भारत सरकार
Government of India
विद्युत मंत्रालय
Ministry of Power
पूर्वी क्षेत्रीय विद्युत समिति
Eastern Regional Power Committee
14, गोल्फ क्लब रोड, टालीगंज, कोलकाता-700033
सत्यमेव जयते
Azadi Ka Amrit Mahotsav
Tel. No.: 033-24239651,24239658 FAX No.:033-24239652, 24239653 Web: **www.erpc.gov.in**

सं./NO. पू.क्षे.वि.स./PROTECTION/2022/ 272 **दिनांक /DATE:30.05.2022**

सेवा में / To,

संलग्न सूची के अनुसार / As per list enclosed.

विषय : दिनांक - 13.05.2022 को आयोजित 114वीं पीसीसी बैठक का कार्यवृत्त ।

Sub: Minutes of the 114th PCC meeting held on 13.05.2022.

Sir,

13.05.2022 को आयोजित **114वीं** पीसीसी बैठक का कार्यवृत्त पू.क्षे.वि.स. की वेबसाइट (**http://www.erpc.gov.in/**) पर उपलब्ध है । कृपया देखें ।

Please find the minutes of the **114th PCC** meeting of ERPC held on **13.05.2022** available at ERPC website (**http://www.erpc.gov.in/**).

यदि कोई अवलोकन हो, तो कृपया इस कार्यालय को यथाशीघ्र भेजा जाए ।

Observations, if any, may please be forwarded to this office at the earliest.

भवदीय / Yours faithfully,

(पी.पी.जेना / P.P.Jena)
Executive Engineer (PS)
कार्यपालक अभियंता(पी.एस)

LIST OF ADDRESSES:

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General Manager (OS), ERHQ-I, NTPC Ltd., LoknayakJaiprakashBhawan, (2nd Floor), DakBunglowChawk, Patna-800001	Manager (Electrical), Adhunik Power & Natural Resources Ltd. "Lansdowne Towers, Kolkata-700020 (Fax No. 033-2289 0285)
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Chief Engineer (Trans.) Power Deptt., Govt. of Sikkim, Gangtok-731010	Sr. Manager (CTMC) Durgapur Projects Limited, Durgapur-713201
Executive Director, ERLDC, POSOCO, Tollygunge, Kolkata-700033	The Head Maithon Power Limited, Maithon Office, MA 5 Gogna, Dist. Dhanbad, Jhankand State, PIN-828207
General Manager (AM), ER-II Power Grid Corporation of India Ltd., J-I-15, Block-EP, Sector-V,Salt Lake,Kolkata-91	Head –Regulatory and contracts, IndiGrid Limited , 247 Embassy, Office No 107, 'B' Wing, Hindustan Co. Bus Stop, Gandhi Nagar, L.B.S. Road, Vikhroli West, Mumbai – 400 079. Ph : +91 845509 96408
General Manager (P&O), PTC Ltd., Kanchanjunga Bldg.,18, Barakhamba Road, New Delhi-110001	
Managing Director, Bhutan Power Corporation Post Box no. 580, Thimpu, Bhutan.	Managing Director, Druk Green Power Corprn. P.O. Box-1351, Thimpu, Bhutan.

Associate Director (Commercial and Regulatory) Darbhanga-Motihari Transmission Company Limited (DMTCL),503, Windsor, Off CST Road, Kalina, Santacruz(E), Mumbai-400098	The Plant Head, JITPL, Angul, Odisha (FAX:011-26139256-65)
Shri D. P. Bhagava, Chief Consultant (O&M), TeestaUrja Limited, New Delhi (FAX:011-46529744)	Director (GM Division), Central Electricity Authority Sewa Bhawan, R. K. Puram, New Delhi-110066
Director (NPC), CEA, NRPC Building, Katwaria Sarai, New Delhi- 110016	President, Dans Energy Pvt. Ltd, 5th Floor, DLF Building No. 8, Tower-C, Gurgaon - 722OO2
Director, Shiga Energy Pw. Ltd., 5th Floor, DLF Building No. 8, Tower-C, Gurgaon - 722OO2	DGM (E&I), HALDIA ENERGY LIMITED, BARIK BHAWAN, KOKATA-700072, FAX: 033-22360955
President , TPTL, BhikajiCama Place, New Delhi , 110066	

Minutes
of
114th PCC Meeting

Date: 30.05.2022
Eastern Regional Power Committee
14, Golf Club Road, Tollygunge
Kolkata: 700 033

EASTERN REGIONAL POWER COMMITTEE

MINUTES OF 114th PROTECTION COORDINATION SUB-COMMITTEE MEETING HELD ON 13.05.2022 AT 10:30 HOURS

Member Secretary, ERPC chaired the meeting. List of participants is enclosed at **Annexure-A.**

PART – A

ITEM NO. A.1: Confirmation of minutes of 113th Protection Coordination sub-Committee Meeting held on 12th April 2022 through MS Teams online platform.

The minutes of 113th Protection Coordination sub-Committee meeting held on 12.04.2022 was circulated vide letter dated 09.05.2022.

Members may confirm the minutes of meeting.

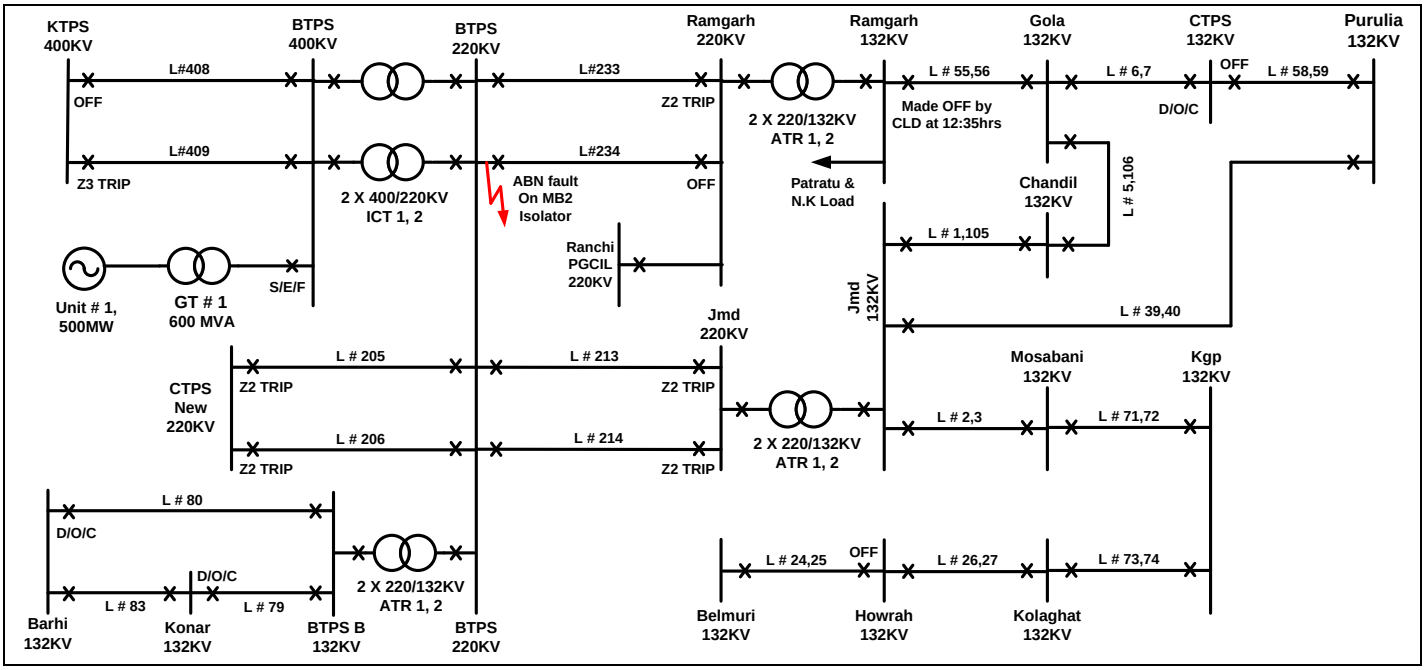
Deliberation in the meeting

Members confirmed the minutes of 113th PCC Meeting.

PART – B

ITEM NO. B.1: Disturbance at 220 kV Ramgarh (DVC) S/s on 09/04/2022 at 12:31 Hrs

On 09/04/2022 at 12:31 Hrs, during diversion of 220 kV Ramgarh-Bokaro-2 at Ramgarh from main bay to tie-bay, bus fault occurred at Ramgarh. Subsequently total power failure occurred at 220 kV Bokaro & Ramgarh S/s due to delayed clearance of the fault. Consequently as entire load of Jamshedpur shifted to 220 kV Joda-JSPL-Jamshedpur, the line got tripped on overcurrent protection. 400 kV Koderma-Bokaro-1 and unit 1 at Bokaro A also tripped at the same time.



Gen. Loss: 470 MW, Load Loss: 400 MW
Outage Duration: 01:04 Hrs

DVC may explain.

Deliberation in the meeting

*Disturbance report received from DVC is enclosed at **Annexure B.1**.*

DVC representative explained the event as follows:

- *Low air Pressure annunciation was appeared in 220 kV BTPS B – Ramgarh Line 2 panel and after examination it was planned to isolate the breaker. Accordingly, 220 kV BTPS B – Ramgarh -2 was made off from Ramgarh end and after checking zero current in all three phases, it was attempted to open the bus side isolator in line charged condition.*

- *However, as soon as the main bus-2 side isolator was opened, huge flashing occurred due to arcing and ionization of associated air creating a bus fault in Main bus 2. During the fault bus bar protection check zone appeared but no main zone appeared in the relay.*

- *As the fault was not cleared by bus bar protection, the following elements tripped from remote end to clear the fault.*

S.No.	***Line***	***End 1***	***End 2***
1	*220 kV BTPS B- Jmd -1*	*Pickup zone 4*	*Zone 2*
2	*220 kV BTPS B- Jmd-2*	*Pickup zone 4*	*Zone 2*
3	*220 kV BTPS B – CTPS -1*	*Pickup zone 4*	*Zone 2*
4	*220 kV BTPS B- CTPS - 2*	*Pickup zone 4*	*Zone 2*
5	*220 kV BTPS B- Ramgarh -1*	*Pickup zone 4*	*Zone 2*
6	*400 kV BTPS A- KTPS -2*	*-*	*Zone 3*
7	*132 kV BTPS B - Konar*	*-*	*Directional overcurrent*
8	*132 kV BTPS B – Barhi*	*-*	*Directional overcurrent*
9	*GT at KTPS*	*Standby E/F*	

- *Regarding tripping of 400 kV BTPS A – KTPS-2 from KTPS end before tripping of 400/220 kV ICTs, he replied that since 400 kV BTPS A – KTPS-2 was not in service, infeed current to the fault via both ICTs was lesser than when both lines are in service. Therefore, lesser infeed caused the 220kV bus fault to be seen within Zone 3 reach of 400 kV KTPS- BTPS A -2 from KTPS end. As the ICT earth fault overcurrent settings is coordinated to trip in about 1.2sec for other voltage level bus fault and the KTPS end Zone 3 timer was set at standard setting of 1.0sec, the 400 kV line tripped earlier than the ICT relays. He further informed that as corrective action, Zone 3 timer at KTPS End of the said line had already been revised to 1.5s to remain coordinated with ICT protection in case of encroachment in case only one line is in service.*

- *Regarding tripping of 132 kV BTPS B – Konar and 132 kV BTPS B – Barhi before tripping of 220/132 kV ICTs, he informed that these lines got tripped before ICTs as the directional overcurrent pick up setting of these lines are 540A in comparison to overcurrent pickup setting of 800A of ICTs.*

- *During the disturbance, generating transformer at BTPS end tripped in standby earthfault protection because of improper coordination with overcurrent settings of 400/220 kV ICTs. The setting has been corrected subsequently.*
- *After tripping of above lines, the load of Gola, Ramgarh, Patratu, North Karanpura region shifted to 220kV Ramgarh – Ranchi line. In order to restrict the overload of the above line, 132kV Ramgarh Gola d/c were made off and the load of Gola Chandil region began to be fed from CTPS end via 132kV Gola- CTPS d/c line. Subsequently both lines got tripped on overload from CTPS end by directional overcurrent protection. He informed that about the same time 132kV Jamshedpur – Mosabani Lines also tripped from Jamshedpur end through directional overcurrent protection due to overloading*.

Regarding non-operation of busbar protection, DVC representative replied that thorough checking of busbar differential relays, bus wire supervision relays and related circuitry was carried out after the event however revealed no abnormality in the busbar protection scheme was found. Hence no real reason could be established for non-operation of bus bar protection during the disturbance. He made a apprehension that as the isolator was opened manually it took some seconds to open the isolator blade therefore it might be possible that in the initial stages before creation of the major fault, the current mismatch caused during opening of the isolator blades had resulted in operation of the CT Supervision relay of Bus 2 consequently blocking of the busbar protection of main bus-2.

Further he added that the busbar relay is of high impedance electromechanical type and the replacement and augmentation of complete protection system including busbar relay at BTPS, KTPS, CTPS stations is under planning stage and the same would be taken up very soon.

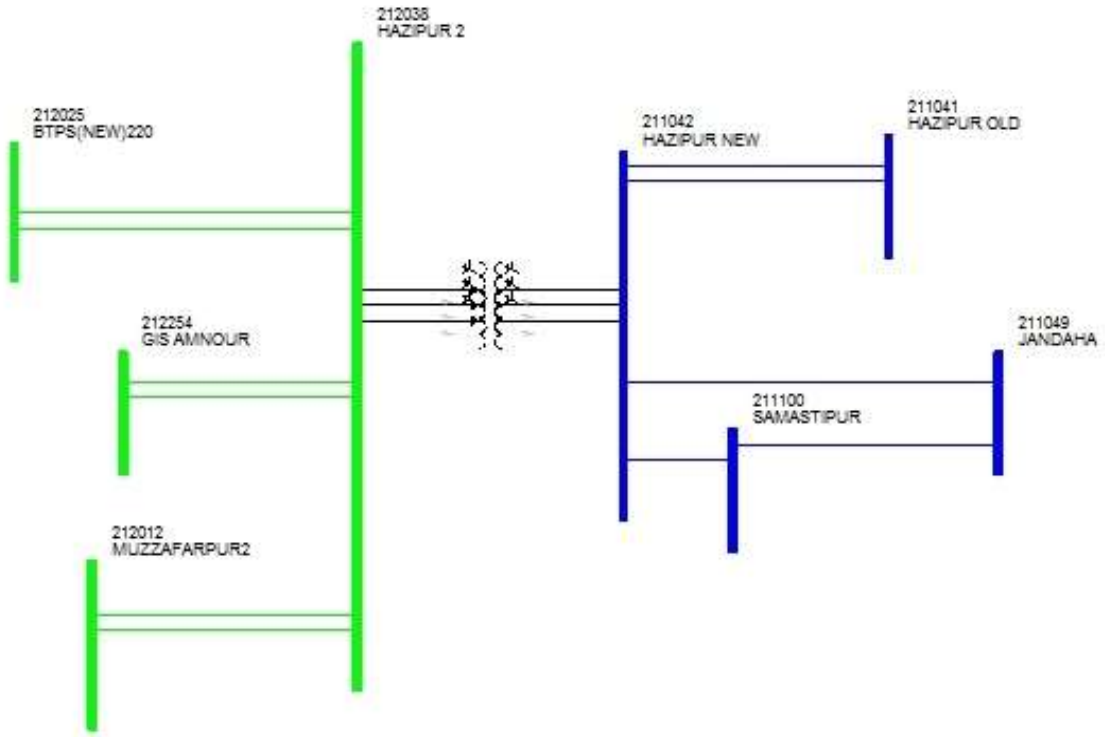
ERLDC representative enquired about overcurrent settings of bus coupler relay and suggested for coordinating the overcurrent setting such a way so that in case of failure of busbar protection relay, the bus coupler breaker shall trip to isolate the faulty bus. DVC responded that generally they keep the bus coupler setting to a comparatively high value in their system and the practice of coordinating bus coupler with busbar protection is not followed in their system however the same can be explored.

After detailed deliberation PCC advised DVC to explore the possibility of reducing the bus coupler overcurrent setting so as to enable it to isolate the bus fault in case of the failure of busbar protection. Initially the setting may be reduced and coordinated for relays at substations where busbar is out of service or the busbar relay is of electro-mechanical type.

ITEM NO. B.2: Total Power Failure at 220 kV Hajipur S/s on 05/04/2022 at 18:03 Hrs

The disturbance occurred due to failure of Y-phase LA of 220 kV Barauni-Hazipur circuit-1 at Hazipur end. Subsequently all lines emanating from 220 kV Hazipur tripped resulting in total supply failure at Hazipur & Amnour.

Grid disturbance report is attached at **Annexure B.2.**



Load Loss: 260 MW
Outage Duration: 00:21 Hrs

BSPTCL may explain.

Deliberation in the meeting

BSPTCL representative informed that the fault was developed due to failure of Y phase LA of 220 kV Barauni-Hazipur circuit-2 at Hazipur end. The relay at Hazipur end sensed the fault in zone1 of distance protection and issue trip command to the breakers. However due to delayed opening of breaker, LBB protection operated and all lines emanating from 220 kV Hazipur tripped.

ERLDC representative informed that as per DR received to them, the fault in 220 kV Muzaffarpur -Hazipur circuit-2 was cleared within 100 ms and the same is also observed from PMU plot.

Regarding relay indications at BTPS end, BSPTCL representative informed no information was received from Barauni end.

Members raised concern over non availability of proper information from the concerned utilities in respect of this disturbance which hinders the analysis of the disturbance.

BSPTCL was advised to submit the correct DR of Hazipur end to ERLDC immediately. Regarding relay indications at BTPS end, PCC opined that for disturbances in Bihar system, SLDC Bihar should coordinate with intrastate utilities like BTPS to collect the basic information e.g. disturbance report, DR/EL for analysing the event.

ERLDC representative opined that in case of operation of LBB, only those feeders that are connected to bus at which 220 kV Barauni-Hazipur circuit-2 was connected should had tripped along with bus coupler instead of tripping of all feeders. BSPTCL representative replied that all feeders got tripped due to issue with CT switching scheme.

After detailed deliberation the followings were decided:

- *SLDC Bihar would coordinate with Barauni end to get the DR/EL from their end for 220 kV Hazipur-Barauni-2 line.*

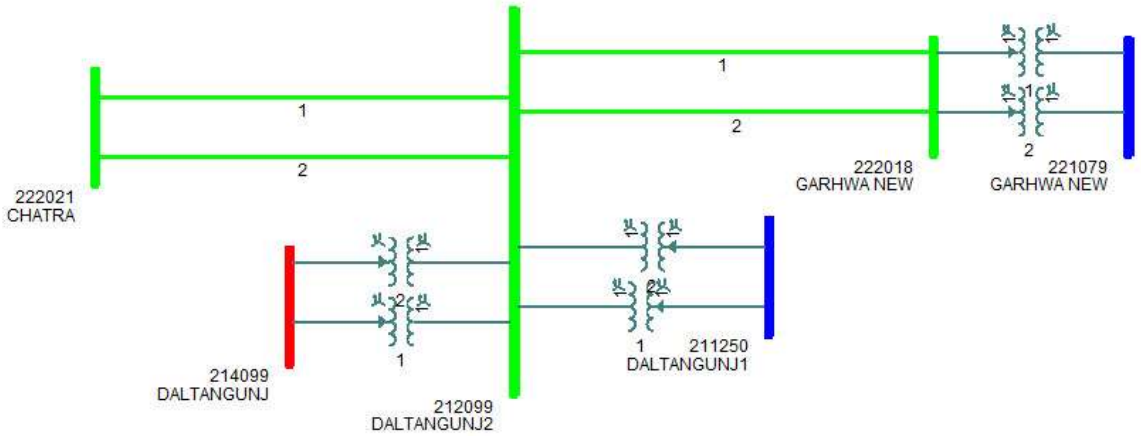
- *BSPTCL would submit the DR of Hazipur end to ERLDC immediately and further they would investigate the root cause of the tripping of all feeders at Hazipur end during the disturbance and submit a report to ERPC/ERLDC before next PCC Meeting.*

- *The CT switching scheme w.r.t. LBB protection may be checked at Hazipur end.*

ITEM NO. B.3: Total Power Failure at 220 kV Garhwa S/S on 05/04/2022 at 12:19 Hrs

220 kV Daltonganj-Garhwa D/c tripped due to B-N fault in 220 kV Daltonganj-Garwah circuit-1. Subsequently total power failure occurred at Garhwa S/s as well as radially fed downstream S/s.

Grid disturbance report is attached at **Annexure B.3.**



Relay Indications:

Time	Name	End 1	End 2	PMU Observation
12:19	220 kV Daltonganj-Garhwa-1	Daltonganj: B_N, Zone-1, 2.4 kA, 32.5 km, A/r successful, tripped again within reclaim time	Garhwa: B_N, Zone-1, 1.24 kA, 58.17 km	35 kV dip in B_ph voltage at Daltonganj. A/r successful after 1 sec. Line tripped again within reclaim time after 600 msec.
	220 kV Daltonganj-Garhwa-2	Daltonganj: Didn't trip	-	

Load Loss: 40 MW
Outage Duration: 01:42 Hrs

JUSNL may explain.

Deliberation in the meeting

Inclement weather was reported during the disturbance. It was informed that B phase to earth fault occurred in 220 kV Daltonganj-Garwah circuit-1 for which relay at both end sensed the fault and cleared it within 100 msec.

JUSNL representative informed that relay for 220 kV Daltonganj-Garhwa-2 at Garwah end also operated during the disturbance and tripped resulting in supply failure to Garwah. However, there was no tripping occurred at Daltongnj end for circuit-2. PCC opined that in case of fault in circuit-2, Daltonganj being the source end must have sensed the fault and tripped. Both Powergrid & JUSNL were advised to reverify whether the fault was present in the circuit-2.

From the DR analysis it was observed that single phase tripping had occurred at Garwah end even after auto-reclose was failed in the first instance for which JUSNL representative replied that SOTF is not enabled for zone 1 protection which might had resulted the issue.

PCC opined that SOTF shall be enabled for zone-1 operation too to avoid single phase tripping during fault in reclaim time. On query from JUSNL, it was further clarified that SOTF may be enabled for all zones except zone-4 protection.

ITEM NO. B.4: Total Power Failure at 400 kV Teesta V S/s

1. On 23/04/2022 at 12:37 Hrs

400 kV Teesta V-Rangpo-2 was under shutdown. 400 kV Teesta V-Rangpo-1 tripped from Teesta V end due to delayed clearance of fault in 400 kV Rangpo-Binaguri-1. Subsequently one running unit at Teesta-5 got tripped due to loss of evacuation path.

