



सत्यमेव जयते



भारत सरकार
Government of India
विद्युत मंत्रालय
Ministry of Power
पूर्वी क्षेत्रीय विद्युत समिति

Eastern Regional Power Committee

14, गोल्फ क्लब रोड, टॉलीगंज, कोलकाता-700033
14 Golf Club Road, Tollygunj, Kolkata-700033

स./NO. पू.क्षे.वि.स./PROTECTION/2024/485

दिनांक /DATE:13/06/2024

सेवा में / To,

संलग्न सूची के अनुसार / As per list enclosed.

विषय : दिनांक – 21.05.2024 को आयोजित 135 वीं पीसीसी बैठक का कार्यवृत्त ।

Sub: Minutes of the 135th PCC meeting held on 21.05.2024

महोदय/ Sir,

21.05.2024 को आयोजित 135वीं 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 135th PCC meeting of ERPC held on 21.05.2024 available at ERPC website (<http://www.erpc.gov.in/>).

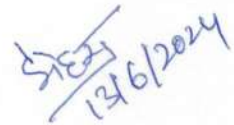
यदि कोई अवलोकन हो, तो कृपया इस कार्यालय को यथाशीघ्र भेजा जाए।

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

यह सदस्य सचिव, पू. क्षे. वि. स. के अनुमोदन से जारी किया जाता है।

This issues with approval of Member Secretary, ERPC.

भवदीय / Yours faithfully,



(आई.के.मेहरा / I.K.Mehra)

अधीक्षण अभियंता(पी.एस)
Superintending Engineer (PS)

LIST OF ADDRESSES:

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Chief Engineer(System Operation), SLDC , BSPTCL, Patna-800021	
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General Manager (OS), ERHQ-I, NTPC Ltd., LoknayakJaiprakashBhawan, (2 nd Floor), DakBunglowChawk, Patna-800001	Manager (Electrical), Adhunik Power & Natural Resources Ltd. “Lansdowne Towers, Kolkata-700020 (Fax No. 033-2289 0285)
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Dy. General Manager (Electrical) IB Thermal Power Station, OPGCL Banhapalli, Dist. Jharsuguda-768234, Orissa	General Manager (AM), ER-I Power Grid Corporation of India Ltd., Alankar Place, Boring Road, Patna-800001
Chief Engineer (Trans.) Power Deptt., Govt. of Sikkim, Gangtok-731010	Sr. Manager (CTMC) Durgapur Projects Limited,Durgapur-713201
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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. (FAX:011-26139256-65)
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Director (NPC), CEA, NRPC Building, KatwariaSarai, New Delhi- 110016	President, Dans Energy Pvt. Ltd, 5th Floor, DLF Building No. 8, Tower-C, Gurgaon - 722002
Director, Shiga Energy Pw. Ltd., 5th Floor, DLF Building No. 8, Tower-C, Gurgaon - 722002	DGM (E&I), HALDIA ENERGY LIMITED, BARIK BHAWAN, KOKATA-700072, FAX: 033-22360955
The Plant Head, Dikchu HEP, Sikkim	



Minutes
of
135th PCC Meeting

Date:13.06.2024
Eastern Regional Power Committee
14, Golf Club Road, Tollygunge
Kolkata: 700 033

EASTERN REGIONAL POWER COMMITTEE

MINUTES OF 135th PROTECTION COORDINATION SUB-COMMITTEE MEETING HELD ON 21st MAY 2024 AT 10:30 HRS THROUGH MS TEAMS

Member Secretary chaired the meeting. ERLDC presented the protection performance of the ER utilities. The presentation is enclosed at **Annexure-A.1**. List of participants is attached at **Annexure A.2**.

PART – A

ITEM NO. A.1: Confirmation of Minutes of 134th Protection Coordination sub-Committee Meeting held on 16th April 2024 at ERPC, Kolkata.

The minutes of 134th Protection Coordination sub-Committee meeting held on 16.04.2024 was circulated vide letter dated 16.05.2024.

Members may confirm the minutes of the Meeting.

Deliberation in the meeting

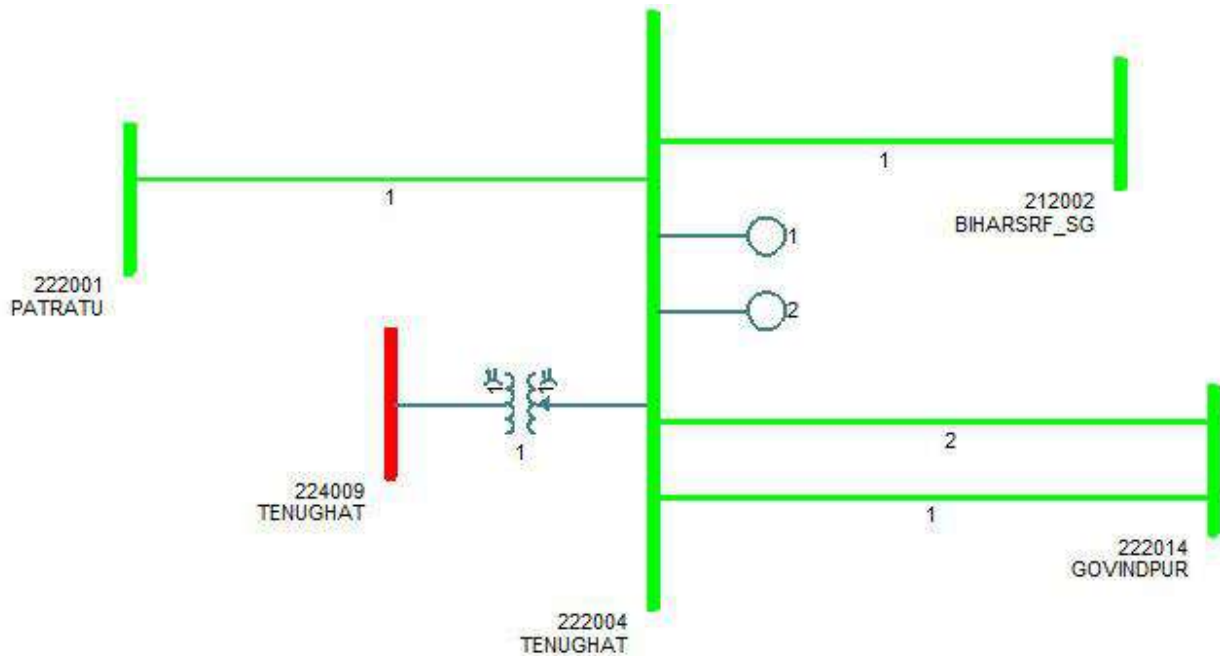
Members confirmed the minutes of 134th PCC Meeting.

PART – B

ITEM NO. B.1: Disturbance at 220 kV Tenughat(TVNL) S/s on 18.04.2024 at 22:12 Hrs

An insulator flashover occurred in Y-phase of 220 kV Bus-1 at 400/ 220kV Tenughat S/s leading to a bus fault. Bus bar protection didn't operate and subsequently 220kV Tenughat-Biharsarif and 220kV Tenughat-Govindpur D/C tripped from remote ends in Zone-2 protection. This caused tripping of both the running units at Tenughat.

Disturbance Report from ERLDC is attached at **Annexure B.1**.



Gen. Loss: 300 MW
 Outage Duration: 01:30 Hrs

TVNL may explain.

Deliberation in the meeting

Based on the information received from TVNL, ERLDC explained the disturbance as follows:

- *The disturbance occurred due to puncture of Y phase suspension insulator of 220 kV Bus-1 resulting in a Y-phase fault in Bus-1.*
- *The busbar protection at 220 kV TVNL failed to detect the fault and did not operate. As a result, 220 kV Tenughat-Biharsharif S/C and 220 kV Tenughat-Govindpur D/C line got tripped from remote ends in Zone-2 to clear the fault.*
- *During the incident, PUVNL was availing startup power from Tenughat. After tripping of the feeders of Biharsharif and Govindpur, island was formed with around 300 MW Tenughat generation along with startup power line of PUVNL. The island was not successful due to load generation imbalance and both units got tripped on overspeed protection.*
- *Overcurrent earth fault protection of unit #1 operated during the incident.*

On busbar protection, TVNL representative submitted that the existing busbar relay is static type and plan for replacement of busbar protection with numerical relay is under consideration. He added that as four new bays are going to be added at Tenughat switchyard in near future, the busbar replacement will be done considering the additional four bays. JUSNL representative informed that the commissioning time for proposed new lines is by 2026.

ERPC Secretariat stated that the issue of non-operation of busbar protection at Tenughat S/s has been observed in past and it was advised to replace the busbar relay at the earliest however no progress has been made in this regard for past two years. PCC raised serious concern for not having a reliable busbar protection at Tenughat Generation station.

PCC advised TVNL that the testing of existing busbar relay may be done in consultation with the OEM and the present event may be referred to OEM for analysis and suggestion. As the

implementation with numerical relay will take considerable time, the existing relay may be tested thoroughly and the problems may be rectified.

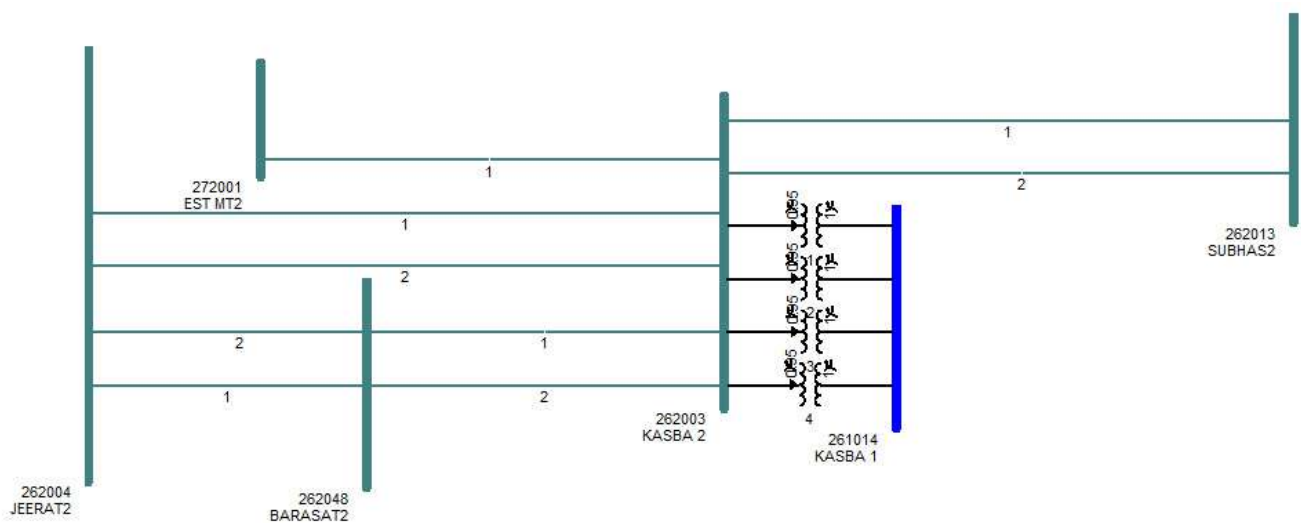
DVC representative stated that they are having static busbar relay in two of their generating stations and the relays are working well. PCC advised TVNL representative that they may take help of DVC for identifying and resolving the issues in existing busbar relay.

On DR synchronization issue, TVNL intimated that the work order has been issued and the issue will be resolved by Aug-24. For Biharsharif end, BSPTCL representative replied that GPS clock is not working at Biharsharif end and regarding rectification of the same, they would update at the earliest.

ITEM NO. B.2: Repeated disturbances at 220 kV Kasba (WBSETCL) S/s

a) Disturbance at 220 kV Kasba (WBSETCL) S/s on 25.04.2024 at 21:42 Hrs

Due to B phase CT bursting of 220 kV Kasba-Subahshgram-1 line at Kasba end, bus bar protection operated at Kasba. Since it has single main and transfer bus scheme, total power failure occurred at substation. CESC system which was synchronized at Kasba got islanded during the event.



Disturbance Report from ERLDC is attached at **Annexure B.2.1**.

Load Loss: 601 MW

Outage Duration: 00:23 Hrs

WBSETCL may explain.

Deliberation in the meeting

WBSETCL representative informed the following:

The event occurred due to bursting of Y phase CT of 220 kV Subahshgram-Kasba-1 at Kasba S/s. The fault was sensed in zone-1 of distance protection and relay operated successfully from Kasba end.

However, during this event, B phase CT also got damaged resulting in a bus fault. Subsequently busbar protection was operated. As 220/132 kV Kasba has Single Main and transfer scheme, therefore all elements at Kasba got tripped in operation of busbar protection leading to total power failure at Kasba end and further islanding of CESC system.

ERLDC representative informed that since Kasba is critical s/s with respect to power supply at Kolkata so possibilities may be explored for upgrading single main and transfer bus scheme at Kasba S/s to double main and transfer scheme. WBSETCL updated that there is space constraint for constructing a second bus therefore they are planning to segregate the bus by a sectionalizer bay.

ERLDC representative further pointed out that DR of 220 kV Subhashgram-Kasba-1 is not time synchronized at Kasba end.

After deliberation, PCC advised WBSETCL following:

- a) to expedite the implementation of bus sectionalizer at Kasba S/s.
- b) to synchronize DR of 220 kV Subhashgram-Kasba-1 with GPS clock.
- b) Root cause analysis of CT failure may be done and the failure event may be reported to CEA.

c) Disturbance at 220 kV Kasba (WBSETCL) S/s on 25.04.2024 at 23:17 Hrs

On 25.04.2024, at 23:17 Hrs, 220 kV Kasba-subhashgram-2 got tripped on overcurrent protection with current reaching around 1180 A in each phase. Load restriction scheme is also implemented in this line which tripped 220 kV Kasba-Barast D/c and 132 kV feeders at Kasba. Consequently 220 kV Kasba S/s became dead. CESC system got islanded again during the event.

Disturbance Report from ERLDC is attached at **Annexure B.2.2.**

Load Loss: 489 MW

Outage Duration: 00:09 Hrs

WBSETCL may explain.

Deliberation in the meeting

Based on the information received from WBSETCL & CESC, ERLDC explained the disturbance as follows:

- 220 kV Subhashgram-Kasba-1 was under breakdown prior to this disturbance. At 23:17:16 Hrs, flow of each circuit of 220 kV Kasba-EMSS South D/C suddenly jumped from 125 MW to around 200 MW each which led to increase in flow of 220 kV Subhashgram-Kasba-2. Condition for Load Restriction Scheme which is set at 695 A in any circuit of the 220 kV Subhashgram-Kasba D/c was satisfied and as a result 220 kV Barasat-Kasba D/c and 132 kV KasbaSonarpur D/c, 132 kV Kasba-Salt Lake D/C got tripped at 23:17:19 Hrs.
- At 23:17:23 Hrs, 220 kV Subhashgram-Kasba-2 got tripped from Subhashgram end on O/c protection as current in each phase reached around 1190 A. Further, Power flow got reversed in 220 kV Kasba-EMSS South D/c and started feeding remaining 132kV load at Kasba.
- At 23:17:25 Hrs, 220 kV Kasba-EMSS South D/c tripped from Kasba which resulted in total power failure at Kasba S/s. CESC system got islanded at this instance.

The following major issues were identified and deliberated:

Overcurrent Settings in 220 kV Subhashgram-Kasba D/C line:

It was observed that overcurrent protection has been enabled for 220 kV Subhashgram-Kasba D/C line though both main-1 & main-2 protections are available. Further the pickup setting of overcurrent has been kept as 800A (CT Ratio :800). WBSETCL submitted that the lines are

susceptible to overloading and cases of jumper snapping during overloading has been observed in past. Therefore, as a preventive measure the Overcurrent protection has been enabled.

ERLDC pointed out that as per CEA standard the overcurrent protection is not desirable for 220 kV lines having both main-1 and main-2 protection. Further he suggested that the pickup settings may be increased so that operator will get some time to take appropriate decision to reduce the line loading and therefore avoiding the line tripping.

PCC advised that the overcurrent pick up setting may be increased to 110 % of CT ratio for these lines.

Review of Load Restriction Scheme at Kasba end:

ERLDC representative highlighted that as per present load restriction scheme implemented by WBSETCL, in case of load rise happens beyond 700 MW due to tripping of any one circuit of 220 kV Kasba-Subhashgram D/C line, 220 kV Kasba-Barasat D/C also got tripped. This tripping operation of 220 kV Kasba-Barasat circuit leads to further rise in loading of remaining healthy circuit of 220 kV Kasba-Subhashgram D/C line hence aggravating the system condition. He suggested that the scheme may be reviewed considering the present network configuration.

WBSETCL representative replied that matter regarding load restriction scheme had already been communicated to SLDC and the same is under review by SLDC WB. He added that the status in this regard will be updated after consulting the SLDC.

Sudden Increase in loading of 220 kV EMSS-Kasba and Islanding of CESC system:

On sudden increase in flow of 220 kV Kasba-EMSS South D/c at 23:17:16 hrs, CESC representative replied that due to network issue of WBSETCL, SLDC advised CESC to shift certain load to Subhasgram source from Kasba source. Accordingly load transfer was carried out. During the changover load sharing of Kasba increased leading to momentary increase in flow in EMSS_Kasba line. He further informed that after tripping of 220 kV Subhashgram-Kasba-2, power flow of 80 MW occurred from CESC to Kasba end to meet loads at Kasba end through the ICT. Consequently, overloading occurred to CESC generation and voltage became less than 83 % for more than 2 seconds therefore undervoltage islanding condition was satisfied and resulted in islanding of CESC system.

ERLDC opined that as the sudden increase in loading of the lines could not be explained, load flow study or analysis of the event need to be carried out by CESC for this event. PCC advised CESC that the matter may be taken up with their system operation team for their comment.

ITEM NO. B.3: Total Power Failure at 220 kV Chatra (JUSNL) S/s on 06.04.2024 at 14:05 Hrs

On 06.04.2024 at 14:05 Hrs, 220kV Chatra-Latehar got tripped only from Latehar end in Zone-2. At the same time, 220kV Chatra Daltongunj-1 tripped in Zone 4 from Chatra end. Subsequently total power failure occurred at 220kV Chatra S/S.

Disturbance Report from ERLDC is attached at **Annexure B.3**.

Load Loss: 40 MW
Outage Duration: 00:56 Hrs

JUSNL may explain.

Deliberation in the meeting

The disturbance occurred due to a R phase fault in 220 kV Chatra-Latehar-1 line near Chatra end. However, the fault was not cleared from chatra end. The fault persisted for around 500 msec. Thereafter, to clear the fault 220 Latehar-Chatra-1 tripped from Latehar end in Zone-2 and 220 kV Daltonganj-Chatra-1 tripped from Chatra in Zone-4 protection resulting in total power failure at Chatra end.

JUSNL representative replied that no DR was generated at Chatra end for this event and no relay pickup was noticed for this disturbance. On a query regarding healthiness of the relays at Chatra end, he submitted that the relays have operated correctly for the events after this disturbance.

PCC opined that DR may be configured incorrectly leading to non-availability of the DR file. Further suggested that JUSNL shall analyse the event and find out the reason why no protection was operated at Chatra end. JUSNL replied that their team is schedule to visit the substation in end of May-24.

After deliberation, JUSNL was advised following:

- *Disturbance Recorders of all the relays at Chatra end may be reconfigured as per the PCC guidelines and compliance of the same shall be intimated to ERLDC/ERPC at the earliest.*
- *The relays at Chatra end may be tested for their healthiness in phased manner.*
- *Submit the event analysis report after site visit of CRITL team*

ITEM NO. B.4: Total Power Failure at 220 kV Pratapsasan (OPTCL)S/s on 23.04.2024 at 14:22 Hrs

On 23.04.2024, at 14:22 Hrs, 220 kV Pandiabili-Pratapsasan D/c got tripped due to operation of bus bar protection at Pratapsasan during some testing work, leading to total power failure at the substation.

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

Load Loss: 226 MW

Outage Duration: 00:16 Hrs

OPTCL may explain.

Deliberation in the meeting

OPTCL representative informed that there was no fault in the system and no testing work was going on at the time of disturbance. He further informed that due to broken fiber optic ring between 87 A, 87 B, 87 C. the isolator and CB status was unavailable to the busbar relay. Subsequently the busbar relay operated and as all feeders are connected to single bus, there was a total power failure occurred at 220 kV Pratapsasan S/s

PCC opined that blocking of isolator and CB status should not cause busbar relay operation and suggested that this event of mal-operation of busbar relay shall be consulted with relay OEM and logic of busbar relay may be reviewed.

OPTCL updated that the issue had already been communicated to the relay OEM(M/s GE) and the logic will be rectified after getting input from the OEM. PCC advised the issue may be resolved within a month.

On segregation of feeders, he replied that due to issue in bus coupler isolators, the feeders were kept on single bus however the issue has been attended and now the feeders have segregated in both bus.

ITEM NO. B.5: Major grid events other than GD/GI

A) Bus tripping occurred in Eastern Region during April'24

Element Name	Tripping Date	Reason	Utility
220 Kv Bus-1 at Ramchandrapur	02.04.2024 at 22:46	Bus bar protection operated	JUSNL
220 Kv Bus-4 at Mejia (DVC)	20.04.2024 at 16:15 Hrs	Bus-4 PT burst	DVC

Concerned utilities may explain.

Deliberation in the meeting

- **Tripping of 220 Kv Bus-1 at Ramchandrapur on 02.04.2024 at 22:46**

JUSNL representative explained the event with help of presentation which is attached at **Annexure B.5.1**.

- At 22:46 Hrs, Y- Phase CT of 220 kV Chandil bay got burst due to which Y phase fault got developed in 220 k V Ramchandrapur- Chandil line.
- The fault was sensed in Z1 from Ramchandrapur end but breaker didn't open. At Chandil end, the relay sensed the fault in zone-2 however the line tripped instantaneously on receipt of carrier from RCP end.
- From the flames of CT burst, the fault converted to 3 phase bus 1 fault. However due to instantaneous tripping of bus coupler, bus 2 got isolated from fault within 100ms.
- As the only bus PT was connected to bus-2 and the same was isolated after the bus coupler relay operation, hence zone-4 was not operated for remaining connected feeders of bus-1.
- To clear the fault, all 220 kV feeders of bus-1 were tripped from remote end in zone -2 protection.

Regarding bus bar protection and LBB, he informed that at the time of event Bus bar protection and LBB was out of service. The busbar has been kept out due to defective R 7 Y phase unit of the central busbar unit.

On enquiry from PCC regarding remedial measures taken, he informed that tripping circuit and relay at Ramchandrapur end was tested on 04.04.2024 for 220 k V Ramchandrapur- Chandil line but no discrepancies were found. However, DC +ve supply was found fully earthed and the same has rectified.

PCC advised JUSNL following:

- The overcurrent settings of bus coupler relay may be revised and some time delay may be kept instead of making it instantaneous.
- The rectification status of busbar & LBB protection at Ramchandrapur may be submitted.

- **Tripping of 220 kV Bus-4 at Mejia (DVC) on 20.04.2024 at 16:15 Hrs**

DVC representative informed that bus fault developed due to Bus-4 PT burst at Mejia S/s. The busbar protection for bus-4 operated and isolated the fault bus from other healthy bus. On faulty PT, he stated that tan delta test of damaged PT was done in the year 2022 and it was in order at that time however test was not performed in 2023 because of non-availability of bus shutdown. They have now put tan delta test as mandatory test in yearly maintenance schedule.

B) Islanding of CESC system

CESC system got islanded on 25.04.2024(twice) & 26.04.2024 (once). CESC may explain all three islanding events.

CESC may explain.

Deliberation in the meeting

ERLDC representative informed that preliminary study was carried out from ERLDC end however detailed report needs to be received from CESC to which CESC representative replied that detailed report for each of the events will be shared to ERPC/ERLDC at earliest.

ERLDC representative informed that it is generally observed that due to huge AC loads during peak loading condition, stalling of ac loads occur after clearance of any fault (even transient fault). This results in increase in drawl of inductive current therefore delayed recovery in voltage is observed which takes around 15 seconds. ERLDC suggested to increase islanding criteria of undervoltage from 2 seconds to around 8 seconds. CESC representative replied that this issue of delayed recovery of undervoltage and its effect on islanding criteria is already being discussed internally and it will be revised after getting approval from higher authority.

C) Repeated Tripping of 400 kV Barh-Kahalgaon-1 without any fault

Element Name	Tripping Date	Tripping Time	Reason	Revival Date	Revival Time
400KV-KHSTPP-BARH-1	14-05-2024	17:42	DT send from KHSTPP End	14-05-2024	18:04
400KV-KHSTPP-BARH-1	11-05-2024	11:30	DT Received at Barh End	11-05-2024	12:00
400KV-KHSTPP-BARH-1	09-03-2024	16:18	DT recieved at BARH end	09-03-2024	16:57
400KV-KHSTPP-BARH-1	04-03-2024	17:24	DT receipt at Barh end.	04-03-2024	18:07

In the above tripping, line got tripped from Barh end only on DT receipt.

NTPC KhSTPP may explain.

Deliberation in the meeting

NTPC Kahalgaon representation was not present in the meeting.

Powergrid informed that end to end testing of PLCC has been done and no discrepancy was found. ERLDC representative informed that as per communication received from NTPC Kahalgaon, cable and relay replacement is planned however the procurement of relays is expected in October-24. PCC opined that as this issue might get repeated again so the procurement process must be expedited and replacement of cable and relay may be completed at the earliest

NTPC Barh representative further requested PCC to reiterate the guideline for idly charging line as it is generally observed that line is charged after delay from another end.

D) Repeated Tripping of 220 kV Darbhanga (DMTCL)-Darbhanga D/c

Element Name	Tripping Date	Tripping Time	Reason	Revival Date	Revival Time
220KV-DARBHANGA (DMTCL)-DARBHANGA-1	12-05-2024	12:23	Darbhang(BSPTCL) End: B-Ph,FC:1.53 kA	12-05-2024	13:30
220KV-DARBHANGA (DMTCL)-DARBHANGA-1	09-05-2024	16:26	BH end: R ph earth fault relay operated. 587 meters, IR=0.31 kA	09-05-2024	17:26
220KV-DARBHANGA (DMTCL)-DARBHANGA-2	09-05-2024	09:11	DARBHANGA (DMTCL):- R-N,13.97kA,1.8kM,Z-1.DARBHANGA:-E/F	09-05-2024	13:45
220KV-DARBHANGA (DMTCL)-DARBHANGA-1	09-05-2024	09:11	DARBHANGA (DMTCL):- Not Tripped.DARBHANGA-E/F	09-05-2024	10:55
220KV-DARBHANGA (DMTCL)-DARBHANGA-1	07-05-2024	18:50	Darbhang (BSPTCL): R-N,1.71 kA, dist= -75.7 km; Darbhanga (DMTCL): Not tripped	07-05-2024	20:49
220KV-DARBHANGA (DMTCL)-DARBHANGA-1	03-05-2024	01:27	Darbhang End: R-N Fault, IL1=1.15KA IL2=0.24KA, IL3=0.24KA.Distance:186Km	03-05-2024	04:08
220KV-DARBHANGA (DMTCL)-DARBHANGA-1	15-04-2024	13:02	Tripped only from Darbhanga end: -E/F (Main-2 distance protection relay	15-04-2024	14:36
220KV-DARBHANGA (DMTCL)-DARBHANGA-1	04-04-2024	12:30	Darbhang - IL1- 0.74 kA, IL2-.0.17 kA & IL3-0.59 kA, A/R lockout and Master trip relay (86). DMTCL - C.B does not opened	04-04-2024	15:25
220KV-DARBHANGA (DMTCL)-DARBHANGA-1	01-04-2024	11:42	Bihar end: Main-2 of ckt-1: dist- 4.1 km, Zone-2, Ia- 273 kA, Ib- 0.19 kA, Ic- 0.29 kA	01-04-2024	13:46
220KV-DARBHANGA (DMTCL)-DARBHANGA-2	01-04-2024	11:42	Darbhang (DMTCL) end: R-ph, FC:14.24 kA, Z-1, FD:1.802 Km	01-04-2024	13:50

BSPTCL and DMTCL may explain.

Deliberation in the meeting

ERLDC representative informed that 220kV-DARBHANGA (DMTCL)-DARBHANGA D/C is around 2.5 km long line and it is observed that lines had tripped around 10-12 times since April 2024. He further said that two types of incidences were observed during these tripping-

- a) In few incidences, it is observed that fault is present in any one of circuit and other circuit had tripped without any fault.
- b) Instantaneous DEF protection is operated in few incidences.

DMTCL representative informed that circuit-1 had not tripped from DMTCL end on any incident. He further added that issue was also discussed with BSPTCL end and it was informed by another end that either there is issue with breaker/relay for circuit 1 or due to tripping on downstream, this tripping had occurred. Regarding circuit 2, He informed that tripping had occurred in R phase after HTLS reconductoring of line due to jumper/insulator issue at certain place (1.8 km).

220 kV Darbhanga (DMTCL)-Darbhanga circuit-1:

The circuit is getting tripped in DEF protection from Darbhanga (BSPTCL) end in case of fault in parallel circuit. BSPTCL representative informed that DEF tripping was initiated from main-2 relay (Siemens make) of circuit 1. The settings have been revised to 0.35 with time delay 0.6 sec from existing 0.2 with time delay 0.6. PCC suggested that the pickup may be reduced, and time delay may be increased (preferably more than 1 sec) for DEF.

Further in some of the instances, instantaneous tripping has been observed. BSPTCL replied that it was not possible to extract DR for these events that's why proper analysis could not be done.

BSPTCL informed that after HTLS reconductoring work, R-phase current of this circuit is generally found to be higher than rest two phases under normal condition.

For 220 kV Circuit-2, it was informed that sag issue was found in one location which has been rectified on 12th May 2024. Thereafter no further tripping has been observed.

After deliberation, PCC advised following:

- As the lines are short, permissive overreach scheme may be implemented with current reversal guard.
- The DEF settings may be revised and for the directional element, negative sequence may be selected instead of zero sequence.

ITEM NO. B.6: Submission of protection performance indices on monthly basis by users to RPC and RLDC for 220 kV and above lines

As per IEGC 2023 Clause 15(6), 15(7) all users shall submit protection performance indices of previous month to ERPC and ERLDC along with reasons for performance indices less than unity of individual element wise protection system to the respective RPC and action plan for corrective measures. For the month of April'24, only NTPC NKSTPP & WBSETCL have submitted the same, . Other utilities are requested to submit the details every month for necessary compliance.

Members may note.

Deliberation in the meeting

PCC advised all utilities to submit protection performance indices details every month to ERPC and ERLDC along with reasons for performance indices less than unity of individual element wise protection system to the respective RPC and action plan for corrective measures.

ITEM NO. B.7: Single Line Tripping Incidences in month of April 2024

Single line tripping incidents in the month of April 2024 which needs explanation from constituents of either end is attached.

Members may discuss.

Deliberation in the meeting

*Explanation from constituents of either end for single line tripping incidents in April 2024 is attached at **Annexure B.7.***

PART- C: OTHER ITEMS

ITEM NO. C.1: Protection Philosophy of Eastern Region

In 129th PCC Meeting, ERPC Secretariat pointed out the relevant clauses of IEGC 2023 regarding Protection code which will be in force w.e.f. 01.10.2023. He intimated that the existing protection philosophy of ER is not comprehensive and have not been reviewed since long. In compliance to the IEGC regulation and to form a comprehensive protection philosophy, it was suggested to form a committee of protection experts from state transmission utilities, Powergrid, NTPC/NHPC, IPPs as well as representative from SLDCs, ERLDC & ERPC secretariat to review the existing protection philosophy of ERPC and suggest necessary changes to be incorporated in the philosophy.

PCC agreed for the formation of committee as mentioned above and requested concerned utilities to nominate member from their respective organization.

Subsequently ERPC Secretariat vide email dated 26th Feb 2024 had shared draft protection philosophy to committee members which is attached. However, no comments have been received till date.

*In 134th PCC Meeting, ERPC Secretariat informed that in compliance to the IEGC 2023, protection protocol for Eastern Region had been prepared. The same is attached at **Annexure C.1.***

NHPC representative submitted following observations:

- i. For 220 kV D/C lines, the zone-2 reach setting may be defined similar to the 400 kV Lines.*
- ii. Zone-4 setting where busbar protection is not available may be set to 160 msec.*
- iii. Overvoltage setting may be kept at the 220 kV lines at generating station end where line is having cable section. The settings will be coordinated with unit overvoltage setting.*
- iv. Cases for which direct trip inter tripping command will be sent to remote end may be specified.*

After discussion, PCC agreed for inclusion of point i, iii, and iv in the protection protocol.

PCC further advised all other utilities to go through the protocol and submit their observation at the earliest so that it can be finalized in next PCC Meeting.

