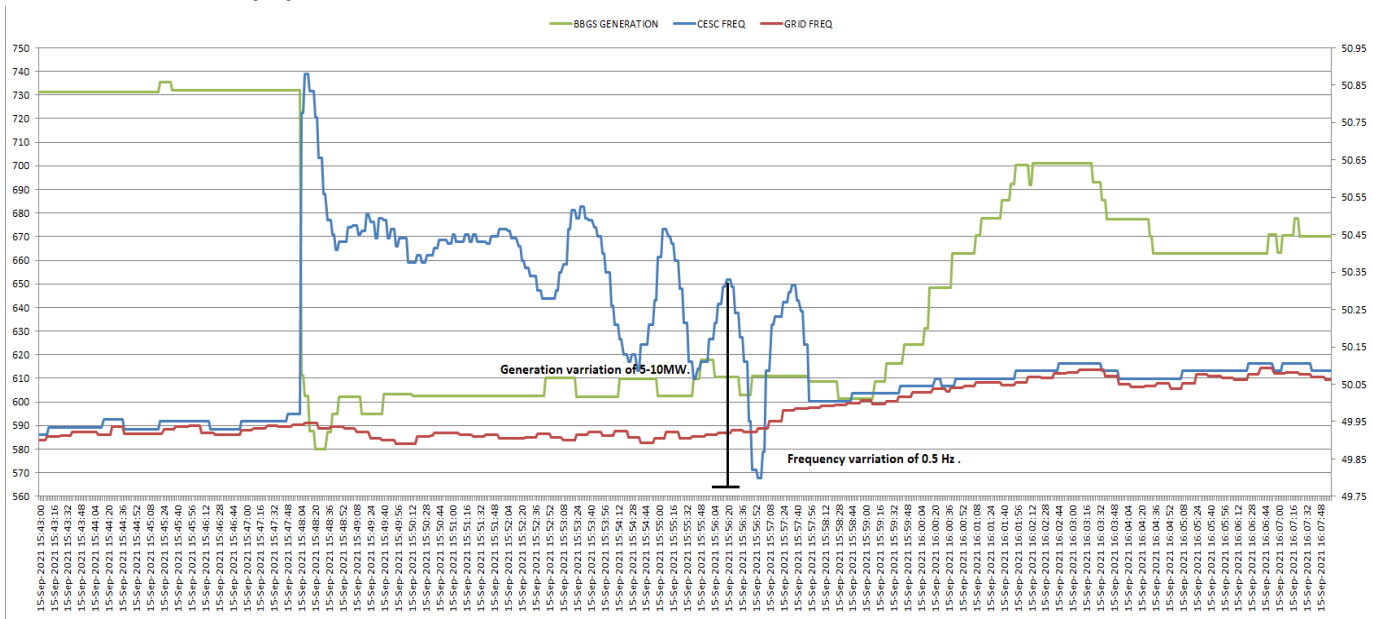


SCADA plot for EVENT 2: 01st August 19:50 Hrs ,BugBug generation Vs CESC frequency vs Grid Frequency



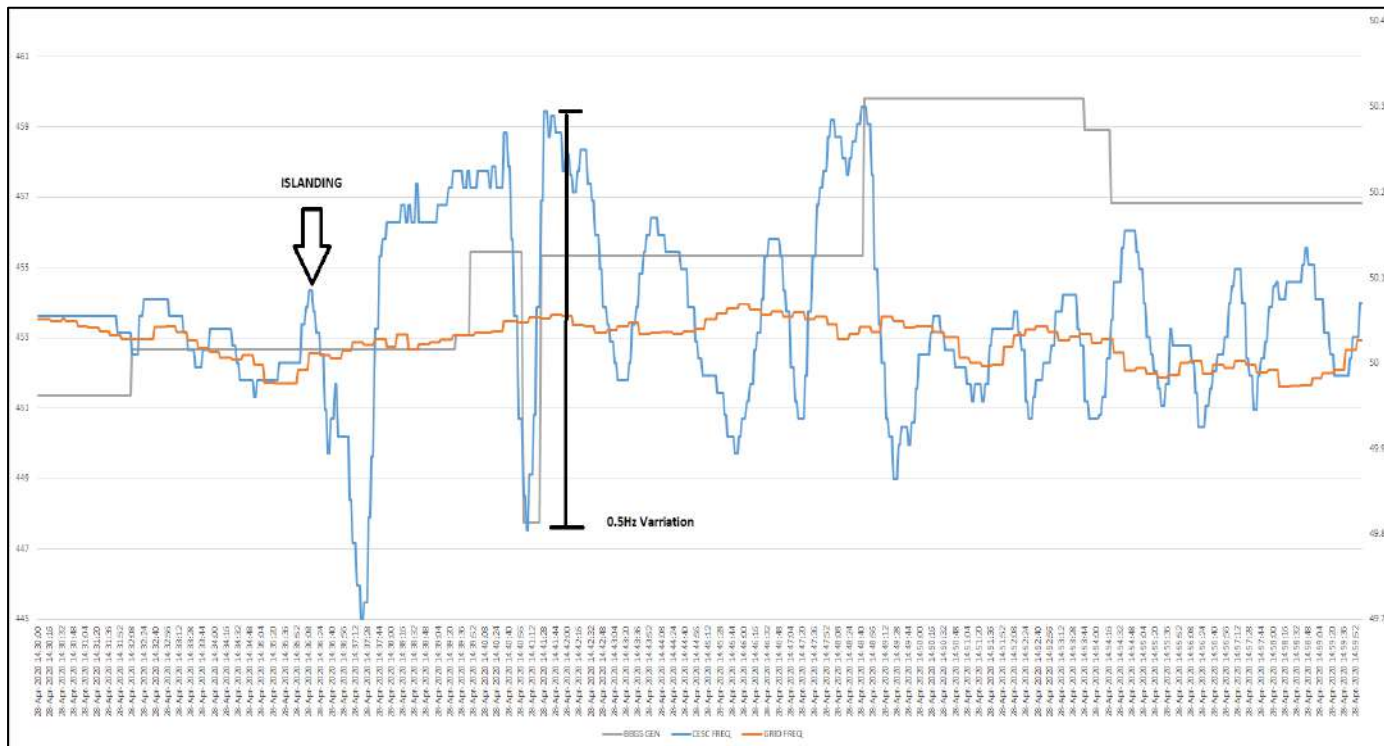
EVENT 3: Variation on 15th September Islanding: SCADA plot with 2 second resolution

Same pattern of Frequency variation observed. Governor performance during Islanding needs to be checked. In 15th September event also Budge-budge generation is oscillatory this needs to be checked and also any cyclic load variation for the same to be looked.

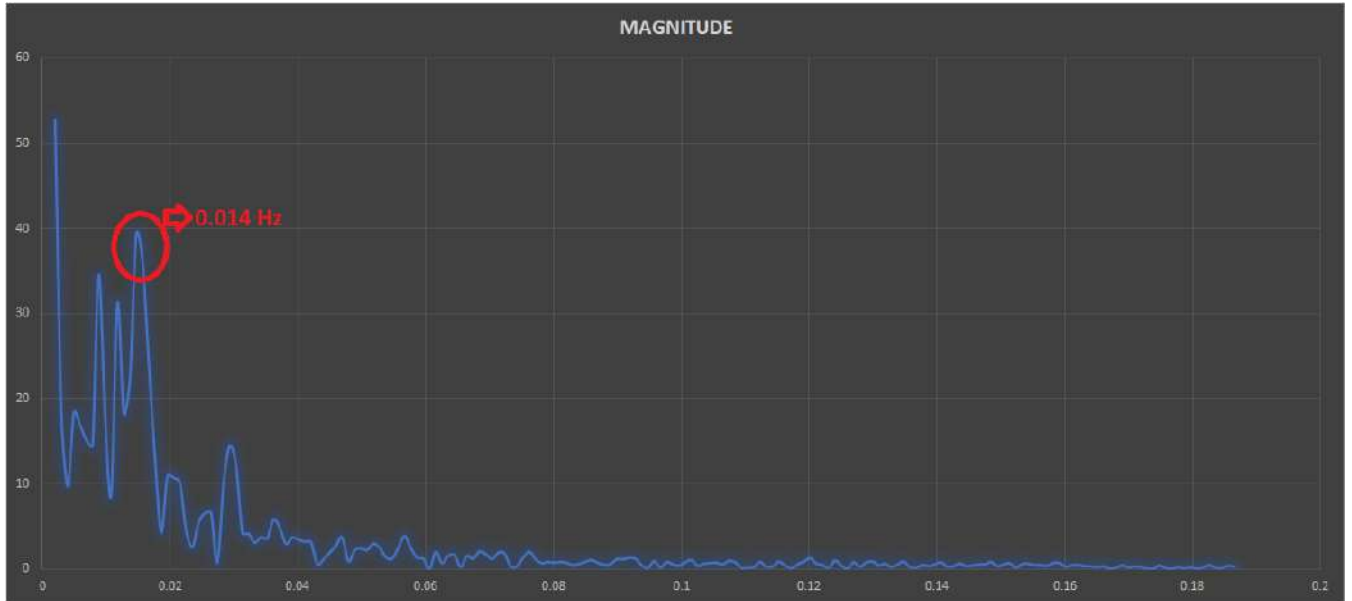


EVENT 4 :PAST ISLANDING ON 28 APRIL 2020:

In the 2020 Event also same very low frequency oscillatory variation observed



Oscillation Frequency as observed from FFT Spectrum: Very low frequency of 0.014 Hz observed

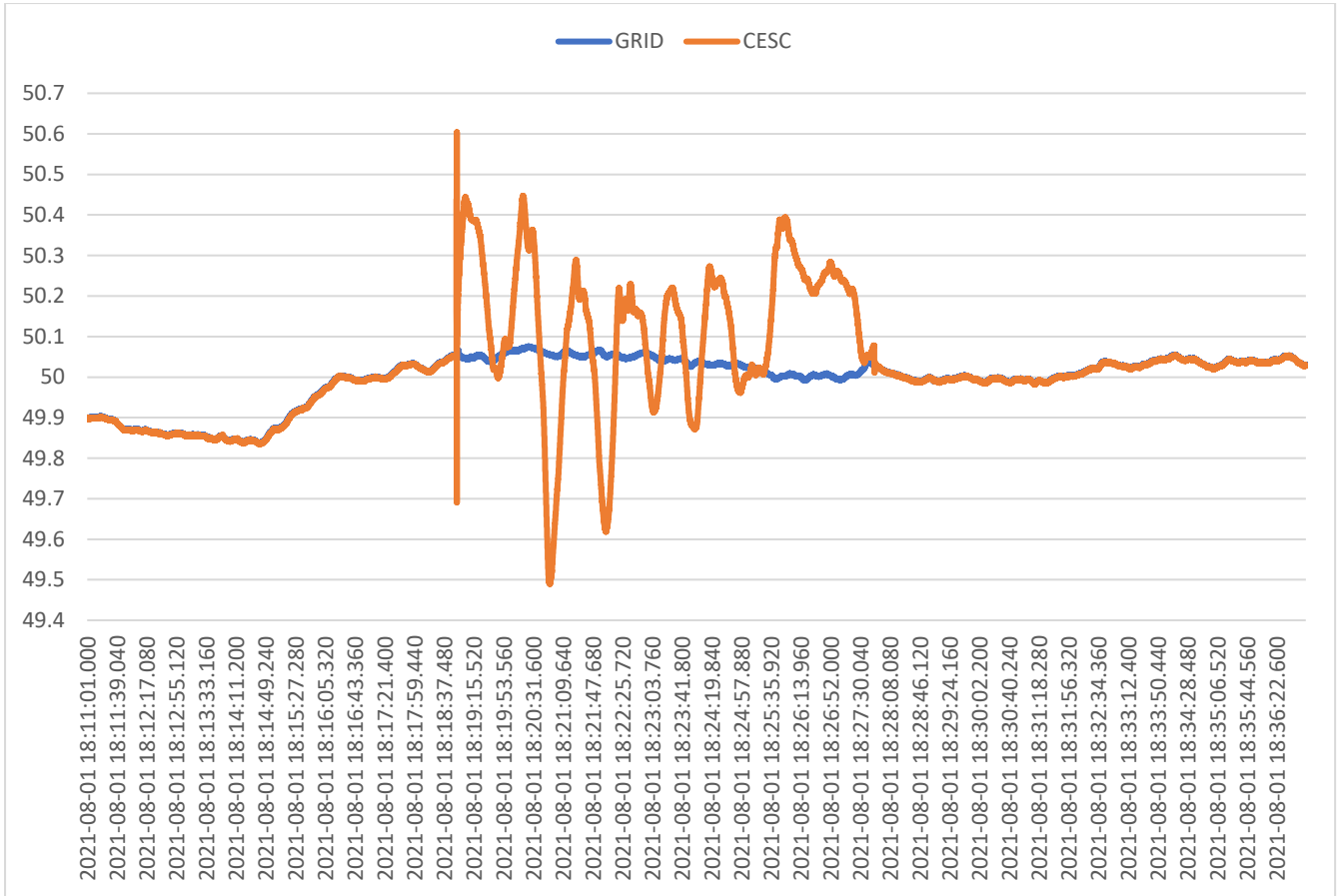


UFR setting for First Two stages:

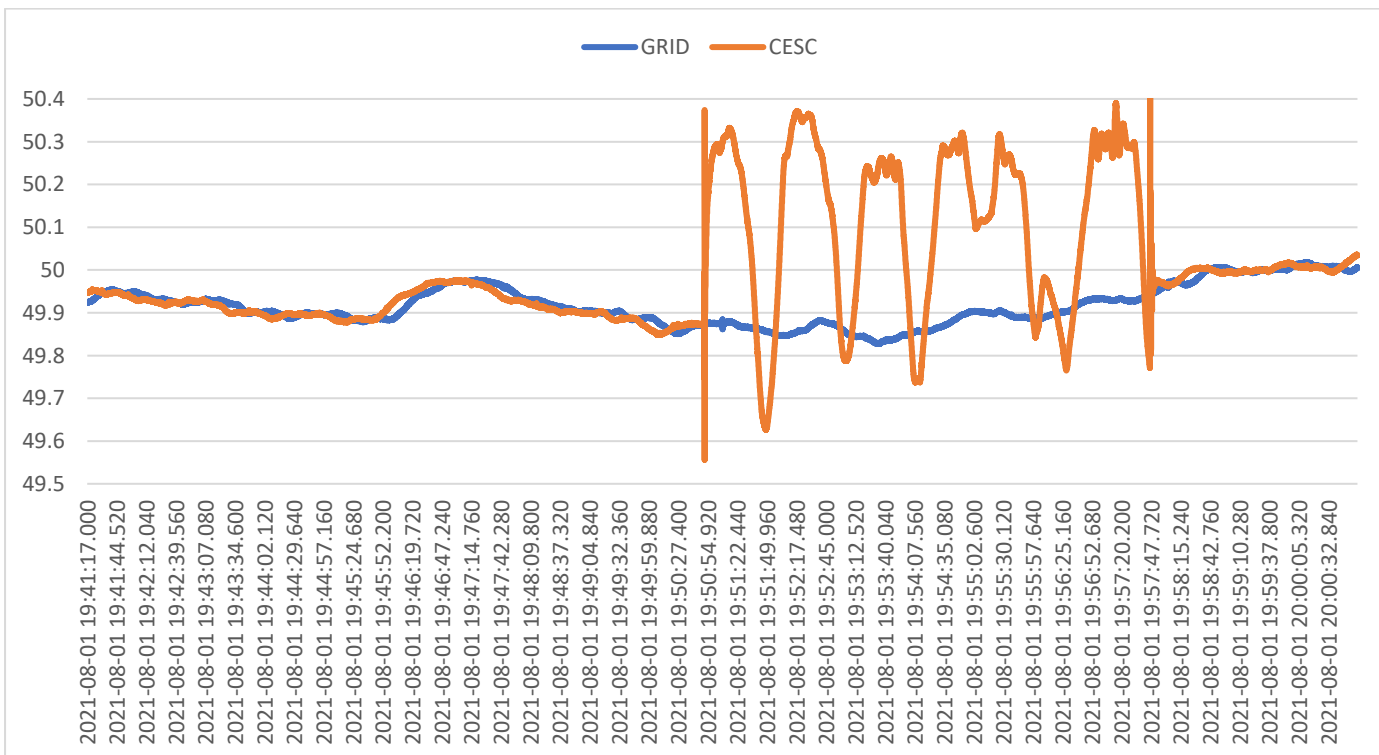
Settings of Under frequency relays				
CESC system				
Stage	132/33kV G/S/S	33kV Feeder	Max Load in MW	
Stage-I			SUMMER	WINTER
49.4Hz	CHAKMIR	55 MVA TRF - 1 & 2	47	29
	NCGS	KAMARHATI TRF - 1	8	6
		KUTIGHAT TRF - 3	10	8
TOTAL			65	43
Stage-II				
49.2Hz	DUMDUM	NEW DUMDUM TRF - 1	15	11
		NEW DUMDUM TRF - 2	14	9
		SOUTH DUMDUM TRF - 1	15	8
		DUMDUM TRF - 3	12	7
	BBGS	BAURIA 1 & 3	18	12
		FORESHORE RD D/S(6 KV FEEDER)	9	5
		SALIMAR D/S (6 KV FEEDER)	7	3
TOTAL			90	55

VERIFICATION BY PMU PLOTS FOR ALL EVENTS

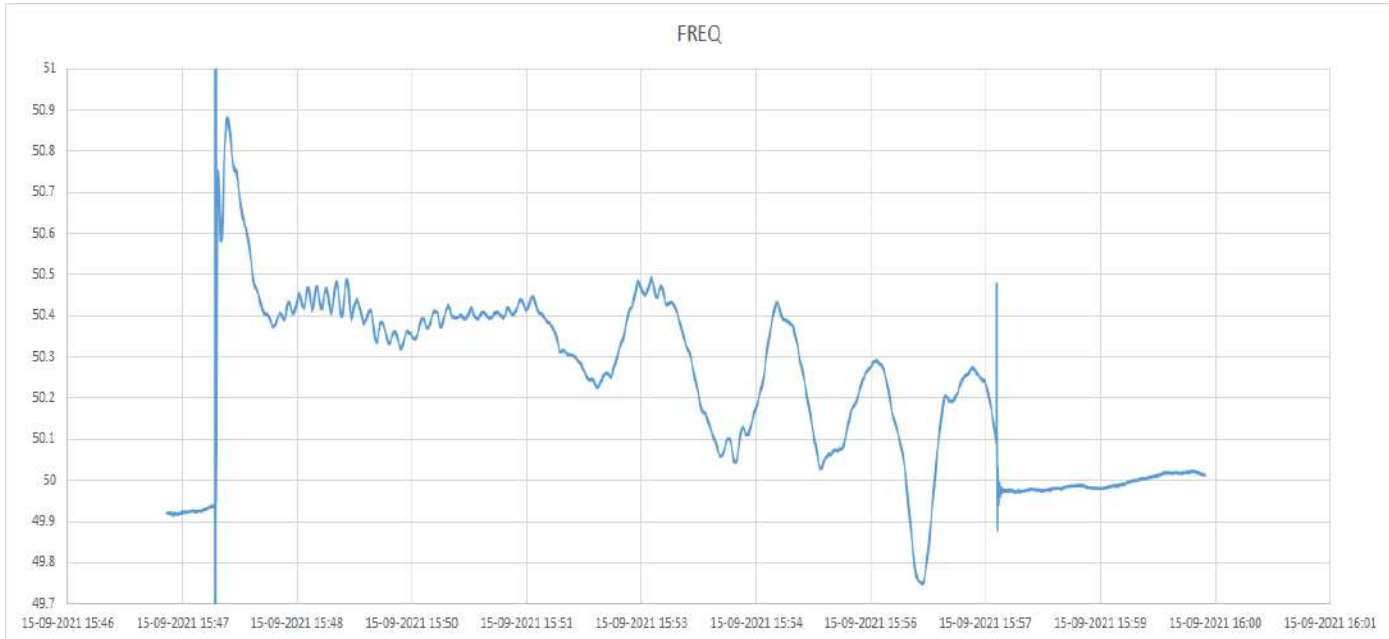
EVENT 1: Frequency comparison by PMU Plot:



EVENT 2 Frequency comparison by PMU Plot:



EVENT 3: PMU PLOT 15 September 2021



LOW FREQUENCY OSCILLATION BETWEEN 03:52 TO 03:58 Hrs ON 20/09/2021

LFO of **0.8-0.9 Hz** was observed between 03:53 Hrs to 03:57 Hrs near Subhasgram area, magnitude of which was observed most near Subhas gram and magnitude started reducing as moving away from Subhasgram.

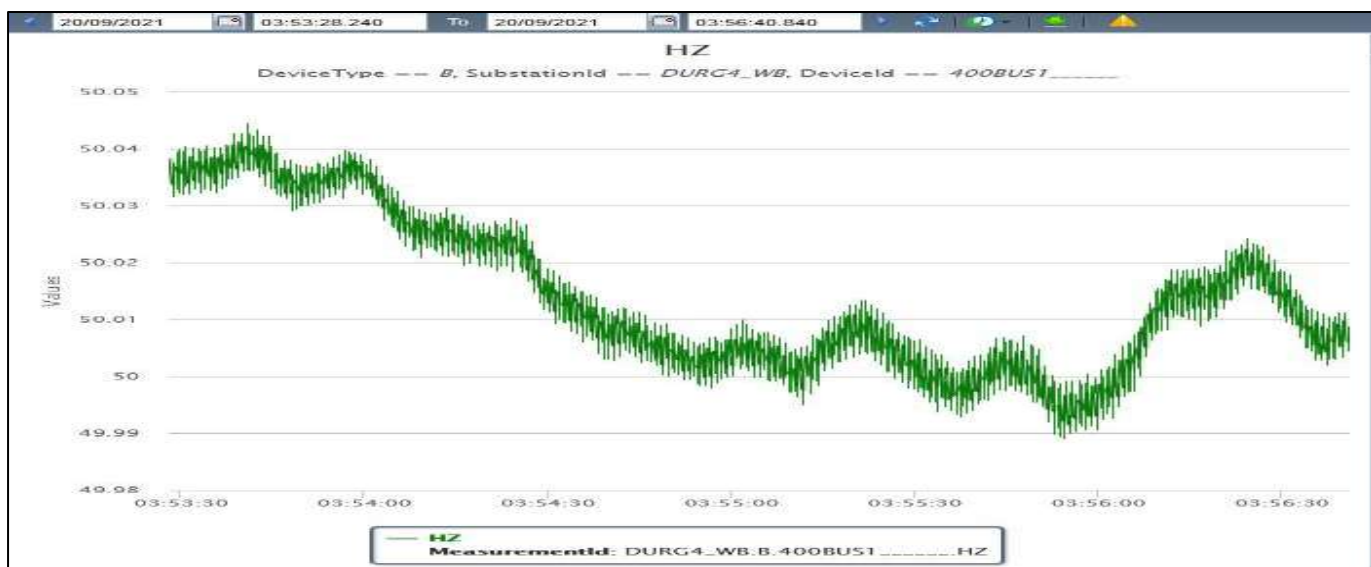
It was most prominent in Frequency only.

LFO was of Local mode which indicates that the oscillation initiated with hunting of any nearby unit.

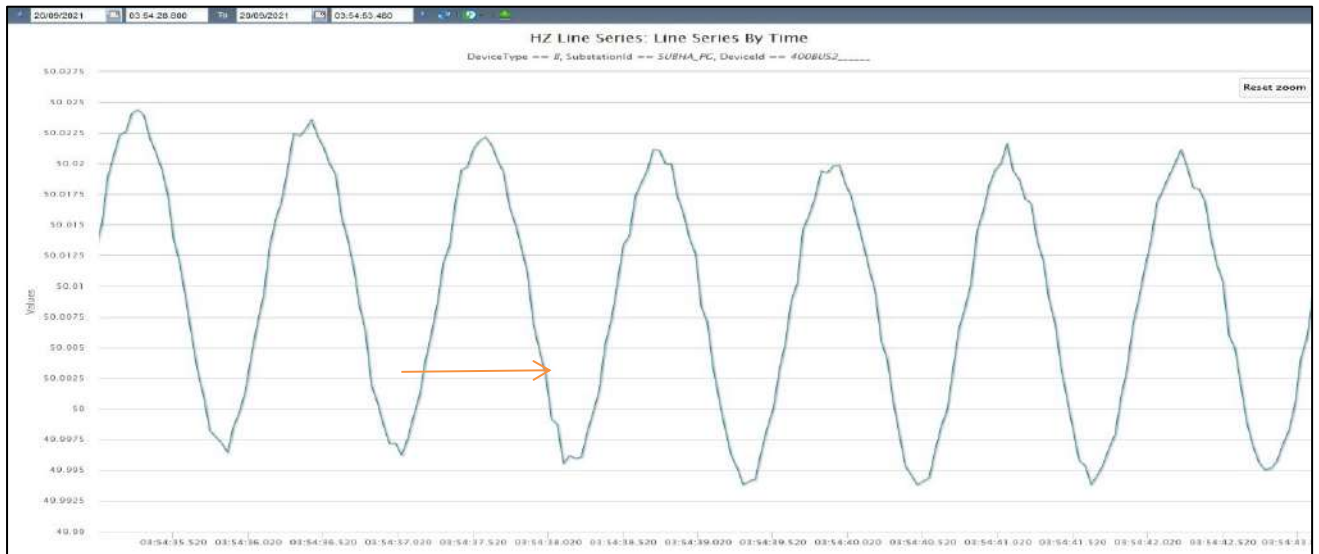
Subhas gram Frequency



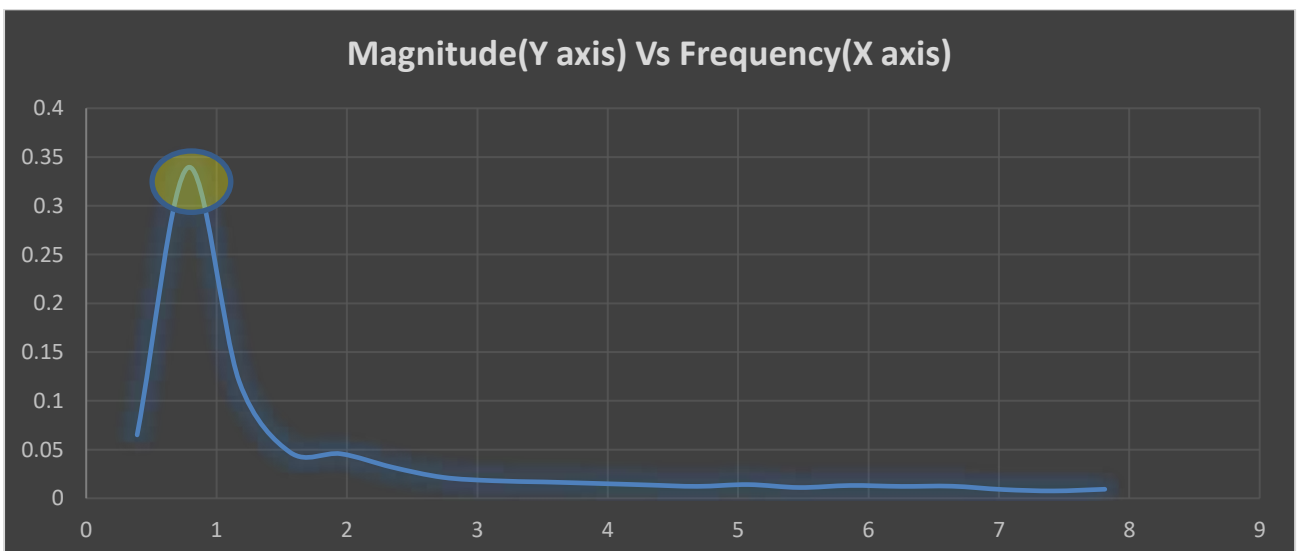
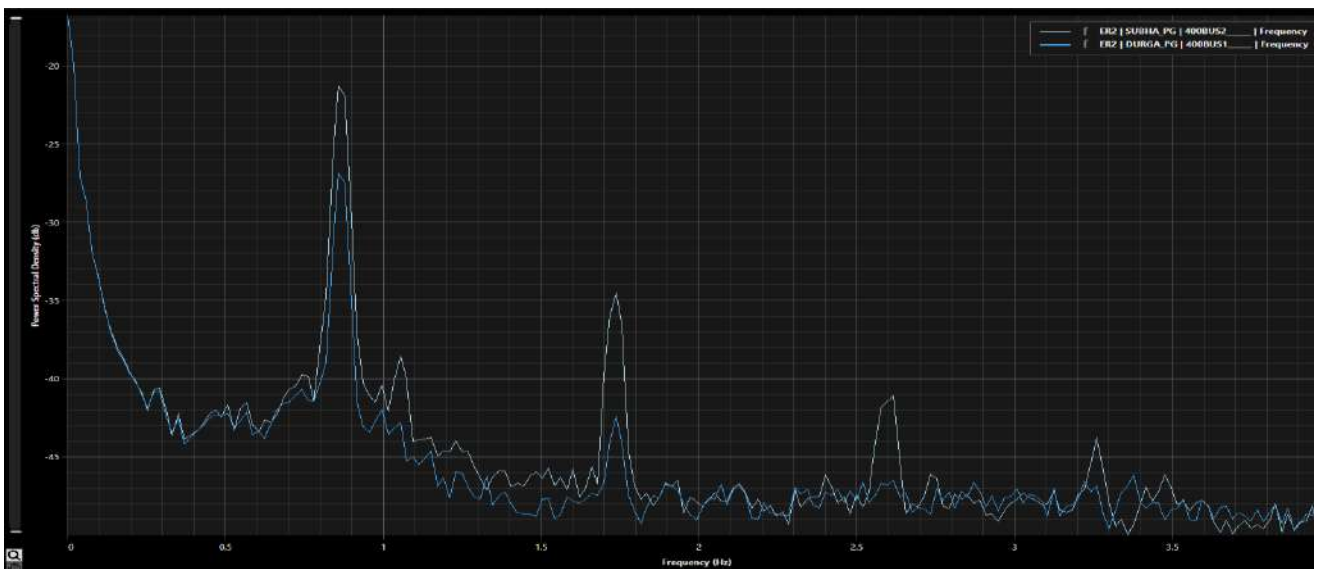
Durgapur Frequency: Frequency variation in Durgapur was comparatively less as moving away from Subhasgram



Mode : 0.8 to 0.9 hz (Local mode) ,This also indicates towards oscillation of any plant against the whole grid of Hunting of any unit due to any problem.

