Minutes
of
99th PCC Meeting

Date: 26.02.2021
Eastern Regional Power Committee
14, Golf Club Road, Tollygunge
Kolkata: 700 033

EASTERN REGIONAL POWER COMMITTEE

MINUTES OF 99TH PROTECTION SUB-COMMITTEE MEETING HELD ON 12.02.2021 AT 10:30 HOURS

Member Secretary, ERPC chaired the 99th PCC Meeting. The meeting was conducted through Microsoft Teams online platform.

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

PART – A

ITEM NO. A.1: Confirmation of minutes of 98th Protection sub-Committee Meeting held on 13th January 2021 through MS Teams.

The minutes of 98th Protection Sub-Committee meeting held on 13.01.2021 circulated vide letter dated 28.01.2021.

Members may confirm the minutes of 98th PCC meeting.

Deliberation in the meeting

Members confirmed the minutes of 98th PCC Meeting.

PART – B

ITEM NO. B.1: Total Power Failure at 400 kV HEL Substation on 05.01.2021 at 13:37 hrs

400 kV HEL- Subhasgram - 1 was under shutdown since 04-01-2021 for rectification of damaged OPGW. HEL unit #2 was also not in service due to annual overhauling. HEL was connected to rest of the grid through 400 kV HEL - Subhasgram - 2 with only unit#1 in service.

As per the information received from HEL, during relay testing of 400 kV HEL Subhasgram -1 at HEL, CT Switching relay malfunctioned and bus bar protection operated at HEL end. As a result, 400 kV HEL - Subhasgram - 2 tripped and total power failure occurred at HEL. DT signal was sent to Subhasgram.

No fault was observed in PMU data at the time of the fault.

The detailed report received from HEL is enclosed at **Annexure B1.**

Gen. Loss : 280 MW

HEL & Powergrid may explain.

Deliberation in the meeting

HEL informed that 400 kV HEL- Subhasgram - 1 was under shutdown since 04-01-2021 for OPGW work & HEL unit #2 was out of service due to annual overhauling.

They added that 400kV Main Bus-1 was taken shut down for isolator maintenance of 400 kV HEL- Subhasgram-1 bay & bus coupler bay. The disturbance occurred during testing of line differential relay for HEL-Subhsgram line-1 and was due to simultaneous failure of LBB inhibition and CT Switching relay reset operation.

They explained that during current injection to the P543 relay of line-1, differential trip, any trip & LBB trip operated. Though LBB protection for the said line was disabled before relay testing, the LBB protection operated due to a wrong PSL file being uploaded by OEM(M/s GE) engineers during testing.

Further they informed that due to loose connection of wiring in CT switching relay, the reset coil did not get energized though the main bus-2 isolator was in open condition. As a result, CT switching relay of line-1 for main bus-2 operated and subsequently zone-B busbar protection got operated for main bus-2 resulting in tripping of 400 kV HEL-Subhasgram-2, GT-1, ST-1 & ST-2 which were connected to main bus-2.

They added that the issue of CT switching relay has been rectified and put into operation after due checking.

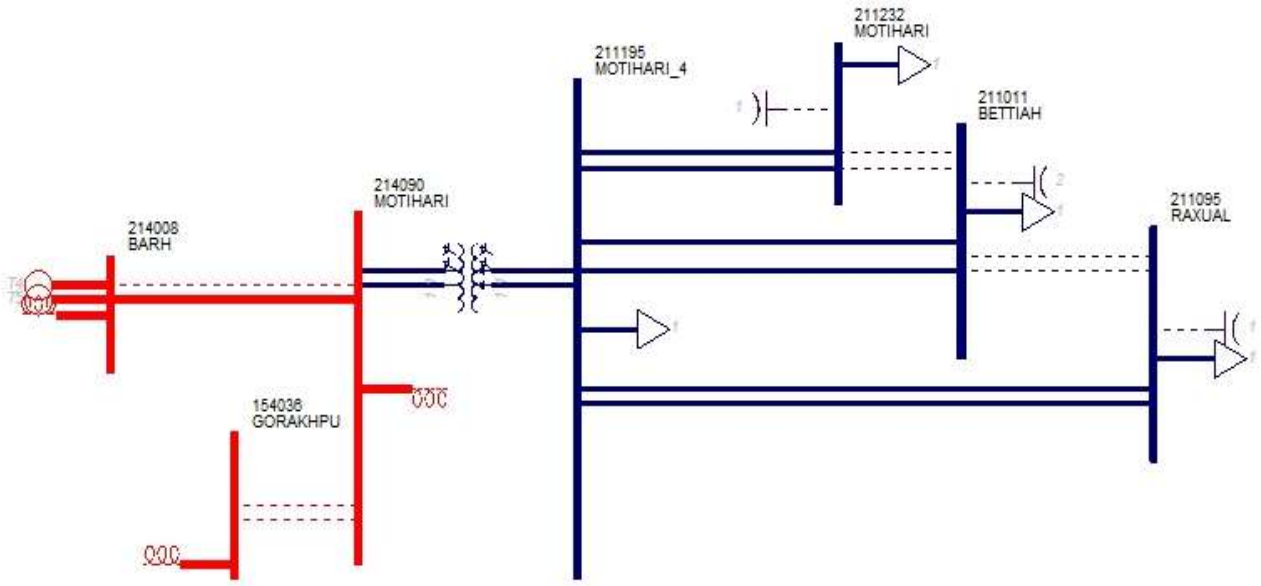
PCC advised HEL to take proper measures during testing of the relays and other equipments in order to avoid such type of disturbances in future.

ITEM NO. B.2: Total Power Failure at 400 kV Motihari Substation on 15.01.2021 at 05:36 hrs

400 kV Motihari-Gorakhpur D/C and 400 kV Motihari-Barh-1 were out of service due to tower collapse. Motihari was connected to rest of the grid through 400 kV Motihari-Barh - 2.

On 15-01-2021 at 05:36 hrs, 400 kV Barh-Motihari - 2 tripped due to R and B phase to earth fault resulting in total power failure at Motihari S/S and loss of power supply to nearby areas such as Motihari, Bettiah, Raxaul, Ramnagar, Narkatiaganj.

Barh end tripped in Zone -1 protection and Motihari end tripped after DT receipt from Barh end.



Relay Indications :

Time	Name	End 1	End 2	PMU Observations
05:36 Hrs	400 kV Barh Motihari – 2	R-B-N, Zone – 1, F/C 10 kA, 46 km from Barh	DT received. Pre tripping current < 0.3 kA	Around 40 kV dip has been observed in R & B phase voltage at Barh PMU data. The fault clearing time was less than 100 ms.

Load Loss : 187 MW

DMTCL, NTPC & Powergrid may explain.

Deliberation in the meeting

Powergrid informed that the disturbance occurred while carrying out the OPGW work in the 400 kV Barh-Motihari-2 line. The pilot wire got broken during the work which caused R -B phase to ground fault.

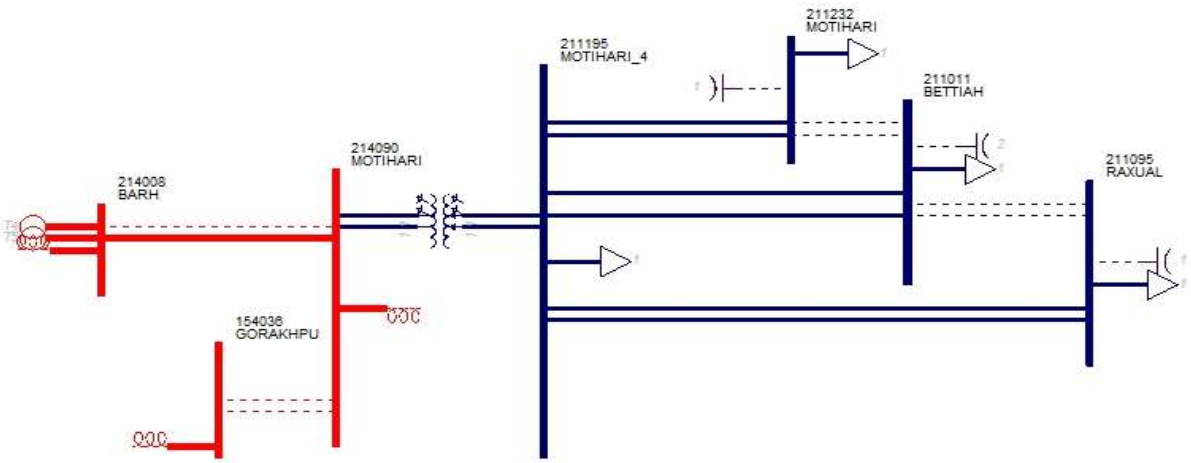
NTPC Barh end tripped in zone-1 of distance protection and DMTCL tripped on DT receipt from Barh end.

ITEM NO. B.3: Total Power Failure at 400 kV Motihari Substation on 21.01.2021 at 11:20 hrs

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

At Barh end, the tie breaker was successfully auto reclosed. But main breaker tripped again after auto-reclose operation. Then 400 kV Barh Motihari - 2 tripped from Motihari end on receipt of DT signal from Barh end. As a result total power failure occurred at Motihari S/S and loss of power supply occurred at nearby areas such as Motihari, Bettiah, Raxaul, Ramnagar, Narkatiaganj.

Load Loss : 215 MW



Relay Indications :

Time	Name	End 1	End 2	PMU Observations
11:20 Hrs	400 kV Barh Motihari – 2	B-N, Zone – 2, F/C 2.6 kA, 175 km from Barh. PD operated for main breaker	B-N, Zone – 1, F/C 0.8 kA, 28 km from Motihari. DT received	Around 15 kV dip has been observed in B phase voltage at Barh PMU data. The fault clearing time was less than 100 ms.

Following points need to be explained by concerned utility:

a) As the line was charged through tie-breaker at Barh end such occurrence of grid disturbance could have been avoided if DT was not sent from Barh end. The reason for sending DT from Barh end during the event may be explained.

b) The reason for non-reclose of B pole (faulted phase) of the main breaker at Barh may be shared.
c) Breaker operation of tie-breaker is not captured by DR recorded at Barh end. The same may be implemented in DR output as unused channels are available.

Report received from NTPC is enclosed at Annexure B.3.

NTPC & DMTCL may explain.

Deliberation in the meeting

NTPC informed that there was a transient Y-phase to earth fault in 400 kV Barh-Motihari line. The auto reclosure was successful for tie bay at Barh end. However, B-pole breaker of main bay did not reclose during the autorecloser operation. They informed that after opening of the B-phase breaker the compressor air pressure went low due to which autoreclosure got blocked in BCU.

DMTCL informed that autoreclosure was successful from DMTCL end.

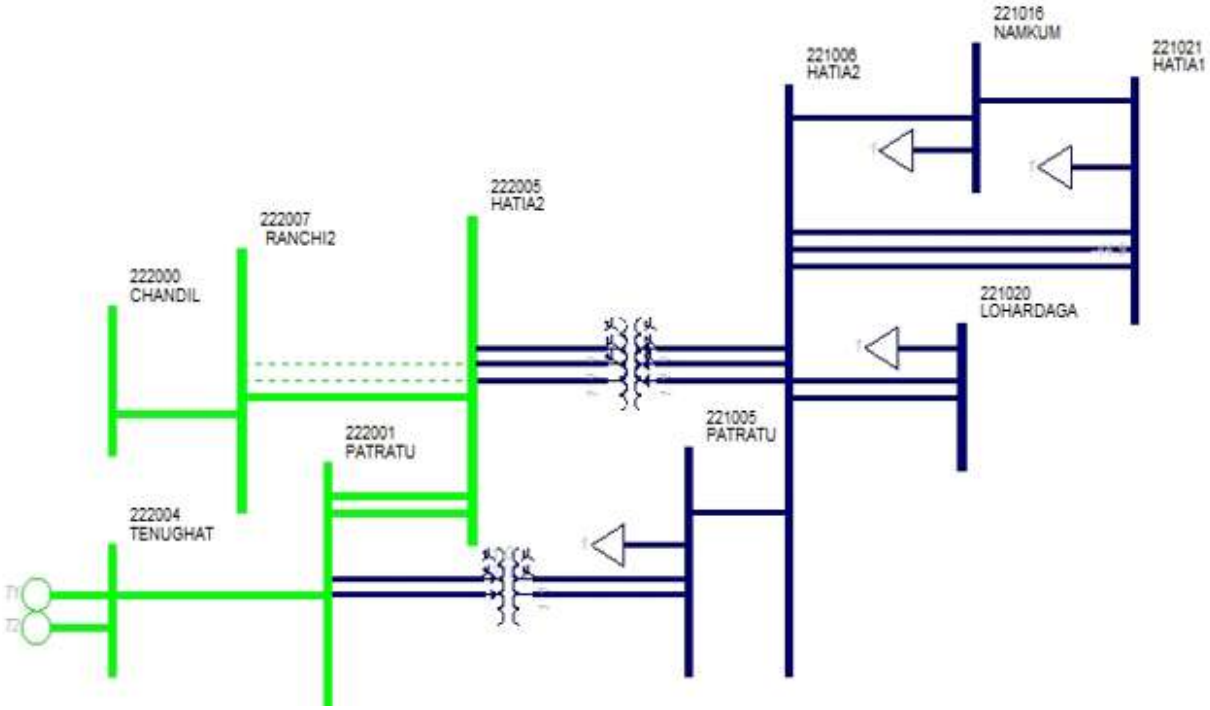
Regarding DT send from Barh end, NTPC informed that 50N1 protection of line reactor got picked up during the disturbance and tripped the line reactor after a delay of 1.2 sec. The master trip relay of the line also got operated which send DT signal to Barh end. They added that operation of master trip relay for the line is being investigated.

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

ITEM NO. B.4: Disturbance at 220 k V Hatia Substation on 29.01.2021 at 10:44 hrs

220 kV Ranchi - Hatia - 1 and 220 kV Hatia - Patratu - 2 were under shutdown.

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



Load Loss: 195 MW, Gen. Loss :54 MW

JUSNL may explain.

Deliberation in the meeting

*JUSNL explained the event with help of presentation which is attached at **Annexure B4.** They explained following:*

- *The shutdown of 220 kV Hatia Bus-1 was planned on that day for isolator maintenance and all the elements were being shifted from Bus-1 to Bus-2.*
- *During shifting of 220KV Ranchi- Hatia ckt-3 from 220KV Bus-1 to Bus-2 at Hatia GSS, sparking was observed in Bus-2 isolator of above feeder. Subsequently bus fault occurred which lead to tripping of all feeders connected to Bus 1 and Bus 2.*
- *It was informed that bus bar protection at 220 kV Hatia S/s was not in service.*
- *The following elements tripped after the disturbance:*

Name	***End 1***	***End 2***
220 kV Hatia-Ranchi-2	*YBN Fault, Z4, trip on -300ms, IB-3.81KA,IC-3.44KA,*	
220 kV Hatia-Ranchi-3	*YBN Fault, Z4, trip on -300ms, IA-0.14KA,IB-3.25KA,IC-3.07KA,*	
220 kV Hatia-PTPS-1	*YBN Fault, Z4, trip on -300ms, IA-175A,IB-2KA,IC-2.039.44KA,*	
220KV Bus Coupler	*O/C , E/F*	

132 kV Hatia I - Tamar		*YBN Fault, E/F & O/C, Fault Duration-592ms.*
132 kV Hatia I – Kanke (8C)		*YBN Fault, Zone3 ,Fault Location-41.9KM IR-0.87KA,IY-1.57KA,IB-1.18KA*
132 kV Hatia I – PTPS (9C)		*YBN Fault, Z1, Fault Location-24.95KM IR-438.2A, IY-1.069KA, IB-726A.*

- *220 /132 kV ICT-2 & 3 at Hatia end did not trip during the disturbance. However, there was some pick up in backup overcurrent protection of ICTs.*

JUSNL added that 132 kV Hatia-II -- Hatia -I lines were also failed to trip during the disturbance.

During analysis the following discrepancies were observed:

i. *Non-operation of back up overcurrent protection for 220/132 kV ICTs at Hatia.*
ii. *Non -operation of backup overcurrent protection at 132 kV level for Hatia-II & Hatia-I S/s.*
iii. *Tripping of 132 kV Hatia I-Kanke from Kanke end on zone-3 of distance protection.*
iv. *Tripping of 132 kV Hatia I-PTPS from PTPS end on zone-1 of distance protection.*

After detailed deliberation, PCC advised followings to JUSNL:

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

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

ITEM NO. B.5.1: Grid event at 220/132 kV Lalmatia S/s on 11-01-2021 at 11:57 hrs.

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

Repeated tripping of 132 kV KhSTPP – Lalmatia S/C and 132 kV Khalgaon (BSPTCL) – Lalmatia S/C is reducing the reliability of power supply to Sahebgunj and Rajmahal areas. Tripping incidents of 132 kV KhSTPP – Lalmatia S/C and 132 kV Khalgaon (BSPTCL) – Lalmatia S/C in 2020-21 are shown below.