Deliberation in the meeting

Powergrid ER-II representative informed that he has few observations related to protection philosophy which will be shared by 24th May 2024.

PCC further advised all other utilities to go through the protocol and submit their observation by 28th May 2024 so that it can be finalized at earliest.

ITEM NO. C.2: Internal Protection Audit Plan of Sub stations for the Year 2024-25

The Clause (5) of Regulation 15 of IEGC Regulations, 2023 envisages as below:

Quote

(1) All users shall conduct internal audit of their protection systems annually, and any shortcomings identified shall be rectified and informed to their respective RPC. The audit report along with action plan for rectification of deficiencies detected, if any, shall be shared with respective RPC for users connected at 220 kV and above (132 kV and above in NER).

(5) Annual audit plan for the next financial year shall be submitted by the users to their respective RPC by 31st October. The users shall adhere to the annual audit plan and report compliance of the same to their respective RPC."

Unquote

All utilities are requested to submit the annual audit plan for the substations 220kV and above voltage level for FY 2024-25 to ERPC by 31.10.2023. Annual audit plans for internal audit of their protection systems and third-party protection audit shall be furnished separately.

In 131st PCC Meeting, PCC advised all utilities to submit annual audit plan for the substations 220kV and above voltage level for FY 2024-25 to ERPC at earliest.

The audit plan was received from NHPC & JUSNL.

In 133rd PCC Meeting, It was informed that audit plan had been received from WBSETCL, NHPC and JUSNL.

OPTCL representative informed that detailed protection audit plan will be submitted soon. BSPTCL representative informed that during winter maintenance activities, protection audit of substations was done however it had not been done as per prescribed format. He further informed that detailed protection audit plan will be submitted soon.

PCC advised Powergrid, NTPC, DVC and IPPs to share their protection audit plan at the earliest.

In 134th PCC Meeting, ERPC representative informed that till date audit plan had been received from WBSETCL, NHPC, JUSNL, BSPTCL and PG Odisha.

PCC advised Powergrid (ER 1 and ER 2), NTPC, DVC and IPPs to share their protection audit plan at the earliest.

*WBPDCCL representative enquired about the format to carry out protection audit. PCC decided that the prescribed format given in IEGC 2023 will be used to carry out protection audits. The format is also enclosed at **Annexure C.2**.*

DVC and CESC have also submitted the protection audit plan to ERPC.

Concerned Utilities are requested to submit the audit plan at the earliest.

Deliberation in the meeting

Member Secretary, ERPC advised remaining utilities to share protection audit plan to ERPC within two weeks.

Member Secretary, ERPC suggested that nodal officer from each utility shall be nominated so that protection audit plan other related matter can effectively be monitored.

Powergrid ER-1 representative informed that at present, audit for one substation is done on monthly basis and detailed plan will be shared within a week.

NTPC representative informed that as per present procedure, audit for each substation is done on two yearly basis. ERPC representative replied that as per IEGC 2023, internal audit of each substation needs to be done on yearly basis therefore audit for each of their generating station may be planned accordingly and the plan may be shared within a week.

ITEM NO. C.3: 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 of decisions of previous PCC meetings are attached at **Annexure C.3**.*

ITEM NO. C.4: Details of equipment failure in FY 2023-24--ERLDC

There have been many instances of equipment failure (CT, PT, LA) in the Eastern region. All utilities are requested to provide details of such equipment failure in the following format:

S.No.	Name of the Element	Equipment failed	At S/s	Equipment Make	Equipment in Service since (Date)

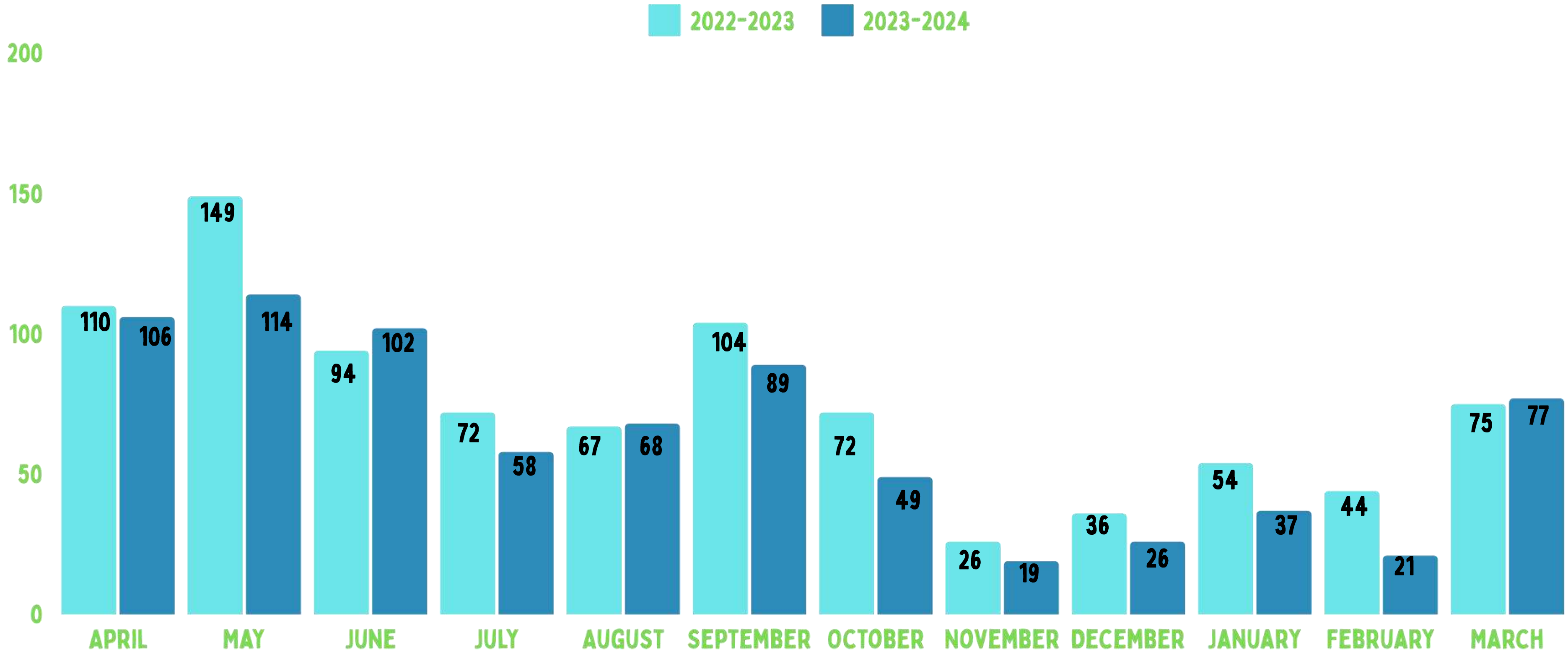
Members may provide details.

Deliberation in the meeting

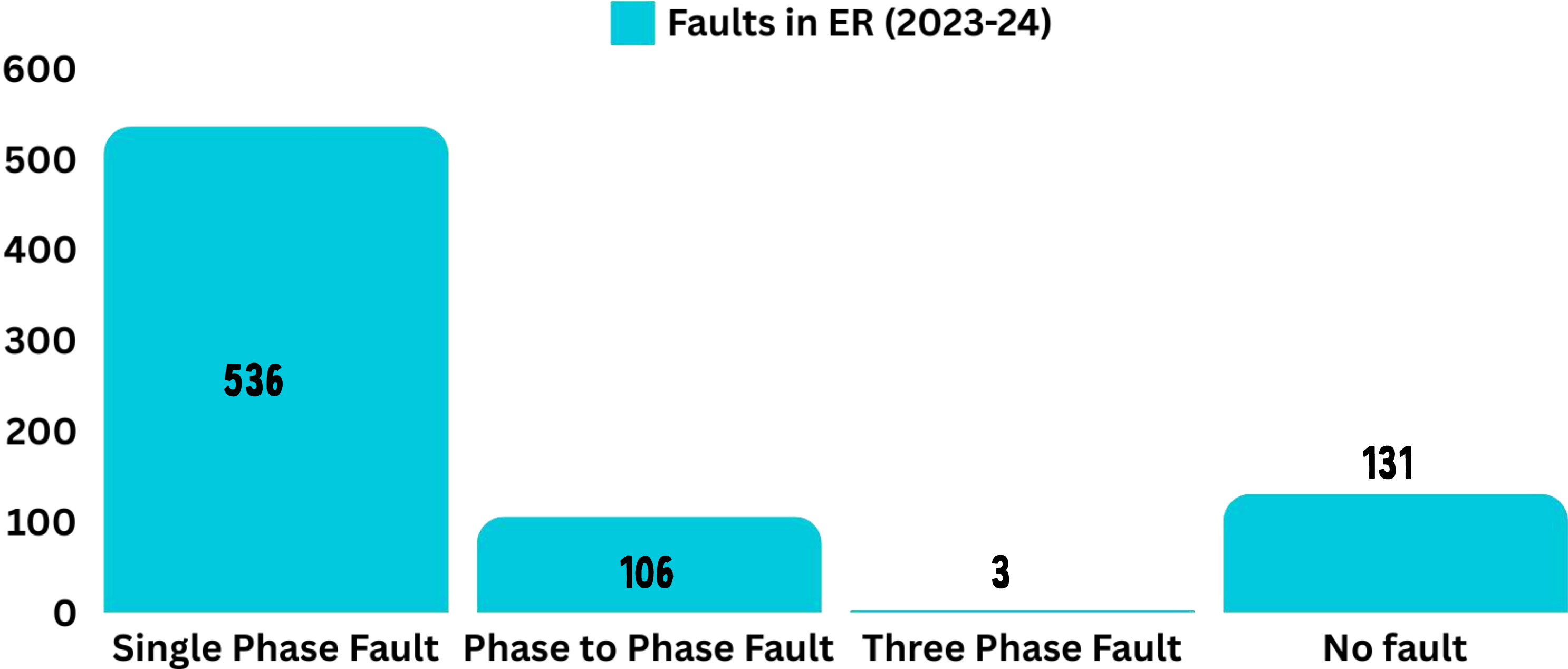
PCC advised utilities to submit the requisite information as per the above format to ERPC/ERLDC.

LINE TRIPPING STATISTICS FOR 2023-24 (EASTERN REGION)

SINGLE LINE TRIPPING IN EASTERN REGION

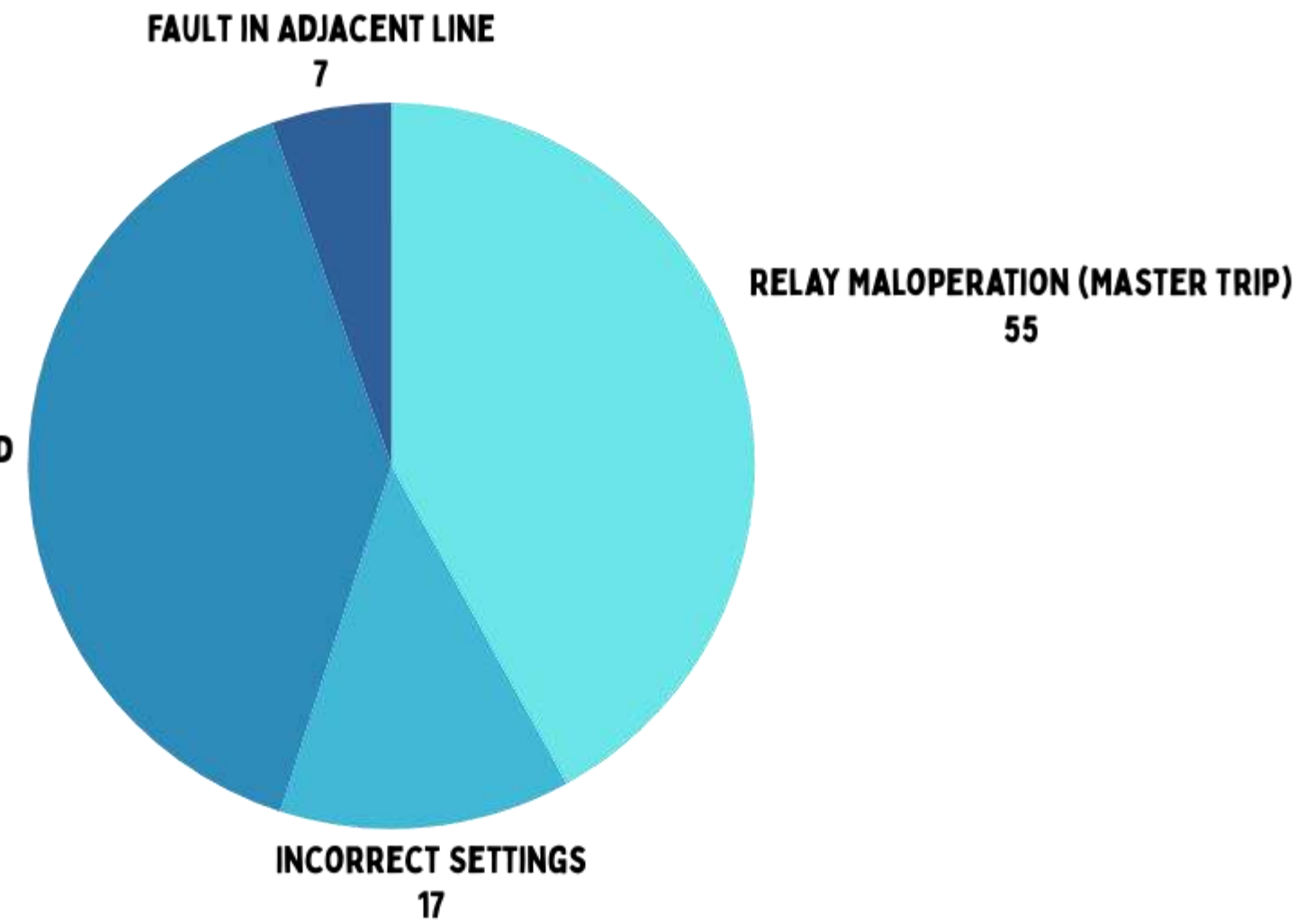
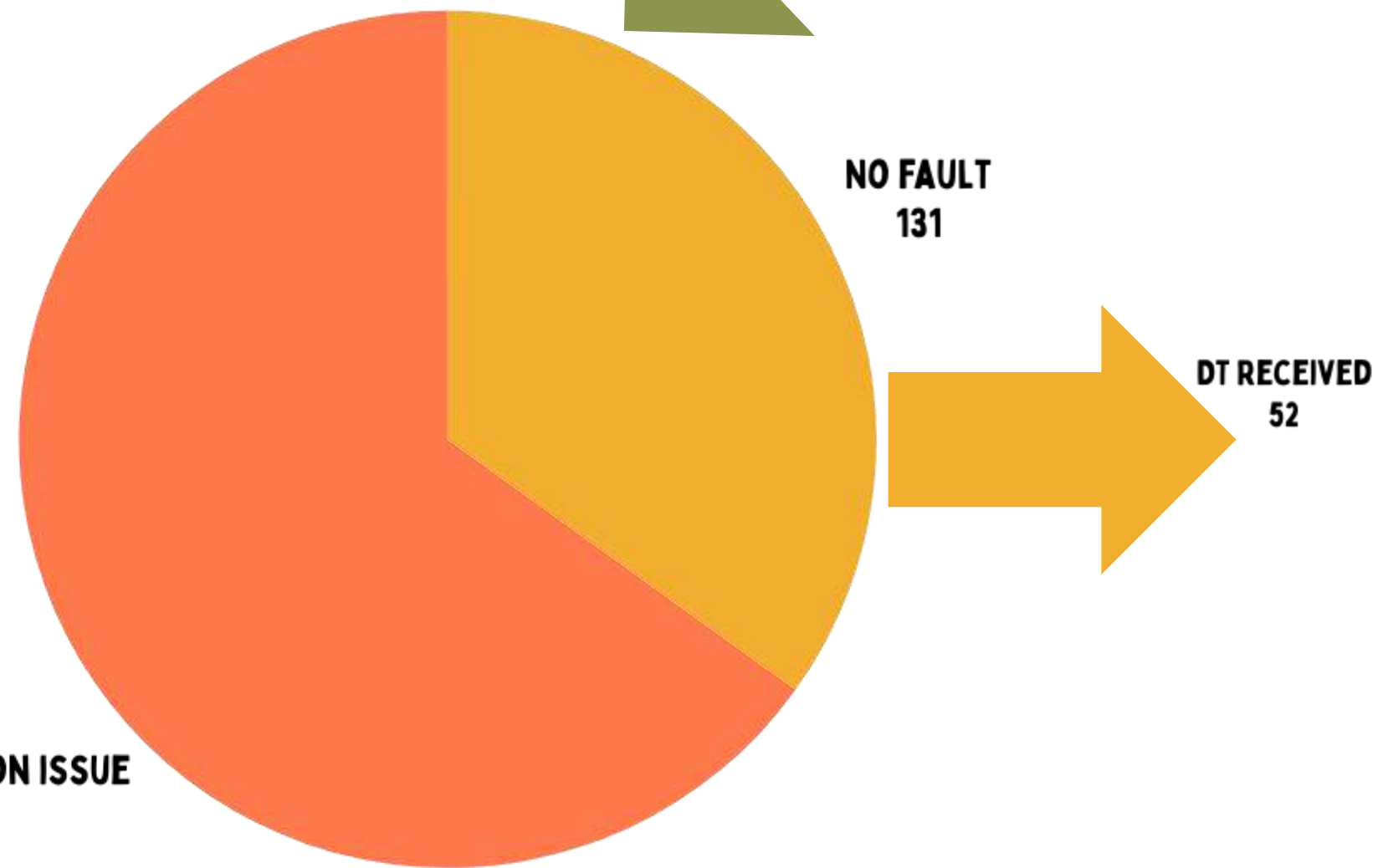
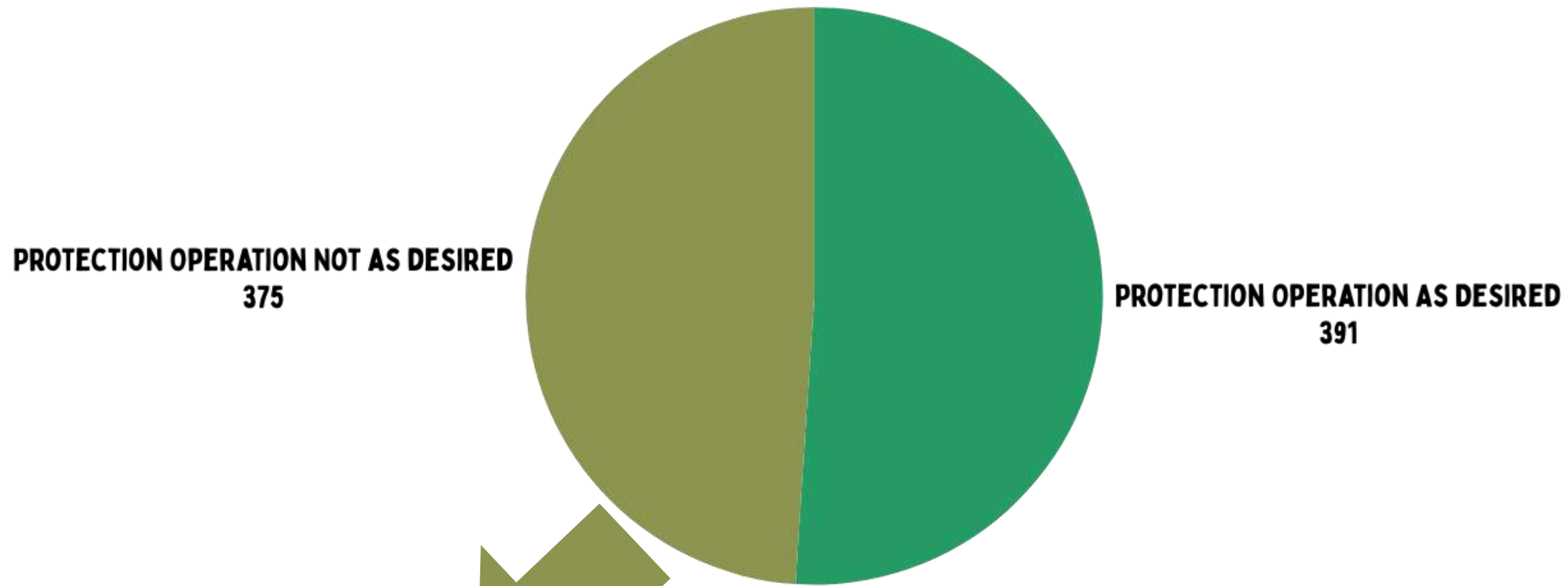


TYPES OF FAULT



PROTECTION

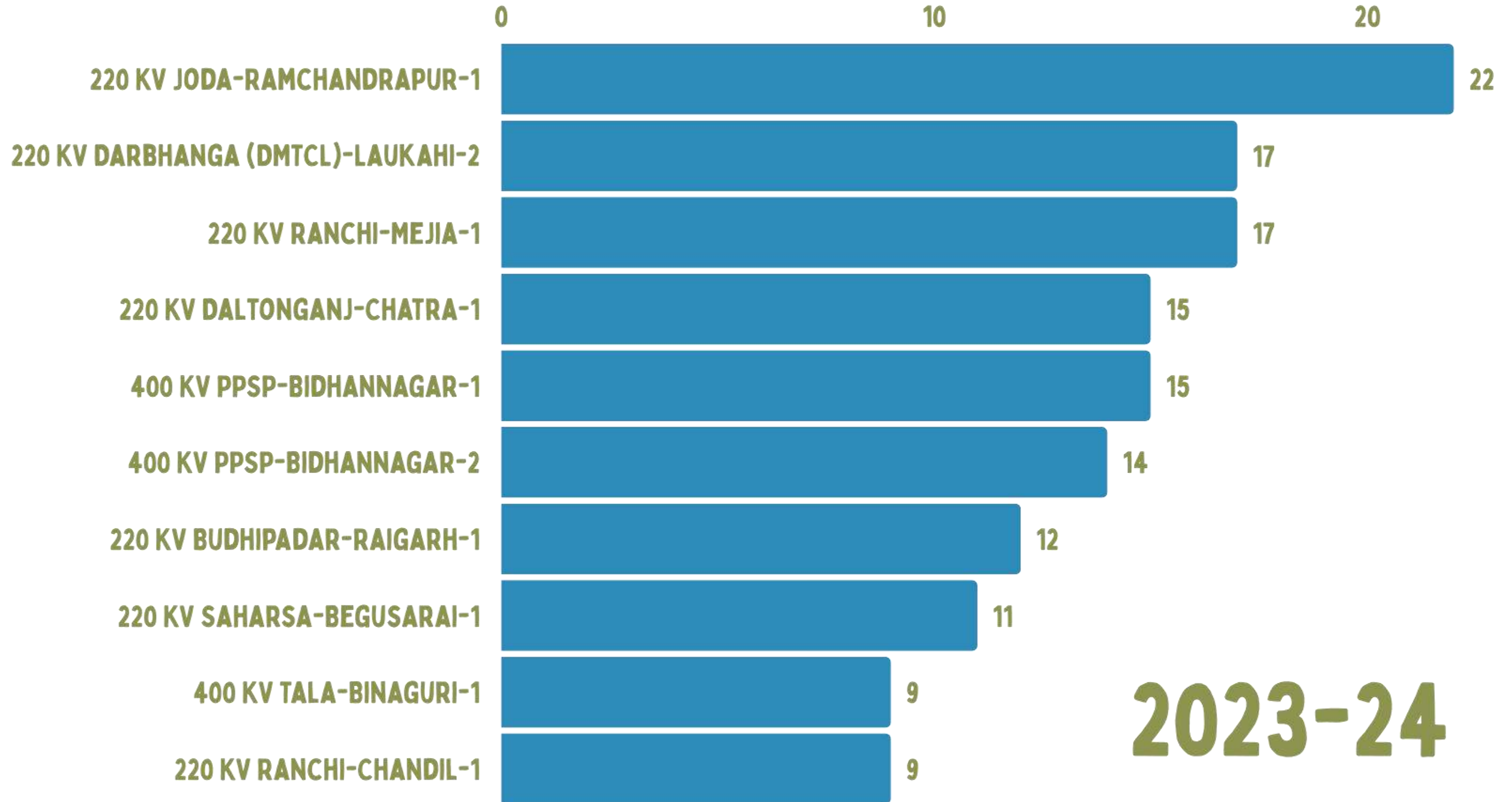
PERFORMANCE



TRIPPING WITHOUT ANY LINE FAULT (UTILITIES)

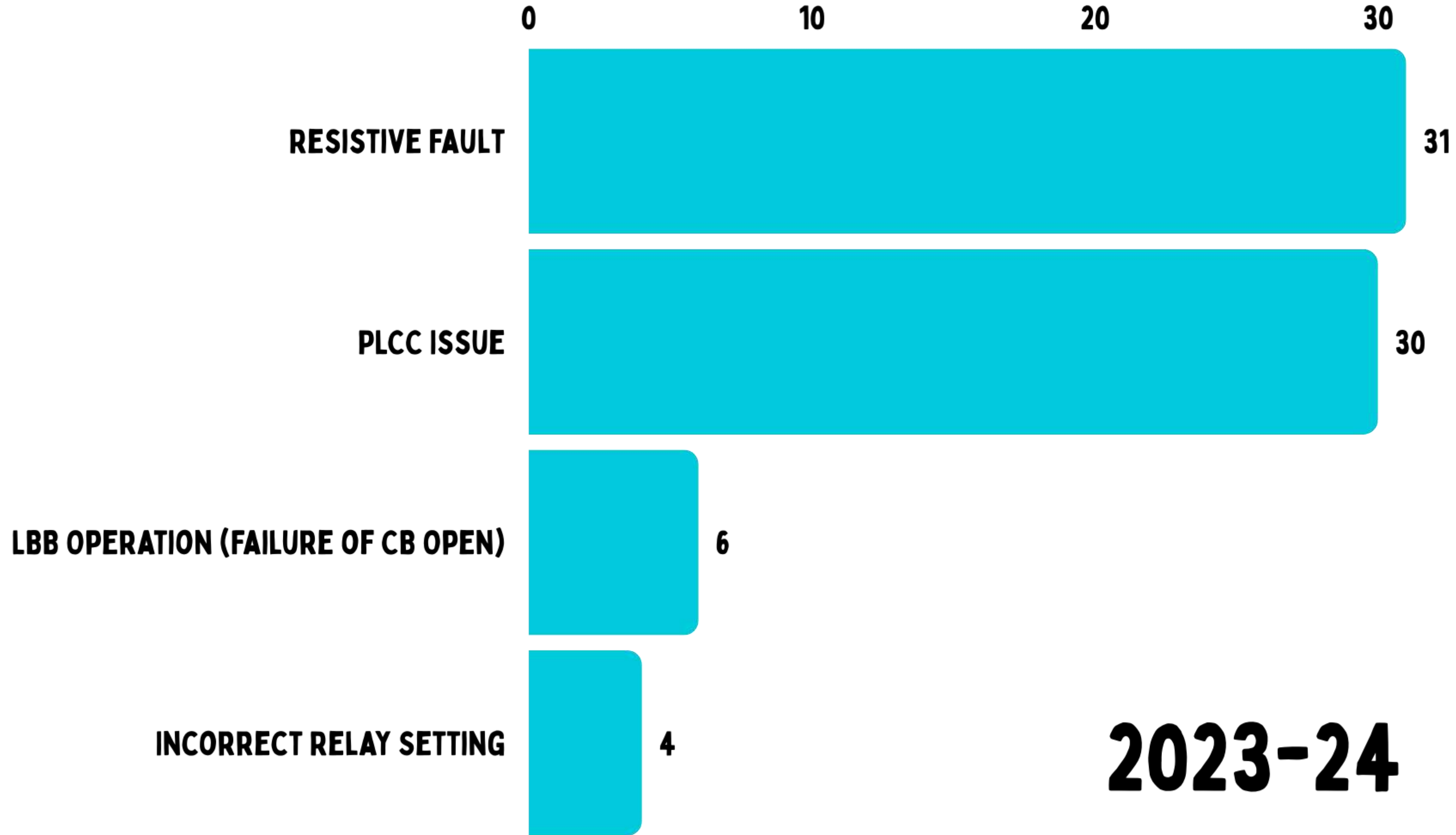


FREQUENT TRIPPING

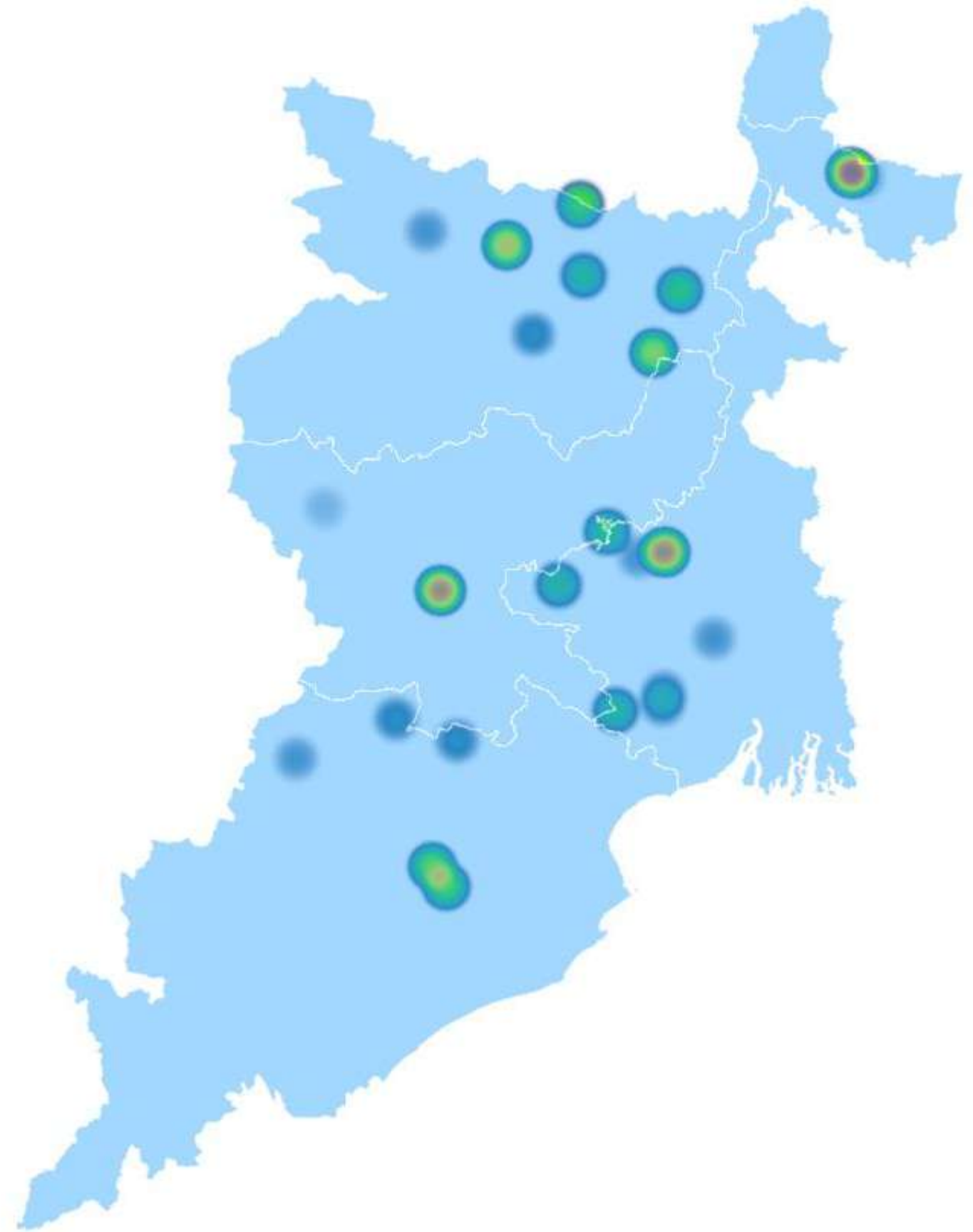


2023-24

REASON FOR DELAYED TRIPPING



REPEATED TRIPPING IN EASTERN REGION



List of participants in 135th PCC Meeting held on 21.05.2024 `

Annexure A.2

Name	First Join	Email			
Pranay Jena	5/21/24, 10:17:28 AM	ppjena@KolkataMST.onmicrosoft.com			
Rajerdra Prasad (Unverified)	5/21/24, 10:17:56 AM				
Pravin Ram (Unverified)	5/21/24, 10:17:56 AM				
rp (Unverified)	5/21/24, 10:17:56 AM				
Mohan Ramasamy (External)	5/21/24, 10:17:57 AM	RMOHAN01@NTPC.CO.IN			
CE CTD WBSETCL (Unverified)	5/21/24, 10:17:57 AM				
SLDC ODISHA (Unverified)	5/21/24, 10:17:57 AM				
PARAG CHATTERJEE (External)	5/21/24, 10:17:57 AM	PARAGCHATTERJEE@NTPC.CO.IN			
WBPDC (Unverified)	5/21/24, 10:17:57 AM				
rajendra prasad (Guest) (Unverified)	5/21/24, 10:17:59 AM				
Kiran Sai (Unverified)	5/21/24, 10:18:00 AM				
Mohan (Unverified)	5/21/24, 10:18:02 AM				
sibesh kumar (Unverified)	5/21/24, 10:21:42 AM				
EMR BBSR (Unverified)	5/21/24, 10:21:43 AM				
RAHUL RAJ (Unverified)	5/21/24, 10:21:49 AM				
Mayank Teotia (Unverified)	5/21/24, 10:23:51 AM				
P K PRUSTY,E&MR OPTCL Burla (Unverified)	5/21/24, 10:24:27 AM				
Rajiv Singh (Unverified)	5/21/24, 10:26:14 AM				
SMS SAHOO, DGM(ELECT), OPTCL, BHUBANESWAR (Unverified)	5/21/24, 10:27:02 AM				
Akash Kumar Modi (External)	5/21/24, 10:27:05 AM	akmodi@erldc.onmicrosoft.com			
Kumar Satyam, AEE, ERPC (Unverified)	5/21/24, 10:28:18 AM				
CRITL BSPTCL (Unverified)	5/21/24, 10:29:41 AM				
Rakesh Kr Pradhan (External)	5/21/24, 10:30:05 AM	rkpradhan@erldc.onmicrosoft.com			
NISAR HUSAIN (Unverified)	5/21/24, 10:30:43 AM				
arindam (Unverified)	5/21/24, 10:31:00 AM				
Vikash Kumar	5/21/24, 10:31:46 AM				
SAMIR KUMAR KASHYAP (External)	5/21/24, 10:32:18 AM	SKKASHYAP@NTPC.CO.IN			
Gulshan, Rongnichu (Unverified)	5/21/24, 10:33:14 AM				
Alok Pratap Singh (External)	5/21/24, 10:33:23 AM	apsingh@erldc.onmicrosoft.com			
s Konar (Unverified)	5/21/24, 10:33:30 AM				
N S MONDAL (Guest) (Unverified)	5/21/24, 10:34:35 AM				
Manas Das (External)	5/21/24, 10:34:43 AM	manasd@erldc.onmicrosoft.com			
Asit (Unverified)	5/21/24, 10:34:56 AM				

