EASTERN REGIONAL POWER COMMITTEE

MINUTES OF 27th PROTECTION SUB-COMMITTEE MEETING HELD AT ERPC, KOLKATA ON 21.01.2015 (WEDNESDAY) AT 11:00 HOURS

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

Member Secretary (I/C), ERPC chaired the meeting and welcomed the participants.

Thereafter, he requested SE (PS), ERPC to take up the agenda points in seriatim.

PART – A

ITEM NO. A.1: Confirmation of minutes of 26th Protection sub-Committee Meeting held on 22nd December, 2014 at ERPC, Kolkata.

1. The minutes of 26th Protection Sub-Committee meeting held on 22.12.14 circulated vide letter dated 13.01.15.
2. The minutes of Special Protection Coordination meeting for "Implementation and Review of Protection Philosophy of ER vis-à-vis adoption of Task Force recommended methodology for relay settings for ER Constituent Systems" held at ERPC, Kolkata on 30.12.2014 circulated vide letter dated 01.01.15.

No comments have been received from any constituent.

The minutes of the above meetings may be confirmed.

Deliberation in the meeting

Members confirmed the above minutes.

PART – B

ANALYSIS & DISCUSSION ON GRID INCIDENCES WHICH OCCURRED IN CTU/STU SYSTEMS DURING DECEMBER, 2014.

(The detailed report was highlighted by ERLDC/respective constituents)

ITEM NO. B.1: Disturbance at 400 kV Meramundali & Mendhasal S/S on 05.12.14 at 14:01hrs & 19:05 hrs.

1. Disturbance at 400 kV Meramundali S/S on 05.12.14 at 14:01hrs.

At 14:01hrs, 400kV Meramundali-Angul-II tripped due to bursting of Y-Ph LA at Meramundali and subsequently other elements tripped from Meramundali end due to LBB operation at Meramundali.

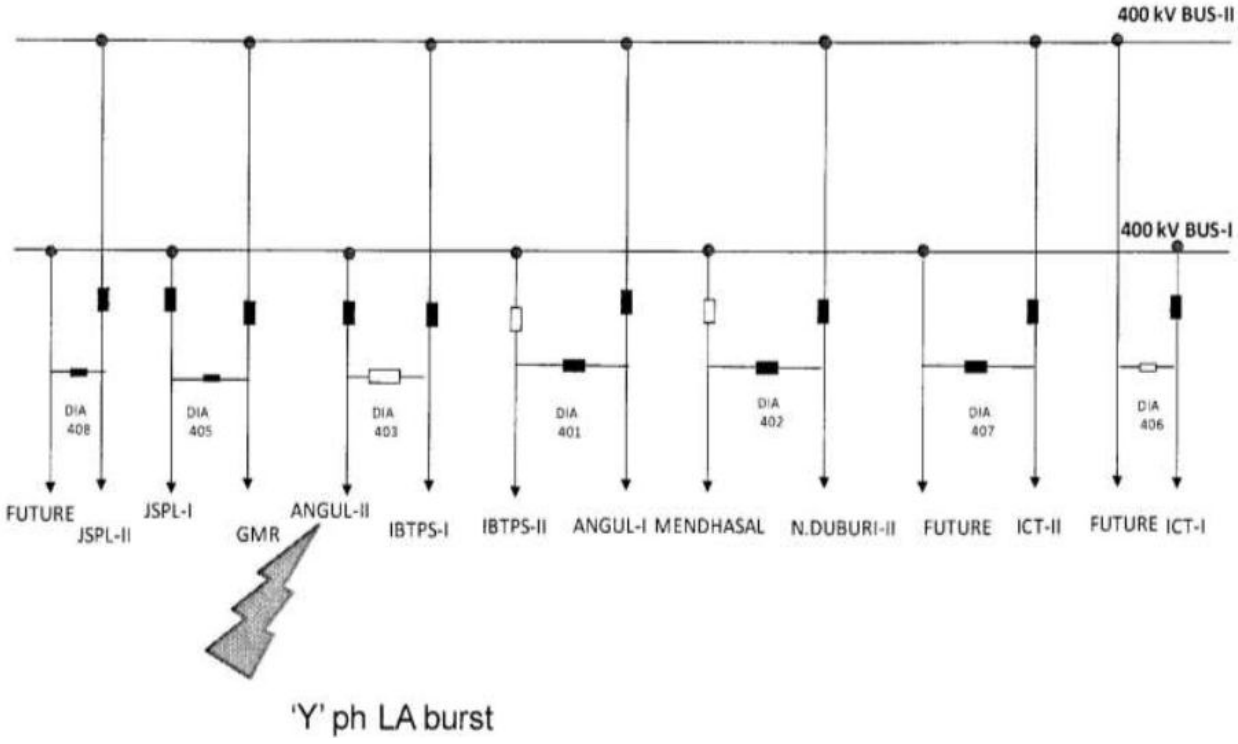
Following elements tripped from Meramundali end:-

- 400kV Meramundali-Angul-II (with relay indication of Y-Ph, E/F, Dist.- 18.0KM)
- 400kV Meramundali-JSPL-I (LBB protection)
- 400/220kV, 315MVA ICT-I at Meramundali (LBB protection)
- 400kV Meramundali-Mendhasal S/C (LBB protection/O/V protection)
- 400/220kV, 315MVA ICT-II at Meramundali (HV side O/C)
- 400kVMeramundali-IBTPS-II(idle charged at Meramundali)(O/V protection)

- 400kVMeramundali-Duburi-II(idle charged at Meramundali)(O/V protection)
- 400kV Meramundali-JSPL-II (O/V protection)
- 400kV Meramundali-Angul-I (O/V protection)
- 400kV JITPL-Angul-II

The following elements tripped from GMR end:

- 400kV Meramundali-GMR S/C
- 400kV Talcher- GMR S/C
- GMR unit# 1 & 2



OPTCL and GMR may deliberate on following points:

i. As per OPTCL report, 400kV Meramundali-Mendhasal S/C tripped on Y-Ph, E/F,at Dist-18 kM from Meramundali end and bursting of Y-Ph LA at Meramundali are conflicting each other.
ii. GMR may place the details of tripping
iii. Relays settings of 400 kV GMR-Meramundali and GMR-Talcher at GMR end needs to be checked and corrected.

It is to be noted that, in 25th PCC, GMR was advised to examine the relay settings of 400kV GMR-TSTPP line in coordination with NTPC and report.

Further, PCC advised GMR to review their protection settings after the commissioning of their dedicated ATS and submit the new settings.

Deliberation in the meeting

OPTCL explained the tripping incidence with DR and EL output files and informed that Y ph LA of 400KV Meramundali-Angul line-II was bursted at Meramundali end & the distance relay at Meramundali has picked up the fault after 637 msec and CB cleared the fault in 1035 msec. Because of delay in fault clearance, the LBB protection had operated and tripped all the lines connected in Bus-1 of 400kV Meramundali S/s.

On enquiry, OPTCL informed that both Main-I & Main-II distance protection relays are of same make (Siemens 7SA522 model).

It was opined that generally Main-I & Main-II should have been of different manufacturer to avoid common feature failures.

After detailed deliberation, PCC could not conclude the reason behind the delay in fault clearance by the primary protection of the line.

PCC advised OPTCL to carry out the following actions and place the outcome in the ensuing 29th TCC Meeting to be held on 13.02.2015:

- *Investigate the tripping incident with the relay manufacturer on delayed fault detection by the distance protection, which was supposed to detect in zone 1.*
- *Check all the protection elements pertaining to 400KV Meramundali-Angul line-II*
- *Implement Main-I & Main-II relays of different manufacturers for distance protection of 400kV lines at Meramundali S/s.*

OPTCL agreed.

GMR end tripping details are not available and GMR representative was not available for discussion.

2. Tripping of 400 kV Meramundali-Mendhasal S/C line on 05.12.14 at 19:05hrs.

At 19:05 hrs, 400kV Meramundali-Mendhasal S/C tripped due to bursting of B-Ph LA at Meramundali caused tripping of following elements from Meramundali S/S:

- 400kV Meramundali-Mendhasal S/C (tripped from Meramundali, B-Ph, E/F, Dist. 12.3kM)
- 400kV Meramundali-GMR S/C (tripped from GMR end only)
- 400/220kV, 315MVA ICT-I and ICT-II at Meramundali (tripped from LV side on O/C, E/F)

OPTCL and GMR may deliberate on following points:

i. OPTCL may explain the tripping of ICTs from LV side on O/C since the power flow was around 120-150MW in each ICT prior to the disturbance and the PMU plot shows fault clearance time was around 80ms.
ii. GMR may place the details of tripping
iii. Relays settings of 400 kV GMR-Meramundali needs to be checked and corrected.

Deliberation in the meeting

OPTCL explained that consequent upon B-ph, LA burst out, 400kV Meramundali-Mendhasal S/c line tripped from both ends. This tripping was in order, but 400/220kV, 315MVA ICT-I and ICT-II tripped from LV side on O/C, E/F. OPTCL has submitted the O/C relay settings of both the ICTs and informed that OPTCL is reviewing the high current set value.

Relay Element	400kV side	220kV side
CT Ratio	1000/1A	1200/1A
I>>	5A , TD-O	6A , TD-O
I>	3A,TD-0.3S	5A,TD-0.3S
Ip	0.5A, TM- 0.30	0.7A, TM- 0.25
IN >>	4A , TD-O	5A , TD-O
IN >	2A,TD-0.3S	2A,TD-0.3S
IpN	0.2A, TM- 0.35	0.2A, TM- 0.30

PCC felt that frequent tripping incidences are being occurred in OPTCL system because of bursting of LA, OPTCL should check the healthiness of LAs by injecting 3rd harmonic resistive current periodically.

On sharing the experiences with the constituents, Powergrid informed that they generally carry out this testing on pre and post monsoon season when the chance of moisture ingress is high and with this, they are able to identify the defective LAs.

Since OPTCL did not have such testing kit at present, Powergrid-Odisha projects was requested to extend help to OPTCL by providing the test kit to measure the condition of LAs at Meramundali. OPTCL was advised to submit the report in the ensuing 29th TCC Meeting to be held on 13.02.2015.

OPTCL agreed.

GMR end tripping details are not available and GMR representative was not available for discussion.

ITEM NO. B.2: Disturbance at 400kV Meramundali S/S on 06.12.14 at 17:47 hrs

At 17:47hrs, B-Ø LA of 400kV Meramundali-Angul-II line blasted at Meramundali end causing tripping of following elements:

- 400kV Meramundali-Angul-II (B-Ø, ib-19.77kA at Meramundali, DT received at Angul end)
- 400kV Meramundali-Mendhasal (Reverse zone, E//F at Meramundali, DT received at Mendhasal)
- 400/220kV, 315MVA ICT-I & II at Meramundali (tripped from 220kV side, B-Ø, O/C, 4.69kA)
- 400kV GMR-Meramundali (MICOM P442: start ph B, trip ph RYB, O/C (instantaneous), If=9kA at GMR end, Meramundali end did not trip)
- 400kV GMR-Talcher (MICOM P442: start ph ABC, O/V stg-1 at GMR end, Talcher end did not trip)
- GMR Unit-1 and 2(2X350 MW)
- 400kV Bolangir-Angul (DT received at Bolangir end but Angul end did not trip)

OPTCL, Powergrid and GMR may deliberate on following points:

i. The fault in 400kV Meramundali-Angul-II was not detected from Angul end, only received a DT signal from Meramundali.
ii. Tripping of both ICTs from LV side of Meramundali also needs to be explained.
iii. Since the PMU plot shows the fault clearance time was around 80ms, OPTCL may explain the tripping of 400kV Meramundali-Mendhasal line in reverse zone. OPTCL may place reverse zone settings.
iv. OPTCL may explain the tripping incidence with DR, EL and relay flags.
v. Relays settings of 400 kV GMR-Meramundali and GMR-Talcher at GMR end needs to be checked and reviewed.
vi. Bolangir end has received the DT but Angul end did not trip needs to be investigated.
vii. OPTCL may place the latest status on commissioning of remaining breakers at Meramundali for a stronger coupling of 400kV Bus-I & II.