Relay Indications:

Time	Name	End1	End2	PMU Observations
12:37	400 kV Teesta 5-Rangpo-1	Teesta 5: DEF	Didn't trip	Gradual dip in voltage at Rangpo. 21 kV dip observed. Fault clearance time: 1.8 sec
	400 kV Binaguri-Rangpo-1	Binaguri: DT received	Rangpo: DEF, Ir: 2.7 kA	

Detailed report from ERLDC is attached at **Annexure B.4.**

Gen. Loss: 168 MW
Outage Duration: 00:19 Hrs

2. On 26/04/2022 at 18:20 Hrs

400 kV Teesta V-Rangpo-2 was under shutdown. 400 kV Teesta V-Rangpo-1 tripped due to R_B_N fault resulting in tripping of all three running units at Teesta-V due to loss of evacuation path.

Gen. Loss: 512 MW
Outage Duration: 00:22 Hrs

3. On 26/04/2022 at 18:59 Hrs

400 kV Teesta V-Rangpo-2 was under shutdown. 400 kV Teesta V-Rangpo-1 tripped due to R_B_N fault resulting in tripping of all three running units at Teesta-V due to loss of evacuation path.

Gen. Loss: 350 MW
Outage Duration: 03:34 Hrs

NHPC & Powergrid may explain.

Deliberation in the meeting

- ***Total Power Failure at 400 kV Teesta V S/s on 23/04/2022 at 12:37 Hrs***

400 kV Teesta V-Rangpo circuit-2 was under planned shutdown prior to the disturbance.

It was informed that a high resistive fault was developed in 400 kV Rangpo-Binaguri circuit-1 which was sensed & cleared by Directional earthfault relay at Rangpo end at around 1.8 sec. Binaguri end relay cleared the fault on receipt of DT from Rangpo end.
Meanwhile relay at Teesta V for 400 kV Teesta V-Rangpo-1 sensed the fault and tripped in DEF protection in around 1.6 second prior to tripping of 400 kV Rangpo-Binaguri line.

NHPC representative informed that the DEF setting of line was earlier coordinated with zone-3 time settings and further within their station the settings were coordinated among line, bus coupler and GT neutral overcurrent settings. He updated that after the disturbance the pick-up current setting of DEF of line has been increased to 200 A from existing 150 A in consultation with ERLDC.

PCC stated that PRDC is conducting a revised study for backup earth fault protection settings for Sikkim complex and opined that the present setting may be continued till the time the report of PRDC gets finalized.

It was informed that during the DEF relay operation at Teesta V end, DT signal was sent to Rangpo end however the same was not received at Rangpo end. PCC advised Powergrid to test the healthiness of PLCC of the line in coordination with NHPC.

- ***Total Power Failure at 400 kV Teesta V S/s on 26/04/2022 at 18:20 Hrs and 18:49 Hrs***

Inclement weather was reported during the disturbance for both the events.

R-B-N fault developed in 400 kV Teesta V-Rangpo-1 for which relay at Teesta V end sensed the fault in zone 2 and got tripped while relay at Rangpo end sensed the fault in zone 1 and got tripped. As 400 kV Teesta V-Rangpo Circuit-I was already under planned shutdown, total [power failure occurred at Teesta V station due to loss of evacuation path.

On enquiry from PCC regarding location of fault, Powergrid representative informed that patrolling was done in concerned section of line however they did not find any fault signature physically.

ITEM NO. B.5: Total Power Failure at 220 kV Jorethang S/S

1. On 08/04/2022 at 10:15 Hrs

220 kV Jorethang-New Melli D/c tripped from Jorehtang end due to DC Earth fault in trip coil. subsequently one running unit at Jorethang tripped.

Relay Indications:

Time	Name	End1	End2	PMU Observations
10:15	220 kV Jorethang-New Melli D/c	Jorethang: DC Earth Fault	New Melli: Didn't trip	No fault observed from PMU data

Gen. Loss: 48 MW
Outage Duration: 00:03 Hrs

2. On 26/04/2022 at 19:24 Hrs

220 kV Jorethang-New Melli-2 tripped due to R-N fault subsequently total power failure occurred at Jorethang HEP as 220 kV Jorethang-New Melli-1 had already tripped at 19:11 Hrs.

Relay Indications:

Time	Name	End1	End2	PMU Observation
19:24	220 kV Jorethang-New Melli-2	Jorethang: R_N	New Melli: R_N	35 kV dip in R_ph voltage for 350 msec

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

Load & Generation Loss: Nil
Outage Duration: 00:41 Hrs

Deliberation in the meeting

Regarding disturbance on 08/04/2022, Jorethang HEP representative informed that during maintenance work of DC system at Jorethang HEP, DC earth fault occurred and subsequently bus bar protection operated leading to tripping of 220 kV Jorethang-New Melli D/C line from Jorethang end.

Regarding disturbance on 26/04/2022, he informed that the inclement weather was observed during disturbance and both the circuits got tripped during the event.

Powergrid representative informed that as per DR at their end, 220 kV Jorethang-New Melli-1 got tripped at 19:11 Hrs due to Y-B fault and 220 kV Jorethang-New Melli-2 got tripped in zone 2 at 19:24 Hrs due to Y-B fault.

PCC advised Powergrid to share DR of the incident to ERPC/ERLDC.

ITEM NO. B.6: Total Power Failure at 400 kV Dikchu S/s on 17/04/2022 at 15:07 Hrs

On 17/04/2022 at 15:07 Hrs, 400 kV Rangpo-Dikchu tripped on R phase to earth fault. As main bay of 400 kV Teesta 3-Dikchu was already under breakdown, total power failure occurred at Dikchu HEP.

Relay Indications:

Time	Name	End 1	End 2	PMU Observations
15:07	400 kV Rangpo- Dikchu	Rangpo: R_N, 11.4 km, 10.8 kA	Dikchu: R_N, 48.4 km, Zone-2	156 kV dip in R_ph voltage at Rangpo.
	400 kV Teesta 3-Dikchu	-	Tripped due to tripping of Rangpo-Dikchu line as main bay out of service	

Detailed report from ERLDC is attached at **Annexure B.6.**

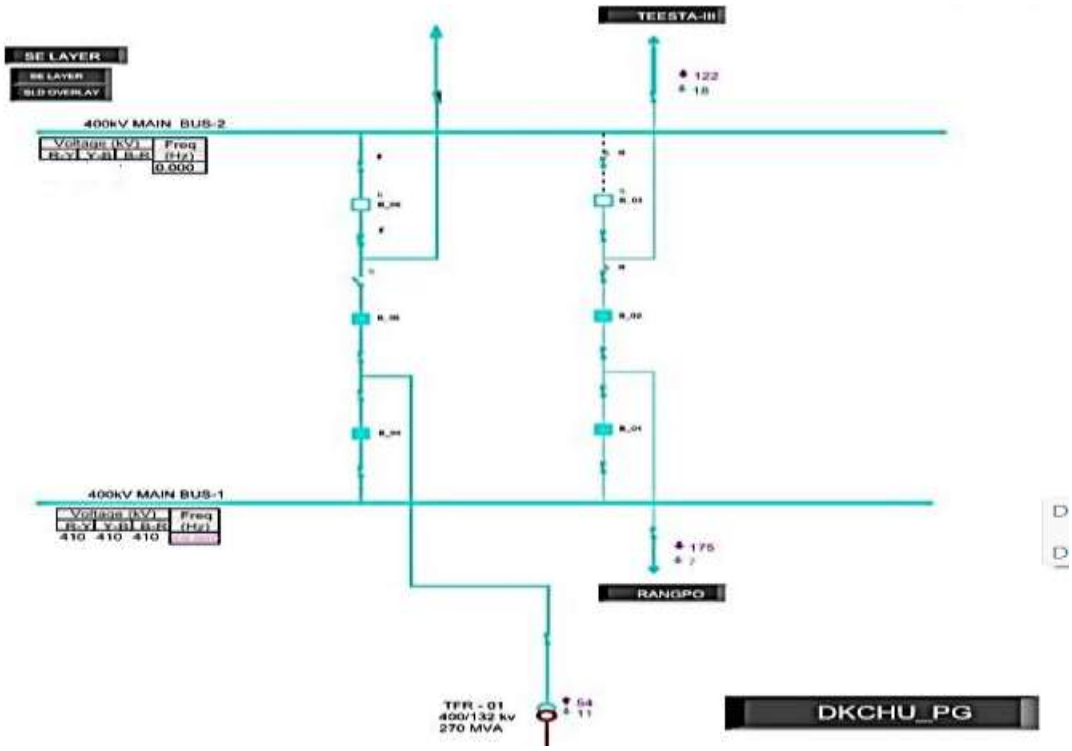
Gen. Loss: 55 MW
Outage Duration: 01:08 hrs

Dikchu HEP may explain**.**

Deliberation in the meeting

It was informed that disturbance initiated due to a R phase to earth fault in 400 kV Rangpo-Dikchu line at 48 km from Dikchu end. Dikchu end relay sensed the fault in zone-2 of distance protection and on receipt of carrier from Rangpo it got tripped within 100msec. Relay at Rangpo end sensed the fault in zone-1 and got tripped. It was reported that autorecloser was switched off due to ongoing OPGW work in the line.

Further as main bay of 400 kV Dikchu-Teesta III circuit was out for a long time, total power failure occurred at Dikchu HEP due to loss of evacuation path.



Dikchu representative submitted that the main bay of 400 kV Teesta 3-Dikchu line would be restored by September-22. PCC advised Dikchu HEP to restore the main bay as early as possible for reliable & secure operation of the grid.

ITEM NO. B.7: Bus tripping occurred in Eastern Region during April 2022

During April 2022, following incidents of bus bar tripping was reported in Eastern Region.

Element Name	Tripping Date	Reason	Utility
400 kV Main Bus-1 & 2 at Meramundali B	07-04-2022 at 17:16 Hrs	-	OPTCL
220 kV Main Bus-1 at Durgapur (PG)	28-04-2022 at 05:58 Hrs		PG ER-2
400 kV Main Bus-2 at Malda	29-04-2022 at 20:01 Hrs	R_ph bus connector of 400 kV New Purnea-2 snapped	PG ER-2
220 kV Main Bus-1 at Kishanganj New (BSPTCL)	29-04-2022 at 23:00 Hrs	Bus bar protection operated	BSPTCL

Concerned utilities may explain.

Deliberation in the meeting

- ***Tripping of 400 kV Main Bus-1 & 2 at Meramundali B on 07/04/2022 at 17:16 Hrs***

OPTCL representative informed that 400 kV Main Bus-1 & 2 at Meramundali B is charged through 400/220 kV ICT which in turn charged through 220 kV Meramundali -Joda line. On the day of incident, some testing work was being carried out in the substation during which the only 220 kV

Meramundali-Joda line got tripped. This resulted in supply failure to 400/220 kV ICT as well as 400 kV Bus at Meramundali-B.

- ***Tripping of 220 kV Main Bus-1 at Durgapur(PG) on 28/04/2022 at 05:58 Hrs***

Powergrid representative informed that one of R phase bus post insulator of 220 kV Durgapur(PG) – Durgapur(DVC) circuit-1 got burst which resulted in bus fault at 220 kV side. Subsequently busbar protection operated and 220 kV Main Bus-1 at Durgapur (PG) got tripped.

- ***Tripping of 400 kV Main Bus-2 at Malda on 29/04/2022 at 20:01 Hrs***

Powergrid representative informed that on day of incident, heavy rain and thunderstorm was observed. At 20:01 Hrs, R phase bus connector of 400 kV Malda- New Purnea-2 got snapped subsequently flashover occurred and 400 kV Main Bus 2 at Malda got tripped. On enquiry from ERLDC regarding tripping of 400 kV Malda- New Purnea-1 from Malda end during the incident, he replied that line isolator was selected in zone 1 however during this event isolator status became high in zone-2 for intermittent time which led to tripping of the line. PCC advised Powergrid to share DR/report of this event to ERPC/ERLDC.

- ***Tripping of 220 kV Main Bus-1 at New Kishanganj (BSPTCL) on 29/04/2022 at 23:00 Hrs***

BSPTCL representative informed that on day of incident heavy rain and thunderstorm was observed and the event occurred during the inclement weather situation. After the event inspection of switchyard was done, however no physical evidence of fault was found.

ITEM NO. B.8: Repeated Tripping of Transmission Lines and associated issues

Following lines had tripped repeatedly in the month of April'22 and it was observed that in almost all cases faults are of similar nature.

Sl. No.	Name of the Element	No. of times Tripped	Remarks	Utility
1	400 kV Meramundali-Mendhasal-2	5	R_ph fault in all instances. 9-25 km from Meramundali	OPTCL
2	400 kV New PPSP-Arambagh-1	4	B_ph fault in all instances. Line charged within an hour in three instances	WBSETCL
3	220 kV Tenughat-Biharsharif	7	Fault in either B_ph or R_ph. Fault around 65 km or 120 km from Tenughat	JUSNL, BSPTCL
4	132 kV Lakhisarai-Lakhisarai-1	4	R_ph fault in all instances	BSPTCL
5	132 kV Lakhisarai-Lakhisarai-2	5		

Concerned utilities may explain.

Deliberation in the meeting

- *OPTCL representative informed that in four out of five tripping for 400 kV Mermaundali-Mendhasal-2, clearance issue was found on account of vegetation under the line. The vegetation was already cleared and there has been no tripping since then.*

- *WBSETCL representative informed that all tripping incidences in month of April 2022 in 400 kV PPSP-Arambagh-1 line occurred due to clearance issues. Further he updated that tree pruning work was carried out from 10th April 2022 to 14th April 2022 in the concerned location with the help of district administration.*

- *Regarding tripping of 220 kV Tenughat-Biharsharif line, BSPTCL representative informed that tree pruning work was already completed for the line sections under their jurisdiction. JUSNL representative informed that tripping incidences in month of April 2022 had occurred due to clearance issues in one location where tree cutting work was delayed due to resistance from local people. He further informed that with help of local administration, tree pruning work was carried out on 28th and 29th April 2022.*

  ERDLC representative enquired about healthiness of PLCC for 220 kV Tenughat-Biharsharif line as auto-reclose was not successful in all these tripping incidents. BSPTCL representative informed that a meeting was held among TVNL, BSPTCL and OEM in the year 2020 and as per OEM observation it is difficult to implement PLCC at Tenughat end due to some limitation in switchyard at Tenughat end. TVNL representative informed that they had not received any communication so far from BSPTCL side regarding the deficiency at their end. Further they stated that in case of any technical constraint, they would take up with their higher authority to resolve the issue.

  PCC advised BSPTCL to share the observation of OEM with TVNL immediately and coordinate with TVNL in order to implement PLCC at respective ends.

- *Regarding tripping of 132 kV Lakhisarai-Lakhisarai D/C line, BSPTCL representative informed that reconductoring work of line from panther to HTLS was done recently after which sag issues had developed in OPGW of the line at certain locations which resulted in tripping of the lines.*

  He informed that line shutdown has already been planned and the sag issue would be rectified at the earliest.

ITEM NO. B.9: Tripping Incidence in month of April-2022

Tripping incidents in the month of April-2022 which needs explanation from constituents of either of the end is attached.

Concerned utilities may explain.

Deliberation in the meeting

Members explained the tripping incidences. The updated status is enclosed at ***Annexure B.9.***

PART-C :: OTHER ITEMS

ITEM NO. C.1: Follow-up of Decisions of the Previous Protection Sub-Committee Meeting(s)

The decisions of previous PCC meetings are attached.

Members may update the latest status.

Deliberation in the meeting

*Updated status for decisions of previous PCC meetings is given at **Annexure C.1**.*

ITEM NO. C.2: Information regarding auto-synchronization settings :: ERLDC

To enhance operational capabilities and better situational awareness, operational practices of auto synchronization of islands implemented in field need to be properly understood subsequently following information may be shared by PGCIL or any other transmission licensee-

- Auto synchronization operation principle, time delay, setting, checks, communication delay
- Maximum allowable angular difference for breaker closing operation at each voltage level
- Whether auto synchronization setting can be changed remotely (from RTAMC or NTAMC in case of PGCIL)
- Digital Auto synchronization display availability for RTAMC operator and substations SA
- How to avoid wrong synchronization, preventive, and precautionary measures

Members may discuss.

Deliberation in the meeting

ERLDC representative informed that they need information regarding operational practices of utilities during auto synchronization of the system like auto synchronization settings(voltage, angle, frequency settings etc.) and information regarding any limitation on breaker side w.r.t. angular difference of the system. This will enable them to take informed decision for smooth synchronization of the system in real time operation.

Powergrid ER-II representative informed that they would share their practice and auto-synchronization settings to ERPC and ERLDC.

PCC opined that ERLDC may send a separate communication with a format for required details with concerned utilities and advised all the utilities to share the requisite information to ERLDC.

ITEM NO. C.3: Schedule of Training Program on PSCT and PDMS by PRDC

As part of 5th year support period, PRDC is going to conduct online training program for West Bengal, Jharkhand as per the following schedule.

Sl No.	Date	State
1	19.05.2022-20.05.2022	West Bengal
2	26.05.2022-27.05.2022	Jharkhand

Members may note.

Deliberation in the meeting

Members noted. PCC advised PRDC to coordinate with concerned utilities for nomination and for conducting the training program.

ITEM NO. C.4: Automation of Protection Settings extraction from PDMS

To facilitate protection co-ordination and protection audit, automation of protection setting extraction from the database is required. In this regard, a model excel sheet was shared with PRDC and automation of extraction of settings from PDMS was also discussed.

In 112th PCC, PRDC representative informed that their IT team is looking into it and the facility of relay data extraction from protection database is expected to be implemented by July-2022.

In 113th PCC, ERPC secretariat informed that a meeting would be held on 19th April 2022 among ERPC, ERLDC & PRDC to discuss the above issue.

PRDC may update.

Deliberation in the meeting

PRDC representative informed that development of facility for relay data extraction from protection database is under progress and it is expected to be implemented within 45 days.

ITEM NO. C.5: Protection Audit in Eastern Region

In 110th PCC Meeting, ERPC Secretariat informed that third party protection audit for the year 2022 would be commenced as soon as the current covid situation gets improved.

It was further informed that protection audit of following substations in Odisha would be carried out at first.

- 765/400 kV Jharsuguda (Powergrid) S/s
- 765 kV NTPC Darlipalli S/s
- 400/220kV Lapanga(OPTCL) S/s
- 220 kV Budhipadar(OPTCL) S/s
- 220 kV IB TPS(OPGC) S/s

PCC advised the concerned utilities to verify and update existing relay data and protection settings available in PDMS for the above-mentioned substations before the field visit by audit team.

PCC further advised utilities to submit their comments, if any, regarding the protection audit procedure and format for finalization of the document.

In 112th PCC, PCC informed that protection audit of mentioned substations would be carried out in tentatively in second week of April 2022 and further advised concerned utilities of Odisha to verify and update existing relay data and protection settings available in PDMS before the field visit by audit team.

In 113th PCC, it was decided that the protection audit of various substations in Odisha would be carried out during last week of April-22.

Members may update.

Deliberation in the meeting

ERPC secretariat representative informed that protection audit of mentioned substations was carried out from 25.04.2022 to 28.04.2022 by audit team and observation of audit team is attached at ***Annexure C.5.***

PCC advised concerned utilities to comply the recommendations submitted by audit team.

ITEM NO. C.6: New Element Integration

C.4.1: LILO of 220 kV Arrah-Khagaul D/c at Naubatpur

As per information received at ERLDC, 220 kV Arrah -Khagul will be LILOed at 220 kV Naubatpur.

Line parameters are as below:

Name	Conductor Type	Length (km)
220 kV Arrah -Naubatpur D/c	ACSR Zebra	43.05 km
220 kV Khagaul -Naubatpur D/c	ACSR Zebra	16.9 km

Protection coordination may be required as per the following table

Reason	S/S may be affected	Remarks	Utility to respond
220 kV Arrah -Khagaul D/C LILO at Naubatpur	Arrah & Khagaul	Protection coordination to be done for all newly connected elements as per ERPC's guidelines	POWERGRID ER-1&BSPTCL
	Naubatpur	Protection coordination to be done for all newly connected elements as per ERPC's guidelines.	BGCL
	S/S connected to Arrah & Khagaul: Patna, Sipara, Dumrao New	For all adjacent substations connected to Khagaul, which is Patna and Sipara adjacent shortest line length will reduce significantly, so Zone-2 settings will be affected. Now Naubatpur-Khagaul will be shortest (16.9km) For Substation connected to Arrah which is Dumrao new adjacent line length will reduce to 43km (Arra- Naubatpur). In case of Zone 2 &Zone 3 overlap of adjacent sections Time grading to be ensured. Kindly check and confirm any setting revision if required.	POWERGRID ER-1, BSPTCL

Following Details to be shared:

- POWERGRID ER-1, BSPTCL, BGCL 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 Arrah, Khagul, Naubatpur may be shared with ERPC and ERLDC.
- Status of carrier protection and PLCC channel in all above-mentioned section may be shared.

Concerned utilities may update.

Deliberation in the meeting

Concerned utilities were advised to share revised protection settings for their respective ends to ERPC/ ERLDC.

C.4.2: LILO of 400 kV Darbhanga-Kishanganj D/c at Saharsa

As per information received at ERLDC, 400 kV Darbhanga-Kishanganj D/c was LILOed at 400 kV Saharsa S/s.

Line parameters along with configuration are as below:

Name	Conductor Type	Length
400 kV Kishanganj-Saharsa-3 & 4	Quad Moose ACSR	158.677 km
400 kV Saharsa-Darbhanga-1 & 2	Quad Moose ACSR	86.684 km

Protection Co-ordination maybe reviewed as per following table:

Reason	Settings to be reviewed	At S/s	Utility	Remarks
LILO of 400 kV Darbhanga-Kishanganj D/c at Saharsa	400 kV Kishanganj-Saharsa 3&4	Kishanganj, Saharsa	PG ER-1, PMTL	Protection coordination to be done for newly connected element as per ERPC guidelines.
	400 kV Darbhanga-Saharsa D/c	Darbhanga, Saharsa	ATL, PMTL	Protection coordination to be done for newly connected element as per ERPC guidelines.
	400 kV New Purnea-Kishanganj D/c	New Purnea	PG ER-1	Adjacent longest line for these lines will now be 400 kV Rangpo-Kishanganj D/c (189 km-QM). Hence Zone-3 settings at respective S/s may be reviewed keeping in view it should not encroach next voltage level
	400 kV Saharsa-Kishanganj D/c	Saharsa	PMTL	
	400 kV Binaguri-Kishanganj D/c	Binaguri	PG ER-2	
	400 kV Rangpo-Kishanganj-1&2	Rangpo	PG ER-2	Adjacent longest line for these lines will now be 400 kV Saharsa-Kishanganj D/c (183 km-QM). Hence Zone-3 settings at respective S/s may be reviewed keeping in view it should not encroach next voltage level
	400 kV Sitamarhi-Darbhanga D/c	Sitamarhi	PMTL	Adjacent longest line will now be 400 kV Muzaffarpur-Darbhanga D/c (62 km-QM). Hence Zone-3 settings at respective

				S/s may be reviewed keeping in view it should not encroach next voltage level.
	400 kV Muzaffarpur-Darbhanga D/c	Muzaffarpur	PG ER-1	Adjacent longest line will now be 400 kV Sitamarhi-Darbhanga D/c (80 km-QM). Hence Zone-3 settings at respective S/s may be reviewed keeping in view it should not encroach next voltage level.

Concerned utilities may update.

Deliberation in the meeting

Concerned utilities were advised to share revised protection settings for their respective ends to ERPC/ ERLDC.

C.4.3: FTC of 220 kV Muzaffarpur-Garaul D/c

As per information received at ERLDC, 220 kV Muzzaffarpur-Garaul D/c is going to be first time charged.

Line parameters are as below

Name	Conductor type	Length
220 kV Muzzafferpur-Goraul I	ACSR Zebra	19.9 km
220 kV Muzzafferpur-Goraul II	ACSR Zebra	19.9 km

Protection coordination may be required as per the following table.

Reason	S/S may be affected	Remarks	Utility to respond
FTC of 220 kV Muzzaffarpur-Garaul	220 kV Muzaffarpur	Protection coordination to be done for all newly connected elements as per ERPC's guidelines	POWERGRID ER-1& BSPTCL
	Garaul	Protection coordination to be done for all newly connected elements as per ERPC's guidelines. • Status of carrier protection and PLCC channel in all above-mentioned section may be shared.	
	S/S connected to Muzaffarpur Hazipur,MTPS	As per ERLDC no change in adjacent short and long length of line. Kindly check and ensure the co-ordin ation at your end Kindly check and confirm any setting revision if required.	POWERGRID ER-1, BSPTCL

Following Details to be shared:

- POWERGRID ER-1, 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.
- Protection settings may be shared with ERPC and ERLDC.
- Status of carrier protection and PLCC channel in all above-mentioned section may be shared.

Concerned utilities may update.

Deliberation in the meeting

Concerned utilities were advised to share revised protection settings for their respective ends to ERPC/ ERLDC.

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Annexure A

List of participants in 114th PCC Meeting

Full Name	Join Time
ERPC Kolkata	5/13/2022, 10:01:27 AM
Santosh Ghodekar, DANS Energy, Jorethang (Guest)	5/13/2022, 10:02:31 AM
PGCIL ER1	5/13/2022, 10:05:29 AM
Kumar Satyam ,AE, ERPC	5/13/2022, 10:05:32 AM
Teesta-V Power Station, NHPC (Guest)	5/13/2022, 10:19:19 AM
NIRMAL MONDAL (WBSETCL) (Guest)	5/13/2022, 10:20:30 AM
SANJEEV KUMAR (THEP) (Guest)	5/13/2022, 10:23:35 AM
Satya Prakash	5/13/2022, 10:24:57 AM
Dikchu (Guest)	5/13/2022, 10:25:51 AM
Powergrid, Odisha projects (Guest)	5/13/2022, 10:27:30 AM
Arindam bsptcl	5/13/2022, 10:28:18 AM
EEE TD HZB	5/13/2022, 10:28:27 AM
SMS SAHOO, DGM(ELECT), OPTCL, BHUBANESWAR	5/13/2022, 10:28:31 AM
Rishabh Soni, DANS Energy (Guest)	5/13/2022, 10:28:31 AM
Nishant Kumar Shankwar	5/13/2022, 10:29:25 AM
Biplob Sarkar (Guest)	5/13/2022, 10:30:15 AM
BS (Guest)	5/13/2022, 10:30:23 AM
Prachi Gupta	5/13/2022, 10:30:33 AM
Amresh Prusti	5/13/2022, 10:30:56 AM
KUMAR AMRENDRA MADANPURI	5/13/2022, 10:31:26 AM
E&M.R DIVISION,OPTCL,BURLA (Guest)	5/13/2022, 10:31:35 AM
Binod Goswami	5/13/2022, 10:32:25 AM
RAMBABOO SINGH	5/13/2022, 10:32:50 AM
SUDIPTA DVC	5/13/2022, 10:34:41 AM
TEESTA-III VIJAY CHANDRA (Guest)	5/13/2022, 10:35:29 AM
M K Kirtania (Guest)	5/13/2022, 10:36:07 AM
shashikant sharma (Guest)	5/13/2022, 10:36:36 AM
Shabari Pramanick	5/13/2022, 10:36:40 AM
M K Kirtania, Powergrid, ER-2 (Guest)	5/13/2022, 10:37:59 AM
Sankhadeep Choudhury	5/13/2022, 10:41:05 AM
BRAJESH KUMAR, ESE, BSPTCL (Guest)	5/13/2022, 10:41:08 AM
"prabhat k (TPTL) (Guest)	5/13/2022, 10:42:21 AM
Dharm Das Murmu, CRITL, JUSNL (Guest)	5/13/2022, 10:43:15 AM
aditya jha	5/13/2022, 10:45:50 AM
CRITL	5/13/2022, 10:46:04 AM
Gagan Kumar	5/13/2022, 10:47:17 AM
JAGANATH PANI, NHPC (Guest)	5/13/2022, 10:47:53 AM
jitesh kumar (Guest)	5/13/2022, 10:48:26 AM
Amita Nand	5/13/2022, 10:51:46 AM
Deepak, EEE, CRITL, BSPTCL	5/13/2022, 10:53:19 AM
ASHISH KUMAR	5/13/2022, 10:54:09 AM
Rajiv Ranjan EEE Bsptcl	5/13/2022, 10:55:40 AM
Akash Kumar Modi	5/13/2022, 10:56:21 AM
Uma Kanta Mishra	5/13/2022, 10:57:36 AM
ASHISHTVNL (Guest)	5/13/2022, 11:02:51 AM
Vijay chandra TEESTA-III	5/13/2022, 11:05:16 AM
Rahul	5/13/2022, 11:09:34 AM
S Konar (Guest)	5/13/2022, 11:11:14 AM

Sougato Mondal	5/13/2022, 11:11:18 AM
Rajib Sutradhar	5/13/2022, 11:13:21 AM
rambaboos.ph21.ee	5/13/2022, 11:14:17 AM
Abanindra Mishra	5/13/2022, 11:17:32 AM
critl	5/13/2022, 11:18:51 AM
SLDC ODISHA (Guest)	5/13/2022, 11:23:13 AM
d k das	5/13/2022, 11:23:15 AM
DOLAGOBINDA PATEL OPTCL MERAMUNDALI	5/13/2022, 11:23:36 AM
Arun Kumar	5/13/2022, 11:26:46 AM
TVNL (Ashish Kr Sharma) (Guest)	5/13/2022, 11:31:31 AM
Teesta V P S (Guest)	5/13/2022, 11:35:30 AM
MS ERPC (Guest)	5/13/2022, 11:39:46 AM
Ajay Majhi	5/13/2022, 11:40:14 AM
Amita Nand	5/13/2022, 11:41:21 AM
emr meramundali (Guest)	5/13/2022, 11:47:12 AM
Purn Prakash Chand	5/13/2022, 11:49:58 AM
AEE TELECOM	5/13/2022, 11:53:18 AM
Prabhat Anand	5/13/2022, 12:00:45 PM
Saibal Ghosh	5/13/2022, 12:03:19 PM
ranjan jusnl	5/13/2022, 12:03:54 PM
Mohan Rao (Guest)	5/13/2022, 12:08:15 PM
Ritam Koley	5/13/2022, 12:11:55 PM
WBPDCL (Guest)	5/13/2022, 12:13:06 PM
ODP -1	5/13/2022, 12:13:07 PM
Manjesh Kumar	5/13/2022, 12:19:30 PM
MAHARO, JUSNL	5/13/2022, 12:24:32 PM
Anup Saha (Guest)	5/13/2022, 12:36:47 PM
RAVI RANJAN SINHA	5/13/2022, 12:42:27 PM
Aarif Dikchu (Guest)	5/13/2022, 12:43:31 PM
ele.smajhi	5/13/2022, 1:26:23 PM
Abanindra Mishra	5/13/2022, 1:52:25 PM

INVESTIGATION REPORT REGARDING TOTAL POWER FAIL OF BTPS 220 KV & 400KV SYSTEM ALONG WITH OUTAGE OF UNIT # 1 ON 09.04.2022.

Brief History:

At about 12:00hrs of 09/04/22, Low Air Pressure L/O along with TC1 & TC2 Faulty annunciation appeared in Line # 234 [BTPS B – Ramgarh Line 2] panel. Air Pressure of the said CB was checked and found to be very low at 3-4kg/cm^2 as opposed to normal operating pressure of about 15kg/cm^2. As the CB was not in a condition to operate, it was planned to isolate the breaker to attend to the trouble. Accordingly L # 234 was made OFF from Ramgarh End and after checking zero current in all three phases, it was attempted to open the bus side isolator in line charged condition. As soon as the Main Bus 2 side isolator was opened, huge flashing occurred due to arcing and ionization of associated air creating a bus fault in Main bus 2. During the fault Bus Bar Protection Check Zone appeared but no Main Zone appeared as reported by BTPS B (O & M). As the fault was not cleared by operation of Busbar Protection, there was widespread trippings at respective remote ends and other area leading to TPF in BTPS B 220KV, BTPS 400KV and some 132KV systems.

System Conditions prior to Event:

1. 400KV BTPS A – KTPS Line 1 was charged only from BTPS A End.
2. L # 234 BTPS B – Ramgarh was charged only from BTPS B End. Ramgarh End CB was OPEN.
3. 132 KV CTPS – Purulia Lines were OFF from CTPS End.
4. Howrah Belmuri loop was OPEN from Howrah End.

Relevant SLD of affected area: Attached as Annexure – A in last page of report.

Chronology of Events and Tripping Analysis:

From the downloaded DR and fault report read out from HMI of the various numerical relays at BTPS and others the following chronology of faults and subsequent line trippings could be established:

1. There was a bus fault on BTPS B 220KV Main Bus 2. As the fault was not correctly cleared vide operation of Bus Differential Relay, all the other 220KV lines tripped from remote end by Distance Protection Zone 2 to clear the fault. At 132KV level the lines emanating from BTPS B 132KV [BTPS B – Barhi & BTPS B – Konar] both tripped through O/C Protection to clear this fault. These lines tripped before ATRs tripped as the D/O/C pick up of these lines are 540A in comparison to ATR O/C pick up of 800A.
2. As there was only one BTPS A – KTPS 400KV line in service, the infeed current to the fault via both ICTs was lesser than when both BTPS A – KTPS lines are in service. This lesser infeed caused the 220KV bus fault to be seen within Zone 3 reach of KTPS BTPS A line from KTPS end. As the ICT O/C & E/F Protection is coordinated to trip in about 1.2sec for other voltage level bus fault and the KTPS End Zone 3 timer was set at standard setting of 1.0sec, the 400KV line tripped earlier than the ICT relays. Calculations in ASPEN Oneliner as well as manual impedance calculations showed that this encroachment of Zone 3 into BTPS B 220KV bus fault would not have taken place if both BTPS A – KTPS lines were in service. The Zone 3 timer at KTPS End of the said line has already been revised to 1.5s to remain coordinated with ICT protection in case of encroachment in case only one line is in service.

3. The tripping of GT Standby E/F earlier than ICTs was due to a wrong setting implemented in the GT S/E/F relay. This setting has now been corrected to be properly coordinated with ICT O/C & E/F protection for ICT LV (i.e. BTPS 220KV) bus faults.
4. After tripping of BTPS B 220KV source (due to tripping of L # 213, 214 & 233 from remote ends) the load of Gola, Ramgarh, Patratu, North Karanpura region shifted to 220KV Ramgarh – Ranchi line. In order to restrict the overload of the above line, 132KV Ramgarh Gola lines [L # 55 & 56] were made OFF at about 12:35hrs. This action had saved the overloading of 220KV Ranchi Ramgarh line and thus Ramgarh, Patratu and North Karanpura region did not face power outage.
5. After Ramgarh – Gola lines were made OFF manually by CLD, the load of Gola Chandil region began to be fed from CTPS End via Line # 6 & 7, both of which tripped on overload from CTPS End by D/O/C Protection. Probably about the same time both Jamshedpur – Mosabani Lines (Line # 2 & 3) tripped from Jamshedpur End through D/O/C Protection due to overloading.

Corrective Actions taken:

1. The Zone 3 time delay of KTPS – BTPS A line at KTPS end has been increased to 1.5 seconds to ensure time coordination with ICT relays even in case only one KTPS BTPS line is in service.
2. The GT Standby E/F Protection Time delay has been increased to allow ICTs to trip earlier for LV bus faults even if one KTPS – BTPS A line is not in service.

Tests done in Busbar Circuit:

1. Operation and Pick Up of Main Bus-1, Main Bus-2 and Check Zone Bus Bar Protection Relays was checked through current injection and the relevant Bus Bar Relay operation was found as desired. Tripping of individual Bus Zones were checked at the same time (after drawing out all 96 relays from various bays) and also found O.K.
2. Operation of Bus Wire Supervision relays 95A, 95B, 95CH, 95AX, 95BX, 95CHX were checked and found O.K except for 95AX whose coil was found damaged. The damaged relay has been replaced.
3. Healthiness of Bus-Differential protection circuit in the relay panel was thoroughly checked through current injection from Relay panel and I.R checking, and no such abnormality was found on protection panel CT Circuitry.
4. Continuity of Bus wire of CT cables from S/Y to Control panel of Main Zone # 1 and Main Zone # 2, was checked and no abnormality (i.e. discontinuity or break) observed.

Remarks about Bus Bar Protection non-operation:

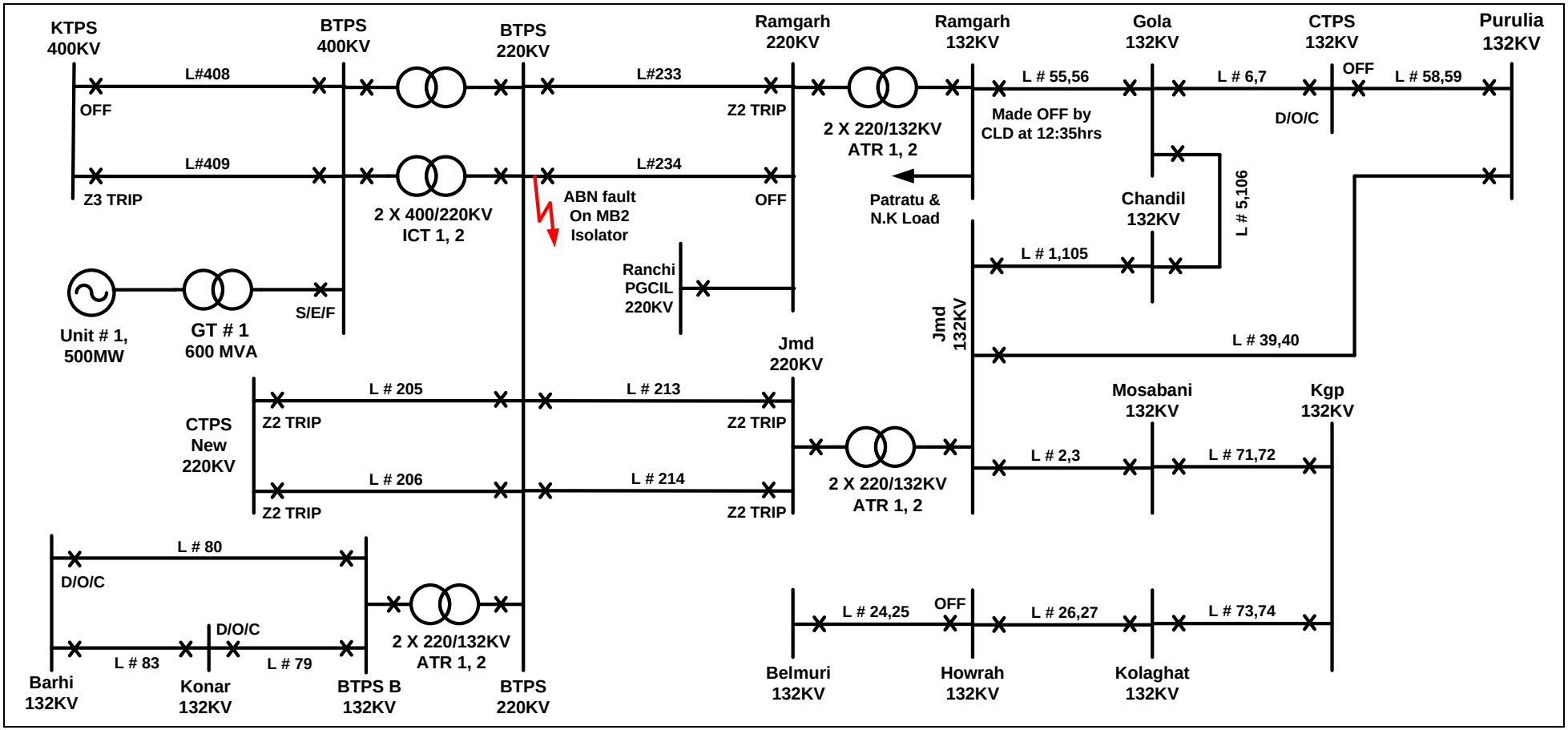
1. As checking of busbar differential relays, bus wire supervision relays and related circuitry revealed no abnormality in the busbar protection scheme no real reason could be established for it's non-operation during the said fault.
2. However it is a conjecture that as the isolator was opened manually it actually took some seconds to open the isolator blades. It might be possible that in the initial stages before creation of the major fault (sparking between isolator blades) the current mismatch caused during

opening of the isolator blades had caused the CT Supervision relay of Bus 2 to operate thereby blocking of the Busbar protection of Main Bus 2 (Bus Wire supervision time is 3 sec).

Recommendations:

1. A complete refurbish of Bus Differential Scheme with Numerical Relays is strongly recommended.
2. Complete retrofitting of all the relay panels at BTPS B 220 & 132KV Control room along with implementation of SAS (to understand chronological event records) is necessary as done in all DVC 220KV substations under PSDF project.

ANNEXURE 1: Relevant SLD of affected area:



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

घटना संख्या: **05-04-2022/1** दिनांक: **05-04-2022**

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

1. Summary of the event (घटना का सारांश):

At 18:03 hrs, 220kV switchyard at Hajipur (BSPTCL) became dead after tripping of 220KV Hajipur-Muzaffarpur D/c and 220KV Hajipur -Barauni II ,(Other ckt under breakdown) due to Y phase LA blast of Barauni -II at Hajipur end. Total load loss occurred of 260 MW. Area affected Chapra Siwan, Amnour ,Sheetalpur, Ekma ,Raghunathpur, Hajipur. Power extended to Hajipur thro' 220KV Hajipur-Muzaffarpur D/c. All load restored by 18:35 hrs.

Date / Time of disturbance: 05-04-2022 at 18:03 hrs.

- **Event type:** GD- 1

Systems/ Subsystems affected: Chapra, Siwan, Amnour, Sheetalpur, Ekma ,Raghunathpur and Hajipur Traction load from Chhapra and Siwan(13mw)

Load and Generation loss.

- Nil.
- 260 Mw load loss reported during the event

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

- 220KV Hajipur -Barauni I under breakdown

3. Major elements tripped (प्रमुख ट्रिपिंग)

Transmission/Generation element name संचरण लाइन / विधुत उत्पादन इकाईं का नाम	Trip Date बंद होने की तिथि	Trip Time बंद होने का समय
220KV-MUZAFFARPUR(PG)-HAZIPUR-1	05-04-2022	18:03
220KV-MUZAFFARPUR(PG)-HAZIPUR-2		
220KV-HAJIPUR-BARUANI-1		
220KV-HAJIPUR-AMNOUR 1		
220KV-HAJIPUR-AMNOUR 2		

4. Network across the affected area (प्रभावित क्षेत्र का नक्शा)

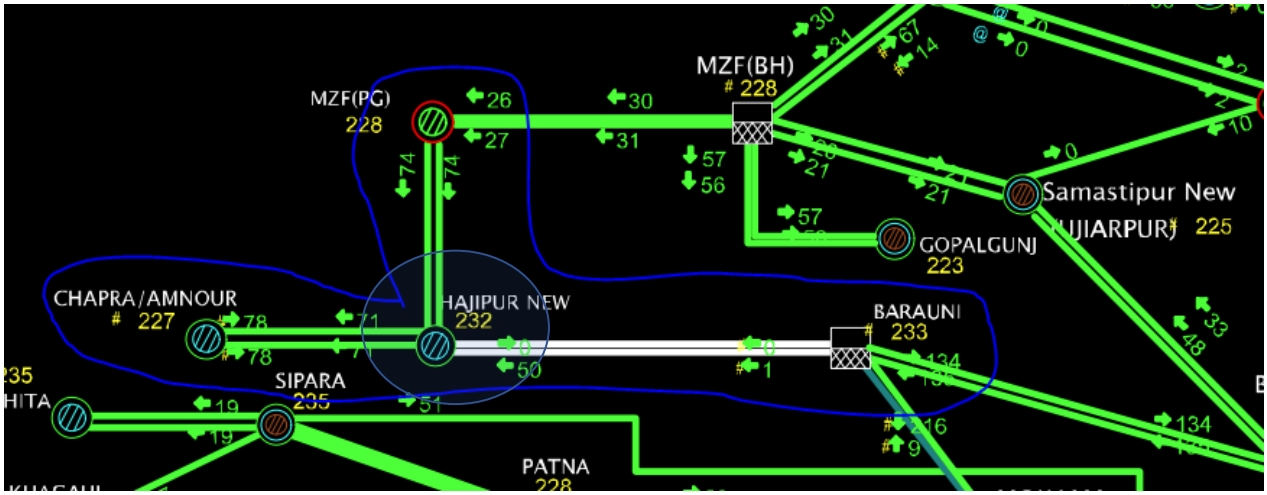


Figure 1: SCADA snapshot for of the system

Relay indication and PMU observation (रिले संकेत और पीएमयू पर्यवेक्षण): Not received till date

Figure 2: PMU voltage snapshot of 400/220 kV Muzzafferpur S/s

5. Restoration (पूर्वावस्था की प्रप्ति)

Transmission/Generation element name संचरण लाइन / विधुत उत्पादन इकाई का नाम	Trip Date बंद होने की तिथि	Trip Time बंद होने का समय	Restoration Date वापस आने की तिथि	Restoration time वापस आने का समय
220KV-MUZAFFARPUR(PG)-HAZIPUR-1	05-04-2022	18:03	05-04-2022	18:24
220KV-MUZAFFARPUR(PG)-HAZIPUR-2				18:24
220KV-HAJIPUR-BARUANI-1				Under Outage
220KV-HAJIPUR-AMNOUR 1				18:35
220KV-HAJIPUR-AMNOUR 2				18:35

6. Analysis of the event (घटना का विश्लेषण):

At 18:03 Hrs ,220 kv Muzzafferpur -Barauni -II ,Y phase LA bursted at Hazipur end and the same line tripped within 100 ms .From PMU it appears fault was cleared within 100 ms .Same fault was also sensed by Muzzafferpur- Hazipur D/C and tripped immediately .

This caused Hazipur substation blackout as 220 kv Muzzafferpur -Barauni -I was already under breakdown and both the sources of Hazipur S/s which are Muzaffarpur & Barauni were cut off ,leading to load loss at HAZIPUR .

Muzzaffrepur-Hazipur DR at Hazipur end shows the tripping of line immediately sensing Y-ERATH fault of Hazipur -Barauni ,but this fault should be sensed in reverse direction by hazipur end and should be delayed tripping if fault persists .**This should be checked by BSPTCL .**

7. Protection issue (सुरक्षा समस्या):

- Muzzaffrepur-Hazipur DR at Hazipur end shows the tripping of line immediately sensing Y-ERATH fault of Hazipur -Barauni ,but this fault should be sensed in reverse direction by hazipur end and should be delayed tripping if fault persists .**This should be checked by BSPTCL .**
- Carrier signal unhealthy was also high in DR ,Whether carrier is unhealthy should be also checked for successful A/R and Transfer trip scheme operation .
- No DR/EL, relay details, or report received regarding event from Powergrid ER-1 .Whether any tripping occurred from Pg end or any relay picked up .
- DR of Barauni end not received .

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

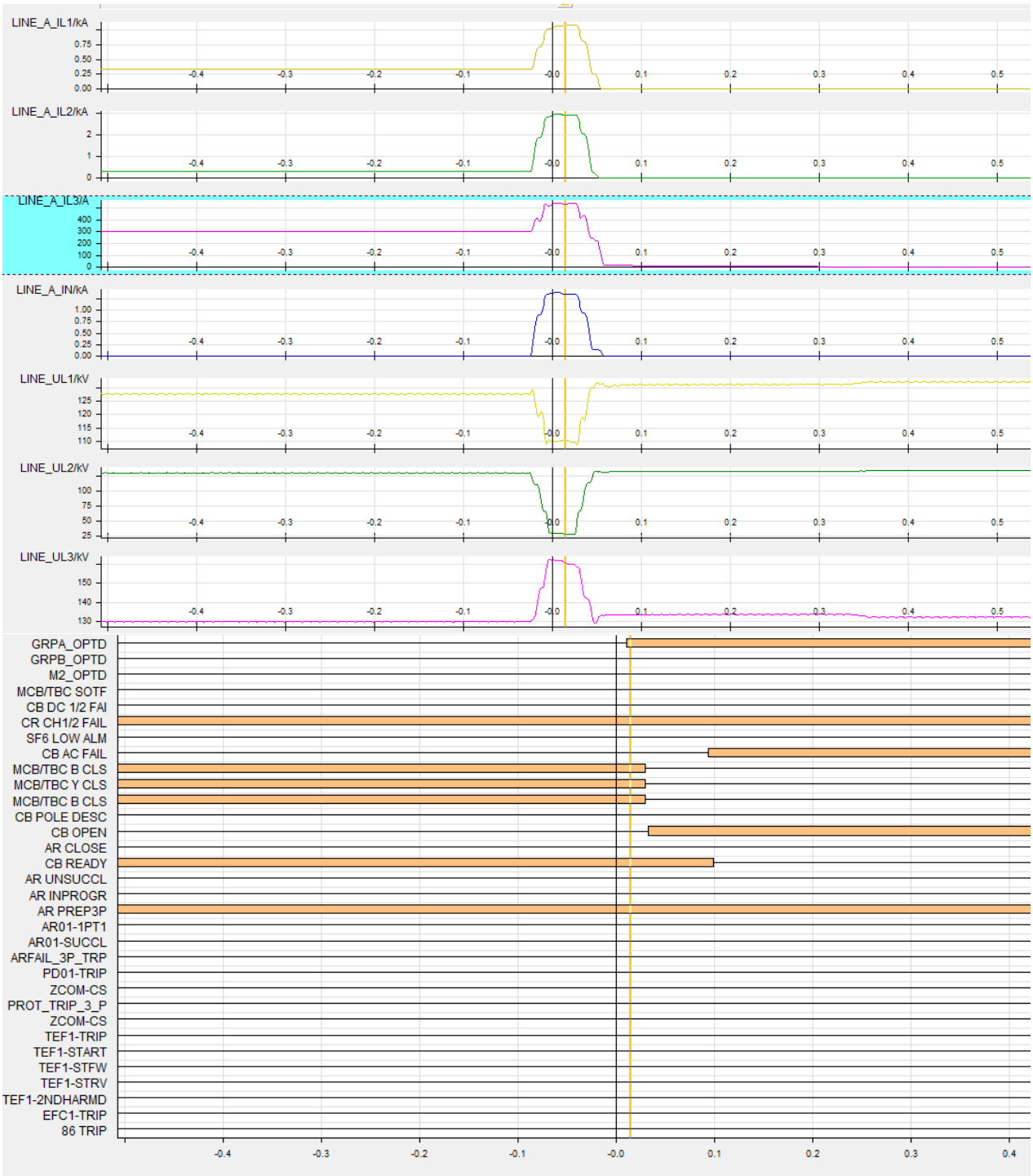
Issues	Regulation Non-Compliance	Utility
DR/EL not provided within 24 Hours	1. IEGC 5.2 (r) 2. CEA grid Standard 15.3	**BGCL,BSPTCL**
Incorrect/ mis-operation / unwanted operation of Protection system	1. CEA Technical Standard for Construction of Electrical Plants and Electric Lines: 43.4.A. 2. CEA (Technical standards for connectivity to the Grid) Regulation, 2007: Schedule Part 1. (6.1, 6.2, 6.3)	**BSPTCL**
Non-Availability of Numerical Bus Bar/LBB Protection at 220 kV and above S/s	1. CEA Technical Standard for Construction of Electrical Plants and Electric Lines 43.4.A 2. CEA Technical Standard for Construction of Electrical Plants and Electric Lines 43.4.C.4 3. CEA (Technical standards for connectivity to the Grid) Regulation, 2007 – 6.1, 6.4.	
DR/EL are not time synchronized	1. Indian Electricity Grid Code 4.6.3 2. CEA Technical Standard for Construction of Electrical Plants and Electric Lines: 43.4.D. 3. CEA (Technical standards for connectivity to the Grid) Regulation, 2007: Schedule Part 1.7.	**BSPTCL**

9. Status of Reporting (रिपोर्टिंग की स्थिति):

DR/EL not received from **BGCL , PG-ER-1 , Muzzaffrepur-HAZIPUR -I at Hazipur end not received by BSPTCL .**

10. Annexure DR

220 kV Muzzafferpur-Hazipur -II DR at Hazipur end :



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घटना संख्या: **05-04-2022/1** दिनांक: **28-04-2022**

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

1. Summary of the event (घटना का सारांश):

At 12:19 Hrs on 05th April 2022, 220 kV Daltonganj-Garhwa D/c tripped leading total supply failure at Garhwa and radially fed downstream S/s. As reported by SLDC Jharkhand, 40 MW load loss occurred at Garhwa.

- **Date / Time of disturbance:** 05-04-2022 at 12:19 hrs.
- **Event type:** GD - 1
- **Systems/ Subsystems affected:** 220/132 kV Garhwa S/s
- **Load and Generation loss**.
  - No generation loss occurred during the event.
  - 40 MW load loss reported during the event by SLDC Jharkhand

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

- NIL

3. Major elements tripped (प्रमुख ट्रिपिंग)

- 220 kV Daltonganj-Garhwa D/c

4. Network across the affected area (प्रभावित क्षेत्र का नक्शा)

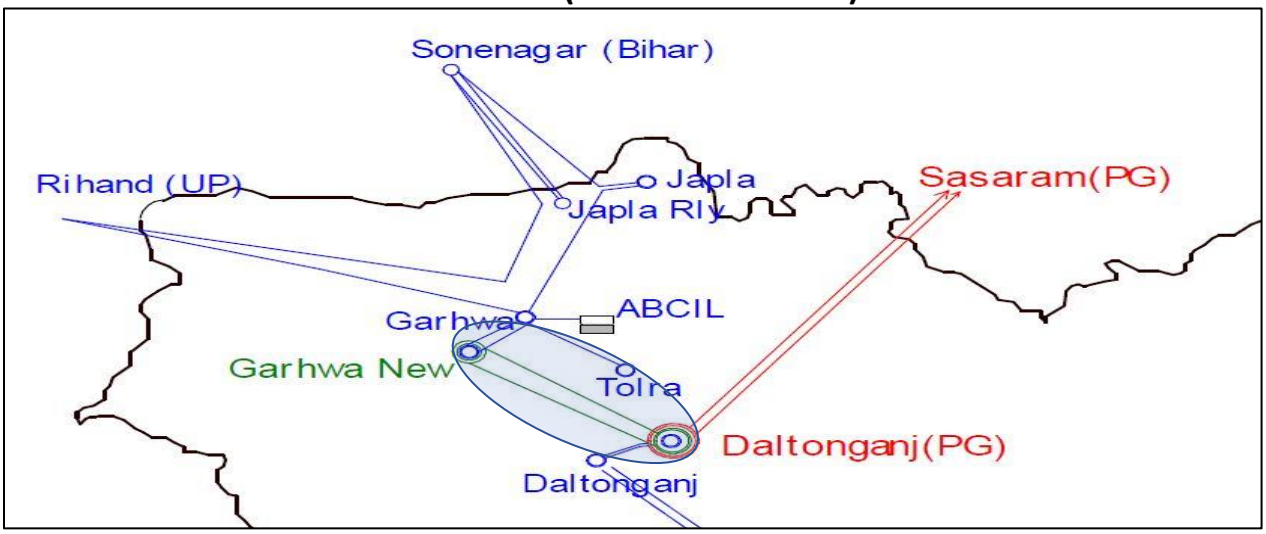


Figure 1: Network across the affected area

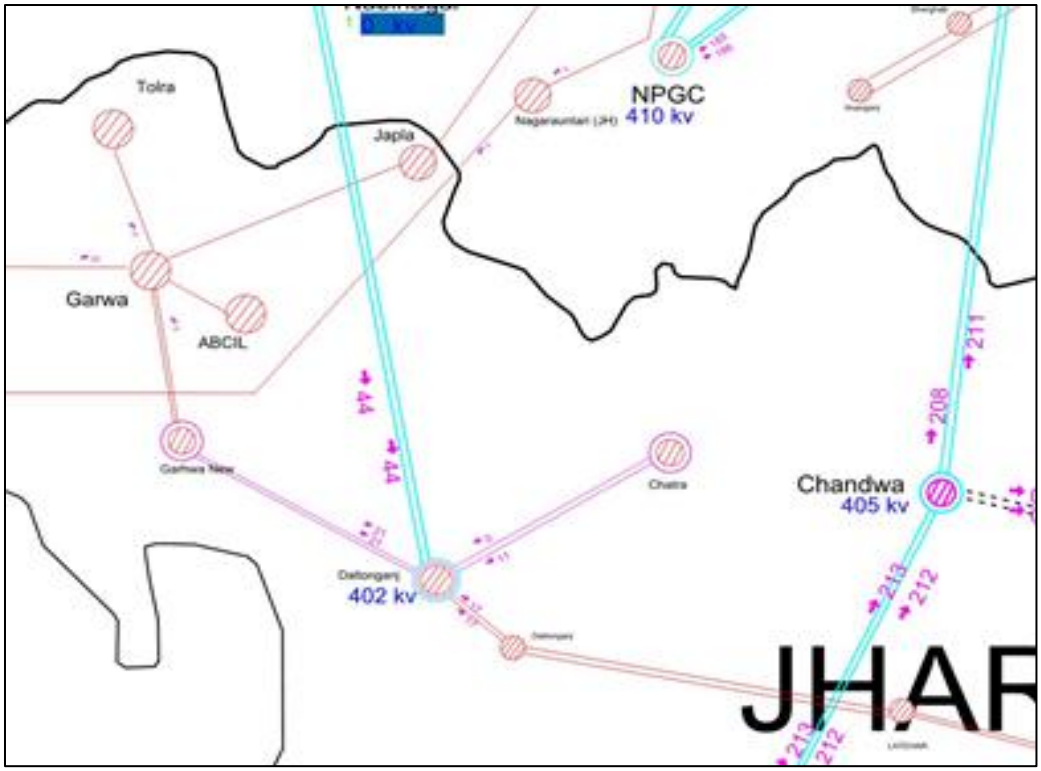
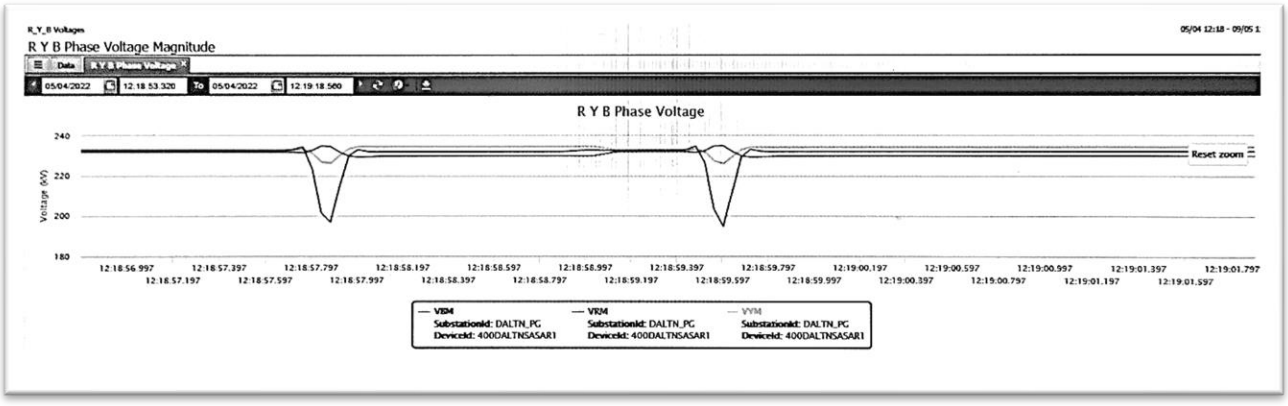


Figure 2: SCADA snapshot for of the system

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

समय	नाम	उप केंद्र 1 रिले संकेत	उप केंद्र 2 रिले संकेत	पीएमयू पर्यवेक्षण
12:19	220 kV Daltonganj-Garhwa-1	Daltonganj: B_N, Zone-1, 2.4 kA, 32.5 km, A/r successful, tripped again within reclaim time	Garhwa: B_N, Zone-1, 1.24 kA, 58.17 km	35 kV dip in B_ph voltage at Daltonganj. A/r successful after 1 sec. Line tripped again within reclaim time after 600 msec.
	220 kV Daltonganj-Garhwa-2	Daltonganj: Didn't trip	-	



PMU Voltage snapshot of 400/220 kV Daltonganj S/s

5. Restoration (पूर्वावस्था की प्राप्ति)

Transmission/Generation element name	Restoration time
220 kV Daltonganj-Garhwa-1	14:02
220 kV Daltonganj-Garhwa-2	14:01

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

- There was a B_N fault in 220 kV Daltonganj-Garhwa-1.
- A/r successful from both ends after 1 second. Line tripped again after 600 msec in reclaim time.
- Single phase tripping at Garhwa end during tripping in reclaim time. JUSNL may explain.
- Reason for tripping of 220 kV Daltonganj-Garhwa-2 from Garhwa end maybe shared by JUSNL.

7. 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**
Incorrect/ mis-operation / unwanted operation of Protection system	1. CEA Technical Standard for Construction of Electrical Plants and Electric Lines: 43.4.A. 2. CEA (Technical standards for connectivity to the Grid) Regulation, 2007: Schedule Part 1. (6.1, 6.2, 6.3)	**JUSNL**
DR/EL are not time synchronized	1. Indian Electricity Grid Code 4.6.3 2. CEA Technical Standard for Construction of Electrical Plants and Electric Lines: 43.4.D. 3. CEA (Technical standards for connectivity to the Grid) Regulation, 2007: Schedule Part 1.7.	**JUSNL**

8. Status of Reporting (रिपोर्टिंग की स्थिति):

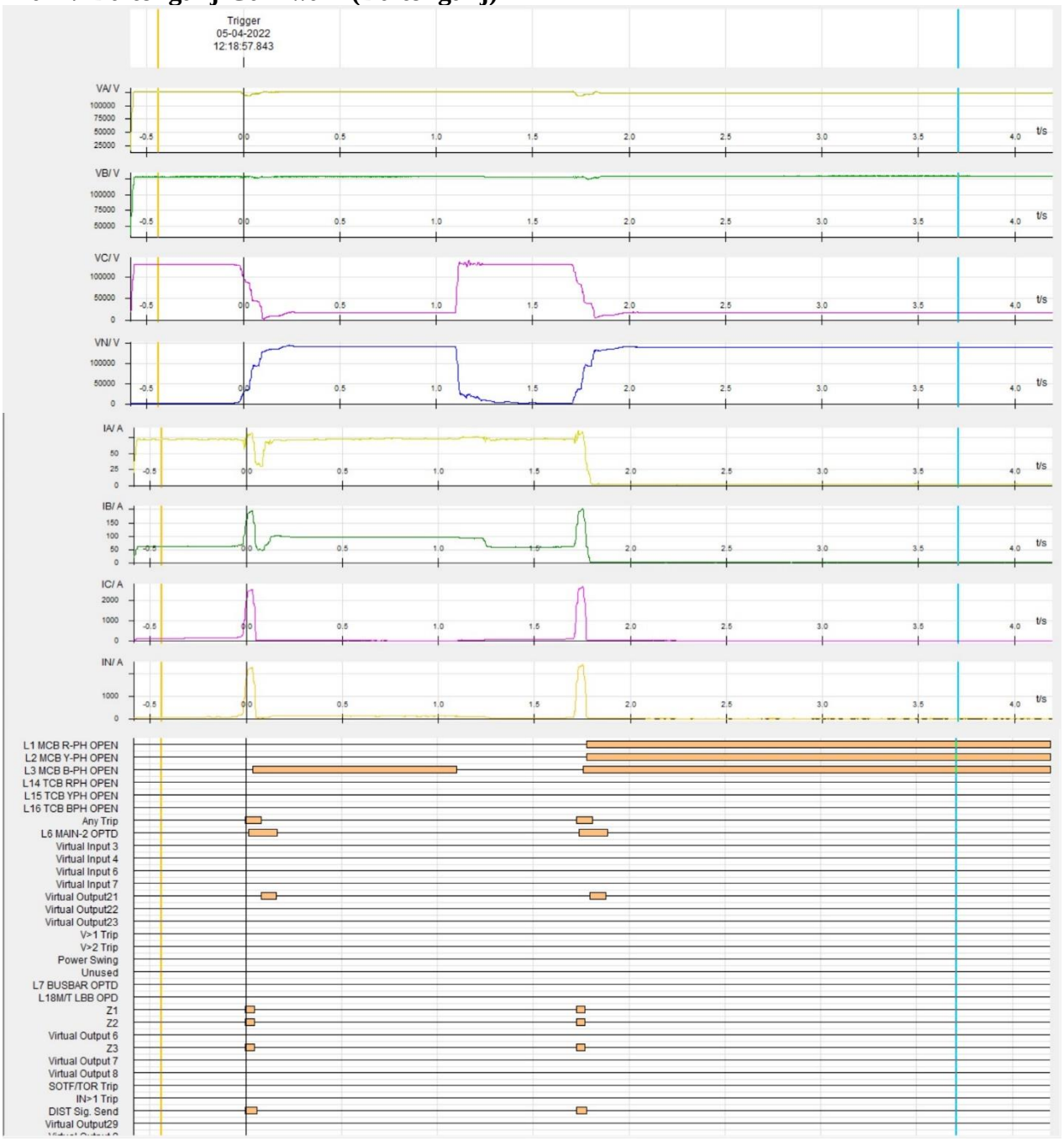
- DR/EL received from PG ER-1.
- Complete DR/EL yet to be received from JUSNL.

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

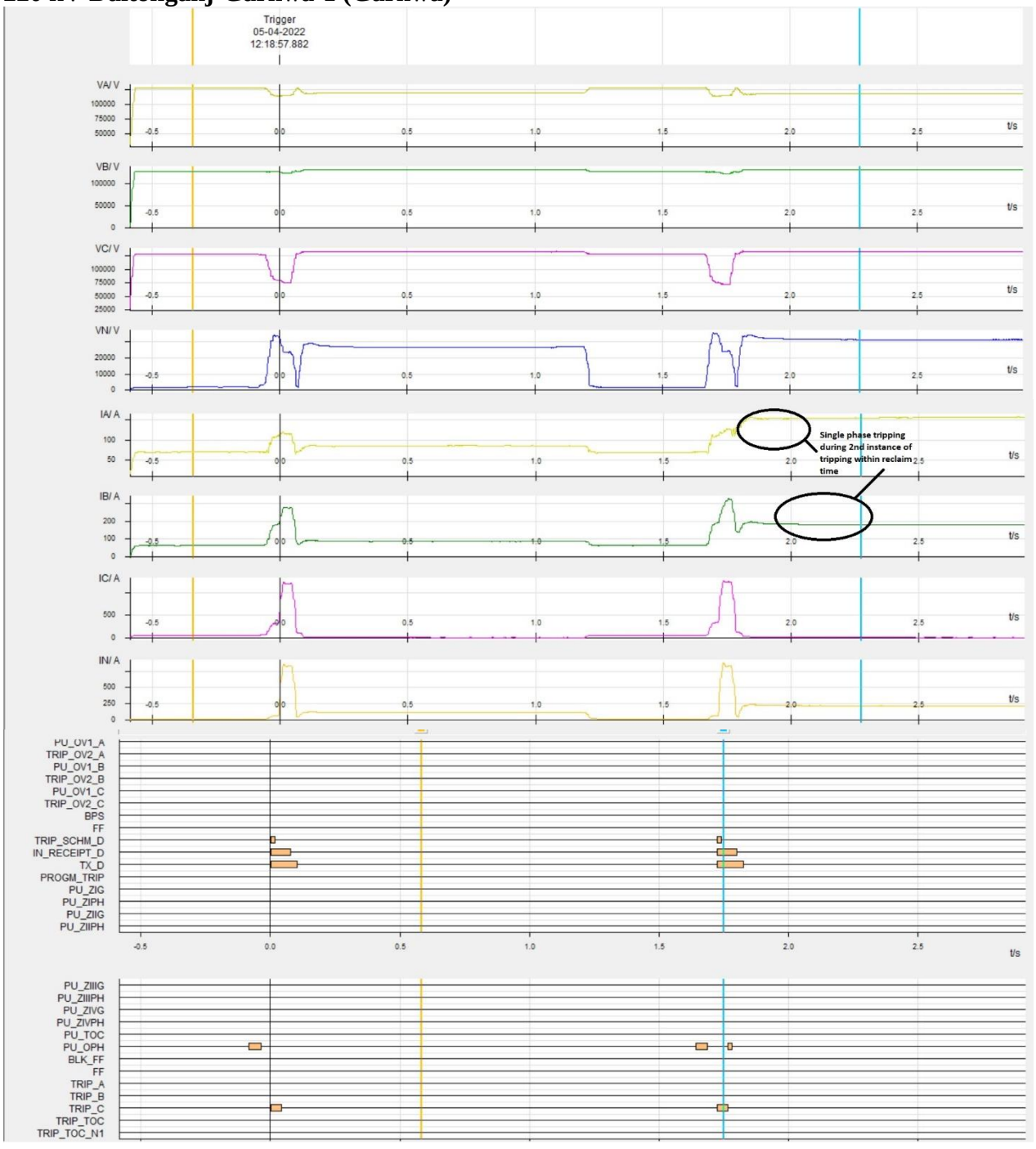
TIME	STATION	DESCRIPTION	STATUS
12:18:58.739	DALTN_PG	220_GARHWA_1_CB	Travel
12:18:59.816	DALTN_PG	220_GARHWA_1_CB	Closed
12:19:00.484	DALTN_PG	220_GARHWA_1_CB	Open

Annexure 2: DR recorded

220 kV Daltonganj-Garhwa-1 (Daltonganj)



220 kV Daltonganj-Garhwa-1 (Garhwa)



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घटना संख्या: **23-04-2022/1** दिनांक: **28-04-2022**

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

Summary of the events (घटनाओं का सारांश):

Event 1: At 12:37 Hrs on 23-04-2022, 400 kV Teesta 5-Rangpo-1 tripped from Teesta 5 end only due to delayed clearance of fault in 400 kV Rangpo-Binaguri-1. This led to total power failure at Teesta 5 (400 kV Teesta 5-Rangpo-2 was under shutdown). One running unit at Teesta-5 tripped and 168 MW generation loss occurred.

Event 2: At 18:20 Hrs on 26-04-2022, 400 kV Teesta 5-Rangpo-1 tripped due to R_B_N fault. This led to total power failure at Teesta 5 (400 kV Teesta 5-Rangpo-2 was under shutdown). All three running units at Teesta-5 tripped and 512 MW generation loss occurred.

Event 3: At 18:59 Hrs on 26-04-2022, 400 kV Teesta 5-Rangpo-1 tripped again due to R_B_N fault. This led to total power failure at Teesta 5 (400 kV Teesta 5-Rangpo-2 was under shutdown). Two running units at Teesta-5 tripped and 340 MW generation loss occurred.

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

- 400 kV Teesta 5- Rangpo-2

Network across the affected area (प्रभावित क्षेत्र का नक्शा)

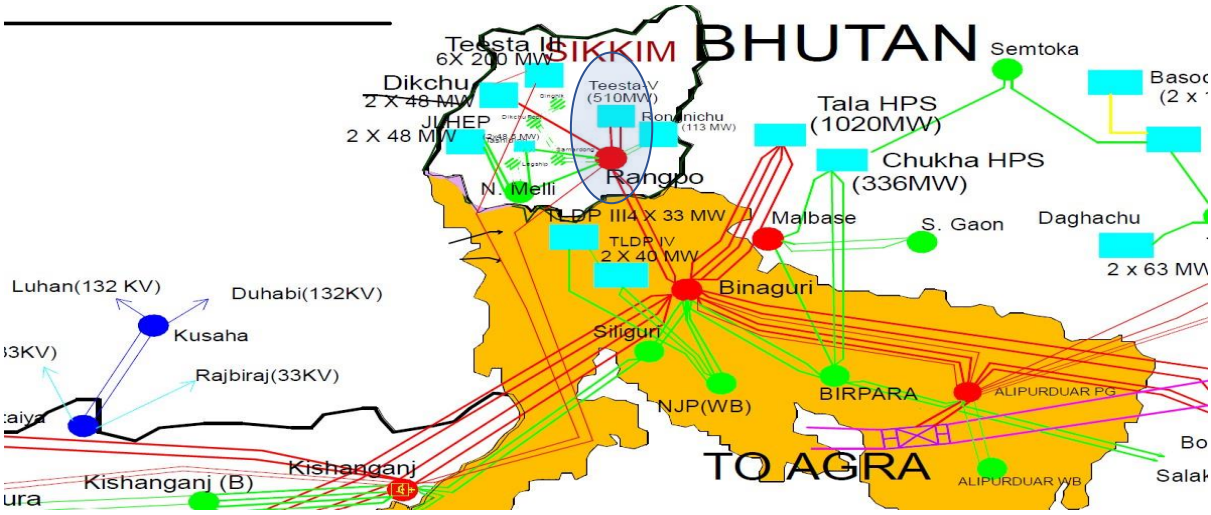


Figure 1: Network across the affected area

Event 1: 12:37 Hrs on 23.04.2022

At 12:37 Hrs, 400 kV Teesta 5-Rangpo-1 tripped from Teesta 5 end only due to delayed clearance of fault in 400 kV Rangpo-Binaguri-1. This led to total power failure at Teesta 5 (400 kV Teesta 5-Rangpo-2 was under shutdown). One running unit at Teesta-5 tripped and 168 MW generation loss occurred.

- **Date / Time of disturbance:** 23-04-2022 at 12:37 hrs.
- **Event type:** GD - 1
- **Systems/ Subsystems affected:** 400 kV Teesta-5 S/s
- **Load and Generation loss**.
  - 168 MW generation loss reported during the event.

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

समय	नाम	उप केंद्र 1 रिले संकेत	उप केंद्र 2 रिले संकेत	पीएमयू पर्यवेक्षण
12:37	400 kV Teesta 5-Rangpo-1	Teesta 5: DEF	Didn't trip	Gradual dip in voltage at Rangpo. 21 kV dip observed. Fault clearance time: 1.8 sec
	400 kV Binaguri-Rangpo-1	Binaguri: DT received	Rangpo: DEF, Ir: 2.7 kA	

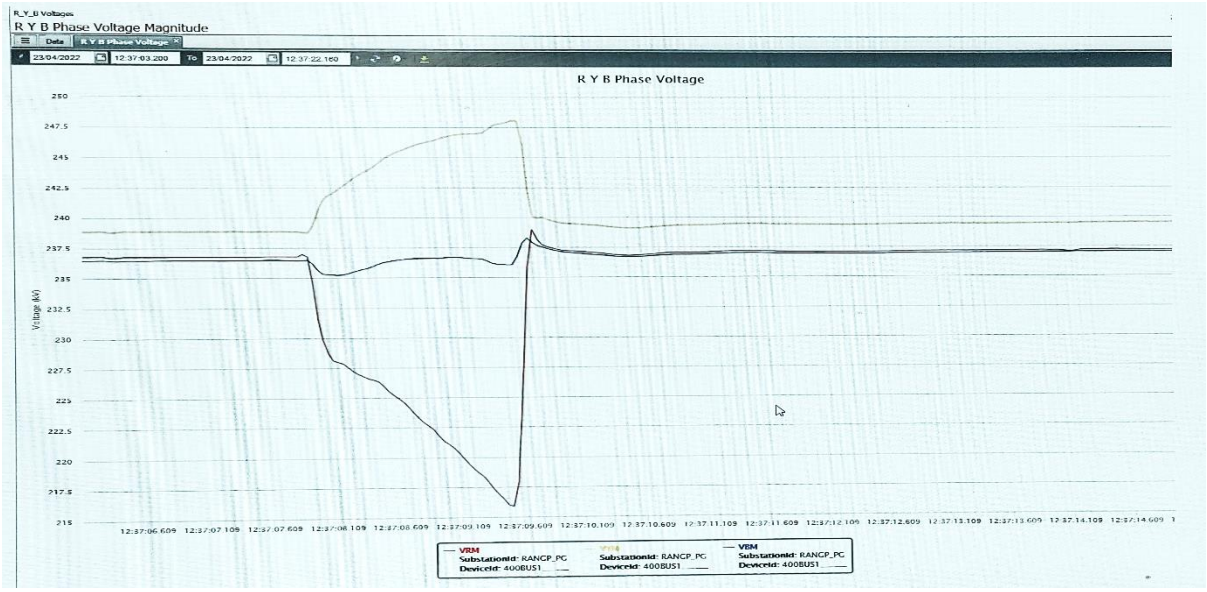


Figure 2: PMU voltage snapshot of 400/220/132 kV Rangpo S/s

Restoration (पूर्वावस्था की प्रप्ति)

Transmission/Generation element name	Restoration time
400 kV Teesta 5-Rangpo-1	12:56
400 kV Binaguri-Rangpo-1	13:20

Analysis of the event (घटना का विश्लेषण):

- There was a highly resistive fault in 400 kV Rangpo-Binaguri-1 line, which was cleared in around 1.8 seconds by Rangpo.
- 400 kV Teesta 5-Rangpo-1 tripped from Teesta 5 end on DEF in 1.6 seconds prior to tripping of 400 kV Binaguri-Rangpo-1. **DEF settings to be co-ordinated to avoid tripping of healthy lines.**

Status of Reporting (रिपोर्टिंग की स्थिति):

- DR/EL received from Teesta-5 and PG ER-2.

Event 2: 18:20 Hrs on 26.04.2022

At 18:20 Hrs, 400 kV Teesta 5-Rangpo-1 tripped due to R_B_N fault. This led to total power failure at Teesta 5 (400 kV Teesta 5-Rangpo-2 was under shutdown). All three running units at Teesta-5 tripped and 512 MW generation loss occurred.

- **Date / Time of disturbance:** 26-04-2022 at 18:20 hrs.
- **Event type:** GD - 1
- **Systems/ Subsystems affected:** 400 kV Teesta-5 S/s
- **Load and Generation loss**.
  - 512 MW generation loss reported during the event.

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

समय	नाम	उप केंद्र 1 रिले संकेत	उप केंद्र 2 रिले संकेत	पीएमयू पर्यवेक्षण
18:20	400 kV Teesta 5-Rangpo-1	Teesta 5: R_B_N, Ir: 1.96 kA, Ib: 2.6 kA	Rangpo: R_B_N, Ir: 13.7 kA, Ib: 14.3 kA	

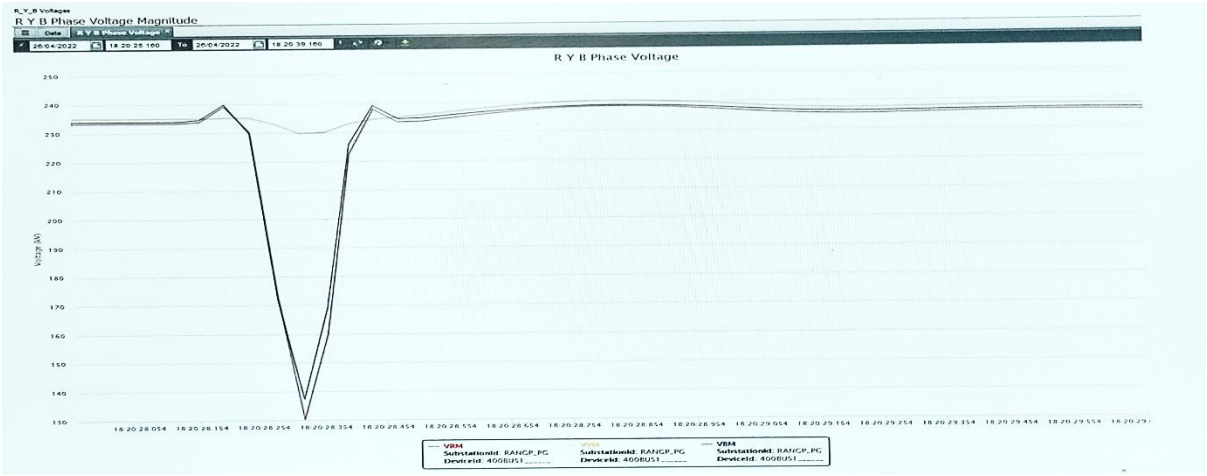


Figure 3: PMU voltage snapshot of 400/220/132 kV Rangpo S/s

Restoration (पूर्वावस्था की प्राप्ति)

Transmission/Generation element name	Restoration time
400 kV Teesta 5-Rangpo-1	18:42

Analysis of the event (घटना का विश्लेषण):

- There was a R_B_N fault in the line. All three running units tripped after tripping of line due to loss of evacuation path.

Status of Reporting (रिपोर्टिंग की स्थिति):

- DR/EL received from Teesta-5 and PG ER-2.

Event 3: 18:59 Hrs on 27.04.2022

At 18:59 Hrs, 400 kV Teesta 5-Rangpo-1 tripped again due to R_B_N fault. This led to total power failure at Teesta 5 (400 kV Teesta 5-Rangpo-2 was under shutdown). Two running units at Teesta-5 tripped and 340 MW generation loss occurred.

- **Date / Time of disturbance:** 27-04-2022 at 18:59 hrs.
- **Event type:** GD - 1
- **Systems/ Subsystems affected:** 400 kV Teesta-5 S/s
- **Load and Generation loss**.
  - 340 MW generation loss reported during the event.
  - No load loss occurred during the event.

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

समय	नाम	उप केंद्र 1 रिले संकेत	उप केंद्र 2 रिले संकेत	पीएमयू पर्यवेक्षण
18:59	400 kV Teesta 5-Rangpo-1	Teesta 5: R_B_N, Ir: 1.39 kA, Ib: 2.39 kA	Rangpo: R_B_N, 9.9 km Ir: 3.14 kA, Ib: 9.9 kA	

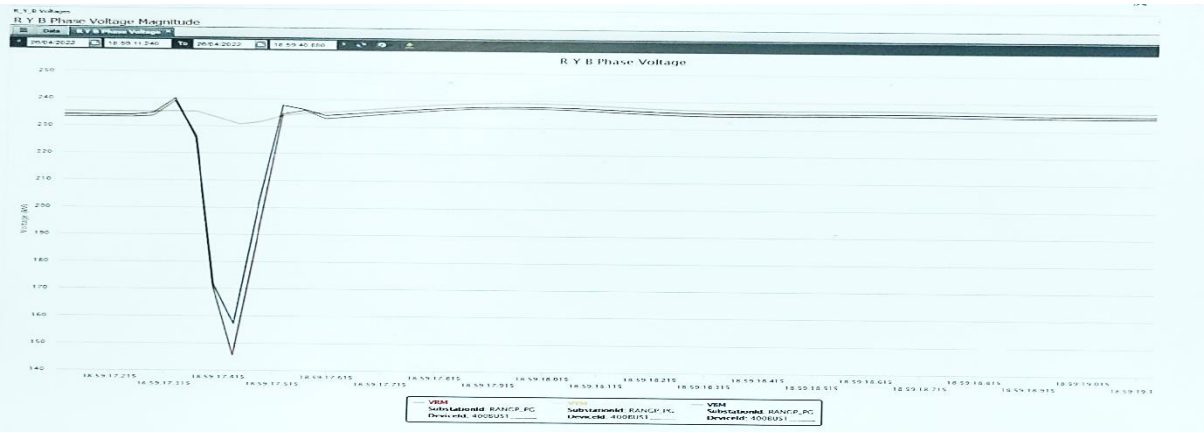


Figure 4: PMU voltage snapshot of 400/220/132 kV Rangpo S/s

Restoration (पूर्वावस्था की प्राप्ति)

Transmission/Generation element name	Restoration time
400 kV Teesta 5-Rangpo-1	21:33

Analysis of the event (घटना का विश्लेषण):

- There was a R_B_N fault in the line. All three running units tripped after tripping of line due to loss of evacuation path.

Status of Reporting (रिपोर्टिंग की स्थिति):

- DR/EL received from Teesta-5 and PG ER-2.

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

Issues	Regulation Non-Compliance	Utility
DR/EL not provided within 24 Hours	1. IEGC 5.2 (r) 2. CEA grid Standard 15.3	**PG ER-2**
Incorrect/ mis-operation / unwanted operation of Protection system	1. CEA Technical Standard for Construction of Electrical Plants and Electric Lines: 43.4.A. 2. CEA (Technical standards for connectivity to the Grid) Regulation, 2007: Schedule Part 1. (6.1, 6.2, 6.3)	**Teesta 5, PG ER-2**
DR/EL are not time synchronized	1. Indian Electricity Grid Code 4.6.3 2. CEA Technical Standard for Construction of Electrical Plants and Electric Lines: 43.4.D. 3. CEA (Technical standards for connectivity to the Grid) Regulation, 2007: Schedule Part 1.7.	**Teesta 5**

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

Event 1

TIME	STATION	DESCRIPTION	STATUS
12:37:09.562	SI400_PG	400_RANGP_PG_1_Main_CB	Open
12:37:09.577	RANGP_PG	400_SI400_PG_1_CB	Open
12:37:13.766	TEEST_PG	400_Unit3_CB	Open

Event 2

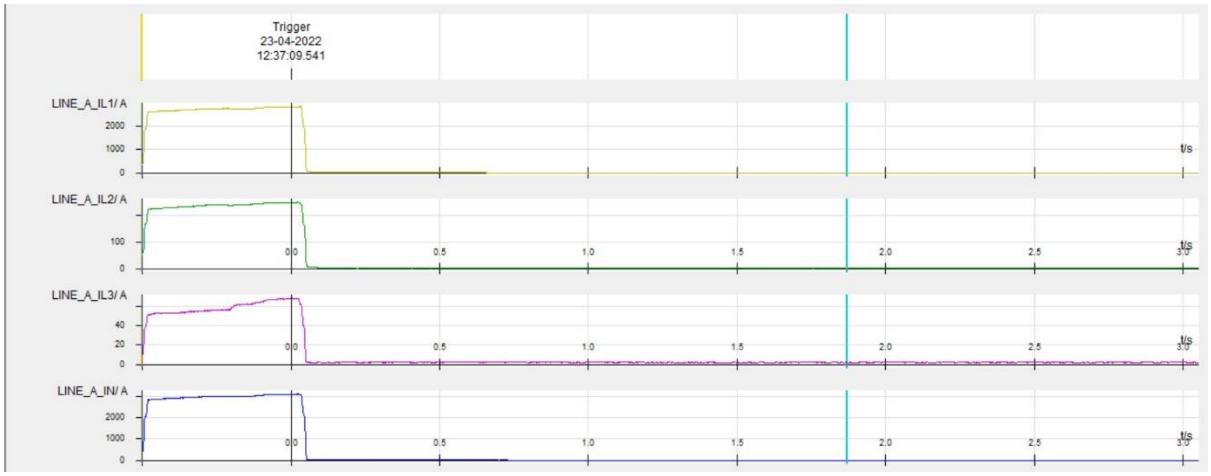
TIME	STATION	DESCRIPTION	STATUS
18:20:27.168	TEEST_PG	400_RANGP_PG_1_CB	Open
18:20:28.359	RANGP_PG	400_TEEST_PG_1_CB	Open
18:20:31.336	TEEST_PG	400_Unit1_CB	Open
18:20:31.339	TEEST_PG	400_Unit3_CB	Open
18:20:31.343	TEEST_PG	400_Unit2_CB	Open

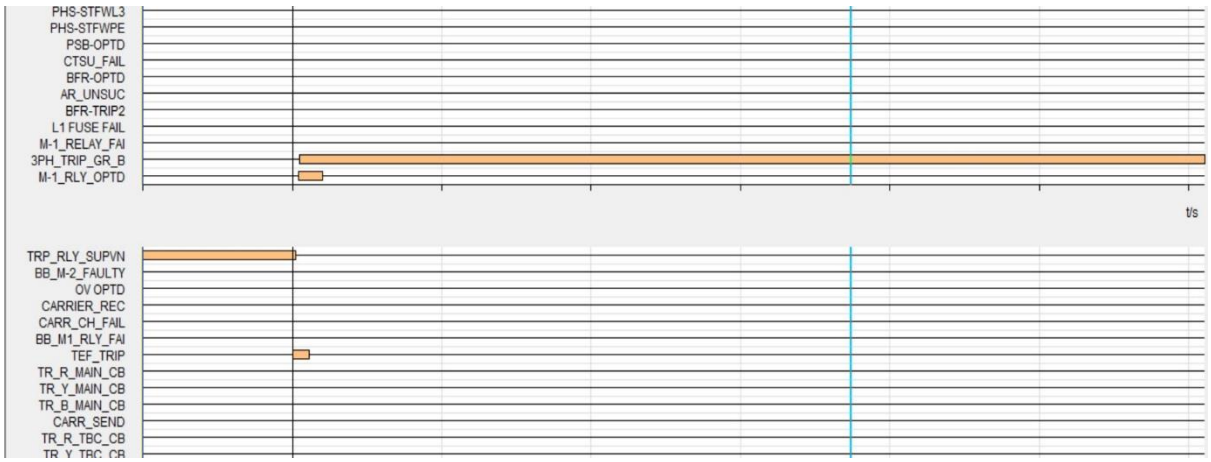
Event 3

TIME	STATION	DESCRIPTION	STATUS
18:59:16.247	TEEST_PG	400_RANGP_PG_1_CB	Open
18:59:17.464	RANGP_PG	400_TEEST_PG_1_CB	Open
18:59:20.500	TEEST_PG	400_Unit3_CB	Open
18:59:20.506	TEEST_PG	400_Unit1_CB	Open

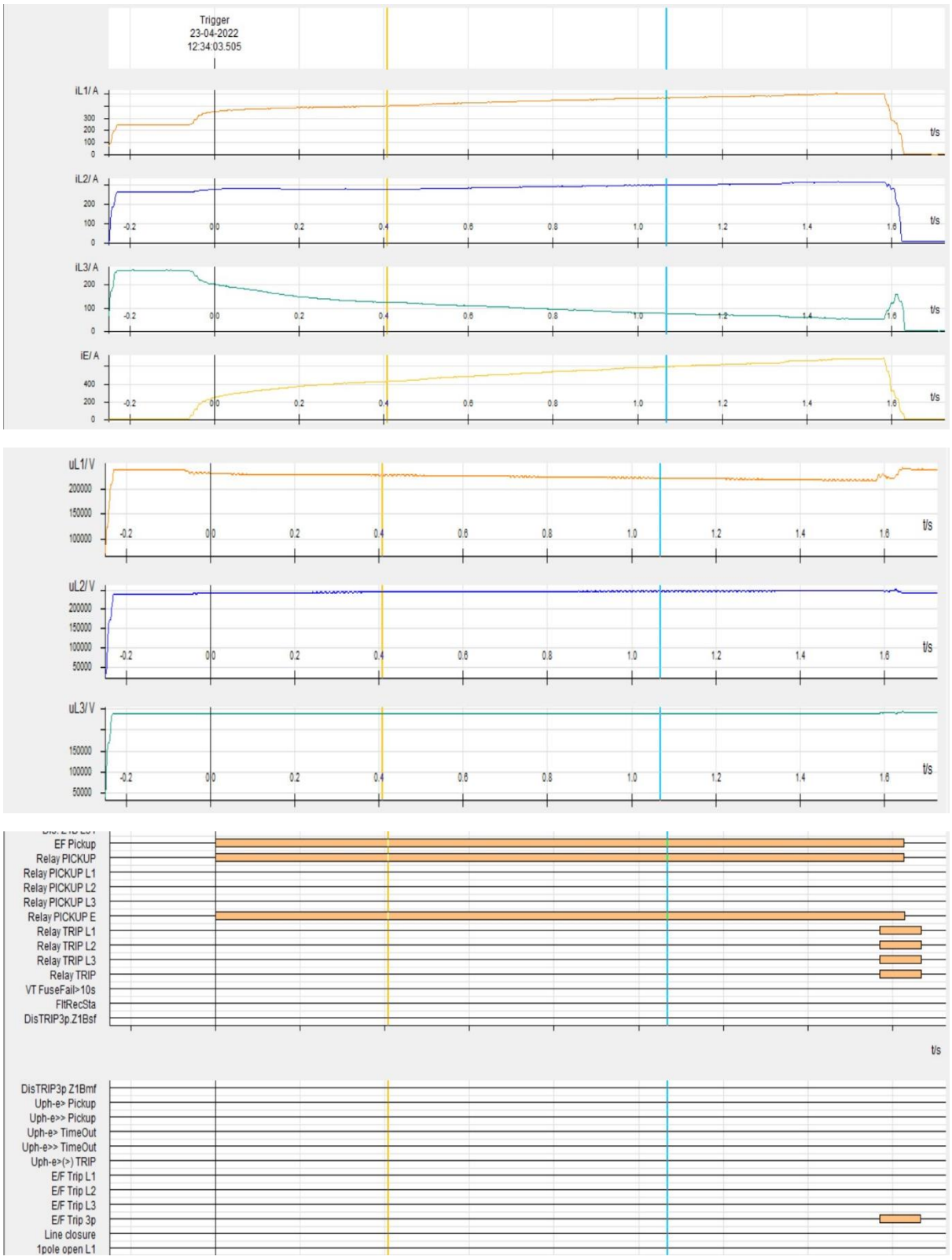
Annexure 2: DR recorded

Event 1: 400 kV Binaguri-Rangpo-1 (Rangpo end)