Rajiv Ranjan (Unverified)	5/21/24, 10:35:13 AM			
Mithun Gayen (Unverified)	5/21/24, 10:36:02 AM			
RA REDDY (External)	5/21/24, 10:37:47 AM	RAREDDY@NTPC.CO.IN		
Kumar Niraj (External)	5/21/24, 10:38:13 AM	nirajkumar@tatapower.com		
Nishant Kumar Shankwar (External)	5/21/24, 10:38:38 AM	Nishant.Kumar@energy-sel.com		
K A Madanpuri (Unverified)	5/21/24, 10:39:57 AM			
Pandi Krishnan N {पाण्डी कृष्णन एन.} (External)	5/21/24, 10:40:02 AM	pandikrishnan.n@powergrid.in		
TCSD, Tenughat (Unverified)	5/21/24, 10:40:05 AM			
Sanjeev (Unverified)	5/21/24, 10:43:46 AM			
Premkant Kumar Singh (External)	5/21/24, 10:44:12 AM	premkant@erldc.onmicrosoft.com		
DHARM DAS MURMU (Unverified)	5/21/24, 10:45:18 AM			
BSPTCL (Unverified)	5/21/24, 10:45:37 AM			
Pinki Debnath (External)	5/21/24, 10:45:53 AM	pinkidebnath@erldc.onmicrosoft.com		
DHARMADAS TRIPATHI (External)	5/21/24, 10:46:36 AM	dharmadas.tripathi@dvc.gov.in		
P K Senapati (Unverified)	5/21/24, 10:46:59 AM			
DGM,EMR DIV,J ROAD (Unverified)	5/21/24, 10:48:34 AM			
D Tripathi (Unverified)	5/21/24, 10:50:18 AM			
Amresh Prusti (External)	5/21/24, 10:50:57 AM	amresh.prusti@opgc.co.in		
Avinash Kumar	5/21/24, 10:53:19 AM			
Manager Latehar (Unverified)	5/21/24, 10:53:53 AM			
JAGANATH PANI (Unverified)	5/21/24, 10:54:38 AM			
P K PRUSTY OPTCL BURLA (Unverified)	5/21/24, 10:54:46 AM			
Varun Vinit,EEE, CRITL	5/21/24, 10:56:39 AM			
Srity kumari (Unverified)	5/21/24, 10:57:00 AM			
Dilip Kant Jha (Unverified)	5/21/24, 10:59:21 AM			
NITIN KATIYAR (External)	5/21/24, 11:02:34 AM	NITINKATIYAR@NTPC.CO.IN		
J Mishra (Unverified)	5/21/24, 11:04:16 AM			
aditya jha (Unverified)	5/21/24, 11:04:36 AM			
Ved Prakash (External)	5/21/24, 11:04:54 AM	VEDPRAKASH01@NTPC.CO.IN		
ESE BSPTCL (Unverified)	5/21/24, 11:04:54 AM			
CRITL, JUSNL (Unverified)	5/21/24, 11:05:34 AM			
Amit Kumar.. (External)	5/21/24, 11:10:12 AM	AMITKUMAR29@NTPC.CO.IN		
R.L.PASWAN, Dy. General Manager, JUSNL (Unverified)	5/21/24, 11:11:37 AM			
RAMBABOO SINGH (Unverified)	5/21/24, 11:12:50 AM			

Yamana Ayyappa	5/21/24, 11:14:13 AM	ya@sikkimurjalimited.in		
OPTCL MERAMUNDALI (Unverified)	5/21/24, 11:22:59 AM			
Bilash Achari (External)	5/21/24, 11:36:49 AM	bilash.achari@erldc.onmicrosoft.com		
Devendra Choubey	5/21/24, 11:38:35 AM			
Biswaranjan Mohanty (Unverified)	5/21/24, 12:07:01 PM			
Saibal Ghosh (External)	5/21/24, 12:13:31 PM	saibal@erldc.onmicrosoft.com		
SE,ERPC (Unverified)	5/21/24, 12:32:45 PM			
Pritam Goswami (Unverified)	5/21/24, 12:33:40 PM			
"prabhat kumar CGM(SPTL) (Unverified)	5/21/24, 12:37:54 PM			
EMR BURLA (Unverified)	5/21/24, 12:47:45 PM			
rajendra patna (Unverified)	5/21/24, 12:58:00 PM			
Rajerdra Prasad (Unverified)	5/21/24, 12:58:17 PM			
I K MEHRA,SE,ERPC (Unverified)	5/21/24, 1:22:50 PM			



ग्रिड-इंडिया
GRID-INDIA

ग्रिड कंट्रोलर ऑफ इंडिया लिमिटेड
(भारत सरकार का उद्यम)
GRID CONTROLLER OF INDIA LIMITED
(A Government of India Enterprise)
[formerly Power System Operation Corporation Limited (POSOCO)]




पूर्वी क्षेत्रीय भार प्रेषण केन्द्र / Eastern Regional Load Despatch Centre

कार्यालय : 14, गोल्फ क्लब रोड, टॉलिंगंज, कोलकाता - 700033
Office : 14, Golf Club Road, Tollygunge, Kolkata - 700033
CIN : U40105DL2009GOI188682, Website : www.erdc.in, E-mail : erdcinfo@grid-india.in, Tel. : 033 23890060/0061

पूर्वी क्षेत्र के 400/220 केवी उप-केन्द्र में ग्रिड घटना पर विस्तृत रिपोर्ट / Detailed Report of grid event in 400/220 kV Tenughat of Eastern Region

(To be submitted by RLDC/NLDC during Grid Disturbances/Grid Incidents/Near Miss Event as per IEGC section 37.2 (f))

(आई ई जी सी 37.2 (एफ) के अनुपालन में)

Date(दिनांक):26-04-2024

1. Event Summary (घटना का सारांश):

At 22:12 Hrs on 18.04.2024, an insulator flashover occurred in Bus#1 Y-phase at 220kV Tenughat which was not cleared by bus bar protection and subsequently 220kV Tenughat-Biharsariff (BH) line and 220kV Tenughat-Govindpur D/C tripped from remote ends in Zone-2. This caused tripping of both the running units at Tenughat and resulted in a generation loss of about 300MW.

2. Time and Date of the Event (घटना का समय और दिनांक): 22:12 hrs of 18.04.2024

3. Event Category (ग्रिड घटना का प्रकार): Grid Disturbance (GD)-1

4. Location/Control Area (स्थान/नियंत्रण क्षेत्र): Jharkhand

5. Antecedent Conditions (पूर्ववर्ती स्थिति):

	Frequency	Regional Generation	Regional Demand	State Generation	State Demand
				Jharkhand	Jharkhand
Pre-Event (घटना पूर्व)	49.97 Hz	29829 MW	28679 MW	300 MW	1585 MW
Post Event (घटना के बाद)	49.96 Hz	29529 MW	28679 MW	0 MW	1585 MW

**Pre and post data of 1 minute before and after the event*

Important Transmission Line/Unit if under outage (महत्वपूर्ण संचरण लाइने/ विद्युत उत्पादन इकाइयां जो बंद हैं)	Nil
Weather Condition (मौसम स्थिति)	Normal weather

6. Load and Generation loss (लोड और जनरेशन हानि): Generation loss: 300 MW; Load loss: NIL.

7. Duration of interruption (रूकावट की अवधि): 00:29 Hrs

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

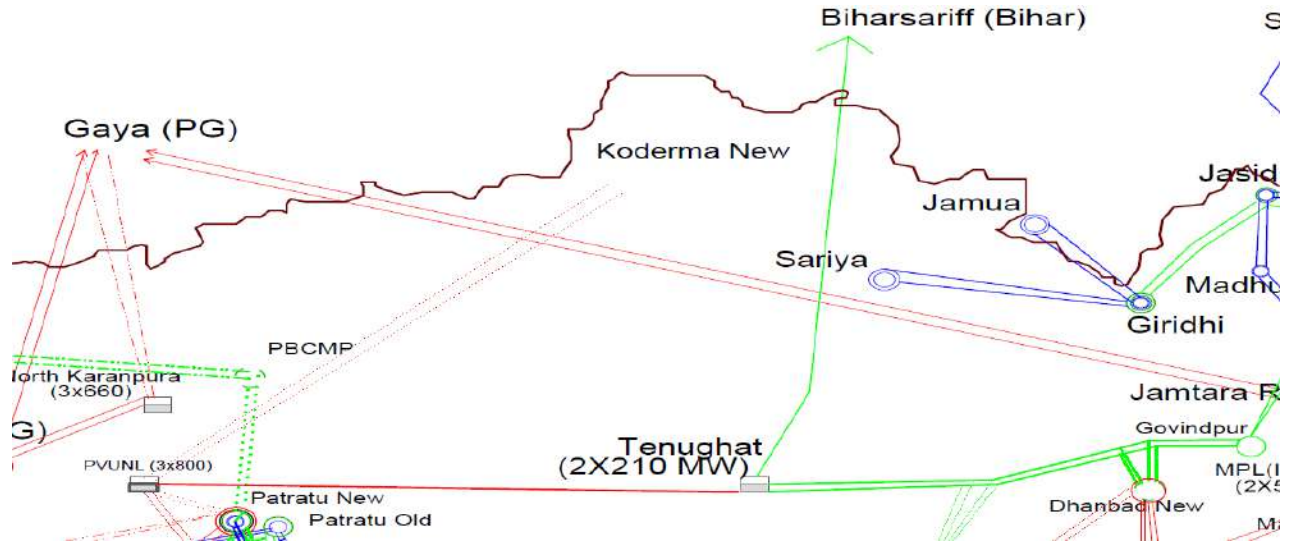


Figure 1: Network across the affected area

9. Details of Equipment Failure (if any during the event) (उपकरण विफलता का विवरण): NA

10. Major Elements Tripped (प्रमुख ट्रिपिंग)

क्र०सं०	नाम	Trip time (hh:mm:ss)	उप केंद्र 1 रिले संकेत	उप केंद्र 2 रिले संकेत	Restoration time
1	220 kV Tenughat-Govindpur-1	22:12:18	Tenughat: Didn't trip (Y_N, Zone-4 Pick)	Govindpur: R_N, Zone-2, 90.24 km, 1.16 kA	08:45 (19.04.24)
2	220 kV Tenughat-Govindpur-2		Tenughat: Didn't trip (Y_N, Zone-4 Pick)	Govindpur: Didn't trip (R_N, Zone-2 pick)	08:26 (19.04.24)
3	220 kV Tenughat-Biharsharif-1		Tenughat: Didn't trip (Y_N, Zone-4 Pick)	Biharsharif: R_N, Zone-2, 155.1 km, 1.602 kA	23:42
4	2*210 MW Units at Tenughat	22:12:19	Tenughat: Loss of evacuation path		U#1: 09:45 U#2: 09:41
5	220 kV Bus-1 & 2 at Tenughat		All emanating lines tripped		-/Bus 2: 23:42

11. Event Analysis (Based on PMU, SCADA & DR) (घटना का विश्लेषण):

- Y_ph suspension insulator of 220 kV Bus-1 near bypass bay got punctured. Bus bar protection didn't operate.
- All emanating feeders, 220 kV Tenughat-Biharsharif and 220 kV Tenughat-Govindpur D/c tripped from remote ends in Zone-2.
- PVUNL is availing startup power from 400 kV Tenughat-PVUNL radially.
- Thus, island was formed with around 300 MW Tenughat generation, startup power while feeding the bus fault.
- The so formed island collapsed after 1 second when both units tripped on overspeed. O/c E/f also operated in U#1.

PMU Snapshot:

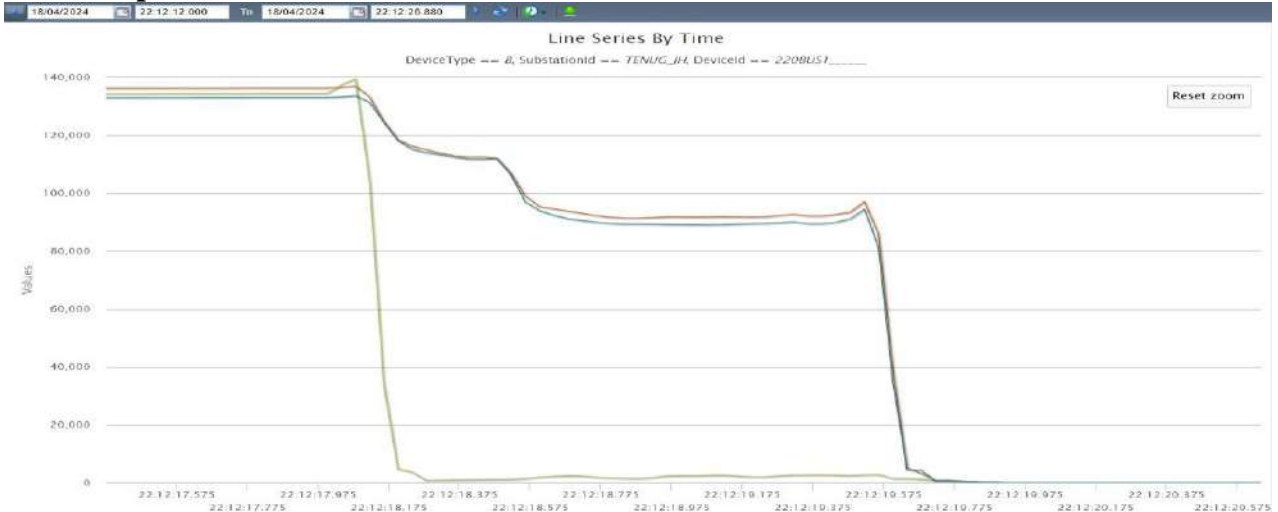


Figure 2: PMU Voltage snapshot of 220 kV Tenughat S/S

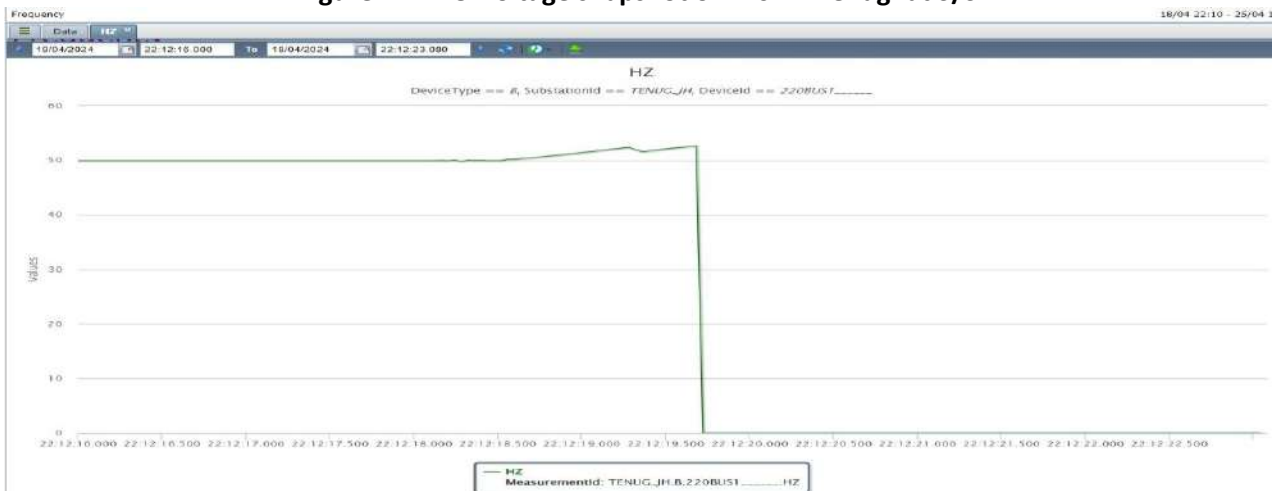


Figure 3: PMU Frequency snapshot of 400/220 kV Tenughat S/s

12. Protection/Operational issues observed (सुरक्षा/परिचालन संबंधी समस्या):

- Bus bar protection at Tenughat is of electromechanical type which didn't operate for the bus fault. The reason for non-operation may be analyzed. Earlier also, there have been several instances when bus bar protection has not operated at Tenughat.
- DRs of Tenughat and Biharsharif are not time synchronized.

13. Action Taken/Remedial Measures (सुधारात्मक उपाय):

- Electromechanical bus bar protection may be replaced with numerical relay as per CEA Technical Standards.

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

S.No.	Issues	Regulation Non-Compliance	Utilities
2.	DR/EL not provided within 24 Hours	1. IEGC section 37.2 (c) 2. CEA grid Standard 15.3	BSPTCL, JUSNL

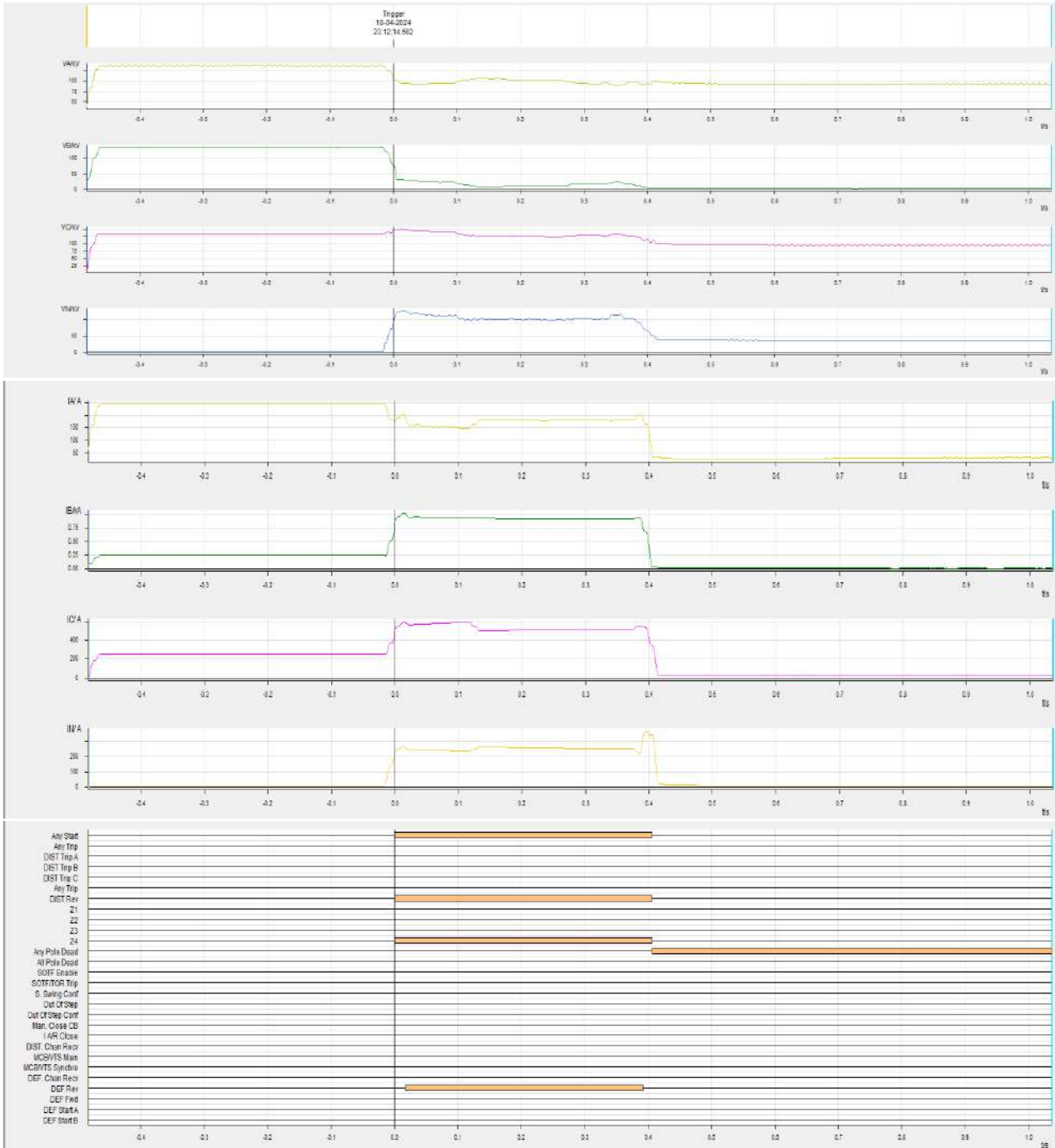
15. Key Lessons Learnt (प्रमुख अधिगम बिंदु): Nil

Annexure 1: (Sequence of Events-As per ERLDC SCADA)

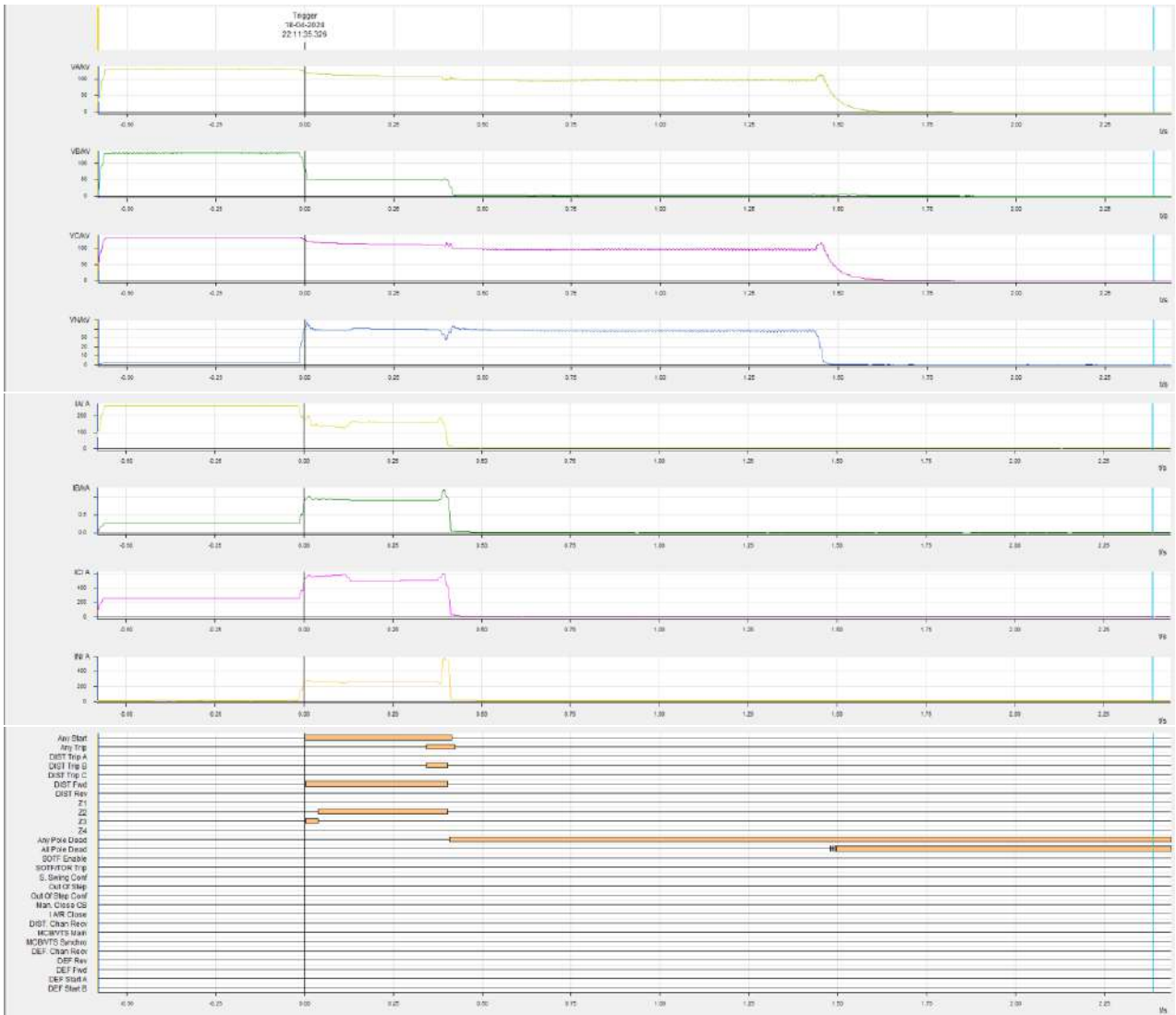
SoE data not available in ERLDC Scada.

Annexure 2:

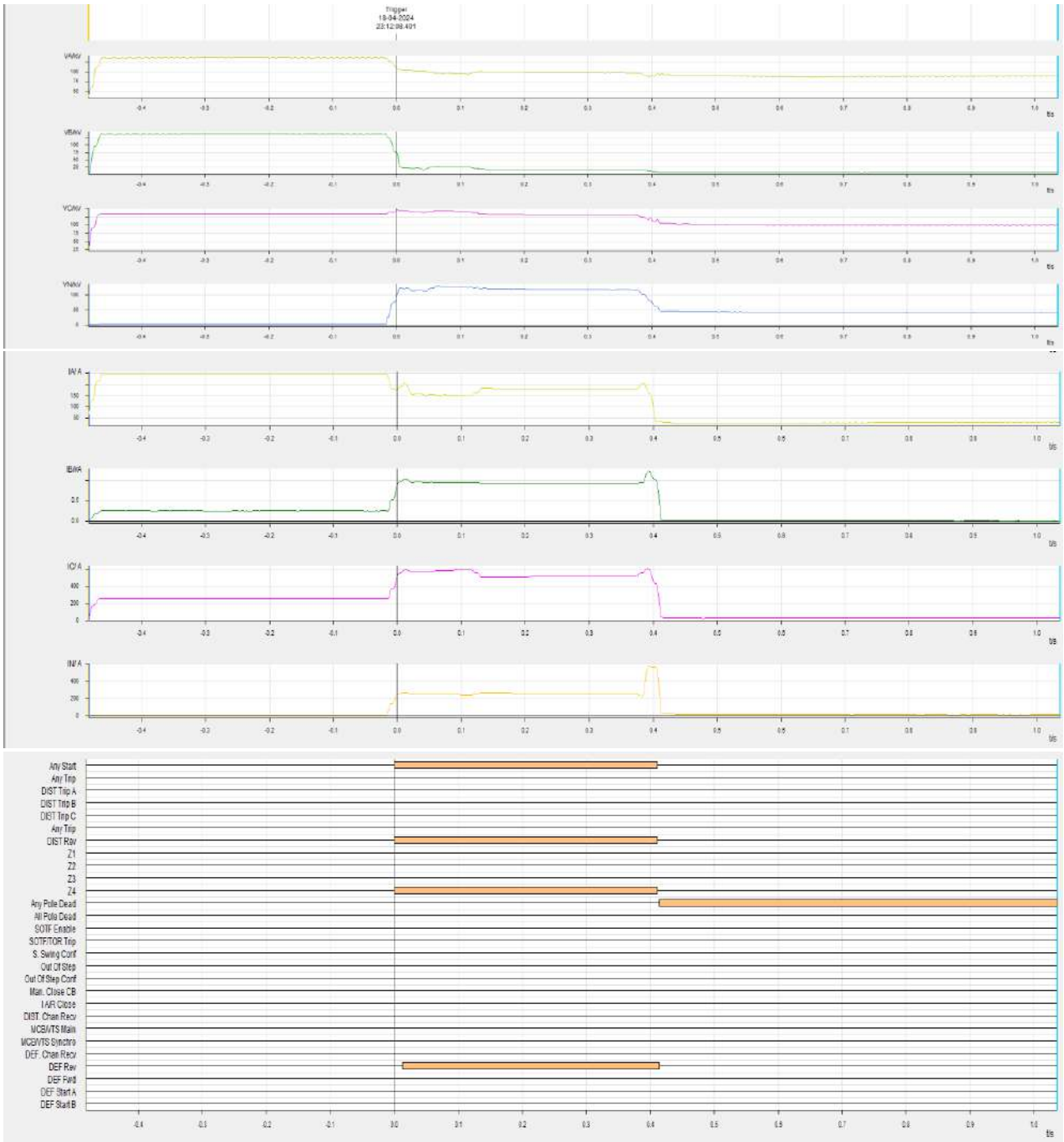
DR of 220 kV Tenughat-Govindpur-1 (Tenughat)



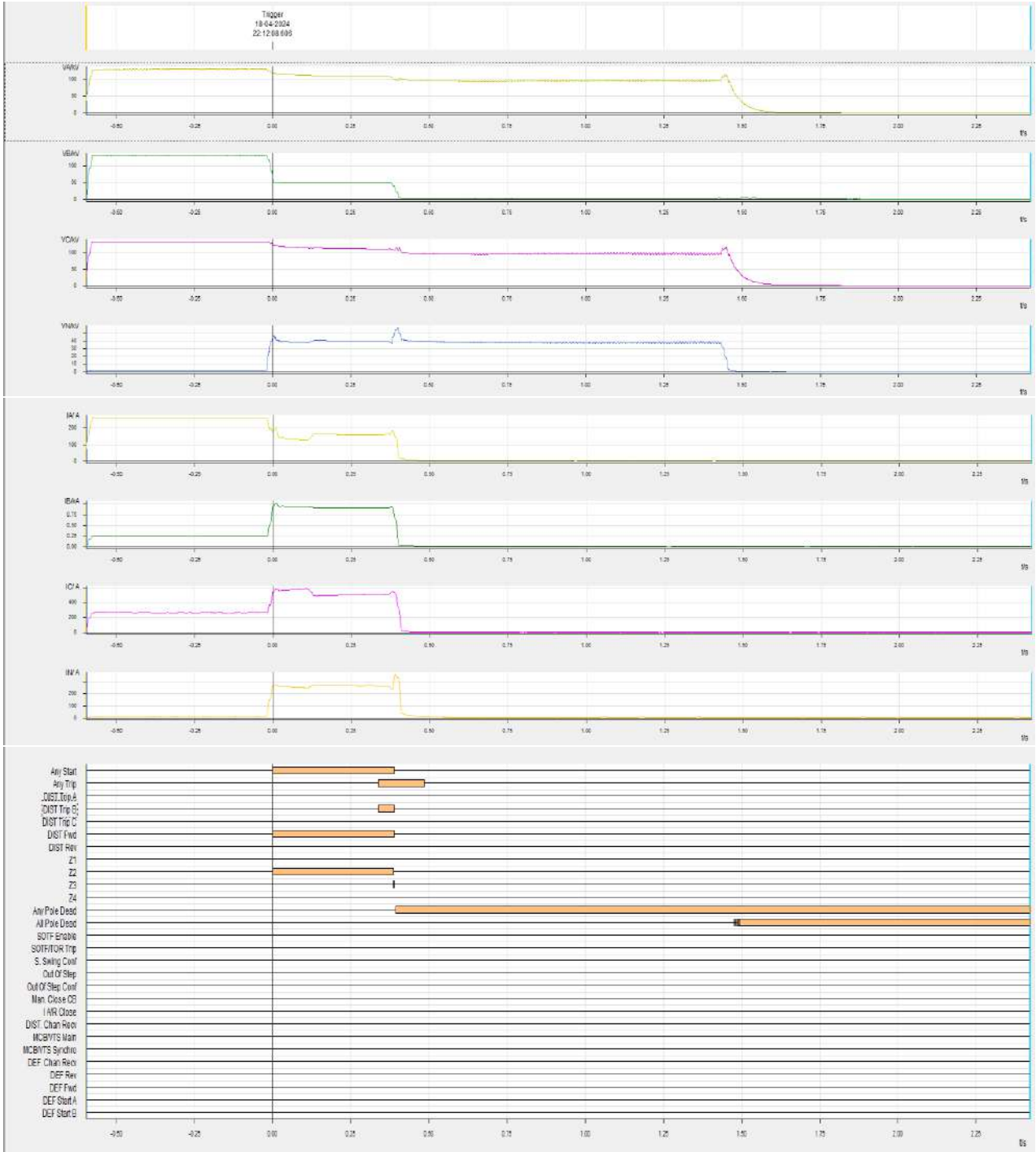
DR of 220 kV Tenughat-Govindpur-1 (Govindpur)