Element Name	Tripping Date	Tripping Time	Reason	Revival Date	Revival Time
132KV-KHSTPP-LALMATIA-1	11-01-2021	11:57	R_N Fault, 9.4 KM, Ir: 3.08 kA (Lalmatia) R_N, 28 KM, 3.2 kA(KhSTPP)	11-01-2021	13:47
132KV-KAHALGAON(BSEB)-LALMATIA-1	11-01-2021	11:57	R_N Fault, 9.4 KM, Ir: 3.08 kA (Lalmatia) R_N, 34 KM, 1.42 kA(kahalgaon BSEB)	11-01-2021	12:27
132KV-KAHALGAON(BSEB)-LALMATIA-1	06-01-2021	07:05	from jseb end on overload	06-01-2021	07:24
132KV-KHSTPP-LALMATIA-1	03-01-2021	13:42	KHALGAON: OC EARTH FAULT, Y_N,FD-104Km, FC-1.316Km: LALMATIA: Z-1, EARTH FAULT	03-01-2021	14:35
132KV-KHSTPP-LALMATIA-1	15-12-2020	11:50	R-N, 2.15 KA, Z1, 21.1 Km from lalmatia. KHSTPP: R-N 15.km, Z1, 4.35 KA.	15-12-2020	12:16
132KV-KHSTPP-LALMATIA-1	24-11-2020	13:54	R_N, 24.9 KM, 1.9 kA (Lalmatia)	24-11-2020	14:21
132KV-KHSTPP-LALMATIA-1	24-10-2020	12:12	Lalmatia: Z1, FD 24.1 kM, R-N, Ir 1.92 kA	24-10-2020	13:05
132KV-KAHALGAON(BSEB)-LALMATIA-1	22-10-2020	05:40	Kahelgaon: Distance protection location, Z1	22-10-2020	06:20
132KV-KHSTPP-LALMATIA-1	25-09-2020	11:23	Lalmatia: R-N, Z-1,FC-1.9kA, 25.7km	25-09-2020	13:35
132KV-KHSTPP-LALMATIA-1	20-09-2020	17:00	R-N, 37.3 KM	20-09-2020	19:38
132KV-KAHALGAON(BSEB)-LALMATIA-1	15-09-2020	17:40	R_Y_N Fault, 73.1 KM, Ir: 2.1 kA, Iy: 1.8 kA	15-09-2020	17:58
132KV-KAHALGAON(BSEB)-LALMATIA-1	08-09-2020	13:51	Kahelgaon: R-N, Z1	08-09-2020	14:28
132KV-KAHALGAON(BSEB)-LALMATIA-1	21-08-2020	07:01	Z1	21-08-2020	07:30
220KV-KHALGAON BSEB-LALMATIA-1	16-08-2020	07:11	Y_N, 0.9 kA (Lalmatia)	16-08-2020	07:41
132KV-KAHALGAON(BSEB)-LALMATIA-1	30-07-2020	14:05	Over Current in R phase,Distance protection zone 1	30-07-2020	14:25

			operated		
132KV-KHSTPP-LALMATIA-1	06-07-2020	12:50	RY Fault Z2 R=3.06 KA Y=3.05 KA 39.1km from khstpp	06-07-2020	17:18
132KV-KHSTPP-LALMATIA-1	03-07-2020	19:31	B_N, 27 KM, 1.24 kA (Lalmatia)	03-07-2020	20:02
132KV-KAHALGAON(BSEB)-LALMATIA-1	03-07-2020	12:20	Y_N, 3.7 kA, 8.8 KM (Kahalgaon)	09-07-2020	18:12
132KV-KHSTPP-LALMATIA-1	03-07-2020	12:19	KHSTPP: Y-N,34.2Km, 2.52KA	03-07-2020	13:05
132KV-KAHALGAON(BSEB)-LALMATIA-1	26-06-2020	06:45	R-Y PH O/C & E/F	26-06-2020	07:10
132KV-KAHALGAON(BSEB)-LALMATIA-1	04-06-2020	22:46	R_Y_N, Ir: 2.077 kA, Iy: 1.816 kA, 77.46 KM	04-06-2020	23:09
132KV-KAHALGAON(BSEB)-LALMATIA-1	27-05-2020	16:10	BSTPCL-O/C operated	27-05-2020	16:54
132KV-KAHALGAON(BSEB)-LALMATIA-1	20-05-2020	21:13	R-N	20-05-2020	21:30
220KV-KHALGAON BSEB-LALMATIA-1	20-05-2020	12:40	Kahalgaon: O/C	20-05-2020	13:25
132KV-KHSTPP-LALMATIA-1	13-05-2020	13:05	KHSTPP:Y-B-N,37.1 KM	13-05-2020	13:58
132KV-KAHALGAON(BSEB)-LALMATIA-1	07-05-2020	15:42	tripped due to heavy wind and rain	07-05-2020	16:20
132KV-KHSTPP-LALMATIA-1	04-05-2020	07:01	CVT blast in Lalmatia-ECL line at Lalmatia	04-05-2020	09:16
132KV-KAHALGAON(BSEB)-LALMATIA-1	04-05-2020	07:01	CVT blast in Lalmatia-ECL line at ECL	04-05-2020	07:58
220KV-KHALGAON BSEB-LALMATIA-1	02-05-2020	14:20	E/f	02-05-2020	14:38
132KV-KAHALGAON(BSEB)-LALMATIA-1	28-04-2020	10:22	O/C & E/F	28-04-2020	10:55
132KV-KAHALGAON(BSEB)-LALMATIA-1	19-04-2020	23:55	Distance protection zone 1 operated at gss Kahalgaon	20-04-2020	01:00
132KV-KAHALGAON(BSEB)-LALMATIA-1	12-04-2020	03:02	Y,B-Ph overcurrent @Kahalgaon	12-04-2020	03:17

JUSNL and BSPTCL may explain.

Deliberation in the meeting

JUSNL informed that both 132 kV Kahalgaon (Bihar)-Lalmatia line and KHSTPP-Lalmatia line are in the same tower. There was an R-phase to ground fault in 132 kV Kahalgaon (Bihar)-Lalmatia line and the line tripped from both the end in zone-1 protection. They added that 132 kV KSTPP-Lalmatia from Lalmatia end and 132 KV Lalmatia-Sahebgunj line from Sahebgunj end also tripped during this disturbance.

JUSNL could not explain the tripping of 132 kV Lalmatia-Sahebgunj line from Sahebgunj end as the line was being radially fed from Lalmatia S/s. PCC advised JUSNL to submit the DR of Sahebgunj end and also to review the protection settings at Sahebgunj end.

On a query from BSPTCL, JUSNL informed that dedicated bay along with protection system for 132 kV Lalmatia-Sahebgunj line at separate transfer bus of Lalmatia S/s have been commissioned and put into operation. PCC advised JUSNL to submit Substation SLD along with relay settings to ERPC for updation of the same in protection database.

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

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

ITEM NO. B.5.2: Disturbance at 220/132 kV Kalyaneswari S/s on 21-01-2021 at 16:06 hrs.

On 21-01-2021 at 16:06 hrs., 220 kV Main bus-2 of 220/132 kV Kalyaneshwari substation got tripped resulting in total power failure at 132 kV Kalyaneswari, Kalipahari, Maithon Hydel, Panchet Hydel, Kumardubi and Ramkanali S/S.

DVC may explain.

Deliberation in the meeting

The report received from DVC is attached in the Annexure-B5.2.

DVC explained the following:

- *On 21-01-2021 at 16:06 hrs., the bus side isolator of 220 kV Kalyanesweri-MTPS line(Line # 240) connected to main bus-2 of 220 kV Kalyanesweri S/s opened by itself on load which resulted in bus fault and triggered the busbar protection for main bus-2. The busbar protection operated and tripped all the feeders connected to 220 kV bus-2.*

- *They informed that 220 kV MTPS-Kalyanesweri line (line#228) got tripped in zone-1 protection from MTPS end during this disturbance. The tripping occurred due to wrong zone settings which has been rectified after the incident.*

- *After tripping of ATR 2 & 3 connected to 220 kV bus-2, the loading in 132 kV DTPS-Kalipahari circuits got increased and as a result Y-phase conductor got snapped in one of the cicuits of 132 kV DTPS-Kalipahari line(Line #20). This further caused overloading in the healthy circuit and tripped other circuit of 132 kV DTPS-Kalipahari line i.e. Line # 21.*

- *The tripping of both the circuits of 132 kV DTPS-Kalipahari line further aggravated the overload in ATR-1 at Kalyanesweri end and subsequently the ATR got tripped in overcurrent protection from 220 kV end.*

- *After tripping of the above elements, the loading of 160 MVA ATR at Dhanbad and 132 kV Dhanbad-Patherdih lines got increased. Further 132 kV Patherdih-MHS lines(Line# 14 & 15) were hand tripped to avoid further overloading of ATR at Dhanbad S/s.*

DVC informed that reason for opening of the isolator could not be traced. The damaged R and Y pole plate of the isolator has been replaced and the operation of isolator was checked and put into operation. The wiring and the scheme of isolator was also checked after the disturbance and found in order.

On a query from PCC, they added that the isolator was very old (H&M make, manufactured in year 1991) and the same would be replaced under PSDF project soon.

ITEM NO. B.5.3: Disturbance at 132 kV Lakhisarai (BSPTCL) Substation on 27-01-2021 at 12:59 hrs

On 27-01-2021 at 12:59 Hrs. 132 kV Lakhisarai (POWERGRID) – Lakhisarai (BSPTCL) D/C tripped due to jumper dropping of Jamalpur bay at 132 kV Lakhisarai (BSPTCL). As a result, total power failure occurred at 132 kV Lakhisarai (BSPTCL) S/S.

BSPTCL may explain.

Deliberation in the meeting

BSPTCL explained the event with a presentation.
They informed that disturbance occurred due to snapping of wavetrap jumper of 132 kV Lakhisarai(BSPTCL)-Jamalpur line at Lakhisarai end. Jamalpur end cleared the fault in overcurrent earthfault protection.

They further informed that distance protection for 132 kV Lakhisarai-Jamalpur line at Lakhisarai end had picked up during the disturbance but did not operate. The back up overcurrent relay at Lakhisarai end also picked up the fault. However, before tripping of this line, 132 kV kV Lakhisarai (POWERGRID) – Lakhisarai (BSPTCL) D/C got tripped from Powergrid end in zone-2 of distance protection. This resulted into total power failure at 132 kV Lakhisarai(BSPTCL) S/s.

BSPTCL explained that the distance protection for 132 kV Lakhisarai-Jamalpur line did not tripped due to close-in fault condition. The relay was checked after the disturbance and found healthy.

PCC opined that for close-in faults backup overcurrent protection should operate and tripp the line before tripping of other lines from remote end. PCC advised BSPTCL to review the backup overcurrent settings at 132 kV Lakhisarai(BSPTCL) end.

ITEM NO. B.5.4: Grid event at Motihari on 30-01-2021 at 13:16 hrs

On 30-01-2021 at 13:16 hrs,132 kV Motihari – Batiah D/C tripped on R phase to earth fault.

Relay indication for both the circuits are shown below:

Line Name	Relay Indication End 1	Relay Indication End 2
132 kV Motihari Betiah - 1	R-N, Zone – 2, F/C 2.3 kA, 36.5 km from Motihari	Did not trip
132 kV Motihari Betiah - 2	Did not trip	Yet to be received

As per PMU data captured at Muzaffarpur, fault clearing time was around 450 ms.

As a result, 90 MW load loss occurred at Betiah, Narkatiyaganj, Ramnagar. Catering of power to Surajpura (Nepal) got interrupted due to this event. Both the circuits were restored by 14:09hrs.

The following points need to be explained by respective utilities:

- Location of fault.
- Reason for delayed clearance of fault
- Relay indication recorded at Betiah end for 132 kV Motihari Betiah – 2.

DMTCL and BSPTCL may explain.

Deliberation in the meeting

BSPTCL informed that the fault was occurred due to bursting of R-phase pole of circuit breaker of 132 kV Bettiah- Thakraha-2 bay. The said line has not been commissioned but the bay was charged upto circuit breaker at Bettiah end. They added that protection system was also not commissioned for the 132 kV Bettiah- Thakraha-2 bay.

They further informed that 132 kV Bettiah-DMTCL-2 got tripped from DMTCL end in zone-2 timing and 132 kV Bettiah-DMTCL-1 got tripped from Bettiah end in zone-1 of distance protection.

They explained that due to close-in fault the 132 kV Bettiah-DMTCL-1 tripped in zone-1 protection from Bettiah end. The relay settings and CT polarity of this bay was checked after the event and found in order.

PCC advised BSPTCL to submit DR files for 132 kV Bettiah-DMTCL-1 at Bettiah end at the earliest.

After detailed deliberation, PCC opined that in case of charging of bay for a under commissioned line, the protection system of the corresponding bay should be commissioned and be kept in operation before charging the bay and advised BSPTCL to put protection system in operation before charging any under commissioned bay.

ITEM NO. B.5.5: Bus tripping occurred in Eastern Region during January' 2021.

B.5.5.1: Tripping of 400 kV Bus-1 at Koderma TPS on 18-01-2021 at 04:42 hrs

On 18-01-2021 at 04:42 hrs, 400 kV Gaya – Koderma -1 tripped on Y phase to earth fault. At the same time, 400 kV bus-1 tripped at Koderma.

DVC may explain.

Deliberation in the meeting

DVC informed that there was Y-phase to ground fault in 400 kV Koderma-Gaya-I. The autoreclosure was not successful as the fault was permanent in nature.

They informed that from the DR analysis it was observed that, after unsuccessful autoreclosure, the Y-phase pole of circuit breaker again reclosed without receiving any command from the relay. The breaker was also found in closed condition after the event.

As the Y-pole breaker remained in closed condition, the LBB protection operated after 200 msec from re-closing of the breaker and initiated busbar protection which tripped 400 kV bus-I at Koderma S/s.

They informed that reason for reclosing of Y-pole breaker without any command from relay could not be identified and added that they would do the complete checking of the scheme and breaker control circuit during the shutdown planned in the March'2021.

B.5.5.2: Tripping of 220 kV Bus-1 at 400/220 kV Jeerat S/s on 27-01-2021 at 18:57 hrs

On 27-01-2021 at 18:57 hrs 220 kV bus-1 at Jeerat tripped during its restoration of after shutdown work. 400/220 kV 315 MVA ICT-2 and 220/132 kV 160 MVA ICT -1 & 3 at Jeerat tripped at the same time.

WBSETCL/WBSLDC may explain.

Deliberation in the meeting

WBSETCL informed that there was no fault during the disturbance and 220 kV bus-1 at Jeerat was under shutdown prior to the event.

While charging a single phase spare transformer from bus-1 after completion of work, the busbar protection operated and tripped all the connected feeders to bus-1.

They informed that the busbar protection operated due to wrong settings of CT polarity in the relay. The same has been rectified after the disturbance.

B.5.5.3: Tripping of 220 kV Bus-1 at 400/220 kV Rourkela on 28-01-2021 at 10:49 hrs

On 28-01-2021 at 10:49 hrs, 220 kV bus 1 at Rourkela got tripped. As a result, 220 kV Rourkela-Tarkera D/C tripped from Rourkela end.

Powergrid may explain.

Deliberation in the meeting

*Powergrid explained the event with a report which is attached at **Annexure B5.5.3.***

They informed that disturbance occurred during changeover of bus side isolator for 315 MVA ICT 2 & 4(parallel operation) from bus-2 to bus-1 for taking shutdown of 220 kV bus-2 for AMP work.

They informed that when close command was issued to 220 kV bus-I isolator for ICT bay, the busbar protection operated and tripped both the 220 kV bus-1 & bus-2.

They informed that in the transient state during changeover of isolator, the individual bus zone for both bus-1 & bus-2 busbar protection might have operated due to current mismatch but the check zone should prevent operation of busbar protection.

They further informed that during checking it was found that due to faulty CT supervision relay, the DC got extended to check zone which triggered the busbar protection. They added that the auxiliary relay has been replaced.

PCC enquired about checking of healthiness of auxiliary relays during regular maintenance work in the substation and advised Powergrid to explore some mechanism forchecking the healthiness of auxiliary relays related to busbar protection before any changeover or taking bus out for shutdown work in order to avoid this type of disturbance in future.

ITEM NO. B.6: Repeated tripping of 132 kV Chuzachen – Rangpo – 1 with same fault location

During January 2021, 132 kV Chuzachen Rangpo – 1 tripped repeatedly due to B phase to earth fault at the almost same fault location. ERLDC vide mail dated 15th January 2021 advised Sikkim STU and Sikkim SLDC to find the root cause of repeated tripping and take action to reduce the no of tripping. Tripping incident of 132 kV Chuzachen – Rangpo – 1 in the last 3 months is shown below.

Element Name	Tripping Date	Tripping Time	Reason	Revival Date	Revival Time
132KV-CHUZACHEN-RANGPO-1	27-01-2021	15:01	B_N, 12.28 KM, 1.362 kA (Chuzachen) B_N, 5.2 kA, 2.872 KM (Rangpo)		
132KV-CHUZACHEN-RANGPO-1	25-01-2021	14:21	B-N , 2.9KM , F/C-4.2KA FROM RANGPO	26-01-2021	18:56
132KV-CHUZACHEN-RANGPO-1	25-01-2021	13:42	B-N , 2.9KM , F/C-4.2KA FROM RANGPO B-N,FD 12.36KM,F/C 2.25KA FROM CHEP	25-01-2021	14:16
132KV-CHUZACHEN-RANGPO-1	22-01-2021	15:08	Rangpo: Z1, B-N, 2.925 KM, 4.479 KA	24-01-2021	14:53
132KV-CHUZACHEN-RANGPO-1	22-01-2021	14:04	B-N, Chuzachen: 12.43 KM, ; Rangpo: 2.92 km, Fc= 4.32 kA, Z-1	22-01-2021	14:54
132KV-	21-01-	13:50	B - N FAULT , FAULT	21-01-	15:00

CHUZACHEN-RANGPO-1	2021		4.9 KA , Z1 2.9 KM (RANGPO)	2021	
132KV-CHUZACHEN-RANGPO-1	15-01-2021	13:54	Rangpo: B-N, 3km, 1kA; Chuzachen: B-N, 12.7km, 0.8kA.	15-01-2021	14:56
132KV-CHUZACHEN-RANGPO-1	13-01-2021	14:53	Rangpo: B_N, 2.874 KM, 5.3 kA, Chuzachen: B_N, FD-12.25 Km	13-01-2021	15:41
132KV-CHUZACHEN-RANGPO-1	31-12-2020	09:47	B-N,Z1 3.01 KM 5.809 KA FROM RANGPO B-N,15.69 KM 2.452 KA FROM CHUZACHEN	31-12-2020	10:32
132KV-CHUZACHEN-RANGPO-1	27-12-2020	08:30	Rangpo-B-N FD-3.3km FC-6.37kA Chuzachen-B-N, FD-15km FC-2.9kA	27-12-2020	09:16
132KV-CHUZACHEN-RANGPO-1	05-11-2020	13:01	B-N , Z-1, 5.98KA, 2.77KM AT rangpo end	05-11-2020	14:34

The following may be clarified.

- Root cause of repeated tripping of 132 kV Chuzachen Rangpo – 1 on same fault indication and location
- Remedial action taken by utilities to reduce the no of tripping.

Sikkim & Chuzachen HEP may explain.

Deliberation in the meeting

The agenda could not be discussed as Sikkim representative was not present in the meeting. PCC decided to refer this agenda to upcoming OCC meeting for discussion.

ITEM NO. B.7: Repeated tripping of Circuits from NTPC Barh and Associated protection Issues

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

Sr. No	Element Name	Tripping Date	Tripping Time	Reason	DISCREPANCY	REMARKS
1	400KV-GORAKHPUR-BARH-1	21-01-2021	5:25	119,114 A,95.32 A B-N,DISTANCE NT SHOWN FROM BARH END DT received at Gorakhpur	**No fault in the line, tripped due to master trip relay operation at Barh end.**	**No fault, Mal-operation of the relay could have been avoided.**
2	400KV-PATNA-BARH-1	21-01-2021	5:52	TRIPPED FROM PATNA END y-n,81 km,6.97 KA main 1 ,58.7	**A/R Successful only from the Barh end .**	**Tripping could have been avoided if A/R operated at**

				km ,3.85 KA in y -n Z1 A/R SUCCESSFUL FROM BARH Z1,Y-N,15.49 KA,22.4 KM		**Patna end.**
3	400KV-PATNA-BARH-1	19-01-2021	0:24	PATNA: B-N,FC 7.2KA,FD 81KM BARH :Z1,B-N, 11.6KA,FD 30.6KM	**At Barh end all 3 phase main CB opened and only B phase TCB opened, rest Y and B phase TCB were closed which also got opened after 900 ms. At patna end A/R was successful.**	**Tripping could have been avoided if A/R operated at Barh end.**
4	400KV-BARH-GORAKHPUR-1	12-1-2021	3:57	Barh: Z1, B-N, 2kA, 183km	A/R Unsuccessful.	
5	400KV-PATNA-BARH-2	12-1-2021	3:41	Patna: B-N, 7.2kA, 71km; Barh: B-N, Z1, 18.6kA, 21km	**A/R unsuccessful. At Barh end Y-phase voltage became very low up to zero along with B phase and recovered fully. At the time of A/R also, Y phase voltage became zero while at Patna end it was normal. The reason for such dip at Barh end may please be explained.**	

Report on the above tripping incidents is attached in Annexure-B7.

NTPC, Powergrid may explain.

Deliberation in the meeting

For the event under sl no.1, NTPC informed that 400 kV Barh – Gorakhpur-1 tripped from Barh end due to DT receipt from Gorakhpur end.
Powergrid informed that Gorakpur end tripped due to DT receipt from Barh end.

PCC advised Powergrid to submit DR files of Gorakhpur end for the above line so that tripping can be analysed.

For the event under sl no.2, NTPC informed that relay at their end sensed Y-phase to ground fault in 400 k V Patna – Barh-1 and auto-reclose was successful.

Powergrid informed that both main and backup protection relay for 400 k V Patna – Barh-1 line at Patna end sensed phase to phase fault and tripped in zone-1 of distance

protection. Powergrid informed that the autoreclosure for this line was being successful in earlier cases. PCC advised to check the autoreclosure scheme at their end.