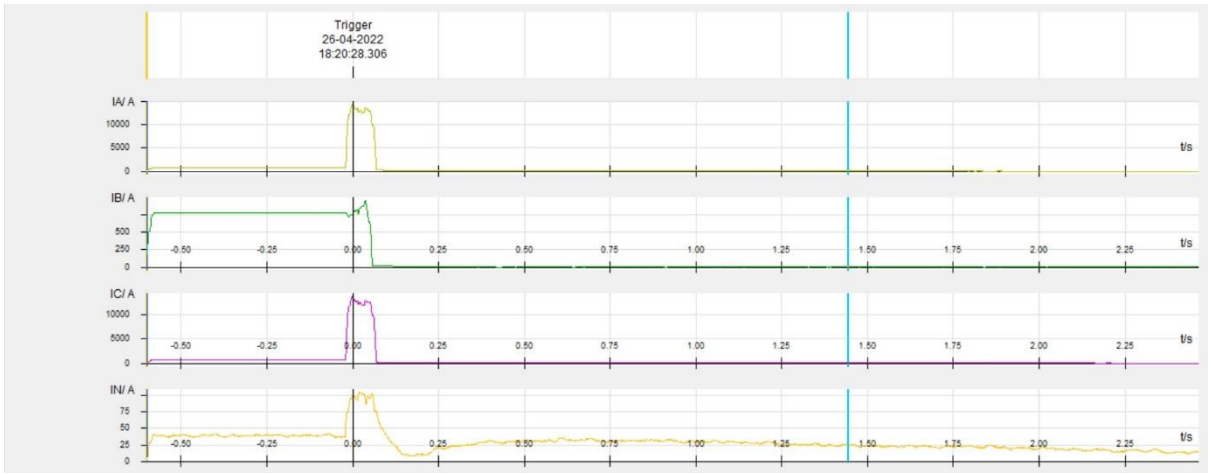


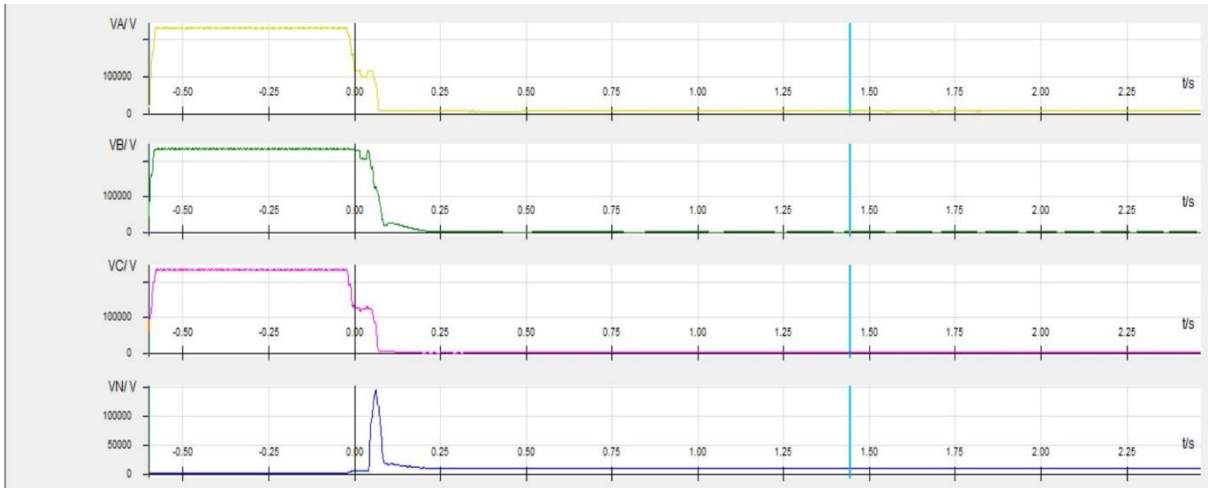


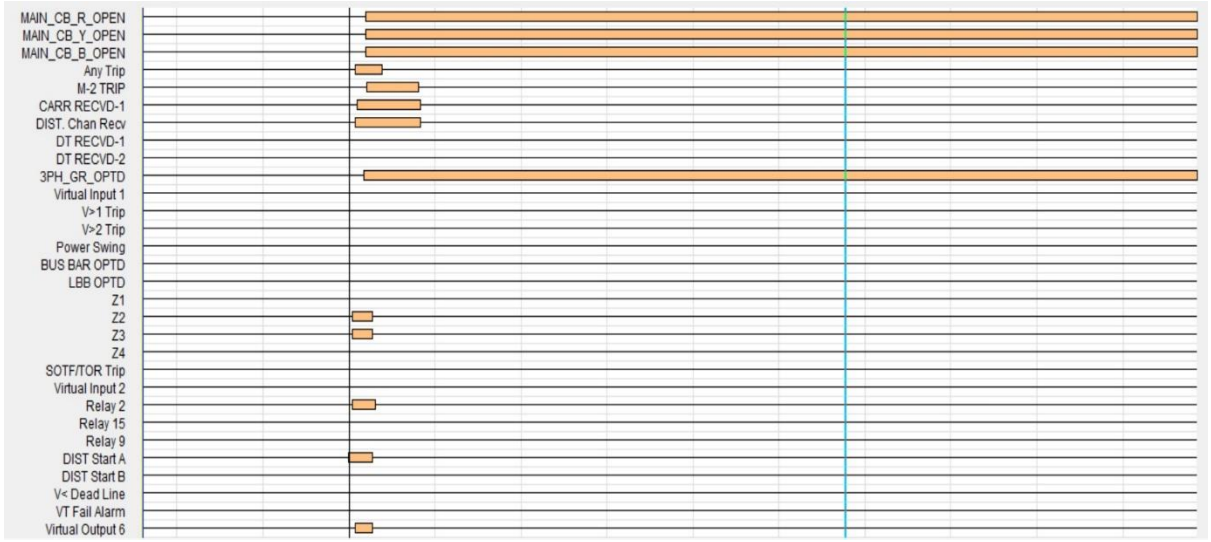
Event 1: 400 kV Teesta 5-Rangpo-1 (Teesta 5 end)



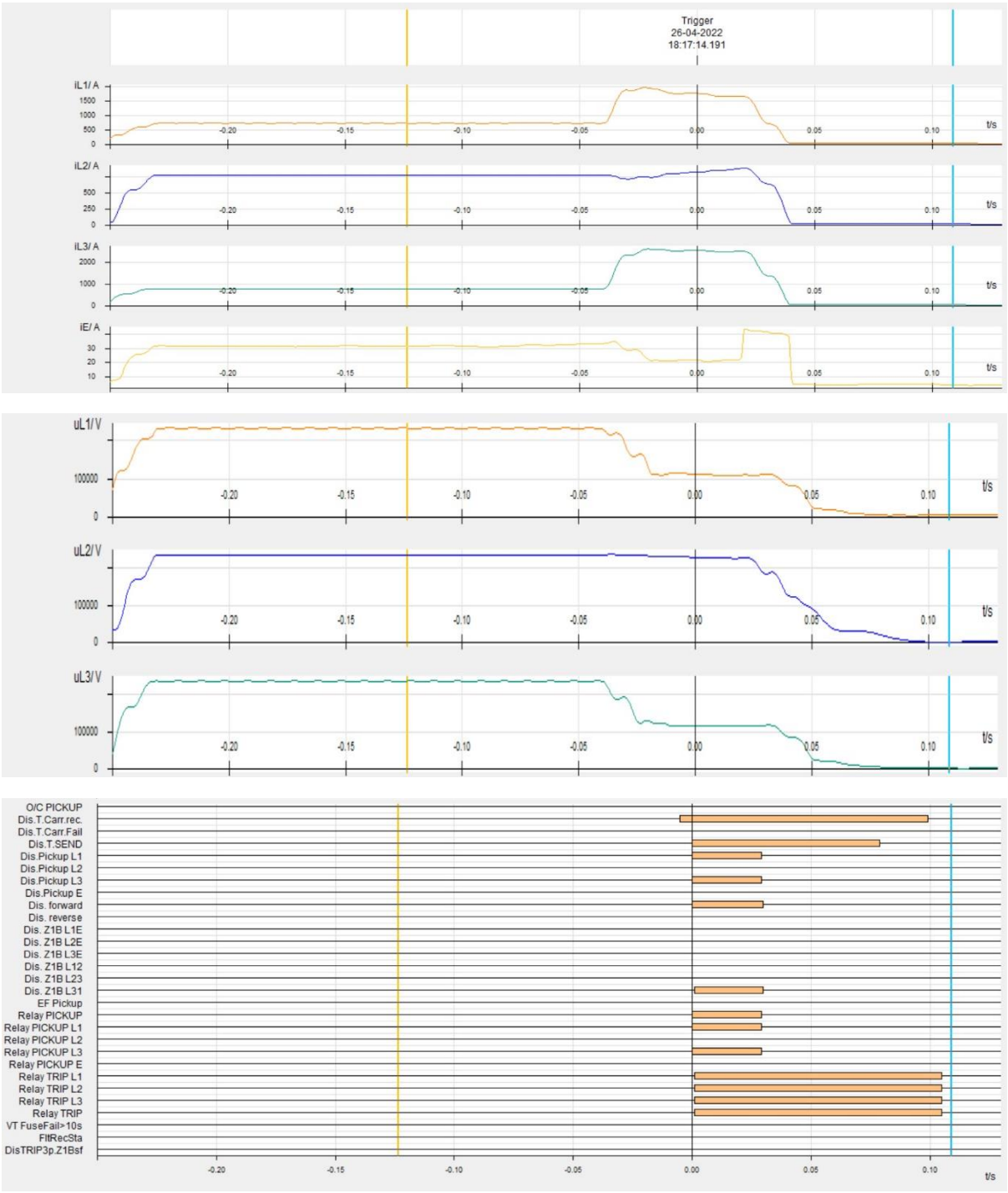
Event 2: 400 kV Teesta 5-Rangpo-1 (Rangpo end)



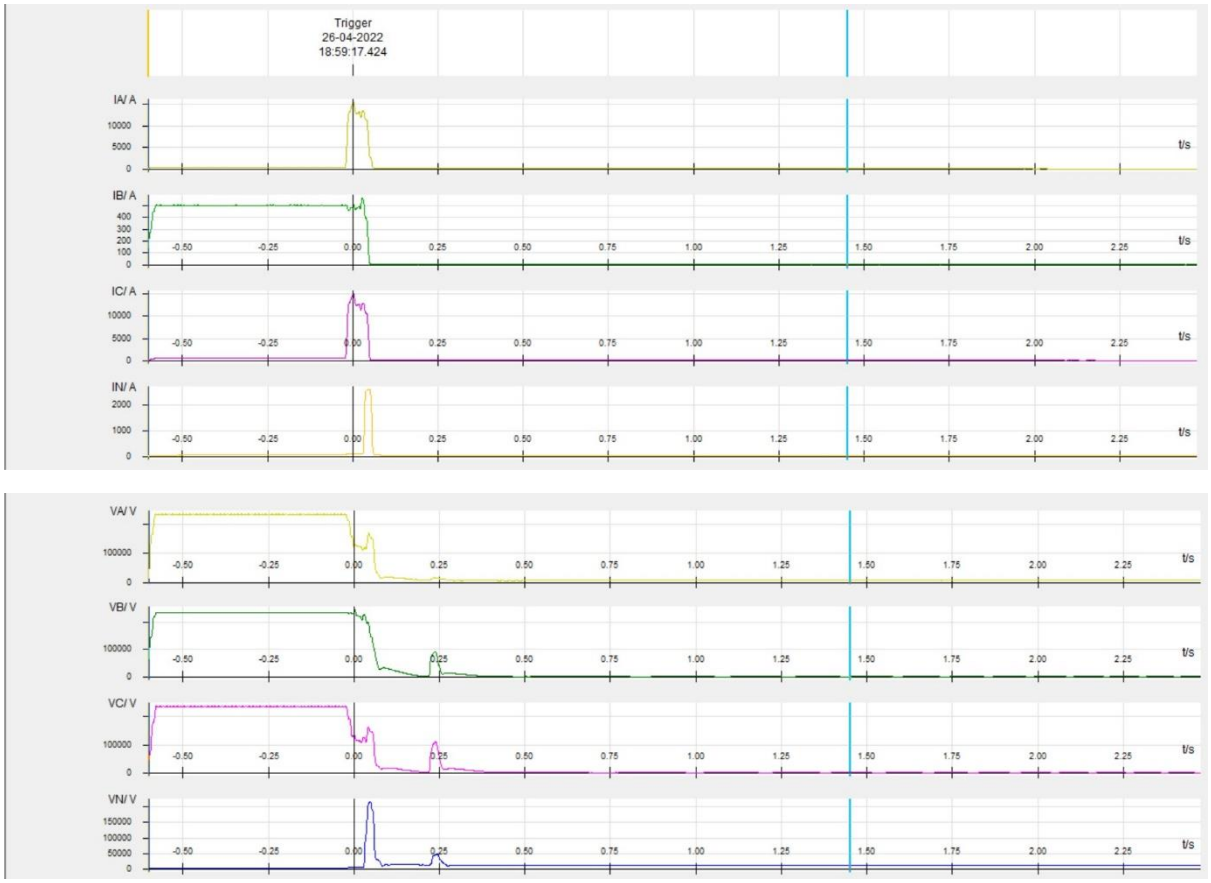


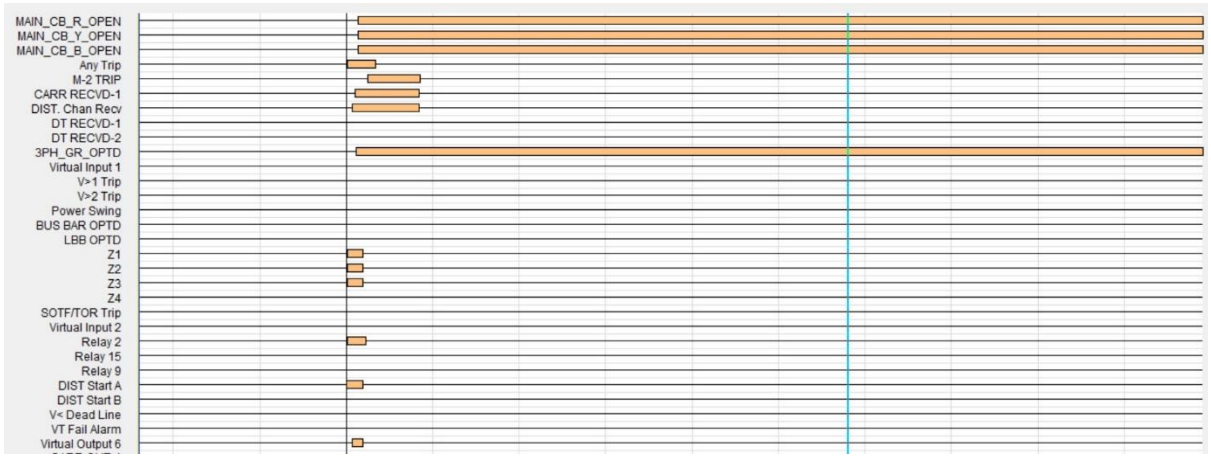


Event 2: 400 kV Teesta 5-Rangpo-1 (Teesta end)

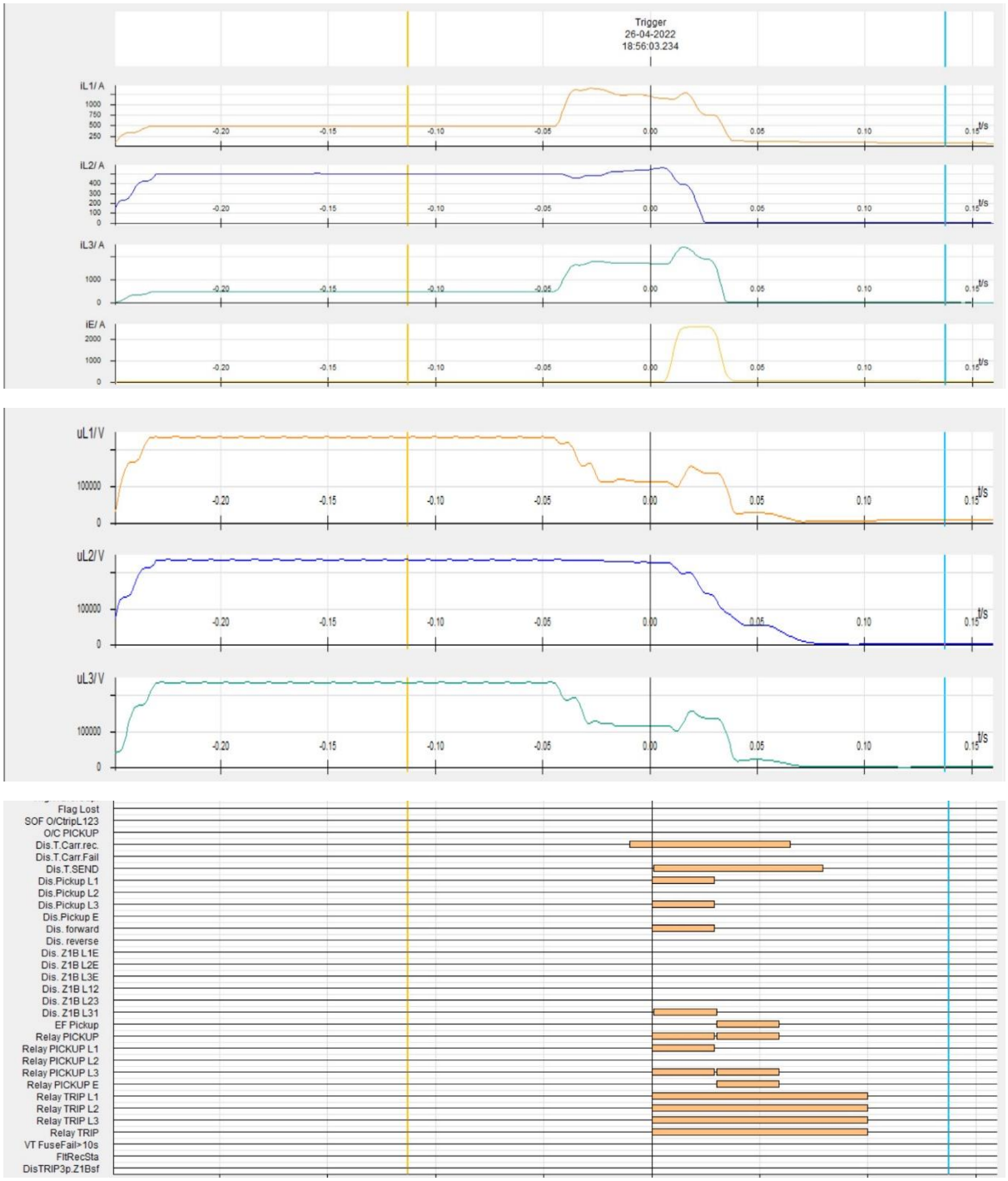


Event 3: 400 kV Teesta 5-Rangpo-1 (Rangpo end)





Event 3: 400 kV Teesta 5-Rangpo-1 (Teesta 5 end)



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

घटना संख्या: **26-04-2022/1** दिनांक: **28-04-2022**

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

1. Summary of the event (घटना का सारांश):

At 19:24 Hrs on 26th April 2022, 220 kV Jorethang-New Melli-2 tripped due to R_N fault leading to total power failure at Jorethang as 220 kV Jorethang-New Melli-1 already tripped at 19:11 Hrs. No generation loss occurred.

- **Date / Time of disturbance:** 26-04-2022 at 19:24 hrs.
- **Event type:** GD - 1
- **Systems/ Subsystems affected:** 220 kV Jorethang S/s
- **Load and Generation loss**.
  - No generation loss or load loss reported during the event.