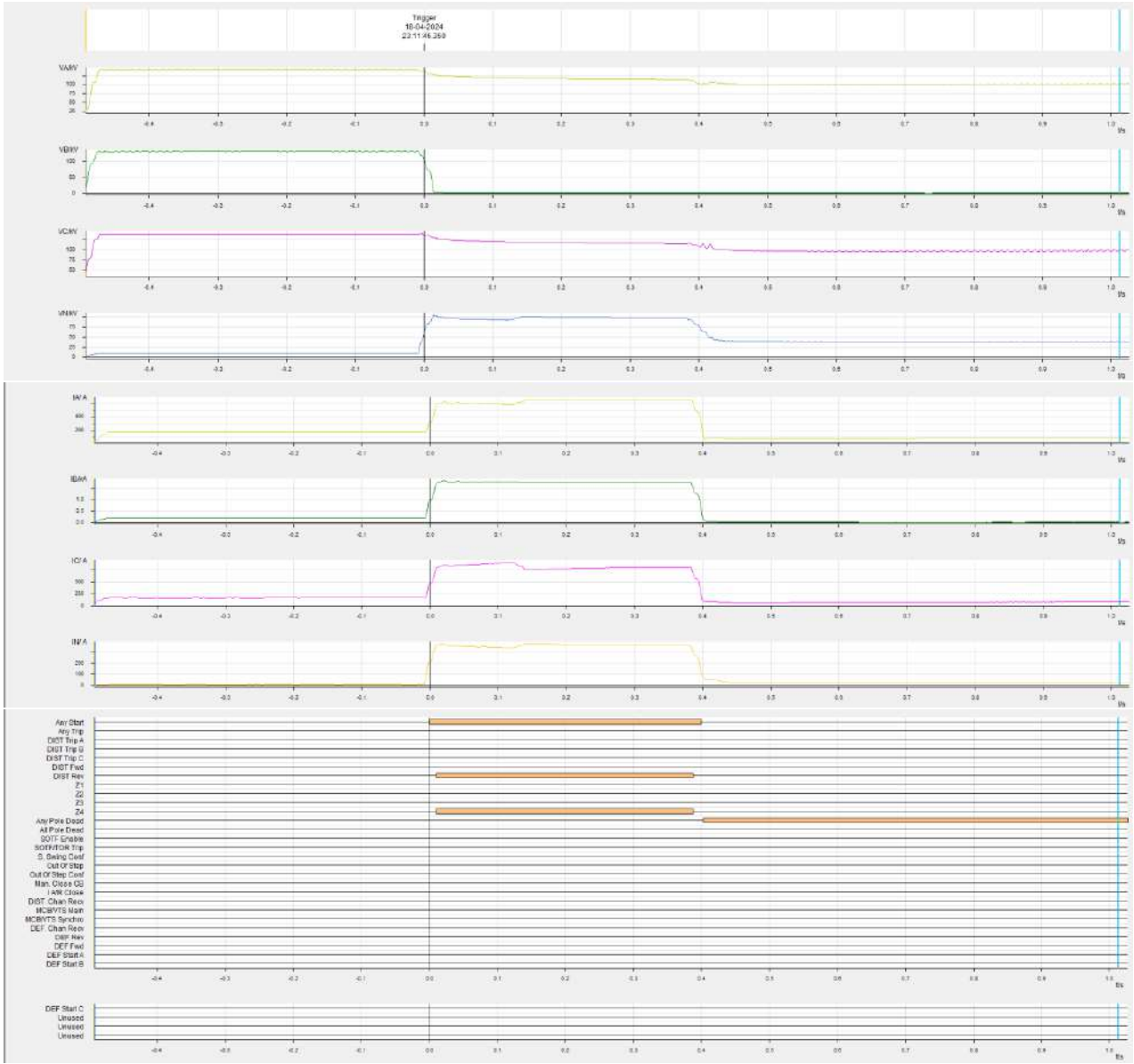
DR of 220 kV Tenughat-Govindpur-2 (Tenughat)



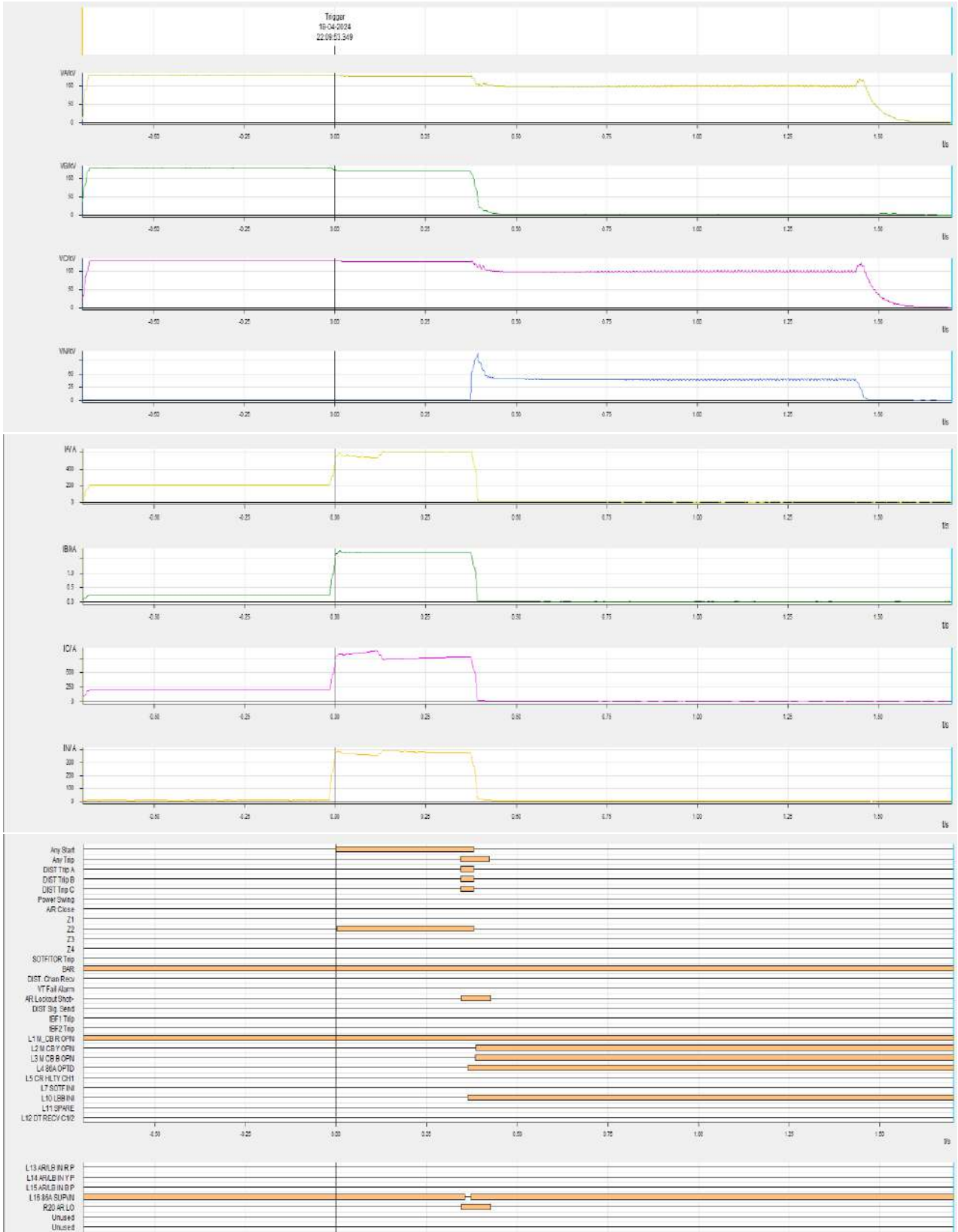
DR of 220 kV Tenughat-Govindpur-2 (Govindpur)



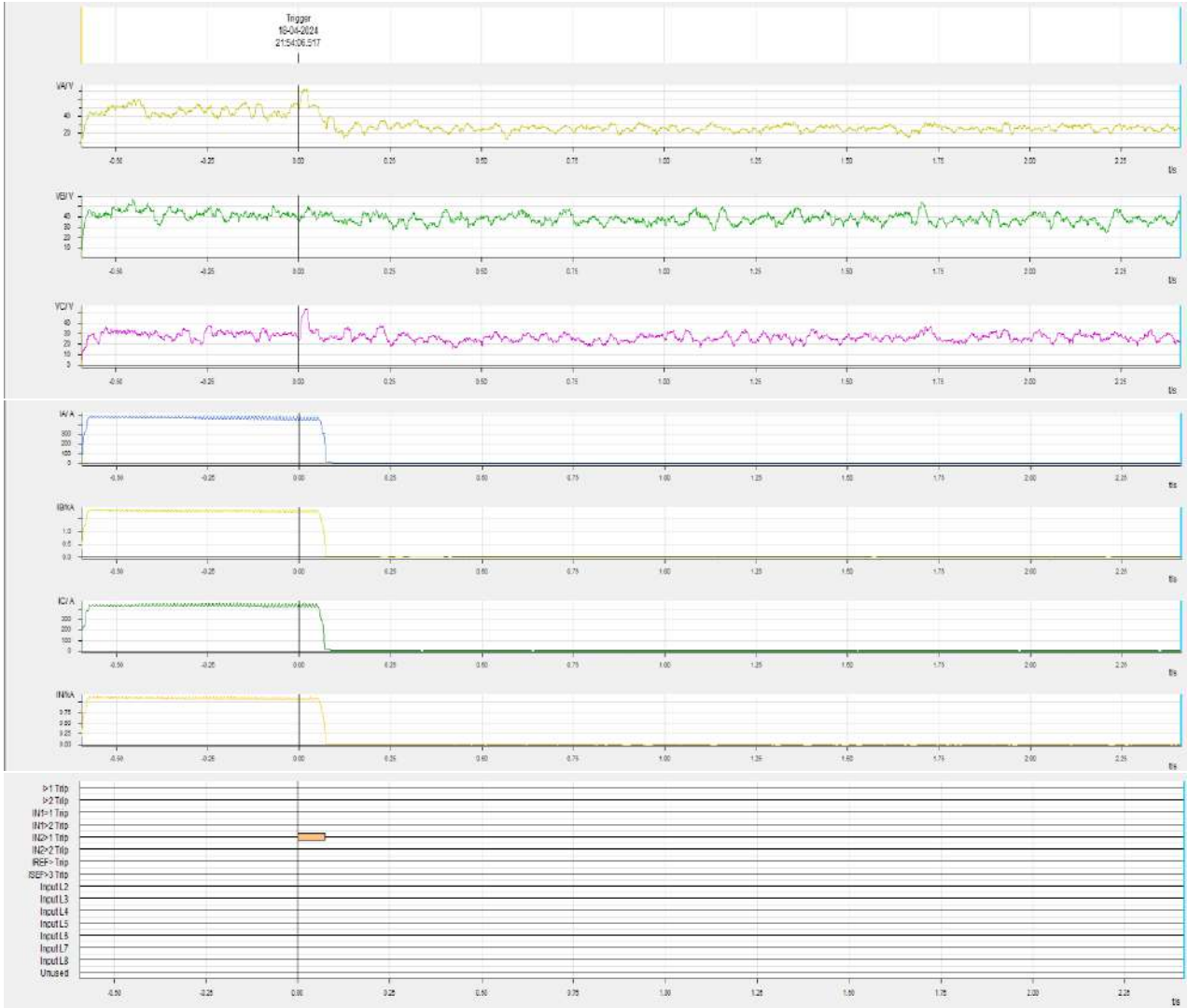
DR of 220 kV Tenughat-Biharsharif-1 (Tenughat)



DR of 220 kV Tenughat-Biharsharif-1 (Biharsharif)



DR of U#1 at Tenughat




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पूर्वी क्षेत्रीय भार प्रेषण केन्द्र / Eastern Regional Load Despatch Centre

कार्यालय : 14, गोल्फ क्लब रोड, टॉलिंगंज, कोलकाता - 700033
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 CIN : U40105DL2009GOI188682, Website : www.erfdc.in, E-mail : erfdinfo@grid-india.in, Tel.: 033 23890060/0061

पूर्वी क्षेत्र के 220/132 केवी कसबा एस/एस में ग्रिड घटना की विस्तृत रिपोर्ट / Detailed Report of grid event at 220/132 kV Kasba S/s of Eastern Region

(To be submitted by RLDC/NLDC during Grid Disturbances/Grid Incidents/Near Miss Event as per IEGC section 37.2 (f))

(आई ई जी सी 37.2 (एफ) के अनुपालन में)

Date(दिनांक):13-05-2024

1. Event Summary (घटना का सारांश):

At 21:42 Hrs on 25.04.2024, Y-ph CT of 220 kV Subahshgram(WB)-Kasba-1 burst leading to operation of bus bar differential protection at Kasba and subsequently B_ph CT also got damaged. Kasba has single main and transfer scheme, thus all elements at Kasba tripped, leading to total power failure at Kasba S/s. CESC system got islanded from the grid. Around 601 MW load loss occurred.

2. Time and Date of the Event (घटना का समय और दिनांक): 21:42 hrs on 25.04.2024

3. Event Category (ग्रिड घटना का प्रकार): Grid Disturbance (GD)-1

4. Location/Control Area (स्थान/नियंत्रण क्षेत्र): 220/132 kV Kasba S/s, CESC system

5. Report submitted by Utility on: 06-05-2024

6. Antecedent Conditions (पूर्ववर्ती स्थिति):

	Frequency	Regional Generation	Regional Demand	State Generation	State Demand
				West Bengal	West Bengal
Pre-Event (घटना पूर्व)	49.97 Hz	32264 MW	29135 MW	6212 MW	11058 MW
Post Event (घटना के बाद)	49.97 Hz	32138 MW	28534 MW	6086 MW	10457 MW

**Pre and post data of 1 minute before and after the event*

Important Transmission Line/Unit if under outage (महत्वपूर्ण संचरण लाइने/ विद्युत उत्पादन इकाइयां जो बंद हैं)	Nil
Weather Condition (मौसम स्थिति)	Normal

Load and Generation loss (लोड और जेनरेशन हानि): Approximate load loss of 601 MW at Salt Lake, Sonarpur & CESC area of West Bengal.

7. Duration of interruption (रूकावट की अवधि): 00:23 Hrs

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

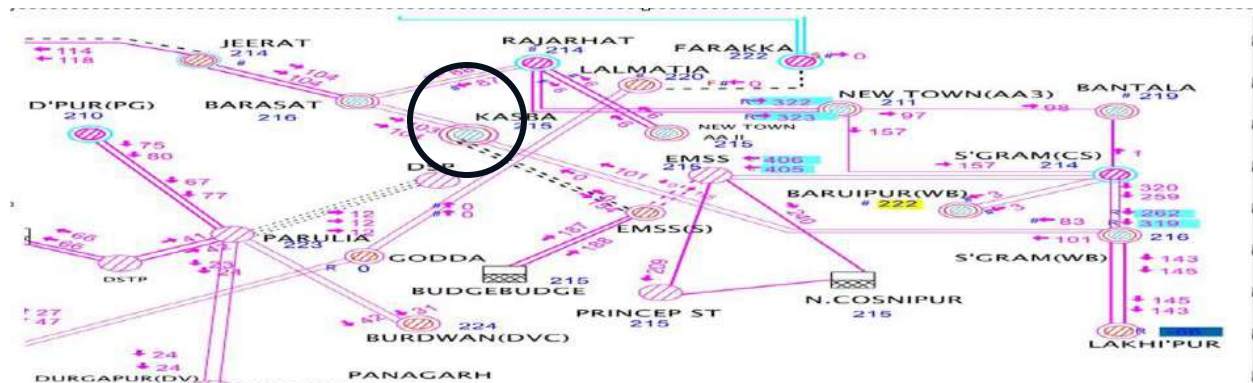


Figure 1: Network across the affected area

9. Details of Equipment Failure (if any during the event) (उपकरण विफलता का विवरण): B_ph CT of 220 kV Subhashgram-Kasba-1 burst at Kasba.

10. Major Elements Tripped (प्रमुख ट्रिपिंग):

क्र०स०	नाम	Trip time (hh:mm:ss.ms)	उप केंद्र 1 रिले संकेत	उप केंद्र 2 रिले संकेत	Restoration time
1	220 kV Subhahsgram-Kasba-1	21:42:09.890	Subhashgram: Y_N, 5.13 kA	Kasba: Y_N, 0.2 km, 18.55 kA	08:38 (26.04.2024)
2	220 kV Kasba- Subahshgram-2	21:42:10.000	Kasba: Bus bar protection operated	Subhashgram: Didn't trip	22:12
3	220 kV Kasba-Barasat D/c			Barasat: DT received	21:57
4	220 kV Kasba-EMSS South D/c			-	22:01
5	220 kV Main Bus-1 at Kasba			-	21:57

6	4*220/132 kV ATRs at Kasba			-	21:58/21:58/22:04/22:13
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12. Event Analysis (Based on PMU, SCADA & DR) (घटना का विश्लेषण):

- Y_ph CT of 220 kV Subahshgram-Kasba-1 burst at Kasba S/s. This was seen in Zone-1 at Kasba and distance protection operated. After around 110 msec, due to CT blast, B_ph CT also got damaged and bus fault developed in B_ph leading to operation of bus bar differential protection.
- 220/132 kV Kasba has Single Main and transfer scheme, therefore all elements at Kasba tripped leading to total power failure at Kasba.
- At the same time, CESC system got islanded with its load and generation.

PMU Snapshot:

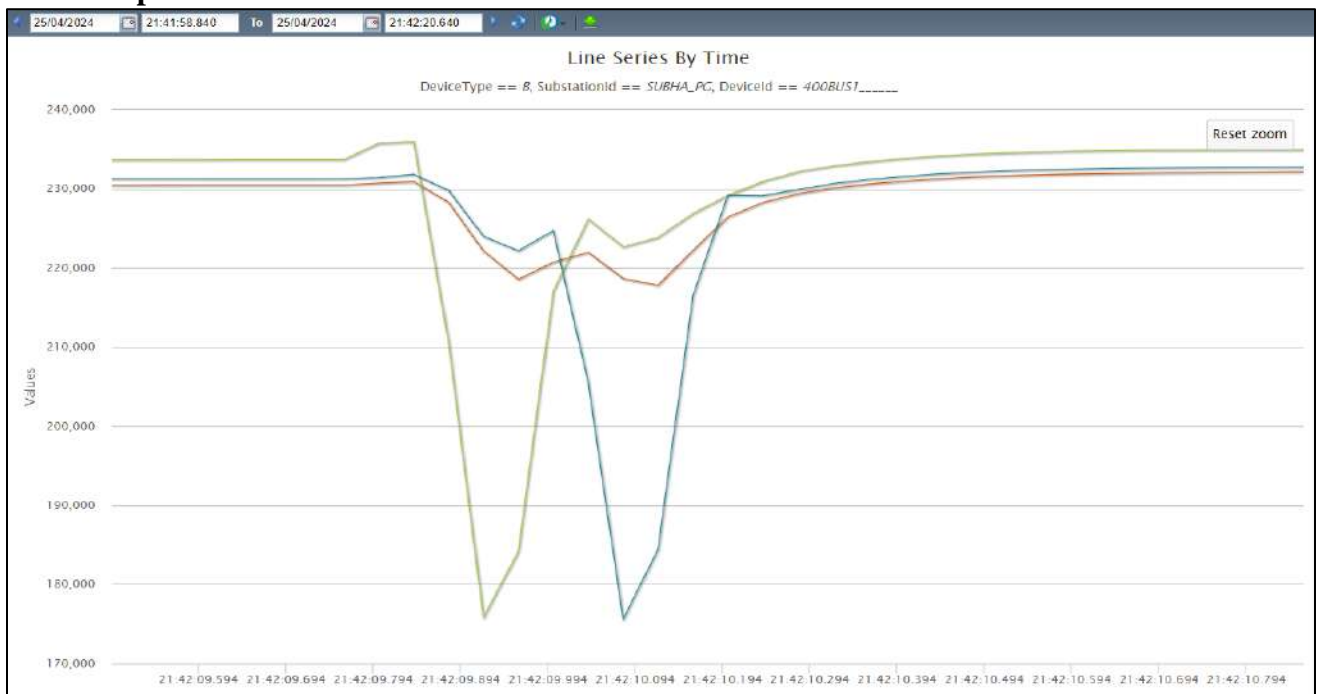


Figure 2: PMU Voltage snapshot of 400/220 kV Subhashgram S/S

CESC Island:

- Due to load generation imbalance after islanding, frequency touched 51.2 Hz on the higher side and 49.2 Hz on the lower side. UFR operated twice when frequency touched 49.2 HZ,

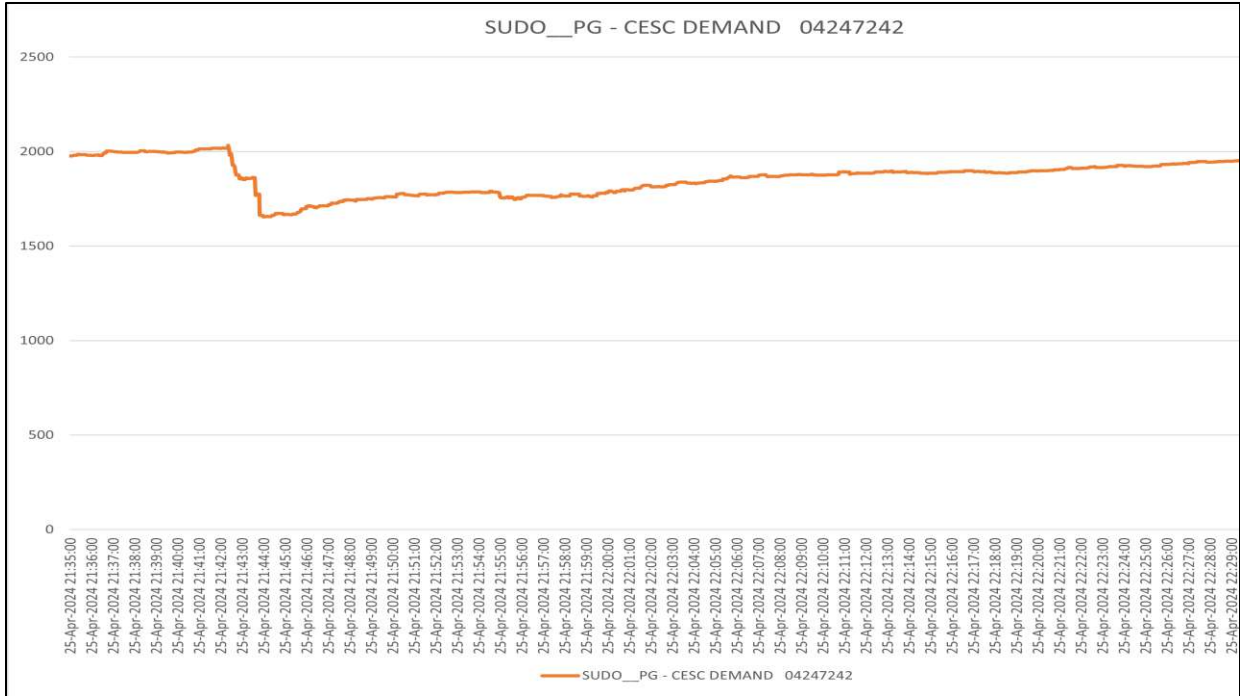


Figure 3: SCADA snapshot of CESC demand

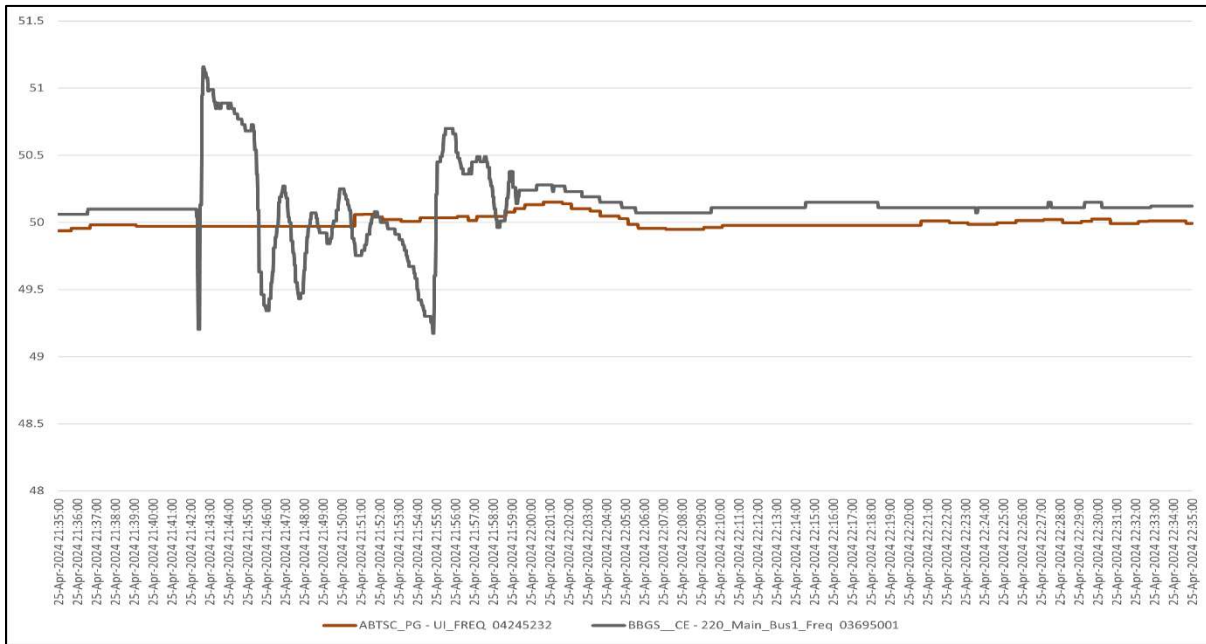


Figure 4: SCADA snapshot of Grid frequency vs island frequency

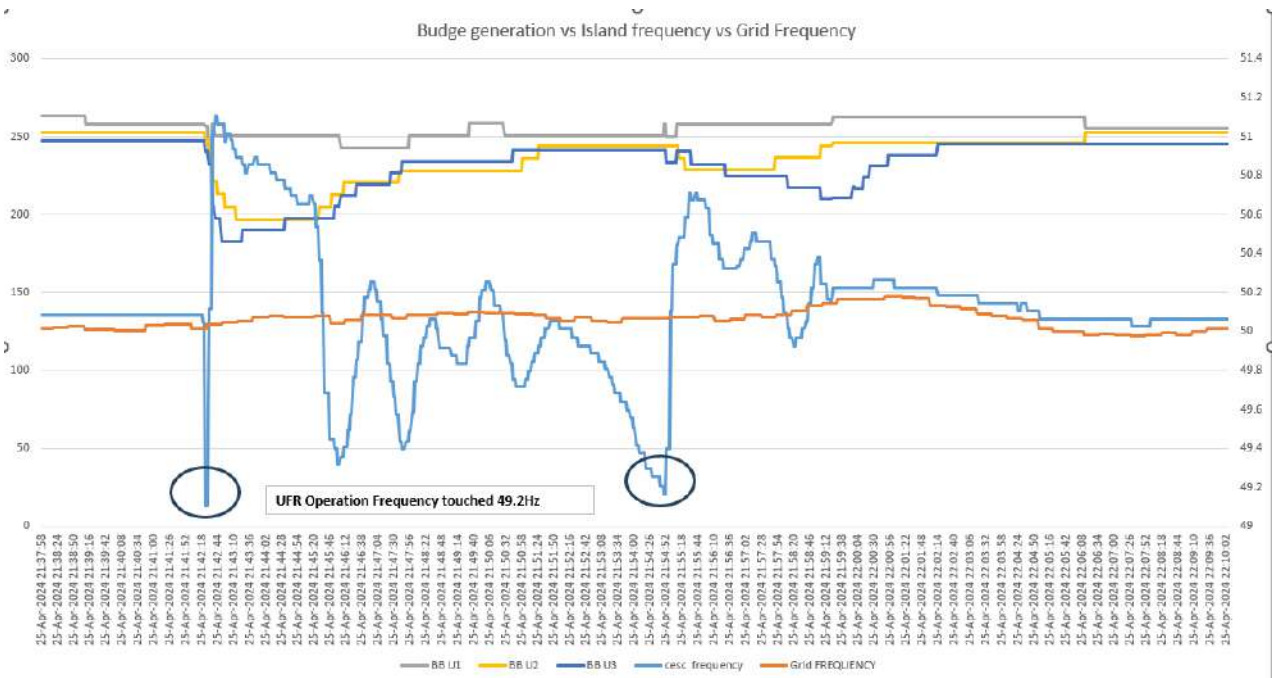


Figure 5: SCADA snapshot of Grid frequency vs island frequency vs Budge generation

13. Protection/Operational issues observed (सुरक्षा/परिचालन संबंधी समस्या):

- 220 kV Kasba has single main bus and transfer scheme. Possibilities may be explored for upgrading it to double main and transfer scheme.
- DR of 220 kV Subhashgram-Kasba-1 not time synchronized at Kasba end.

14. Action Taken/Remedial Measures (सुधारात्मक उपाय):

- Root cause analysis of CT failure may be done.