For the event under sl no. 3,4 & 5, after detailed deliberation PCC advised to NTPC following:

- *Regarding rise in voltage in healthy phases at Patna end, PCC advised to check for CVT earthing issue for the 400 kV Barh-Patna lines.*

- *Regarding autoreclosure issue under sl no. 3, PCC advised NTPC to do the thorough checking of the A/R scheme, relay configuration & settings and resolve the A/R issue at the earliest.*

- *During DR analysis, it was observed that there was a delay of more than 100 msec for carrier received at Barh end for 400 kV Barh-Patna lines. PCC advised NTPC & Powergrid to resolve the carrier delay issue at the earliest.*

- *PCC advised NTPC to submit a detailed report with respect to the above disturbances and action taken thereof to ERLDC/ERPC secretariat at the earliest.*

It was observed that in many cases the DR files of either main-I or main-II is being submitted instead of both relays of main protection. PCC advised all the utilities to submit the DR files for both the relays of main protection in case of any disturbance.

ITEM NO. B.8: Islanding schemes of Eastern Region

1) Chandrapura Islanding Scheme:

The islanding scheme in DVC is under Chandrapura TPS considering unit 1, 2 and 3 having capacity of 3x130 MW (Namely CTPS-A plant) along with connected load of CTPS-A itself. However unit 1 and 2 were decommissioned.

In the OCC meeting, DVC informed that they are planning implement the islanding scheme with the new units (unit 7 and 8) of Chandrapura TPS having capacity of 2 x 250 MW (namely CTPS-B plant).

The detailed plan of islanding scheme is given at **Annexure B8.**

In 98th PCC, DVC explained the Chandrapura islanding scheme in detail with a presentation.

The scheme as explained by DVC in brief as follows:

- *The proposed islanding scheme would be implemented considering 2X 250 MW Generators of CTPS-B generating station along with loads of CTPS-A(120 MVA), Putki (180 MVA), Patherdih (141 MVA) and Nimiaghat (40 MVA).*

- *The islanding relay is to be placed at CTPS-B station with voltage & frequency of 220 kV CTPS-B as reference.*

- *On actuation of islanding relay at 220 kV CTPS-B, the trip commands will be extended further to 220 kV CTPS-A, 132 kV CTPS-A, 132 kV Putki, 132 kV Patherdih, and 132 kV Nimiaghata using OPGW communication network.*

They informed that the timeline for implementation of the islanding scheme would be 18 months from the date of finalization of the scheme.

They added that OPGW network is already present in order to extend trip signal of islanding relay to the related substations.

On a query from PCC regarding healthiness of the breakers at substations associated with this islanding scheme, they informed that circuit breakers are comparatively new in these substations and the breakers are being checked and maintained regularly during annual maintenance program.

During discussion, the frequency settings for islanding operation could not be discussed as representative from CTPS generating station was not present in the meeting.

ERLDC stated that DVC can conduct a dynamic study instead of steady state analysis which might help in finalizing the islanding frequency.

PCC advised DVC to conduct a dynamic study in coordination with ERLDC by January' 2021.

PCC decided that a separate meeting to be conducted among DVC, ERPC and ERLDC to finalize the islanding scheme.

DVC may update.

Deliberation in the meeting

ERLDC presented the dynamic study report on CTPS islanding scheme. The report is attached at Annexure B8.1.

The study has been carried out for four different cases based on different scenarios of Generation and Demand. ERLDC informed that stability of islanding schemes was confirmed in each cases. However, over-frequency (upto 53.6 Hz) condition is being observed for cases having minimum demand condition.

They further informed that the over-frequency settings for units at CTPS-B is 52 Hz with 100 sec delay.

PCC opined that over frequency setting of the units need to be discussed/reviewed.

PCC advised ERLDC to share the study report with DVC Planning team and decided to conduct a separate meeting to finalize the scheme.

2) IB-TPS Islanding Scheme:

The islanding scheme was discussed in special meeting held on 12-12-2018

After detailed discussion the following were decided:

- The alarm for islanding scheme shall be initiated at 49.2 Hz at both Budhipadar and IB TPS to alert the operators

- Islanding of one unit (210 MW) of IBTPS with the selected loads of 149 MW connected through 132 kV level at Budhipadar substation will be initiated at 47.8 Hz of grid frequency with 250msec time delay.
- The islanding relay Micom P341 at Budhipadar will give trip command to all 220KV feeders connected to Bus-I and Bus II along with Bus coupler except Auto transformer- I & II and selected islanding IB TPS ckts either (IB -1 & 3) or (IB-2 & 4).
- Give trip command to circuit breakers of 132kV Budhipadar-Lapanga S/c line, 132kV Budhipadar-Jharsuguda D/C line and 132kV Budhipadar-Rajgangpur S/C lines at Budhipadar end.
- It will send carrier command to both Kalunga and Tarkera end to trip 132kV Kalunga-Tarkera S/c line from both the ends to make radial load at Kalunga.
- It will send carrier signal to IB TPS to start ramping and adjust IB TPS (one unit) generation to match the load.

Regarding implementation, OPTCL and OPGC informed the following:

- The islanding relay Micom P341 is already installed at bus coupler panel of 220kV Budhipadar S/s
- OPGW is available for 220 kV lines
- Installation of OPGW is in progress for 132kV lines
  Logic for generation control of islanding after receiving the command from Budhipadar is to be implemented at IB TPS.

In 98th PCC, OPGC informed that as per their recent communication with the OEM i.e. BHEL, high speed governing system is required for operating the unit in islanding mode of operation. As IB-TPS units are around more than 35 years old and having low speed governing system at present, it would be difficult to implement islanding scheme at IB-TPS.

PCC advised OPGC to place final observations from OEM regarding implementation of islanding scheme at IBTPS units in the PCC meeting.

OPGC and OPTCL may update.

Deliberation in the meeting

OPGC representative was not present in the meeting.

1) MTPS, Kanti Islanding Scheme:

The islanding scheme was discussed in 68th PCC Meeting held on 18-06-2018.

After detailed deliberation, PCC in principle agreed with the following islanding scheme at Kanti TPS:

· Stage II units (2x195 MW) of Kanti TPS will be islanded with station load of 40 MW and radial load of 150 MW (approx.) of 220kV Kanti TPS-Gopalganj D/C line.
· Once the grid frequency falls to 48.2 Hz, the PLC at Kanti TPS would initiate the islanding process after 500 ms time delay.

In 97th PCC following deliberations were made

KBUNL informed that the islanding scheme would be implemented with Stage II units (2x195 MW) of Kanti TPS. The relevant data related to Stage II units (2x195 MW) of Kanti TPS were already shared to ERLDC. KBUNL added that at present MTPS is having two bus system and they are implementing bus sectionalizer in both the 220 kV buses to isolate the Stage II units (2x195 MW) and 220kV Kanti TPS-Gopalganj D/C lines from rest of the grid.

KBUNL explained that the construction work of relevant bays of bus sectionalizer is pending due to some contractual issues. The work has been awarded to a new contractor and it is expected to be completed by end of 2021.

KBUNL further informed that all the hardware related to islanding schemes have been procured and the islanding scheme is expected to be implemented by December 2021.

PCC opined that implementation of MTPS, Kanti Islanding Scheme is very important for restoration of Bihar system during major grid disturbances. PCC advised KBUNL to expedite the work and implement the islanding scheme by June 2021.

In 98th PCC Meeting, BSPTCL informed that details of the availability of PLCC for the lines associated with KBUNL islanding scheme had already been shared. PCC advised BSPTCL to ensure the healthiness of the PLCC in all the 220kV and 132kV lines connected to the Gopalganj Sub-station within the timeframe of implementation of Islanding scheme at KBUNL.

KBUNL and BSPTCL may update.

Deliberation in the meeting

NTPC informed that the out of five no. of bays, work for two no. of bay has been completed. They added that remaining work would be completed by June'2021.

PCC advised BSPTCL & NTPC to complete pending works, if any, related to implementation of KBUNL islanding scheme other than the construction work at KBUNL switchyard, before June'2021 so that the scheme can be implemented at the earliest.

PCC also advised ERLDC to share the detailed action plans and requirements for implementation of the islanding scheme to NTPC & BSPTCL so that the same can be implemented by them within June' 2021.

4) Review of FSTPS Islanding Scheme

In 175th OCC Meeting, JUSNL informed that 220 kV Lalmatia-Godda line has been charged and the islanding scheme will be reviewed based on this change in network configuration.

OCC advised JUSNL to submit the load details and change in network configuration after commissioning of 220 kV Lalmatia-Godda line to ERLDC at the earliest.

JUSNL may update.

Members may discuss.

Deliberation in the meeting

It was informed that JUSNL has submitted load details related to Farakka islanding scheme.

PCC advised ERLDC to study and submit revised scheme based on the revised network configuration & load details and advised JUSNL to coordinate with ERLDC in order to finalize the scheme.

ITEM NO. B.9: Islanding Schemes for major cities of Eastern Region

A special Meeting on reviewing of Islanding Schemes was held on 28th Dec 2020 chaired by Hon'ble Minister of state (IC) for Power and New & Renewable Energy.

In this regard a letter from NPC division has been received to discuss the following action points.

a) Islanding schemes must be designed for all major cities and if there is need to establish power plant in / around such city, the proposal may be submitted to Ministry.

b) All strategic and essential loads need to be considered for Islanding Scheme and Ministry of Defence may also be consulted for finalizing strategic loads.

c) Generators which are spatially nearby the strategic and essential load shall be given priority in designing islanding scheme.

d) All concerned utilities to ensure functionality of AUFLS and df/dt relays at all points of time.

Members may discuss.

Deliberation in the meeting

PCC advised all SLDCs as well as ERLDC to plan for islanding schemes in line with the action points received from NPC division of CEA and submit the proposal in PCC for discussion.

ITEM NO. B.10: Total Power Failure at 220 /132 k V Dehri Substation on 21.12.2020 at 06:21 hrs

On 21-12-2020 at 06:21 hrs, 220 KV Dehri - Gaya D/C and 220 kV Pusauli - Dehri S/C tripped from Gaya and Pusauli end respectively resulting in total power failure at Dehri end. Existence of Y phase to earth fault has been captured by PMU data as well as DR recorded at Gaya end. The fault clearing time as per Gaya PMU is around 800 ms.

In 98th PCC meeting,

BSPTCL was advised to review the settings of main protection of the 132 kV Dehri-Kochas S/C line and back up protection of all the 220/132 kV ICTs at Dehri immediately.

PCC further advised as follows:

- BSPTCL to review all the relay settings at 132 kV Dehri S/s where new relays have been installed and in case of any change in the settings, the same should be shared with ERPLDC/ERPC for updation in the protection database.
- Powergrid to review zone-3 settings of 220 kV Gaya-Dehri line and 220 kV Pushauli-Dehri line. The same should be coordinated with back up overcurrent protection of 220/132 kV ICTs at Dehri.
- BSPTCL to check the PT connections to the main relay as well as back up protection relay at Dehri end.

BSPTCL and Powergrid may update.

Deliberation in the meeting

BSPTCL informed that the settings for new relays have already been shared. They also informed that the PT connections for main as well as backup protection relay were checked and found in order.

Regarding review of ICT overcurrent protection at Dehri end and zone-3 settings at powergrid end, PCC advised BSPTCL to coordinate with Powergerid and revise the settings at the earliest.

ITEM NO. B.11: Disturbance at 220 kV Meramundali Substation on 01.10.2020 at 04:07 hrs

On 30th September 2020 at 22:36 hrs, 220 kV Meramundali – NALCO - 1 was tripped on overcurrent protection. The line was charged at 00:05 hrs on 01st October 2020. At 01:35 hrs, sparking was noticed on this circuit at Meramundali end switchyard due to which GRIDCO SLDC advised NALCO to reduce the loading of the circuit.

At 04:07 hrs, line side pipe at Meramundali end of the above-mentioned circuit got broken and fell on the ground along with the breaker jumper causing line fault at Meramundali S/s. Bus jumper of 220 kV bus 1 at Meramundali also got damaged at several places which led to bus fault at 220 kV bus 1 at Meramundali. All the elements connected with 220 kV bus 1 along with the bus coupler tripped at Meramundali.

In 97th PCC following deliberations were made

- OPTCL to analyze the reason for rise in healthy phase voltage at Meramundali S/s during single phase to ground fault and send a report to ERPC and ERLDC.
- OPTCL to send latest status of OPGW work and implementation of carrier protection in 220 kV lines to ERPC and ERLDC.

In 98th PCC, SLDC Odisha informed that thorough checking of all earthing points are being carried at out at Meramundali S/s.

They further informed that the status of OPGW work and implementation of carrier protection in 220 kV lines would be submitted within a week.

OPTCL may update.

Deliberation in the meeting

SLDC Odisha informed that status of OPGW work and implementation of carrier protection in 220 kV lines would be submitted within two weeks.

They further informed that regarding reason for rise in healthy phase voltage at Meramundali S/s, OPTCL has taken up the issue with CPRI. PCC advised to share the progress in this matter to PCC.

ITEM NO. B.12: Tripping of 400 kV Barh- Kahalgaon line at Barh end on 22.12.2020.

On 22 December 06:09 Hrs ,400 Kv Barh -Patna-I line tripped at Barh end due to Y phase fault and at the same time 400 kV Barh -Kahalgaon-I which is in same dia also tripped with the operation of TEED protection associated with the line.

ERLDC informed that on 09th July 2020 at 13:40 Hrs, Teed protection has also operated for section associated with BARH-Kahalgaon-I for through fault in 400 kV Patna -NPGC line.

In 98th PCC, NTPC representative was not present in the meeting.

PCC advised NTPC to submit a report regarding the disturbance to ERLDC/ERPC secretariat at the earliest.

NTPC may update.

Deliberation in the meeting

NTPC informed that TEED Protection had mal-operated due to core issues of CT and the same has been replaced with new CT.

PCC advised NTPC to submit a report regarding this disturbance to ERLDC and ERPC secretariat at the earliest.

ITEM NO. B.13: Backup Overcurrent Relay coordination of Sikkim Complex

In 97th PCC following deliberations were made

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

It was informed that ERPC would share the revised settings as per the study carried out by PRDC to all concerned utilities.

In 98th PCC, PCC advised all concerned utilities to go through revised settings as per the study carried out by PRDC and provide their observations within one week.

Members may update.

Deliberation in the meeting

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

ITEM NO. B.14: Resistive reach setting guidelines and model calculation for distance protection--ERLDC

1. **Proposed Criteria for Phase-earth fault:**

    a. Calculation of minimum load impedance should be as per Ramkrishna Committee Recommendation:
        - Maximum load current (Imax) 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 (Vmin) to be considered as 0.85pu (85%).
    b. Minimum setting for resistive reach should be such that it must cover fault resistance, arc resistance and the tower footing resistance.
    c. Generally Maximum reach setting should be 80% of the minimum load impedance.
    d. Resistive reach setting < 4.5 times the zone reactive reach setting.

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

2. **Proposed Criteria for Phase-Phase fault:**

    a. Calculation of minimum load impedance as per the same method mentioned above.
    b. Minimum setting for resistive reach should be such that it must cover fault resistance and arc resistance.

c. Generally, 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 is set 60% of minimum load impedance. R2ph and R1ph are set 80% of R3ph-R4ph respectively.
d. Resistive reach setting < 3 times the zone reactive reach setting.

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

Another important point is consideration of remote end in feed for zone-2 and 3 reach calculations.

In 98th PCC, ERLDC informed that thermal loading value would be considered based on the design loading value of the individual line. The design loading value (75° or 85°) has been decided during the design phase of the line as per CEA planning criteria.

Powergrid informed that the specifications in point d) may change with the OEM therefore this condition may be modified accordingly.

PRDC informed that in case of short lines, with the proposed guidelines related to resistive reach settings the relay may not be able to clear high resistive fault.

Powergrid informed that they would submit their views with respect to point d) after due consultation from their end.

PCC viewed that these are general guidelines and modification can be done in resistive reach settings as per OEM specifications to solve the issue of clearing highly resistive faults.

It was decided that the guidelines would be finalized after receiving the comments from Powergrid.

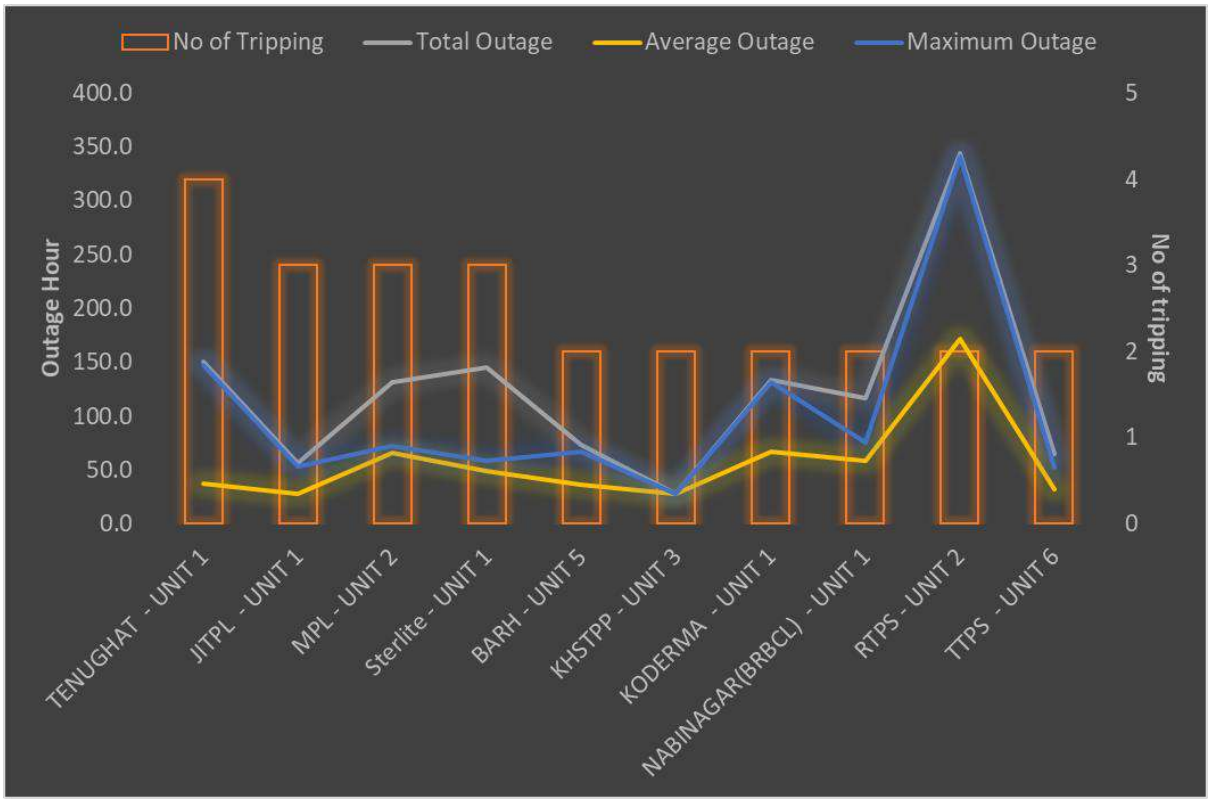
Members may discuss.

Deliberation in the meeting

After detailed deliberation, PCC advised Powergrid, DVC &CESC to give their comments to finalize the guidelines.

ITEM NO. B.15: Repeated tripping of generating units in January 2021

During January 2021, repeated tripping has been observed for a few generating units. A list of such generating units along with the number of tripping and outage duration is shown in the below figure.