Deliberation in the meeting

Already discussed in Item no. B1, OPTCL was advised to place the details in the ensuing 29th TCC Meeting to be held on 13.02.2015.

ITEM NO. B.3: Disturbance at 400kV Meramundali S/S on 17.12.14 at 16:43 hrs

At 16:43hrs, R-Ø LA of 400kV Meramundali-IBTPS-I reactor burst at Meramundali S/s casing tripping of following elements:

- 400kV Meramundali-IBTPS-I line tripped on R-Ø, E/F, Z-1 at Meeramundali.
- 400kV Meramundali-Mendhasal ckt tripped on R-Y-B-Ø relay indication.
- 400kV GMR-Meramundali ckt tripped from GMR end on R-Ø, E/F.

OPTCL and GMR may deliberate on following points:

i. OPTCL may place DR output of 400kV Meramundali-IBTPS-I line tripping and the details of Meramundali end fault clearance time.
ii. OPTCL may explain the tripping of 400kV Meramundali-Mendhasal ckt along with DR output.
iii. OPTCL may place all the relay settings of 400kV Meramundali-Mendhasal line at Meramundali end.
iv. Relays settings of 400 kV GMR-Meramundali needs to be checked and reviewed.

Deliberation in the meeting

Already discussed in Item no. B1, OPTCL was advised to place the details in the ensuing 29th TCC Meeting to be held on 13.02.2015.

ITEM NO. B.4: Repeated tripping of lines from Meramundali end on over-voltage

Repeated instances of tripping of lines from Meramundali end have been observed in the recent past. From SCADA data it has been observed that the over-voltage trippings are taking place when voltage levels are 430kV or lower. On 02/01/15 there was a tripping of all lines from Meramundali end on over-voltage. From the SCADA plots the following can be confirmed:

a) Jumps in 400kV voltages were observed at 05:40Hrs and at 06:04Hrs. During each of these sudden jumps in the Bus voltage tripping of lines occurred from Meramundali end occured. OPTCL may explain the reasons for these sudden jumps in voltages.
b) The source of O/V relays need to be confirmed for each of the lines and if input is taken from the line CVT the outputs need to be tested. The Bus PT also needs to be checked to conclude whether the sudden jump in voltages was due to problem in Bus PT.
c) The over-voltage Stage-I relays are all set at 110%, 5 secs as per data available. It is felt that the over-voltage settings should be graded to ensure tripping of 400kV Meramundali-Duburi-II and Meramundali-IBTPS D/C idle charged lines.

It needs to be noted that again on 11/01/15 there were similar tripping from Meramundali end on over-voltage.

Members may deliberate.

Deliberation in the meeting

OPTCL informed that 400kV Meramundali S/s is presently facing severe over voltage problem and because of this phenomenon the over voltage relays are being operated since the drop off to pickup ratio setting is 95% in the over voltage relay (stand alone).

OPTCL confirmed that over-voltage relays Stage-I setting at 400kV Meramundali S/s was at 110%, 5 sec, now they have raised the setting to 112%.

On enquiry, OPTCL replied that star configuration, which measures Ph to Earth voltage is only

available in the over-voltage relay. Delta configuration is not available in the relay. It was opined that Delta configuration (ph to ph voltage measurement) is much accurate for over voltage measurement.

Further, PCC advised OPTCL to explore the possibilities of charging idle charged lines from other end instead of charging from Meramundli end or at suitable voltage level so that the over voltage tripping problem at 400kV Meramundali S/s could be minimized.

Even after the above action does not yield results, OPTCL may consider to do the grading in over voltage settings, so that idle charged lines will trip first and provide relief for over voltage.

OPTCL agreed.

Thereafter, ERLDC informed that on 2nd January, 2015 sudden rise in voltage (440kV) had been observed at 400kV Meramundali S/s and it was remained for about 30 min.

PCC advised OPTCL to examine the reason behind such high voltage, and check the output of bus CVT in particular and report. OPTCL may also consider to employ numerical relay for over voltage protection which has pickup to drop off ratio above 95%.

OPTCL agreed.

ITEM NO. B.5: Oscillations observed in CESC system at early hours of 06/01/15

Starting from 00:06 Hrs of 06/01/15, oscillations were observed in CESC system with comparatively higher amplitude oscillations observed in Budge-Budge, 220kV Budge-Budge-EM S/S and import through Kasba ICTs. Oscillations of lower amplitude were observed in 132kV Budge-Budge–Chakmir sections. The following were noted w.r.t the incident:

a) The generation at Budge-Budge units were getting ramped up possibly on FGMO action prior to the incident with the units under-excited and in absorption mode. As the generation increased oscillations in MVAR/MW output were observed and oscillations were observed in the lines/generators mentioned above. At that time the machine was already loaded to its MCR(Maximum Continuous Rating) and generation increased to 105% of MCR and more on FGMO action. CESC resorted to immediate reduction of generation with possible enforcement of load limiters. CESC may confirm the same.
b) MVAR spikes were observed in 132kV Budge-Budge-Chakmir section. CESC may explain the reasons.
c) On observation of osicllations, CESC shifted the point of synchronization from Kasba to Howrah point at 00:14Hrs and immediately the oscillations stopped. CESC may provide further inputs.
d) Data appears to have got clamped w.e.f 00:14 Hrs. CESC may confirm the reasons.

On analysis of the incident, preliminarily it is suspected that there the oscillations arose due to AVR oscillations in AVR output. Any damping out on synchronization at Howrah point may have been due to nearby presence of Southern machines.

Members may deliberate.

Deliberation in the meeting

CESC informed that from 1st January, 2015 mostly during lean hours they have observed significant active power flow fluctuations in MW (but not in MVAR). On 6th January, 2015 the oscillations were so severe fluctuations of power flow remained in the ranges of about 130 MW to 150 MW. Finding no other alternatives, they had changed the grid synchronizing point from 132kV Kasba S/s to Howrah S/s and thereafter the situation got stabilized. At present, they are not observing any oscillations.

CESC also informed that they had already engaged PRDC to investigate the problem and PRDC agreed to give the report within one month.

CESC, SLDC was advised to continue their grid synchronizing point at Howrah S/s until they get report from PRDC.

ERLDC informed that they observed sudden spikes in MVAR flow of CHMKR-I & II lines on 6th January, 2015 at around 00:01 hrs and shown the SCADA output.

PCC advised CESC to look into it. CESC agreed.

ITEM NO. B.6: Tripping incidences in the month of December, 2014

Other tripping incidences occurred in the month of December, 2014 which needs explanation from constituents of either of the end. Details are circulated in the meeting.

Members may discuss.

Deliberation in the meeting

Members explained the tripping incidences. Details are given in **Annexure-B.6.**

ITEM NO. B.7: Submission of Grid incidence reports

It has been observed that grid incidence reports though being submitted in the prescribed format are not furnished properly as they are not accompanied by relay indications or supported by proper analysis and are without DR/EL printouts. Also, in case of disturbances, ERLDC is issuing messages asking for DR/EL printouts with full relay indications, and such data are sometimes not received properly or are time delayed.

Accordingly, a list of disturbances that occurred in the month of December,2014 is attached and correspondingly the status and delay in receipt of data from the constituents involved have been compiled and place at **Annexure-B.7**.

Constituents from which there is a delayed or incomplete receipt of data as per **Annexure-B.7** are requested to note that they should take necessary action in future to furnish the complete data including DR/EL/tripping analysis, within the stipulated time.

Members may note.

Deliberation in the meeting

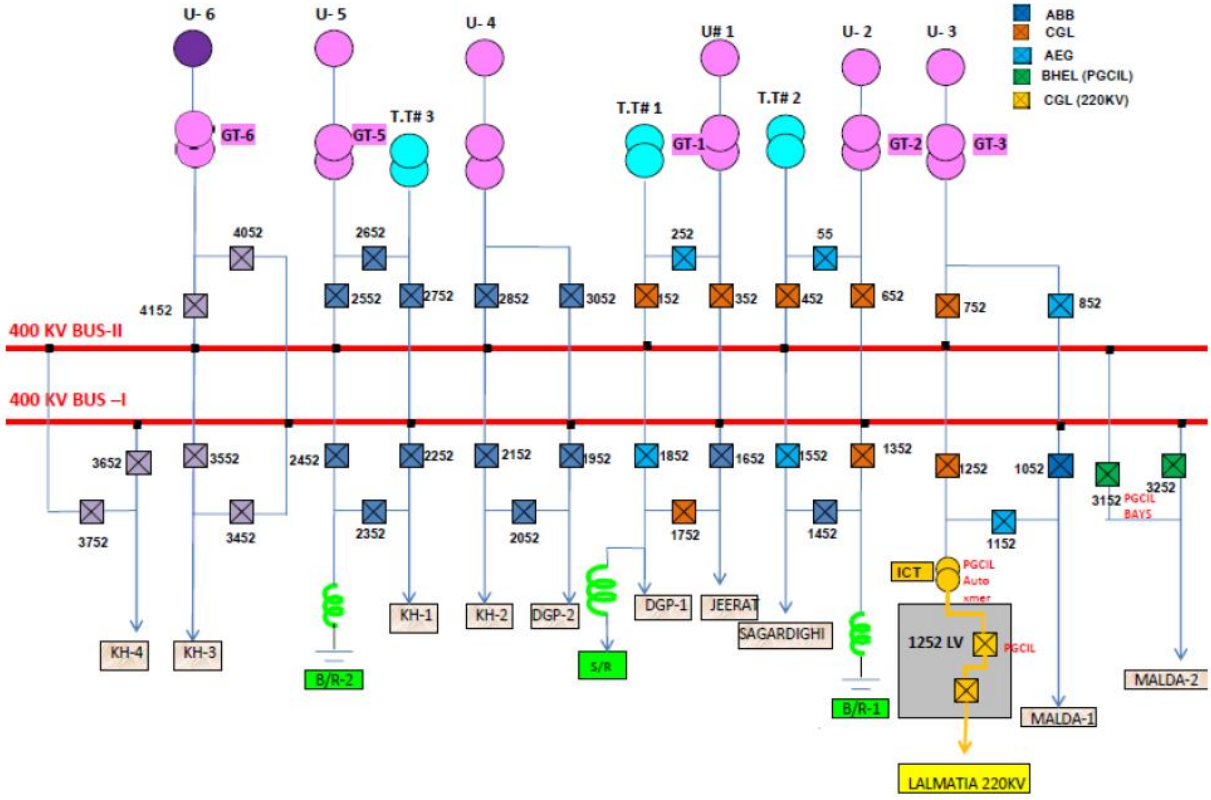
Members noted. PCC advised all constituents to send the proper tripping report within stipulated time. Constituents agreed.