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

S.No.	Issues	Regulation Non-Compliance	Utilities
1.	DR/EL not provided within 24 Hours	1. IEGC section 37.2 (c) 2. CEA grid Standard 15.3	WBSETCL, CESC

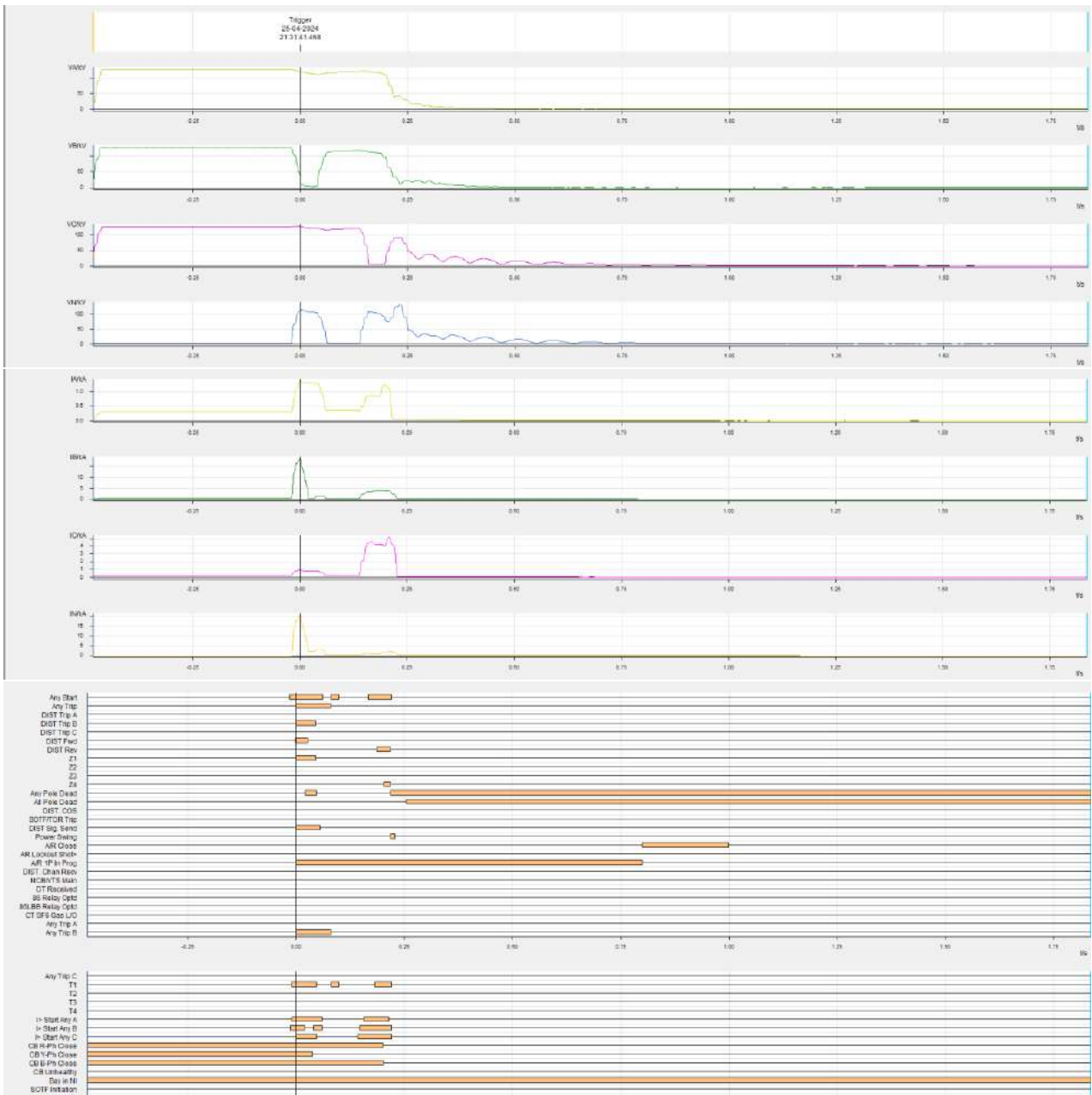
16. Key Lessons Learnt (प्रमुख अधिगम बिंदु): Nil

Annexure 1: (Sequence of Events-As per ERLDC SCADA)

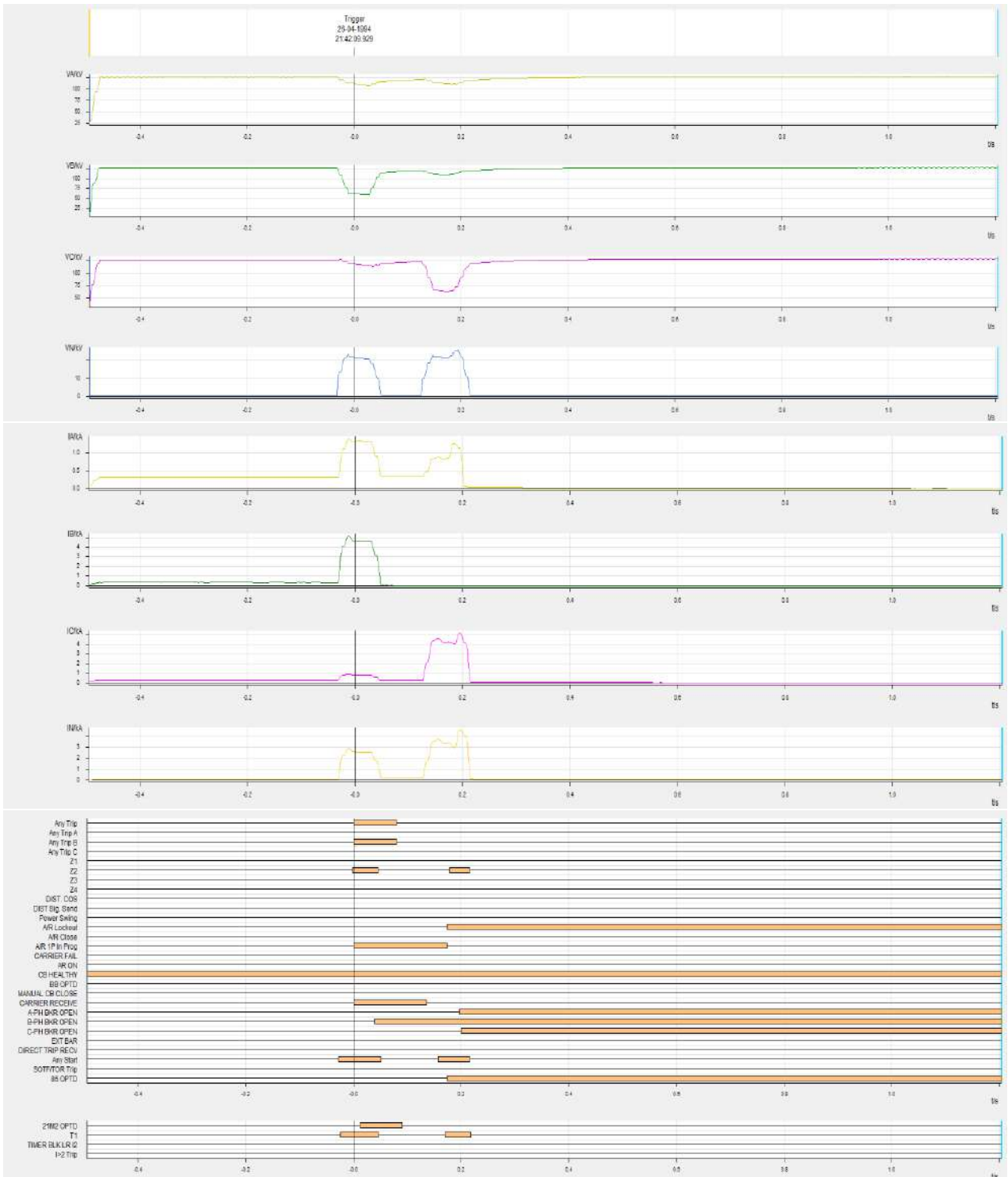
SoE data not available in ERLDC SCADA.

Annexure 2:

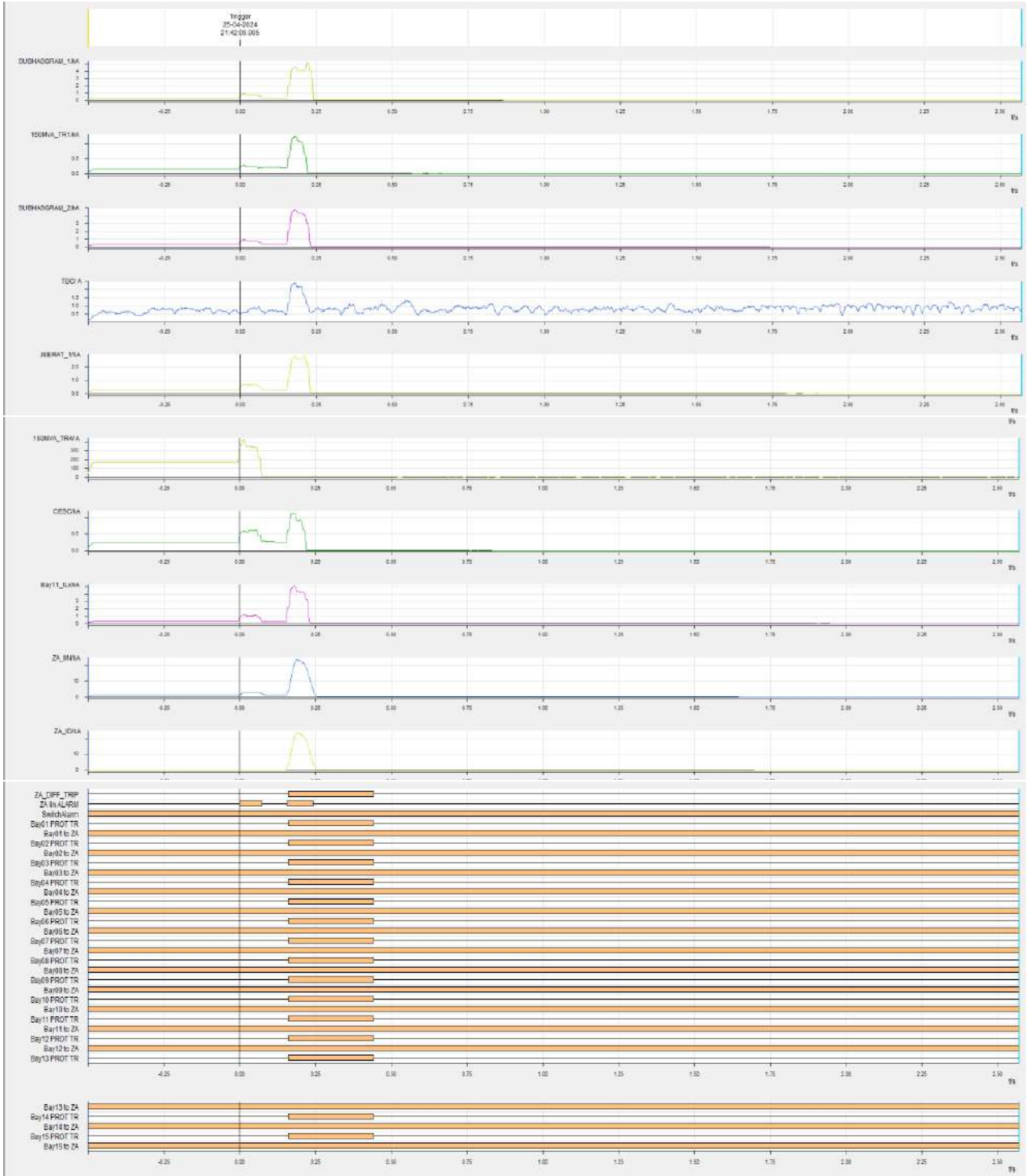
DR of 220 kV Subhashgram-Kasba-1 (Kasba)



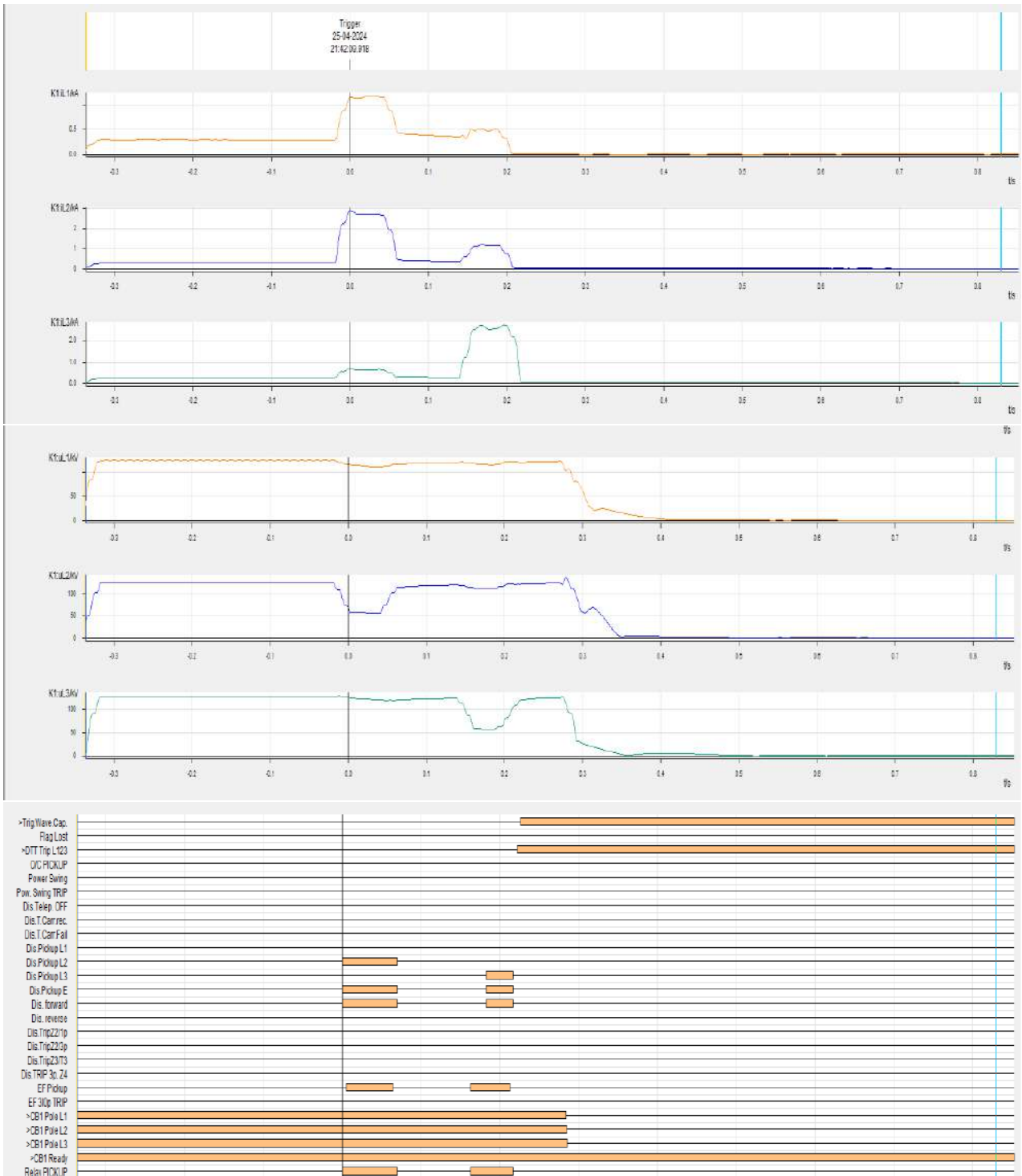
DR of 220 kV Subhashgram-Kasba-1 (Subhashgram)



220 kV Bus Bar at Kasba



DR of 220 kV Barasat-Kasba-1 (Barasat)




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पूर्वी क्षेत्र के 220/132 केवी कसबा एस/एस में ग्रिड घटना की विस्तृत रिपोर्ट / Detailed Report of grid event at 220/132 kV Kasba S/s of Eastern Region

(To be submitted by RLDC/NLDC during Grid Disturbances/Grid Incidents/Near Miss Event as per IEGC section 37.2 (f))

(आई ई जी सी 37.2 (एफ) के अनुपालन में)

Date(दिनांक):13-05-2024

1. Event Summary (घटना का सारांश):

At 23:17 Hrs on 25.04.2024, 220 kV Kasba-subhahsgram-2 tripped on O/c with current reaching around 1180 A in each phase. Load restriction scheme is also implemented in this line which tripped 220 kV Kasba-Barast D/c and 132 kV feeders at Kasba. Thereby, 220 kV Kasba S/s became dead as 220 kV Subahshrgam-Kasba-1 was already under breakdown. CESC system got islanded. Load loss of around 489 MW occurred.

2. Time and Date of the Event (घटना का समय और दिनांक): 23:17 hrs on 25.04.2024

3. Event Category (ग्रिड घटना का प्रकार): Grid Disturbance (GD)-1

4. Location/Control Area (स्थान/नियंत्रण क्षेत्र): 220/132 kV Kasba S/s, CESC system

5. Report submitted by Utility on: 06-05-2024

6. Antecedent Conditions (पूर्ववर्ती स्थिति):

	Frequency	Regional Generation	Regional Demand	State Generation	State Demand
				West Bengal	West Bengal
Pre-Event (घटना पूर्व)	49.95 Hz	32958 MW	29782 MW	6897 MW	11895 MW
Post Event (घटना के बाद)	49.95 Hz	32686 MW	29293 MW	6625 MW	11406 MW

**Pre and post data of 1 minute before and after the event*

Important Transmission Line/Unit if under outage (महत्वपूर्ण संचरण लाइने/ विद्युत उत्पादन इकाइयां जो बंद हैं)	220 kV Subahshgram-Kasba-1 (Under breakdown)
Weather Condition (मौसम स्थिति)	Normal

Load and Generation loss (लोड और जेनरेशन हानि): Approximate load loss of 489 MW at Salt Lake, Sonarpur & CESC area of West Bengal.

7. Duration of interruption (रूकावट की अवधि): 00:09 Hrs

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

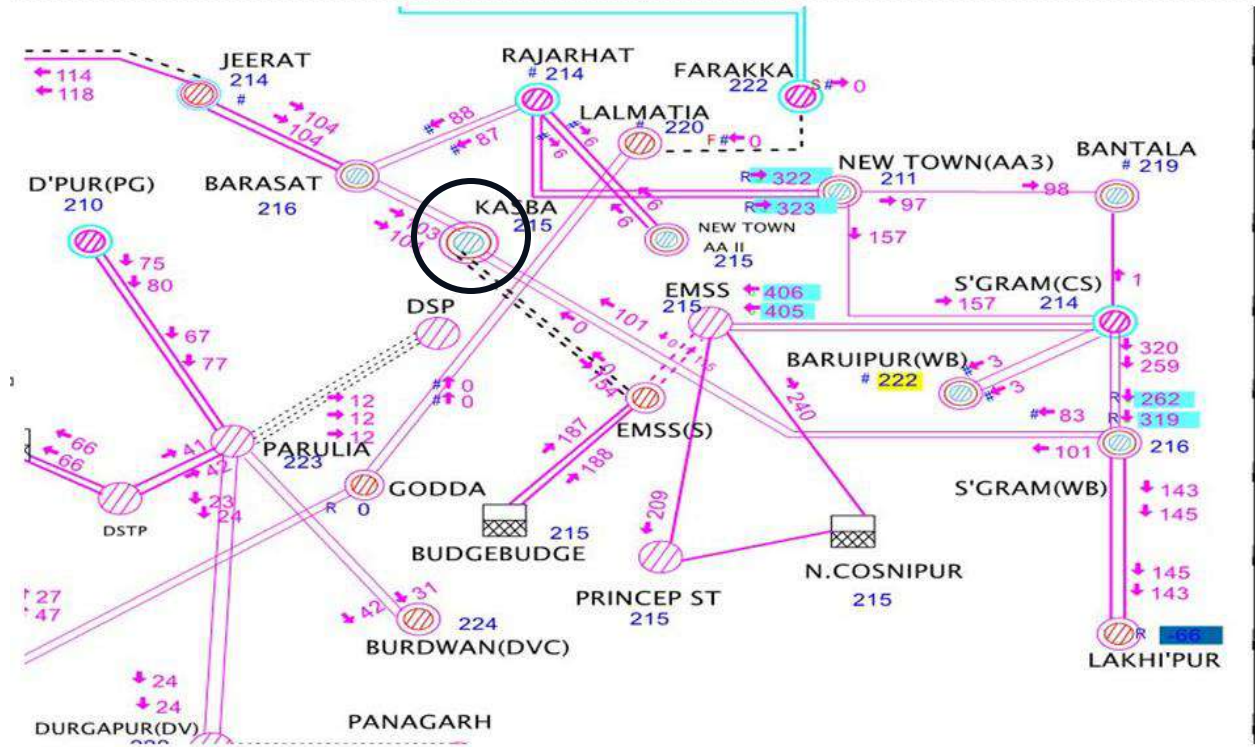


Figure 1: Network across the affected area

9. Details of Equipment Failure (if any during the event) (उपकरण विफलता का विवरण): NA

10. Major Elements Tripped (प्रमुख ट्रिपिंग):

क्र०सं०	नाम	Trip time (hh:mm:ss)	उप केंद्र 1 रिले संकेत	उप केंद्र 2 रिले संकेत	Restoration time
1	220 kV Subhahsgram-Kasba-2	23:17:23	Subhahsgram: O.c, I _r =I _y =I _b =1.19 kA	Kasba: Didn't trip	23:25
2	220 kV Barasat-Kasba D/c	23:17:19	Kasba: Tripped as per LRS	-	23:26
3	220 kV Kasba-EM South D/c	23:17:25	-	-	23:29

12. Event Analysis (Based on PMU, SCADA & DR) (घटना का विश्लेषण):

- At 23:17:16 Hrs, flow of each ckt. of 220 kV Kasba-EMSS South D/c suddenly jumped from 125 MW to around 200 MW each. This led to increase in flow of 220 kV Subhashgram-Kasba-2 (Ckt-1 was under breakdown).
- Condition for Load Restriction Scheme which is set at 695 A in any ckt. of the 220 kV Subhashgram-Kasba D/c was satisfied and 220 kV Barasat-Kasba D/c and 132 kV Kasba-Sonarapur D/c, 132 kV Kasba-Salt Lake D/c tripped at 23:17:19 Hrs.
- At 23:17:23 Hrs, 220 kV Subhashgram-Kasba-2 tripped from Subhashgram on O/c. Current in each phase reached around 1190 A.
- Power flow reversed in 220 kV Kasba-EMSS South D/c and started feeding remaining 132 kV load at Kasba.
- At 23:17:25 Hrs, 220 kV Kasba-EMSS South D/c tripped at Kasba and Kasba S/s became dead. CESC system got islanded at this instance.

PMU Snapshot:



Figure 2: PMU Voltage snapshot of 220 kV Kasba S/S

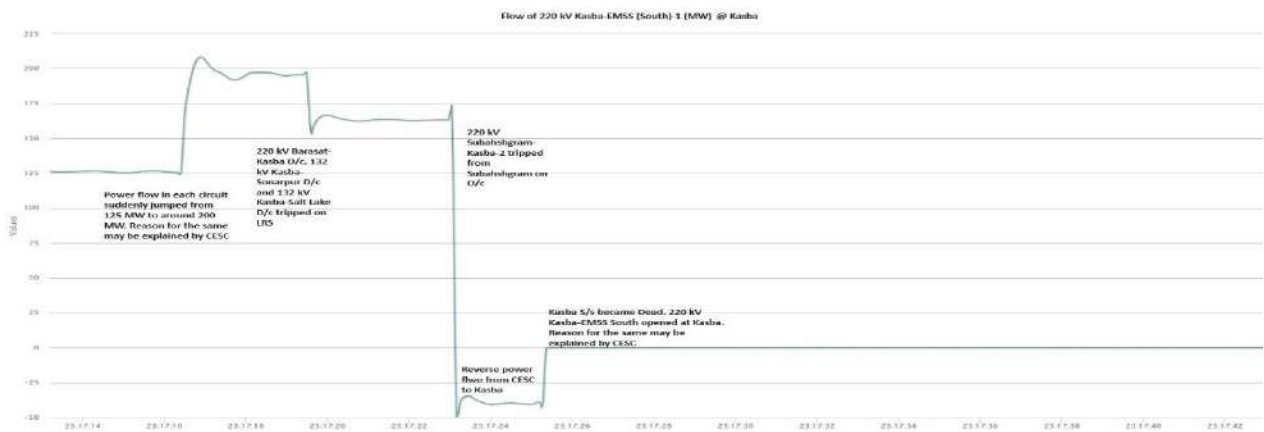


Figure 3: PMU snapshot of flow of 220 kV Kasba-EMSS South-1 @ Kasba (MW)

CESC Island:

- After islanding, CESC demand reduced to around 1900 MW from 2300 MW. Island frequency shot up to 51.4 Hz due to load generation imbalance.

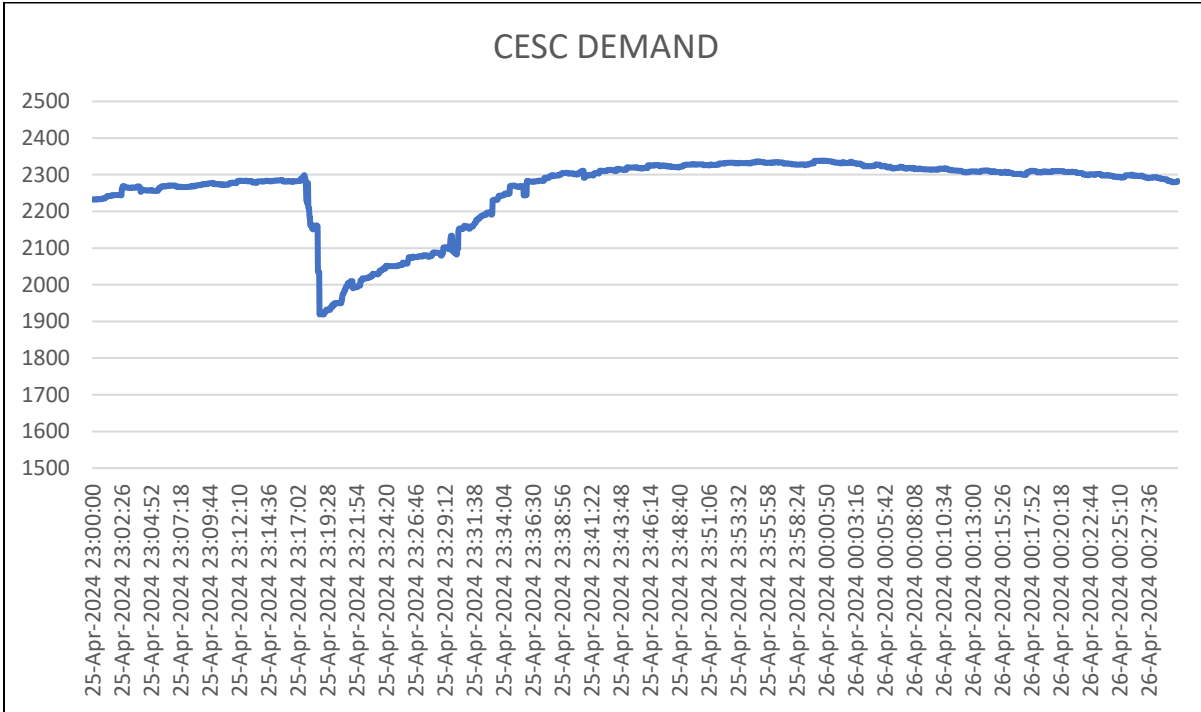


Fig 4: SCADA Plot of CESC Demand

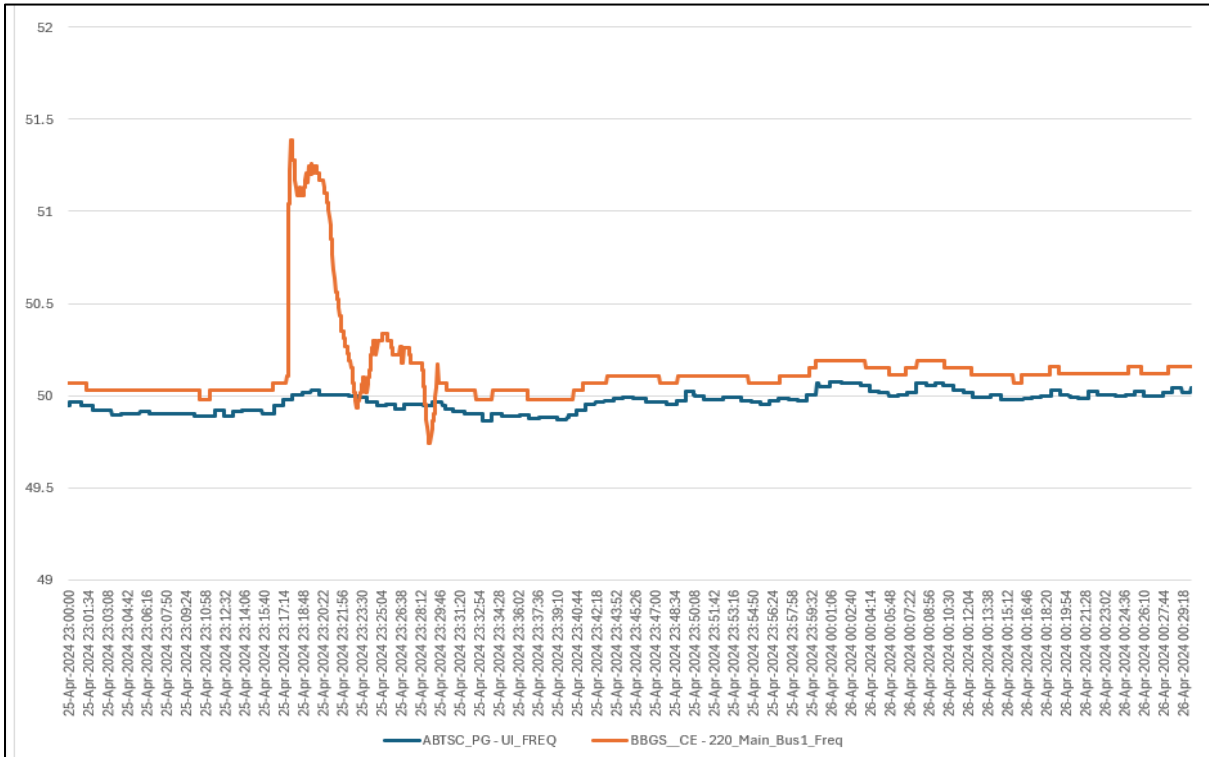


Fig 5: System frequency Vs Island frequency during the disturbance

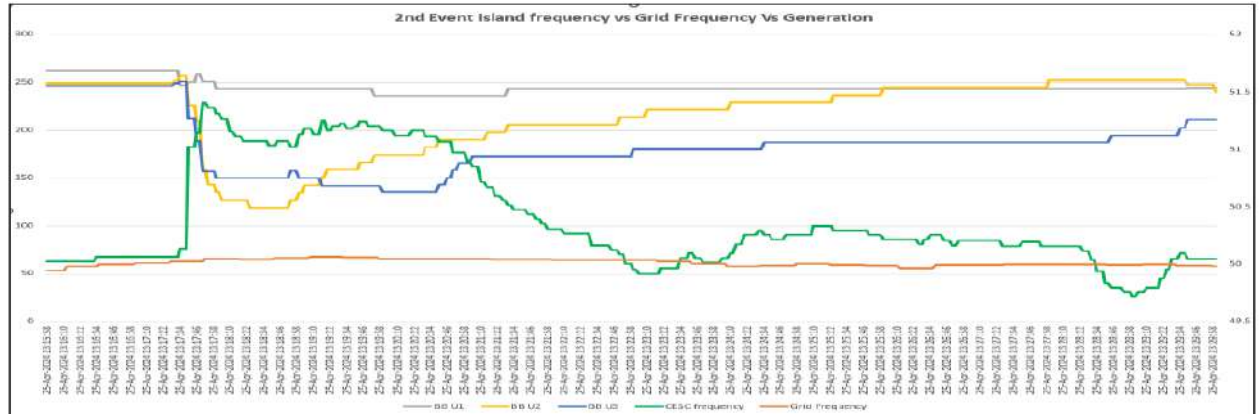


Fig 6: System frequency Vs Island frequency Vs Budge Budge generation during the disturbance

13. Protection/Operational issues observed (सुरक्षा/परिचालन संबंधी समस्या):

- Reason for the sudden increase in flow of 220 kV Kasba-EMSS South D/c at 23:17:16 Hrs may be explained by CESC.
- Load restriction scheme currently also trips 220 kV Kasba-Barasat D/c which is presently feeding Kasba S/s and providing relief to loading of 220 kV Kasba-Subhashgram D/c. This scheme may be reviewed for the present configuration.
- O/c has been kept for 220 kV Subahshgram-Kasba D/c. Whether Main-1 & Main-2 scheme is not available for this line. WBSETCL may explain.
- Reason for tripping of 220 kV Kasba-EMSS South D/c may be explained by CESC.

14. Action Taken/Remedial Measures (सुधारात्मक उपाय):

- Few Sub-stations around the metropolitan city of Kolkata have Single Main and Transfer scheme at 220 kV. Planning may be done for double main and transfer scheme on priority basis.