Reasons for tripping for units with multiple tripping events in January 2021 is given below:

Name of generating units	Reason for tripping	No of tripping	Utility to respond
Tenughat TPS Unit 1	Tripping of PA Fan, High Drum level, Low main steam temperature, Problem in Air Preheater	4	TVNL/Jharkhand SLDC
JITPL unit 1	Bottom Ash problem (2), Drum level protection operation	3	JITPL
MPL TPS Unit 2	Boiler tube leakage	3	MPL
STERLITE TPS Unit 1	ID Fan Problem, Ash Handing Problem (2)	3	SEL/Orissa SLDC

TVNL, JITPL, MPL , SEL , Jharkhand SLDC and Orrisa SLDC may explain.

Deliberation in the meeting

TVNL informed that tripping of units occurred due to air preheater issue and flame stabilization issue. They added that overhauling of unit was scheduled in February'2021, however, the same has not been started yet as materials had not been received at site due to Covid-19 pandemic.

Representative from JITPL, MPL & SEL were not present in the meeting.

PCC advised TVNL to avail unit shutdown before onset of summer season and complete the overhauling work at the earliest.

PART- C:: OTHER ITEMS

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

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

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

Members may note.

Deliberation in the meeting

It was informed that PRDC personnel would visit physically to new substations mentioned in the list in order to collect substation/relay data for protection database.

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

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

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

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

Concerned utilities are advised to upload the relay settings in PDMS or send the relay settings to erpcprotection@gmail.com.

In 98th PCC, PCC advised all concerned utilities to upload the pending relay settings in PDMS or send the relay settings to erpcprotection@gmail.com.

Members may note and comply.

Deliberation in the meeting

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

ITEM NO. C.3: Schedule of Training Programme to be conducted by PRDC

PRDC is going to conduct training programme on PSCT & PDMS for the 4th year of support period in state utility premises of Eastern Region. The tentative schedule is given below:

Sl. No.	Venue	Date
1	Bihar	17/03/2021 to 19/03/2021
2	Jharkhand	21/04/2021 to 23/04/2021
3	ERPC Secretariat	13/05/2021 to 14/05/2021
4	West Bengal	09/06/2021 to 11/06/2021
5	Odisha	21/07/2021 to 23/07/2021
6	Sikkim	26/08/2021 to 27/08/2021

Members may discuss.

Deliberation in the meeting

Members noted.

ITEM NO. C.4: Protection coordination of the new transmission elements to be charged in Eastern Region

ITEM NO. C.4.1: LILO of 220 kV Gaya Sonenagar D/C at Chandauti S/S

As per information received at ERLDC, 220 kV Gaya Sonenagar D/C will be LILOed at Chandauti S/S.

Details of the modified line after LILO (as received at ERLDC)

Name	Conductor type	Length
220 kV Gaya Chandauti D/C	Single ACSR Zebra	18 km
220 kV Sonenagar Chandauti D/C	Single ACSR Zebra	76 km

As per information available at ERLDC, protection coordination may be required as per the following table.

Reason	S/S may be affected	Remarks	Utility to respond	Response received
LILO of 220 kV Gaya Sonenagar D/C at Chandauti S/S	Chandauti	Protection coordination to be done for all newly connected elements as per ERPC's guidelines	PMTL/ POWERGRID	Protection coordination has been done as per ERPC's guideline
	Gaya	Protection setting may be revised for 220 kV Gaya – Chandauti D/C (Earlier it was 220 kV Gaya Sonenagar D/C). Longest line connected to Gaya S/S (Earlier it was 220 kV Gaya Sonenagar D/C as per details available at	POWERGRID ER - 1	**Yet to be received**

		ERLDC) may get changed.		
	Sonenagar	Protection setting may be revised for 220 kV Sonenagar – Chandauti D/C (Earlier it was 220 kV Gaya Sonenagar D/C).	BSPTCL	**Yet to be received**
	S/S connected to Gaya: Bodgaya, Dehri, Khijesarai	Longest line connected to Gaya S/S (Earlier it was 220 kV Gaya Sonenagar D/C as per details available at ERLDC) may get changed.	BSPTCL	**Yet to be received**

Following Details to be shared:

- POWERGRID ERTS – 1 & BSPTCL may share whether revision of any existing protection setting at above mentioned S/S is required or not. In case of any revision, the revised setting may be shared with ERPC and ERLDC.
- The protection setting at Chandauti may be shared with ERPC and ERLDC.
- Status of carrier protection and PLCC channel in 220 kV Gaya, Chandauti and Sonenagar section may be shared.

Members may discuss.

Deliberation in the meeting

Powergrid informed that protection setting for 220 kV Gaya – Chandauti D/C would be revised by next week.

PCC advised BSPTCL to revise protection settings for Sonenagar S/s and for substations connected to 220 kV Gaya S/s and send the revised settings to ERLDC/ERPC.

ITEM NO. C.4.2 : Charging of 220/132 100 MVA ICT - 4 at Rangpo Sub-station

As per the scheme agreed in ER Standing Committee, 220/132 100 MVA ICT - 4 is to be charged at Rangpo S/S. Protection coordination may be required as per the following table.

Reason	**S/S may be affected**	**Remarks**	**Utility to respond**	**Response received**
Charging of 220/132 100 MVA ICT - 4 at Rangpo Sub-station	Rangpo	Protection coordination to be done for all newly connected elements as per ERPC's guidelines	POWERGRID ER-2	Protection coordination would be done as per ERPC's guideline
	S/S connected to Rangpo: New Melli & Tashiding (at 220 kV level) Gangtok & Chujachen (at 132 kV level)	Protection coordination to be checked for change in impedance due to charging of new ICT	POWERGRID ER – 2, Tashiding HEP and Chujachen HEP	**Yet to be received**

Following may be shared:

- Concerned utilities may share whether revision of any existing protection setting is required or not. In case of any revision, the revised setting may be shared with ERPC and ERLDC.
- POWERGRID ER-2 may share the protection setting at Rangpo for newly charged ICT.

Members may discuss.

Deliberation in the meeting

PCC advised Powergrid to submit the protection settings of 220/132 kV ICT-4 at Rangpo for updation in the protection database.

PCC also advised Powergrid, Tashiding HEP & Chuzachen HEP to review the protection settings at their substations connected to 220/132 kV Rangpo S/s. In case of any revision, the revised setting may be shared with ERPC secretariat and ERLDC.

ITEM NO. C.4.3 : Charging of 400/220 KV 315 MVA ICT - 3 at Rourkela Sub-station

As per the scheme agreed in ER Standing Committee, 400/220 kV 315 MVA ICT - 4 was connected in parallel with existing 315 MVA ICT-2 without using any additional CBs for the new elements at Rourkela S/S. As per same scheme, 315 MVA ICT-3 will be connected in parallel with existing ICT-1 without any additional breaker. Protection coordination may be required as per following table.

Reason	S/S may be affected	Remarks	Utility to respond	Response received
Charging of 400/220 KV 315 MVA ICT - 4 at Rourkela Sub-station (Two more 400/220 kV 315 MVA ICT is present at Rourkela)	Rourkela	Protection coordination to be done for all newly connected elements as per ERPC's guidelines	POWERGRID Odisha	Protection coordination would be done as per ERPC's guideline
	S/S connected to Rourkela: Ranchi, Chaibasa, Talcher STPS, Jharsuguda (at 400 kV level) Tarkhera (at 220 kV level)	Protection coordination to be checked for change in impedance due to charging of new ICT	POWERGRID ER – 1, POWERGRID Odisha, NTPC Talcher STPS, OPTCL	No revision in existing protection setting is required for Ranchi, Chaibasa and Jharsughuda.

Talcher NTPC and OPTCL to share whether revision of any existing protection setting is required or not. In case of any revision, revised setting may be shared with ERPC and ERLDC.

Members may discuss.

Deliberation in the meeting

It was informed that protection coordination has already completed.

ITEM NO. C.4.4: Charging of 220 kV Subhasgram (PG)- Baruipur D/C

As per information received at ERLDC, 220 kV Subhasgram (PG) - Baruipur D/C will be charged up to dead end tower of Baruipur.

Details of lines to be charged (as received at ERLDC)

Name	Conductor type	Length
220 kV Subhasgram (PG) - Baruipur D/C	Single ACSR Zebra	29 km

As per information available at ERLDC, protection coordination may be required before charging at both ends as per following table.

Reason	S/S may be affected	Remarks	Utility to respond	Response received
Charging of 220 kV Subhasgram (PG) - Baruipur D/C	Subhasgram (PG)	Protection coordination to be done for all newly connected elements as per ERPC's guidelines.	POWERGRID ER- 2	
	Baruipur	Protection coordination to be done for all newly connected elements as per ERPC's guidelines.	WBSETCL	
	S/S connected to Subhasgram (PG): Subhasgram (WB), KLC, New Town A, EM Bypass	Longest and shortest line connected to Subhasgram (PG) S/S may be checked and protection coordination may be done for feeders connected to Subhasgram (PG) S/S in case of change in longest and shortest line connected to Subhasgram (PG) S/S.	WBSETCL& CESC	WBSETCL has confirmed protection coordination. CESC may confirm protection coordination at EM Bypass S/S.

Following may be shared:

- Protective relay setting at Subhasgram (PG) and Baruipur to be shared to ERLDC/ERPC for newly charged lines for update in ERPC protection database.
- In case of change in any existing protection relay setting, WBSETCL to share revised setting may be shared with ERPC and ERLDC for update in protection database.
- Status of carrier protection and PLCC channel of newly charged line to be shared.

Members may discuss.

Deliberation in the meeting

It was informed that required details have been received for idle charged line of 220 kV Subhasgram-Baruipur D/C line.

ITEM NO. C.4.5: LILO of 400 kV Kharagpur New Chanditala D/C at Medinipur along with charging of 400 kV main bus 1 & 2 at Medinipur along with 2 x 125 MVAr Bus reactor at Medinipur

As per information received at ERLDC following elements will be charged/LILOed in near future:

- 400 kV Main Bus 1 & 2 at Medinipur
    - Type of Conductor- QUAD AAC Bull
- 400 kV 125 MVAr Bus reactor 1 & 2 at Medinipur
- LILO of 400 kV Kharagpur New Chanditala D/C at Medinipur. Details modified lines after LILO (as received at ERLDC) are provided in table below.

Details of modified line after LILO (as received at ERLDC)

Name	Conductor type	Length
400 kV Kharagpur - Medinipur D/C	Twin ACSR Moose	115 km
400 kV New Chanditala - Medinipur D/C	Twin ACSR Moose	96 km

As per information available at ERLDC, protection coordination may be required as per following table.

Reason	S/S may be affected	Remarks	Utility to respond	Response received
LILO of 400	Medinipur	Protection coordination to	PMJTL/	Confirmed

kV Kharagpur - New Chanditala D/C at Medinipur	(New)	be done for all newly connected elements as per ERPC's guidelines	POWERGRID	
	Kharagpur	Protection setting may be revised for 400 kV Kharagpur – Medinipur D/C (Earlier it was 400 kV Kharagpur - New Chanditala D/C).	WBSETCL	Confirmed
	New Chanditala	Protection setting may be revised for 400 kV New Chanditala – Medinipur D/C (Earlier it was 400 kV Kharagpur - New Chanditala D/C).	WBSETCL	Confirmed
	S/S connected to Kharagpur: Chaibasa, Kolaghat, Baripada	Longest and shortest line connected to Kharagpur S/S may be checked and protection coordination may be done for feeders connected to Kharagpur S/S in case of change in longest and shortest line connected to Kharagpur S/s.	POWERGRID ER-1, WBPDCL, POWERGRID Odisha	Distance protection setting to be changed at Kolaghat end. * No modification of protective relay setting is required at Baripada and Chaibasa.
	S/S connected to New Chanditala: Kolaghat, Arambag, Bidhannagar, Jeerat	Longest and shortest line connected to New Chanditala S/S may be checked and protection coordination may be done for feeders connected to New Chanditala S/S in case of change in longest and shortest line connected to New Chanditala S/S.	WBPDCL, WBSETCL	Confirmed.

Protection relay setting may be shared in pdf for all newly charged elements which are as follows:

Element Name	S/S Name	Utility to respond	Received for S/S
400 kV Kharagpur - Medinipur D/C	Kharagpur and Medinipur	PMJTL/ POWERGRID & WBSETCL	All
400 kV New Chanditala - Medinipur D/C	New Chanditala & Medinipur	PMJTL/ POWERGRID & WBSETCL	All
765 and 400 kV Main Bus 1 & 2 at Medinipur	Medinipur	PMJTL/ POWERGRID	All
765 and 400 kV bus reactor 1 & 2 at Medinipur	Medinipur	PMJTL/ POWERGRID	All
765/400 kV ICT 1 & 2 at Medinipur	Medinipur	PMJTL/ POWERGRID	All
400 kV Bidhannagar New Chanditala	Bidhannagar	WBSETCL	None
400 kV KTPP - Kharagpur	KTPP	WBPDCL	None

Members may discuss.

Deliberation in the meeting

PCC advised WBPDCL to review the protection settings at Kolaghat.

ITEM NO. C.4.6: Upgradation of 220 kV Tata Steel Kalinganagar – New Duburi D/C to 400 kV voltage level.

As per information received at ERLDC, 220 kV TATA steel Kalinganagar-New Dubri was charged at 400 kV voltage level. **Details of modified line after Charged at 400 kV (as received at ERLDC)**

Name	Conductor type	Length
400 kV New Dubri-TATA Steel D/C	Twin ACSR Moose	5 km

As per information available at ERLDC, protection coordination may be required as per following table.

Reason	S/S may be affected	Remarks	Utility to respond	Response received
Charging of 220 kV New Dubri-TATA Steel D/C at 400 kV level	New Dubri	Protection setting may be revised for 400 kV level. shortest line connected to New Dubri S/S may get changed.	OPTCL	No change is required at New Duburi end
	TATA Steel,Kalinganagar	Protection setting may be revised as per ERPC philosophy	TATA Steel	Protection setting has been shared by Tata Steel.
	S/S connected to New Duburi: Pandiabili, Baripada, Meramundali	Shortest line connected to New Dubri S/S may get changed.	OPTCL, Powergrid Odisha	Protection coordination has been confirmed.

Following to be shared:

- Status of carrier protection and PLCC channel in 400 kV New-Dubri and TATA Steel, Kalinganagar section to be shared.

Members may discuss.

Deliberation in the meeting

PCC advised OPTCL to provide status of carrier protection and PLCC channel for 400 kV New-Dubri-Tata Steel D/C line.

ITEM NO. C.4.7: First time charging of 220 kV Hatia new - Ranchi Smart City S/C.

As per information received at ERLDC, 220 kV Hatia new - Ranchi Smart City S/C will be charged for first time.**Details of newly charged cable are shown below (as received at ERLDC)**

Name	Conductor type/capacity	Length/Impedence
220 kV Hatia new - Ranchi Smart City S/C	800 sqmm XLPE Cable	6 km
220/34.5 kV ICT at Ranchi Smart City	65 MVA	12.17%

As per information available at ERLDC, protection coordination may be required as per following table.

Reason	S/S may be affected	Remarks	Utility to respond	Response received
Charging of 220 kV Hatia new - Ranchi Smart City S/C	Hatia New	Protection relay setting is to be coordinated for newly charged element	JUSNL	
	Ranchi Smart City	Protection relay setting is to be coordinated for newly charged element	JUSNL	
	S/S connected to Hatia: Ranchi & Patratu	Longest and Shortest line connected to Hatia may be checked. In case of any change, protective relay setting is to be revised accordingly.	POWERGRID ER-1 & JUSNL	

Following to be shared along with confirmation of protection coordination as per above table:

- Protection relay setting of 220/34.5 kV 65 MVA ICT at Ranchi Smart City.
- R, X and B value of the newly charged/to be charged cable
- Maximum power carrying capability of transmission cable.
- In case of any change in existing protection setting at Hatia and Patratu, revised protection relay setting may be shared with ERLDC and ERPC.

JUSNL may update.

Deliberation in the meeting

It was informed that required details have already been received.

****

Annexure A

S.No.	Name	Designation	Organisation	Contact No.	Email Id
1.	N.S. Mondal	Member Secretary	ERPC	9958389967	nsmondal34@gmail.com
2.	D.K.Jain	Executive Director	ERLDC	9910344127	dk.jain@posoco.in
3.	D.K.Bauri	SE	ERPC	9883617236	eeop.erpc@gov.in
4.	Sanatan Sarvesh	AEE	ERPC	9599219638	sanatan.sarvesh@gmail.com
5.	P.P. Jena	EE	ERPC	9776198991	pranayapiyusha@gmail.com
6.	Sanatan Sarvesh	AEE	ERPC	9599219638	sanatan.sarvesh@gmail.com
7.	K. Satyam	AE	ERPC	7355225072	satyam24365@gmail.com
8.	A. Malick	CGM	ERLDC	9436302720	amreshmalick@posoco.in
9.	Ankur Kumar	Manager(AM)	Powergrid ER-1	9431815656	ankur@powergridindia.com
10.	Rajendra Prasad		TUVNL	9031049936	rp.ttps@gmail.com
11.	Abhinaba Basu	AE	BSPTCL	7033091492	abasu.14bsptcl@gmail.com
12.	Alok Pratap Singh		ERLDC	9007285390	apsingh@posoco.in
13.	Ch. Mohan Rao		Powergrid	9437962193	mohan.rao@powergridindia.com
14.	Pallavi Kansal		TVTPL	9898596883	pallavi.k@tvptl.com
15.	Rajdeep Bhattacharjee		BSPHCL		
16.	Pankaj Mishra		BSPTCL , CRITL		
17.	S M S SAHOO	AGM	Meramundul i, OPTCL		
18.	DEEPAK THAKUR	AEE	BSPTCL	7033092545	deepak.aashish@gmail.com
19.	Sonam		BSPTCL		
20.	Nishant Kumar Shankwar		DMTCL	79872 10324	Nishant.Kumar@sekura.in
21.	Satya Deep Tangudu		Dikchu HEP		makarandprakash.j@greenkogroup.com
22.	Umakant	DGM	OPTCL	9438907493	ele.umishra@optcl.co.in

	Mishra				
23.	Saibal Ghosh		ERLDC	8584072079	saibal@posoco.in
24.	Chandan Kumar	Manager	ERLDC	9869251460	chandan@posoco.in
25.	Raj Protim Kundu	Dy. Manager	ERLDC	9903329591	rajprotim@posoco.in
26.	Arindam Choudhary	AEE	BSPTCL	9572324275	ari010689@gmail.com; esecritil@gmail.com
27.	Rahul Anand	Senior Manager (O & M)	NTPC	9425823430	rahulanand@ntpc.co.in
28.	Alka Rani				
29.	SURAJIT BANERJEE	SR. GM	ERLDC	9433041823	Surajit.benerjee@posoco.in
30.	Jayanata Kanjilal	ACE	WBSETCL	9434910189	jayanta.kanjilal@wbsetcl.in
31.	Saurav Sahay	Ch. Manager	ERLDC		
32.	Debdas Mukherjee	Manager	WBPDCL		
33.	Sukhdev Pal				sukdev123@gmail.com
34.	Rambaboo Singh				
35.	Alok Pratap Singh		ERLDC		
36.	Souvik Banerjee	SE	WBSETCL	9434910171	svkbanerjee@yahoo.com
37.	Prachi Gupta	AEE	SLDC BIHAR		
38.	Sandip Ghosh				
39.	Dhirendra Guru	DGM	OPGC	9338715939	dhirendra.guru@opgc.co.in
40.	Sudeep Kumar	Deputy Manager	Powergrid	9431820338	sudeepkumar@powergridindia.com
41.	Tushar Ranjan	AEE	Jharkhand SLDC	9326374226	ranjtushar@gmail.com
42.	Sourav Biswas	Dy. Manager	ERLDC		
43.	Gagan Kumar		Bihar SLDC		

Annexure B1

Incidence report on total power failure at HEL on 5th January, 2021.