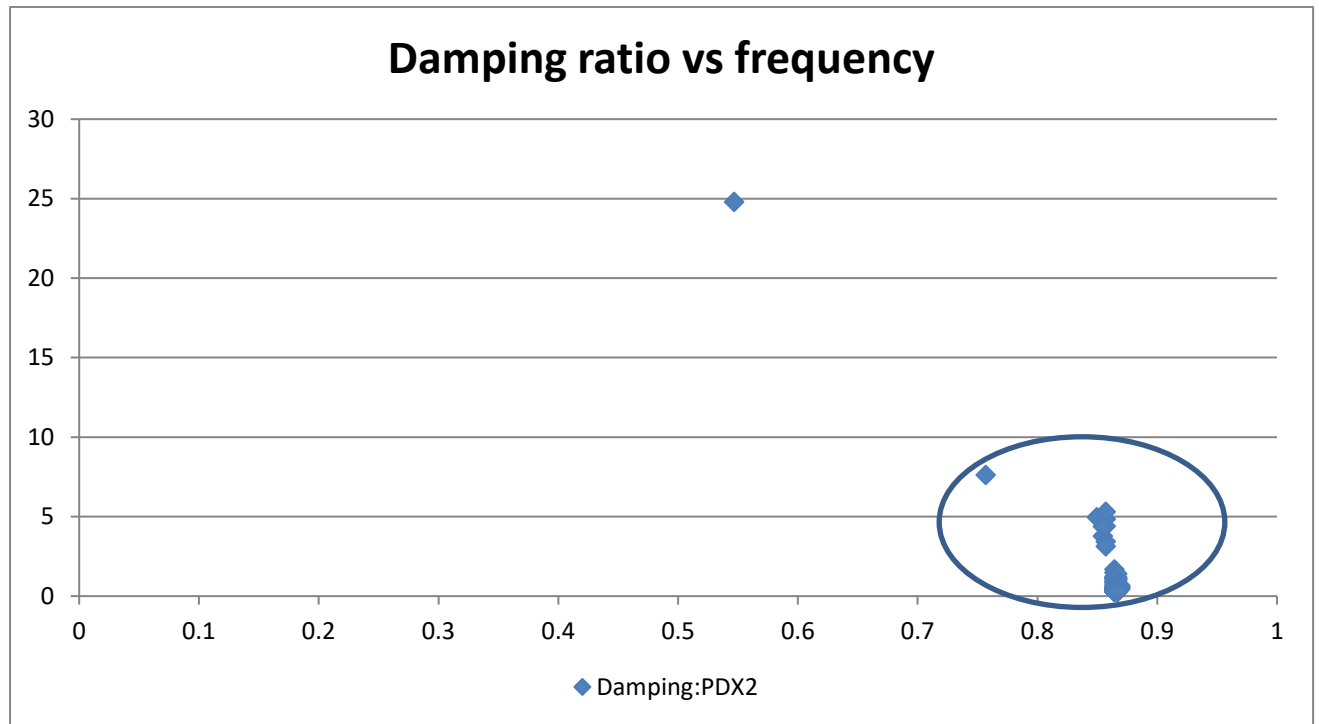


Power Spectral Density as shown below also shows that the highest energy is of 0.8-0.9Hz .

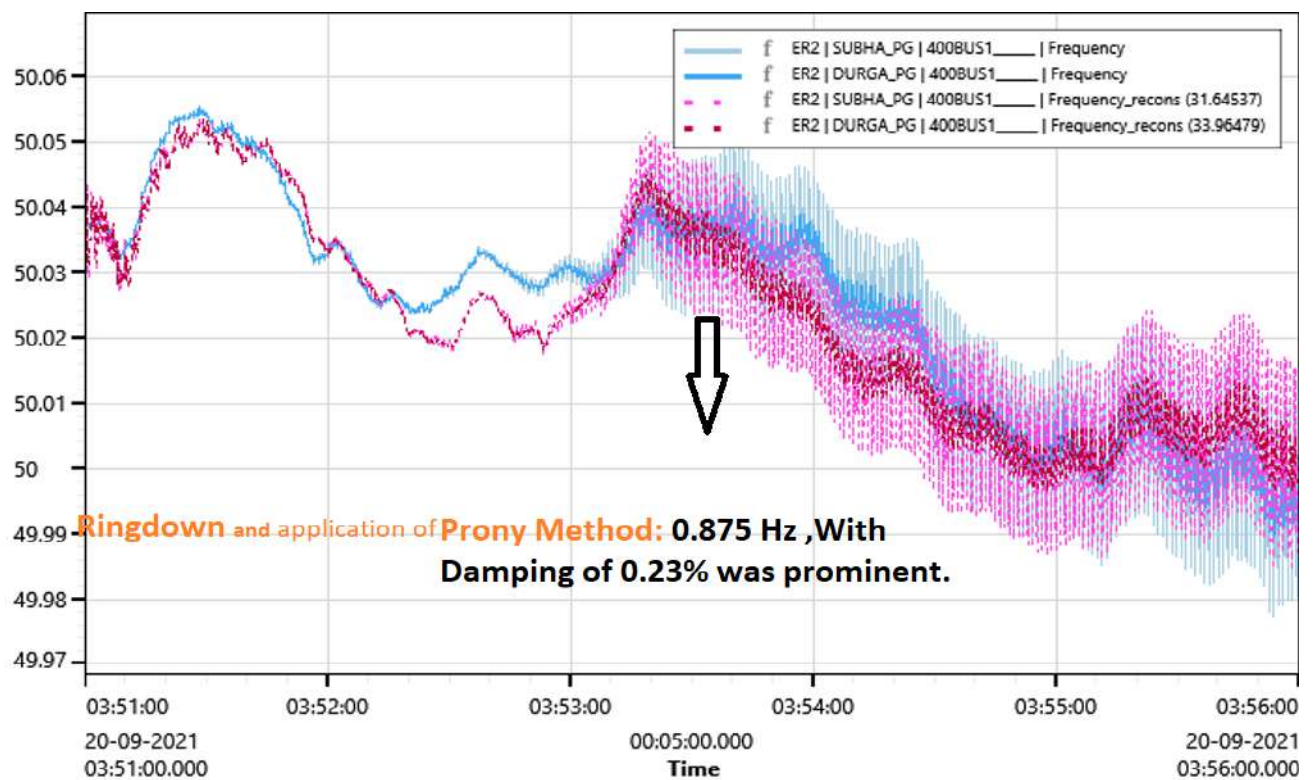


Above signal conditioning PSD and FFT of plot also shows Prominent mode of oscillating frequency 0.8-0.9 Hz (Local mode).

Critical modes as observed from below plot can be seen as between 0.8-0.9Hz with damping ratio less than 5%



Ringdown and application of Prony Method: 0.875Hz with Damping ratio of 0.23 Hz



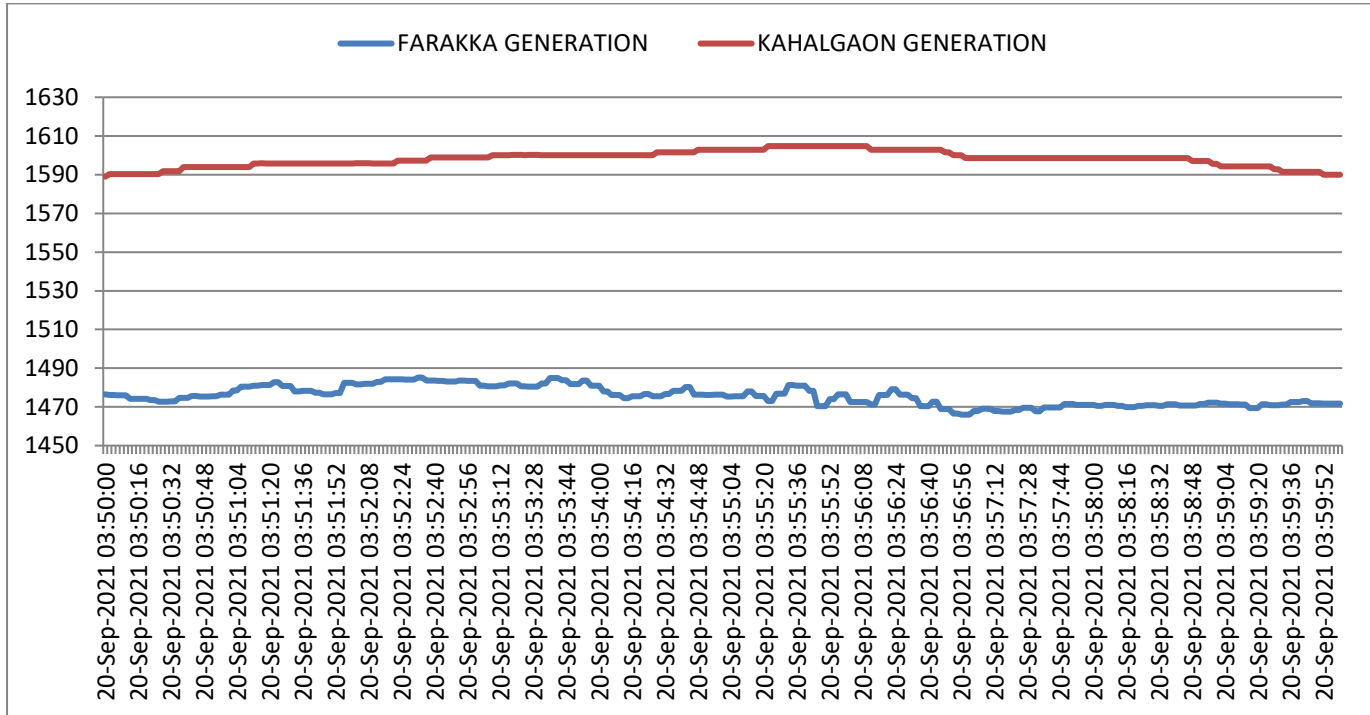
SOURCE OF OSCILLATION:

Scada plot of active power variation of Nearby units:

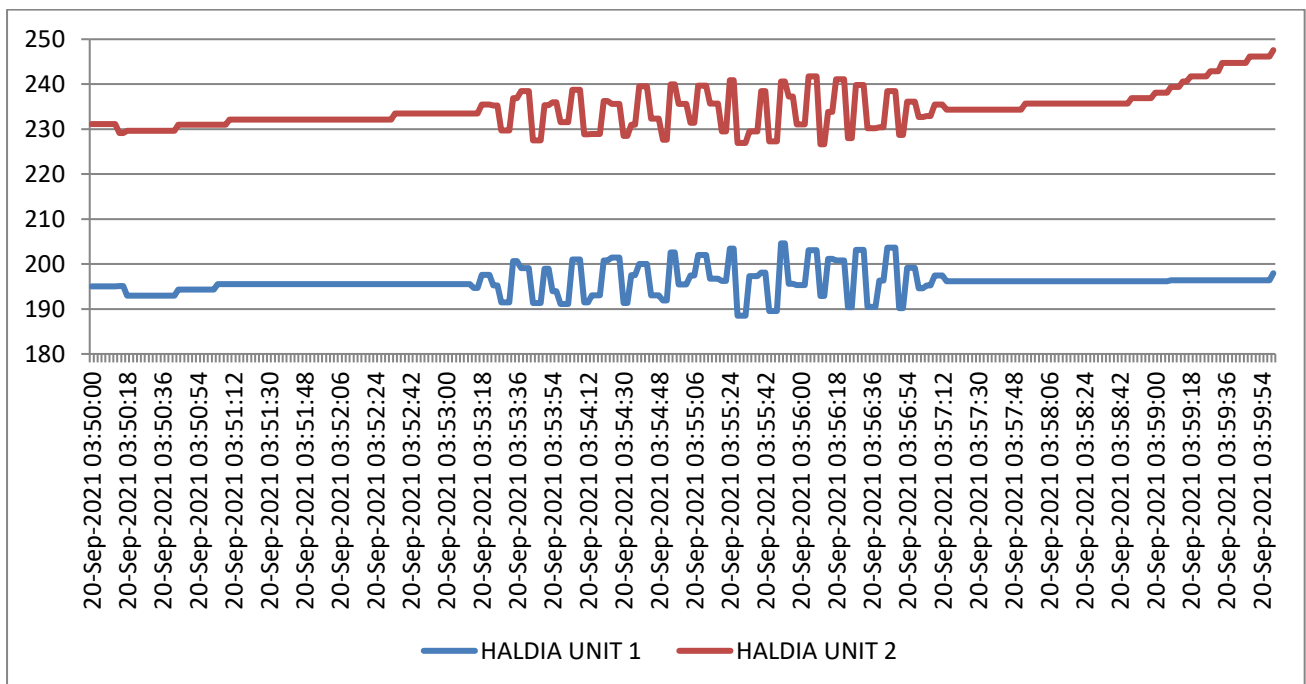
Farakka –Kahalgaon generation:

Farakka overall plant wise only 10 Mw variation unit wise it was only 2 to 3 Mw.

While Kahalgaon no variation observed. This also indicates as we are moving further away from Subhasgram ,units are having less impact .



HALDIA GENERATION VARRIATION: 10 TO 20 Mw in each unit of Haldia observed .

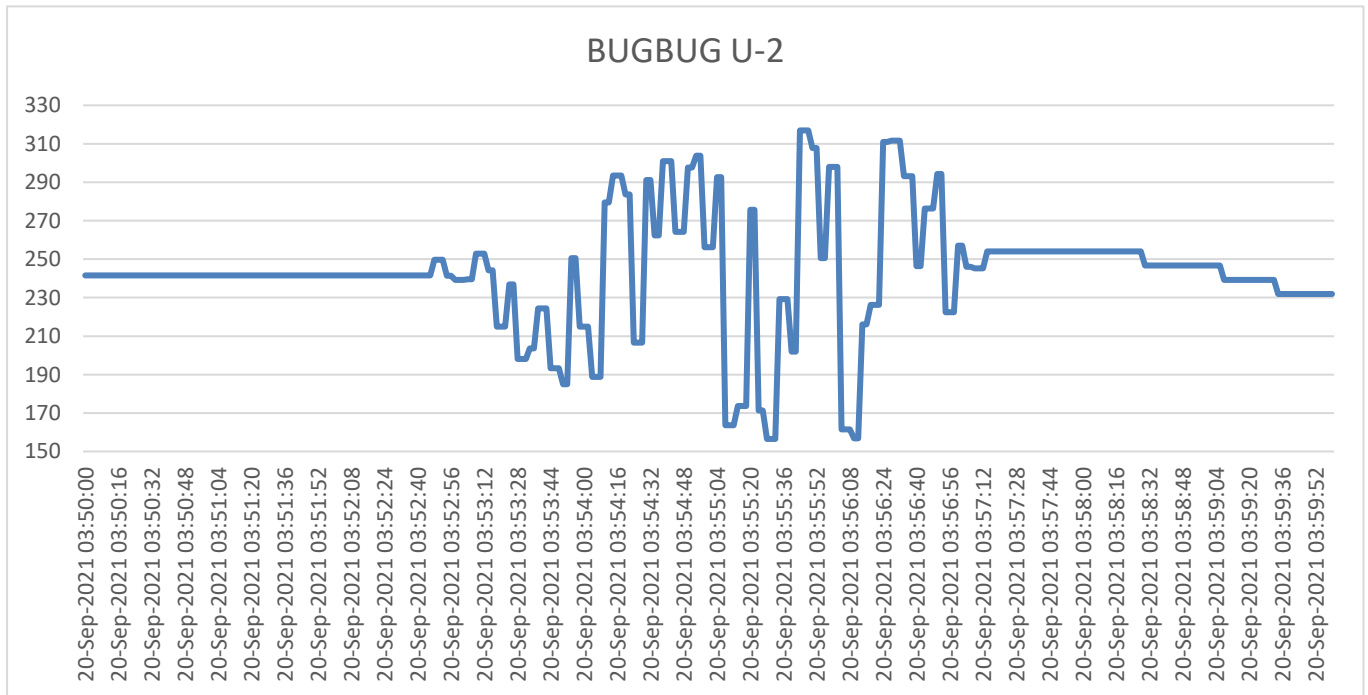


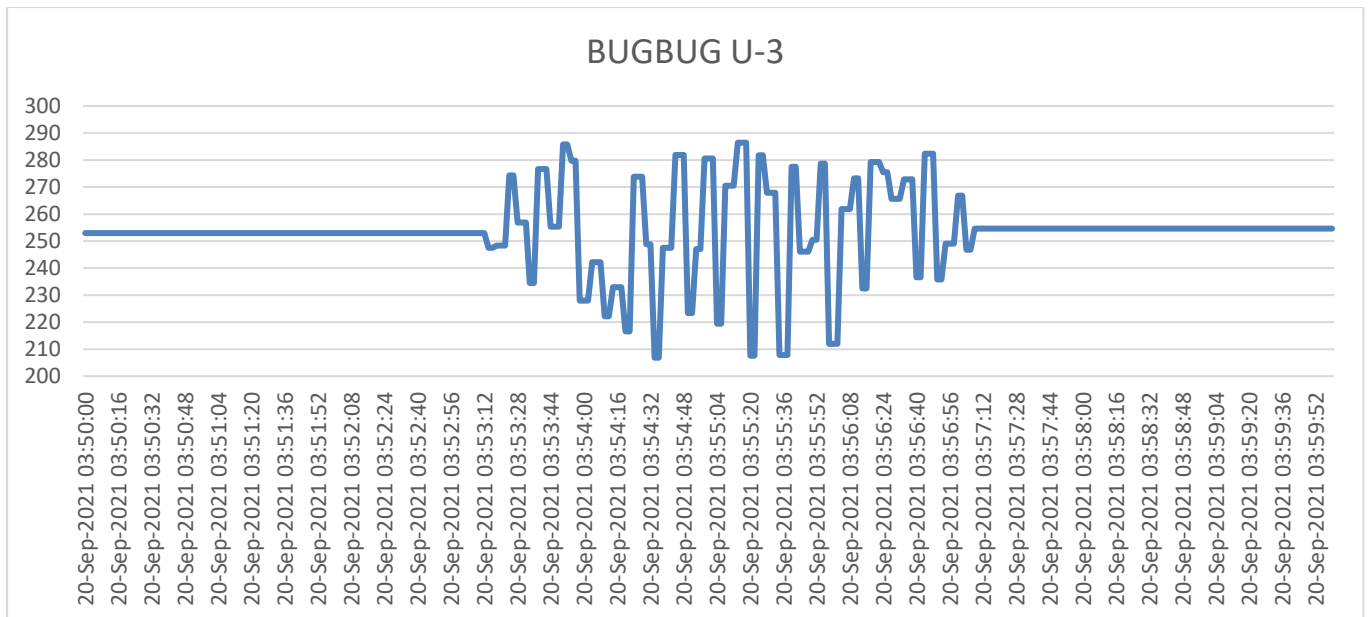
Same was also observed in Haldia Subhasgram power flow variation: 10 Mw variation in each circuit observed as Haldia generation varied.



It was most prominent in Budge-budge units: 140 to 160 Mw variation observed in each unit ,which is maximum and hunting of these units seems to be the source of oscillation .CESC also observed the hunting in these units.

Unit wise variation of Budge-budge Plant:





As observed from the above plots maximum variation in MW oscillation was observed for Budge-budge units ,which appears to be the source of oscillation as the Mw variation damped out ,oscillation was also damped .

At 03:46 Hrs BUDGE-BUDGE unit -1 was taken out due to suspected ash bridging over bottom ash hopper and after 8 minutes of taking unit 1 out hunting started .

Detailed root cause analysis from CESC and reasons are required for the hunting of BUDGE-BUDGE units .

**SUB: REPORT ON TRIPPING OF 220 KV BUS-1 at 400/220/132KV RANGPO SUBSTATION
AT 16:37:25 HRS ON DATED: 11.09.2021.**

1.0 BACKGROUND

220KV Bus-I at Rangpo substation tripped due to mal-operation of GD-1 of Y-phase CB compartment of 220KV Rangpo-Rongnichu Ckt.-I (Bay-212).

Tripped elements: 220KV Bus coupler, 220KV Rangpo-Tashiding line, 400/220KV ICT-1 & 220/132KV ICT-2.

2.0 OBSERVATIONS:

Timer relay (KGD1-T4Y) of 220KV Rongdichu Ckt.-I (bay-212) found burnt. This causes extension of +ve to GD trip relay (KGD1-4Y).

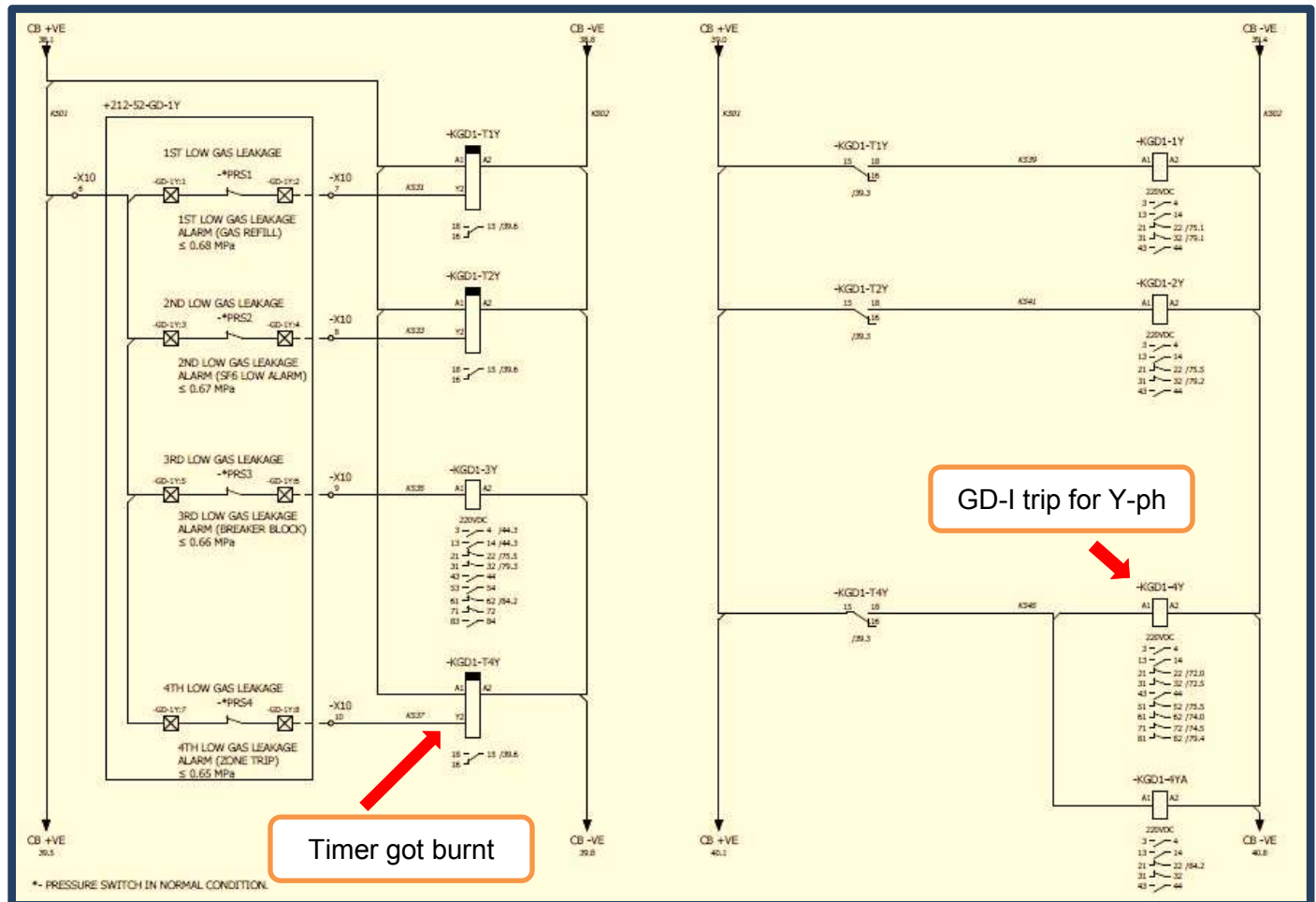
Picture of faulty Timer relay (KGD1-T4Y):

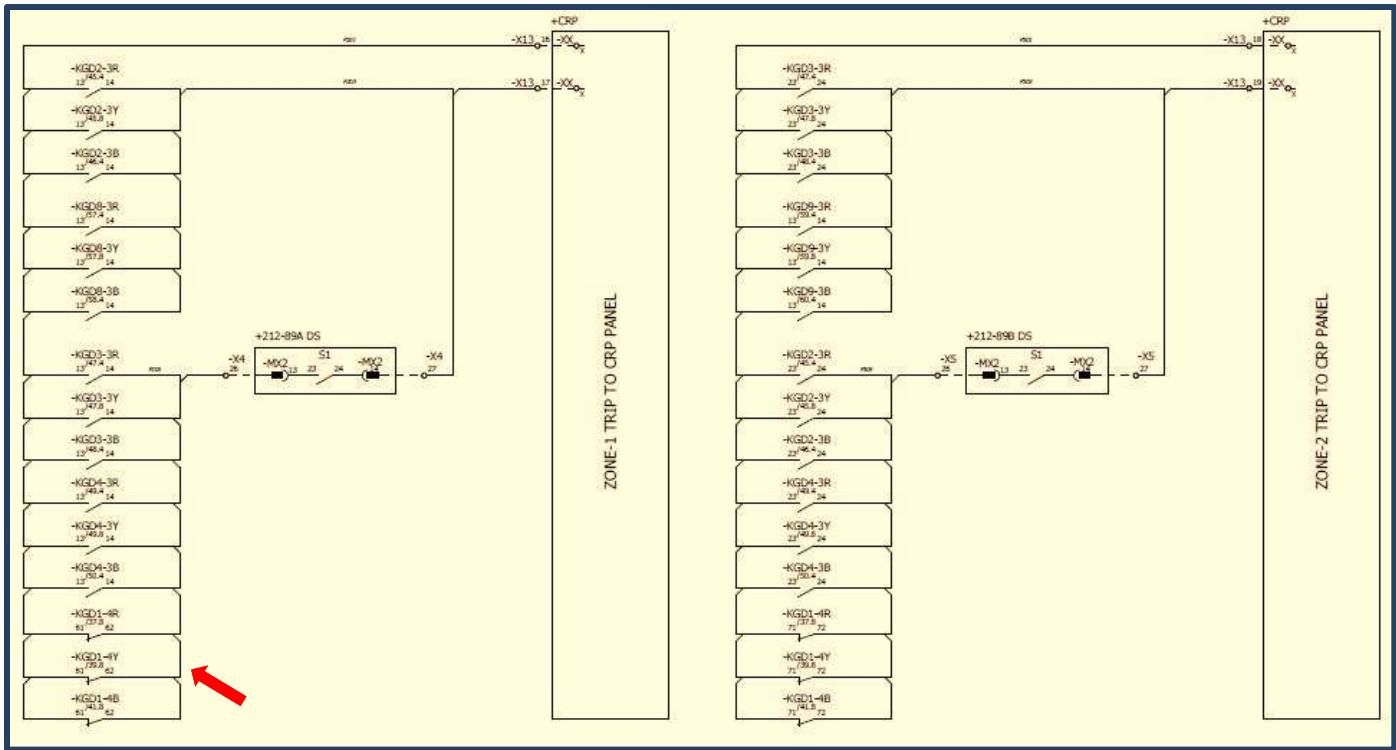


3.0 Root Cause Analysis:

Due to burning of timer relay (KGD1-T4Y) the trip contacts got shorted and '+ve' was extended to GD trip relay (KGD1-4Y) as shown below.

Scheme drawing of 220KV Rangpo-Rongdichu Ckt.-I

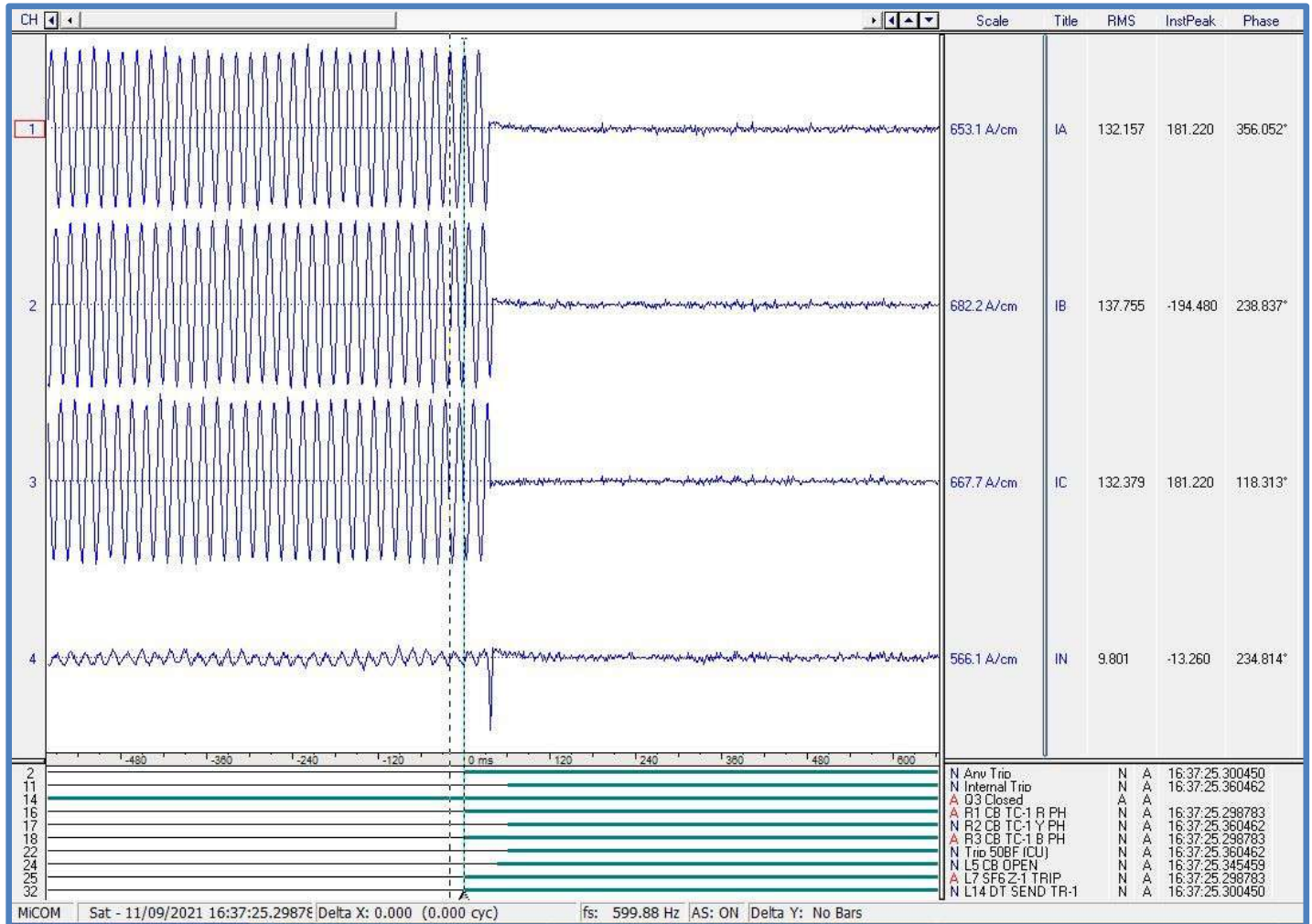




Trip SCADA Event log :

Date	Origin	Description	Message
2021-09-11 16:37:25.393	RANGPO / 400 KV / 409 ICT-1 / REF-RELAY_SYSTEM	86-B	TRIP
2021-09-11 16:37:25.383	RANGPO / 220 KV / 204 TASHIDING / 21-MAIN-1_SYST	GROUP RELAY-A	TRIP
2021-09-11 16:37:25.383	RANGPO / 220 KV / 204 TASHIDING / 21-MAIN-1_SYST	GRP RELAY 86A GOOSE	TRIP
2021-09-11 16:37:25.383	RANGPO / 220 KV / RONGNICHU-1 / P546-RELAY_SYST	LBB PROT. OPTD	OPERATED
2021-09-11 16:37:25.383	RANGPO / 220 KV / 204 TASHIDING / 21-MAIN-2_SYST	GRP RELAY 86B	TRIP
2021-09-11 16:37:25.382	RANGPO / 220 KV / RONGNICHU-1 / GOOSE	LBB OPT	RUN
2021-09-11 16:37:25.379	RANGPO / 220 KV / 210 220/132ICT-2 / P141HV-RELAY_SYS	GRP RELAY 86A	TRIP
2021-09-11 16:37:25.373	RANGPO / 220 KV / 204 TASHIDING / 21-MAIN-1_SYST	LBB PROTECTION	TRIP
2021-09-11 16:37:25.368	RANGPO / 220 KV / 204 TASHIDING / PROTECTION PANEL	DIRECT TRIP CHANNEL-2	SEND
2021-09-11 16:37:25.368	RANGPO / 220 KV / 204 TASHIDING / AUTORECLOSE-PROT	BLOCK CONTACTS	ALARM
2021-09-11 16:37:25.368	RANGPO / 220 KV / 204 TASHIDING / PROTECTION PANEL	DIRECT TRIP CHANNEL-1	SEND
2021-09-11 16:37:25.356	RANGPO / 220 KV / RONGNICHU-1 / P546-RELAY_SYST	CB Y PH OPEN	OPEN
2021-09-11 16:37:25.355	RANGPO / 220 KV / P741-87CU / SYSTEM	BUSBAR ZONE-1 TRIP	TRIP
2021-09-11 16:37:25.353	RANGPO / 220 KV / RONGNICHU-1 / P546-RELAY_SYST	CB B PH OPEN	OPEN
2021-09-11 16:37:25.353	RANGPO / 220 KV / RONGNICHU-1 / P546-RELAY_SYST	CB R PH OPEN	OPEN
2021-09-11 16:37:25.339	RANGPO / 220 KV / RONGNICHU-1 / CB-52	CB YPH POSITION	OPEN
2021-09-11 16:37:25.339	RANGPO / 220 KV / RONGNICHU-1 / CB-52	CB POSITION	OPEN
2021-09-11 16:37:25.336	RANGPO / 220 KV / RONGNICHU-1 / CB-52	CB BPH POSITION	OPEN
2021-09-11 16:37:25.336	RANGPO / 220 KV / RONGNICHU-1 / CB-52	CB RPH POSITION	OPEN
2021-09-11 16:37:25.321	RANGPO / 220 KV / RONGNICHU-1 / P546-RELAY_SYST	BUSBAR PROT. OPTD	State 1
2021-09-11 16:37:25.321	RANGPO / 220 KV / RONGNICHU-1 / PROTECTION PANEL	BB PROT. N	SET
2021-09-11 16:37:25.304	RANGPO / 220 KV / RONGNICHU-1 / PROTECTION PANEL	AR BLOCK	ALARM
2021-09-11 16:37:25.304	RANGPO / 220 KV / RONGNICHU-1 / PROTECTION PANEL	DIRECT TRIP CH-2	SEND
2021-09-11 16:37:25.303	RANGPO / 220 KV / RONGNICHU-1 / PROTECTION PANEL	DIRECT TRIP CH-1	SEND
2021-09-11 16:37:25.291	RANGPO / 220 KV / RONGNICHU-1 / CB-52	4TH STAGE GAS PRESSURE LOW GD-1	ALARM
2021-09-11 16:19:52.340 (*)	RANGPO / 400 KV / 417 SILIGUR#1 / 21-MAIN-2_PROT	POWER SWING BLOCK	State 0
2021-09-11 16:19:52.325	RANGPO / 400 KV / 417 SILIGUR#1 / 21-MAIN-1_PROT	DIR. EARTH FAULT START	State 0
2021-09-11 16:19:52.323	RANGPO / 400 KV / 417 SILIGUR#1 / 21-MAIN-1_PROT	DIR. EARTH FAULT START	State 1

Snap of DR:

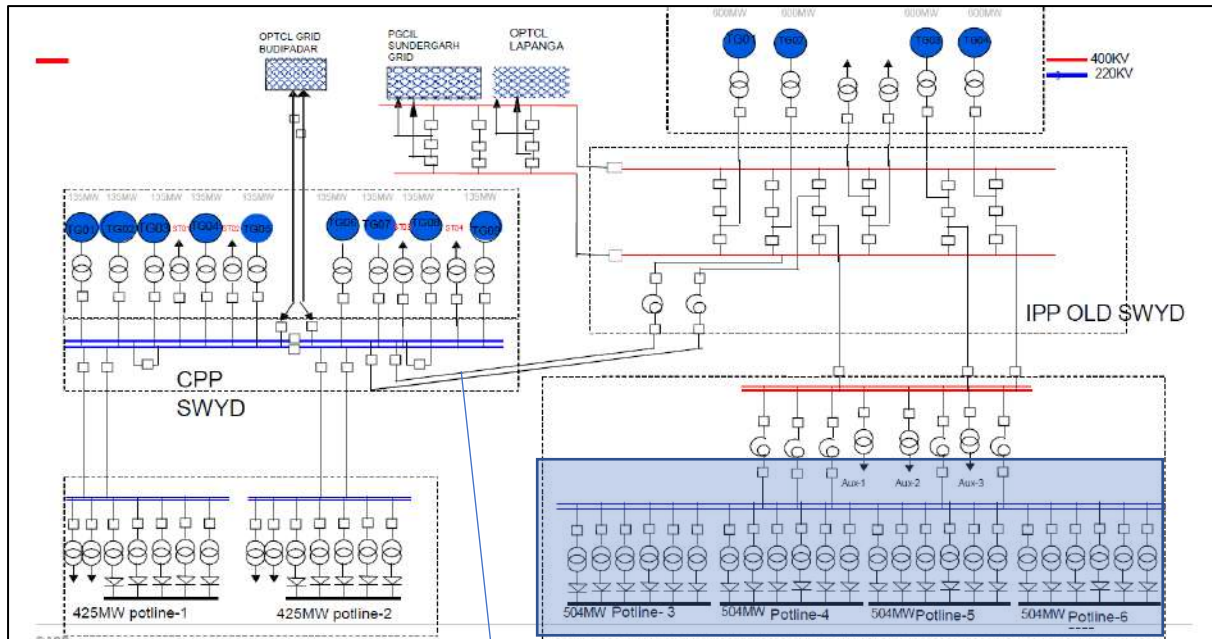


5.0 Corrective action taken:

- 1) Faulty timer replaced with new spare. 220KV Bus-I and other connected feeders restored.

EVENT OF SMELTER LOAD TRIPPING ON 28th September

Sterlite SLD:



400 & 220 kv are decoupled with each other.

Smelter load at 400 Kv.

Plant scenario prior to event:

- Unit 3 was out and Unit 1,2&4 was running with total generation of 1232 Mw.
- Sterlite was drawing 258 Mw from Grid ,so total load was 1490 MW.

At 17:48 Hrs due to fault in downstream within 400 kv Sterlite switchyard ,Smelter load reduced by 1450 Mw .

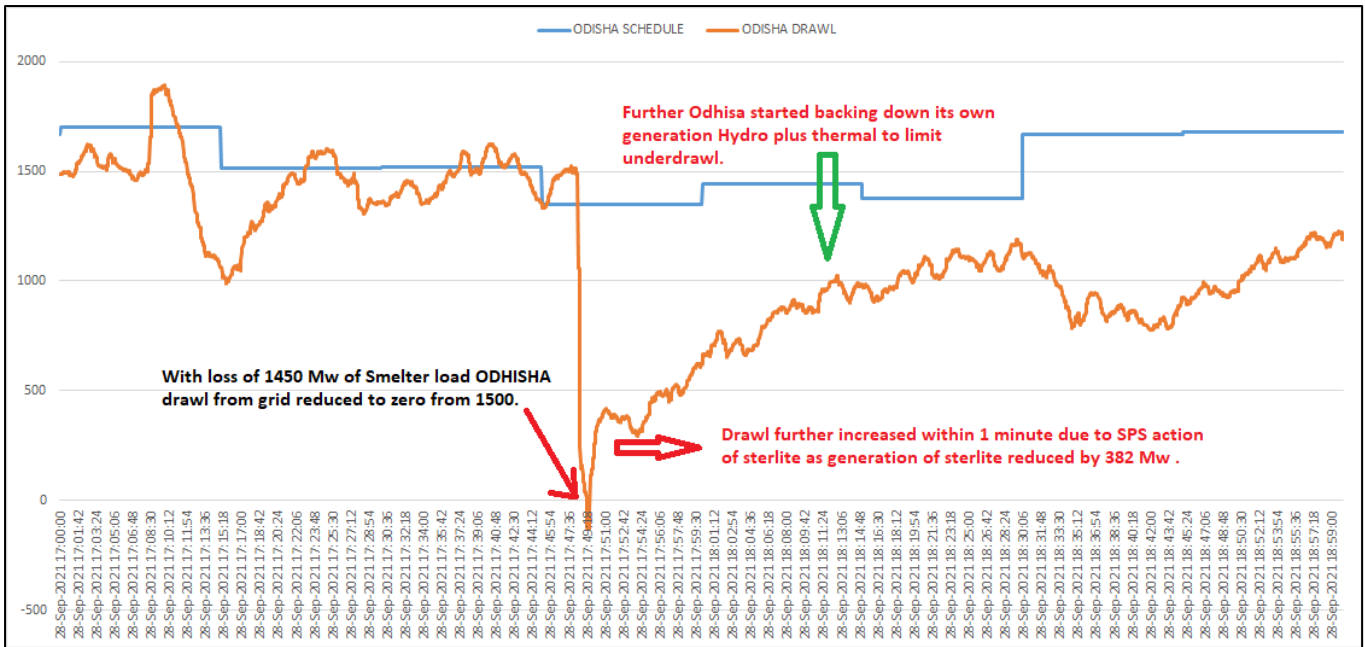
- As Sterlite load reduced ,Sterlite started exporting to the grid by 1182 Mw so total load reduced was 1450 Mw .
- At Sterlite SPS is there to take care of Huge injection in the grid which was set at 800Mw whenever injection is more than 800 MW it will limit it by generation reduction logic .
- Hence total generation to be reduced to limit till 800 Mw was ,1182-800= 382 Mw.

As per logic shown below priority 6 was satisfied

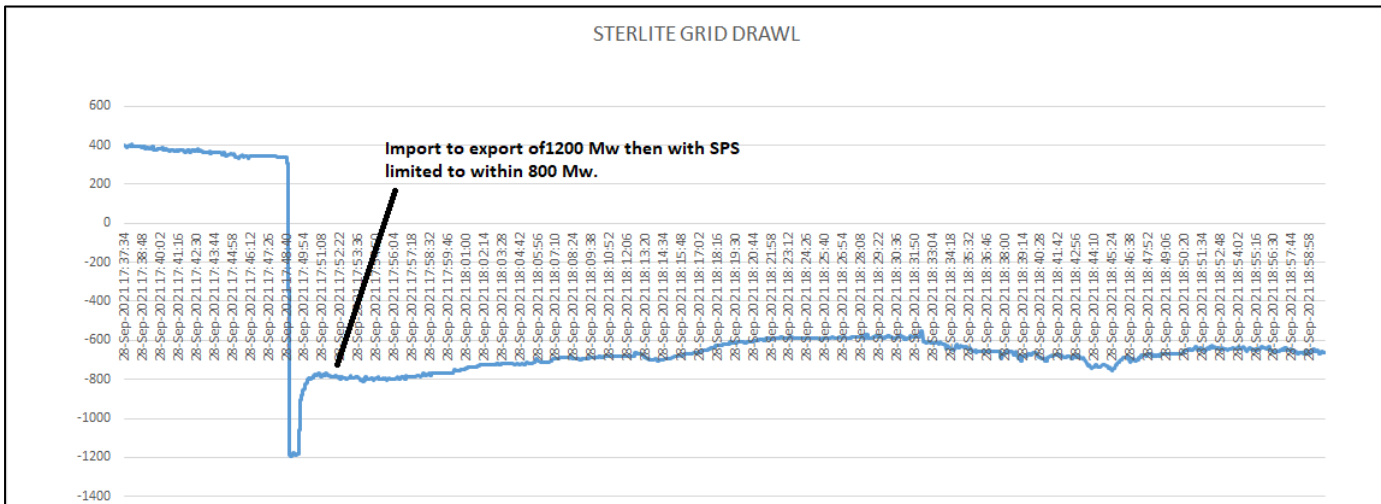
So generator 1 HP,LP Bypass occurred with generator 1 shedding which reduced the grid export within 800 Mw within 1 minutes .

Accumulated generation shed table	Priority	MW
GEN2 HPLP	1	81.417
GEN2 HPLP+GEN1 HPLP	2	225.621
GEN2HPLP+GEN1 HPLP+GEN 4 HPLP	3	369.45
GEN2HPLP+GEN1 HPLP+GEN 4 HPLP+GEN3 HPLP	4	369.45
GEN2	5	271.39
GEN2+ GEN1 HPLP	6	415.594
GEN2+ GEN1 HPLP+GEN4 HPLP	7	559.423
GEN2+ GEN1 HPLP+GEN4 HPLP+GEN 3 HPLP	8	559.423
GEN2+GEN1	9	752.07
GEN2+GEN1+GEN4 HPLP	10	895.899
GEN2+GEN1+GEN4 HPLP+GEN3 HPLP	11	895.899
GEN2+GEN1+GEN4	12	1231.5
GEN2+GEN1+GEN4+GEN3 HPLP	13	1231.5
GEN2+GEN1+GEN4+GEN3	14	1231.5

ODISHA schedule vs Draw



Sterlite Draw from Grid:



Repeated Tripping of 220KV DALTONGANJ – GARWA D/C and related Issues.

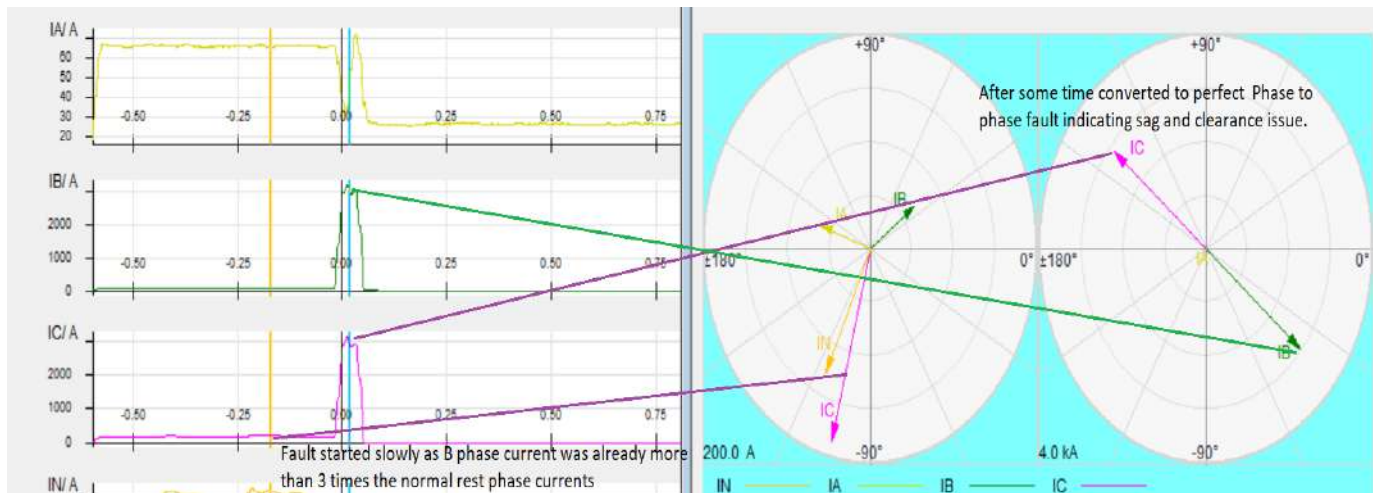
Following tripping's Occurred during month of September and brief remarks are also mentioned.
Detailed issues as found are also mentioned below.

Sr No	Element Name	Tripping Date	Tripping Time	Reason	Remarks
1	220KV-DALTONGUNJ-GARWAH (NEW)-2	03-09-2021	12:22	GARWAH: Z1, YB, Iy-518A, Ib-555A, 49.59km DALTONGUNJ: YB, Iy-2.8kA, Ib-2.9kA, 27.6km	B phase fault started first and after some time converted to perfect phase to phase fault indicating, sag and clearance issue. For Phase-to-phase fault at Daltonganj end R phase did not opened and was holding only YB phase opened.
2	220KV-DALTONGUNJ-GARWAH (NEW)-2	06-09-2021	09:16	Garwah B-N, 479.9 A 60.5 km	B phase fault but at Garwa end ,No A/R occurred and breaker was open for some time after that tripped in PD ,while at Daltonganj A/R successful. Arc over occurring at Peak voltage .
3	220KV-DALTONGUNJ-GARWAH (NEW)-2	07-09-2021	14:43	DALTONGUNJ:- R-Y, 64.4KM, Ir=Iy=1.8KA, Z-2 GARWAH:- Z-1, 25.2KM, R-Y, Ir=Ib=1.1KA	y phase fault converted to perfect R-Y phase to phase fault , with fault occurring at Voltage peak.
4	220KV-DALTONGUNJ-GARWAH (NEW)-2	13-09-2021	18:38	Daltongunj: A/R successful,137.7Km,0.978Ka,b-n Garwa New: Z-1, 18.07 kM,Ia=165.9A, Ib=219.3A, Ic=916.2A	B phase fault but at Garwa end ,No A/R occurred and breaker was open for some time after that tripped in PD ,while at Daltonganj A/R successful. Arc over occurring at Peak voltage .
5	220KV-DALTONGUNJ-GARWAH (NEW)-2	17-09-2021	11:23	A/R SUCCESSFUL FROM DALTONGANJ; GARHWA: Z-1, B-N, Fc= 0.88 kA, Fd= 54.25km	B phase fault but at Garwa end ,No A/R occurred and breaker was open for some time after that tripped in PD ,while at Daltonganj A/R successful. Arc over occurring at Peak voltage .
6	220KV-DALTONGUNJ-GARWAH (NEW)-2	26-09-2021	15:31	Garwah: B-N,1.4kA, 65Km , Daltongunj - did not trip	B phase fault , A/R unsuccessful at both end in ckt-1 while ckt-2 tripped from only Garwa end .Current reversal guard implementations to be checked as racing has caused tripping of ckt-1.

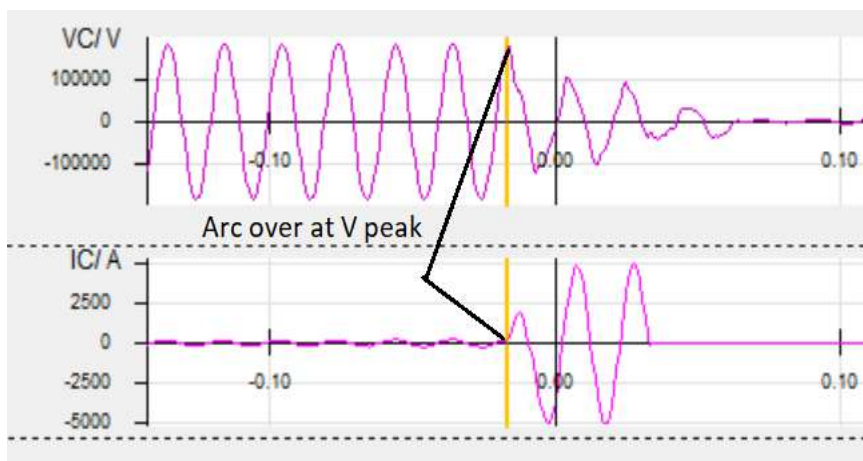
 **Fault Nature ,Sag and Clearance Issue:**

It can be observed from below plots that B phase current started rising slowly and then got converted to perfect phase to phase fault (as phase currents of Y and B are 180 degree apart) due to arc over at voltage peak instance. B phase was involved in each fault.

Same phenomenon as mentioned above is observed in almost all cases, which indicates that the fault is **occurring due to sag and clearance issues, hence** proper line patrolling and healthiness of line should be maintained, same kind of fault nature was also observed in this line few months ago which was resolved by, jumper tightening and tree pruning at some locations. This needs to be looked into again and taken care.



ARC OVER AT Volatge Peak:



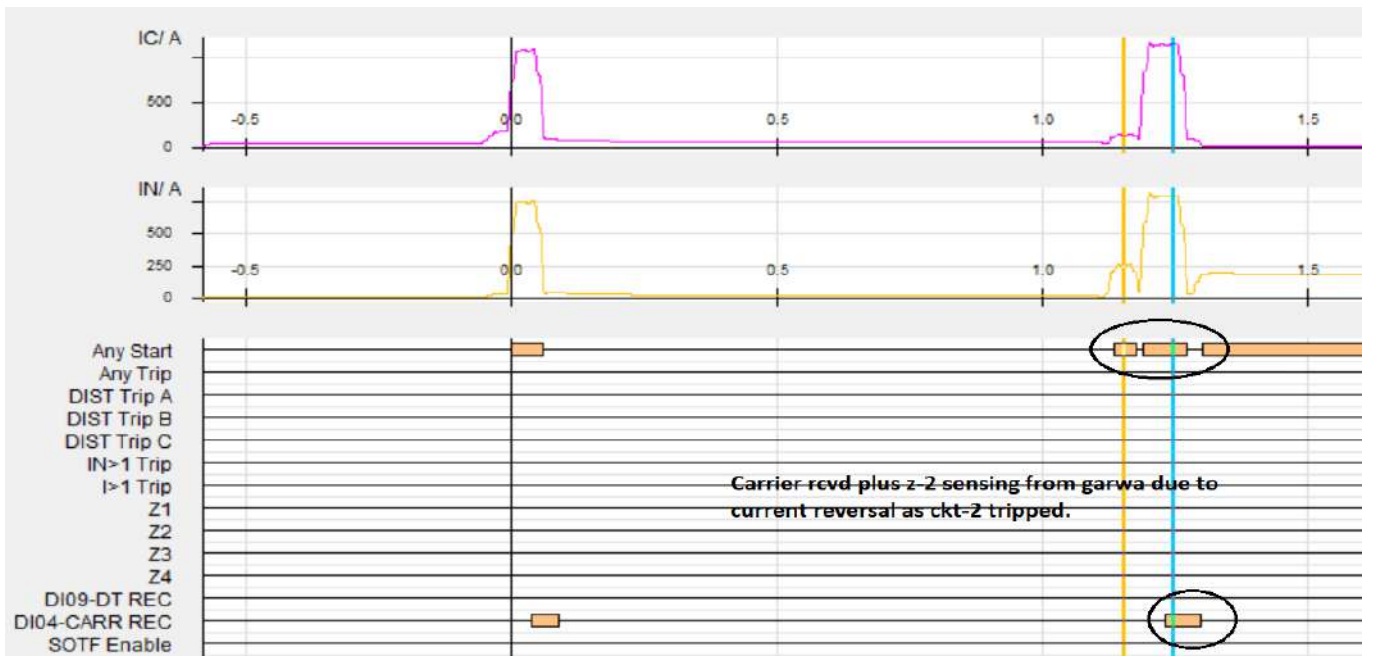
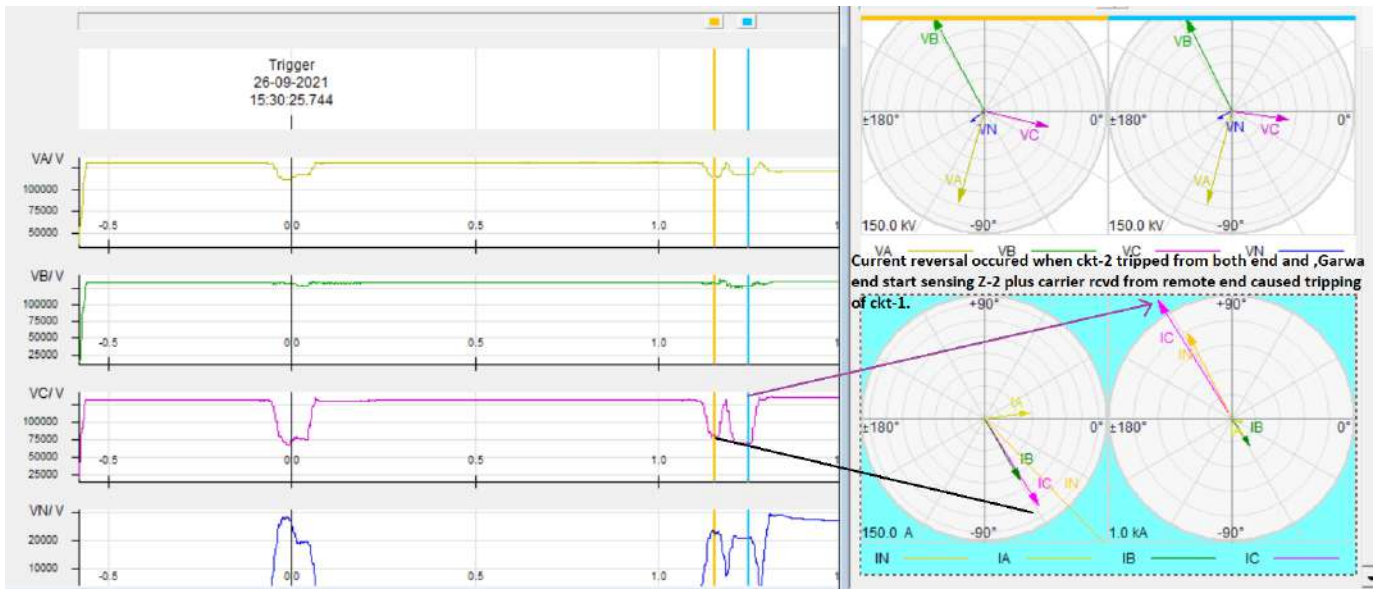
Non-Operation of Auto Reclose:

At 3 instances it was observed that for B-Earth single phase fault Single(B) phase opening is occurring at Garwa end but ,after dead time A/R is not occurring and B phase kept opened until Pole discrepancy operated and caused tripping of line .For all these instances A/R was successful from Daltonganj end proper A/R operation at Garwa end could have avoided tripping .

Implementation of proper Current Reversal guard for POTT scheme:

As the line is radial in nature POTT scheme is implemented, it was observed that on 26th for the fault in Ckt-2 both lines tripped .

- At the A/R instance of ckt-2 ,Daltonganj end of ckt-1 was sensing the fault of ckt-2 in Zone-2 and was sending carrier to Garwa end .
- Then as the A/R of Ckt-2 got failed and ckt-2 opened from garwa end ,suddenly current reversal took place and Garwa end of ckt-1 started sensing the same fault in zone -2 ,and it was receiving the carrier also so tripping condition for ckt-1 at Garwa end got satisfied and caused the ckt-1 tripping from Garwa end only(can be observed from below plot) .This also caused the load loss at Garwa.
- Proper implementation of Current reversal guard needs to be ensured to avoid such tripping



TENUGHAT ISLANDING STUDY

1. Introduction:

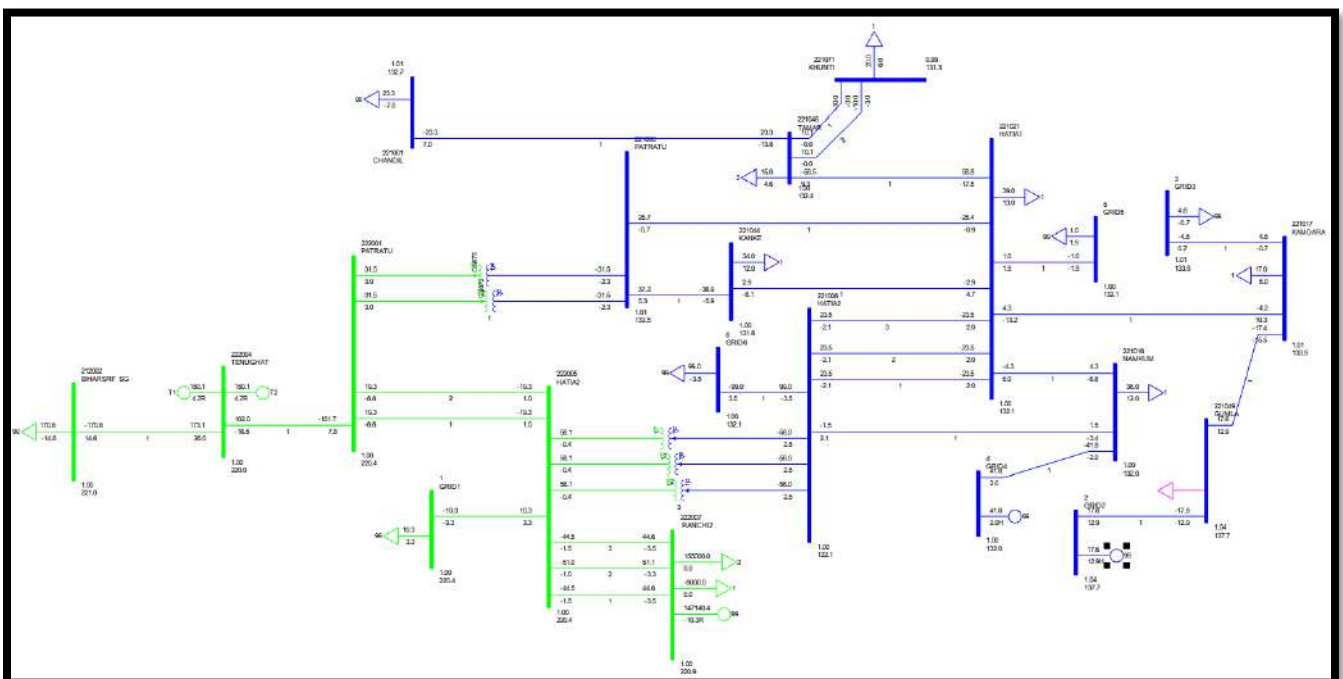
One of the key features of a resilient power system is robust islanding scheme. Success of an islanding scheme depends on the design as well as implementation of the logic. Logic needs to be robust as well as simple. Extensive study is required to design an effective islanding scheme. For TENUGHAT islanding 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	X _d		
8	1.7360	X _q		
9	0.2290	X _d		
10	0.4810	X _q		
11	0.1790	X _{'d} = X _{'q}		
12	0.1570	X _l		
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 IEEE1SDU 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

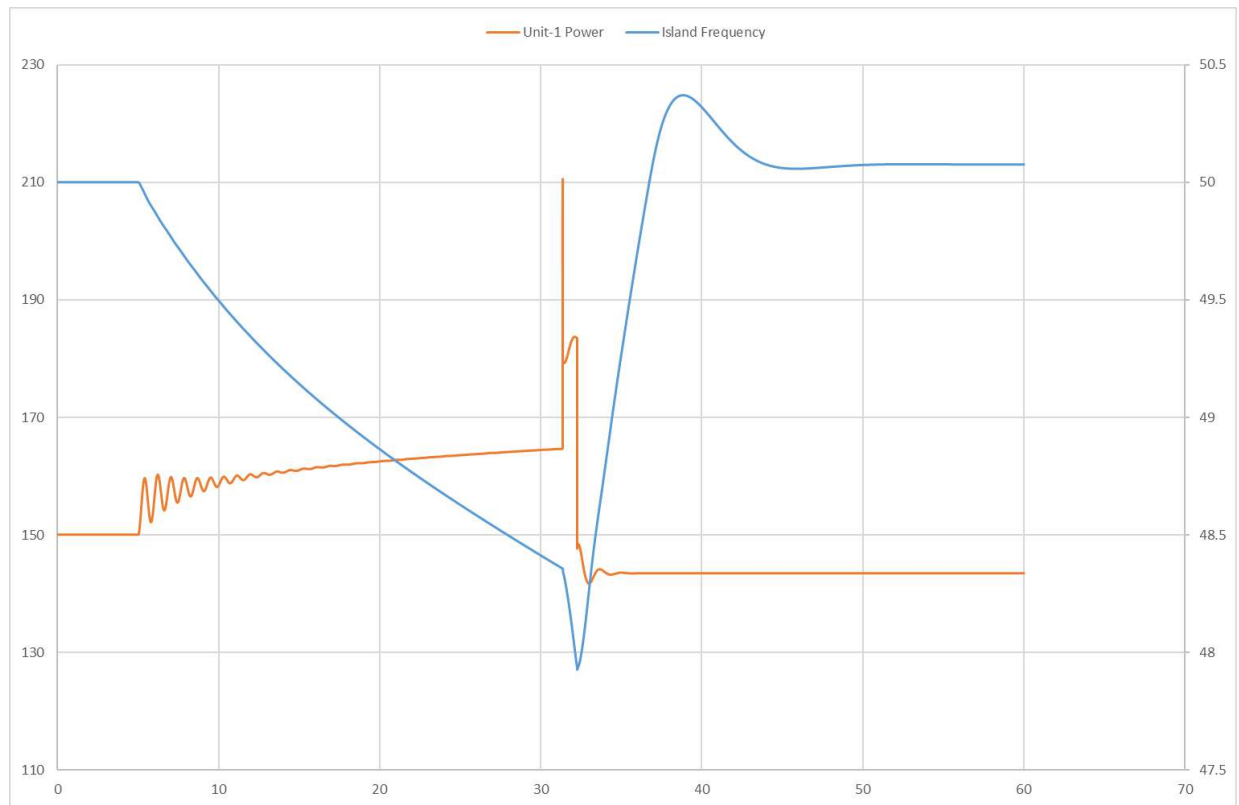
The above LGB is prepared based on input from SLDC.

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.

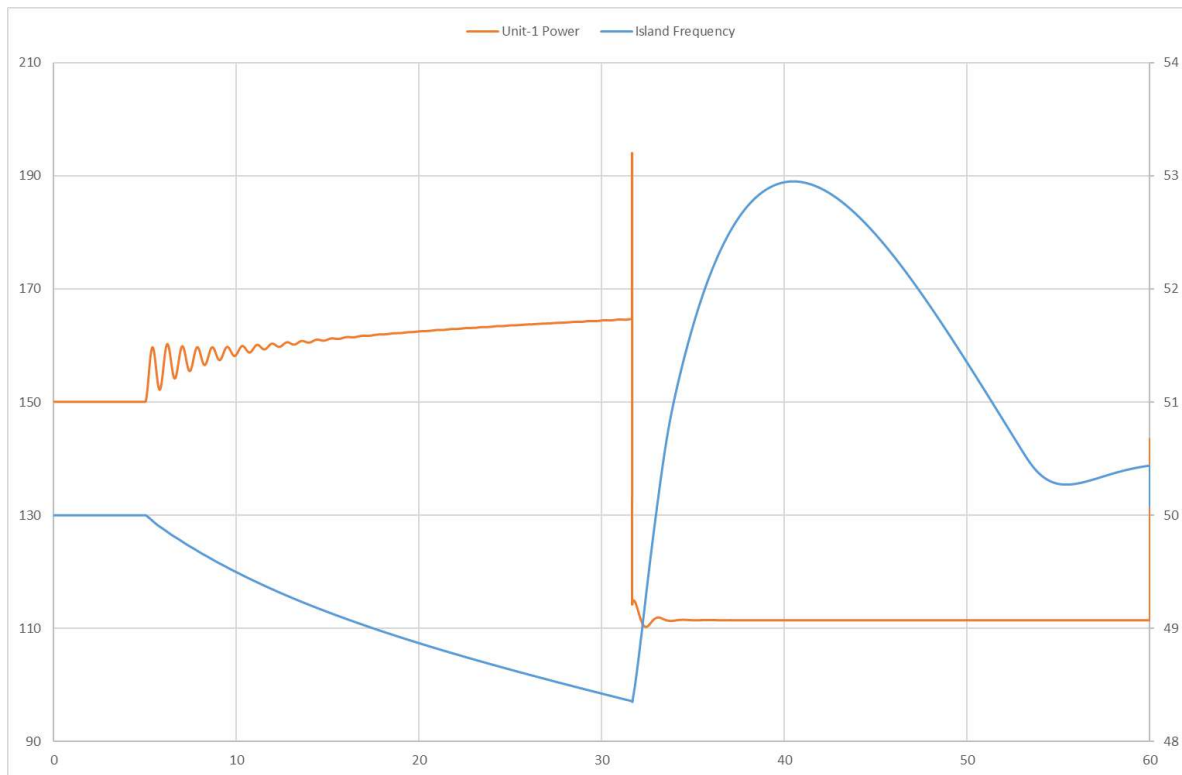
Scenario-1: Maximum generation & Maximum load