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

S.No.	Issues	Regulation Non-Compliance	Utilities
1.	DR/EL not provided within 24 Hours	1. IEGC section 37.2 (c) 2. CEA grid Standard 15.3	WBSETCL, CESC

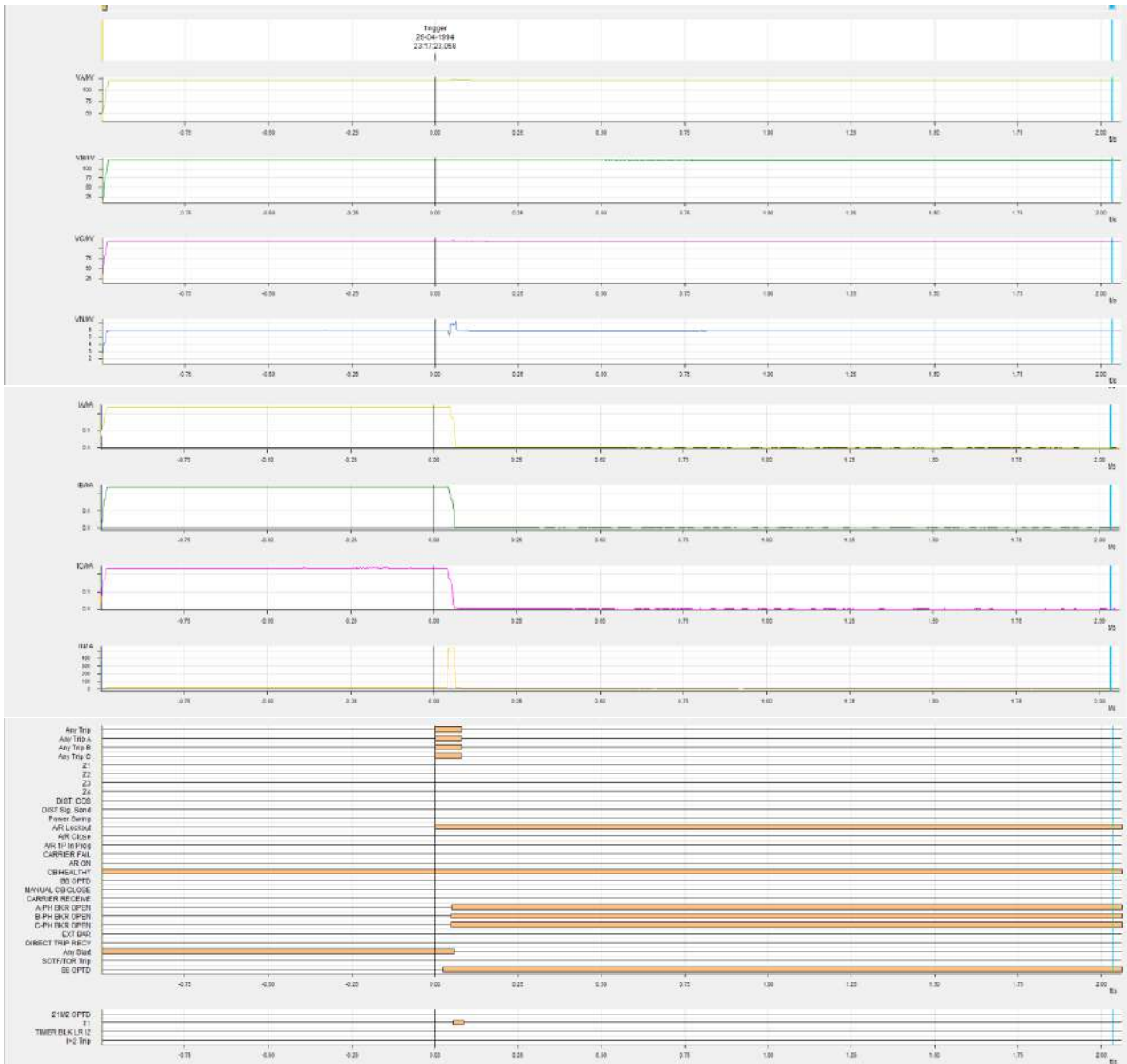
16. Key Lessons Learnt (प्रमुख अधिगम बिंदु): Nil

Annexure 1: (Sequence of Events-As per ERLDC SCADA)

SoE data not available in ERLDC SCADA.

Annexure 2:

DR of 220 kV Subahshgram-Kasba-2 (Subhahsgram)




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पूर्वी क्षेत्र के 220/132 केवी चतरा उपकेंद्र में ग्रिड घटना की विस्तृत रिपोर्ट / Detailed Report of grid event at 220/132 kV Chatra Substation of Eastern Region

(To be submitted by RLDC/NLDC during Grid Disturbances/Grid Incidents/Near Miss Event as per IEGC section 37.2 (f))

(आई ई जी सी 37.2 (एफ) के अनुपालन में)

Date(दिनांक):13-05-2024

1. Event Summary (घटना का सारांश):

At 14:05 Hrs on 06.04.2024, 220kV Chatra-Latehar-1 tripped from Latehar end only in Zone-2. At the same time 220kV Chatra-Daltonganj-1 tripped in Zone-4 from Chatra end. This led to complete power failure at 220kV Chatra S/S with approximate load loss of around 40 MW. At 15:01 Hrs, 220kV Chatra-Latehar was charged, and power was restored at Chatra S/s.

2. Time and Date of the Event (घटना का समय और दिनांक): 14:05 hrs of 06.04.2024

3. Event Category (ग्रिड घटना का प्रकार): Grid Disturbance (GD)-1

4. Location/Control Area (स्थान/नियंत्रण क्षेत्र): Jharkhand

5. Report Submitted on: Not submitted yet

6. Antecedent Conditions (पूर्ववर्ती स्थिति):

	Frequency	Regional Generation	Regional Demand	State Generation	State Demand
				WB	WB
Pre-Event (घटना पूर्व)	50.01 Hz	27564 MW	26265 MW	316 MW	1605 MW
Post Event (घटना के बाद)	50.03 Hz	27564 MW	26225 MW	316 MW	1565 MW

**Pre and post data of 1 minute before and after the event*

Important Transmission Line/Unit if under outage (महत्वपूर्ण संचरण लाइने/ विद्युत उत्पादन इकाइयां जो बंद हैं)	Nil
Weather Condition (मौसम स्थिति)	Normal weather

7. Load and Generation loss (लोड और जेनरेशन हानि): Approximate load loss of 40 MW at Chatra (JH) area.

8. Duration of interruption (स्कावट की अवधि): 00:56 Hrs

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

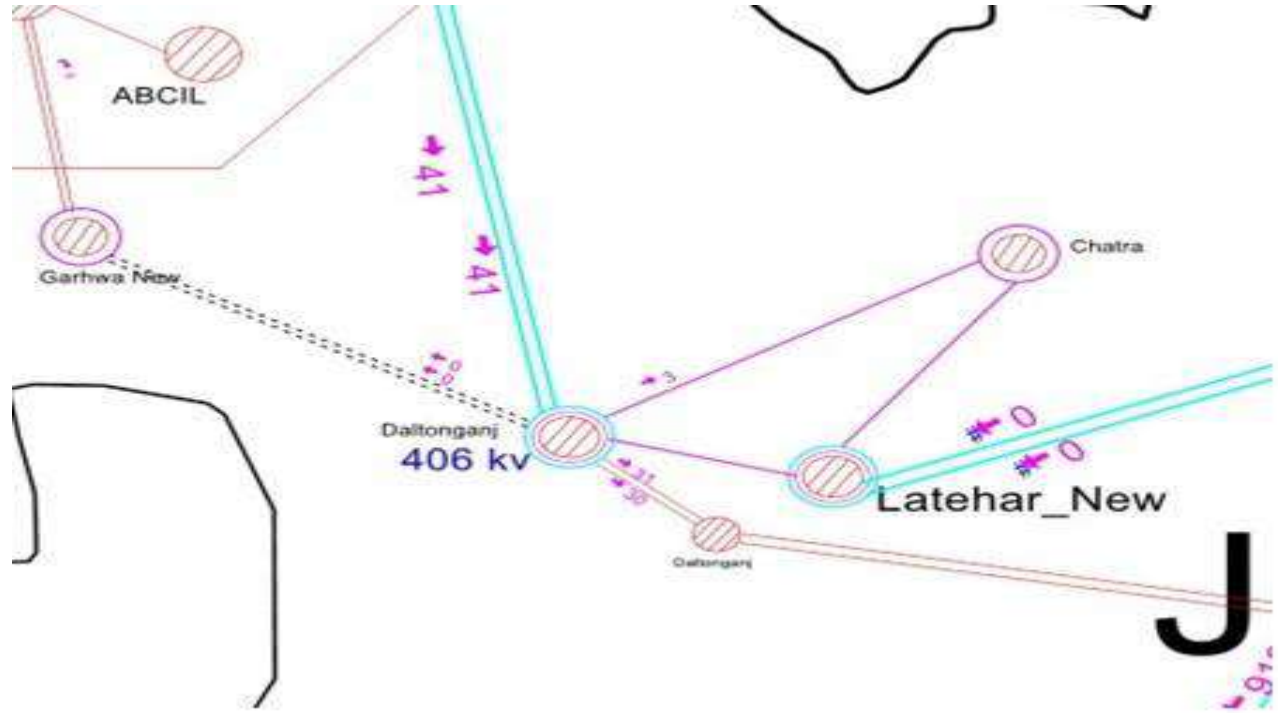


Figure 1: Network across the affected area

10. Details of Equipment Failure (if any during the event) (उपकरण विफलता का विवरण): NA

11. Major Elements Tripped (प्रमुख ट्रिपिंग)

क्र०स०	नाम	Trip time (hh:mm:ss)	उप केंद्र 1 रिले संकेत	उप केंद्र 2 रिले संकेत	Restoration time
1	220 kV Daltonganj-Chatra-1	14:05:13	Daltonganj: Didn't trip	Chatra: R_N, Zone-4	15:08
2	220 kV Chatra-Latehar-1		Daltonganj: Didn't trip	Latehar: R_N, Zone-2	15:01

12. Event Analysis (Based on PMU, SCADA & DR) (घटना का विश्लेषण):

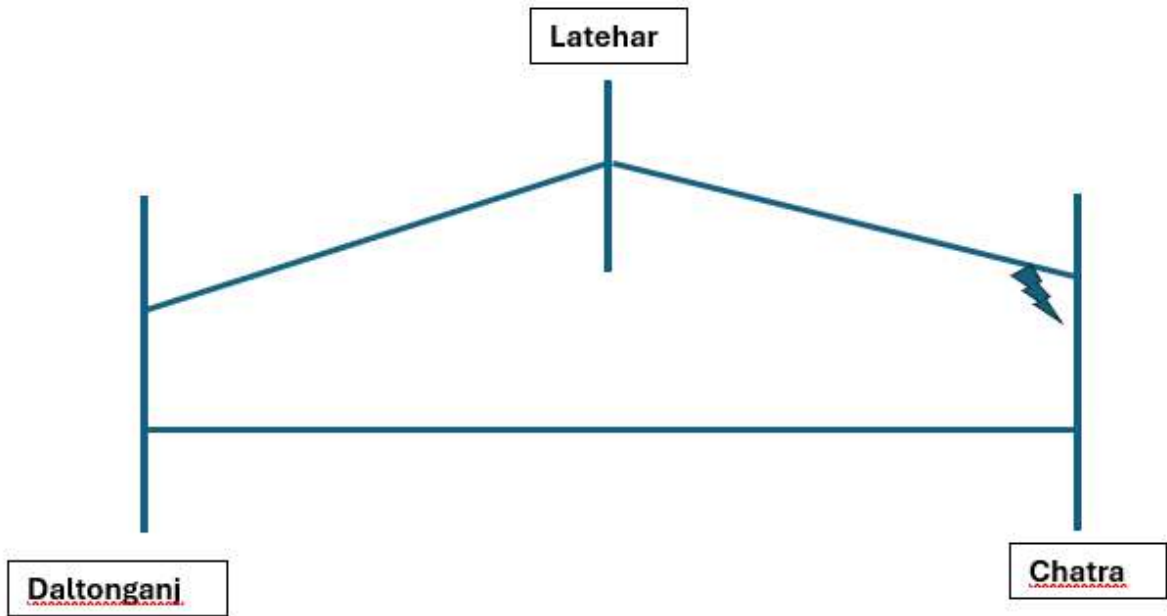


Figure 2: Schematic Network diagram

- As per relay indications available, it seems fault was in 220 kV Chatra-Latehar-1, close to Chatra.
- This fault was not cleared from Chatra end and fault persisted for around 500 msec. Thereafter, 220 Latehar-Chatra-1 tripped from Latehar end in Zone-2 and 220 kV Daltonganj-Chatra-1 tripped from Chatra in Zone-4.

PMU Snapshot:



Figure 3: PMU Frequency snapshot of 400 kV Sasaram S/s

13. Protection/Operational issues observed (सुरक्षा/परिचालन संबंधी समस्या):

- DR/EL not received yet. The inference drawn is based on PMU data and relay indications available.
- Reason for non-opening of breaker of 220 kV Latehar-Chatra-1 at Chatra may be investigated.

14. Action Taken/Remedial Measures (सुधारात्मक उपाय): Nil

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

S.No.	Issues	Regulation Non-Compliance	Utilities
2.	DR/EL not provided within 24 Hours	1. IEGC section 37.2 (c) 2. CEA grid Standard 15.3	JUSNL

16. Key Lessons Learnt (प्रमुख अधिगम बिंदु): Nil

Annexure 1: (Sequence of Events-As per ERLDC SCADA)

SoE data not available in ERLDC Scada.

Annexure 2:

DR/EL not submitted yet.


ग्रिड-इंडिया
GRID-INDIA

ग्रिड कंट्रोलर ऑफ इंडिया लिमिटेड
 (भारत सरकार का उद्यम)
GRID CONTROLLER OF INDIA LIMITED
 (A Government of India Enterprise)
 [formerly Power System Operation Corporation Limited (POSOCO)]

पूर्वी क्षेत्रीय भार प्रेषण केन्द्र / Eastern Regional Load Despatch Centre

कार्यालय : 14, गोल्फ क्लब रोड, टॉलिंगंज, कोलकाता - 700033
 Office : 14, Golf Club Road, Tollygunge, Kolkata - 700033
 CIN : U40105DL2009GOI188682, Website : www.erldc.in, E-mail : erldcinfo@grid-india.in, Tel. : 033 23890060/0061

पूर्वी क्षेत्र के 220/132 केवी प्रताप सासन उप-केन्द्र में ग्रिड घटना पर विस्तृत रिपोर्ट / Detailed Report of grid event at 220/132 kV Pratapsasan S/s of Eastern Region

(To be submitted by RLDC/NLDC during Grid Disturbances/Grid Incidents/Near Miss Event as per IEGC section 37.2 (f))

(आई ई जी सी 37.2 (एफ) के अनुपालन में)

Date(दिनांक):07-05-2024

1. Event Summary (घटना का सारांश):

At 14:22 Hrs on 23.04.2024, 220 kV Pandiabili-Pratapsasan D/c tripped due to operation of bus bar protection at Pratapsasan during some testing work, leading to total power failure. Load loss of around 226 MW occurred at Pratapsasan.

2. Time and Date of the Event (घटना का समय और दिनांक): 14:22 hrs of 23-04-2024

3. Event Category (ग्रिड घटना का प्रकार): Grid Disturbance (GD)-1

4. Location/Control Area (स्थान/नियंत्रण क्षेत्र): Odisha

5. Report Submitted by utility on: 07-05-2024

6. Antecedent Conditions (पूर्ववर्ती स्थिति):

	Frequency	Regional Generation	Regional Demand	State Generation	State Demand
Pre-Event (घटना पूर्व)	50.10 Hz	26628 MW	25551 MW	3194 MW	5819 MW
Post Event (घटना के बाद)	50.11 Hz	26628 MW	25325 MW	3194 MW	5593 MW

**Pre and post data of 1 minute before and after the event*

Important Transmission Line/Unit if under outage महत्वपूर्ण संचरण लाइने/ विद्युत उत्पादन इकाइयां जो बंद है	Nil
Weather Condition (मौसम स्थिति)	Normal

7. Load and Generation loss (लोड और जेनरेशन हानि): Generation loss: Nil; Load loss: 226 MW

8. Duration of interruption (रूकावट की अवधि): 00:16 Hrs

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

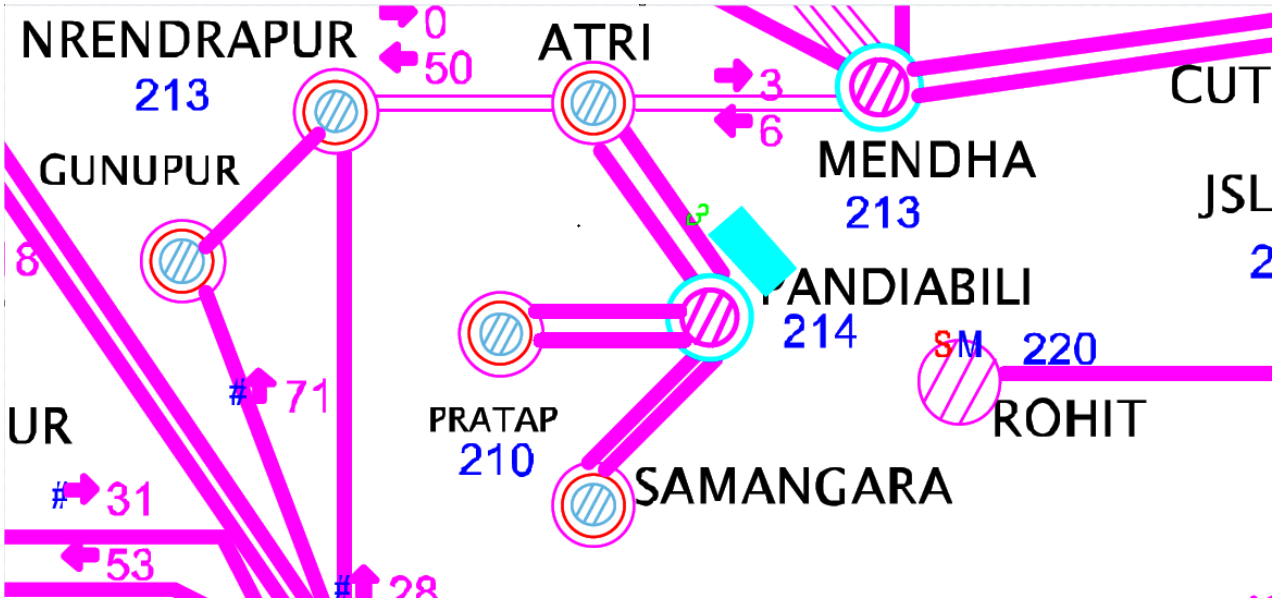


Figure 1: Network across the affected area

10. Details of Equipment Failure (if any during the event) (उपकरण विफलता का विवरण): NA

11. Major Elements Tripped (प्रमुख ट्रिपिंग):

क्र०स०	नाम	Trip time (hh:mm)	उप केंद्र 1 रिले संकेत	उप केंद्र 2 रिले संकेत	Restoration time
1	220 kV Pandiabili-Pratapsasan-1	14:22	Bus Bar Protection Operated		14:38
2	220 kV Pandiabili-Pratapsasan-2				14:38
3	220/132 kV ICT-1 & 2 at Pratapsasan				14:38/14:39

12. Event Analysis (Based on PMU, SCADA & DR) (घटना का विश्लेषण):

- At 14:22 Hrs, 220 kV Bus-1 & Bus-2 at Pratapsasan tripped on operation of bus bar protection leading to total power failure at Pratapsasan.
- No fault was observed from PMU. As reported, some testing was going on at Pratapsasan and during which both bus at Pratapsasan tripped.

- As reported by OPTCL, the fibre optic ring b/w 87A, 87B, 87C was found broken, thereby, isolator and breaker status was unavailable to the bus bar relay and thereafter bus bar protection operated. There was no rise in differential current.
- As reported, some testing work was going on. OPTCL may confirm whether this event occurred during some testing. Report received from OPTCL is attached.

13. Protection/Operational issues observed (सुरक्षा/परिचालन संबंधी समस्या):

- Both bus at Pratapsasan tripped without any fault in the system. Bus bar protection operated due to unavailability of breaker and isolator status which is not desirable. In such situation, differential protection itself gets disabled.
- As reported, Bus coupler was in switched off condition at Pratapsasan. The reason for the same may be explained by OPTCL.

14. Action Taken/Remedial Measures (सुधारात्मक उपाय):

- OPTCL has taken up with OEM for modification in relay logic to avoid such situation in future.

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

S.No.	Issues	Regulation Non-Compliance	Utilities
2.	DR/EL not provided within 24 Hours	1. IEGC section 37.2 (c) 2. CEA grid Standard 15.3	OPTCL

16. Key Lessons Learnt (प्रमुख अधिगम बिंदु): Nil

Annexure 1: (Sequence of Events-As per ERLDC SCADA):

SoE data not available for the event.

Annexure 2:

DR/EL not submitted.

Annexure 3: Report by OPTCL
Flash Report by SLDC/GENERATOR/ISTS/USER/UTILITY
(As per IEGC section 5.9.5, 5.9.6 (a), (b) & (c))

1. Name of the reporting entity: OPTCL
2. Date and time of the Incident: 23.04.2024, 14:22 Hrs
3. Antecedent Conditions (Just Prior to Event):
 - a. Frequency:50Hz
 - b. Demand/Generation Met: 217.2 MW
 - c. Lines/units/elements under shutdown: Nil
4. Details of tripping (Along with cause of the event and relay flag, whatever available):

Sl. No.	Area/ Region	Loss of Load(MW)	Loss of Generation(MW)
1	220KV, 132KV & 33KV Load loss	Load data attached below	Load data attached below

Transmission/Generation Elements tripped during event: *BB-BUSBAR

Sl. No.	Name of the Element	Tripping Time	Restoration Time	Relay Indication (if available)	Extra Info
1	220KV Pratapsasan-Pandiabili ckt-1	14:22 Hrs/ 23.04.2024	14:38 Hrs/ 23.04.2024	No Indication	NA
2	220KV Pratapsasan-Pandiabili ckt-2	14:22 Hrs/ 23.04.2024	14:38 Hrs/ 23.04.2024	No Indication	NA
3	220/132kv 160MVA Auto-1	14:22 Hrs/ 23.04.2024	14:38 Hrs/ 23.04.2024	No Indication	NA
4	220/132kv 160MVA Auto-2	14:22 Hrs/ 23.04.2024	14:39 Hrs/ 23.04.2024	No Indication	NA
5	220KV Bus-coupler	Already in Open Condition			

5. Action Taken/Remedial measures taken: After thorough investigation of busbar relay the fibre optic ring found broken between 87 A , 87 B, 87 C. Due to broken ring the isolator and CB status was unavailable to the busbar relay. From DR we found that, there is no rise in differential current, also no initiation from LBB side. We have consulted M/S GE regarding the issue and the protection block logic need to be modified for isolator and CB status unavailability.

6. Restoration details: After resetting the Bus Bar relay, first the supply restored from 220KV Pandiabili-1&2, then Auto Transformer-1 & 2 charged first 220KV side then 132KV side. Then consequently all 132KV & 33KV feeders & Transformers charged.

7. Duration of the disturbance: 14:22 Hrs to 14:39 Hrs

Copy to: MS,
ERPC, SCE

Load Data of 220kv GSS Pratapsasan on Dt.23.04.2024 (Before and After Fault)

Sl. No.	Name of the 220KV feeders	Load Flow in MW		Remarks
		Before fault	After fault	
		During 14:00Hrs	During 15:00Hrs	
1	220 kv Pandiabili 1 & 2	-108MW x 2	- 109MWx 2	

Note: - (-) indicates import
(+) indicates export

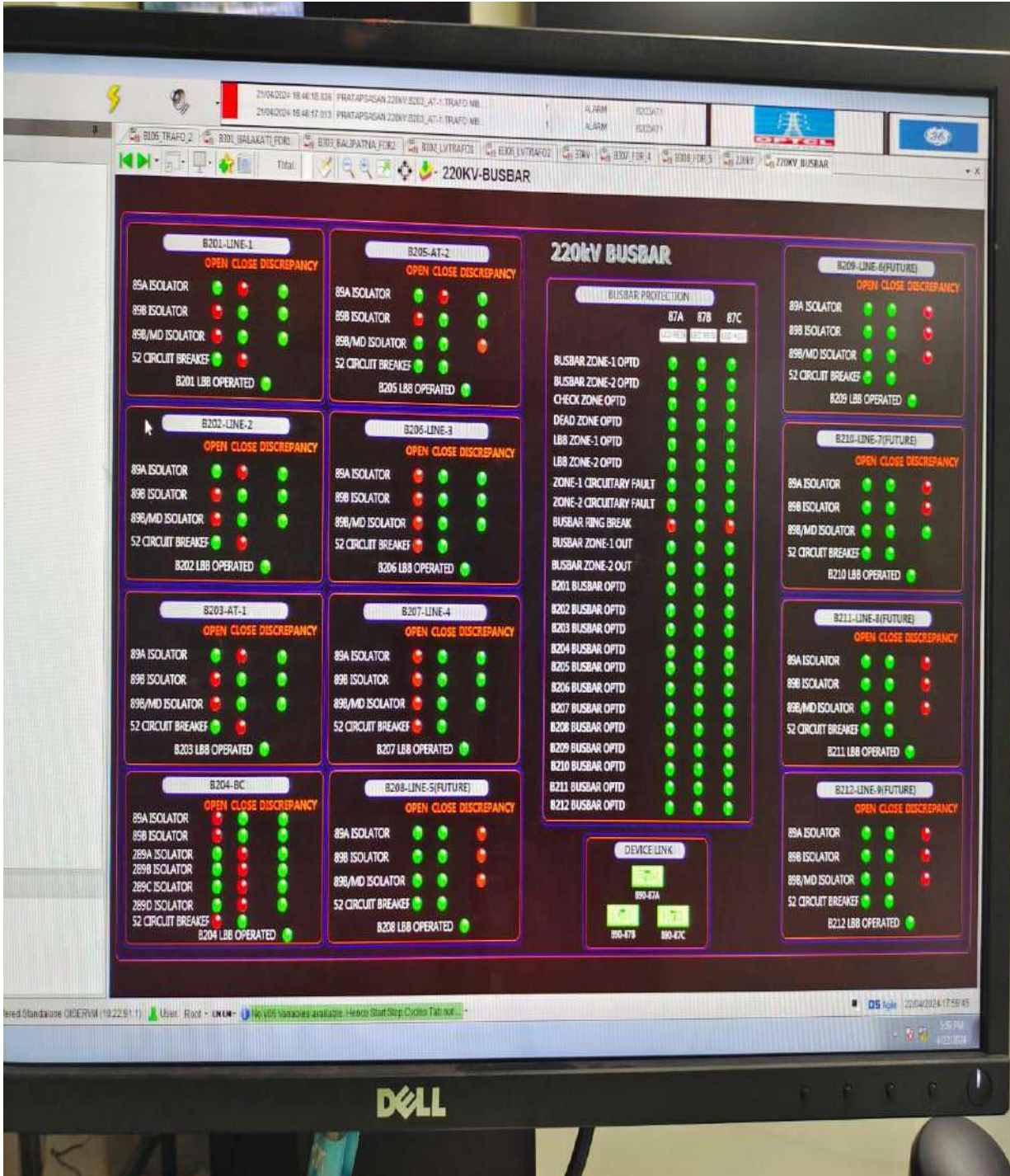
220KV Feeders BUS Arrangement

220KV Main Bus-I:

- 220KV Pratapsasan Pandiabili ckt-1
- 220KV Pratapsasan Pandiabili ckt-2
- 160MVA Auto-1
- 160MVA Auto-2

220KV Main Bus-II:

- NIL



B201-LINE-1
OPEN CLOSE DISCREPANCY

89A ISOLATOR
89B ISOLATOR
89B/MID ISOLATOR
52 CIRCUIT BREAKER
B201 LBB OPERATED

B205-AT-2
OPEN CLOSE DISCREPANCY

89A ISOLATOR
89B ISOLATOR
89B/MID ISOLATOR
52 CIRCUIT BREAKER
B205 LBB OPERATED

220KV BUSBAR

BUSBAR PROTECTION

	87A	87B	87C
BUSBAR ZONE-1 OPTD	●	●	●
BUSBAR ZONE-2 OPTD	●	●	●
CHECK ZONE OPTD	●	●	●
DEAD ZONE OPTD	●	●	●
LBB ZONE-1 OPTD	●	●	●
LBB ZONE-2 OPTD	●	●	●
ZONE-1 CIRCUTARY FAULT	●	●	●
ZONE-2 CIRCUTARY FAULT	●	●	●
BUSBAR RING BREAK	●	●	●
BUSBAR ZONE-1 OUT	●	●	●
BUSBAR ZONE-2 OUT	●	●	●
B201 BUSBAR OPTD	●	●	●
B202 BUSBAR OPTD	●	●	●
B203 BUSBAR OPTD	●	●	●
B204 BUSBAR OPTD	●	●	●
B205 BUSBAR OPTD	●	●	●
B206 BUSBAR OPTD	●	●	●
B207 BUSBAR OPTD	●	●	●
B208 BUSBAR OPTD	●	●	●
B209 BUSBAR OPTD	●	●	●
B210 BUSBAR OPTD	●	●	●
B211 BUSBAR OPTD	●	●	●
B212 BUSBAR OPTD	●	●	●

B209-LINE-6(FUTURE)
OPEN CLOSE DISCREPANCY

89A ISOLATOR
89B ISOLATOR
89B/MID ISOLATOR
52 CIRCUIT BREAKER
B209 LBB OPERATED

B202-LINE-2
OPEN CLOSE DISCREPANCY

89A ISOLATOR
89B ISOLATOR
89B/MID ISOLATOR
52 CIRCUIT BREAKER
B202 LBB OPERATED

B206-LINE-3
OPEN CLOSE DISCREPANCY

89A ISOLATOR
89B ISOLATOR
89B/MID ISOLATOR
52 CIRCUIT BREAKER
B206 LBB OPERATED

B210-LINE-7(FUTURE)
OPEN CLOSE DISCREPANCY

89A ISOLATOR
89B ISOLATOR
89B/MID ISOLATOR
52 CIRCUIT BREAKER
B210 LBB OPERATED

B203-AT-1
OPEN CLOSE DISCREPANCY

89A ISOLATOR
89B ISOLATOR
89B/MID ISOLATOR
52 CIRCUIT BREAKER
B203 LBB OPERATED

B207-LINE-4
OPEN CLOSE DISCREPANCY

89A ISOLATOR
89B ISOLATOR
89B/MID ISOLATOR
52 CIRCUIT BREAKER
B207 LBB OPERATED

B211-LINE-8(FUTURE)
OPEN CLOSE DISCREPANCY

89A ISOLATOR
89B ISOLATOR
89B/MID ISOLATOR
52 CIRCUIT BREAKER
B211 LBB OPERATED

B204-BC
OPEN CLOSE DISCREPANCY

89A ISOLATOR
89B ISOLATOR
289A ISOLATOR
289B ISOLATOR
289C ISOLATOR
289D ISOLATOR
52 CIRCUIT BREAKER
B204 LBB OPERATED

B208-LINE-5(FUTURE)
OPEN CLOSE DISCREPANCY

89A ISOLATOR
89B ISOLATOR
89B/MID ISOLATOR
52 CIRCUIT BREAKER
B208 LBB OPERATED

B212-LINE-9(FUTURE)
OPEN CLOSE DISCREPANCY

89A ISOLATOR
89B ISOLATOR
89B/MID ISOLATOR
52 CIRCUIT BREAKER
B212 LBB OPERATED

DEVICE LINK

890-47A
890-47B
890-47C





Annexure B.5.1

*Grid Disturbance at 220/132 kV
GSS Ramchandrapur on 02.04.2024
at 22:46 Hrs*

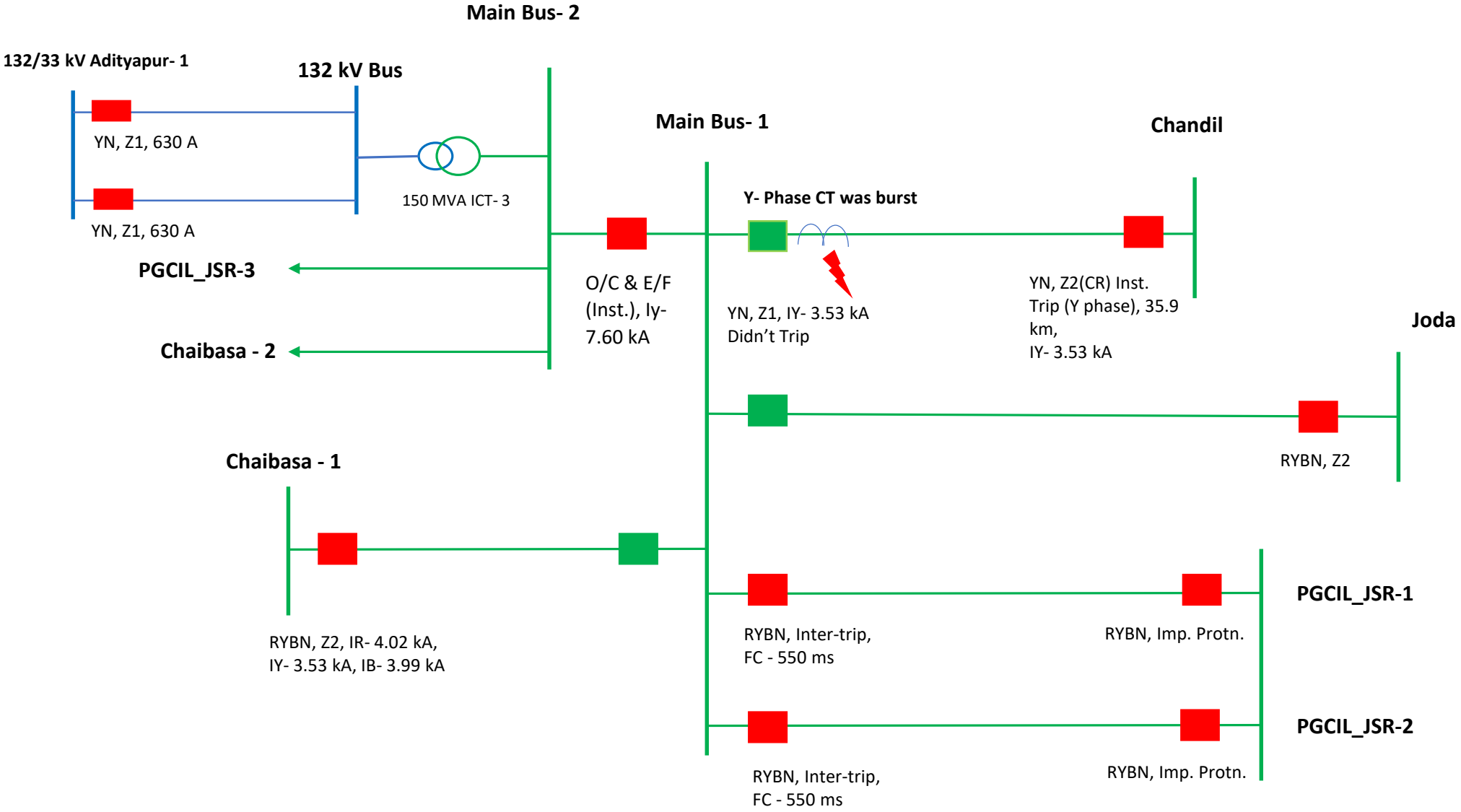
Overview of Incident :-

- ❑ Y- Phase CT of 220 kV Chandil bay got burst, the fault was sense in Z1 from Ramchandrapur end but breaker didn't trip this leads to bus fault at Bus-1 and all the elements were tripped from remote end and consequently outage of 220 kV BUS - 1.

Feeder position at the time of event -

- ❑ **Elements at Bus – 1:-** 220 kV Chandil, 220 kV Joda, 220 kV PGCIL – I & II, 220 kV Chaibasa- I, 220/132 kV ICT – I & II.
- ❑ **Elements at Bus – 2:-** 220 kV PGCIL – III, 220 kV Chaibasa- II and 220/132 kV ICT – III.

220/132 kV RAMCHANDRAPUR GSS



Analysis of the event :-

- ❑ There was YN fault due to bursting of Y- Phase CT of 220 kV Chandil bay, the fault was sense in Z1 from Ramchandrapur end but breaker didn't trip and the fault was seen in Z2 from Chandil end and Y- phase tripped instantaneously (on carrier received).
- ❑ Due to bursting of CT and non clearing fault, the fault converted to 3ph- fault after 200ms and this leads to bus fault at Bus-1.
- ❑ Due to tripping of B/C instantaneously, Bus- 2 got isolated from fault.
 - Bus Coupler Setting :-** CTR= 600/1
 - O/C Setting –** Pick Up – 8.0 A, T. Delay – 0 s, Direction – Non- dir
 - E/F Setting –** Pick Up – 1.60 A, T. Delay – 0 s, Direction – Non- dir
- ❑ Since breaker of 220 kV Chandil bay failed to clear the fault, the all 220 kV feeders were tripped from remote end in zone – 2.

Analysis of the event :-

- ❑ At the time of event Bus bar protection and LBB was out of service.
- ❑ Bus-2 PT was service at the time of event due to which there was no Z4 pick up of any of the elements. (Bus-2 got isolated within 100 ms)
- ❑ 132 kV Ramchandrapur – Adityapur d/c were tripped on Z1 from Adityapur due to power swing.

Power swing setting at Adityapur = Z2 and higher block.

Relay Indication :-

Element's Name	Relay Indication End - 1	Relay Indication End - 2	Remarks
220 kV Ramchandrapur - Chandil	YN, Z1, IY- 3.53 kA Breaker didn't Trip.	YN, Z2(CR) Inst. Trip (Y phase), 35.9 km, IY- 3.53 kA	After 600 ms, R & B tripped in pole discrepancy relay from Chandil end.
220 kV Ramchandrapur - Joda	Didn't trip.	RYBN, Z2	
220 kV Ramchandrapur - Chaibasa- 1	Didn't trip.	RYBN, Z2, IR- 4.02 kA, IY- 3.53 kA, IB- 3.99 kA	
220 kV Ramchandrapur – PGCIL (JSR) - 1	RYBN, Inter-trip, FC - 550 ms	RYBN, Imp. Protn.	
220 kV Ramchandrapur – PGCIL (JSR) - 2	RYBN, Inter-trip, FC - 550 ms	RYBN, Imp. Protn.	
220 kV Bus Coupler	O/C & E/F (Inst.), Iy- 7.60 kA		
132 kV Ramchandrapur – Adityapur - 01	Didn't trip.	YN, Z1, 630 A (tripped inst.)	
132 kV Ramchandrapur – Adityapur - 02	Didn't trip.	YN, Z1, 630 A (tripped inst.)	

Protection issues observed during the event -

- Breaker of 220 kV Ramchandrapur – Chandil bay at Ramchandrapur didn't trip.

The tripping circuit and relay was tested on 04.04.2024 but no discrepancies were observed. However, DC +ve supply was found fully earthed.

- Bus bar protection and LBB was kept off at the time of event due to defective R and Y phase central unit.
- No Z4 pick up observed during the event due to PT supply from Bus-2 which got isolated within 100 ms.

List of important transmission lines in ER which tripped in April-2024

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 END	DR/EL RECEIVED FROM REMOTE END	LOCAL END UTILITY	REMOTE END UTILITY	UTILITY RESPONSE
1	400KV-BINAGURI-BONGAIGAON-1	03-04-2024	15:34	03-04-2024	17:02	Binaguri: DT Received		No fault	NA	DT received at Binaguri. No fault in line. PG ER-2 may share details of the event.		Yes	NA	PG ER-2	NER	Sudden rise in voltage at Bongaigaon end due to some CVT issue. O/V St.1 operated at Bongaigaon and DT received at Binaguri.
2	400KV-DARBHANGA (DMTCL)-MUZAFFARPUR-2	07-04-2024	12:03	07-04-2024	12:20	Darbhanga : B-N,Z-1.,49 km, 4.64 kA	Muzaffarpur: A/R successful,B-N, 31.3 km,7.5 kA	B-Earth	100	A/r successful from Muzaffarpur only. No A/r attempt at Darbhanga and other two phase opened after 2.5 seconds on PD.	DR of another instance uploaded by DMTCL.	Yes	Yes	DMTCL	PG ER-1	Signal not received in BCU @ Darbhanga. Issue rectified.
3	400KV-MENDHASAL-PANDIABILI-1	07-04-2024	18:02	07-04-2024	19:26	Mendhasal : Y_N	Pandiabili End: Y-N, 10.2 KA, 0.5 Km	Y-Earth	100	A/r successful at Pandiabili. No A/r attempt at Mendhasal. All three phase tripped during the fault.		No	Yes	OPTCL	PG Odisha	M1 relay BO masking was not proper at Mendhasal. Rectified.

4	765KV-ANGUL-JHARSUGUDA-1	17-04-2024	09:15	17-04-2024	10:07	Tripped due to 708 Tie LBB operated at Angul. Dia element i.e. 765/400 kV ICT-2 also tripped	Jharsuguda: DT received			PG Odisha may explain.							Yes	Yes	PG Odisha	PG Odisha	765KV-Jharsuguda-Angul Ckt#2 switched off at 09:15hrs from Jharsuguda end. At the same time i.e 09:15 hrs, 765KV-Jharsuguda-Angul Ckt#1 and ICT 2 tripped. Both 765KV-Jharsuguda-Angul Ckt#1 and ICT # 2 are in the same Dia of 765kV Bus arrangement. As per preliminary report of site, this is due to malfunctioning of single ph trip relay (21.1XY2) used for LBB initiation. LBB initiation was
5	220KV-DEHRI-GAYA-2	18-04-2024	13:46	18-04-2024	15:52	Dehri : B-N, 1.007 KA	Gaya: B_N, 36.6 KM, 3.7 KA			A/r failed after 1 second. Y_ph breaker at Dehri didn't open during failed A/r attempt. It opened after 3 seconds. BSPTCL may explain							Yes	Yes	BSPTCL	PG ER-1	Delayed opening of breaker observed. Shutdown planned in last week of the month to check the issue.
6	220KV-RENGALI(OPTCL)-RENGALI-1	20-04-2024	18:52	20-04-2024	20:22	Rengali (OPTCL): R Y B N , Over Current, Ia = 1.055 kA, Ib= 5.677 kA, Ic =1.640 kA	Rengali (PG): Not Tripped	Y-Earth		Non-directional hi-set O/c was enabled at Rengali (OPTCL) end. Y-Ph CT blast of 220 kV Deogharh feeder at Rengali (OPTCL).							Yes	NA	OPTCL	PG Odisha	O/c hi-set kept due to non-availability of bus bar protection. Time delay increased to 100 msec.
7	220KV-KHAGARIA-NEW PURNEA-1	21-04-2024	13:52	21-04-2024	14:38	Khagaria - B_N, 76.8 km, Ib-1.37 kA	New Purnea: B_N, 51.37 Km, 1.86 KA			Resistive fault. A/r attempted after 700 msec from Khagaria and this time fault was seen in Zone-2 and line tripped in Zone-2 after 450 msec.	DR length less at New Purnea						Yes	Yes	BSPTCL	PG ER-1	PLCC expected to be commissioned by the next month
8	220KV-KHAGARIA-NEW PURNEA-1	21-04-2024	14:46	21-04-2024	18:48		New Purnea:-B-N, 48.7 km, 1.9kA			Resistive fault. A/r attempted after 700 msec from Khagaria and this time again resistive fault was there which was cleared in around 500 msec.	DR length less at New Purnea						Yes	Yes	BSPTCL	PG ER-1	PLCC expected to be commissioned by the next month

9	400KV-KODERMA-BOKARO-1	23-04-2024	19:56	23-04-2024	21:13	Koderma: B_N	Bokaro: B-N, FC: 9.26 kA			No A/r attempt at Koderma. Other two phase tripped after 1.5 seconds. A/r successful at Bokaro and tripped again within reclaim time.	DR length less at Koderma						PLCC issue @ Koderma. BPL make panels are planned to be replaced.
								B-Earth	100			No	No	DVC	DVC		
10	400KV-JEYPORE-GAJUWAKA-1	26-04-2024	16:26	26-04-2024	22:24	Jeypore: DT received		No fault		RPC operation from NLDC for 650MW to 400MW, during operation CB didn't open due to mechanical issue in the Circuit Breaker, hand tripped line to isolate fault. Pole 1 also tripped. PG Odisha may explain.							Line was handtripped at Gazuwaka and DT received at Jeypore.
									NA			Yes	NA	PG Odisha	SR		
11	400KV-JEYPORE-GAJUWAKA-2	26-04-2024	16:28	26-04-2024	20:30			No fault		Pole 1 tripped at 16:26 Hrs. Power then adjusted to Pole-2 , Pole-2 RPC gave a command for taking its own filter in to service, which tripped the other line on over voltage. Pole-2 tripped on NO AC Voltage. PG Odisha may explain							O/V St.1 appeared at Gazuwaka and DT received.
									NA			Yes	NA	PG Odisha	SR		

EASTERN REGIONAL POWER COMMITTEE
KOLKATA

PROTECTION PROTOCOL OF EASTERN REGION

Prepared in Compliance to

Clause 12(2) and Clause 13 of Central Electricity Regulatory
Commission Indian Electricity Grid Code Regulations, 2023

Contents

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PROTECTION PROTOCOL OF EASTERN REGION

1. Background

1.1. The Protection Protocol of Eastern region is prepared in accordance with Clauses 12(2) & 13 of the Indian Electricity Grid Code, 2023 (IEGC 2023) notified by the Central Electricity Regulatory Commission.

1.1.1. The clause 12(2) of the IEGC 2023:

“There shall be a uniform protection protocol for the users of the grid:

- a) for proper co-ordination of protection system in order to protect the equipment/system from abnormal operating conditions, isolate the faulty equipment and avoid unintended operation of protection system;*
- b) to have a repository of protection system, settings and events at regional level;*
- c) specifying timelines for submission of data;*
- d) to ensure healthiness of recording equipment including triggering criteria and time synchronization; and*
- e) to provide for periodic audit of protection system.”*

1.1.2. The clause 13 of the IEGC 2023:

“13. Protection protocol

- (1) All users connected to the integrated grid shall provide and maintain effective protection system having reliability, selectivity, speed and sensitivity to isolate faulty section and protect element(s) as per the CEA Technical Standards for Construction, the CEA Technical Standards for Connectivity, the CEA (Grid Standards) Regulations, 2010, the CEA Technical Standards for Communication and any other applicable CEA Standards specified from time to time.*
- (2) Back-up protection system shall be provided to protect an element in the event of failure of the primary protection system.*
- (3) RPC shall develop the protection protocol and revise the same, after review from time to time, in consultation with the stakeholders in the concerned region, and in doing so shall be guided by the principle that minimum electrical protection functions for equipment connected with the grid shall be provided as per the CEA Technical Standards for Construction, the CEA Technical Standards for Connectivity, the CEA Technical Standards for Communication, the CEA (Grid Standards) Regulations, 2010, the CEA (Measures relating to Safety and Electric Supply)*

Regulations, 2010, and any other CEA standards specified from time to time.

- (4) *The protection protocol in a particular system may vary depending upon operational experience. Changes in protection protocol, as and when required, shall be carried out after deliberation and approval of the concerned RPC.*
- (5) *Violation of the protection protocol of the region shall be brought to the notice of concerned RPC by the concerned RLDC or SLDC, as the case may be.”*

1.2. The Protection Protocol of Eastern Region stipulates General Protection Philosophy of Protection System, Protection Schemes for Generators & various Transmission Elements in Power System, Protection Settings & their Coordination among entities, Disturbance Monitoring, Analysis and Reporting, Time Synchronization of Protection Systems, Protection Audit Plan, Performance of Protection Systems & Compliance Monitoring.

2. Applicability

The Protection Protocol of Eastern Region shall be applicable to all Eastern Regional entities, State/Central/Private Generating Companies/ Generating Stations including REGs, RHGS, integrated RE with Pumped Storage Plant (PSP), SLDCs, ERLDC, CTU, STUs, Transmission Licensees and ERPC.

3. Definitions

Words and expressions used in this Protection Protocol are defined in the Act or any other regulations specified by the Central Commission or Central Electricity Authority shall, unless the context otherwise requires, have the meanings assigned to them under the Act or other regulations specified by the Central Commission, as the case may be.

4. General Philosophy of Protection System

4.1. Protection philosophy shall be in accordance with below mentioned objectives, design criteria and other details. However, protection design in a particular system may vary depending upon judgment and experience in the broad contours of the protection philosophy. Consideration must also be given to the type of equipment to be protected as well as the importance of this equipment to the system. Further, protection must not be defeated by the failure of a single component.

4.1.1. Objectives:

The basic objectives of any protection schemes should be to:

- (i) Automatically isolate the faulty element.
- (ii) Mitigate the effect of short circuit and other abnormal conditions in minimum possible time and area.
- (iii) Indicate the location and type of fault and

- (iv) Provide effective tools to analyses the fault and decide remedial measures.

4.1.2. **Design Criteria:**

To accomplish the above objectives, the four design criteria for protection that should be considered are:

- (i) fault clearance time/speed;
- (ii) selectivity;
- (iii) sensitivity and
- (iv) reliability (dependability and security)

4.1.2.1.**Fault clearance time/speed:** To minimize the effect on customers and maintain system stability, Fault clearance time shall be as per CEA Grid Standard Regulations 2010, as amended to date.

4.1.2.2.**Selectivity:** To ensure Selectivity, coordination shall be ensured with the adjacent protection schemes including breaker failure, transformer downstream relays, generator protection and station auxiliary protection.

4.1.2.3.**Sensitivity:** To ensure Sensitivity, the settings must be investigated to determine that they will perform correctly for the minimum fault current envisaged in the system, yet remain stable during transients and power swings from which the system can recover.

4.1.2.4.**Reliability:** To ensure Reliability, two independent auxiliary direct current-supplies shall be provided for Main-I and Main-II relays. The Main-I and Main-II relays should be from two different makes or operating with different algorithm. The CB's shall have two independent trip coils and two independent trip circuits. Each protection device should trip at least one of them by independent auxiliary DC- supplies.

4.1.2.5.**Security:** To ensure Security, the protection shouldn't limit the maximum transmission capacity of the element. Distance protection in particular could cause spurious tripping due to specific grid conditions, in case of high load operation. Therefore, any special topologies must be known and considered for protection parameterization. For parallel Over Head Lines it is necessary to consider the rapid increase of load current in the healthy line when the faulty line trips and the protection operation must allow such conditions The load encroachment detection function of the relays must be used, when the highest distance zone resistance reach conflicts with the maximum transmitted load on the protected element.

4.2. All generating units shall have standard protection system to protect the units not only from faults within the units and within the Station but also from faults in sub-stations and transmission lines.

4.3. The generator, generator transformer, unit auxiliary transformer shall be provided with protection systems connected to two independent channels or groups, such that one

channel or group shall always be available for any type of fault in the generator and these transformers;

- 4.4. Protection relays shall be configured in such a way that digital input points shall not pick up due to stray voltages.
- 4.5. Protective relays shall be used to detect electrical faults, to activate the alarms and disconnect or shut down the faulted apparatus to provide for safety of personnel, equipment and system.
- 4.6. Electrical faults shall be detected by the protective relays arranged in overlapping zones of protection.
- 4.7. The protection relays for the generators, motors, transformers and the transmission lines shall generally be of numerical type.
- 4.8. All relays used shall be suitable for operation with CTs secondary rated for one ampere or five amperes as per relevant Indian Standards or International Electrotechnical Commission or Institute of Electrical and Electronics Engineers standards.
- 4.9. Relevant Indian Standards or International Electrotechnical Commission or Institute of Electrical and Electronics Engineers standards shall be applied for protection of generators, transformers and motors.

5. Protection Schemes

The electrical protection functions for equipment connected with the grid shall be provided as per the Central Electricity Authority (Technical Standards for Construction of Electrical Plants and Electric Lines) Regulations 2022 amended to date, the CEA (Technical Standards for connectivity to the Grid) Regulations 2007 amended to date, the CEA (Technical Standards for Communication System in Power System Operation) Regulations 2020 amended to date, the CEA (Grid Standards) Regulations 2010 amended to date, the CEA (Measures relating to Safety and Electric Supply) Regulations 2023 amended to date, and any other CEA standards specified from time to time.

5.1. Thermal Generating Units

The electrical protection functions for generator, generator transformer, unit auxiliary transformer and station transformer shall be provided in accordance with but not limited to the list given in **SCHEDULE-I** of CEA (Technical Standards for Construction of Electrical Plants and Electric Lines) Regulations 2022 amended to date.

5.2. Hydro Generating Units

- 5.2.1. For the generating units with a rating of more than one hundred megawatt, protection system shall be configured into two independent sets of protection (Group A and B) acting on two independent sets of trip coil fed from independent DC supplies, using separate sets of instrument transformers, and segregated cables of current transformers and voltage transformers.

5.2.2. The protection functions for Generator, Excitation Transformer, Generator Transformer, Generator and Generator Transformer, Unit Auxiliary Transformer, and Station Auxiliary Transformer shall be provided in accordance with but not limited to the list given in SCHEDULE-IV of CEA (Technical Standards for Construction of Electrical Plants and Electric Lines) Regulations 2022 amended to date except for variable speed units which will have specialized protection functions.

5.3. REGs/RHGS/BESS

Protection Schemes for Renewable Energy (RE) Power Plants of Solar power generation, Wind power generation, Battery Energy Storage System (BESS) and Hybrid of these connected with grid at voltage level above 650 volts shall be in accordance with the Central Electricity Authority (Technical Standards for Construction of Renewable Energy Power Plants) Regulations, 2023 from the date as & when these regulations are notified (Presently the finalization of these Standards by CEA is under progress).

5.4. Substations & Transmission System Elements

5.4.1. All major protection relays for the Voltage levels 66 kV and above shall be of numerical type and communication protocol shall be as per IEC-61850.

5.4.2. Grouping of Protection systems for the voltage level 66 kV and above:

- i. The protection circuits and relays shall be electrically and physically segregated into two groups each being independent and capable of providing uninterrupted protection even in the event of one of the protection group fails or taken out for maintenance.
- ii. Interconnection between these two groups shall not generally be attempted. However, such interconnection shall be kept to the bare minimum, if found absolutely necessary.

5.4.3. The protections required in respect of transmission lines, transformers, reactors and bus bars but not limited to shall be in accordance with **SCHEDULE-V** of CEA (Technical Standards for Construction of Electrical Plants and Electric Lines) Regulations 2022 amended to date.

5.4.4. **Bus Bar Protection and Local Breaker Backup Protection (breaker failure protection):**

- i) Bus bar protection and local breaker backup protection shall be provided in 220 kV and higher voltage interconnecting sub- stations as well as in all generating station switchyards.
- ii) Duplication of bus bar protection shall be done for all main buses of 400kV and above voltage class.
- iii) The bus bar protection scheme shall be centralized or distributed type and have provision for planned future expansion.

5.5. HVDC Terminals/ Stations

5.5.1. Classical HVDC Terminals/ Stations

- i) HVDC system protection shall consist of two parts:

(A) AC side protection:

AC side protection function shall cover the zone for converter transformer, AC filters, shunt capacitors, shunt reactors, and bus bars. These protections shall generally follow the same philosophy as in a typical substation i.e. detection of fault by relay and tripping of circuit breaker.

(B) DC side protection:

DC side protection shall cover the zones consisting of the valve hall, DC switchyard including smoothing reactor and DC filters, DC line, DMR line / electrode line and ground electrode. The protection equipment shall be designed to be fail safe and shall ensure high security to avoid mal-operation/ unwanted shutdown due to protection equipment failures.

- ii) Following a DC Line fault, the HVDC System shall have the facility to restart, one or more times, the faulted pole at a variable pre-selected DC voltage level(s), not below 80% of the nominal voltage rating. The DC transmission system shall be capable of recovery in a controlled and stable manner without commutation failures during recovery following ac and dc system faults. The post fault power order shall be equal to the pre-fault power order unless AC/ DC systems dictate otherwise.
- iii) Protection system required in respect of Classical HVDC Terminals/ Stations but not limited to shall be in accordance with 13 (b) of Part A of **SCHEDULE-VI** of CEA (Technical Standards for Construction of Electrical Plants and Electric Lines) Regulations 2022 amended to date.
- iv) Software based controls and protection shall be used to permit flexibility in effecting modifications. Protection and controls shall be duplicated for reliability. The control & protection shall provide fast controllability of the HVDC system.

5.5.2. Voltage Source Converter (VSC) based HVDC Terminals/Stations

- i) The protection equipment shall be designed to be fail-safe and shall ensure high security to avoid mal-operation/ unwanted shutdown due to protection equipment failures.
- ii) Protection system required in respect of Voltage Source Converter (VSC) based HVDC Terminals/ Stations but not limited to shall be in accordance with 8 (b) of Part B of **SCHEDULE-VI** of CEA (Technical Standards for Construction of Electrical Plants and Electric Lines) Regulations 2022 amended to date.
- iii) Software based controls and protection shall be used to permit flexibility in effecting modifications. Protection and controls shall be duplicated for

reliability. Protection shall be provided by numerical relays to suit the requirement of the HVDC system.

5.6. Philosophy of Transmission Line Protection

5.6.1.

Sl. No.	Zone	Direction	Protected Line Reach Settings	Time Settings (in Seconds)	Remarks
1	Zone-1	Forward	80%	Instantaneous (0)	As per CEA
2a	Zone-2	Forward	For single ckt- 120 % of the protected line	0.5 to 0.6 - if Z2 reach overreaches the 50% of the next shortest line ; 0.35- otherwise	As per CEA
			For double ckt- 150 % of the protected line		As per CEA
2b	Zone-2 (for 220 kV and below voltage Transmission lines of utilities)	Forward	120 % of the protected line, or 100% of the protected line + 50% of the adjacent shortest line	0.35	As per CEA with minor changes
3	Zone-3	Forward	120 % of the (Protected line + Next longest line)	0.8 - 1.0	As per CEA
4	Zone-4	Reverse	10%- for long lines (for line length of 100 km and above) 20%- for shot lines (for line length of less than 100 km)	0.5 (Where Busbar Protection is not available: 0.25)	As per CEA

Note:

- 1) Zone-2:- Z2 Reach should not encroach the next lower voltage level.
- 2) Zone-3:- If Z3 reach encroaches in next voltage level (after considering “in-feed”), then Z3 time must be coordinated with the fault clearing time of remote end transformer.
- 3) Zone-4:- If utility uses carrier blocking scheme, then the Z4 reach may be increased as per the requirement. It should cover the LBB of local bus bar and should be coordinated with Z2 time of the all other lines.
- 4) The above settings are recommended primarily (exclusively) for uncompensated lines.

5.6.2.

<p>Lines with Series and other compensations in the vicinity of Substation</p>	<ul style="list-style-type: none"> • Zone-1: 80% of the protected line with 100ms-time delay. POR Communication scheme logic is modified such that relay trips instantaneously in Zone-1 on carrier receive. • Zone-2: 120 % of uncompensated line impedance for single circuit line. For Double circuit line, settings
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	<p>may be decided on basis of dynamic study in view of zero sequence mutual coupling.</p> <ul style="list-style-type: none"> Phase locked voltage memory is used to cope with the voltage inversion. Alternatively, an intentional time delay may be applied to overcome directionality problems related to voltage inversion. over-voltage stage-I setting for series compensated double circuit lines may be kept higher than 113%.
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5.6.3.

	Power Swing Blocking	<p>For all lines, block tripping in all zones except zone-1.</p> <p>Out of Step tripping to be applied on all inter regional tie lines. Deblock time delay = 2s</p>
	Protection for broken conductor	<p>Negative Sequence current to Positive Sequence current ratio more than 0.2 (i.e. $I_2/I_1 \geq 0.2$)</p> <p>Only for alarm: Time delay = 3-5 sec</p>
	Switch on to fault (SOTF)	<p>Switch on to fault (SOTF) function to be provided in distance relay to take care of line energization on fault</p>
	VT fuse fail detection function	<p>VT fuse fail detection function shall be correctly set to block the distance function operation on VT fuse failure.</p>
	Carrier Protection	<p>To be applied on all 220kV and above lines with the only exception of radial feeders.</p>
	Back up Protection	<p>On 220kV and above lines with 2 Main Protections:</p> <ul style="list-style-type: none"> Back up Earth Fault protections alone to be provided. No Over current protection to be applied.

		At 132kV and below lines with only one Main protection: <ul style="list-style-type: none"> • Back up protection by IDMT O/C and E/F to be applied.

5.6.4. Overvoltage Protection:

FOR 765kV LINES:	Low set stage (Stage-I): 106% - 109% (typically 108%) with a time delay of 5 seconds. High set stage (Stage-II): 140% - 150% with a time delay of 100 milliseconds.
400kV LINES/CABLE:	Low set stage (Stage-I): 110% - 112% (typically 110%) with a time delay of 5 seconds. High set stage (Stage-II): 140% - 150% with a time delay of 100 milliseconds.
FOR 220 KV LINES:	No over-voltage protection shall be used in general. If necessary, may be enabled on case-to-case basis after due approval from SLDC/ERLDC.
FOR 220 KV CABLE:	Low set stage (Stage-I): 110% - 112% (typically 110%) with a time delay of 5 seconds. High set stage (Stage-II): 140% - 150% with a time delay of 100 milliseconds.

- The lines emanating from same substation shall be provided with pick-up as well as time grading to avoid concurrent trippings. Grading to be done in such a way that inter-regional lines and lines with generation evacuation should trip last, as far as practicable.
- The overvoltage relay shall have better than 98% drop-off to pick-up ratio.
- To achieve required discrimination for OVR grading on account of limitation imposed by voltage resolution of the relay, Ph-to-Ph voltage to be used for Over Voltage detection.

5.6.5. Resistive Reach Setting

Setting for Phase-earth fault:

- a. Calculation of minimum load impedance shall be as per Ramkrishna Committee Recommendations.
- b. Maximum load current (I_{max}) may be considered as 1.5 times the thermal rating of the line or 1.5 times the associated bay equipment current rating (the minimum of the bay equipment individual rating) whichever is lower. Minimum voltage (V_{min}) to be considered as 0.85pu (85%).
- c. Minimum setting for resistive reach shall be such that it must cover fault resistance, arc resistance and the tower footing resistance.
- d. In general, maximum reach setting shall be 80% of the minimum load impedance.
- e. Utility should try to set Resistive reach setting < 4.5 times the zone reactive reach setting, however if there is any limitation from relay manufacturer's side then recommendation of OEM may be followed for maximum resistive reach setting.

Resistive reach shall be the maximum of the value determined by the above rules.

Setting for Phase-Phase fault:

- a. Calculation of minimum load impedance as per the method mentioned above for phase earth fault.
- b. Minimum setting for resistive reach shall be such that it must cover fault resistance and arc resistance.
- c. In general, the resistive reach of zone-3 is set less than 80% of minimum load impedance. For power swing consideration, a margin of DR is given. Therefore, it is essential that load should not encroach this DR. In view of this, R3ph-R4ph may be set 60% of minimum load impedance. R2ph and R1ph may be set 80% of R3ph-R4ph respectively.
- d. Utility should try to set Resistive reach setting < 3 times the zone reactive reach setting, however if there is any limitation from relay manufacturer's side then recommendation of OEM may be followed for maximum resistive reach setting.

Resistive reach shall be the maximum of the value determined by the above rules.

- e. For underground cable, as the fault mechanism and earthing resistance of sheath are different from tower footing resistance of overhead lines, the resistive reach setting of cable may be set as per OEM recommendation. However, effort shall be made to keep the setting within the above-mentioned range as far as possible honoring OEM guidelines.

5.6.6. Auto Reclosing:

The single-phase high-speed auto-reclosure (HSAR) at 220 kV level and above (except for the composite feeders: overhead plus underground) shall be implemented, including on lines emanating from generating stations. If 3-phase auto reclosure is adopted in the application of the same on lines emanating from generating stations should be studied and decision to be taken on case to case basis.

i) Scheme Special Requirements:

- a) Modern numerical relays (IEDs) have AR function as built-in feature. However, standalone AR relay or AR function of Bay control unit (BCU) for 220kV and above voltage lines may be used. For 132kV/110kV lines, AR functions built-in Main distance relay IED can be used.
- b) Fast simultaneous tripping of the breakers at both ends of a faulty line is essential for successful auto-reclosing. Therefore, availability of protection signalling equipment is a pre-requisite.
- c) Starting and Blocking of Auto-reclose Relays:

Some protections start auto-reclosing and others block. Protections which start A/R are Main-I and Main-II line protections. Protections which block A/R are:

- i. Breaker Fail Relay
- ii. Line Reactor Protections
- iii. O/V Protection
- iv. Received Direct Transfer trip signals
- v. Busbar Protection
- vi. Zone 2/3 of Distance Protection
- vii. Carrier Fail Conditions
- viii. Circuit Breaker Problems.
- ix. Phase to Phase Distance Trip
- x. AR selection switch in OFF position
- xi. Logic AR OFF in SAS
- xii. Phase Distance Start (when Auto reclosure is in progress)

When a reclosing relay receives start and block A/R impulse simultaneously, block signal dominates. Similarly, if it receives 'start' for 1-phase fault immediately followed by multi-phase fault the later one dominates over the previous one.

ii) **Requirement for Multi breaker Arrangement:**

Following schemes shall be adhered to multi-breaker arrangements of one and half breaker or double breaker arrangement:

- a) In a multi-Circuit Breaker (C.B.) arrangement one C.B. can be taken out of operation and the line still be kept in service. After a line fault only those CBs which were closed before the fault shall be reclosed.
- b) In multi-C.B. arrangement it is desirable to have a priority arrangement so as to avoid closing of both the breakers in case of a permanent fault.
- c) A natural priority is that the C.B. near the busbar is reclosed first. In case of faults on two lines on both sides of a tie C.B. the tie C.B. is reclosed after the outer C.Bs. The outer C.Bs. do not need a prioritizing with respect to each other.

iii) **Setting Criteria:**

- a) Auto reclosing requires a dead time which exceeds the de-ionising time. The circuit voltage is the factor having the predominating influence on the de-ionising time. Single phase dead time of 1.0 sec. is recommended for 765 kV, 400 kV and 220 kV system. For the lines emanating from generating stations single-phase dead time upto 1.5 sec may be adopted.
- b) According to IEC 62271-101, a breaker must be capable of withstanding the following operating cycle with full rated breaking current:

O - 0.3 s - CO - 3 min - CO

O stands for Open

CO stands for Close-Open

The rated operating cycle of the circuit breaker consisting of an opening, a holding time of 0.3 seconds, a CO cycle, a 3-minute wait, and another CO cycle.

The recommended operating cycle at 765kV, 400 kV and 220 kV is as per the IEC standard. Therefore, reclaim time of 25 Sec. is recommended.

5.7. Transmission Relay Loadability

Transmission Relay Loadability means the loading permitted in the transmission line by the relay including a security margin. The relay loadability is to be arrived in such a way as far as possible not to interfere with system operator actions, while allowing for short-term overloads, with sufficient margin to allow for inaccuracies in the relays and instrument transformers. Transmission relay do not prematurely trip the transmission elements out-of-service and allow the system operators from taking controlled actions consciously to alleviate the overload.

5.7.1. Protective relay settings shall

- i) Not limit transmission loadability;

- ii) Not interfere with system operators' ability to take remedial action to protect system reliability and;
- iii) Be set to reliably detect all fault conditions and protect the electrical network from the faults.

5.7.2. The protective functions which could trip with or without time delay, on load current i.e. load responsive phase protection systems including but not limited to:

- i) Phase distance.
- ii) Out-of-step tripping.
- iii) Switch-on-to-fault.
- iv) Overcurrent relays.
- v) Communications aided protection schemes including but not limited to:
 - Permissive overreach transfer trip (POTT).
 - Permissive under-reach transfer trip (PUTT).
 - Directional comparison blocking (DCB).
 - Directional comparison unblocking (DCUB).
- vi) Phase overcurrent supervisory elements (i.e., phase fault detectors) associated with current based, communication-assisted schemes (i.e., pilot wire, phase comparison, and line current differential) where the scheme is capable of tripping for loss of communications.

5.7.3. Each Transmission Licensee and Generating Company shall use any one of the following criteria for any specific circuit terminal to prevent its phase protective relay settings from limiting transmission system loadability while maintaining reliable protection of the Grid for all fault conditions. Relay loadability at 0.85 per unit voltage and a power factor angle of 30 degrees shall be evaluated.

- i) For Distance protection relays of transmission lines, the Zone-3 shall prevent load encroachment, considering the following criteria:
 - a) Maximum load current (I_{max}) may be considered as 1.5 times the thermal rating of the line or 1.5 times the associated bay equipment current rating (the Minimum of the bay equipment individual rating) whichever is lower.

(The rating considered is approximately 15 minutes rating of the Transmission facility).
 - b) For setting angle for load blinder, a value of 30 degree may be adequate in most cases.
 - c) The Distance protection relays shall have provision for load blinder characteristic or load encroachment detection.
- ii) For Directional Overcurrent relays, wherever used in a transmission line (132/110 kV level), the following shall be adopted:

- a) An overload alarm shall be set at 110% of the thermal rating of the line with sufficient delay. This alarm shall allow the operator to take corrective action.
- b) The Directional Overcurrent relay shall allow the line to carry 1.2 times of the thermal rating of the associated line or bay equipment (whichever is lower) at least 10 minutes.
- iii) For transformer protection relays the following shall be adopted:
 - Set the definite time transformer overload relay at 105% of the transformer ratings with sufficient delay. It shall be wired for alarm purpose only to allow the operator to take corrective action. No tripping shall be issued from this relay.
 - The back-up overcurrent relays shall use IDMT characteristics and be suitably coordinated with the upstream transmission network.
 - Install supervision for the transformer using either a top oil or simulated winding hot spot temperature element. The alarm and trip settings for these relays shall be set by individual entities based on the manufacturer's recommendation.

Thermal ratings as specified in the prevailing CEA's Manual on Transmission Planning Criterion shall be used for above requirement.

6. Protection Settings & Coordination

The purpose is to ensure system protection is coordinated among the grid connected entities. The Protection systems coordination comprises the following:

- i) Each Transmission Licensee, Load Dispatch Centre (LDC) and Generating Company shall keep themselves familiarized with the purpose and limitations of Protection System schemes applied in its area of control.
- ii) Each Transmission licensee shall coordinate its Protection System schemes with concerned transmission system, sub-transmission system and generators.
- iii) Each Generating Company shall coordinate its Protection System schemes with concerned transmission system and station auxiliaries.
- iv) Each Transmission Licensee and Generation Company shall be responsible for settings calculations for protection of elements under its ownership. It shall be the responsibility of the respective asset owner to obtain the inputs (adjacent line settings, infeed values etc.) from STU/Generating Company/ Transmission Licensee necessary for calculation of the settings.
- v) STU/Generating Company/Transmission Licensee shall provide the infeed values/latest network model to the requesting entity, within 15 days of receipt of such a request from the entity.
- vi) Each Generating Company and Transmission Licensee, for voltage levels 400kV and above and interstate lines, shall submit the protection settings as per the format

prescribed, along with the calculation sheets, co-ordination study reports and input data, in advance, to ERPC/ERLDC for every new element to be commissioned. The mentioned information shall be submitted to the ERPC/ERLDC two months in advance for all the elements proposed to be commissioned. ERPC shall furnish the approved settings within forty days from the date of submission of the settings by the entity.

- vii) The PCC of ERPC shall review the settings to ensure that they are properly coordinated with adjacent system and comply with the existing guidelines. The onus to prove the correctness of the calculated settings shall lie with the respective Transmission licensee/Generation Company. In case, the PCC feels that the adjacent transmission system settings need to be changed, in view of the new element, it shall inform the concerned entity for revision of the existing settings.
- viii) The PCC of ERPC shall review and approve the settings based on the inputs /report submitted by the entities.
- ix) The approved settings shall be implemented by the entity and proper record of the implemented settings shall be kept. The modern numerical relays have several settings for various features available in the relay. It shall be ensured that only the approved features and settings are enabled in the relay. No additional protection/setting shall be enabled without the prior approval of ERPC.
- x) Each Transmission licensee and Generating Company shall co-ordinate the protection of its station auxiliaries to ensure that the auxiliaries are not interrupted during transient voltage decay.
- xi) Any change in the existing protection settings, for voltage levels 400kV and above & interstate lines, shall be carried out only after prior approval from the ERPC. The owner entity shall inform all the adjacent entities about the change being carried out.
- xii) In case of failure of a protective relay or equipment failure, the Generating Company and Transmission Licensee shall inform appropriate SLDC/ERLDC/ERPC. The Generating Company and Transmission Licensee shall take corrective action as soon as possible.
- xiii) Each Transmission Licensee shall coordinate Protection Systems on major transmission lines and interconnections with neighbouring Generating Company, Transmission Licensee and appropriate LDC.
- xiv) ERPC in consultation with the ERLDC & Eastern Regional entities shall undertake review of the protection settings, assess the requirement of revisions in protection settings and revise protection settings, from time to time and at least once in a year. The necessary studies in this regard shall be carried out by the ERPC. The modifications/changes, if any, in protection settings shall be advised to the respective users and STUs.
- xv) ERPC shall maintain a centralized database and update the same on periodic basis in respect of their respective region containing details of relay settings for grid elements connected to 220 kV and above. ERLDC also shall maintain such database.

Respective Transmission licensee/Generating Company/Entities are responsible for ensuring to make available the implemented protection settings in the centralized database within fifteen days from the date of commissioning.

- xvi) If System Protection Schemes (SPS) is recommended to be implemented by the appropriate forum/Sub-Committee of ERPC on account of operational & system constraints, the same shall be implemented by the concerned Transmission licensee/Generating Company/Entities within the specified timelines.

7. Disturbance Monitoring, Analysis and Reporting

The Purpose is to ensure that adequate disturbance data is available to facilitate Grid event analysis. The analysis of power system disturbances is an important function that monitors the performance of protection system, which can provide information related to correct behavior of the system, adoption of safe operating limits, isolation of incipient faults,

7.1. The Disturbance Monitoring Requirements include the following:

- i) Each Transmission Licensee and Generating Company shall provide Sequence of Event (SOE) recording capability by installing Sequence of Event recorders or as part of another device, such as a Supervisory Control and Data Acquisition (SCADA) Remote Terminal Unit (RTU), a generator plants Digital (or Distributed) Control System (DCS) or part of Fault recording equipment.

This capability shall be provided at all substations and at locations to record all the events in accordance with CEA Grid Standard Regulations, 2010 amended to date. The following shall also be monitored at each location:

- a) Transmission and Generator circuit breaker positions
 - b) Protective Relay tripping for all Protection Groups that operate to trip circuit breakers identified in (a) above.
 - c) Tele protection keying and receive
- ii) In either case, a separate work station PC shall be identified to function as the event logger front end. The event logger work-station PC should be connected to UPS (Uninterrupted Power Supply).

The event logger signals shall include but not limited to

- All Circuit Breaker and isolator switching Operations
- Auxiliary supply (AC, DC and DG) supervision alarms
- Auxiliary supply switching signals
- Fire-fighting system operation alarms
- Operation signals (Alarm/Trip from all the protection relays.)
- Communication Channel Supervision Signals.
- Intertrip signals receipt and send.
- Global Positioning System (GPS) Clock healthiness.

- Control Switching Device healthiness (if applicable).
 - RTU/Gateway PC healthiness
 - All Circuit Breaker Supervision Signals.
 - Trip Circuit Supervision Signals.
- iii) Each Transmission Licensee/Generating Company/Users shall provide Disturbance recording capability for the following Elements at facilities:
- All transmission lines (Each line shall be provided with facility for distance to fault locator)
 - Autotransformers or phase-shifters connected to busses.
 - Shunt capacitors, shunt reactors.
 - Individual generator line interconnections.
 - Dynamic VAR Devices.
 - HVDC terminals.
 - Bus Bars
- iv) The Disturbance recording feature shall be enabled and configured in all the numerical relays installed. Disturbance recording system shall have minimum recording time of 3 seconds (0.5 seconds for pre-fault and 2.5 seconds for post fault).
- v) Each Generating Company shall provide Disturbance recording capability for Generating Plants in accordance with Central Electricity Authority (Technical Standards for Construction of Electrical Plants and Electric Lines) Regulations 2022 amended to date, the CEA (Technical Standards for connectivity to the Grid) Regulations 2007 amended to date.
- vi) Each Transmission Licensee and Generating Company shall record for Faults, sufficient electrical quantities for each monitored Element to determine the following:
- Three phase-to-neutral voltages. (Common bus-side/line side voltages may be used for lines.)
 - Three phase currents and neutral currents.
 - Polarizing currents and voltages, if used (As applicable).
 - Frequency (As applicable).
 - Real and reactive power (As applicable).

The Minimum parameters to be monitored in the Fault record is given at Annexure.

- vii) Each Transmission Licensee and Generating Company shall provide Disturbance recording with the following capabilities:
- The Disturbance recorders shall have time synchronization and a standard format for recording analogue and digital signals (DR labels to be standardized

as per the Report of FOLD Working Group - 3 on DR Parameter Standardization). The data files shall be capable of being viewed, read, and analyzed with a generic COMTRADE analysis tool as per the latest revision of IEEE Standard C37.111.

- Each Fault record duration and the trigger timing shall be settable and set for a minimum 3 second duration including 0.5 seconds for pre-fault and 2.5 seconds for post fault
 - Each Fault recorder shall have sampling frequency of 1 kHz or better.
 - Each Fault recorder shall be set to trigger for at least the following:
Internal protection trip signals, external trigger input and additional triggers may be assigned as necessary.
- viii) Each Transmission Licensee and Generating Company shall keep the recording instruments (disturbance recorder and event logger) in proper working condition and shall establish a maintenance and testing program for Disturbance Recorder (DR) that includes
- Maintenance and testing intervals and their basis.
 - Summary of maintenance and testing procedures.
 - Monthly verification of communication channels used for accessing records remotely (if the entity relies on remote access and the channel is not monitored to a control centre staffed around the clock, 24 hours a day, 7 days a week (24/7)).
 - Monthly verification of time synchronization (if the loss of time synchronization is not monitored to a 24/7 control centre).
 - Monthly verification of active analog quantities.
 - A requirement to return failed units to service within 90 days. If a Disturbance Recorder (DR) will be out of service for greater than 90 days, the Transmission Licensee and Generating Company shall keep a record of efforts aimed at restoring the DR to service.
- ix) The time synchronization of the disturbance recorders shall be corroborated with the PMU data or SCADA event loggers by ERLDC. ERLDC shall list out for Disturbance recorders which are non-compliant for discussion in PCC meetings of ERPC.
- x) Each Transmission Licensee and Generating Company shall submit the data files to the ERLDC conforming to the following format requirements:
- The data files shall be submitted in COMTRADE and PDF format.
 - File shall have contained the name of the Relay, name of the Bay, station name, date, time resolved to milliseconds, event point name, status.

The DR archives shall be retained for a period of three years.

xi) A separate work-station PC, powered through UPS (Uninterrupted Power Supply) shall be identified with access to all the relays for extraction of DR. Auto-Download facility shall be established for automatic extraction of the DR files to a location on the work- station PC.

xii) **Time Synchronization Equipment**

- a) Time Synchronizing Equipment complete with antenna, all cables and processing equipment shall be provided to receive synchronizing pulse through Global Positioning System or Indian Regional Navigation Satellite System Navic compatible for synchronization of event logger, disturbance recorder, Phasor Measurement Units, and Supervisory Control and Data Acquisition System or Substation Automation System.
- b) Each substation shall have time synch equipment to synchronize all the numerical relays installed. Before any extension work, the capability of the existing Time-sync equipment shall be reviewed to ensure the synchronization of upcoming numerical relays.
- c) The status of healthiness of the time-sync device shall be wired as “Alarm” to SCADA and as an “Event” to Event Logger.
- d) The time synch status of all the installed numerical relays and event logger shall be monitored monthly and recorded. The Monthly records for relays not in time-sync shall be reported to ERLDC and ERPC. This record shall be archived for a period of three years by each concerned agency.
- e) Remedial action shall be taken by the concerned substation/ Protection department immediately to make the relays in time synchronization with reference to external time source.
- f) All the new Grid elements/Bay extension shall have accurate and precise Time synchronization equipment.

7.2. Disturbance Analysis and Reporting

- i) Immediately following an event (grid disturbance or grid incidence as defined in the CEA Grid Standards) in the system, the concerned user or SLDC shall inform ERLDC through voice message.
- ii) Written flash report shall be submitted to ERLDC and appropriate SLDC by the concerned Transmission Licensee/Generating Company/User within eight (8) hours from Grid event.
- iii) Disturbance Recorder (DR), station Event Logger (EL), Data Acquisition System (DAS) shall be submitted by the respective Transmission licensee and Generating Company within twenty-four (24) hours from Grid event. These records shall be uploaded by the respective Transmission licensee and Generating Company in the Web Based Tripping Portal of ERLDC.
- iv) ERLDC shall classify the grid incidents and grid disturbances according to CEA (Grid Standards) Regulations, amended to date. ERLDC shall report the event (grid

disturbance or grid incidence) to CEA, ERPC and all regional entities within twenty-four (24) hours of receipt of the flash report.

- v) After a complete analysis of the event, the Transmission licensee and Generating Company/User shall submit a detailed report in the case of grid disturbance or grid incidence within one (1) week of the occurrence of event to ERLDC and ERPC.
- vi) ERLDC shall prepare a draft report of each grid disturbance or grid incidence including simulation results and analysis which shall be discussed and finalized in the PCC meetings of ERPC as per the timeline specified in Table below.

Sl. No	Grid Event (GD/GI Classification as per the CEA Grid Standards)	Flash report submission deadline (Users/SLDC)	Disturbance record and station event log submission deadline by Users/SLDC)	Detailed report and data submission deadline by Users/SLDC)	Draft report submission deadline by ERLDC	Discussion in PCC and final report submission deadline by ERPC
1	GI-1/GI-2	8 hours	24 hours	+7 days	+7 days	+60 days
2	Near miss event	8 hours	24 hours	+7 days	+7 days	+60 days
3	GD-1	8 hours	24 hours	+7 days	+7 days	+60 days
4	GD-2/GD-3	8 hours	24 hours	+7 days	+21 days	+60 days
5	GD-4/GD-5	8 hours	24 hours	+7 days	+30 days	+60 days

vii) The analysis reports submitted by ERLDC shall be discussed in the Protection Coordination Sub-Committee (PCC) meetings of the ERPC. The PCC shall identify the lessons learnt during the events being discussed. The PCC shall scrutinize the correctness of operation of subject protection systems put in place by the concerned Constituents and the final analysis report along with the recommendations shall be concluded. It shall also recommend the appropriate remedial measures for system improvement.

viii) The implementation of the recommendations of the final report shall be monitored by the PCC of ERPC.

ix) Any additional data such as

- Single line diagram (SLD)
- Protection relay settings,
- HVDC transient fault record,
- Location of fault with distance
- Fault details with type & relay indications
- CT/PT/CVT rating details with location
- Bus-bar arrangement/ Configuration of feeders
- CB positions (OPEN/ CLOSE) at the time of fault

- Isolator & Earth-switch positions (OPEN/CLOSE)
- Voltage, frequency & power flows with direction at the time of fault
- DR&EL records
- switchyard equipment

and any other relevant station data required for carrying out analysis of an event by ERPC, ERLDC and concerned SLDC shall be furnished by the Users including ERLDC and respective SLDC, as the case may be, within forty- eight (48) hours of the request. All Users shall also furnish high-resolution analog data from various instruments including power electronic devices like HVDC, FACTS, renewable generation (inverter level or WTG level) on the request of ERPCs, NLDC, ERLDCs or SLDCs.

- x) Triggering of STATCOM, TCSC, HVDC run-back, HVDC power oscillation damping, generating station power system stabilizer and any other controller system during any event in the grid shall be reported to the ERLDC and ERPC if connected to ISTS and to the concerned SLDC if connected to an intra-state system. The transient fault records and event logger data shall be submitted to the ERLDC or concerned SLDC within 24 hours of the occurrence of the incident. Generating stations shall submit 1 second resolution active power and reactive power data recorded during oscillations to ERLDC or concerned SLDC within 24 hours of the occurrence of the oscillations.
- xi) A monthly report on events of unintended operation or non-operation of the protection system shall be prepared and submitted by each user/owner of important elements in the regional grid, as identified by the appropriate forum of ERPC including those in the State grids that are critical for regional grid operation to ERPC and ERLDC within the first week of the subsequent month.
- xii) The detailed analysis reports shall be archived periodically. The archive shall be retained for a period of three years by each concerned agency.

8. Protection Audit Plan

- i) All Users/Entities connected at 220 kV and above, shall conduct internal audit, as per the prescribed audit checklist, of their protection systems annually, and any shortcomings identified shall be rectified and informed to ERPC. The audit report along with action plan for rectification of deficiencies detected, if any, shall be shared with ERPC.
- ii) All Users /Entities shall also conduct third party protection audit of each sub-station at 220 kV and above once in five years.
- iii) After analysis of any event, PCC of ERPC may identify a list of substations / and generating stations where third-party protection audit is required to be carried out and accordingly advise the respective users to complete third party audit within three months.
- iv) The third party audit report shall contain all the information as in *Annexure-1(Third*

Party Protection System Checking & Validation Template for a Substation) of CERC (Indian Electricity Grid Code), Regulations 2023). The protection audit reports, along with action plan for rectification of deficiencies detected, if any, shall be submitted to the respective ERPC and ERLDC or respective SLDC, as the case may be, within a month of submission of third party audit report. The necessary compliance to such protection audit report shall be followed up regularly in the PCC meetings of ERPC.

- v) ERPC shall keep all compliance monitoring reports/audit reports at least for five years.
- vi) Annual audit plan for the next financial year shall be submitted by the Users/entities to ERPC by 31st October of every year. The users shall adhere to the annual audit plan and report compliance of the same to ERPC.

9. Performance Monitoring of the Protection Systems

9.1. Users/Entities shall submit the following protection performance indices of previous month to ERPC and ERLDC on monthly basis for 220 kV and above by 15th of the subsequent month and the same shall be reviewed in the ensuing PCC meeting of ERPC.

- a) The Dependability Index defined as $D = N_c / (N_c + N_f)$

Where, N_c is the number of correct operations at internal power system faults and N_f is the number of failures to operate at internal power system faults.

- b) The Security Index defined as $S = N_c / (N_c + N_u)$

Where, N_c is the number of correct operations at internal power system faults and N_u is the number of unwanted operations.

- c) The Reliability Index defined as

$$R = N_c / (N_c + N_i)$$

Where, N_c is the number of correct operations at internal power system faults and N_i is the number of incorrect operations and is the sum of N_f and N_u

9.2. Users/Entities shall furnish the reasons for performance indices less than unity of individual element wise protection system to the ERPC and action plan for corrective measures. The action plan will be followed up regularly in the PCC Meetings.

10. Compliance Monitoring

10.1. The Protection Protocol of ER shall be reviewed as and when required, in consultation with the stakeholders of the Eastern Region.

10.2. Violation of the Protection Protocol of the Eastern Region shall be brought to the notice of ERPC by the ERLDC or concerned SLDC, as the case may be.

10.3. In case any User/Entity fails to comply with the Protection Protocol or fails to undertake remedial action identified by the PCC of ERPC within the specified timelines, the ERPC would approach the Commission with all relevant details for suitable directions.

ANNEXURE - 1
THIRD PARTY PROTECTION SYSTEM CHECKING & VALIDATION
TEMPLATE FOR A SUBSTATION

1. INTRODUCTION

- (1) The audit reports, along with action plan for rectification of deficiencies found, if any, shall be submitted to RPC or RLDC within a month of submission of report by auditor.
- (2) The third-party protection system checking shall be carried at site by the designated agency. The agency shall furnish two reports:
 - (a) Preliminary Report: This report shall be prepared on the site and shall be signed by all the parties present.
 - (b) Detailed Report: This report shall be furnished by agency within one month after carrying out detailed analysis.

2. CHECKLIST

- (1) The protection system checklist shall contain information as per this Regulation.
 - (a) General Information (to be provided prior to the checking as well as to be included in final report):
 - (i) Substation name
 - (ii) Name of Owner Utility
 - (iii) Voltage Level (s) or highest voltage level?
 - (iv) Short circuit current rating of all equipment (for all voltage level)
 - (v) Date of commissioning of the substation
 - (vi) Checking and validation date
 - (vii) Record of previous tripping's (in last one year) and details of protection operation
 - (viii) Previous Relay Test Reports

- (ix) Overall single line diagram (SLD)
- (x) AC aux SLD
- (xi) DC aux SLD
- (xii) SAS architecture diagram
- (xiii) SPS scheme implemented (if any)

(b) The preliminary report shall inter-alia contain the following:

TABLE A: FORMAT OF PRELIMINARY REPORT

S. No.	Issues	Remarks
1	Recommendation of last protection checking and validation	Status of works and pending issues if any
2	Review of existing settings at substation	Recommended Action
3	Disturbance Recorder out available for last 6 tripping's (Y/N)	Recommended Action
4	Chronic reason of tripping, if any	Recommended Action
5	Major non-conformity/deficiency observed	Recommended Action

(c) The relay configuration checklist for available power system elements at station:

- (i) Transmission Line
- (ii) Bus Reactor/Line Reactor
- (iii) Inter-connecting Transformer
- (iv) Busbar Protection Relay
- (v) AC auxiliary system
- (vi) DC auxiliary system
- (vii) Communication system
- (viii) Circuit Breaker Details

- (ix) Current Transformer Details
 - (x) Capacitive Voltage Transformers Details
 - (xi) Any other equipment/system relevant for protection system operation
- (d) The minimum set of points on which checking and validation shall be carried out is covered in this clause. The detailed list shall be prepared by checking and validation team in consultation with concerned entity, RLDC and RPC.
- (i) Transmission Line Distance Protection/Differential Protection
 - a. Name and Length of Line
 - b. Whether series compensated or not
 - c. Mode of communication used (PLCC/OPGW)
 - d. Relay Make and Model for Main-I and Main-II
 - e. List of all active protections & settings
 - f. Carrier aided scheme if any
 - g. Status of Power Swing/Out of Step/SOTF/Breaker Failure/Broken Conductor/STUB/Fault Locator/DR/VT fuse fail/Overvoltage Protection/Trip Circuit supervision/Auto-reclose/Load encroachment etc.
 - h. Relay connected to Trip Coil-1 or 2 or both
 - i. CT ratio and PT ratio
 - j. Feed from DC supply-1 or 2
 - k. Connected to dedicated CT core (mention name)
 - l. Other requirements for protection checking and validation
 - (ii) Shunt Reactor & Inter-connecting Transformer Protection
 - a. Whether two groups of protections used (Group A and Group B)
 - b. Do the groups have separate DC sources
-

- c. Relay Make and Model
- d. List of all active protections along with settings
- e. Status of Differential Protection/Restricted Earth Fault Protection/Back-up Directional Overcurrent/Backup Earth fault/ Breaker Failure
- f. Status of Oil Temperature Indicator/Winding Temperature Indicator/Bucholz/Pressure Release Device etc.
- g. Relay connected to Trip Coil-1 or 2 or both
- h. CT ratio and PT ratio
- i. Feed from DC supply-1 or 2
- j. Connected to dedicated CT core (mention name)
- k. Other requirements for protection checking and validation

(iii) Busbar Protection Relay

- a. Busbar and redundant relay make and model
- b. Type of Busbar arrangement
- c. Zones
- d. Dedicated CT core for each busbar protection (Yes/No)
- e. Breaker Failure relay included (Yes/No), if additional then furnish make and model
- f. Trip issued to both Busbar protection in case of enabling
- g. Isolator indication and check relays
- h. Other requirements for protection checking and validation

(iv) AC auxiliary system

- a. Source of AC auxiliary system

- b. Supply changeover between sources (Auto/Manual)
 - c. Diesel generator (DG) details
 - d. Maintenance plan and supply changeover periodicity in DG
 - e. Single Line Diagram
 - f. Other requirements for protection checking and validation
- (v) DC auxiliary system
- a. Type of Batteries (Make, vintage, model)
 - b. Status of battery Charger
 - c. Measured voltage (positive to earth and negative to earth)
 - d. Availability of ground fault detectors
 - e. Protection relays and trip circuits with independent DC sources
 - f. Other requirements for protection checking and validation
 - g. Communication system
 - i. Mode of communication for Main-1 and Main-2 protection
 - ii. Mode of communication for data and speech communication
 - iii. Status of PLCC channels
 - iv. Time synchronization equipment details
 - v. 7OPGW on geographically diversified paths for Main-1 and main-2 relay
 - vi. Other requirements for protection checking and validation
- (vi) Circuit Breaker Details
- a. Details and Status
 - b. Healthiness of Tripping Coil and Trip circuit supervision relay
 - c. Single Pole/Multi pole operation
-

- d. Pole Discrepancy Relay available(Y/N)
- e. Monitoring Devices for checking the dielectric medium
- f. Other requirements for protection checking and validation

(vii) Current Transformer (CT)/Capacitive Voltage Transformer (CVT) Details

- a. CT/CVT ID name and voltage level
- b. CT/CVT core connection details
- c. Accuracy Class
- d. Whether Protection/Metering
- e. CT/CVT ratio available and ratio adopted
- f. Details of last checking and validation of CT/CVT healthiness
- g. Other requirements for protection checking and validation
- h. Other protections: Direction earth fault, negative sequence, over current, over voltage, over frequency, under voltage, under frequency, forward power, reverse power, out of step/power swing, HVDC protection etc.

3. SUMMARY OF CHECKING:

The summary shall specifically mention minimum following points:

- (1) The settings and scheme adopted are in line with agreed protection philosophy or any accepted guidelines (e.g. Ramakrishna guidelines or CBIP manual based).
- (2) The deviations from the RPC protection philosophy, if any and reasons for taking the deviations shall be recorded.
- (3) All the major general deficiency shall be listed in detail along with remedial recommendations.

- (4) The relay settings to be adopted shall be validated with simulation based or EMTP studies and details shall be enclosed in report.
- (5) The cases of protection maloperation shall be analysed from protection indices report furnished by concerned utility, the causes of failure along with corrective actions and recommendations based on the findings shall be noted in the report.

SI No.	Name of the incidence	PCC Recommendation	Latest status
134th PCC Meeting			
1.	Disturbance at 400 kV Barh (NTPC) S/s on 31.03.2024 at 07:29 Hrs	<p>ERLDC requested NTPC Barh to analyse discrepancy regarding carrier communication to Barh.</p> <p>On tripping of 400 kV Barh-Kahalgaon-2 from Kahalgaon end, NTPC Kahalgaon representative replied that details will be confirmed from site and will be shared to ERPC/ERLDC.</p>	
2.	Disturbance at 220 kV Garhwa (JUSNL)S/s on 31.03.2024 at 07:29 Hrs	<p>PCC advised JUSNL to analyze the reason for failure of towers for this line and the report shall be sent to PSETD division of CEA for further analysis and recommendation.</p> <p>On enquiry from PCC regarding status of restoration, JUSNL representative replied that restoration will be completed by first week of May 2024.</p>	<p><i>JUSNL representative replied that line had been charged on 12th May 2024.</i></p> <p><i>PCC advised JUSNL to analyze the reason for failure of tower for this line and the report shall be sent to PSETD division of CEA for further analysis and recommendation.</i></p>
3.	Bus tripping occurred in Eastern Region during March'24	<p>PCC advised BSPTCL representative to share last test report of failed CT to ERPC/ERLDC.</p> <p>PCC advised BSPTCL following:</p> <ul style="list-style-type: none"> • To review Protection settings of ICT • To test the relay of Laukahi-DMTCL line-1 • To test the bus bar protection and submit details by 23rd April 2024. • To segregate feeders on both bus in balanced way so that in case of one bus tripping, feeders on other bus can remain in charged condition. 	<p><i>BSPTCL representative informed that bus bar protection is not in operation at Laukahi S/s and issue had been intimated to higher authority for making bus bar protection operational at earliest.</i></p> <p><i>PCC advised to revise zone 4 time settings of the connected feeders at Laukhi to 250 ms till the time busbar is not available.</i></p> <p><i>BSPTCL representative informed that protection settings of ICT had not</i></p>

			<p><i>been reviewed till date and it is planned to be reviewed during internal audit.</i></p> <p><i>PCC advised BSPTCL representative to segregate feeders among both bus at Laukhai S/s.</i></p>
133rd PCC Meeting			
4.	Status of Busbar Protection at 220 kV Substations-reg	PCC advised state transmission utilities to share the present status of bus bar protection at 220 kV and above substations to ERPC as per the format.	<i>PCC advised state transmission utilities to share the present status of bus bar protection at 220 kV and above substations to ERPC as per the format.</i>
5.	Review of SPS at Sterlite (Vedanta)	SLDC Odisha representative informed that the meeting to discuss the modalities of implementation of proposed SPS scheme will be convened within a week.	<i>SLDC Odisha representative informed that Vedanta has sought some additional time for implementation of the SPS. PCC advised SLDC to coordinate with Vedanta for early implementation of the SPS.</i>
132nd PCC Meeting			
6.	Disturbance at 220 kV Biharsharif S/s on 14.01.2024	<ul style="list-style-type: none"> ➤ PCC advised Powergrid and BSPTCL to jointly review the highset overcurrent protection considering the present network configuration and fault level. ➤ PCC advised BSPTCL to review E/F setting of the ICTs as well as lines at 220 kV Biharsharif S/s ➤ DR configuration to be done by BSPTCL for the relays of ICT-1 & 2 and relays of Mokama lines. 	<p><i>In 133rd PCC, BSPTCL representative informed that Powergrid had been communicated to revise overcurrent settings at their end and settings at their end will be revised consequently. He further informed that shutdown of ICT 1 and 2 is applied for 18th March 2024 in order to rectify DR and other issues.</i></p> <p><i>BSPTCL representative informed that DR configuration had been rectified.</i></p>

			<i>Powergrid representative informed that review of setting is in progress and details will be shared with BSPTCL/ERLDC.</i>
130th PCC Meeting			
7.	Tripping of 220 kV Main Bus-2 at Budhipadar on 06.10.23 at 16:14 Hrs	<p>PCC advised to replace the defective bay unit at the earliest and restore the busbar protection for bus-2 thereafter.</p> <p><i>In 132nd PCC Meeting, OPTCL representative informed that OEM M/s Siemens had been communicated for this issue. He further informed that bus bar protection for bus 2 is in off condition and for bus 1 is in service at present.</i></p>	<p><i>In 133rd PCC, OPTCL representative informed that M/s Siemens had been communicated to submit estimate for procurement of new relay.</i></p> <p><i>OPTCL representative informed that offer price had been received from M/s Siemens and work order will be placed soon.</i></p>
125th PCC Meeting			
8.	Repeated Line tripping of 220 kV Ramchandrapur - Joda in April 2023	<p>Regarding status of commissioning of DTPC in the line, PCC advised the matter may be taken with their telecom wing for early commissioning of the same.</p> <p><i>In 132nd PCC Meeting, JUSNL representative informed that the tendering for procurement of DTPC is in process.</i></p>	<p><i>JUSNL representative informed that no vendor had participated during second time tendering. The matter has been put up before higher authority for further decision in this regard.</i></p>