Preconditions:

1. Unit-2 was shut down for annual overhauling.
2. Line-1 was shut down for transmission tower maintenance job.
3. 400kV Main Bus-1 was shut down for isolator maintenance of Line-1 bay & MBC bay.
4. Relay maintenance of Line-1 was in progress with current injection kit.

Sequence of Events:

1. Current injection was done in P543 relay of Line-1. Before current injection, CB Fail protection was disabled in the relay setting file.
2. At 13:37:40:360541, in P543, R phase differential trip, Any Trip and the LBB output relay R13 operated.
3. The Zone-B trip bus got energized, resulting in the tripping of the Circuit Breakers of Line-2, GT-1, ST-1 & ST-2 which were connected to Main Bus-2.
4. Unit 1 came to house load (13 MW). But without Station transformers in service, it was not possible to keep the unit in operation. Therefore, unit-1 was tripped manually.

Observations and findings:

Corrective and Preventive Actions:

1. Correct CT switching operation shall be ensured before relay testing.
2. The LBB output shall be physically isolated from the busbar protection scheme before starting relay testing and will be reconnected after completion of relay testing.
3. No modification of the existing PSL shall be done for testing purpose.

एनटीपीसी NTPC

एनटीपीसी लिमिटेड
(भारत सरकार का उद्यम)
NTPC Limited
(A Govt. of India Enterprise)

BARH SUPER THERMAL POWER PROJECT
ELECTRICAL MAINTENANCE DEPARTMENT

The point wise reply against the e-mail dated 04.02.2021 received from ERLDC regarding tripping of 400 kV Barh-Motihari-2 Line on 05:36 Hrs, 15.01.2021(event-1) & 11:20 Hrs, 21.01.2021 (event-2) is as follows:

1. *No sequence of events has been captured at NTPC Barh*.

NTPC Barh Reply: **The communication gateway network with ERLDC was intermittent due to commissioning activities of 660 MW Unit-1 of 3x660 Stage-1and integration/up gradation of SCADA database w.r.t. the new relays and system being installed at CCR.**

2. *As the line was charged through tie-breaker at Barh end such occurrence of grid disturbance could have been avoided if DT was not sent from Barh end. The reason for sending DT from Barh end during the second event may be explained.*

NTPC Barh Reply: The line reactor tripped on 50N1 protection (realized in 7UT613 relay in residual mode) after a delay of 1.2 sec initiating 86 relays of the reactor at 11:20:37.289. The 86 relays of the line also operated at 11:20:38.257 due to which DT from Barh end was sent. The scheme/settings/relay configuration is being reviewed for operation of line 86 relays.

3. *The reason for non-reclose of B pole (faulted phase) of the main breaker at Barh may be shared.*

NTPC Barh Reply: The main breaker B phase pole opened at 11:20:36.052. However the CB Ready status in BCU went low at 11:20:36.170, coincidentally at the same time compressor air pressure went low at 11:20:36.285 due to which AR got blocked in BCU and subsequent closing command from BCU was not initiated.

4. *Breaker operation of tie-breaker is not captured by DR recorded at Barh end. The same may be implemented in DR output as unused channels are available.*

NTPC Barh Reply: The open feedback (NC contacts phase wise) of both main & tie breakers are paralleled in field and has been connected to the binary input of the distance protection relays 21M1 & 21 M2. Hence the same can't be implemented in DR. However the open and close feedback of individual poles of both Main & Tie breakers is programmed in SOE of SCADA.

The SOE retrieved from SCADA is attached for reference.

Annexure B4

Grid Disturbance at 220/132 kV Hatia – II GSS on 29.01.2021 at 10:42 hrs.

Overview of Incident : -

- 220KV Ranchi- Hatia ckt-III was being shifted from 220KV Bus1 to Bus 2 at Hatia GSS. During changeover , sparking was observed in Bus 2 isolator of PGCIL(Ranchi)-3 feeder and subsequently all the feeders are tripped connecting Bus1&2.

  Bus Bar Protection was not in service.

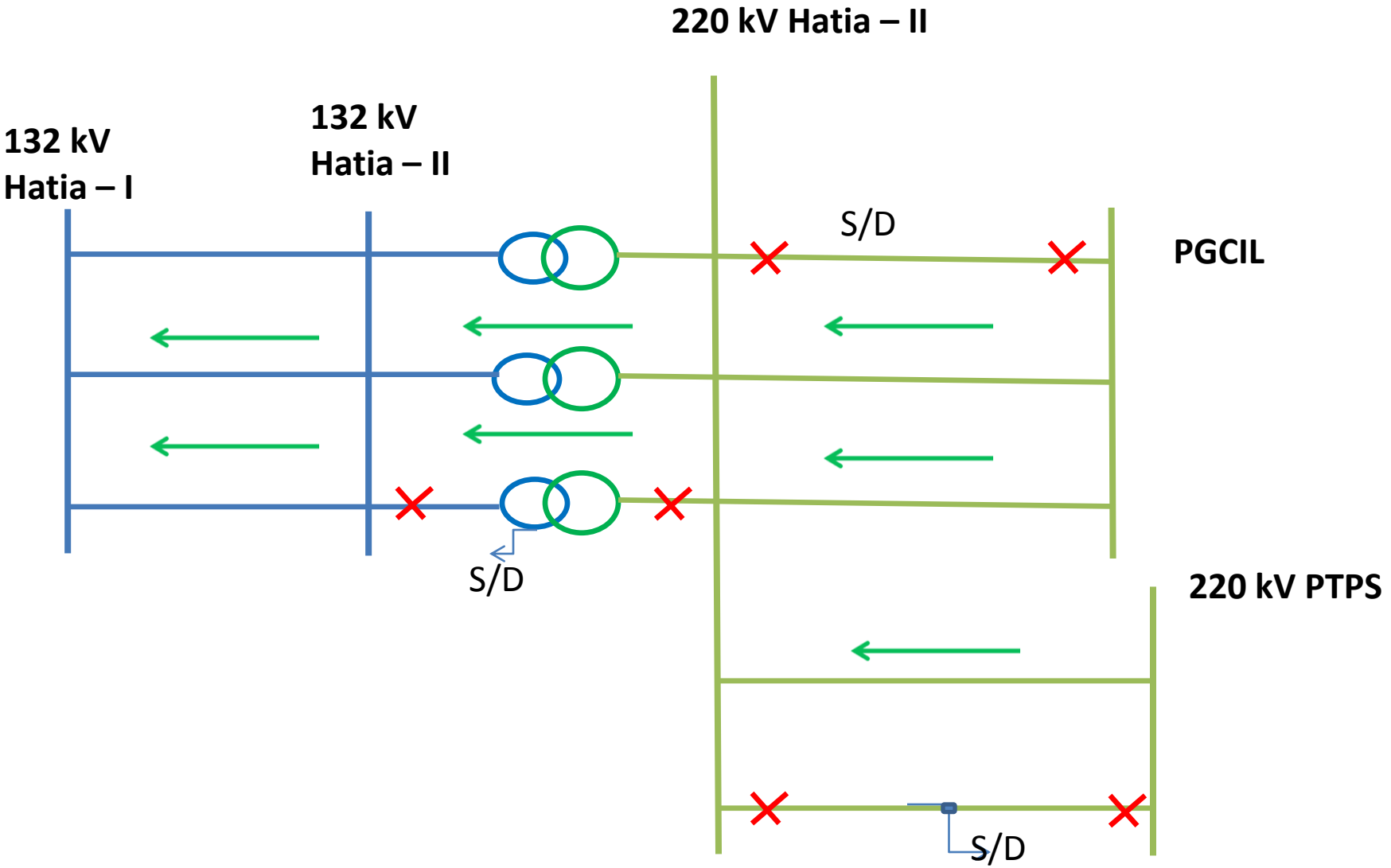
- **Load Loss –** 195 MW
- **Major elements tripped :-**

  220 kV Ranchi - Hatia -2&3, 220 kV PTPS-1

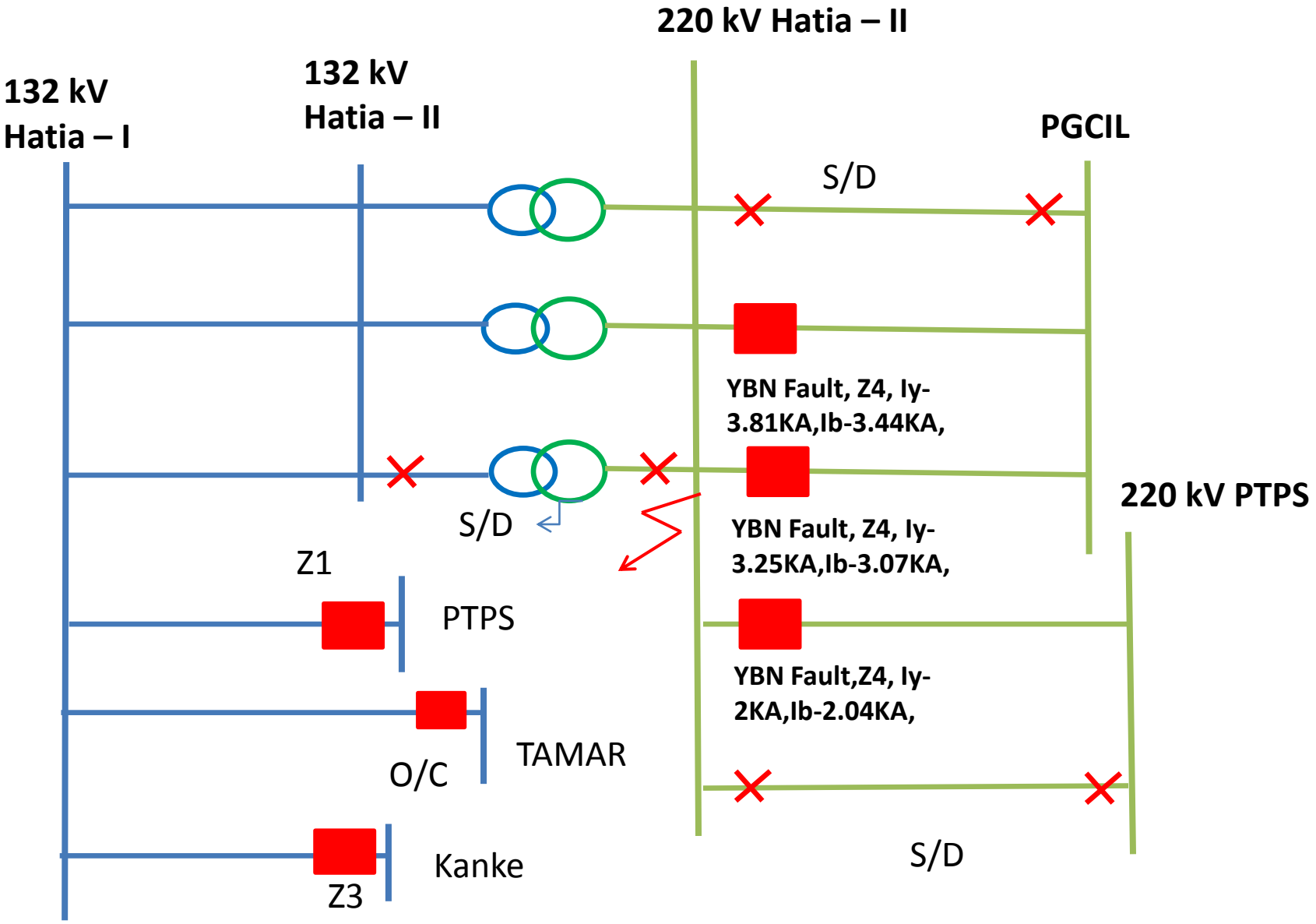
- **Elements Under shut down :-**

  220 kV PGCIL – I, 220 kV PTPS – II & 150 MVA ICT - III

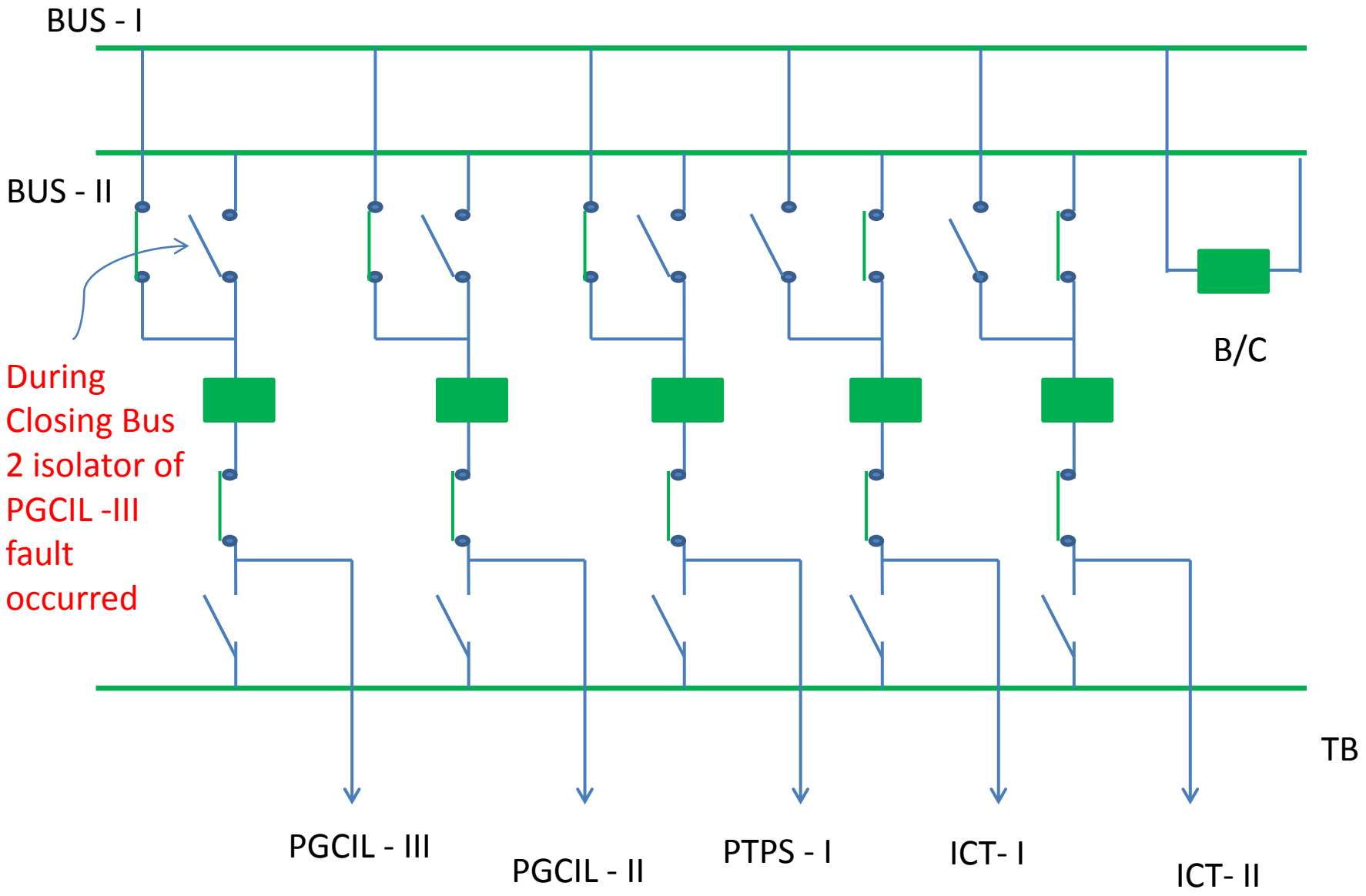
- Prefault Condition :-



- Post fault Condition :-



Prefault Operation



- **Relay Indications :-**

Element Name	Relay indication at Hatia End	Remarks
220 kV Ranchi (PGCIL) - Hatia - 2	YBN Fault,Z4, trip on -300ms, Fault Location- -1.2KM Fault cleared -100ms. IB-3.81KA,IC-3.44KA,VBN-74KV,VCN-53KV	
220 kV Ranchi (PGCIL) - Hatia - 3	YBN Fault,Z4, trip on -300ms, Fault Location- -1.4KM Fault cleared -100ms. IA-0.14KA,IB-3.25KA,IC-3.07KA,VBN-64.85KV,VCN-54.96KV	
220 Kv PTPS-1	YBN Fault,Z4, trip on -300ms, Fault Location- -1.966KM Fault cleared -100ms. IA-175A,IB-2KA,IC-2.039.44KA,VAN-124.1KV,VBN-71.15KV,VCN-60.72KV	
220KV Bus Coupler	O/C , E/F	

- **Relay Indications :-**

Element Name	Relay indication at Remote End	Remarks
132 kV Hatia I - Tamar	YBN Fault, E/F & O/C, Fault Duration-592ms.	
132 kV Hatia I – Kanke (8C)	YBN Fault, Zone3 ,Fault Location-41.9KM IR-0.87KA,IY-1.57KA,IB-1.18KA	
132 kV Hatia I – PTPS (9C)	RYBN Fault, Z1, Fault Location-24.95KM IR-438.2A,IY-1.069KA,IB-726A.	

- **Tripping Analysis :-**

  - **220KVRanchi- Hatia ckt-III was being shifted from 220KV Bus1 to Bus 2 at Hatia GSS. During changeover , sparking was observed in Bus 2 isolator of PGCIL(Ranchi)-3 feeder. In this event post disc insulator of said isolator got damaged ,which might lead to create bus fault and all the feeders sensed in Zone4 tripped subsequently .**

  - **During the event, none of the ICTs got tripped at 220/132KV Hatia II. Also, all 3 ckts of132 KV Hatia II- Hatia I did not tripped.**

  - **132KV Hatia I-Tamar tripped on Dir.O/C & E/F.**

  - **132KV Hatia I-PTPS tripped on Z1,however there was no fault in the line. This might tripped on power swing as zones tripping on power swing are not blocked in relay settings.**

  - **132Kv Hatia I –Kanke are tripped in Z3. Reason for Z3 tripping could not be identified as power swing trip is blocked in relay setting.**

THANK YOU

"DISTURBANCE REPORT"

STATION: 400/220kV Rourkela

Date & Time of Occurrence: 28th Jan 2021, 10:49 Hrs.

Event: 220kV Busbar-1&2 tripped on Bus bar protection during changeover of isolator for taking shutdown of 220kV Bus-II for AMP work.

Status of the elements just before tripping:

Connected Feeder to 220kV Bus-I: Tarkera-1&2.
Connected Feeder to 220kV Bus-II: ICT-2&4
Bus Coupler was in **On** condition.