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

- 220 kV Jorethang-New Melli-1

3. Major elements tripped (प्रमुख ट्रिपिंग)

- 220 kV Jorethang-New Melli-2

4. Network across the affected area (प्रभावित क्षेत्र का नक्शा)

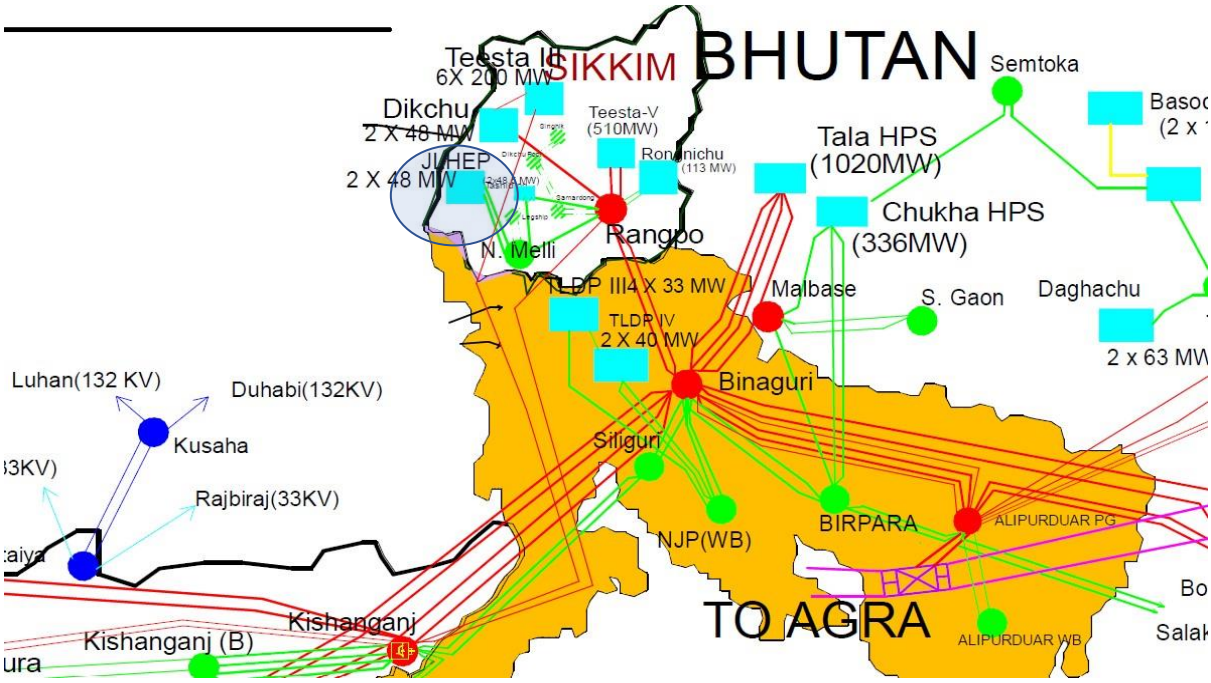


Figure 1: Network across the affected area

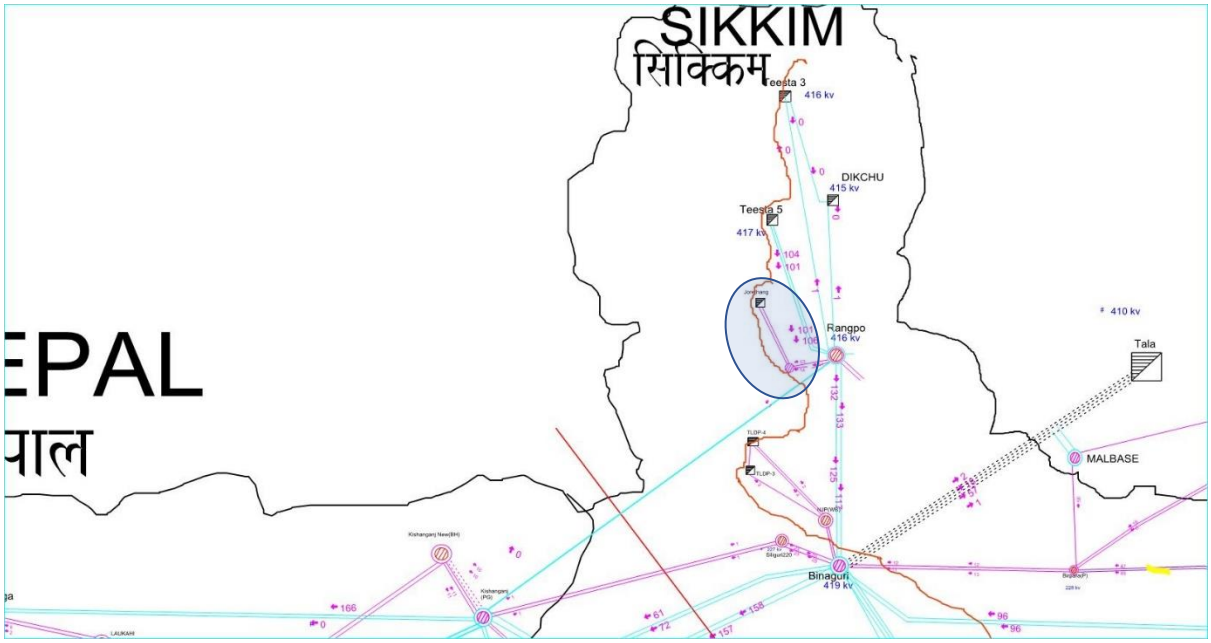


Figure 2: SCADA snapshot for of the system

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

समय	नाम	उप केंद्र 1 रिले संकेत	उप केंद्र 2 रिले संकेत	पीएमयू पर्यवेक्षण
19:24	220 kV Jorethang-New Melli-2	Jorethang: R_N	New Melli: R_N	35 kV dip in R_ph voltage for 350 msec

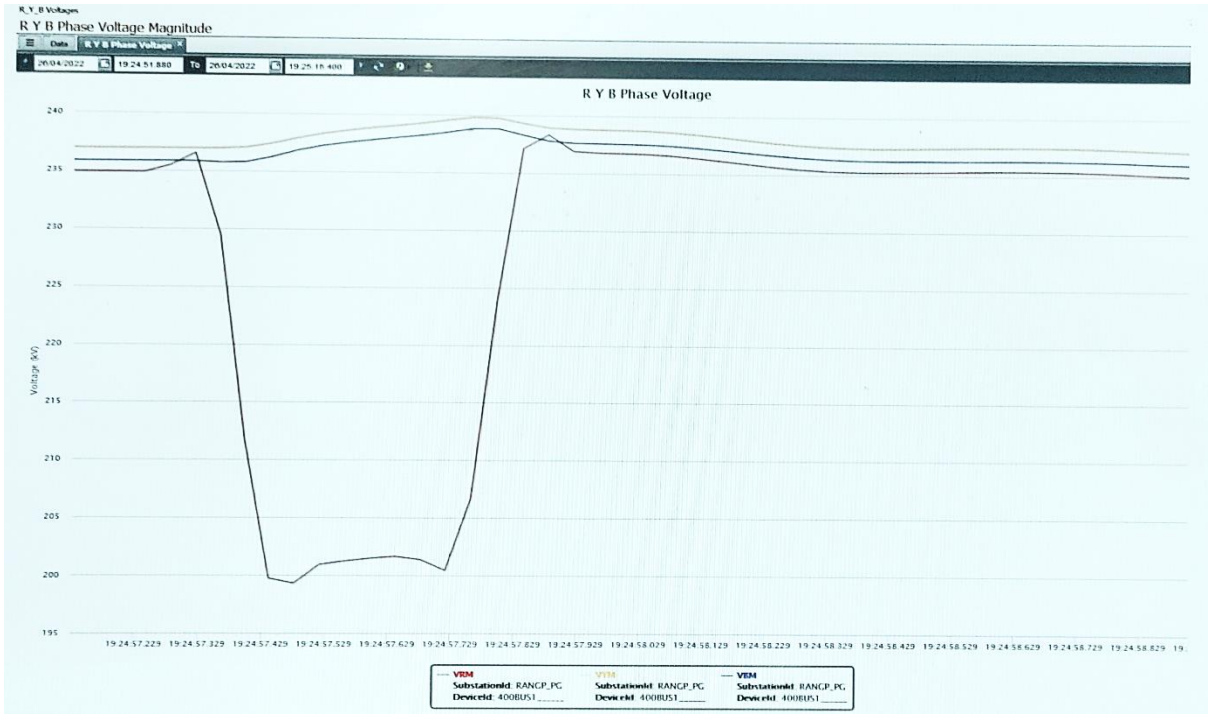


Figure 3: PMU voltage snapshot of 400/220/132 kV Rangpo S/s

5. Restoration (पूर्वावस्था की प्रप्ति)

Transmission/Generation element name	Restoration time
220 kV Jorethang-New Melli-1	20:03
220 kV Jorethang-New Melli-2	20:05

6. Analysis of the event (घटना का विश्लेषण):

- 220 kV Jorethang-New Melli-2 tripped in Zone-2 time (350 msec) from Rangpo. No carrier signal received at Rangpo. Carrier healthiness maybe ensured for A/r operation.

7. Status of Reporting (रिपोर्टिंग की स्थिति):

- DR/EL yet to be received from Jorethang & New Melli.

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

TIME	STATION	DESCRIPTION	STATUS
19:11:34.167	MELNW_PG	220_JORET_PG_1_CB	Open
19:11:35.231	JORET_PG	220_MELNW_PG_1_CB	Open
19:24:57.790	MELNW_PG	220_JORET_PG_2_CB	Open

Annexure 2: DR recorded

DR/EL not received.

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घटना संख्या: **17-04-2022/1** दिनांक: **28-04-2022**

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

1. Summary of the event (घटना का सारांश):

At 15:07 Hrs, 400 kV Rangpo-Dikchu tripped due to R_N fault. This led to total power failure at Dikchu as main bay of 400 kV Teesta 3-Dikchu was already under breakdown, which caused loss of evacuation path. One running unit at Dikchu also tripped. 55 MW generation loss occurred.

- **Date / Time of disturbance:** 17-04-2022 at 15:07 hrs.
- **Event type:** GD - 1
- **Systems/ Subsystems affected:** 400 kV Dikchu S/s
- **Load and Generation loss**.
  - 55 MW generation loss reported during the event.
  - No load loss was reported during the event.

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

- 400 kV Main Bus-2 at Dikchu
- 400 kV Main bay of Teesta 3-Dikchu at Dikchu

3. Major elements tripped (प्रमुख ट्रिपिंग)

- 400 kV Rangpo-Dikchu
- 400 kV Teesta 3-Dikchu

4. Network across the affected area (प्रभावित क्षेत्र का नक्शा)

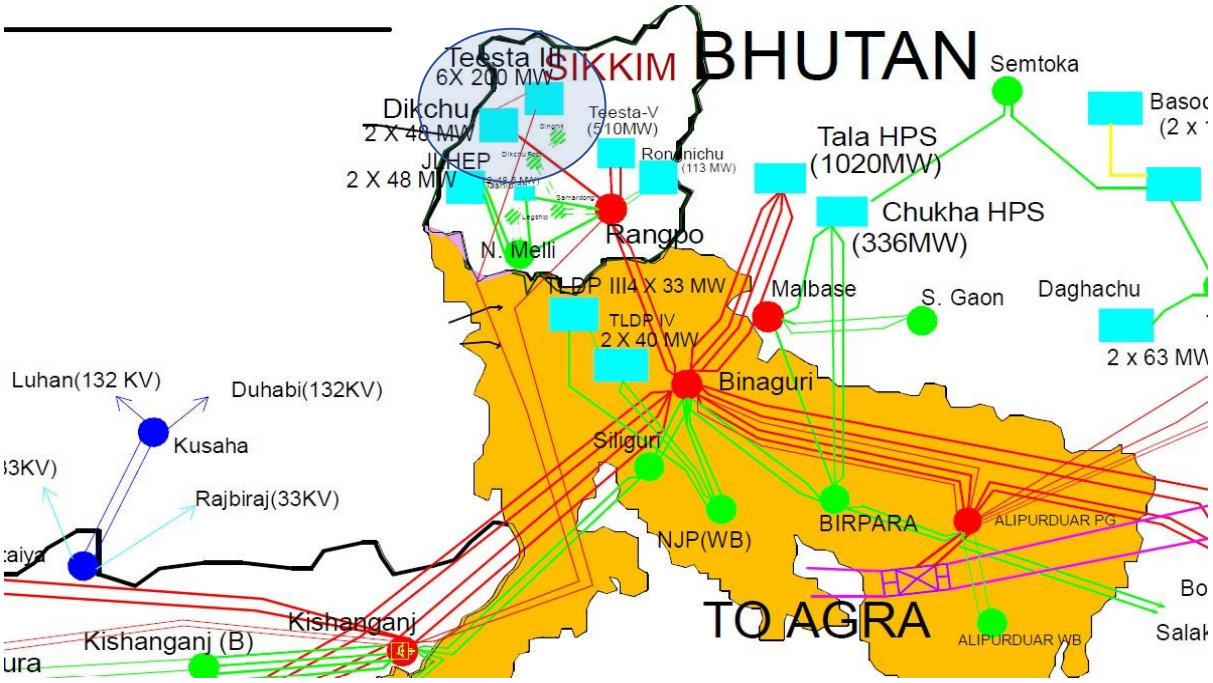


Figure 1: Network across the affected area

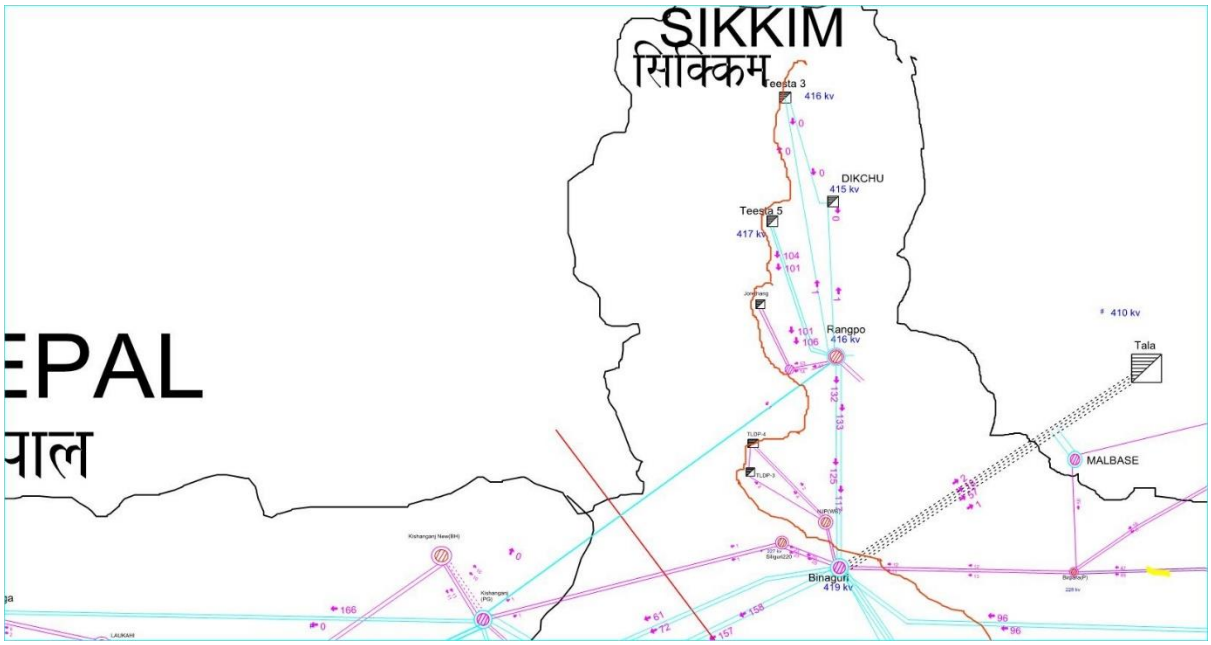


Figure 2: SCADA snapshot for of the system

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

समय	नाम	उप केंद्र 1 रिले संकेत	उप केंद्र 2 रिले संकेत	पीएमयू पर्यवेक्षण
15:07	400 kV Rangpo- Dikchu	Rangpo: R_N, 11.4 km, 10.8 kA	Dikchu: R_N, 48.4 km, Zone-2	156 kV dip in R_ph voltage at Rangpo.
	400 kV Teesta 3-Dikchu	-	Tripped due to tripping of Rangpo-Dikchu line as main bay out of service	

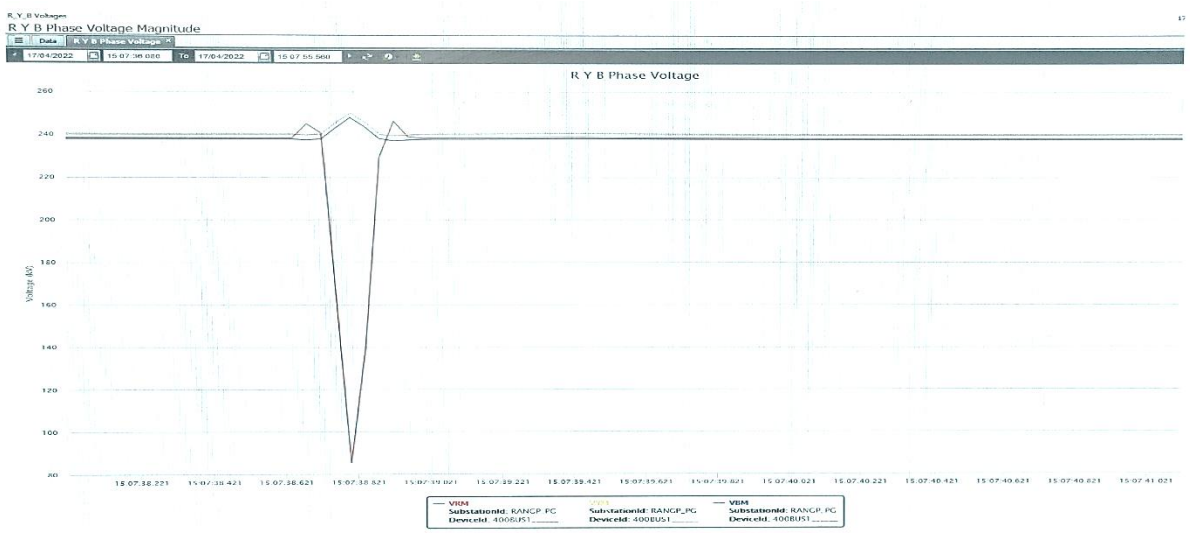


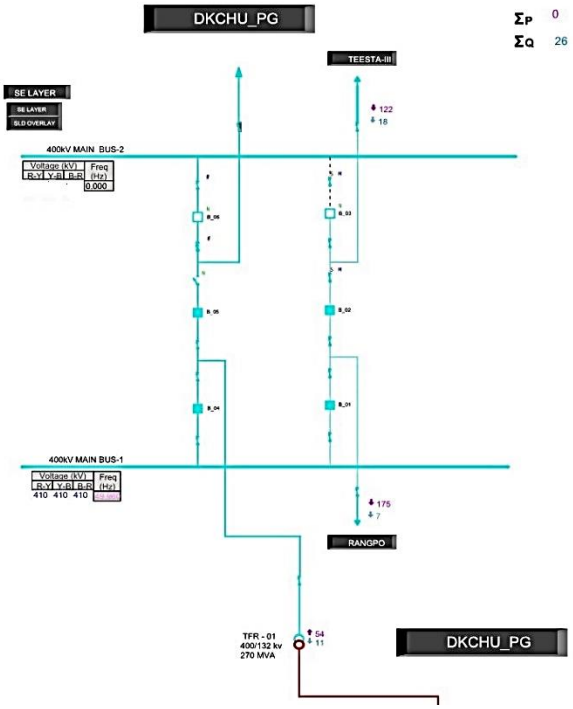
Figure 3: PMU voltage snapshot of 400/220 kV Rangpo S/s

5. Restoration (पूर्वावस्था की प्रप्ति)

Transmission/Generation element name	Restoration time
400 kV Rangpo-Dikchu	16:15
400 kV Teesta 3-Dikchu	16:16

6. Analysis of the event (घटना का विश्लेषण):

- 400 kV Rangpo-Dikchu tripped due to R_N fault and A/r was under shutdown for OPGW work. This led to total power failure at Dikchu S/s



- 400 kV Main Bus-2 and main bay of 400 kV Teesta 3-Dikchu may be updated by Dikchu, which is out since 05-05-2021. Dikchu to take necessary action to restore the bay at the earliest to ensure reliability of generation evacuation.

7. 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	**Dikchu, PG ER-2**

8. Status of Reporting (रिपोर्टिंग की स्थिति):

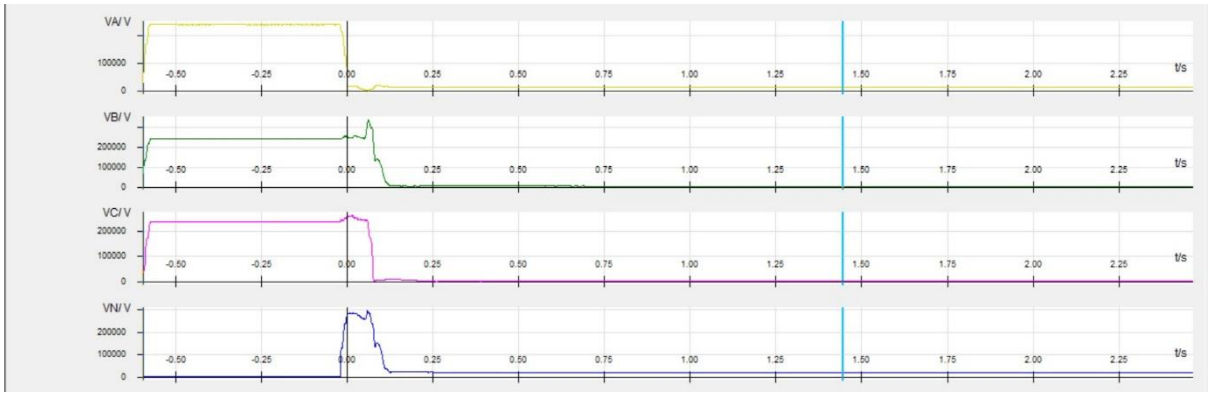
- DR/EL received from PG ER-2, Dikchu.

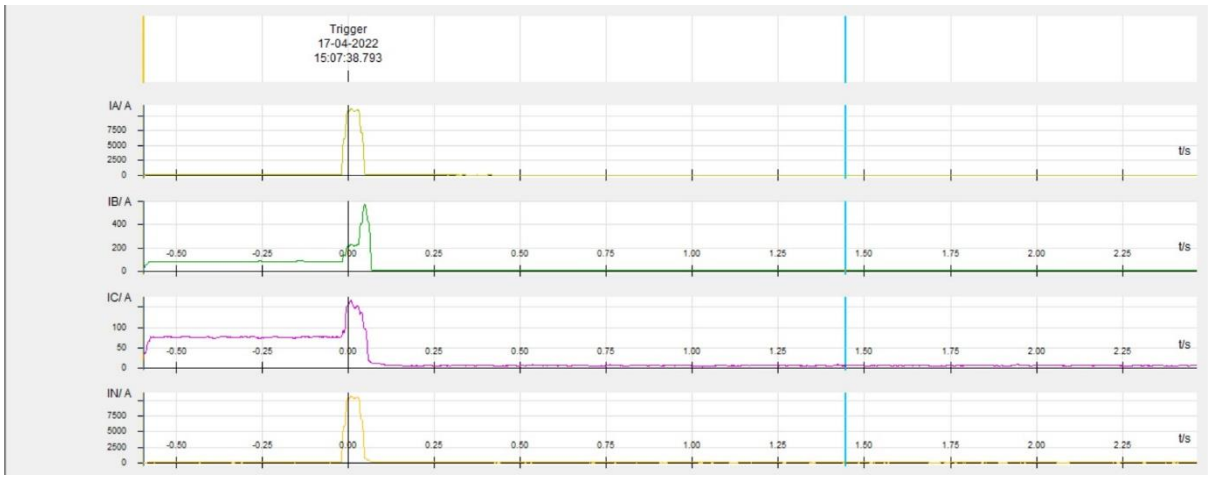
Annexure 1: Sequence of events recorded at ERLDC SCADA data at the time of the event.

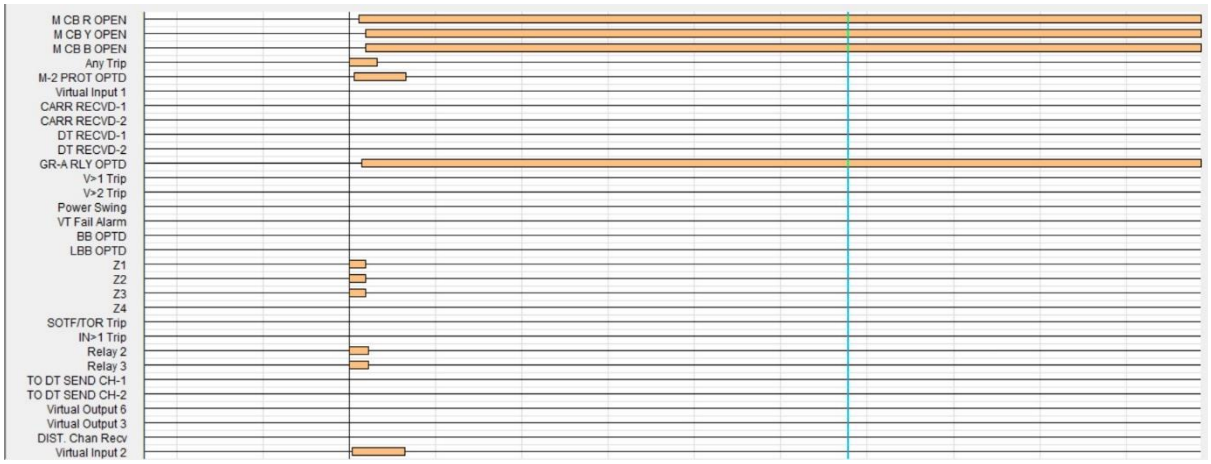
TIME	STATION	DESCRIPTION	STATUS
15:07:38.843	DKCHU_PG	400_TEES3_PG_RANGP_PG_Tie	Open
15:07:38.843	DKCHU_PG	400_RANGP_PG_Main_CB	Open
15:07:38.844	RANGP_PG	400_DIKCHU_PG_CB	Open

Annexure 2: DR recorded

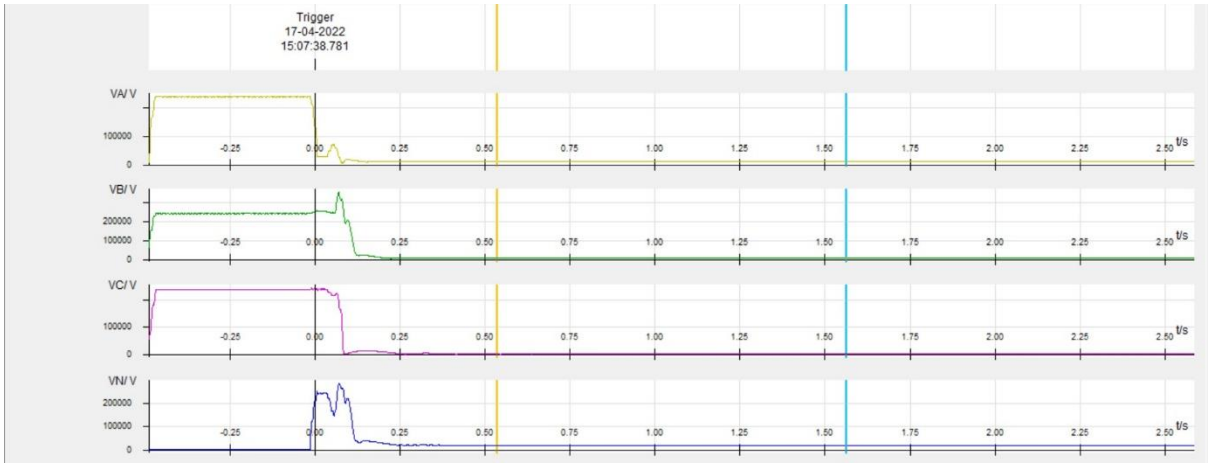
DR of 400 kV Rangpo-Dikchu (Rangpo)

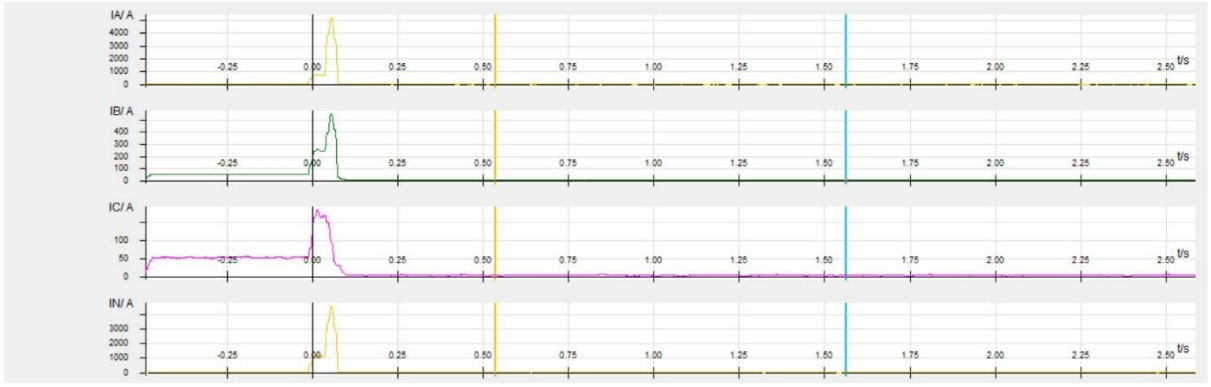


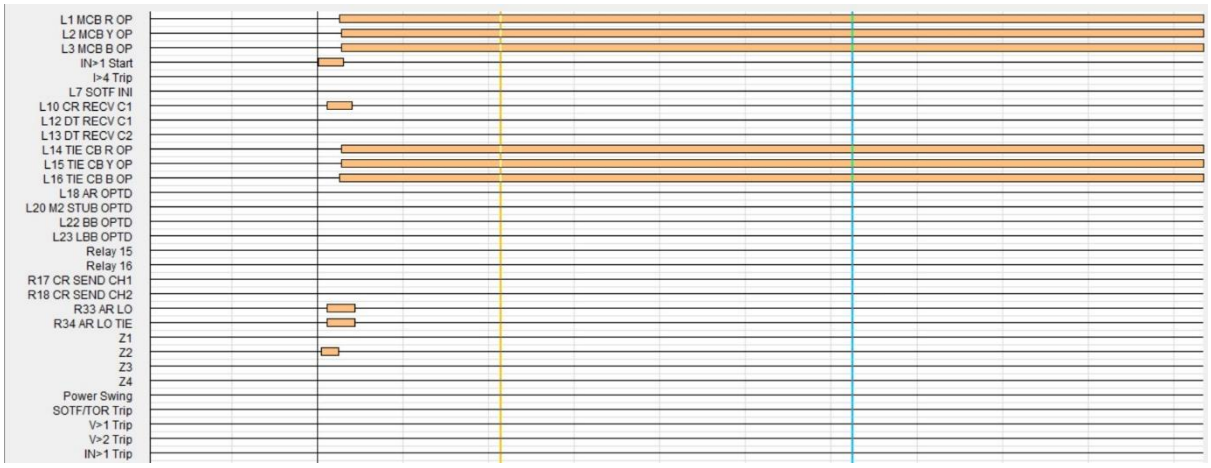




DR of 400 kV Rangpo-Dikchu (Dikchu)







Annexure B.9

List of important transmission lines in ER which tripped in April-2022

Sl. 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	DR Configuration Discrepancy	DR/EL RECEIVED FROM LOCAL	DR/EL RECEIVED FROM REMOTE	LOCAL END UTILITY	REMOTE END UTILITY	UTILITY RESPONSE
1	220kV-DALKHOLA-PURNEA-2	05-04-2022	18:21	06-04-2022	14:51	Dalkhola: CT secondary metering core Ir=0 A			NA	Details maybe shared by PG ER-2		No	No	PG ER-2	PG ER-1	CT cables to control panel damaged
2	220kV-JEYPORE-JAYNAGAR-2	06-04-2022	14:44	06-04-2022	15:28	Jepore: B-N , 2.5 km Ib- 10 kA	Jaynagar: B_N Z-1	B-Earth	260	A/r successful from Jeypore only		Yes	No	PG ODISHA	OPTCL	A/r functionaltiy not available in 220 kV Jeypore-Jaynagar-1&2 due to old relays
3	400kV-RANCHI-ROURKELA-2	07-04-2022	02:52	07-04-2022	05:02	Ranchi: Y-N, 130.6km 2.943 kA	Rourkela : Y-N, 3.016 kA, 0 km	Y-Earth	100	DT received at Ranchi. Teed protection operated at Rourkela. PG Odisha may explain the event		Yes	Yes	PG ER-1	PG ODISHA	Tie Bay (420) of 400kV-RANCHI--2 & 400kV JHARSUGUDA-3 Y-Ph CT was completely blast. During this event

4	400kV JHARSUGUDA-ROURKELA-3	07-04-2022	02:52	07-04-2022	07:32	Jharsuguda: Y_N	Rourkela: Y_N, 2.943 kA, 130.6 km	Y-Earth	100	DT received at Jharsuguda. TEED and later LBB also operated.		Yes	Yes	PG ODISHA	PG ODISHA	During this event TEED & LBB Protection Opreated at Rourkela S/s
5	400kV-BARIPADA-KEONJHOR(PG)-1	07-04-2022	14:24	07-04-2022	16:15	Baripada: B_N, 155.401km Ib= 2.541kA, Zone-2	Keonjhor: B_N, 4.155 kA, 0.899 km	B-Earth	100	Single phase fault. DT received at Baripada alongwith carrier signal and all three phase tripped		Yes	No	PG ODISHA	PG ODISHA	Before the time of tripping, 79A/R block signal was high in tie BCU(40708) of the baripada line due to Air Pressure CB. Which causes the definate trip and DT send to remote end.
6	220kV-SUBHASGRAM(PG)-SUBHASGRAM(WB)-2	09-04-2022	10:42	09-04-2022	11:01	Differential Protection operated		No fault	NA	Differential relay maloperated. WBSETCL may explain		Yes	No	PG ER-2	WBSETCL	Differential relay malfunctioning. Relay replaced
7	220kV-SUBHASGRAM(PG)-SUBHASGRAM(WB)-2	09-04-2022	11:40	09-04-2022	15:37	Differential Protection Operated		No fault	NA	Differential relay maloperated. WBSETCL may explain		Yes	No	PG ER-2	WBSETCL	
8	220kV-BOLANGIR (PG)-KESINGA-1	16-04-2022	10:30	16-04-2022	11:11	Bolangir- DT received		No fault	NA	DC Earth fault in carrier protection cable at Kesinga		Yes	No	PG ODISHA	OPTCL	DC earth fault in carrier protection cable
9	220kV-BOLANGIR (PG)-KESINGA-1	16-04-2022	11:12	16-04-2022	13:44	Bolangir: DT received		No fault	NA	DC Earth fault in carrier protection cable at Kesinga		Yes	No	PG ODISHA	OPTCL	DC earth fault in carrier protection cable

10	220kV-CHANDIL-STPS(WBPDCL)-1	16-04-2022	13:55	16-04-2022	14:27	Chandil: R_N Z-1, 52km, IR= 1.66kA	Santaldih TPS: R-N, Z-I,71 km, Ir=1.88 kA	R-Earth	100	A/r attempt failed at Santaldih. A/r operation can't be ascertained at Chandil		Yes	Yes	JUSNL	WBPDCL	PLCC end to end testing pending. Testing to be done on 14.05.22
11	220kV-BARIPADA-BALASORE-2	16-04-2022	17:19	16-04-2022	17:48	Baripada: R-N , 25.07km Ir= 5kA		R-N	100	Three phase tripping at Baripada end. Pole discrepancy appeared at Baripada after 100 msec and other two phase tripped.A /r successful at Balasore end		Yes	No	PG ODISHA	OPTCL	PD relay mal-operated. And found faulty. same was replaced.
12	220kV-CHANDIL-STPS(WBPDCL)-1	18-04-2022	12:24	18-04-2022	16:15	Chandil:B_N Z-1,3.8km,Ib=5.04kA	STPS:B_N Z-2,107.8km,Ib =1.56kA	B-Earth	350	Tripped in Zone-2 time from Santaldih. Carrier not received		Yes	Yes	JUSNL	WBPDCL	PLCC end to end testing pending. Testing to be done on 14.05.22
13	400KV-PATNA-SAHARSA-1	24-04-2022	18:23	24-04-2022	19:43	MASTER RELAY OPERATED AT PATNA	DT RECEIEVD AT SAHARSA	No fault	NA	PRV-2 trip at Patna. PG ER-1 may explain		Yes	Yes	PG ER-1	PMTL	PRD of line reactor operated at Patna due to squirrel movement

14	765KV-MEDINIPUR-NEW JEERAT-1	28-04-2022	05:57	28-04-2022	07:00	Medinipur:DT received	Jeerat: OV Stage-1	O/V	NA	O/V settings maybe shared (Y_ph voltage touched 808 kV).	DR digital channels not configured properly at Medinip	Yes	Yes	PMJTL	PMJTL	O/V setting was 105%. Changed to 108%
15	400 KV BARIPADA-TISCO-1	30-04-2022	17:17	30-04-2022	17:46	Baripada: B_N, 4.03 k	TISCO:B_N, 13.2 km, 8 kA	B-Earth	100	A/r successful from Baripada end only		Yes	No	PG ODISHA	OPTCL	As per information received from TISCO end, due to dead time of 500ms, the line tripped at TISCO end in subsequent fault, However dead time setting at Baripada end is 1000 ms.

ANNEXURE-C.1

Sl No.	Name of the incidence	PCC Recommendation	Latest status
113th PCC Meeting			
1.	Disturbance at 220/132 kV CTPS A (DVC) S/s on 18.03.2022 at 20:05 Hrs	PCC advised DVC to check power swing block settings for 220 kV CTPS B - BTPS B D/c line at BTPS end. The DR at BTPS end may also be checked. PCC advised DVC to recheck the settings of pole slip protection in the CTPS units. In case the settings are in order, then study may be carried out to find out the critical clearing time for the units for a 3-phase fault at CTPS bus.	
2.	Disturbance at 220 kV Tenughat (TVNL) S/S On 24.03.2022 at 21:37 hrs	PCC advised JUSNL to complete the A/R testing for 220 kV Tenughat-Govindpur line and put the autorecloser in service at the earliest.	*JUSNL representative informed that A/R testing was not done due to PLCC issue at Tenughat end . He added that during inspection, card issue was found in PLCC at Tenught end for which replacement work is in progress.The work will be completed within one month.*
3.	Total Power failure at 220 kV Garhwa(JUSNL) S/s on 30.03.2022 at 18:22 Hrs	PCC advised JUSNL to review the ICT overcurrent setting in coordination with Powergrid. The zone-3 timer setting at Daltonganj end may be increased to 1000msec and TMS of overcurrent relay for 220/132 kV ICT at Garwah may be reduced accordingly by JUSNL.	*PCC advised Powergrid & JUSNL to review the settings at respective end in line with the decision of 113th PCC meeting*
111th PCC Meeting			
4.	DEF protection setting review in Sikkim complex in view of LILO of 400 kV Teesta 3-Kishanganj at Rangpo	In 111th PCC, PCC decided that M/s PRDC would carry out the study for DEF relay setting coordination for Sikkim Complex with revised configuration of transmission network. PRDC was advised to coordinate with ERLDC for	*PRDC was advised to complete the study at the earliest.*

		necessary information related to the study.	
106th PCC Meeting			
5.	Total Power Failure at Dumka S/s on 15/05/2021 at 12:01 Hrs	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. In 110th PCC Meeting, JUSNL informed that approval had been received from higher authority and they are in process to issue the tender. They further informed that PLCC link would be restored by March-2022.	*JUSNL representative informed that a fresh proposal would be initiated for the said work.*
6.	Grid event at 132 kV Motihari (DMTCL) S/S on 21-04-2021 at 20:19 hrs	In 109th PCC Meeting, PMTL representative informed that they are in process of placing the work order with TBEA authorized partners. The quotation has been received and work order would be placed by end of December 2021. In 110th PCC Meeting, PMTL representative informed that LOA had been awarded to vendor in last week of December 2021. The material supply is expected by first week of March 2022 and restoration work would be completed by end of March 2022.	*PMTL representative informed that material had been received at site and the work sould be completed within May 22.*

Annexure C.5

Protection Audit Recommendations for the Stations audited protection audit team of ERPC				
Sl No.	**Name of Substation**	**Owner**	**Date of Audit**	**Remarks/Recommendation**
1	765/400 kV Sundergarh S/s	Powergrid	25.04.2022	1.Switchyard equipments are in good and healthy condition. Switchyard area as well as overall station is well maintained.
				2.Provision for nameplate with bay/line name may be done in front of SPR(Kiosk) in switchyard for easy identification.
2	400/220/132 kV Lapanga(OPTCL) S/s	OPTCL	26.04.2022	1.Event logger is not available for 220 kV System. The same shall be provided.
				2.Time synchronising equipment is not available for 220 kV system.
				3.Busbar/LBB protection is not available for 220 kV system . The same shall be commissioned at the earliest.
				4.Autorecloser is implemented without PLCC for all the 220 kV feeders. It was informed that OPGW for these lines are under commissioning.
				5.OPGW/DTPC commissioning may be expedited and thereafter carrier based autorecloser as well as intertripping scheme may be implemented for 220 kV lines.
				6.For 220 kV control room housing the relay panels, air conditioning shall be provided for proper functioning of protection system panels & to prevent failure of numerical protection systems.
				7.Zone settings(zone-2, zone-3 & zone-4) in distance protection relay may be reviewed for all the 400 & 220 kV lines in line with the ERPC Protection philosophy.
				8.Group protection for 400 kV Lapanga-Meramundali line may be enabled and two group settings may be kept in the relay. One group considering 400 kV M'mundali-Bolangir in service and another group setting when 400 kV M'mundali-Bolangir is not in service. Group to be selected as per the actual configuration.
				9.Autorecloser in 400 kV Lapanga-Meramundali line is having some issue. The same may be rectified.
				10.Power swing blocking enabled for all zones. It may reviewed and blocking may be done all the zones except zone-1.
				11.Grading in terms of time/voltage setting shall be done in Overvoltage settings of 400 kV lines.
3	220/132 kV Budhipadar(OPTCL) S/s	OPTCL	26.04.2022	1. Time synchronising equipment in substation control room is not working. The same may be rectified & put into service.
				2.Main-I relay of 220 kV Budhipadar-Lapanga-I feeder and main-2 relay of 220 kV Budhipadar-SMC feeder was found to be defective and not in operation. Defective relay shall be changed with spare/new relay immediately.

				3.Main-1 relay of following fedders are of static type. 220 kV Budhipadar-IB TPS line, 220 kV Budhipadar-Tarkera D/c line, 220 kV Budhipadar-Raigarh PG. All Electro Static Relays may be replaced with latest version of Numerical relays for quick and accurate analysis of Trippings.
				4.DC earth leakage were found in both DC-I & II sources. The same may be attended. Continous monitoring of dc earth leakage measurements to be done.
				5.PLCC is not in service for most of the lines. Autorecloser w/o PLCC is implemented for some of the feeders like 220 kV Tarkara D/C, 220 kV Lapanga D/C feeder. For rest of the feeders auto recloser was not in service.
				It was informed that OPGW for these lines are under commissioning. OPGW/DTPC commissioning may be expedited and thereafter carrier based autorecloser as well as intertripping scheme shall be implemented for 220 kV lines.
				6.For 220 kV Budhipadar-Korba-1 &2, the PLCC is not working and found to be out of service since long. Being inter-regional line, matter may be taken up with appropriate authority for restoring the PLCC communication in the line. Alternatively, It is suggested that carrier communication through OPGW network may be planned & implemented.
				7.Zone settings for all 220 kV lines need to be reviewed in line ith ERPC Protection Philosophy & considering the present network configuration at the remote end substations.
				8.Busbar protection is available for a single bus only. For other bus, it is out of service due to defective bay units. It is advised to restore the busbar protection for the second bus at the earliest. Similarily zone-4 settings of feeders corresponding to the bus for which busbar is out of service may be reduced to 250 msec.
				9. Oil leakages was observed in 220/132 kV Auto-I. Action may be taken to address the same.
				10.Vegetation shall be cleared & proper PCC and gravelling should be done in the switchyard.
				General:
				1. Uniform protection philosophy may be adopted across OPTCL network
				2. Protection co-ordination to be done as and when there is change in network configuration or commissioning of new lines
				3. O/V voltage/time gradation to be done for S/s level
				4. Periodic internal review of implemented protection settings
4	220 kV IB TPS	OPGC	27.04.2022	1. Event logger is not available for 220 kV system. The same shall be provided.
				2. Zone-2 tmer setting may be reviewed considering the shortest line at remote end(budhipadar) for all 220 kV lines

				3. Zone-4 reach and time delay may be reviewed for all 220 kV lines
				4. Zone-3 time delay may be reviewed as it is encroaching next voltage level (220 kV Lines)
				5. PLCC not operational for all four 220 kV feeders. It was informed that OPGW/DTPC based communication system will be commissioned in near future.
				6. OPGW/DTPC commissioning may be expedited and thereafter carrier based autorecloser as well as intertripping scheme may be implemented for 220 kV lines.
				7. Busbar relay is of static type. It was informed that renovation & upgradation of 220 kV switchyard is under proposal stage.
5	400 kV OPGC S/s	OPGC	27.04.2022	1. At 400 kV level, it was found the both main-1 & main-2 relays of outgoing transmission lines are of same make & model employing different characteristic. It is recommended that different make & model for main-1 &2 relay is preferable and same may be implemented.
				2. Overvoltage setting for the lines need to be reviewed. Time grading / voltage grading may be done in the overvoltage settings for different lines/for overall substation
				3. DR time window may be increased. DR configuration may be done in line with guidelines approved in ERPC PCC meeting.
				4. Overcurrent protection in 400 kV lines may be disabled.
				5. Provision for sending DT signal to other end during operation of DEF protection may be implemented.
				6. Line length for 400 kV OPGC-Lapanga line may be verfied in consultation with OPTCL.
				7. Zone-2 & Zone-3 settings of all 400 kV lines need to be reviewed and set as per the ERPC Protection philosophy.
				8. Adjacent shortest and longest line length maybe verified and zone settings maybe implemented accordingly
				9. Power swing block enabled for all zones. May be reviewed
6	765 kV Darlipali(NTPC) S/s	NTPC	28.04.2022	1. Time grading to be done in stage-I overvoltage settings for 765 kV Darlipalli-Jharsuguda D/c line.
				2. Power Swing blocking enabled for all zones. May be reviewed.
				3. Relay setting data is not available in Protection database of ERPC. The same may be updated at the earliest.