PART- C

FOLLOW-UP OF DECISIONS OF THE PREVIOUS PROTECTION SUB-COMMITTEE MEETING(S)

(The status on the follow up actions is to be furnished by respective constituents)

ITEM NO. C.1: Disturbance in FSTPP, NTPC and JSEB system on 06.11.2014



In 26th PCC meeting, on tripping of 400kV Farakka-Kahalgaon-III from Kahalgaon end, NTPC Kahalgaon informed that they received DT from Farakka end and also confirmed from PLCC counter reading.

PCC advised NTPC Farakka to check the PLCC counter and find out the reason for sending DT.

PCC also advised to expedite the commissioning of remaining un-commissioned breakers at FSTPP for a stronger coupling of 400kV Bus-I & II and update the status in next PCC meeting.

NTPC may update.

Deliberation in the meeting

NTPC Farakka confirmed from PLCC counter reading that DT signal was sent to Kahalgaon end. However, they will test the PLCC system during opportunity shutdown.

On commissioning of remaining 400kV CBs at FSTPP, NTPC informed their action plan as follows:

a) Main bay of FSTPP-Sagardighi at FSTPP end : *Will be completed by January, 2015*
b) Bay connecting FSTPP-Malda-II to Bus-II which is under outage since disturbance at FSTPP on 28/08/14 (Bay connecting to Bus-I in service).: *Will be brought into service in 1st week of February, 2015*
c) FSTPP-KhSTPP-IV Tie bay : *Will be done in February, 2015.*

ITEM NO. C.2: Disturbance at OPTCL on 26th August 2014

In 26th PCC, members updated the status as follows:

1. Testing of CVTs of 400kV Indravati(PG) – Indravati(OHPC) S/C line installed at both ends, for proper output and satisfactory performance. If required, erroneous CVT to be replaced with a new one -----On the request of previous PCC meeting, OHPC finally agreed to change CVT.
2. Making numerical over-voltage protection to ensure desired drop-off to pick-up ratio (above 0.95) be available at PGCIL and OHPC 400kV S/Stns, in place of existing VTU-31 (EE make) electromechanical relay and reviewing their setting based on observed CVT outputs ----- OHPC agreed to implement the O/V settings in numerical relays (Micom-P442 relay).
3. Ensuring that DR is triggered whenever any protection operates and corresponding event log is telemetered to ERLDC with GPS synchronized time stamping.-----PCC felt Disturbance Recorder is essential for 400kV system and advised concern utilities (OHPC & Powergrid) to implement the same.
4. Exploring possibility of incorporating Transient Fault Recorders for the FSCs at Jeypur, for analysis of incidents. ----- Powergrid ER-II (Odisha Projects) representative was not available for discussion.
5. The two 400/220kV ICTs at UIHEP are owned and maintained by different utilities viz. OHPC and PGCIL. For proper maintenance coordination and ease of access it is suggested that O&M of both the ICTs should be done by a single utility.----PCC advised OHPC and Powergrid to resolve the issue bilaterally. If not resolved PCC may recommend to bring the issue in TCC forum.
6. Reviewing over-current protection settings in 220kV lines of OPTCL—OPTCL confirmed submission of such relay settings. It was decided that ERPC and ERLDC will examine the settings and report in next PCC.

PCC advised to complete the above action plans at the earliest.

OPTCL, OHPC & Powergrid may update.

Deliberation in the meeting

Members updated the status as follows:

1. Testing of CVTs of 400kV Indravati(PG) – Indravati(OHPC) S/C line installed at both ends, for proper output and satisfactory performance. If required, erroneous CVT to be replaced with a new one -----*OHPC informed that they agreed to change the defective Y ph CVT by February, 2015.*
2. Making numerical over-voltage protection to ensure desired drop-off to pick-up ratio (above 0.95) be available at PGCIL and OHPC 400kV S/Stns, in place of existing VTU-31 (EE make) electromechanical relay and reviewing their setting based on observed CVT outputs ----- *OHPC informed that they will implement the O/V settings in numerical relay (Micom-P442 relay) by February, 2015 and they will keep the existing EM O/V relay as alarm.*
3. Ensuring that DR is triggered whenever any protection operates and corresponding event log is telemetered to ERLDC with GPS synchronized time stamping. PCC felt Disturbance Recorder is essential for 400kV system and advised concern utilities (OHPC & Powergrid) to implement the same. --- *OHPC informed that they are in the process of tendering. PGCIL informed that they will implement in numerical relays and EL.*
4. Exploring possibility of incorporating Transient Fault Recorders for the FSCs at Jeypur, for analysis of incidents. ----- *PGCIL informed that they will implement in numerical relays and EL.*
5. The two 400/220kV ICTs at UIHEP are owned and maintained by different utilities viz. OHPC and PGCIL. For proper maintenance coordination and ease of access it is suggested that O&M of both the ICTs should be done by a single utility. PCC advised

OHPC and Powergrid to resolve the issue bilaterally.---- *OHPC informed that they will resolve the issue bilaterally before 1st week of February, 2015, if not resolved the point may be taken up to TCC forum.*

6. Reviewing over-current protection settings in 220kV lines of OPTCL—*It was decided that ERPC and ERLDC will examine the settings and report in next week.*

PCC advised to complete the above action plans at the earliest.

ITEM NO. C.3: T-connection in 132kV Lalmatia-Khahalgaon line

During deliberation in 25th PCC meeting, it was informed that a T-connection was made in 132kV Lalmatia-Khahalgaon line at Tower no. 9 from Lalmatia end and drawing the power from 3rd May, 2014.

PCC advised JSEB to check and explore removeing the T-connection immediately in order to maintain protection coordination of the important line like 132kV Lalmatia-Khahalgaon S/C.

In 26th PCC, members took serious note on T connection which was made without any prior permission from ERPC forum. A report from JUSNL was received wherein it was clarified that the jumper connection was done to meet the maximum loads in the Lalmatia areas in view of restrictions imposed by BSPTCL.

To assess the actual network modification by JUSNL PCC decided to convene a separate meeting on 12th January, 2015 for detail deliberation on this issue and advised NTPC, DVC, Bihar and JSEB to attend the meeting.

Respective constituents agreed.

Accordingly, the meeting was held on 12th January, 2015 at ERPC, Kolkata wherein members agreed for the following:

1. Members unanimously recommended that the existing arrangement of supplying Sahebganj load through jumpering of Kahalgaon(B)-Lalmatia line should be removed immediately.
2. On removing of T connection 132kV Kahalgaon(B)-Lalmatia and 132kV Lalmatia-Sahebganj S/C will be restored as per existing network. Depending upon network constraint Jharkhand should manage their load.
3. Subsequently, JUSNL if needs may
    i. Keep Lalmatia, Dumka, Sahebganj and Pakur loads on Farakka-Lalmatia 220kV line by keeping 2X100VA, 220/132kV Lalmatia ICTs, 132kV Lalmatia-Sahebganj S/C and 132kV Lalmatia-Dumka D/C on 132kV main bus at Lalmatia.
    ii. 132kV KhSTPS-Lalmatia S/C would be kept connected at Lalmatia transfer bus, with the TBC in open condition.
4. 132kV Kahalgaon(B)-Lalmatia S/C and 132kV Kahalgaon(B)-Sultanganj D/C would be kept idle charged from Kahalgaon(B) end.
5. In case of (i) above, in the event of loss of 220kV supply from Farakka side, JUSNL would avail restricted power of around 60MW, for the loads at Lalmatia, Dumka, Sahebganj and Pakur. JUSNL would have to further restrict its drawal during shutdown of existing 132kV Banka(PG)-Sabour S/C line (for construction of the 2nd ckt), as BSPTCL would need to draw power through the new 132kV Kahalgaon(B)-Sultanganj D/C line, for meeting Sabour, Sultanganj and Jamalpur loads, during that period.
6. This would continue as an interim arrangement, till energization of 220/132kV Dumka(New) S/Stn of JUSNL and interconnection of the existing Dumka 132kV S/Stn with Dumka(New).

7. All efforts would be made from OCC forum to ensure normalization of 220kV Farakka-Lalmatia S/C line, in order that it may cater to 150-160 MW load of JUSNL, at the earliest.

Diagram-I (Present Condition)

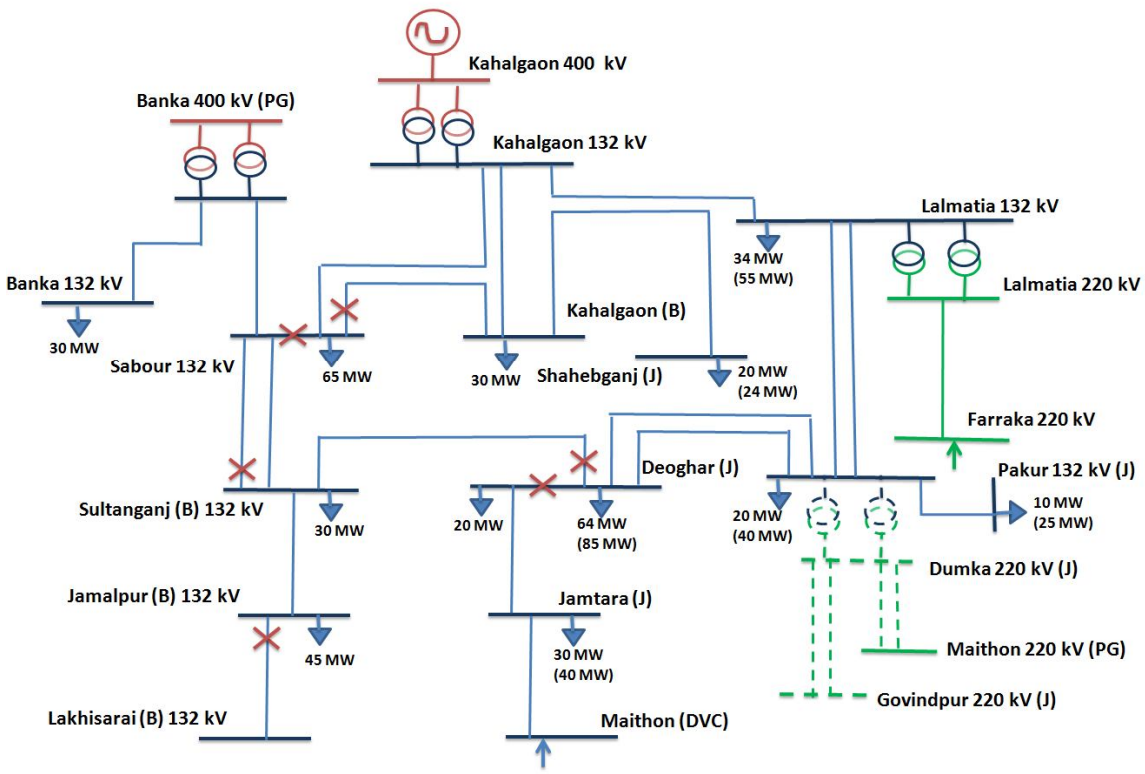
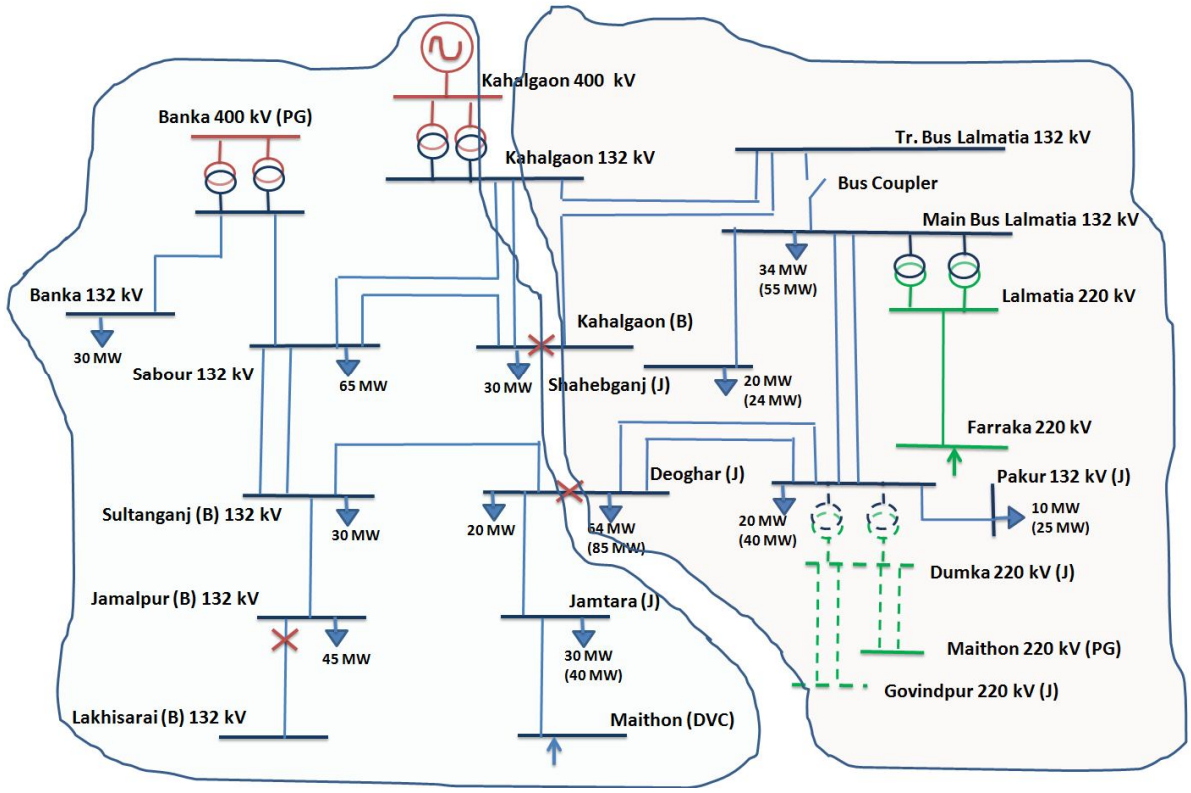