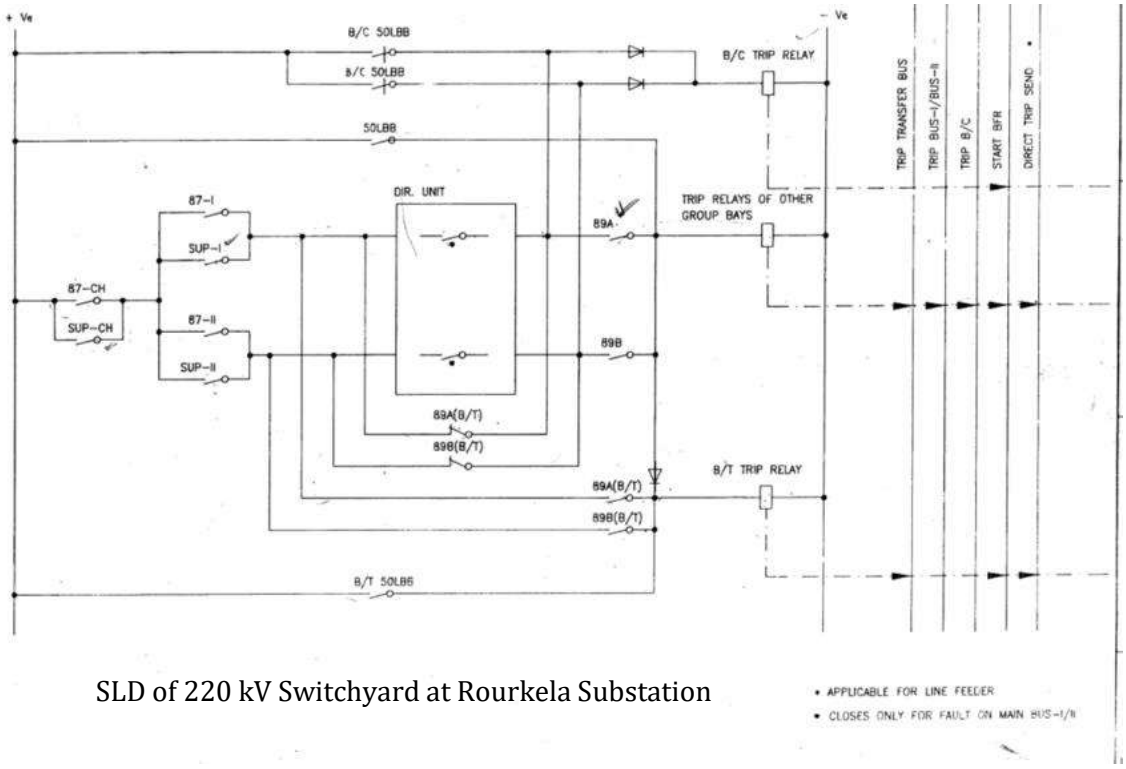
Sequence of Event:

1. There are 04 feeders connected to 220kV Bus-1&2 (DMT scheme)
    a. 220kV Tarkera Line-1- Usually connected to Bus-I.
    b. 220kV Tarkera Line-2- Usually connected to Bus-II.
    c. 2*315 MVA ICT-2&4- Usually connected to Bus-II.
    d. 315 MVA ICT-1 – Usually Connected to Bus I, however was under shutdown for paralleling works
2. 220 kV Tarkera 2 was successfully shifted from Bus II to Bus I by closing 89A and opening 89B.
3. Closing command was issued to 89A (Bus-I Isolator) of 2*315 MVA ICT-2&4.
4. Both Bus –I and Bus –II tripped immediately upon closing of the above Isolator. Flag relays of Zone 1, Zone 2 were found to be raised.

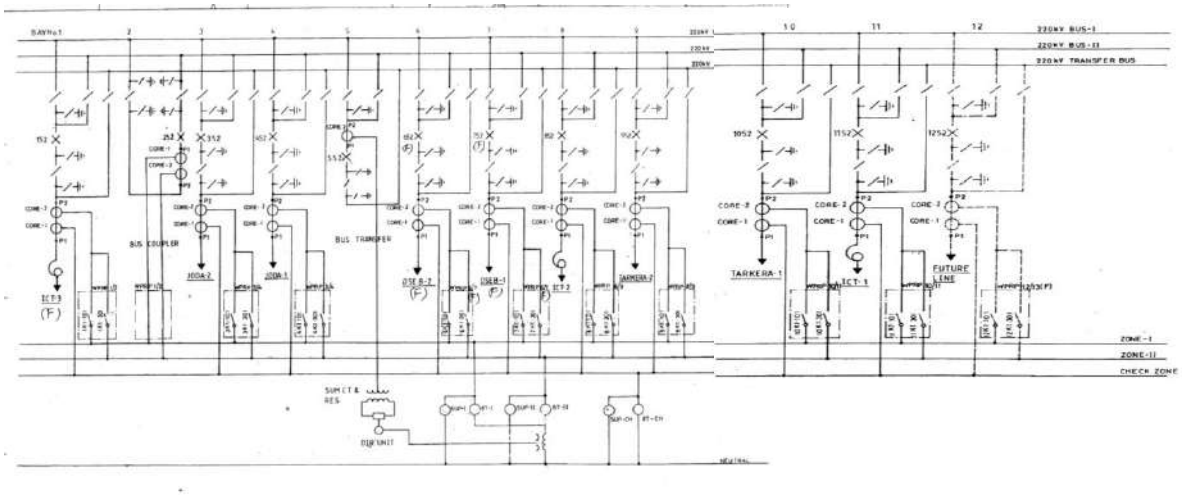
Analysis:

ABB make RADHA relays are installed for 220 kV Bus Bar protection. As per scheme, Bus-bar tripping occurs during following conditions:

i) Operation of actual Bus differential (both main & check zones).
ii) if CT Supervision alarms have been generated simultaneously in Check Zone and in any of the Bus Zone.
iii) If CT Supervision alarm generated in Check Zone and operation of individual Bus Zones or vice-versa.



SLD of 220 kV Switchyard at Rourkela Substation



In the present case of tripping, ICT-I was already under S/D and ICT 2&4 was feeding the entire load (around 270A) of 220kV system.

Prior to changeover of Tarkera-2 and ICT-2&4 from Bus-2 to Bus-1, the current distribution was as under:

Current direction	Current	Remarks
From ICT2 & 4 to Bus-2	270A	Net current in Bus-2 is 0 (as all CTs of ICT-2&4, Tarkera-2 and Bus coupler are connected together to Bus-2)
To Tarkera-2 through Bus-2	135A	
To Tarkera-1 through Bus Coupler	135A	

Initially, changeover of Tarkera-2 from Bus-2 to Bus-1 was done and current distribution was as under:

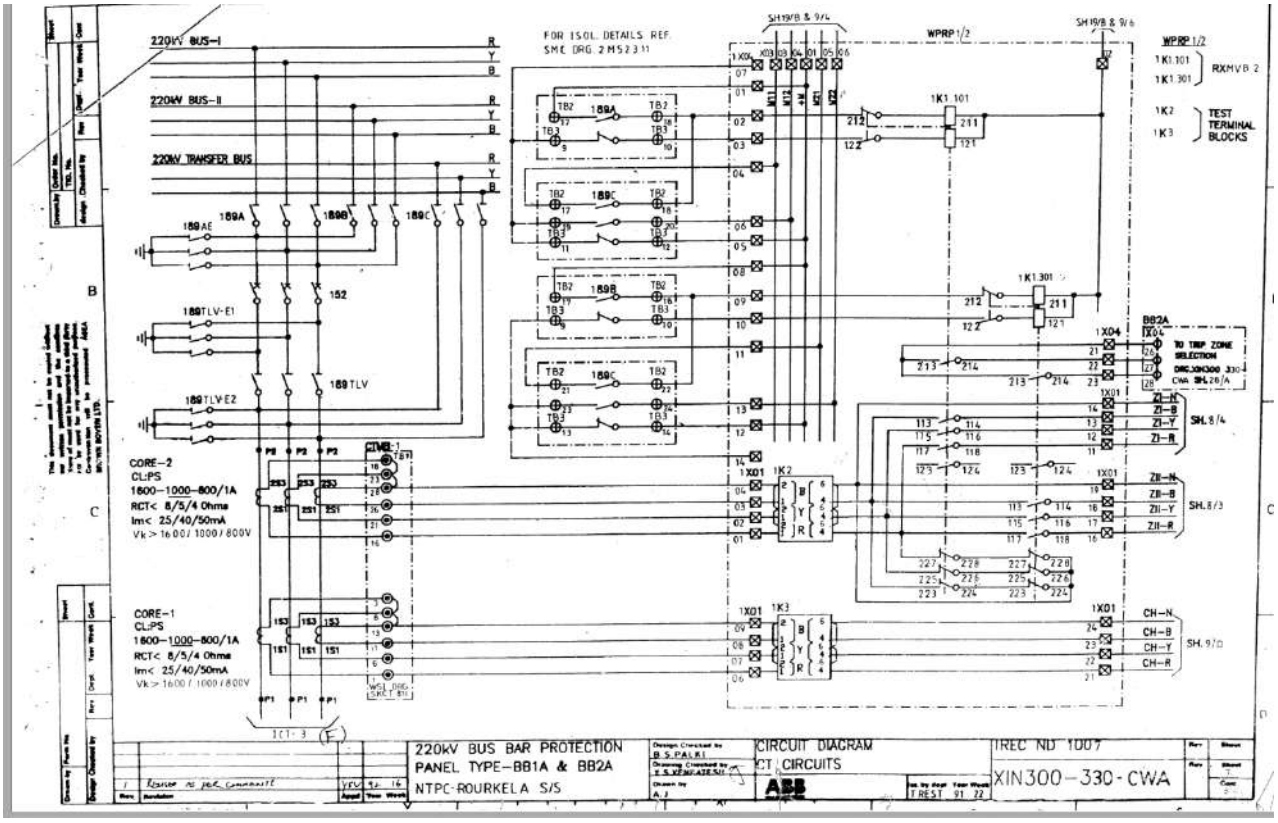
Current direction	Current	Remarks
From ICT2 & 4 to Bus-2	270A	Net current in Bus-2 is 0 (as only CTs of ICT-2&4 and Bus coupler are connected together to Bus-2)
To Bus coupler (to feed both Tarkera-1&2 lines)	270A	

Now, during changeover of ICT-2&4 from Bus-2 to Bus-1, particularly when both 89A & 89B Isolators are closed, current distribution is as under:

Current direction	Current	Remarks
From ICT2 & 4	270A	If there is some delay in closing of Isolator primary and auxiliary contacts, net differential current of 135A in Bus-2 will occur (as CTs of ICT-2&4 and Bus coupler are connected together to Bus-2) and net differential current of 135A in Bus-1 will occur (as CTs of ICT-2&4, Tarkera-1 & 2 are connected together to Bus-1). Setting of Bus-bar is set at 100V (with around 1.75k ohm resistor having pickup current approx.. 60mA.) In the instant case, the differential current of apprx. 135mA has flown in the relay circuit, causing the operation of Bus Zone -1 & 2 simultaneously.
To Tarkera-1&2 through Bus-1	135A	
To Tarkera-1&2 through Bus Coupler	135A	

This spurious operation of both bus bar-1 & 2 relays should not trip the bus 1 & 2 as Check zone was not operated. But, during this operation of Bus- 1 & 2 relays, simultaneous mal-operation of CT supervision relay contact of check zone has occurred and resulted in tripping of Bus-1 & 2. During detailed investigation of the tripping, it was noticed that one of the contact of CT supervision relay of check zone making contact intermittently and extending DC to Bus Zones. The defective Aux. Relay RXMVB-2 has been replaced.

A pre-condition for tripping free operation of this scheme during transient state (any feeder connected to both Bus-1 & II through 89A & 89B Isolators) necessitates the auxiliary NO contact of the Isolator to close earlier than the primary contact.
If the primary contact is made earlier than the Isolator auxiliary for CT switching, then there is a possibility of operation of individual Bus Zones. But even then, the tripping shall not occur as long as Check Zone does not operate.



Same event with same sequence was simulated on 30/01/2021 after isolating the trippings and it was observed that both Bus Zones are picking-up in all the three phases for very short duration during closing of 89A (Bus-2 Isolator operation of ICT-2&4). However, the both bus zone -1 & 2 got reset immediately after complete close of 89A Isolator.

During this simulation on 30/01/2021, 220 kV Tarkera 1 and 2 were carrying a load current of around 225 A each and ICT 2&4 was loaded at around 450A on IV side.

Steady Secondary Currents prior to the switching operation were as follows:

Zone	Current in mA
Zone 1 (R/Y/B)	0.4/0.46/0.34
Zone 2 (R/Y/B)	0.3/0.4/0.36
Check Zone (R/Y/B)	1.0/3.8/0.3

secondary currents when the 208-89A was successfully closed and 89B is also in closed condition:

Zone	Current in mA
Zone 1 (R/Y/B)	0.58/0.4/0.34
Zone 2 (R/Y/B)	0.55/0.46/0.32
Check Zone (R/Y/B)	1.3/4.65/0.43

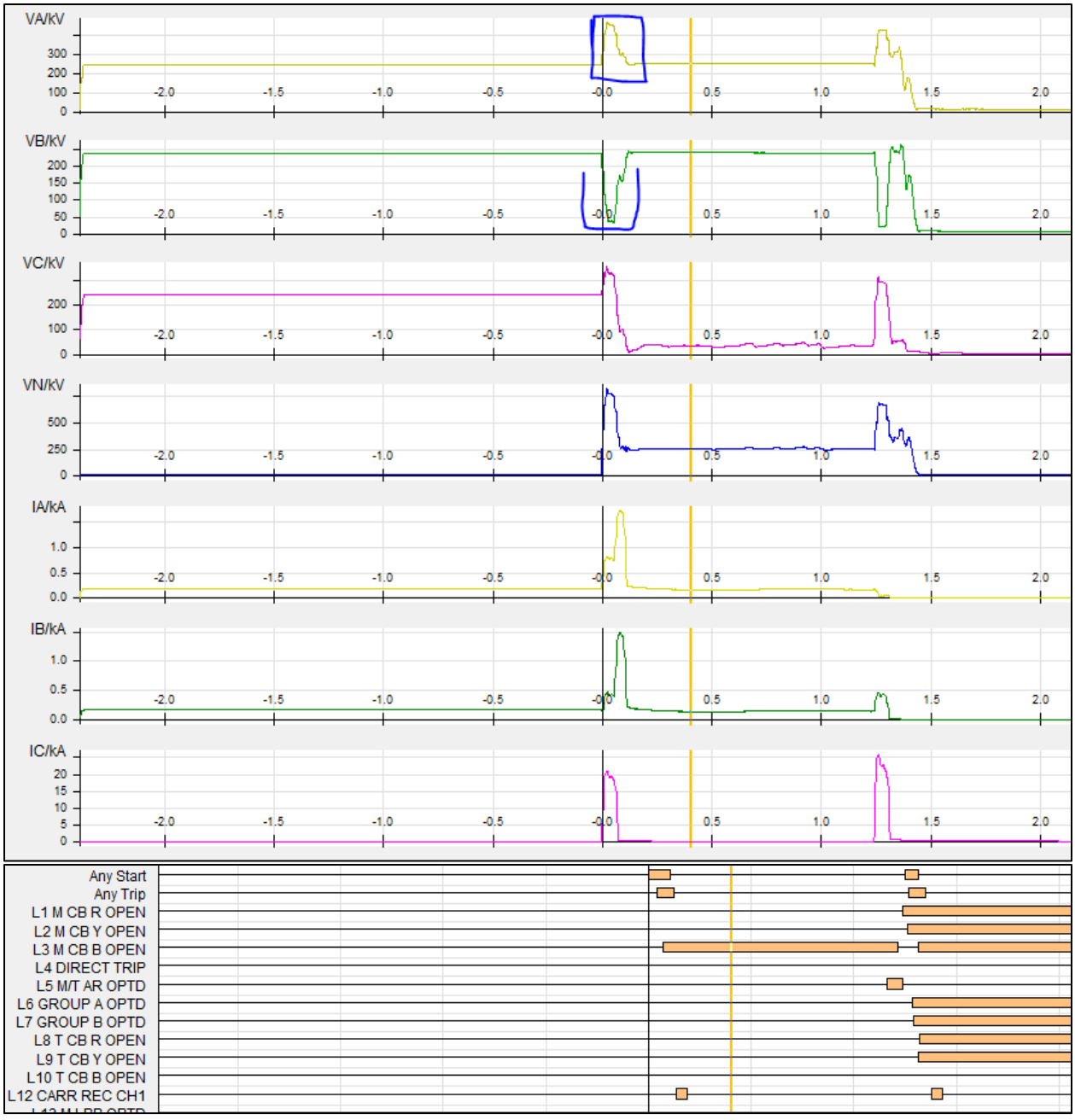
Both Bus Zones were found reset immediately upon complete closing of 208-89A.
Conclusion:

Conclusion:

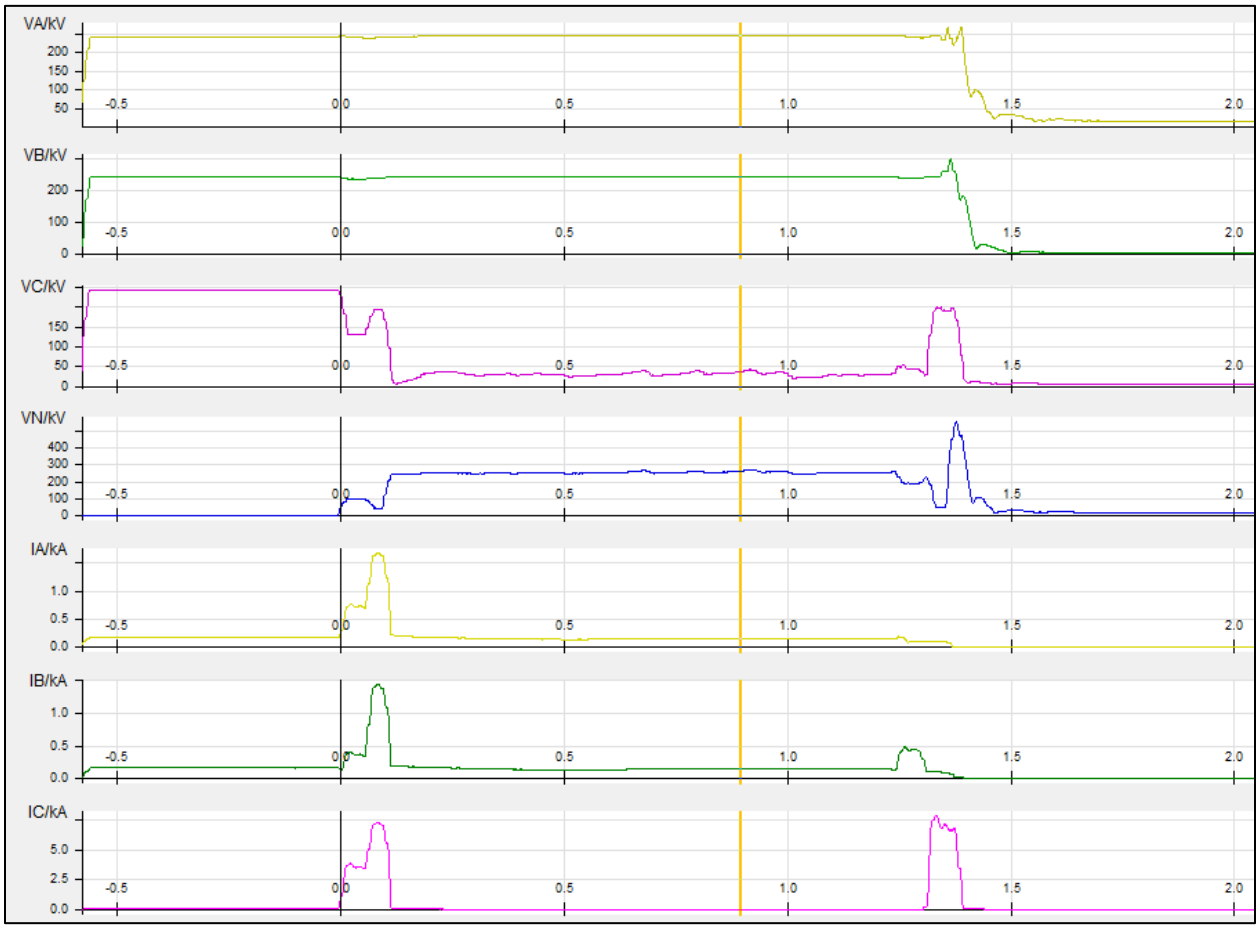
The commencement of current flow through arcing in 89A Isolator, prior to closing of its auxiliary contact for CT switching may be the possible reason for pick-up of Bus Zone 1 & 2 during the switching operation. Further, simultaneous mal-operation of check zone supervision relay contact has caused the tripping of 220kV Bus-bar protection 1 & 2.