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

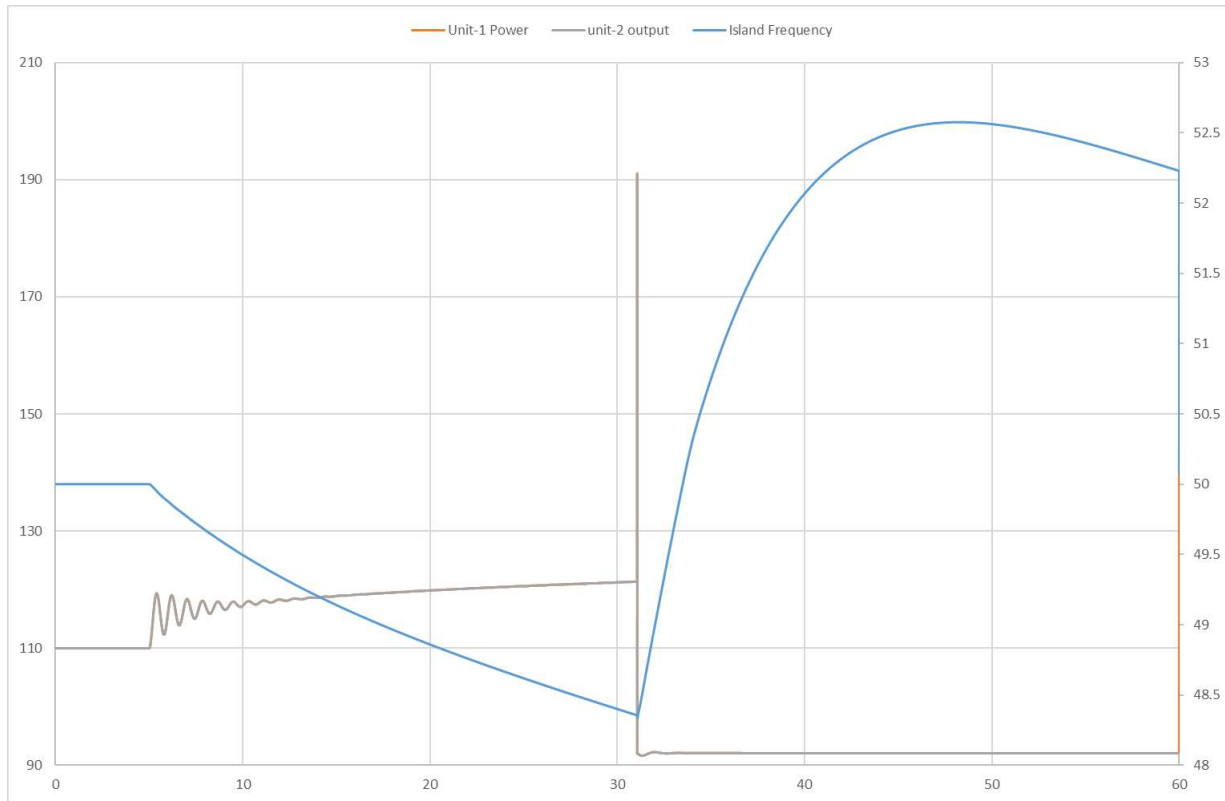
Scenario-2 : Maximum generation & Minimum load



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

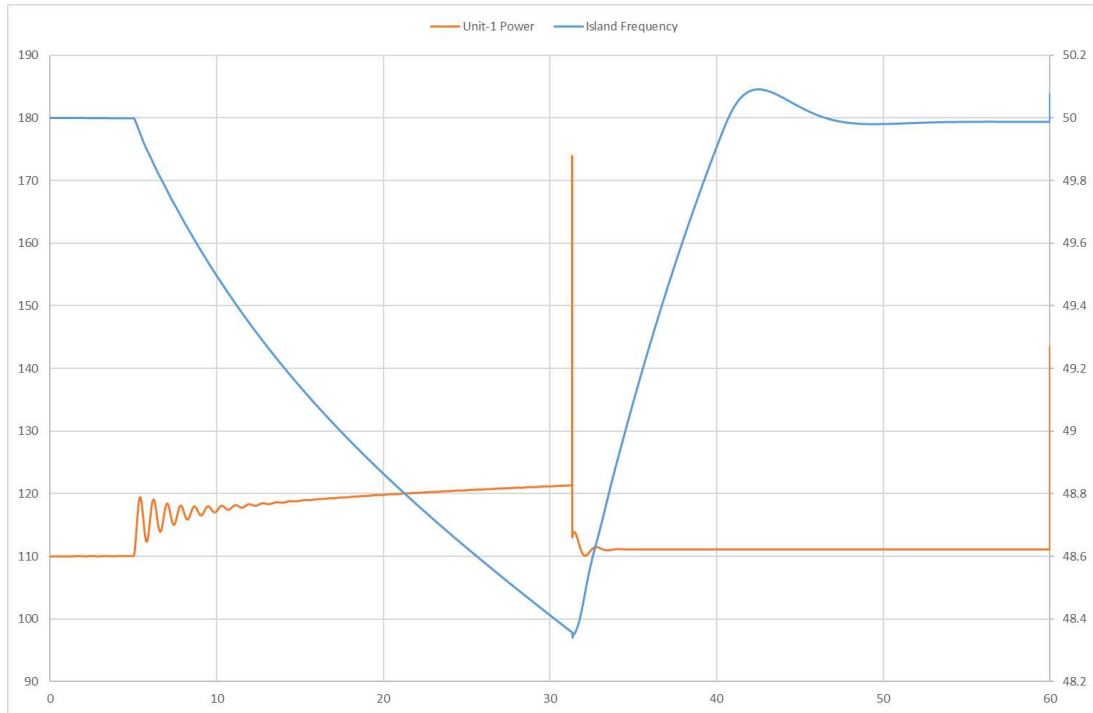


Discussion:

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.

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

Annexure B.11

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	220KV DARBHANGA (DMTCL)-LAUKAHI-2	01-09-2021	08:44	01-09-2021	09:24	Darbhangha: B_N, Z I, 68.56 km, 1.425 kA	Laukahi: B_N, 68.56 km, 1.425 kA	B-Earth	100	Three phase tripping for single phase fault from both ends.	DMTCL	BSPTCL	PLCC channel-2 of both ckts defective. Both parties to check the logic and PLCC issue
2	400KV MERAMUNDALI-LAPANGA-1	01-09-2021	10:02	01-09-2021	12:46	Meramundali: B_N, 188 km, 2.5 kA	Lapanga: B_N, 3.582 km, 20.86 kA	B-Earth	100	A/r failed. But at Lapnaga end MCB & TCB are reclosing one after another within 100ms causing repeated fault feeding.	OPTCL	OPTCL	A/r of TCB after failure of A/r of MCB will be looked into
3	220KV TENUGHAT-PATRATU-1	01-09-2021	11:01	01-09-2021	13:29	Tenughat: Y_N, 40.02 km	Patratu: Y_N, 20.64 km, 7.07 kA	Y-Earth	100	Three phase tripping for single phase fault. A/r not in service	JUSNL	JUSNL	No PLCC available
4	220KV CHANDIL-RANCHI-1	03-09-2021	23:15	04-09-2021	16:37	Chandil: B_N, 2.09 kA, 44.4 km, A/r failed	Ranchi: B_N, 4.316 kA, 36.893 km	B-Earth	350	Carrier signal sent from Ranchi, line tripped from Chandil in Z II time. A/r failed from Ranchi end	JUSNL	PG ER-1	PLCC issue resolved

5	220KV NEW PURNEA- MADHEPURA-1	05-09-2021	11:08	06-09-2021	15:20	New Purnea: Y_B, Z I, Iy=Ib=13.37 kA		Y_B	130	A/r operated from Madhepura but at the A/R instance Phase to phase fault in zone-2 sensed and tripped after 350 ms due to non receipt of carrier .This may be looked.. Y_ph conductor snapped at loc. 42	PG ER-1	BSPTC L	Communication issue
6	400KV BINAGURI- RANGPO-1	10-09-2021	21:58	10-09-2021	22:13	Binaguri: R_N, 89.58 km, 3.359 kA	Rangpo: R_N, 25.485 km, 4.395 kA	R-Earth	100	Tripped in reclaim time from Binaguri. But at the time of fault in reclaim time 3 phase TCB opened but only R phase MCB opened and after 1.5 second of that Y and B phase MCB opened . While at Rangpo end 3 phase tripping occurred directly without any A/R attempt.	PG ER-2	PG ER- 2	Relay at Binaguri end was faulty and replaced
7	220KV NEW PURNEA- MADHEPURA-1	12-09-2021	19:48	12-09-2021	20:01	New Purnea: R_N, 28 km, 4.92 kA, A/r successful		R-Earth	100	A/r attempt not taken from Madhepura	PG ER-1	BSPTC L	Spring was not charged, CB contactor replaced
8	400KV MUZAFFARPUR- DHALKEBAR-2	15-09-2021	20:11	15-09-2021	21:39	Muzaffarpur: PLCC maloperated		No Fault	NA	DT sent and received at Muzaffarpur	PG ER-1	Nepal	Cable IR value was less and PLCC card issue. Both resolved

9	400 KV JEERAT-NEW JEERAT-1	16-09-2021	05:39	16-09-2021	07:42	Jeerat: Y_N, Z III, 51 km, 2.84 kA		Y-Earth	100	Anti theft setting wasnt revised.	WBSETCL	PMJTL	Anti-theft settings revise
10	400KV JEERAT-NEW JEERAT-2	16-09-2021	05:39	16-09-2021	07:42	Jeerat: Y_N, Z III, 51 km, 2.8 kA		Y-Earth	100	Anti theft setting wasnt revised.	WBSETCL	PMJTL	Anti-theft settings revise
11	220KV NEW PURNEA-KHAGARIA-2	16-09-2021	14:08	16-09-2021	15:35			B-Earth	100	Three phase tripping for single phase fault	PG ER-1	BSPTCL	Fault was in 220 kV Khagaria-Begusarai-2 but relay at Khagaria was not operating. Fault was cleared by New Purnea-Khagaria. Relay was replaced
12	400KV NEW PURNEA-MUZAFFARPUR-1	17-09-2021	15:13	17-09-2021	15:45	New Purnea: B_N, Z I, 123.3 km, 4.03 kA	Muzaffarpur: B_N, Z I, 125.58 km, 3.97 kA	B-Earth	100	Three phase tripping for single phase fault. Issue of A/r not resolved yet	PG ER-1	PG ER-1	PLCC issue resolved
13	220KV PUSAULI-SAHUPURI	25-09-2021	11:05	25-09-2021	12:25	Pusaali: B_N, Z I, 8.86 km, 9.1 kA	Sahupuri: B_N, 54.94 km, 2.577 kA	B-Earth		Three phase tripping for single phase fault. A/r attempt not taken	PG ER-1	BSPTCL	A/r relay to be changed. PLCC issue @ Sahupuri
14	500 MVA 400/220 KV ICT 1 AT DARBHANGA (DMTCL)	25-09-2021	12:38	25-09-2021	13:56	Directional O/c			100	BackUp Directional O/c operated within 100 msec for an external fault	DMTCL	NA	Hi-set O/c with IDMT characteristic.

Sl No.	Name of the incidence	PCC Recommendation	Latest status
1.	Total Power Failure at 220 kV TTPS S/s on 11.08.2021 at 13:34 Hrs	In 106 th PCC Meeting, PCC advised OPTCL to submit present status of PLCC communication for all the lines connected to 220 kV TTPS S/s and take actions to operationalize PLCC communication so that carrier-aided tripping scheme and auto-recloser scheme can be implemented in those lines.	<p><i>SLDC Odisha informed that OPGW is present in 220 kV TTPS- Joda D/C and 220 kV TTPS- Meramundali D/C line. They further informed that after handing over of 220 kV TTPS switchyard to OPTCL, the communication link would be operationalized and carrier-aided tripping as well as auto-recloser scheme would be implemented in those lines.</i></p> <p><i>Regarding 220 kV TTPS – TSTPP and 220 kV TTPS – Rengali PH line, they informed that tender process for OPGW installation has been completed and OPGW would be installed in one year.</i></p>
2.	Tripping of Bus-1 at 220 kV Ramchandrapur on 20/08/2021 at 20:24 Hrs.	<p>In 106th PCC Meeting, PCC advised JUSNL following:</p> <ul style="list-style-type: none"> ➤ To restore the busbar protection at 220 kV Ramchandrapur S/s within a month. ➤ 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. 	
3.	Repeated Tripping of 132 kV Sultanganj- Deogarh D/C	In 106 th PCC Meeting, PCC advised BSPTCL to resolve all clearance issues in the line and complete the insulator replacement work at the earliest.	

4.	Total Power Failure at 220 kV Rengali HEP on 27/07/2021 at 08:57 Hrs	In 106 th 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.	
5.	Repeated Tripping of 220 kV Budhipadar-Korba& 220 kV Budhipadar-Raigarh line and associated Issues	In 106 th PCC Meeting,PCC advised OPTCL to implement auto-recloser scheme for remaining feeders at 220 kV Budhipadar end at the earliest.	<i>OPTCL informed that they had implemented auto-recloser scheme (without PLCC) for 220 kV Budhipadar – Lapanga D/C line, 220 kV Budhipadar – Tarkera circuit-1 and for 2 circuits of 220 kV Budhipadar – IB-TPS at Buddhipadar end. They further informed that auto-recloser scheme for remaining feeders at 220 kV Budhipadar end would be implemented at the earliest.</i>
6.	Disturbance at 220 kV Biharsharif Substation on 01.06.2021 at 17:10 Hrs	In 106 th PCC Meeting, Powergrid informed that proposal of extending inter-trip command from LV side to HV side of the ICT through numerical relay instead of 86 relays was going to be implemented through separate cables for ICT-1 & ICT-3. They added that the work is in progress and the scheme would be implemented by October-21.	<i>Powergrid informed that revised inter-tripping scheme would be implemented by December 2021.</i>
7.	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.	
8.	Disturbance at Jasidih(JUSNL) S/S on 27/05/2021 at 10:13 Hrs	In 106 th PCC Meeting, it was informed that draft overvoltage settings philosophy has been received from JUSNL. PCC advised ERLDC/ERPC secretariat to submit their observations on the draft philosophy to JUSNL.	<i>PCC advised JUSNL to keep Minimum pickup voltage for O/V stage-1 to be at least 112%. Rest O/V Settings maybe implemented by JUSNL as per their draft overvoltage settings philosophy considering equipment voltage withstand</i>

			<i>capability in consultation with OEM.</i>
9.	Grid event at 132 kV Motihari (DMTCL) S/S on 21-04-2021 at 20:19 hrs	<p>In 106th PCC Meeting, PMTL informed that offers received from OEM i.e., M/s TBEA regarding restoration of the damaged GIS section is under examination.</p> <p>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.</p>	
10.	Repeated delayed clearance of faults at 220 kV Chandil STPS S/C	In 106 th 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.	<i>JUSNL informed that they are yet to receive the approval to carry out the restoration work.</i>
11.	Backup Overcurrent Relay coordination for Sikkim Complex.	<p>In 106th PCC Meeting, PCC advised PRDC to analyse the tripping of the 400 kV Teesta III – Kishangunj line on 03.09.2021 and the settings may be proposed considering the actual fault current observed in the line.</p> <p>PCC advised Powergrid to implement the proposed DEF settings as given in the report of PRDC at their end.</p> <p>PCC further advised PRDC to carry out a study for DEF relay coordination for the lines at Sikkim complex considering fault level corresponding to minimum hydro generation at Sikkim complex.</p>	<p><i>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.</i></p> <p><i>PRDC was advised to coordinate with ERLDC for getting required information for the study.</i></p>