Diagram-II (Proposal-I)



Members may note.

Deliberation in the meeting

JUSNL informed that they have not yet removed the T connection of the above line. PCC advised JUSNL to remove the T connection as early as possible and informed that the point will be discussed in tomorrow's OCC meeting.

ITEM NO. C.4: Bihar System

1. Tripping at 220 kV Biharshariff (BSPTCL) S/S at 12:26 hrs on 20/08/14.

At 12:26hrs, 220kV Tenughat-Biharsariff line tripped on earth fault from both the ends. At the same time all the three 400/220kV, 315MVA ICTs at Biharsariff (PG) tripped on back up O/C protection leading to total power failure at 220kV Biharsariff (BSEB) S/s. 220kV Biharsariff-Bodhgaya-D/C also tipped.

It appears that sequences of events were initiated due to Y-Ø earth fault occurred in 220kV Tenughat-Biharsariff line. However there was a delayed clearance of the said fault from Biharsariff (BSPHCL) end (PMU plot of Sasaram shows that the fault was getting cleared in 1400ms) due to which all the three 400/220kV, 315MVA ICTs tripped from Biharsariff(PG) end on backup O/C protection from HV side. 220kV BIharshariff-Bodhgaya-D/C (idle charged from Biharshariff) also tipped at the same time as reported by BSPHCL. As the Biharsariff (BSPHCL) had no other source to feed the downstream load, total power failure occurred at Biharsariff (BSPHCL) end.

Remedial Measures/Suggestions:

Delayed clearance of faults from Biharshariff (BSPHCL) end for 220kV Tenughat-Biharshariff line needs to be checked.

BSPTCL explained that the fault was detected in zone 1 of 220 kV Tenughat- Biharsharif line from Biharsharif end but CB operation might have delayed the fault clearance. BSPTCL informed that they are facing DC supply problem, which may cause delayed CB operation. They reported that DC cable flashing was also observed behind the control panels and same was rectified.

PCC advised BSPTCL for thorough checking of DC supply system and submit the status report to ERLDC/ERPC Secretariat within ten (10) days. BSPTCL agreed.

In 23rd PCC, while enquiring about simultaneous 3x315 MVA ICT tripping at Biharsharif S/s, Powergrid informed that the DR plots indicated the fault was isolated by ICTs in 600 msec. However, ERLDC mentioned that PMU plots obtained from Sasaram S/s showed the total fault duration of 1.4sec.

It could not be concluded the reason behind such long duration of fault isolation. It was opined that DR plots at TVNL end may highlight additional information in this respect. Accordingly, PCC advised JSEB to collect the DR files on 20.08.2014 from TVNL and submit soon to ERLDC/ERPC. JSEB agreed.

In 24th PCC, BSPTCL informed that they have tested the DC supply output and reported that 5V negative voltage was observed. They are planning to shift the Panels to new control room which is at higher level from the ground.

On submitting the DR files from TVNL end, JSEB agreed to send within a week.

In 25th PCC, JSEB has submitted the DR files of TVNL end.

PCC decided to study the report and report the outcome in next PCC.

The report has been submitted by BSPTCL and will be discussed in next PCC.

From DR output of TNVL end it was understood that, the fault was detected in zone-1 by both main-I & II distance protection of 220kV TVNL S/s (Fault distance=130kM). The fault was successfully cleared within 80msec from TVNL end.

Members may discuss.

Deliberation in the meeting

PCC felt that the tripping was in order.

2. ERPC recommendations on repeated trippings at 132 kV Purnea (BSPTCL) S/S

In 28th TCC, Audit team has presented their observations and recommendations of 132kV Purnea and Forbesgunj (BSPTCL). During presentation three types of recommendations (short term, medium term and long term) were given.

TCC advised BSPTCL to implement the short term and medium term recommendations within 2/3 months time and to place the roadmap for implementation of all the recommendations to ERPC Secretariat at the earliest.

In 24th PCC, BSPTCL has submitted the action plan. PCC advised BSPTCL to give the details of last month trippings in around Purnea BSPTCL system along with details to assess the improvement after incorporating ERPC recommendations.

In 25th PCC, BSPTCL has submitted the details of tripping incidences happened in the last few month, which was circulated in the meeting.

PCC advised BSPTCL to submit the latest implementation status on ERPC recommendations on monthly basis.

BSPTCL agreed.

In 26th PCC, BSPTCL has submitted the Tan δ testing report. PCC advised to replace the CTs whose Tan δ is more than acceptable limits.

BSPTCL may update.

Deliberation in the meeting

BSPTCL updated the status as enclosed in **Annexure-C.4**.

ITEM NO. C.5: Disturbance at FSTPP on 28th August 2014.

In 26th PCC, NTPC & Powergrid updated the status as follows:

1. Non-clearance of fault at FSTPP end for 400kV FSTPP-Malda-II. (Action : NTPC & Powergrid) --- Tie CB -3252 (BHEL make) has been tested and found B-ph interrupter defective. The B-ph interrupter has been replaced.
2. DR plots of 400kV FSTPP-Malda-II at FSTPP end (not GPS synchronized) (triggered at 11:06:28:291) depict that opening of 3-ph Tie breakers started at 11:06:28:332 and Main breakers at 11:06:28:333. However opening of the breakers are not confirmed in the DR channels and fault current through B-phase persists even after around 1000ms. It appears that FSTPP end breaker did not open. Powergrid may give a detailed report regarding testing carried out, problems detected and the rectification activities carried out for the main/tie breakers and the associated relays. (Action : Powergrid) --- The relays LZ and REL relays have been replaced with new Micom and Siprotec relays.

3. LBB for 400kV FSTPP-Malda-II connected to Bus-I did not operate. (Action : Powergrid)— Current elements were not functional the same have been replaced. Duplication of LBB scheme will be completed by Jan, 2015.
4. Non-opening of Behrampore end breakers due to which Directional E/F was triggered at Jeerat end. (Action : Powergrid)--- Directional E/F settings have been revised at Behrampore as PMS=0.1, TMS=0.7 and at Jeerat as PMS=0.2 and TMS=0.85.
5. The tripping of 315MVA ICT-III at Malda on backup O/C and that of 132kV Malda(PG)-Malda from Malda(WB) end. (Action : Powergrid)---- Time coordination would be done by Jan, 2015.
6. Occurrence of Over-voltage Stage-I subsequently. (Action : Powergrid)---New CVT has reached the site and it will be installed during next opportunity shutdown.

NTPC and Powergrid may update the status.

Deliberation in the meeting

NTPC & Powergrid updated the status as follows:

1. Non-clearance of fault at FSTPP end for 400kV FSTPP-Malda-II. (Action : NTPC & Powergrid) Tie CB -3252 (BHEL make) has been tested and found B-ph interrupter defective. The B-ph interrupter has been replaced. --- *CB connector problem will be rectified in first week of February, 2015. Thereafter, the CB will be in service.*
2. DR plots of 400kV FSTPP-Malda-II at FSTPP end (not GPS synchronized) (triggered at 11:06:28:291) depict that opening of 3-ph Tie breakers started at 11:06:28:332 and Main breakers at 11:06:28:333. However opening of the breakers are not confirmed in the DR channels and fault current through B-phase persists even after around 1000ms. It appears that FSTPP end breaker did not open. Powergrid may give a detailed report regarding testing carried out, problems detected and the rectification activities carried out for the main/tie breakers and the associated relays. (Action : Powergrid) --- *The LZ and REL relays have been replaced with new Micom and Siprotec relays.*
3. LBB for 400kV FSTPP-Malda-II connected to Bus-I did not operate. (Action : Powergrid). Current elements were not functional the same have been replaced. Duplication of LBB scheme will be completed by Jan, 2015. — *NTPC agreed to extend the trip contacts to Powergrid soon.*
4. Non-opening of Behrampore end breakers due to which Directional E/F was triggered at Jeerat end. (Action : Powergrid)--- *Directional E/F settings have been revised at Behrampore as PMS=0.1, TMS=0.7 and at Jeerat as PMS=0.2 and TMS=0.85.*
5. The tripping of 315MVA ICT-III at Malda on backup O/C and that of 132kV Malda(PG)-Malda from Malda(WB) end. (Action : Powergrid)---- *Time coordination would be done by Jan, 2015. WBSETCL was advised to exchange the information on relay settings.*
6. Occurrence of Over-voltage Stage-I subsequently. (Action : Powergrid)---*New CVT has reached the site and it will be installed during next opportunity shutdown in first week of February, 2015.*

ITEM NO. C.6: Efficient Evacution of Power from 2x210 MW Tenughat TPS, Lalpania— TVNL

Arrangement for evacuation of power from Tenughat TPC is through the following two transmission lines:

1) Tenughat TPS to Bihar Sharif (BSEB) S/S through 400 KV Single Circuit line.
2) Tenughat TPS to Patraru TPS through 400 KV Single Circuit line.