400KV-PATNA-BARH-2	**12/1/2021**	**3:41**	**Patna: B-N, 7.2kA, 71km; Barh: B-N, Z1, 18.6kA, 21km**	**A/R unsuccessful. At Barh end Y phase voltage also became very low upto zero almost along with B phase and recoverd fully then at the time of A/R also Y phase voltage became zero while at Patna end it was normal. Reason for such dip at Barh end may please be explained?**

DR BARH END: There was B phase fault in the line and At Barh end , in Y phase huge dip observed and current in Y and R phase also increased upto 1.4ka, while R and B phase voltage increased momenteraliy upto 800 Kv.**While at Patna end no such voltage dip or increase observed** in any healthy phase Reason for such phenomenon at Barh may be explained?



DR Patna end:

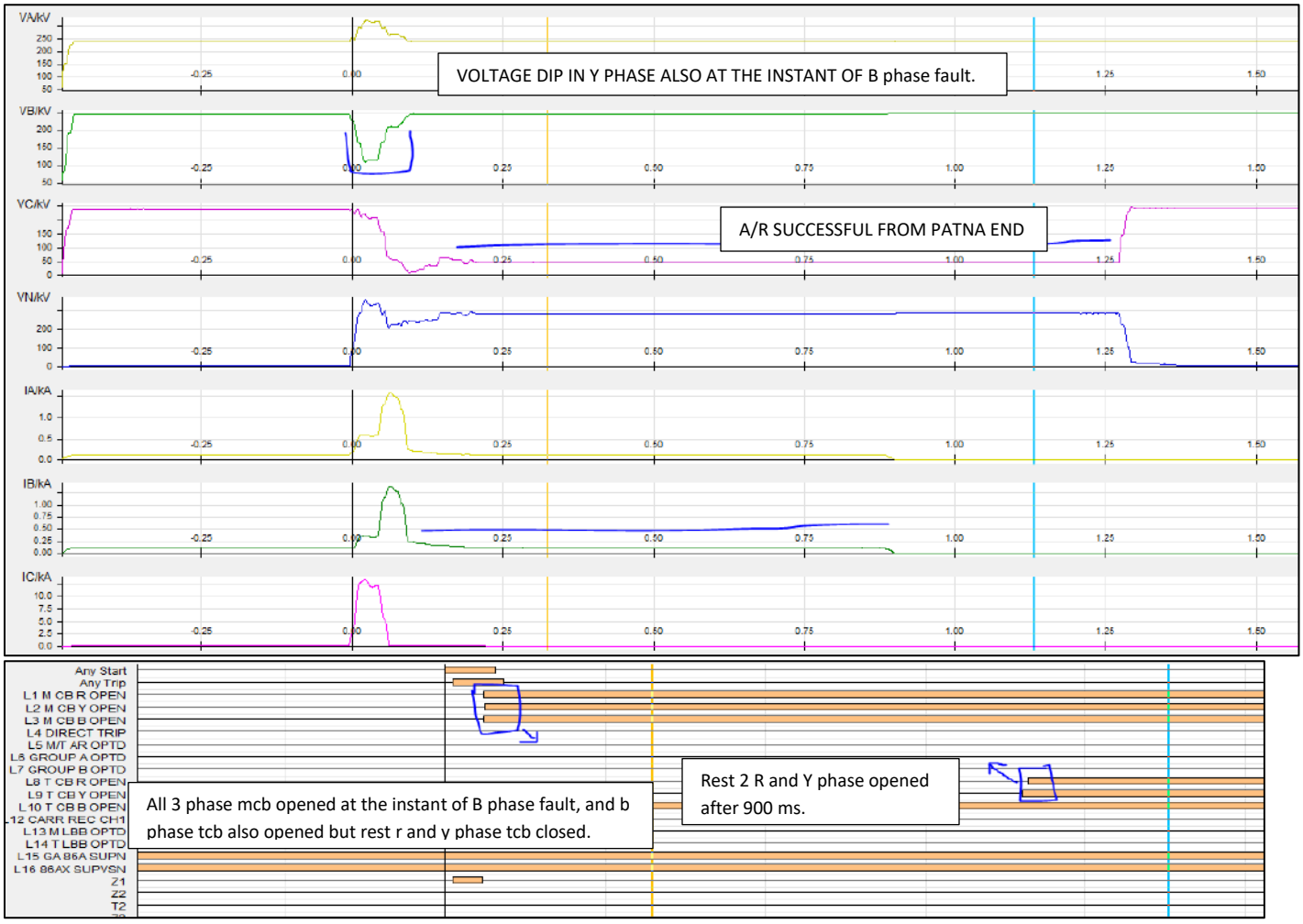

VA/kV
200
150
100
50
-0.5
0.0
0.5
1.0
1.5
2.0
VB/kV
200
100
0
VC/kV
150
100
50
0
VN/kV
400
300
200
100
0
IA/kA
1.0
0.5
0.0
IB/kA
IC/kA
5.0
2.5

400 KV PATNA BARH-1	**19/01/2021**	**0:24**	**PATNA: B-N,FC 7.2KA,FD 81KM BARH :Z1,B-N, 11.6KA,FD 30.6KM**	**At Barh end all 3 phase mcb opened and only B phase TCB opened , rest Y and B phase TCB were closed which also got opened after 900 ms.why this occurred and why A/R did not operated?while At patna end A/R was successful .**	**Tripping could have been avoided if A/R operated at Barh end.**

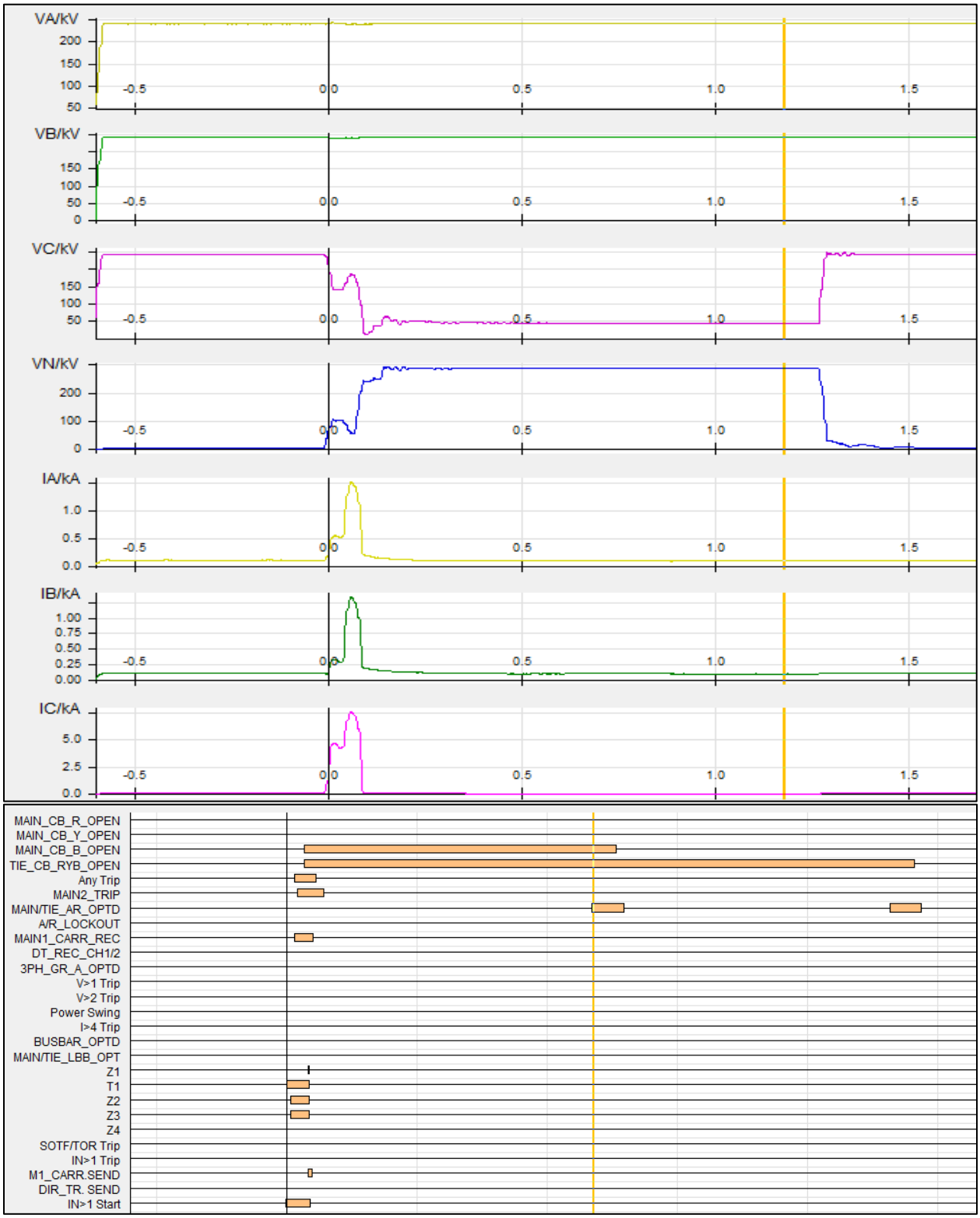
Similar event as previous ,There was B phase fault in the line and At Barh end , in Y phase huge dip observed and current in R &Y phase also increased upto 1.4ka, while R phase voltage increased momenteraliy upto 800 Kv.**While at Patna end no such voltage dip or increase observed** in any healthy phase. Earthing at BArh end may be checked properly . Reason for such phenomenon at Barh may be explained?

At Barh end all 3 phase mcb opened and only B phase TCB opened , rest Y and B phase TCB were closed which also got opened after 900 ms.why this occurred and why A/R did not operated? while At patna end A/R was successful .

BARH END DR:

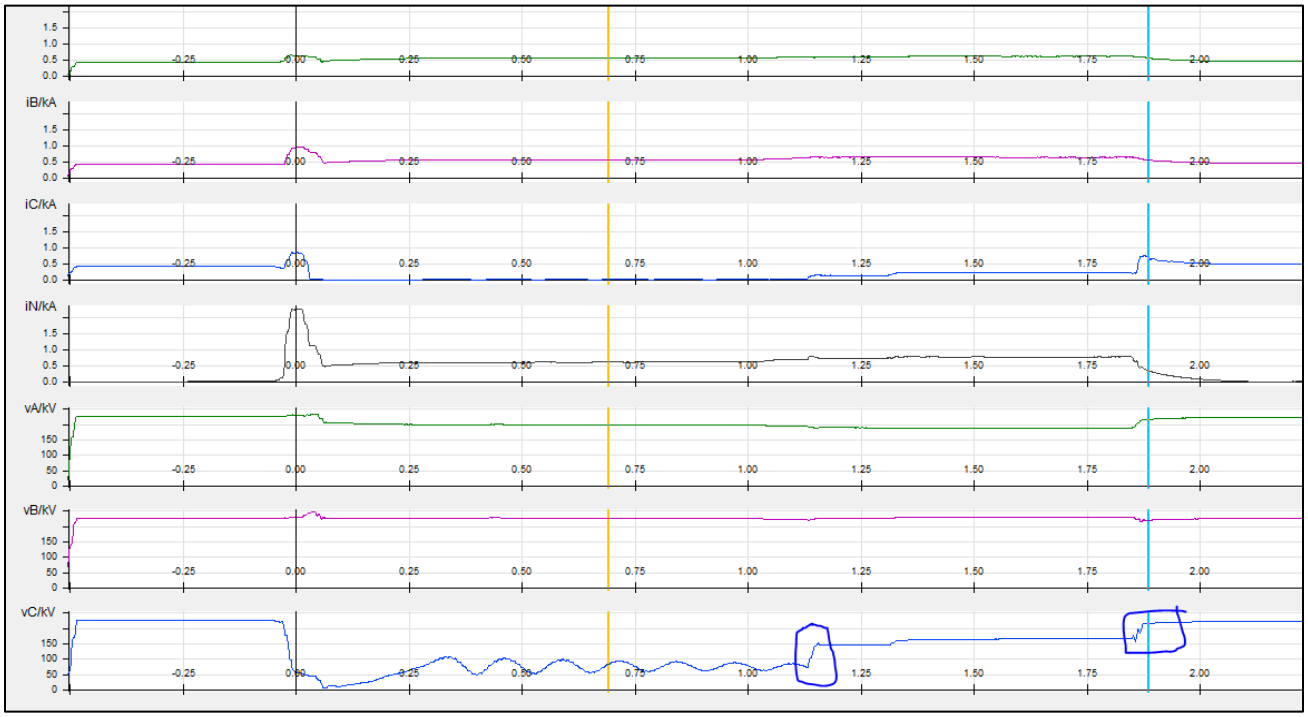


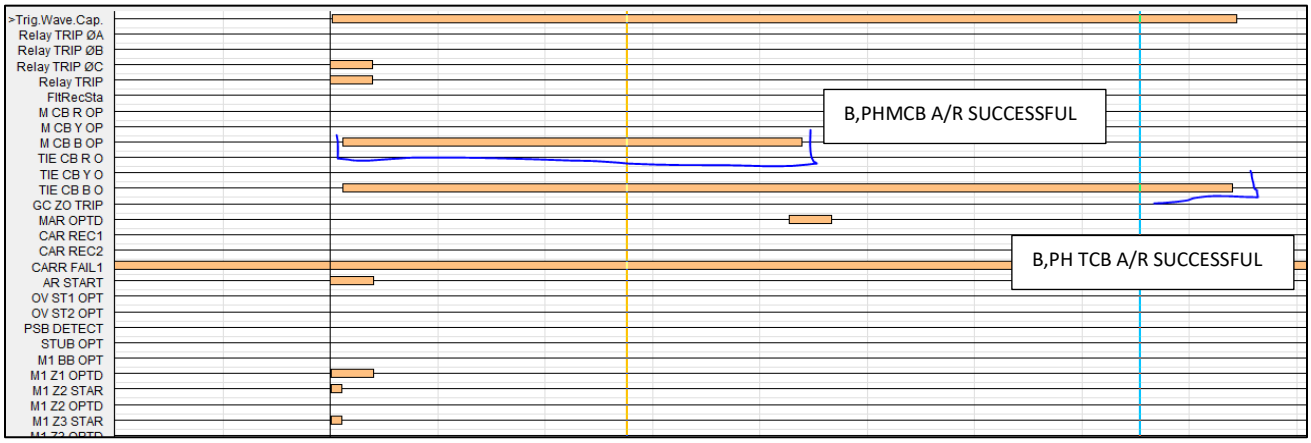
PATNE END:


VA/kV
200
150
100
50
-0.5
0.0
0.5
1.0
1.5
VB/kV
150
100
50
0
VC/kV
150
100
50
VN/kV
200
100
0
IA/kA
1.0
0.5
0.0
IB/kA
1.00
0.75
0.50
0.25
0.00
IC/kA
5.0
2.5
0.0
MAIN_CB_R_OPEN
MAIN_CB_Y_OPEN
MAIN_CB_B_OPEN
TIE_CB_RYB_OPEN
Any Trip
MAIN2_TRIP
MAIN/TIE_AR_OPTD
A/R_LOCKOUT
MAIN1_CARR_REC
DT_REC_CH1/2
3PH_GR_A_OPTD
V>1 Trip
V>2 Trip
Power Swing
I>4 Trip
BUSBAR_OPTD
MAIN/TIE_LBB_OPT
Z1
T1
Z2
Z3
Z4
SOTF/TOR Trip
IN>1 Trip
M1_CARR.SEND
DIR_TR. SEND
IN>1 Start

400KV-MOTIHARI-BARH-2	**21/01/2021**	**11:20**	**B_N, 28.5 KM, 0.82 kA (Motihari) B_N, 175 KM, 2.6 kA (Barh)**	**A/R was successful from Motihari end , which is evident from DR of motihari end ,after 1 second of which DT sent from BArh end due to which line tripped from only Motihari end and from BArh it was charged.**	**Tripping could have been avoided asa fter successful A/R spurious DT receipt.**

Dr at motihari end:





Philosophy towards formulation and implementation of Grid Islanding Scheme considering 2 x 250 MW units (U # 7 & 8) of Chandrapura TPS, DVC connected to 220KV Grid System

The present islanding scheme in DVC is under service at Chandrapura TPS considering Unit # 1, 2 & 3 having capacity of 3 x 130MW (namely, CTPS – A plant) along with connected load of CTPS – A itself. However, U # 1 & 2 were put out of bar.

Hence, a new suitable venue in DVC is felt to be identified towards formulation and implementation of a new Grid Islanding scheme. Accordingly, U # 7 & 8 of Chandrapura TPS having capacity of 2 x 250MW (namely, CTPS – B plant) has been considered after much thinking and threadbare discussions. These units are connected to 220KV grid. Single line connection diagram (DVC Grid) is shown in Annexure – I.

The Grid islanding scheme is proposed to be implemented in two stages namely,

stage I : Islanding from grid &

stage II : Load – Generation balance through sequential load shedding

considering the 2 x 250MW generators of CTPS – B plant along with connected loads of CTPS – A (120 MVA), BIADA (73 MVA), Putki (180 MVA), Patherdih (141 MVA) & Nimiaghat (40 MVA).

The feasibility of the scheme at this preliminary stage is elaborated as below:-

1. Minimum generation of a unit to be considered as 170MW.
2. Monitoring of Total Generation in MW to be implemented using feed from Ex-Bus MW transducers available at 220kV Switchyard of CTPS – B.
3. The Grid Islanding relay (R1) to be placed at CTPS – B end considering 220KV Bus voltage & frequency of CTPS – B as reference.

   [Note :

   a. The old Islanding panel, placed at CTPS – A, may be used after shifting of the same from CTPS – A to CTPS – B. The OEM of this panel i.e. GE (erstwhile ALSTOM) confirmed that the existing panel could be suitably modified.

   b. Entire scheme design including setting of different relays will be taken care of after freezing of the scheme outline.]

4. After actuation of R1 relay – R2, R3, R4, R5, and R6 Relays which will be connected to IEC-61850 compliant substation bus of CTPS – A (220KV), CTPS – A(132KV), Putki (132KV), Patherdih (132KV) & Nimiaghat (132KV) will get actuated through –

   a. OPGW network with gateway & SDH (synchronous digital hierarchy) to be used for communication of inter-tripping logic through tele-protection GOOSE messaging after creation of VLAN.

   b. Media converter (AC/DC operated) for Gateway-SDH link/connectivity to be incorporated, if required (where length between gateway-SDH is greater than 50mtr.).

   and give trip command (stage – I tripping) as per following –

Substation Bus (IEC - 61850)	Relay	Trip command to -
CTPS_B	R1	CTPS – Dhanbad line (L # 203, 204) CTPS – BTPS line (L # 205, 206)
CTPS_A (220KV)	R2	CTPS – Kalyaneswari line (L # 201, 202) CTPS – BSL line (L # 253 & 254)
CTPS_A (132KV)	R3	CTPS – Gola (L # 6 & 7) CTPS – Purulia (L # 58 & 59) CTPS – Ramkanali/Jamuria (L # 60, 61) CTPS - Rajabera (L # 62, 63)
Patherdih	R5	Patherdih - MHS line (L # 14 & 15) Patherdih - Sindri line (L # 49 & 50) 132/25KV Transformer (Traction Load)
Nimiaghat	R6	Nimiaghat – Giridih line (L # 86 & 87) 132/25KV Transformer (Traction Load)

All Railway feeders/Traction load connected to the above buses to be disconnected during stage 1 operation to avoid unbalance loading.