Both lines are operating at 220 kV due to non readiness of 400 K V S/S at terminating ends.

In 27th TCC, TVNL informed that, at TVNL end up gradation to 400 kV level is in process. Accordingly, TCC also advised JSEB to deposit the requisite amount to Powergrid for up gradation/termination work entrusted to Powergrid for operation of the line at rated voltage. This will facilitate Tenughat-Biharshariff line to be operated at 400 kV and stability of the TVNL units.

In 21st PCC, TVNL informed that 2x250 MVA ICT is already available at TVNL and the erection work is in progress. TVNL reported that work will be completed by December, 2014 at TVNL end.

Powergrid informed that, up gradation related works at 400 kV Biharshariff S/s has now stalled due to some payment issues with JSEB. However, it is expected to complete the work by December, 2014, if in the mean time payment issues get settled at earliest.

In 28th TCC Powergrid informed that payment of around 4.58 cr. is pending from JSEB and the completion of the work would take 3 months from date of payment.

JSEB informed that the payment has been delayed due to some fund constraints and it would be released shortly in 2-3 instalments starting from November, 2014.

During deliberation ERLDC expressed that conversion of 220kV Tenughat-Biharshariff line to 400kV level may not bring the total stability of Tenughat Power Station. Status of construction for 400kV Tenughat-New Ranchi D/C line and 220kV Tenughat-Govindpur-Dumka line under Powergrid consultancy were enquired. It was informed that 400kV line is under scope of Powergrid under deposit work of Jharkhand strengthening scheme for which around 450 Cr. Jharkhand has to deposit. Representative from Jharkhand informed that 220kV line is not under scope of Powergrid consultancy. TCC however advised Jharkhand and CTU to deliberate on this in lower forum of ERPC.

In 25th PCC, JSEB informed that JUSNL has already given the requisition to Energy Department (GoJ), expected to divert the fund by 15th December, 2014 for conversion of 220kV Tenughat-Biharshariff line to 400kV level.

TVNL, JUSNL, Powergird may update.

Deliberation in the meeting

JUSNL informed that fund was not yet diverted from their Energy Department. PCC advised JUSNL to settle the payment as early as possible.

ITEM NO. C.7: Members may update the following:

1. In 26th PCC, WBSETCL informed that 220 kV two main bus system will be made operational at Bidhannagar S/s by Feb, 2015.

WBSETCL may update the present status.

Deliberation in the meeting

WBSETCL informed that 220 kV two main bus system at Bidhannagar S/s will be implemented in schedule.

2. In 26th PCC, JSEB informed that,

- Replacement of old EM relays with Micom P442 in 132kV Chandil-Hatia-I line is in progress by M/s Areva and it would complete by 31st December, 2014.
- JSEB informed that work has been awarded to M/S Areva for supply, retrofitting, testing

and commissioning of Micom relays in 33kV feeders. The work will be completed by 31st December, 2014.

JSEB may update.

Deliberation in the meeting

JSEB updated that,

- *For replacement of old EM relays with Micom P442 in 132kV Chandil-Hatia-I line, the work order has been awarded to M/s Areva and the relay is yet to be received.*

- *JSEB informed that work has been awarded to M/S Areva for supply, retrofitting, testing and commissioning of Micom relays in 33kV feeders at Jamshedpur. New relays have been installed in 8 feeders and the installation of relays for rest of the feeders will be completed by 31st January, 2015.*

3. In 23rd PCC, JSEB informed that the relays at 220kV Chandil S/s have been tested and agreed to give the report to ERPC Secretariat.

JSEB may update the status.

Deliberation in the meeting

JSEB has submitted the testing report.

4. OPTCL may please update the latest status on following substations:

a) 220 kV Theruvali S/s

- Some relays at 220 kV Theruvali S/s were already replaced and rest will also be replaced by end of December, 2014.
- The new 220 kV bus bar protection at Theruvali will be put in service by end of December, 2014.

Deliberation in the meeting

- *Some relays at 220 kV Theruvali S/s were already replaced and rest will also be replaced by end of December, 2014. Seven Nos. electromagnetic Over Current & Earth fault relays at 220 kV Theruvali S/s have been replaced. Six are under replacement ,expected to be completed by 2nd week of January.*
- *The new 220 kV bus bar protection has been installed at Theruvali but the same could not put in service because of some defective components. Replacement of defective components is in progress by M/s Siemens. The scheme will be put in service by end of January, 2015.*

b) 220kV Budhipadar S/s

- The new 220 kV bus bar protection at Budhipadar S/s will be put in service by end of December, 2014.

Deliberation in the meeting

- *The new 220 kV bus bar protection at Budhipadar S/s has been completed, but due to some defective relays, the commissioning could not be completed. M/s. Siemens is replacing the defective relays.*

c) 400/220 kV Mendhasal S/s

- In line with advice from 24th PCC carrying out testing of all the relays at Mendhasal S/s and reviewing the resistive reach settings are in progress and wouldl be completed by Mar, 2015.
- 26th PCC advised OPTCL to install the PLCC system to enable inter tripping.

Deliberation in the meeting

- *In line with advice from 24th PCC necessary testing of all the relays at Mendhasal S/s are carrying out and reviewing of resistive reach settings are in progress and would be completed by Mar, 2015.*
- *26th PCC advised OPTCL to install the PLCC system to enable inter tripping.: OPTCL informed that intertripping schme will be implemented after installation of fiber optic cable.*

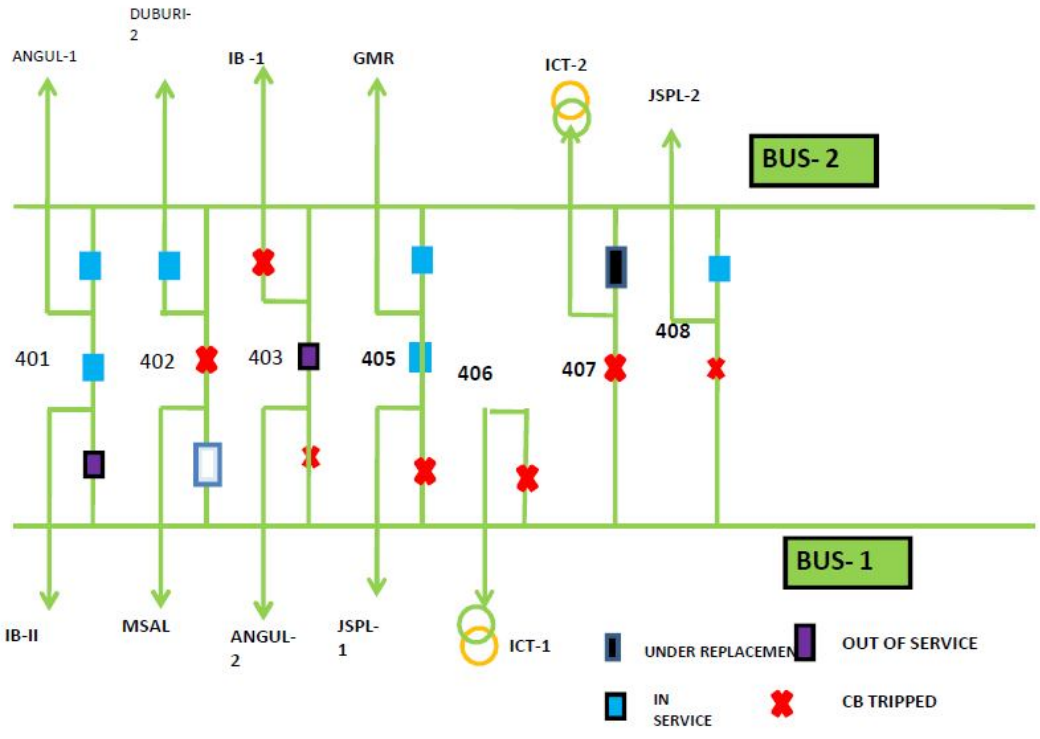
d) 220kV Rengali and Barkote S/s

- Status on testing of pilot wire protection of 220kV Rengali S/Y- Rengali PG feeder I & II (HORM-4)
- Replacement of Electromagnetic O/C & E/F relays with numerical relays at 220kV Rengali S/Y and Barkote S/s would be completed by January 15.

Deliberation in the meeting

- *Status on testing of pilot wire protection of 220kV Rengali S/Y- Rengali PG feeder I & II (HORM-4): OPTCL informed that the protection scheme has been tested and found satisfactory results.*
- *Replacement of Electromagnetic O/C & E/F relays with numerical relays at 220kV Rengali S/Y and Barkote S/s would be completed by January 15.*

e) 400kV Meramundali S/s



- The 400kV CB for BUS –I of 402 diameter (Mendhasal) installation completed expected to be commissioned by 4th week of December, 2014.
- The 403 Dia tie CB (Angul-II) overhauling would be completed by 30.11.2014.
- The installation of BUS-I CB of 401 diameter (Ib-II) is in progress and expected to be commissioned by 15th January'2015.
- 220kV Bus bar protection for Meramundali Grid is in progress, expected to be completed by 31st December'2014.
- 26th PCC advised to check the healthiness of CT and enable CT supervision for all CTs.

Deliberation in the meeting

OPTCL submitted the following status in respect of Meramundali S/s:

- *400kV CB (407 Dia.) replacement completed on 2nd Dec.'2014*
- *The 400kV CB for BUS –I of 402 diameter (Mendhasal) installation completed on 24th December, 2014.*
- *The 403 Dia tie CB (Angul-II) overhauling done by BHEL and taken into service on 30th Nov'2014.*
- *Replacement of BUS-I CB of 401 diameter (Ib-II) is in progress and expected to be commissioned by 30th January'2015.*
- *Replacement of 220kV CB Auto-II is in progress and expected to be commissioned by 30th January 2015.*
- *Installation and testing of 220kV Bus bar protection for Meramundali has been completed, expected to be in service by January, 2015.*
- *26th PCC advised to check the healthiness of CT and enable CT supervision for all CTs: OPTCL informed that work is in progress.*

ITEM NO. C.8: PROTECTION PHILOSOPHY OF EASTERN REGION

In the Special meetings on "Protection Co-ordination of JSEB System and its neighbouring utilities" held on 12.11.13, 05.12.13 & 28.01.14 the protection philosophy for Eastern Region was agreed as given below:

Sl. No.	Zone	Direction	Protected Line Reach Settings	Time Settings
1	Zone-1	Forward	80%	Instantaneous
2	Zone-2	Forward	120%	300 milliseconds
	Zone-2 (for 220kV and below)	Forward	120 % of the protected line or 100% of the protected line + 50% of the adjacent shortest line (whichever is less)	300 milliseconds
3	Zone-3	Forward	100 % of the protected line + Za	1.0 Sec
4	Zone-4	Reverse	20%	1.2 Sec

Where, Za = Impedance of 100% of the adjacent longest line or 90 % of the Transformer impedance (whichever is less).

In 19th PCC, all the constituents were requested to adopt the same philosophy for their inter as well as intra state lines for better protection co-ordination of their systems and Eastern Regional system as a whole. Implementation of this philosophy may also be extended for BSPTCL, DVC and West Bengal systems.

A special meeting was convened to review the zone settings of BSPTCL, DVC and West Bengal systems on 06.08.14. The zone settings as updated by the constituents (till date) are circulated in the meeting**.** Concerned members are requested to confirm the given settings and also update the

bold and blank fields.

The updated zone settings of the various lines are available at ERPC website. PCC advised all constituents to update the settings at their end. Thereafter, a separate meeting will be convened to discuss the implementation of zone settings recommended by the Special Task Force.

A special meeting is scheduled to be convened on 30.12.2014 to review the zone settings based on CEA recommendations at ERPC, Kolkata.

In 26th PCC, the house was informed that a special meeting is scheduled on 30.12.2014 to review the zone settings based on CEA recommendations at ERPC, Kolkata.

Accordingly, the meeting was held at ERPC, Kolkata. The minutes of the meeting is enclosed at **Annexure-C.8**. After detailed deliberation, members decided the zone settings of distance protection as follows:

Sl. No.	Zone	Direction	Protected Line Reach Settings	Time Settings (in Seconds)	Remarks
1	Zone-1	Forward	80%	Instantaneous (0)	As per CEA
2a	Zone-2 (for 400 kV and above)	Forward	For single ckt- 120 % of the protected line	0.35	As per CEA
			For double ckt- 150 % of the protected line	0.5 to 0.6 - if Z2 reach overreaches the 50% of the shortest line ; 0.35- otherwise	As per CEA
2b	Zone-2 (for 220 kV and below)	Forward	120 % of the protected line or 100% of the protected line + 50% of the adjacent shortest line	0.35	As per CEA with minor changes
3	Zone-3	Forward	120 % of the (Protected line + Next longest line)	0.8 - 1.0	As per CEA
4	Zone-4	Reverse	10%- for long lines (for line length of 100 km and above) 20%- for shot lines (for line length of less than 100 km)	0.5- if Z4 reach overreaches the 50 % of reverse shortest line; 0.35- otherwise	As per CEA

Members may finalize.

Deliberation in the meeting

Powergrid informed they have not yet implemented the revised settings as their testing team is testing the revised settings under different power conditions. Powergrid informed that they will implement the settings after approval from their testing team.

Members raised the issue regarding finalizing settings of the Directional Earth Fault (DEF) and Back up O/C.

The house was informed that a separate meeting would be held after 29th TCC Meeting to discuss and finalization of the protection settings. Mean while constituents were advised to send their views on revised settings.

Constituents agreed.

ITEM NO. C.9: Oscillations in and around Talcher

In 25th PCC, ERLDC informed that recently oscillations observed in and around Talcher STPS with a frequency of 0.2 Hz. Since the control systems of generator AVR, Governor, HVDC converter etc. have the potential to trigger the oscillations it was requested to submit the following:

- Whether any functional abnormality was observed or set point re-tuning done for the AVR/PSS or governor control loop of Talcher or GMR units.
- Whether any abnormal performance was observed or control loop re-tuning done for HVDC system at Talcher.

PCC advised concern constituents to submit the information immediately.

Thereafter, ERLDC informed that subsequent to the voltage oscillations on 13th and 14th November, 2014, three more such incidents were observed on 29th and 30th November. The power variations in various 400kV lines as recorded by PMUs in ER, have been analysed for each of these instances using the Power Swing Recognition (PSR) application of Siemens PDP installed at ERLDC and the results are summarized in the table given below:

Date	Time (Hrs.)	Talcher Voltage amplitude (peak-peak)	DOE found in PSR*	Frequency of Dominant mode ** (Hz) found in PSR	Damping Ratio
13/11/14	16:01	0.75 kV	6	0.2	-0.1
13/11/14	18:01	0.75 kV	6	0.2	-0.05
14/11/14	14:04	1 KV	6	0.2	0.0
14/11/14	16:02	1 KV	Not found	Not found	
29/11/14	17:50	0.75 kV	6	0.4	-0.01
30/11/14	08:57	Very less	6	0.5-0.6	0.02
30/11/14	17:28	0.25 KV	Not found	Not found	

* DOE(Degree Of Exposure) denotes the potential hazard of a swing event, based on its amplitude and damping, on an 11-point scale

** Mostly observed in Talcher-Rourkella mode

From the summary of analysis it may be seen that the dominant mode in most of the occasions has a frequency of 0.2 Hz. In this connection it is stated that the amplitude and damping of the dominant mode are sensitive to the AVR/PSS and governor controller parameters of nearby generators as well FACTS controllers. With proper tuning of these parameters, damping of the oscillations can be enhanced (so that they decay out rapidly) and amplitude of the dominant mode can also be attenuated.

While the issue is also being pursued with HVDC Talcher and GMR TPS, in view of repeated instances of oscillations, Talcher STPS is requested to kindly get the PSS and governor parameters of their units tested and if required, re-tuned by OEM, so that such low frequency oscillations can be effectively suppressed.

In 26th PCC, ERLDC informed that they have received communication from GMR and yet to receive the relevant information from HVDC and TSTPS stations.

TSTPS, NTPC informed that they have analyzed the oscillations for 13th and 14th November, 2014 and agreed to send the report. TSTPS, NTPC asked for PMU plots of 29th and 30th November, 2014 to analyze the oscillations. ERLDC agreed to share.

ERLDC may update.

Deliberation in the meeting

NTPC has submitted a report (enclosed at **Annexure-C.9**), *wherein it was mentioned that oscillations are significant in MVAR flow and however, no abnormality has been seen in NTPC Talcher machines. The reactive power control of HVDC system might be the reason.*

Powergrid agreed to look into it.

ITEM NO. C.10: Third Party Protection Audit Format

In 104th OCC, It was decided that the checklist of ERPC used in its 1st third party protection audit would be modified in line with recommendation by the Task Force committee under V. Ramakrishna and on acceptance of the same by 105th OCC the road map for 2nd Protection Audit of ER will be finalized.

Check list is enclosed in **Annexure-C.10**.

Members may decide.

Deliberation in the meeting

The house was informed that second Third Party Protection Audit will be commenced from March, 2015. PCC advised all constituents to examine the revised checklist of Third Party Protection Audit and send their comments on any modification/alternation if required to ERPC Secretariat within February, 2015. The checklist is also made available at ERPC website.

Constituents agreed.

ITEM NO. C.11: ANY OTHER ITEM.

****

Annexure - A

Participants in 27th PCC Meeting

Venue: ERPC Conference Room   Time: 11:00 hrs   Date: 21.01.15 (Wednesday)

Sl No	Name	Designation	Organization	Contact Number	Email	Signature
1	A K Bandyopadhyay	MS	ERPC	9433068533	mserpc-power@nic.in	[signature]
2	U.K. Verma	GM	ERLDC	08902496220	ujjwalkumar.verma@gmail.com	[signature]
3	D.K. SHRIVASTAV	AGM	ERLDC	9433041812	dkshrivastav55@yahoo.co.in	[signature]
4	P S Das	Ass/GM	-do-	9433041837	psdas_psd@yahoo.com	[signature]
5	S. BANERJEE	Asst. GM	ERLDC	9433041823	surajitb@gmail.com	[signature]
6	S P Dash	DGM	POWERGRID	9437575657	spdashpg@gmail.com	[signature]
7	Rohit Kumar	Sr. Engr	POWERGRID, ER-I	9431815774	oandmer1@gmail.com	[signature]
8	Jiten Das	Asst. GM	POWERGRID ER-II	9434739354	ests201@gmail.com	[signature]
9	S.K. SURL	AGM	NTPC Kaniha	9437042785	sksurl@ntpc.co.in	[signature]
10	R.P. Singh.	DGM(OS)	NTPC Patna	9431011366	rpsingh01@ntpc.co.in	[signature]
11	[illegible]	Sr Manager	NTPC Farakka	9434778587	sabi.ntr@gmail.com	[signature]
12	N. Mandal	AGM (E)	Gati	8016082299	niladri.mandal@gatinfra.com	[signature]
13	Bramhanand Verma	Engineer	ERLDC	9903180731	bramhanand18@gmail.com	[signature]
14	Saurav K Sahay	Sr Engineer	ERLDC	9432013173	sahay.saurav@gmail.com	[signature]
15	B.B Bhoi	Dy Mgr	ERLDC	9432351830	bibhu.cet@gmail.com	[signature]
16	S. N. Choudhury	Mgr.	CESC	9831171138	subroto.choudhury@rp-sg.in	[signature]
17	N. De	Manager	CESC	9831562898	nikhilesh.de@rp-sg.in	[signature]
18	H.P. Mahapatra	Manager	OHPC	9861164943	hpm.ohpc@gmail.com	[signature]
19	P.K. Das	DGM (El)	SLDC, OPTCL Bhubaneswar	9438907408	prashanta_das@yahoo.co.in	[signature]
20	P.K. Kundu	SE (E)	SLDC, WBSETCL	9434910263	pkundu_1961@yahoo.co.in	[signature]

"Coming together is a beginning, staying together is progress, and working together is success." –Henry Ford

Participants in 27th PCC Meeting

Venue: ERPC Conference Room   Time: 11:00 hrs   Date: 21.01.15 (Wednesday)

Sl No	Name	Designation	Organization	Contact Number	Email	Signature
21	S. Roy	A.C.E	NRVSETCL	9434910543	srbyan-co @yahoo.com	[signature]
22	G. Maji	SM(PS)	WBSEDCL	8336909686	gmaji@wbsedcl.co.in	[signature]
23	Rajendra Prasad	A.Ex.E.	TVNL	9470383346	r.p.ttps@gmail.com	[signature]
24	Basant Kunda	EEE	JSEB	7858902788	duggu1972@gmail.com	[signature]
25	Rambaboo Singh	EEE	BSPTCL	7763817723	eeecritt@gmail.com	[signature]
26	G. Rao	AEE	ERPC	9547891353	eseb-cea @yahoo.com	[signature]
27	JOYDEB BANDYOPADHYAY	SE	ERPC			[signature]
28	D. SARKHEL	SE(PS)	ERPC	9433067724		[signature]
29	P.K. DE	EE	ERPC	9433125844	pkderpc@gmail.com	[signature]
30	V Kalyanaraman	EE	ERPC	—	—	[signature]
31	RAJDEEP BHATTACHARJEE	RE	BSPHCL	9830380689	rekolbsphcl@gmail.com	[signature]
32	SUDIPTA GHOSH	AM(PS)	WBPDCL	9474363864	g-sudipta1@rediffmail.com	[signature]
33	Debarshi De	DM (SC)	CESC	9163217742	[illegible]	[signature]
34	L. Nayak	GM (Ele)	OPTCL	9438907801	ele.lnayak@optcl.co.in	[signature]
35						
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"Coming together is a beginning, staying together is progress, and working together is success." –Henry Ford

Annexure-B.6

List of transmission lines (220 kV & above) of ER which tripped in Dec'14									
S.NO	LINE NAME	TRIP DATE	TRIP TIME	Fault Clearance time in msec (As Per PMU)	Relay Indication LOCAL END	Relay Indication REMOTE END	Auto Recloser Operated for L-G Fault	DR/EL received within 24 Hrs (Y/N)	Deliberation in the meeting
1	400 KV KAHALGAON-BANKA-2	06.12.14	03:10	<100	NA	Main-I and Main-II operated (R-B fault)	NA	No	R-B fault, Powergrid informed that it was happend during OPGW work.
2	400 KV JEYPUR-BOLANGIR	11.12.14	17:44	PMU data not available	DT received	Did not trip	PMU data not avbl	No	DT RECEIVED AT JAIPUR AND TRIPPED FROM JAIPUR END ONLY. It was happend due to earth fault in DC system. The same had been rectified now in order.
3	400 KV ROURKELA-RANCHI-II	23.12.14	00:14	<100	NA	NA	Successfully autoreclosed only one end	No	Y-N fault. It was transient fault, Ranchi end A/R successfull but Rourkela end did not operated. PG-Odisha agreed to check.
4	400 KV KOLAGHAT-JEERAT	25.12.14	22:53	<100	R-N fault	NA	Did not operated	No	TRIPPED ON R-N FAULT WITH FAILURE IN A/R. WBSETCL reported that since direct trip had recieved from other end, A/R was not operated.
5	400 KV MUZAFFARPUR-BIHARSARIFF-II	26.12.14	01:04	<100	NA	Y-B, Fd=44.81kM from Biharsariff	NA	No	TRIPPED ON Y-B FAULT. Powergrid informed that it was happend during OPGW work.
6	400 KV JEERAT-SUBHASGRAM	27.12.14	05:50	NA	NA	DT received	NA	No	O/V tripped. Since Jeerat is low voltage area, the tripping needs to be invistigated. Powergrid agreed to check.
7	400 kV BARIPADA-JAMSHEDPUR	28.12.14	14:14	<100	NA	Y-N , Fd=22kM from Jamshedpur	Not found in PMU	No	Y-N Fault. Powergrid informed that it was happend during OPGW work.
8	400 kV BARIPADA-JAMSHEDPUR	28.12.14	16:39	<100	NA	Y-N	Not found in PMU	No	Y-N Fault. Powergrid informed that it was happend during OPGW work.
9	220 KV STPS-CHANDIL	05.12.14	23:54	Not found in pmu	Not Tripped	Tripped	NA	No	Fault was in 33kV system. The master trip relay was burnt at Chandil. The same had been replaced.
10	220KV MUZAFFARPUR-HAJIPUR-I	23.12.14	09:14	Not found in pmu	Tripped	Not Tripped	NA	No	TRIPPED AT MUZ END ONLY DUE TO RELAY MAL- OPERATION. BSPTCL agreed to invistigate.

Status of Disturbance Reporting- Dec,2014

Sl no	Disturbance	Date	Time	Agencies involved	Report in format		DR/EL/Tripping analysis		Remarks
					Y/N	DATE	Y/N	DATE	
1	Due to bursting of Y-Ø LA of 400kV Meramundali-Angul-II at 14:01hrs and bursting of B-Ø LA of 400kV Meramundali-Mendhasal at 19:05hrs at Meramundali, various 400kV lines, 315MVA ICTs and running units of GMR tripped.	05/12/2014	14:01hrs & 19:05hrs.	GRIDCO	Y	09/12/2014	Y	09/12/2014	Only tripping report received from GRIDCO and GMR with some relay indication
				GMR	N	05/12/2014	Y	05/12/2014	
				ER-II	N		N		
2	Due to bursting of B-Ø LA of 400kV Meramundali-Angul-II at Meramundali, various 400kV lines, 315MVA ICTs and running units of GMR tripped.	06/12/2014	17:47hrs.	GRIDCO	Y	08/12/2014	Y	08/12/2014	Only tripping report received from GRIDCO and GMR with some relay indication
				GMR	N	06/12/2014	Y	06/12/2014	
				ER-II	N				
3	Due to bursting of R-Ø LA of line reactor of 400kV Meramundali-IBTPS-I at Meramundali, various 400kV lines tripped.	17/12/2014	16:43hrs.	GRIDCO	Y	18/12/2014	Y	18/12/2014	Only tripping report received from GRIDCO with some relay indication
				GMR	N		N		

Annexure-C4

ERPC recommendations:

S.No.	Recommendations:	Latest status
i	CT Secondary cables of all the 132KV Bays are to be replaced by 2.5 sq mm 4 core Multi-stranded Armoured cables with proper terminations at CT Base Terminal Box, CTJB and Panel end.	Work will be completed by March, 2015
ii	The CTJB of all the 132KV Bays are to be replaced by proper CTJB having approved specifications. The terminal Blocks of the CTJB should be stud type which comes along with the CTJB. The Cables should be brought inside the CTJB with proper GLANDS and dressing. The CTJB should be EARHTED through 4mm Flat Earthing strips duly connected to the earthing mesh in the switchyard . The same is also applicable for 132KV Bus PTJB	Completed
iii	Earth Resistance of all the structures of the 132KV Switchyard (i.e. CT Structure, Breaker Structure, Isolator Structure, Gantry, Bus Support Structures, PT structures, etc.) should be measured and it should be brought down within 1(one) ohms wherever applicable.	completed (earth resistance between 0.8 to 1 ohm)
iv	TAN DELTA Measurements of all the 132KV CT's are to be carried out. The TAN DELTA value should be within **2%** (C.P.R.I recommended limit for 132 kV C.T, whereas some utilities prefers 1% also) and if any value exceeds this, or an increasing pattern is observed on subsequent measurements, and if any value exceeds this, then the particular CT has to be replaced by a healthy CT.	Completed, two CTs in Saharsa bay have been replaced with new CTs.
v	132KV CT Specifications are to be standardised for 132KV Lines and transformers for the whole BSPTCL system in order to reduce human error during Installation and Commissioning. This type of varied CT's having different Core Classifications is not advisable to be used in the Protection System. This will in turn reduce the margin of error during commissioning process as well as reduce the INVENTORY for Spares.	In process
vi	Presently the CT Ratio of all the 132KV CT's are to be checked for its ratio and Polarity. Thereafter, the Protection and the Metering Cores are to be identified which will be used for Distance, Backup and Metering Purpose for all the Three Phases. Accordingly, the Connections in the CTJB and thereafter the terminations to the Panel end are to be completed. For a Guideline, the PS class Cores having a saturation of around 1400Volts may be used for Distance Protection, another PS class core or 5P cores can be used for Back-Up Directional Protection (using one PS core for one Phase and 5P core for the other 2 phases having different magnetising characteristics should always be discouraged for High impedance type protections mainly for transformer/ feeders), and the 0.2 or 1.0 Class core should be used for metering.	Completed
vii	Retrofitting of Protection Relays were carried out in different 132KV Lines. There are no approved drawings available for the retrofitted panels and the Installation of some of the New Relay with the individual panel wiring along with the terminations were not done in a proper fashion. From the quality of dressing and terminations, it clearly signifies that there was absolutely no supervision by any BSPTCL authority when the VENDOR was carrying out the work of installation and commissioning. The dressings of the wires along with the terminations are to be completed for all the panels where New Relays have been installed.	In process
viii	The committee also felt that the drawing and documentation was very poor on the Substation Side as well as the MRT side of BSPTCL. Not a single Control and Protection Drawing for 132KV bays were available at the S/Stn end by which a person can work and rectify faults in different circuits.	In process
ix	The work specified in item 3 and 4 under ANALYSIS part are to be completed immediately. Till completion, the existing setting at 132 kV Purnea (PGCIL) end should continue.	work completed

EASTERN REGIONAL POWER COMMITTEE

Minutes of Special Protection Coordination meeting for "Implementation and Review of Protection Philosophy of ER vis-à-vis adoption of Task Force recommended methodology for relay settings for ER Constituent Systems" held at ERPC, Kolkata on 30.12.2014

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

Member Secretary, ERPC welcomed all the participants to the meeting and explained the purpose of convening this meeting. He informed that Zone settings of distance protection relays for inter state ties/lines has since been implemented as per the agreed Protection Philosophy of Eastern Region, which has been shown in the table below. The list of the interstate ties wherein the setting has been provided were previously uploaded in ERPC website. He requested all constituents to share with the existing settings/data for the both ends of their respective distance protection relays. If there were any changes which could be discussed and finalized for better protection coordination point of view. Further, he requested the protection experts how best the Protection philosophy of ER could be adopted in line with the report of the Task Force recommended methodology for relay setting issued by CEA.

PROTECTION PHILOSOPHY AGREED FOR EASTERN REGION

Table-A

Sl. No.	Zone	Direction	Protected Line Reach Settings	Time Settings
1	Zone-1	Forward	80%	Instanteneous
2	Zone-2	Forward	120%	300 milliseconds
2a	Zone-2 (for 220 kV and below)	Forward	120 % of the protected line or 100% of the protected line + 50% of the adjacent shortest line (which ever is less)	300 milliseconds
3	Zone-3	Forward	100% of the protected line+Za	1.0 Sec.
4	Zone-4	Reverse	20%	1.2 sec.

Where Za= Impedance of 100% of the adjacent longest line or 90% of the Transformer impedance (whichever is less)

2 BSPTCL, JUSNL, DVC, OPTCL, WBSETCL, NTPC and Powergrid (ER-I, ER-II & Odisha projects) updated the zone settings of distance protection of their control area. The updated settings are also uploaded in ERPC website (**www.erpc.gov.in**).

While updating the zone settings of Distance relays in respect of inter-regional/ international ties with neibouring state/ country, the following procedure will be taken up:

a. Between BSPTCL and Nepal ties, the line parameter & zone settings data will be collected from NLDC. (Action: ERLDC)
b. The tie-lines between ER to NR state constituents, the zone setting data will be collected from NRPC/NRLDC. (Action: ERPC, ERLDC)

c. The tie-lines between ER to WR state constituents, the zone setting data will be collected from WRPC/WRLDC. (Action: ERPC, ERLDC)
d. OPTCL & NTPC were requested to provide the zone settings of their tie-lines between OPTCL and TTPS/TSTPS, NTPC. (Action: OPTCL, NTPC)
e. For 132 kV Kahalgaon(NTPC)-Kahalgaon (BSPTCL) line, NTPC requested to adopt Z1 settings of 100% at NTPC end. As this line is very short line (about 5 km) from Generating Station, there is a chance of under reach so it was decided that the Z1 settings for this line at NTPC end may be kept at 100 %. (Action: NTPC)
f. All constituents were advised to submit the detailed zone settings of any new tie-lines which were added later or tie-lines which are not listed. (Action: All ER constituents)

The detailed list of inter state tie/ lines zone setting data including their updated values will be validated in the next PCC meeting.

3 Thereafter, detailed deliberations were held for reviewing of zone settings Protection philosophy of ER with respect to the related recommendations of the "Task Force on Power System Analysis under Contingencies" under Sh. V. Ramakrishna, Retd Member (PS), CEA (enclosed as **Appendix-9.1**).

It was opined that the recommendations of Task force issued by CEA could be adopted with minor modifications for Eastern Region constituents practices as per above agreed Protection philosophy (Table-A) of Eastern Region. The modified protection philosophy as agreed upon is as follows:

Table-B

Sl. No.	Zone	Direction	Protected Line Reach Settings	Time Settings (in Seconds)	Remarks
1	Zone-1	Forward	80%	Instantaneous (0)	As per CEA
2a	Zone-2 (for 400 kV and above)	Forward	For single ckt- 120 % of the protected line	0.35	As per CEA
			For double ckt- 150 % of the protected line	0.5 to 0.6 - if Z2 reach overreaches the 50% of the shortest line ; 0.35- otherwise	As per CEA
2b	Zone-2 (for 220 kV and below)	Forward	120 % of the protected line or 100% of the protected line + 50% of the adjacent shortest line	0.35	As per CEA with minor changes
3	Zone-3	Forward	120 % of the (Protected line + Next longest line)	0.8 - 1.0	As per CEA
4	Zone-4	Reverse	10%- for long lines (for line length of 100 km and above) 20%- for shot lines (for line length of less than 100 km)	0.5- if Z4 reach overreaches the 50 % of reverse shortest line; 0.35- otherwise	As per CEA

- However, regarding Z2 settings of 220 kV lines Powergrid informed that as per the CEA recommendations, they are in a process to adopt the same philosophy for all 765kV, 400 kV and 220 kV lines as agreed for 400 kV lines (given at Sl. No. 2a).

  After deliberation, it was decided that for all 220 kV lines Powergrid at their end will adopt same Z2 philosophy as decided for 400 kV lines.

- In regard to Z3 settings, Powergrid viewed that whenever reach is to enter next voltage level and Z3 time setting must co-ordinate with back-up protection (Directional Over Current and Earth Fault) of Auto-transformes. So, the time settings may be kept 1.5 sec wherever the Z3 reach enters the next voltage levels.

  After detailed deliberation, members in general preferred to implement the Z3 time setting as decided above (i.e. 1.0 second) under Table-B for the time being and it will be reviewed further in the subsequent PCC meeting based on experience, if required.

- NTPC informed that they will forward the modifieded settings (Table-B) to their Engineering wing for their comment and expected to submit their comments before next PCC scheduled on 21.01.2015.

4. Members raised the issue regarding finalizing settings of the Directional Earth Fault (DEF) and Back up O/C. Earlier it was decided that all DEF and Back up O/C would be of IDMT characteristic because the operating time of IDMT relay will depend on the magnitude of fault current. Therefore, Back up O/C relay can not be coordinated with Distance Protection Relay, which are of definite time characteristic. So, they can be coordinated only with other IDMT relay instead of line or back up O/C and E/F relay of auto-transformer. Now, the question was how the back up E/F relay can be coordinated with Z3 of Distance relay.

   It was viewed that some flexibility should be allowed in time setting because back up E/F relay should operate prior to or later than Z3 relay will depend on the nature/ importance of the network in the next line section/ next voltage level. It was decided that further deliberations were required and all constituents were advised to submit their views on the issue in the next PCC meeting.

5. PCC requested all the constituents to forward their feedback/comments regarding the Protection Philosophy as given above to ERPC/ERLDC at the earliest so that it can be finalized in the next PCC meeting. All the constituents agreed.

Meeting ended with vote of thanks to the chair.

****

Annexure-C9

एनटीपीसी NTPC
Transforming lives

NTPC Limited
(Talcher- Kaniha)
(A Govt. of India Enterprise)

January 3, 2015

FROM	:	GM (O&M), NTPC/Kaniha.	FAX NO: **(06760) 243260**
TO	:	GM (POSOCO), ERLDC, KOLKATTA.	FAX NO: **(033)**
COPY TO	:		FAX NO: **(06760) 243131**

Your reference – Letter dated 17.11.2014 & 03.12.2014 regarding low frequency oscillation observed around Talcher.

Sir,

The matter regarding the frequent occurrences of low frequency oscillations around talcher area were analyzed at our end & the following is our observation

(i) The magnitude of voltage fluctuations as seen from the plot is not very significant. Also significant quantum of reactive power change is necessary for such voltage fluctuations. Whatever data, the PMU has captured are more precise, which would not have been visible otherwise.

(ii) Due to the reactive power changing event like short circuit or set point change of HVDC flow or a load disconnection, a corrective control action by a combination of device like AVR & HVDC Reactive power control could have triggered the fluctuation.

(iii) The variation/changes do not appear to be either power swings related to dynamic stability or any mechanical system origin like governing system or malfunction of AVR/PSS. The trigger could be due to the reactive power control of the HVDC system.

No abnormality has been seen by our machine during such occurrences.

Regards,

(J. V. N. Rao)

Annexure-C.10

Check List for Transmission Line

Name/Details:

Sl. No	Protection Scheme	Status **	Remarks
1.	Main I-Distance Protection	Yes/No	
2.	Main II-Distance Protection of directional comparison protection or phase segregated line differential protection	Yes/No	
3.	Directional instantaneous definite minimum time (IDMT) type earth fault relay	Yes/No	
4.	Directional IDMT over current and earth fault back up protection	Yes/No	
5.	Two stage over voltage protection	Yes/No	
6.	Auto Reclosing	Yes/No	
7.	Carrier aided inter-tripping/blocking feature	Yes/No	
8.	Are Power Line Carrier Communication (PLCC) equipment with Protection Coupler complete for speech transmission, line protection and data channels provided?	Yes/No Yes/No Yes/No	
9.	Are 100% back up Communication Channels provided for transmission line & line compensating equipment?	Yes/No	
10.	Disturbance Recorder	Yes/No	
11.	Distance to Fault Locator	Yes/No	
12.	Event Logger: i) Stand Alone ii) Part of S/S or switchyard automation system		
13.	Are Time Synchronizing Equipment (TSE) complete with antenna, all cables, processing equipments etc. provided to receive synchronizing pulse through Global Positioning System (GPS) compatible for synchronization of event logger,	Yes/No	

	disturbance recorder and SCADA/automation system ?		
14.	**Are all protection employed Numerical type?**	**Yes/No**	
15.	**Are two protection channels in addition to one speech plus data channel provided for each direction?**	**Yes/No**	
16.	**Local Breaker Backup Protection (LBB)**	**Yes/No**	
17.	**CVT fuse fail detection function**	**Yes/No**	
18.	**(a) What are the zones blocked on Power swing block function:** **(b) Unblock time setting (typical 02sec)** **(c) Out of step trip enabled**	**Z1/Z2/Z3/Z4** **Yes/No**	
19.	**Any other Protection**		

**** Check the availability & functional healthiness.**

Note:

a) **Sl No.2 is optional at voltage level 220KV & not required at voltage level 132KV;**

b) **Sl No.3 is required at 220 KV if both Main-I & Main-II are distance protections, otherwise not required. At 132 KV level it is not required;**

c) **Sl No.4 is required at 220 KV level if Main-II is not provided, otherwise not.**

d) **Sl No.14 is required at 220KV and above;**

Annexure-C.10

Check List for Transformer

Name/Details:

Sl. No	Protection Scheme	Status **	Remarks
1.	Differential Protection	Yes/No	
2.	Over Fluxing	Yes/No	
3.	Restricted Earth Fault	Yes/No	
4.	Backup directional over current and earth fault protection (HV & LV side) or impedance protection	Yes/No	
5.	Buchholz	Yes/No	
6.	Winding Temperature Indicator (WTI)	Yes/No	
7.	Oil Temperature Indicator (OTI)	Yes/No	
8.	Magnetic Oil Gauge (MOG) with low oil level alarm	Yes/No	
9.	Oil Surge Relay (OSR) for On Load Tap Changer (OLTC)	Yes/No	
10.	Pressure Relieve Device (PRD)	Yes/No	
11.	Surge Arrester (SA) on both primary and secondary sides of transformers located outdoors and connected to over head lines	Yes/No	
12.	Tertiary winding protection	Yes/No	
13.	Over load alarm	Yes/No	
14.	Cooling		
15.	Disturbance Recorder	Yes/No	
16.	Any other protection		

**** Check the availability & functional healthiness.**

Note:

a) **Sl No.6 is required at voltage level 220KV for 100MVA & above rating ;**

b) **OTI is required for 1 MVA and above;**

Annexure-C.10

Check List for Reactor

Name/Details:

Sl. No	Protection Scheme	Status **	Remarks
1.	Differential	Yes/No	
2.	Restricted Earth Fault (REF)	Yes/No	
3.	Reactor backup protection (impedance type or definite time over current (O/C) and earth fault (E/F) protection)	Yes/No	
4.	Buchholz	Yes/No	
5.	Winding Temperature Indicator (WTI)	Yes/No	
6.	Magnetic Oil Gauge (MOG)	Yes/No	
7.	Oil Temperature Indicator (OTI)	Yes/No	
8.	Surge Arrestor (SA)	Yes/No	
9.	Cooling		
10.	Any other Protection		

**** Check the availability & functional healthiness.**

Annexure-C.10

Check List for Sub-Station/Switchyard

Name/Details:

Sl. No	Protection Scheme	Status **	Remarks
1.	Local Breaker Backup (LBB)	Yes/No	
2.	Event Logger (EL)	Yes/No	
3.	Synchronizing Facility	Yes/No	
4.	Are Synchro Check Relay provided with requisite settings?	Yes/No	
5.	DC supply: i) 48V ii) 110V iii) 220V	 Yes/No Yes/No Yes/No	
6.	Availability of Battery Charger i) 48V ii) 110V iii) 220V	 Yes/No Yes/No Yes/No	
7.	DG set	Yes/No	
8.	Auxiliary Supply Average trippings per month	Yes/No ____	
9.	Special Protection Scheme (SPS)	Yes/No	
10.	Under Frequency Relay(UFR): i) Stage I ii) Stage II iii) Stage III	 Yes/No Yes/No Yes/No	
11.	Has the Fault level Increased since connected to grid?	Yes/No	
12.	If status at Sl.No 1 isYes, then whether Sectionalisation of the bus/ Series Reactor on the line or bus provided to limit the fault level?	Yes/No	
13.	Has the size and number of ICT in the S/S been planned in a way that the outage of any single unit does not overload the remaining ICTs or the underlying transmission system	Yes/No	
14.	SCADA: i) Voice ii) Data	 Yes/No Yes/No	
15.	Switching Schemes	Yes/No	

16.	**Are Circuit Breakers suitable for single-phase and three-phase auto reclosing?**	**Yes/No**	
17.	**Are Circuit Breakers provided with two trip coils?**	**Yes/No**	
18.	**Are Circuit Breakers provided with Pre Insertion Resistors?**	**Yes/No**	
19.	**Are Earthing Switches provided at appropriate locations to facilitate earthing of outgoing transmission lines to enable maintenance?**	**Yes/No**	
20.	**Are all main protection relays of numerical type?**	**Yes/No**	
21.	**Are protection functions subdivided into two independent groups & capable of providing uninterrupted protection even in the event of one protection groups failing?**	**Yes/No**	
22.	**Are two sets of DC sources (220V or 110V) available?**	**Yes/No**	
23.	**If status to Sl.No 21 is Yes, then whether relays are electrically and physically segregated into two groups to obtain redundancy and to take protection systems out for maintenance while the equipment remains in service?**	**Yes/No**	
24.	**If status to Sl.No 21 is No, then whether relays are electrically and physically segregated into two groups by giving DC supplies through separate fuses?**	**Yes/No**	
25.	**Are two sets of DC sources (48V) available?**	**Yes/No**	
26.	**Bus Bar Protection**	**Yes/No**	
27.	**Bus Bar Protection scheme has provision for future expansion**	**Yes/No**	
28.	**Any other Protection**		

**** Check the availability & functional healthiness.**

Note:

a) Requirements for Sl No.14 are:

Switching Scheme	Voltage level
Main & Transfer Bus or Double bus	**66KV & 132 KV**
Double Main & Transfer Bus or Double bus	**220KV**
Breaker & a half or Double Main and Transfer bus	**400KV**