5. The islanded connection after stage – I tripping is shown in Annexure – II and connected loads (CD in MVA) will be as below having average value of 416 MVA –

CTPS_A	119.90	MVA
BIADA	73.05	MVA
Putki	180.45	MVA
Patherdih	141.40	MVA
Nimiaghat	40.00	MVA
Total Load	554.80	MVA
75% of load	416.10	MVA

Apparently there will be no problem in Load – Generation balance in normal condition –

Generation considered: 225 x 2 MW = 450 MW

Average Load connected: 416 MVA or 400 MW

Considering droop of the TG is 5%,

(450 – 400) MW = 50 MW corresponds to $\frac{5}{450}$ x 50 = 0.56 %

If occurrence freq. is 50 Hz, then it may shoot up to 50 + 50 x 0.56 % = 50.28 Hz.

It will be easily taken care of.

6. However, if

a. Gen.>>Load demand or freq. would exceed a given set point, then one unit (lowest MW) will get tripped and

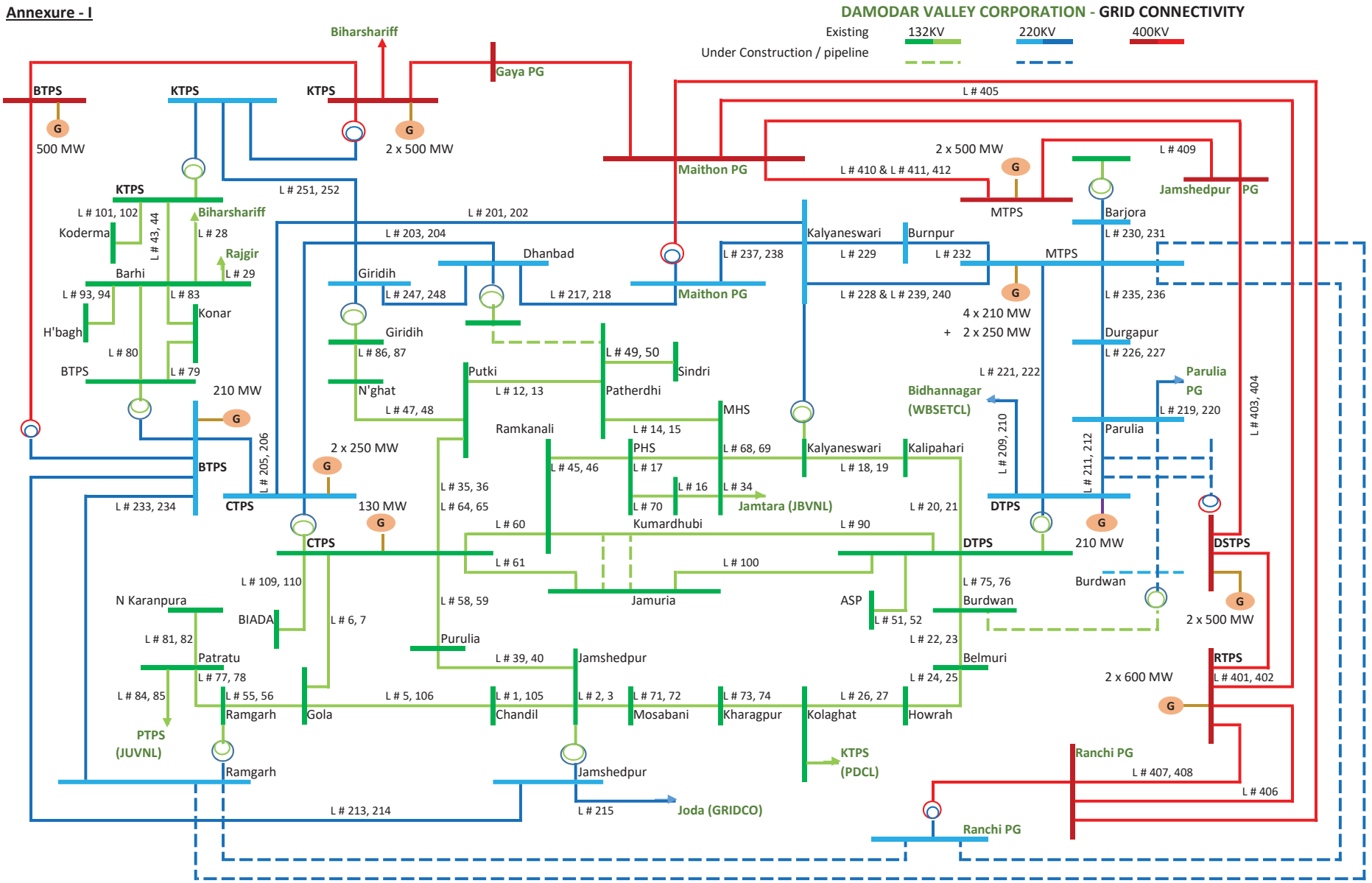
b. Only one unit is in service then

subsequent Load – Generation balancing is to be made by sequential load shedding (stage – II) at different substations as furnished below through protection telemetry (as discussed above) –

Phase - II :: Sequential Load shedding

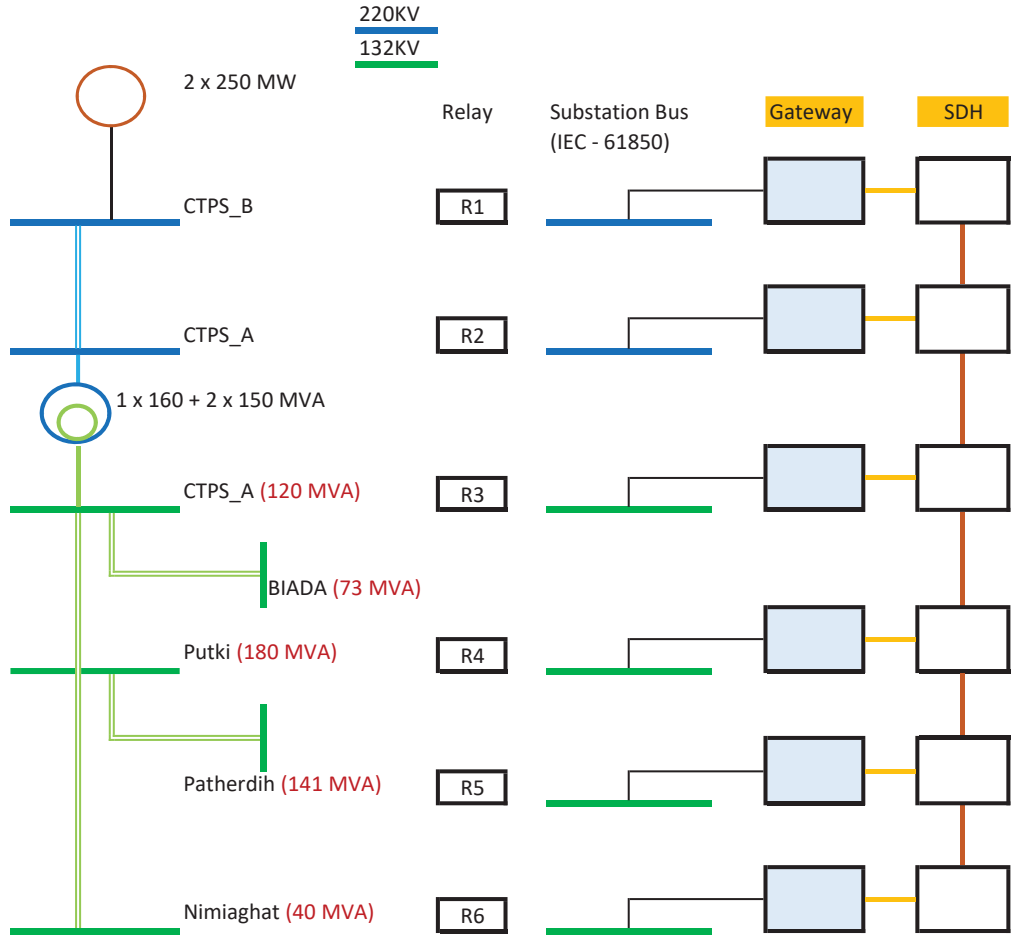
1	JBVNL, Ganeshpur	35.00	Putki
	JBVNL, Digwadih	17.00	Patherdih
		52.00	
2	JUVNL, Godhore	35.00	Putki
	JBVNL, Mukunda	15.00	Patherdih
		50.00	
3	JSEB, Dumri Banaso	40.00	Nimiaghat
4	JBVNL, Dugda	25.00	CTPS
5	JSEB, Jainamore	22.00	CTPS

Annexure - I


DAMODAR VALLEY CORPORATION - GRID CONNECTIVITY
Existing
Under Construction / pipeline
132KV
220KV
400KV
Biharshariff
Gaya PG
BTPS
KTPS
KTPS
500 MW
2 x 500 MW
L # 405
Maithon PG
2 x 500 MW
L # 409
L # 410 & L # 411, 412
MTPS
Jamshedpur PG
KTPS
L # 251, 252
L # 101, 102
Biharshariff
L # 201, 202
Barjora
Koderma
L # 43, 44
L # 28
L # 203, 204
Kalyaneswari
Burnpur
L # 230, 231
Rajgir
Dhanbad
L # 237, 238
L # 229
L # 232
MTPS
Barhi
L # 29
Giridih
L # 247, 248
L # 217, 218
Maithon PG
L # 228 & L # 239, 240
L # 235, 236
L # 93, 94
L # 83
4 x 210 MW
+ 2 x 250 MW
Konar
Giridih
Durgapur
H'bagh
L # 86, 87
L # 226, 227
L # 80
L # 49, 50
Sindri
L # 221, 222
Parulia PG
BTPS
L # 79
Putki
Patherdhi
Bidhannagar (WBSETCL)
210 MW
N'ghat
L # 12, 13
L # 219, 220
L # 47, 48
MHS
Parulia
Ramkanali
L # 14, 15
L # 403, 404
2 x 250 MW
PHS
L # 68, 69
Kalyaneswari
Kalipahari
L # 209, 210
L # 211, 212
L # 205, 206
BTPS
L # 45, 46
L # 17
L # 18, 19
L # 35, 36
L # 64, 65
L # 16
L # 34
Jamtara (JBVNL)
L # 233, 234
CTPS
130 MW
L # 70
L # 20, 21
DTPS
DSTPS
L # 60
Kumardhubi
L # 90
CTPS
DTPS
210 MW
L # 61
L # 100
L # 75, 76
Burdwan
L # 109, 110
Jamuria
ASP
Burdwan
2 x 500 MW
N Karanpura
L # 58, 59
L # 51, 52
BIADA
L # 6, 7
L # 22, 23
L # 81, 82
Purulia
Belmuri
Patratu
L # 39, 40
Jamshedpur
RTPS
L # 77, 78
L # 24, 25
2 x 600 MW
L # 84, 85
L # 55, 56
L # 5, 106
L # 1, 105
L # 2, 3
L # 71, 72
L # 73, 74
L # 26, 27
L # 401, 402
Ramgarh
Gola
Chandil
Mosabani
Kharagpur
Kolaghat
Howrah
PTPS (JUVNL)
KTPS (PDCL)
Ranchi PG
Ramgarh
Jamshedpur
L # 407, 408
L # 406
L # 213, 214
L # 215
Joda (GRIDCO)
Ranchi PG

Islanding Scheme at CTPS

Annexure - II



Phase - I :: Tripping for Islanding

CTPS – Dhanbad line (L # 203, 204)
CTPS – BTPS line (L # 205, 206)

CTPS – Kalyaneswari line (L # 201, 202)
CTPS – BSL line (L # 253 & 254)

CTPS – Gola (L # 6 & 7)
CTPS – Purulia (L # 58 & 59)
CTPS – Ramkanali/Jamuria (L # 60, 61)
CTPS - Rajabera (L # 62, 63)

Patherdih - MHS line (L # 14 & 15)
Patherdih - Sindri line (L # 49 & 50)
132/25KV Transformer (Traction Load)

Nimiaghat – Giridih line (L # 86 & 87)
132/25KV Transformer (Traction Load)

After Phase - I tripping
Load in MVA

CTPS_A	119.90
BIADA	73.05
Putki	180.45
Patherdih	141.40
Nimiaghat	40.00
Total Load	554.80
75% of load	416.10

Phase - II :: Sequential Load shedding

1	JBVNL, Ganeshpur	35.00	Putki
	JBVNL, Digwadih	17.00	Patherdih
		52.00	
2	JUVNL, Godhore	35.00	Putki
	JBVNL, Mukunda	15.00	Patherdih
		50.00	
3	JSEB,Dumri Banaso	40.00	Nimiaghat
4	JBVNL, Dugda	25.00	CTPS
5	JSEB, Jainamore	22.00	CTPS

CTPS ISLANDING STUDY

Following logic was assumed for island formation and its:

i. Islanding should happen before pick up of any of the frequency protection stage and that's why island formation will start at 48.6 Hz with a delay of 1 sec.

ii. Under frequency inside the island is proposed to trigger at 48.4 Hz. The details is as follows

48.4 HZ 1sec 10 % of island load
48.2 Hz 1 sec 10% of Island load
48 Hz 1 sec 10 % of Island load

iii. Generator protection setting: (as submitted by CTPS)
Under Frequency: 47.4 Hz, 2 sec
Over frequency: 52 Hz 100 sec delay

4. Simulation:

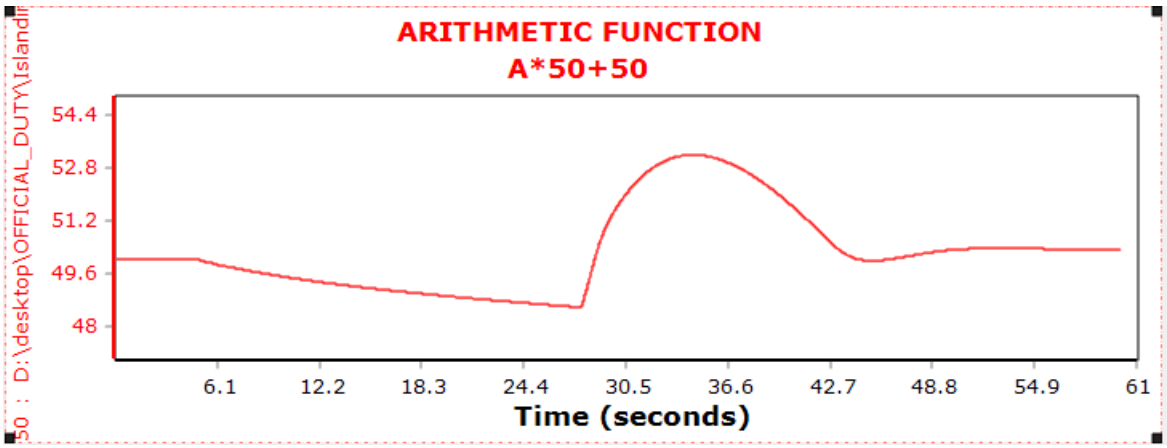
Different LGB scenario is studied in the simulation for checking the robust ness of the proposed scheme. Details of differ scenario are summarized as follows:

Scenario	Generation	Load	Surplus(+)/Deficit(-)
Scenario-1	360 MW	243 MW	118 MW
Scenario-2	360MW	370 MW	-10 MW
Scenario-3	450 MW	370 MW	80 MW
Scenario-4	450MW	243 MW	207 MW

With above islanding logic following steps are followed:

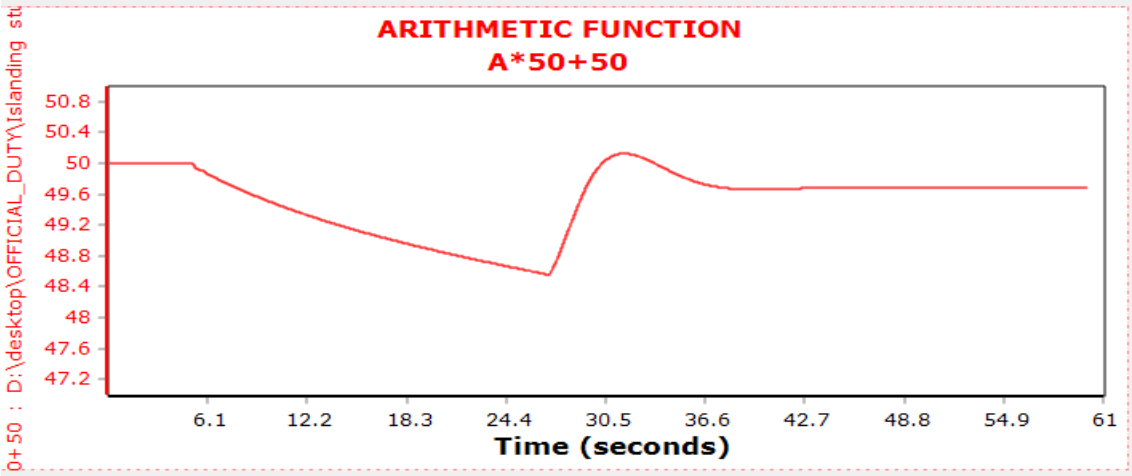
1. First a grid disturbance is created by tripping 8000 MW generation (i.e. the negative load). This triggers the island formation logic in which the equivalent generator bus with its loads is tripped 1 sec after the frequency drops to 48.6 Hz.
2. After formation of island the simulation is further carried out for 100 sec to check stabilization of the island frequency and if any modification in logic is required or not.

Scenario-1:

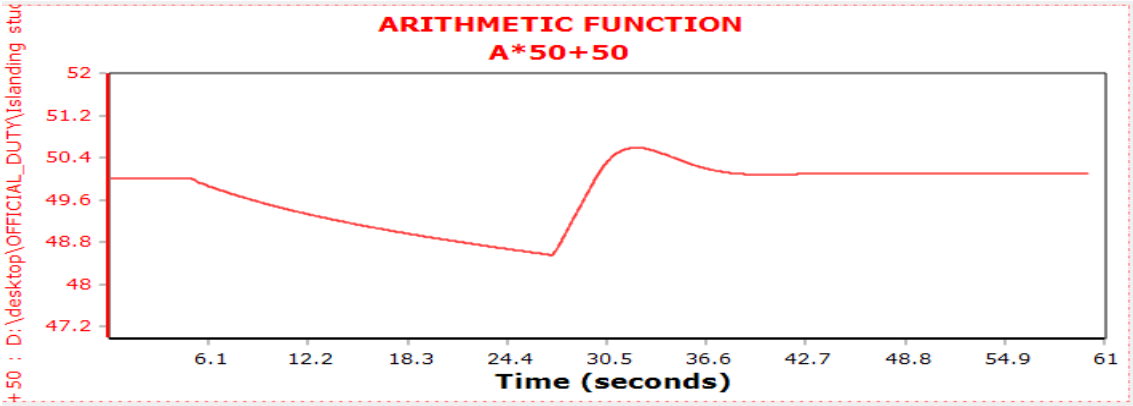


CTPS ISLANDING STUDY

Scenario-2:



Scenario-3:



Scenario-4: