



भारत सरकार
Government of India
विद्युत मंत्रालय
Ministry of Power
उत्तर क्षेत्रीय विद्युत समिति
Northern Regional Power Committee

सं: उ.क्षे.वि.स./प्रचालन/106/01/2019/14089-14130

दिनांक:11/11/2019

विषय: प्रचालन समन्वय उप-समिति की 165^{वीं} बैठक का कार्यसूची ।
Subject: Agenda of 165th OCC meeting.

प्रचालन समन्वय उप-समिति की 165^{वीं} बैठक दिनांक 15.11.2019 को 10:00 बजे से उ.क्षे.वि.स. सचिवालय, नयी दिल्ली में आयोजित की जाएगी। उक्त बैठक की कार्यसूची उत्तर क्षेत्रीय विद्युत समिति की वेबसाइट <http://www.nrpc.gov.in> पर उपलब्ध है।

165th meeting of the Operation Co-ordination sub-committee will be held on 15.11.2019 (10:00 AM onwards) at NRPC Secretariat, New Delhi. The agenda of this meeting has been uploaded on the NRPC web-site <http://www.nrpc.gov.in>.

It is requested that the updated status of various points under follow-up action points of previous OCC meeting may kindly be furnished prior to the meeting.

Kindly make it convenient to attend the meeting.

(सौमित्र मजूमदार)

अधीक्षण अभियंता (प्रचालन)

सेवा में : प्रचालन समन्वय उप समिति के सभी सदस्य।
To : All Members of OCC

1. Confirmation of Minutes

The minutes of the 164th OCC meeting which was held on 14.10.2019 and 15.10.2019 at NRPC Secretariat, New Delhi were issued vide letter of even number dated 25.10.2019.

No comment on the minutes has been received from any of the members till date.

The sub-committee may kindly confirm the Minutes.

2. Review of Grid operations of October 2019**2.1 Supply Position (Provisional) for October 2019**

Anticipated Power Supply Position v/s Actual Power Supply Position (Provisional) of Northern Region during the month of October 2019 is as given below:

State	Req. / Avl.	(MU)			(MW)		
		Anticipated	Actual	Variation	Anticipated	Actual	Variation
Chandigarh	Avl.	140	114	-18.5%	385	223	-42.1%
	Req.	125	114	-8.8%	280	223	-20.4%
Delhi	Avl.	3230	2469	-23.6%	5970	4605	-22.9%
	Req.	2590	2469	-4.7%	4850	4605	-5.1%
Himachal Pradesh	Avl.	5280	4315	-18.3%	9810	7779	-20.7%
	Req.	4450	4315	-3.0%	7860	7779	-1.0%
Haryana	Avl.	850	794	-6.6%	1970	1542	-21.7%
	Req.	850	800	-5.9%	1500	1542	2.8%
Jammu & Kashmir	Avl.	910	1227	34.9%	1940	2434	25.5%
	Req.	1530	1519	-0.7%	3000	3042	1.4%
Punjab	Avl.	5710	4043	-29.2%	8870	7356	-17.1%
	Req.	5090	4043	-20.6%	9910	7356	-25.8%
Rajasthan	Avl.	8560	6143	-28.2%	14220	10533	-25.9%
	Req.	6160	6143	-0.3%	9600	10533	9.7%
Uttarakhand	Avl.	14400	9379	-34.9%	21800	17347	-20.4%
	Req.	11700	9379	-19.8%	19500	17347	-11.0%
Uttar Pradesh	Avl.	1140	1028	-9.8%	2050	1797	-12.3%
	Req.	1100	1028	-6.6%	1970	1797	-8.8%
NR	Avl.	40220	29512	-26.6%	67015	49616	-26.0%
	Req.	33595	29810	-11.3%	52800	50121	-5.1%

As per above, negative / significant variations ($\geq 5\%$) in Actual Power Supply Position (Provisional) vis-à-vis Anticipated figures is observed for the month of October 2019 in terms of Energy Requirement for all states & UT of Northern Region and in terms of Peak Demand for all states & UT, except Haryana and J&K. **These states / UT are requested to submit reason for such variations so that the same can be deliberated in the meeting.**

All SLDCs are requested to furnish provisional and revised power supply position in prescribed formats on NRPC website portal by 2nd and 15th day of the month respectively for the compliance of Central Electricity Authority (Furnishing of Statistics, Returns and Information) Regulations, 2007.

2.2 Power Supply Position of NCR

NCR Planning Board (NCRPB) is closely monitoring the power supply position of National Capital Region. Monthly power supply position for NCR till the month of October 2019 is placed on NRPC website. (<http://nrpc.gov.in/operation-category/power-supply-position/>).

3. Maintenance Programme of Generating Units and Transmission Lines

3.1. Maintenance Programme for Generating Units

The meeting on proposed maintenance programme for Generating Units for the month of December 2019 is scheduled on 14.11.2019 at NRPC Secretariat, New Delhi.

3.2. Outage Programme for Transmission Elements.

The meeting on proposed outage programme of Transmission lines for the month of December 2019 is scheduled on 14.11.2019 at NRPC Secretariat, New Delhi.

4. Planning of Grid Operation

4.1. Anticipated Power Supply Position in Northern Region for December 2019

The Anticipated Power Supply Position in Northern Region for December 2019 is enclosed at **Annexure-A1**.

SLDCs are requested to update their estimated power supply position for December 2019 and measures proposed to be taken to bridge the gap between demand & availability, as well to dispose of the surplus, if any, in the prescribed format.

5. System Study for Capacitor Requirement in NR for the year 2019-20

5.1 The proposal for conducting system study for capacitor requirement in NR at 11/33 kV level for the year 2019-20 was deliberated and decided in the 37th TCC and 40th NRPC meeting. After protracted follow up with states, the desired data for conducting the study was submitted by Delhi, Haryana, Punjab, Rajasthan, Himachal Pradesh and Uttarakhand by 15.10.2019, which was the last date for submission of data as per the decision taken in 43rd TCC and 46th NRPC meeting. UP has also submitted the data, thereafter.

5.2 In view of the above, a meeting was held on 01.11.2019 with representative from CPRI, NRLDC and NRPC Sectt. so as to finalise the modalities for carrying out the study. Following was decided in the meeting:

- i. The date and time of state's peak for which the data has been submitted by individual states need to be verified from respective SLDCs. Initially, the date and time for Punjab shall be verified and intimated to NRLDC and CPRI.

(**Action:** NRPC; **Timeline:** - 05.11.2019)

- ii. Accordingly, NRLDC to provide the PSSE data file of NR region for these dates to CPRI (Initially, for the date and time for which data is submitted by Punjab)

(**Action:** NRLDC; **Timeline:** - 11.11.2019)

- iii. The methodology and the optimum voltages which would be considered by CPRI for calculating the capacitor requirement after modelling of the network shall be shared to NRPC Secretariat/ NRLDC for comments, if any.

(**Action:** CPRI; **Timeline:** - 15.11.2019)

- iv. In the first instance, pilot study shall be done for Punjab state as a whole, based on which the practical difficulties, if any faced in modelling of network, would be highlighted by CPRI and shall be resolved accordingly.

(**Action:** CPRI; **Timeline:** - 15.12.2019)

- 5.3 All the concerned SLDCs were requested to specify the date and time for which the data has been collected and submitted to CPRI for the study. The response received is as under:

Delhi: - 10.07.2018 (15:26:58 Hrs)

Rajasthan: - 13.01.2018 (08:15 Hrs)

Uttar Pradesh: - 12.08.2019 (20:00 Hrs)

Haryana: - 11.07.2018 (00:45 Hrs)

- 5.4 As Punjab has not intimated the date and time, CPRI has been requested to take up the study for Haryana in the first instance in place of Punjab.

Members may kindly take a note.

6. Phase nomenclature mismatch issue with interconnected stations

- 6.1. In a separate meeting held in NRPC Sectt. on 13.08.2019 to deliberate on the issue of phase nomenclature mismatch of BBMB with interconnected substations, it was brought out that there might be such phase nomenclature mismatch issue in other utilities also.
- 6.2. In view of the above, it was decided that all the concerned STUs/SLDCs shall certify about phase nomenclature mismatch of their system considering PGCIL phase nomenclature as reference. Format in this regard was attached at Annexure-III of the minutes of 162nd OCC meeting.
- 6.3. In the 164th OCC meeting, all utilities were advised to submit the desired information in the prescribed format duly signed by the respective Chief Engineer, SLDC by

31.10.2019.

- 6.4. Except BBMB and Rajasthan, no information has been received from utilities/states till date.

Members may deliberate on the future course of action to be taken.

7. Follow up of issues from previous OCC Meetings – Status update

The updated status of Agenda items is enclosed at **Annexure-A2**.

All utilities are requested to update the status.

8. System Protection Scheme (SPS) in NR

8.1. SPS for ICTs at 765 kV Unnao sub-station

It was informed in the 163rd OCC meeting that the finalized logic for SPS is being implemented.

However, in the 164th OCC meeting it was stated that due to some pending payment of the implementing agency, testing of the revised logic was delayed and was informed to be done by 31.10.2019.

UPSLDC / UPRVUNL to update.

8.2. SPS for Kawai – Kalisindh - Chhabra generation complex:

8.2.1. Based on the deliberations held in 164th OCC meeting, Rajasthan has submitted a letter to NRPC Sectt. for written confirmation of the SPS logic for implementation of the scheme.

8.2.2. The same has been forwarded to NRLDC for reverification of the logic. After obtaining the response from NRLDC, the in-principle confirmation will be sent to Rajasthan.

8.2.3. Further, as per the decision of 164th OCC meeting, BHEL representative has been invited in the 165th OCC meeting to resolve the pending issue related to preparation of generic PSS/E models.

Members may deliberate.

9. Automatic Demand Management System

- 9.1. Clause 5.4.2 (d) of IEGC mandates for implementation of the state-of-the-art demand management schemes for automatic demand management to reduce over-drawal from the grid. The responsibility for the implementation of the same has been entrusted on SLDCs/SEB/DISCOMs. CERC in its order in petition No. 5/SM/2014 had granted time till 31.06.2016 to the concerned SLDCs/SEB/DISCOMs to implement ADMS, failing which action under Section 142 of the Act for non-compliance of the Regulation 5.4.2 (d) of the Grid Code and order of the Commission.

State/ Utility	Status
Punjab	Not fully implemented. At SLDC level, 96 feeders of 66 kV are operational. At 11 kV feeder level, ADMS is to be implemented by Distribution Company. As per the information available with SLDC, for 50 feeders of 11 kV at Amritsar and Ludhiana, scheme was under finalization.
Delhi	Fully implemented by TPDDL, BRPL and BYPL. NDMC will be implementing by December 2019.
Rajasthan	Under implementation. LoA placed on 12.12.2018 with an execution period of 18 months for ADMS at the level of 33 kV feeders at EHV Substation of RVPN under SCADA / EMS part of project. ADMS functionality at 11 kV feeders from 33/11 kV substation is under the jurisdiction of the DISCOMs and matter is being perused with DISCOMs authorities
UP	Not fully implemented. Remote operation of 50 feeders at 132 kV level being operated from SLDC. For the down below network, issue taken up with the DISCOMs.
Haryana	Not implemented.

- 9.2. Citing the very slow progress during the past year and lack of clarity among the various state representatives about ADMS, MS, NRPC in the 164th OCC meeting has advised all the states to intimate progress made in this regard by 15.11.2019.
- 9.3. Also, based on the decision of OCC, DO letters have been sent to DISCOM heads for ensuring participation in the OCC and other sub-committees of NRPC.

Members may deliberate on the future course of action.

10. Cyber Security Preparedness Monitoring

- 10.1 In the 156th OCC meeting, it was mentioned that inherent vulnerability in the ICT infrastructure or website or web applications shall be accessed and remedial action thereon shall be taken by all utilities by conducting Vulnerability Assessment & Penetration Test (VAPT) of their respective ICT infrastructure, websites and web applications.
- 10.2 As informed in the 164th OCC meeting, a training on Cyber Security is being organised by NRLDC at NRPC Secretariat on 11.11.2019.
- 10.3 Recently, a cyber-attack has been reported to have occurred in the ICT infrastructure of Kudankulam Nuclear Plant. Considering the seriousness of issue, **NPCIL representative is requested to brief about the incident and the measures taken**

thereafter to avoid such instances in future.

- 10.4 In view of the seriousness of the issue, all utilities are advised to ensure preparedness in terms of any unforeseen cyber-attack and conduct VAPT of their respective ICT infrastructure, websites and web applications at regular intervals.

Members may deliberate.

11. Mapping of UFR, df/dt relay details in SCADA

- 11.1 As per CERC regulation, UFR and df/dt mapping is mandatory. In the 136th OCC meeting dt. 16.06.2017, it was decided that in addition to the SCADA mapping, states should provide the following information regarding the UFR, df/dt relays installed at their respective substations:

- Source of frequency measurement for UFR, df/dt relay viz. positive sequence, phase-to-neutral, phase-to-phase
- Computational time for measurement of frequency, rate of change of frequency in UFR, df/dt relays respectively.

- 11.2 Following action points in this regard were decided in the 160th OCC meeting:

- All the feeders coming under UFR and df/dt scheme shall be mapped in the display despite of data availability, RTU availability. In case data is not available, alternate feeder details to be mapped. All the details (main feeder details and alternate feeder details) to be mapped before 30th June 2019. (**Action by:** All the state utilities of NR)
- All the state utilities shall check and monitor the UFR, df/dt display on monthly basis and submit the monthly progress report to NRPC / NRLDC. (**Action by:** All the state utilities of NR)
- All the suspected data in the mapping shall be monitored on daily basis and accordingly remedial measures shall be taken. (**Action by:** All the state utilities of NR)

- 11.3 It was decided in the 164th OCC meeting that SLDC shall regularly check UFR, df/dt mapping display and share the changes on monthly basis to RLDC before 5th of every month for further updation at NRLDC SCADA. SLDC shall also calculate the average % data availability on monthly basis and report the same to NRPC/ NRLDC. NRLDC representative informed about improvement in mapping of UFR, df/dt in SCADA after issuance of NRPC letter to respective state power secretary.

- 11.4 In view of the agenda point no. A.16.5 of 164th OCC meeting, NRLDC has conducted video conferencing (VC) meeting with SLDC- UP, Haryana, Punjab and Rajasthan. Minutes of Meeting is attached as **Annexure-A.3**. Respective SLDC shall further check the details and report the current status during 165th OCC meeting.

- Following are the general recommendations for all the state SLDCs. SLDCs shall take action accordingly.
 - Each state SLDC shall check the UFR, df/dt display in view of desired load relief, % actual load relief (monthly average), % data telemetry (monthly)

and changes in the SCADA mapping points or any other status changes in UFR and df/dt mapping & share with NRLDC by 5th of every month.

- Each state SLDC shall calculate the quarterly average of actual load of each feeder mapped in UFR and df/dt, calculate the yearly average and cross verify the designed load relief figure with yearly average value. (one time exercise in a year). **(Time Frame- 30 days, All SLDC)**
- Complete updated list of feeders identified for UFR and df/dt (stage wise information) based load relief along with nature of load (radial/ non radial) to be provided. **(Time Frame- 30 days, All SLDC)**
- Relay specific details of UFR and df/dt relay shall be shared in desired format attached as *Annexure-1*. **(Time Frame- 30 days, All SLDC)**
- SCADA Analog and Digital data shall come into the SCADA mapping. All the state utilities shall plan the new scheme for RTU implementation and communication system and further expedite the process of ongoing scheme.
- Each state SLDC shall share the name and contact details (Mobile number, Mail ID etc) of two nodal officers for UFR, df/dt relay related communication with NRLDC/ NRPC. **(Time Frame- 7 days, All SLDC)**
- SCADA Mapping shall be done in common format in all the SLDCs. Sample format is tabulated below:

UFR or df/dt stage (Name and setting)	State/ Utility	S. No.	S/S Name and Voltage Level (in kV)	Feeder name along with voltage level (in kV)	Designed load relief (Average)	SCADA data			UFR or df/dt relay status (in service- Green/ out of service- Red/ Relay operated- Blue)	Alternate SCADA data			Remarks
						Digital data status of CB (ON/OFF)	Station end (MW)	Remote end (MW)		S/S Name and Voltage level (in kV)	Feeder name along with voltage level (in kV) or Transformer Name with both voltage level	MW Flow	

- RLDC suggested all the SLDCs to expedite the scheme to cover all the UFR, df/dt and SPS location for visibility to the operators. As per Hon'ble CERC order dated 23rd Dec'13 in petition no 221/MP/2012 has ordered as follows:
 - “(c) UFRs and df/dt relays also be mapped on the SCADA system of each state so that they can be monitored from SLDC/NRLDC.
 - (d) All STUs and SLDCs to map/network the UFR and df/dt on their SCADA system.”

11.5 NRLDC requested NRPC to follow up of this agenda point also in TeST committee meeting to monitor the progress of implementation of the various scheme for availability of SCADA analog and digital data of all the main feeders. Target shall be finalized and monitored for data telemetry of the main feeders come under defense mechanism.

NRLDC and SLDCs to brief about the outcome of meetings.

12. Non-operation of LVRT/ Protection related problem observed during an event on 16.09.2019 at 400/220kV Bhadla (PG)

The issue was deliberated in the 164th OCC meeting wherein it was decided to hold a separate meeting with Rajasthan SLDC, NRLDC, all solar generators connected at Bhadla and NRPC Sectt.

Accordingly, a meeting is scheduled on 13.11.2019 to deliberate LVRT compliance and other related issues with the solar generators. Outcome of the meeting shall be briefed during the meeting itself.

Members may take a note.

13. Complete outage of Multi Terminal HVDC BNC-APD-Agra on 16th Sep 2019:

As per the deliberations held in 164th OCC meeting, POWERGRID has submitted trip report of the abovementioned incident vide e-mail dated 31.10.2019 (**Annexure-A.4**). However, the report in itself does not portray clearly the reason for the fault and the remedial actions taken. Thus, the following clarifications were sought from POWERGRID vide e-mail dated 04.11.2019 to which response is still awaited:

- i. The reason for DC Line fault between the APD-BNC section has not been identified in the report.
- ii. In the event description, it has been mentioned that initially, the time for restart attempt were 250 msec - 1st attempt, 300 msec - 2nd attempt and 250 msec - 3rd attempt. However, under the corrective action, the same has been mentioned as 200 msec, 250 msec and 200 msec respectively which were thereafter revised as 300 msec, 400 msec and 300 msec.
- iii. Further, telecommunication link failure between the three stations has been highlighted as the reason because of which successive restart of Agra-APD could not take place by isolating APD-BNC section. However, no reasons for its failure and any corrective action has been cited.

POWERGRID may clarify the points as brought out above in view of the submitted report.

14. Certification of personnel involved in planning at CTU and STU

CERC (Planning, Coordination and Development of Economic and Efficient Inter-State Transmission System by Central Transmission Utility and other related matters) Regulations, 2018 under Clause 11 states as follows:

“CTU and STU shall ensure proper and adequate manpower for conducting transmission planning exercise. CTU, in consultation with STUs shall prepare a scheme for certification of personnel involved in planning at CTU and STU and submit to the Commission for approval.”

In view of the above NLDC had prepared draft proposal for certification of Power System Planners has been prepared and the same is uploaded on CTU website for suggestions/observations of STUs. STUs are requested to give their suggestions/observations within 45 days.

The draft proposal is available on <https://bit.ly/34ETioV>.

All STUs are requested to go through the draft proposal and submit their comments, if any by 20.11.2019 to NLDC/ CTU.

15. Replacement of 450 MVA ICT-2 at BBMB, Panipat (agenda by PGCIL)

400/220 kV, 3x150 MVA ICT-2 (Make: TELK) at BBMB, Panipat is owned by POWERGRID and was commissioned in May 1985. The said ICT has already served for more than 34 years.

On 30.06.2018, the ICT tripped on Diff./ PRV/ Buchholz protections operation. On investigation it was found that there was fault in B-phase unit and its LV winding had failed. The said ICT-2 at BBMB Panipat was taken into service by taking in the spare unit available at BBMB, Panipat.

The OEM was asked for repair at site but it was denied as repair was not possible there. Moreover, after such a long service life, it could develop fault again. Hence, replacement with new unit is under process.

Meanwhile, Residual Life Assessment (RLA) was also carried out through CPRI on R & Y-ph units to ascertain the balance life of the transformer. The CPRI has recommended for replacement of both R & Y-ph units citing the condition to be critical. Keeping in view the service life of transformer and failure of B-ph unit it is prudent to go for replacement of units with new one.

In view of the above, POWERGRID is planning to replace all three phase units of 3 x 150 MVA ICT-2 at BBMB Panipat with new units through Addition Capitalization. Copies of recommendation of RLA are enclosed at **Annexure-A.5**.

Members may kindly review and recommend for replacement of 450 MVA ICT-2 at BBMB, Panipat.

16. Significant Mismatch in SCADA and SEM Drawl Data (Agenda by UHBVN)

The drawl data recorded by the SCADA/Panipat and that provided through SEMs at State Boundary Points for 19.10.2019 (as per NRPC website) and 27.10.2019 (as per NRPC site) indicates mismatch of even upto 463 MW, thereby causing huge financial losses to the Haryana Discoms. A comparison of the two sets of data is enclosed at **Annexure-A.6**.

The variation in two sets of data (for 27.10.2019) has shifted to both sides, that is during one duration, the data displayed on SCADA site is seen to be less than the SEM data and within a short span of time this trend has reversed and SCADA data shown on real-time basis has become on the higher side as compared to the SEM data.

Furthermore, the mismatch has occurred during the evening peak period, (on the occasion of Diwali as well).

This has been a regular feature and not the first instance where such gross mismatch has been observed. SCADA/Panipat have conveyed that it is for Power Grid

authorities to attend to the fault in RTUs whether due to data freeze or due to suspected RTUs. It may be checked from records that suspected RTUs are not attended for long hours and even days, during which the Discoms continue to control their demand on the basis of data available to them on real time basis. This mismatch in data translates to huge DSM charges and charges on account of same sign violations. It is seldom seen that the data mismatch for all 7 days in a week is insignificant and data for at least one or more days contains huge mismatch. The drawl data comparison discussed in the agenda on regular basis only shows the error in net drawl LUs whereas the error resides in each slot and DSM & same sign charges are based on the slotwise data and not on the net UI.

The OCC forum is requested that some standards of performance be put in place for setting right the RTU data within a specified time frame (irrespective of weekends or gazetted holidays) and it may be made comparable to readings/values recorded by the SEMs, and responsibility for delay be fixed accordingly and Discoms are not made to suffer on this account.

SCADA/Panipat has clearly indicated that the mismatch is mainly due to frozen or suspected RTUs of Power Grid (majority) which are not under their jurisdiction and they can only escalate the problem to Power Grid authorities.

The disclaimer on all SCADA sites say that this data is to be considered for only monitoring purpose & has no commercial impact whatsoever. However, the SEM data on real-time is not available and all controlling is to be carried out based on the basis of SCADA data which deviates a lot from the actual that is SEM data.

OCC may look into the matter and find a lasting solution to this issue which keeps cropping up every passing week and with more stringent regulations for same sign violation charges shortly coming into force, (from next financial year).

One of the things which can be done is that alternate communication channels (as redundancy) be provided to ensure availability of RTU data at all times. Also the other end RTU values availability should be got ensured (which is not there at present) which can be referred to in case RTU value at one end gets frozen or suspected, for which instructions be passed to the concerned authorities.

Part-B NRLDC

1. 2019-20 Solar eclipses Preparation:

In 162nd OCC meeting, it was discussed that India is expected to witness two annular solar eclipses on 26th Dec 2019 and 21st Jun 2020. Since share of solar generation has been on increasing trend and has significant portion in our portfolio, it is necessary that we prepare ourselves for impact of solar eclipse on this solar PV generation.

NRLDC representative had presented the possible impacts of solar eclipse on generation profile and OCC based on discussion recommended the following during meeting:

- State utilities specially Rajasthan shall estimate the total solar power reduction due to Solar eclipse.
- Keep adequate Reserve to mitigate the impact of solar generation reduction
- Day ahead forecast of PV is very important for 26th December 2019 and 21st Jun 2020 for all the state control area.
- Keeping all state hydro units on bar and maintaining generation at minimum possible levels before start of the eclipse and increasing the generation once Solar eclipse starts.
- Ramp up and Ramp down during solar eclipse start and end time needs to be closely monitored.
- Coordination requirement between RLDCs, SLDCs, Generating plants and NLDC.
- Data needs to be shared after actual impact.

All NR states (specially Rajasthan) are requested to share their action plan for effectively managing solar eclipse expected on 26th Dec 2019.

2. Demand and Generation projections of Q4 2019-20 for POC charges calculation

In line with CERC sharing of ISTS charges and losses regulation 2010 and subsequent amendments thereof, all the DICs have to submit the data for new transmission assets, Yearly transmission charges (YTC), forecast injection and withdrawal and node wise injection/withdrawal data to implementing agency for computation of PoC charges and losses for the application period. The format for data submission is available on NLDC website at <https://posoco.in/transmission-pricing/formats-for-data-submission/>.

NLDC vide its letter dated 09.10.2019 had requested utilities to furnish Technical and commercial data for Jan'20-Mar'20 Q4 (2019-2020). Further, generation and load projection has been done by NLDC/RLDCs based on monthly maximum injection/demand met in the last 3 years from actual metered data and accordingly projections have been made as attached in **Annexure-B.1**. Utilities are requested to kindly check the data and correct anomalies, if any with valid justification.

Members may please like to discuss.

3. Tap optimization exercise in Northern region

NRLDC had requested utilities to provide present tap positions of ICTs for taking it into account while performing tap-change studies before winter season. Present tap positions were provided by NR-1, NR-2, NR-3, and RRVPNL which were taken into consideration. Moreover, for identifying nodes for tap change, the scatter plots of nodes for the month of October 2019 were also taken into account. NRLDC has performed tap change studies and study report is attached as **Annexure-B.2**.

Members are requested to discuss/ approve the tap change exercise at these nodes so that it could be completed within next few weeks.

4. Reactive power performance of generators

Reactive power response of generating stations is being regularly discussed in OCC meetings. Reactive power response in respect of MVAR vs Voltage for **past 15 days (24.10.19 - 08.11.19)** as per NRLDC SCADA data is enclosed in **Annexure-B.3**. Based on available data, it is observed that there are margins available as per capability curves for most of the generating stations. In addition, telemetry (sign and magnitude of MVAR) of various generating station is yet to be corrected. The matter has been discussed in numbers of OCC/TCC meetings. Based on available data, MVAR performance of generators is shown below:

Rihand:	Absorbing up to 350 MVAR
Singrauli:	Absorption up to 250 MVAR
Dadri Stage1:	Generating and absorbing in range of 80 to -80 MVAR (data needs correction)
Dadri Stage2:	Generating and absorbing in the range of 50 to -50 MVAR (MVAR response needs improvement)
IGSTPP Jhajjar:	Generating and absorbing in the range of 150 to -250 MVAR
Unchahar:	Absorption and generation -50 to 100 MVAR (MVAR response needs improvement)
Anpara-C:	Generating up to 150 MVAR most of the time (MVAR response needs improvement)
Bara TPS:	Generating MVAR most of the time (data needs correction)
Anpara-D:	Absorption and generation -100 to 100 MVAR (MVAR response needs improvement)
Anpara TPS:	Absorption and generation -50 to 100 MVAR (MVAR response needs improvement)
Khedar:	Absorption and generation -250 to 50 MVAR
Kawai:	Absorption and generation -200 to 50 MVAR
Kalisindh:	Absorption and generation -200 to 100 MVAR
Suratgarh:	Absorption and generation -100 to 100 MVAR (Telemetry not reliable)
Chhabra:	Absorption and generation -100 to 100 MVAR
Rajpura:	Generating MVAR most of the time (data needs check)
Talwandi Saboo:	Absorption up to 300 MVAR

It was agreed in previous OCC meetings that states shall also develop MVAR vs voltage plots for generators under their jurisdiction. This would also help to improve telemetry of MVAR data and more reliable MVAR vs voltage plots would be available. It is requested that states and generators shall also develop MW vs MVAR and Voltage vs MVAR plots at their end so that their operation based on capability curve be also assessed.

Members may like to discuss.

5. Frequent forced outages of transmission elements in the month of Oct'19:

The following transmission elements were frequently under forced outages during the month of **Oct'19**:

S. NO.	Element Name	No. of forced outages	Utility/SLDC
1	400kV Muradnagar(UP)-Mathura(UP)	6	UP
2	400kV Anpara(UP)-Mau(UP)	5	UP
3	400kV Suratgarh(RS)-Bikaner(RS) ckt-1	4	Rajasthan
4	400kV Amritsar(PG)-Makhu(PS) ckt-1	3	Punjab/POWERGRID
5	400kV Dadri(NT)-Mandola(PG)	3	NTPC/POWERGRID
6	400kV Hindaun(RS)-Chhabra(RS)	3	Rajasthan
7	400kV Muzaffarnagar(UP)-Aaur(UP)	3	UP

The complete details are attached at **Annexure-B.4**. Frequent outages of such elements affect the reliability and security of the grid. Hence, utilities are requested to look into such frequent outages and share the remedial measures taken/being taken in this respect.

Members may like to discuss.

6. Multiple element tripping events in Northern region in the month of Oct'19:

A total of **22** grid events occurred in the month of July'19 of which **13** are of GD-1 category. The preliminary report of all the events have been issued from NRLDC. A list of all these events along with the status of details received by 05-Nov-19 is attached at **Annexure-B.5**.

Further, despite persistent discussions/follow-up in various OCC/PCC meetings, the compliance of the regulations is still much below the desired level.

Maximum Fault Duration is **1360ms** in the event of multiple element tripping at 400/220 kV Sonipat(PG) on 17-Oct-19 at 13:55hrs.

Delayed clearance of fault (more than 100ms for 400kV and 160ms for 220kV system) observed in total **5** events out of 22 grid events occurred in the month.

Members may take expeditious actions to avoid such tripping in future and discuss the same. Moreover, utilities may impress upon all concerned for providing the Preliminary Report, DR/EL & Detailed Report of the events in line with the regulations.

Members may like to discuss.

7. Details of tripping of Inter-Regional lines from Northern Region for Oct'19:

A total of 11 inter-regional lines tripping occurred in the month of Oct'19. The list is attached at **Annexure-B.6**. Out of 11 number of trippings, 5 tripping incidents are related to HVDC system. The status of receipt of preliminary reports, DR/EL within 24hrs of the event and fault clearing time as per PMU data has also been mentioned in the table. The non-receipt of DR/EL & preliminary report within 24hrs of the event is in violation of various regulations. As per regulations, all the utilities shall furnish the DR/EL, flag details & preliminary report to RLDC/RPC within 24hrs of the event. They shall also furnish the detailed investigation report within 7 days of the event if fault clearance time is higher than mandated by CEA (Grid Standard) Regulations.

Members may please note and advise the concerned for taking corrective action to avoid such trippings as well as timely submission of the information.

8. Mock black start exercises in NR:

As per Indian Electricity Grid Code (IEGC) clause 5.8(b) "Mock trial runs of the procedure for different sub-systems shall be carried out by the Users/ CTU/ STU at least once every six months under intimation to the RLDC".

Mock Black-start exercise of power stations therefore needs to be carried out in-order to ensure healthiness of black start facility. The winter months are off peak hydro period and therefore good time to carry out such exercises.

The following is the status and schedule of mock exercises to be carried out:

Scheduled Date	Revised scheduled Date	Name of stations	Comments/Remarks
09-Oct-19		Anta GPS	To be confirmed by Anta. Internal blackstart reportedly conducted on 18-Oct-19.
22-Oct-19	in Nov'19	*Dhauliganga	Revised schedule due to load provision in UP.
25-Oct-19	First week of Dec'19	*N. Jhakri and Rampur	Revised schedule due to overhauling activity at Jhakri.
31-Oct-19	31-Oct-19	*Bairasiul	Exercise was partial successful. Island created but could not sustain long and unit tripped. Final synchronization of island with the grid could not be successful at Bairasiul due to problem in synchronisation at Budhil.
05-Nov-19		Sewa-2	Revised schedule due to load provision in J&K.
8-Nov-19	in Dec'19	*Karcham and Baspa	Exercise deferred by Karcham due to reported internal problem.

15-Nov-19	13, 14-Nov-19	*Uri-I, II HEP, Lower Jhelum HEP, Pampore GT's, Upper Sindh and Kishanganga	NHPC revised dates due to 15 th being Friday. Confirmation yet to be received from J&K.
19-Nov-19		Parbati-3 and *Sainj	
21-Nov-19		Salal	
26-Nov-19		*Chamera-3	
28-Nov-19		Koteshwar	
04-Dec-19		*Auraiya GPS	
10-Dec-19		Chamera-1 and 2	Due to outages of Unit#1 & Unit#2, the mock black start exercise at Chamera-2 Power Station may be avoided.
12-Dec-19		Malana-2, AD Hydro and Phozal	
19-Dec-19		*Dadri GPS	
27-Dec-19		Tehri	
02-Jan-20		Koldam	

* Mock Black start exercise not carried out during Year 2018-19.

SLDC's were also requested to carryout mock black-start of station in their respective control area & inform the tentative dates to the OCC as well as outcome of these exercises. The proposed Hydro Power Stations to undergo the exercise were as follows:

S. NO.	Utility	Hydro Power Station	Installed Capacity(MW)
1	J&K	Baglihar	3x150
2		Baglihar stage-2	3x150
3		Lower Jhelum	3x35
4		Upper Sindh	2x11+3x35
5		Larji	3x42
6		Bhabha	3x40
7		Malana -I	2x43
8		Baspa	3x100
9	Punjab	Ranjit Sagar	4x150
10	Rajasthan	Mahi-I&II	2x25+2x45
11		Rana Pratap Sagar	4x43
12		Jawahar Sagar	3x33
13		Gandhi Sagar	5x23
14		Dholpur GPS	3x110
15		Ramgarh GPS	1x35.5+2x37.5+1x110
16	UP	Rihand	6x50
17		Obra	3x33
18		Vishnuprayag	4x100
19		Srinagar (Alaknanda)	4x82.5

20	Uttarakhand	Gamma Infra	2x76+1x73
21		Shravanti	6x75
22		Ramganga	3x66
23		Chibro	4x60
24		Khodri	4x30
25		Chilla	4x36
26		Maneri Bhali-I&II	3x30+4x76
27	Delhi	IP Extn GTs	6x30+3x30
28	Haryana	Faridabad GPS	2x137.75+1x156.07

During last winter, SLDCs had been requested to carry out mock drills and share their experiences. However, the report of such exercises was not received.

During 163rd OCC meeting, members agreed to confirm the schedule by the end of September'19. However, details are still awaited from all the utilities. It is once again requested to all the members to kindly confirm the schedule as it would be difficult to change the schedule once finalized.

In 164th OCC meeting the following were informed by states:

- Punjab representative informed that black start facility is not available at Anandpur Sahib.
- UP representative informed that Rihand Hydro black start will be carried out during second week of Nov-2019.
- Delhi representative informed that Pragati and Rithala stations don't have black start capability.

SLDCs are once again requested to share the information and program for this year's mock black start exercises and submit the reports of black start exercises carried out last season in their respective control area. SLDCs may also further identify further generating stations/unit for black start exercise.

It has been observed that though the dates of mock blackstart exercises of *Dhauliganga, N. Jhakri-Rampur, Bairasiul, Sewa-2 and Karcham-Baspa* were fired up in 164th OCC meeting the exercise was materialized for *Bairasiul HEP* only.

Members may please discuss.

9. Multiple tripping in Kashmir valley due to heavy snowfall on 07, 08 November 2019:

All 220kV and below level lines in Kashmir valley tripped during snowfall / inclement weather condition in valley on 07, 08 November 2019. Consequently, it resulted in complete interruption of power supply in valley including generation loss of around 150-200MW at Kishanganga HEP (NHPC) and 80MW state own generation. However, valley remained connected through the rest of the grid at 400kV level. Uri generation was getting evacuated through 400kV network for most of the time except

short interruption on account of evacuation constraint. During the restoration of grid, it was found that except 220kV Kishanganga-Delina D/C, other 220kV circuits at Delina damaged thus rendering 220kV Kishanganga-Delina D/C as only evacuation for Kishanganga HEP. Load at Pampore, Zainakote was revived after restoration of downstream network. To revive the load at downstream of Delina, Kishanganga HEP was requested to Blackstar but Kishangana HEP was unable to blackstart the units. It is pertinent to mention that blackstart of Kishanganga HEP would have resulted in restoration of load at Delina. J&K, POWERGRID and NHPC representative requested to brief the event and current status of power system in and around the valley.

Member may discuss.

Annexure-A1

State / UT		Dec-19 (MU)	Dec-19 (MW)
Chandigarh	Availability	115	300
	Requirement	115	265
	Surplus/Shortfall (%)	0.0%	13.2%
Delhi	Availability	3010	5400
	Requirement	2060	4450
	Surplus/Shortfall (%)	46.1%	21.3%
Haryana	Availability	5330	9640
	Requirement	3980	6870
	Surplus/Shortfall (%)	33.9%	40.3%
Himachal Pradesh	Availability	1060	2120
	Requirement	920	1630
	Surplus/Shortfall (%)	15.2%	30.1%
Jammu & Kashmir	Availability	720	1730
	Requirement	1890	3230
	Surplus/Shortfall (%)	-61.9%	-46.4%
Punjab	Availability	5300	6420
	Requirement	3750	6220
	Surplus/Shortfall (%)	41.3%	3.2%
Rajasthan	Availability	9020	15100
	Requirement	7640	13300
	Surplus/Shortfall (%)	18.1%	13.5%
Uttar Pradesh	Availability	9350	16050
	Requirement	8850	16000
	Surplus/Shortfall (%)	5.6%	0.3%
Uttarakhand	Availability	1130	2090
	Requirement	1170	2150
	Surplus/Shortfall (%)	-3.4%	-2.8%
Total NR	Availability	35035	58850
	Requirement	30375	46500
	Surplus/Shortfall (%)	15.3%	26.6%

Follow up issues from previous OCC meetings

Sl. No.	Agenda point	Details	Status
1.	Monitoring of schemes funded from PSDF (Agenda by NPC)	The latest status of the schemes for which grant has been sanctioned from PSDF for the schemes in NR. Utilities are requested to expedite implementation of the schemes and submit information of physical as well as financial progress in the prescribed format by first week of every month on regular basis to Member Convener, PSDF Project Monitoring Group (AGM, NLDC and POSOCO) with a copy to NPC Division.	The updated status for the month of Sep'19 has been received from Punjab . All other states were requested to update the status of the schemes to be funded from PSDF.
2.	Sub-stations likely to be commissioned in next six months.	All the concerned states were requested to submit the details of the downstream network associated specially with POWERGRID substations along with the action plan of their proposed/approved networks.	The updated details of the substations of POWERGRID and their required downstream network is enclosed in Annexure-A.2.1 of the agenda note. All states are requested to update the status of remaining downstream networks on regular basis.
3.	Progress of installing new capacitors and repair of defective capacitors	Information regarding installation of new capacitors and repair of defective capacitors is to be submitted to NRPC Secretariat.	Information received from Delhi and HP (up to Oct'2019) and Uttarakhand (up to Sep'19) . All other states were requested to furnish updated status up to second quarter.
4.	Healthiness of defence mechanism: Self-certification	Report of mock exercise for healthiness of UFRs carried out by utilities themselves on quarterly basis is to be submitted to NRPC Secretariat and NRLDC. All utilities were advised to certify specifically, in the report that <i>"All the UFRs are checked and found functional"</i> .	The information of period ending Sep'2019 received from UP, Delhi, Haryana, HP and BBMB . Punjab and Rajasthan have submitted information up to June'2019 . Observations on the recent self-certification reports are enclosed at Annexure-A.2.2 . All states are requested to submit details of feeder-wise expected load relief through UFR and df/dt relays in the format enclosed at Annexure-A.2.3 .

Sl. No.	Agenda point	Details	Status
5.	Recommendations of Enquiry Committee on grid disturbances on 30 & 31.7.2012	Based on the recommendations of the Enquiry Committee on grid disturbances on 30 th & 31 st July 2012, utilities of NR were requested to take necessary action and submit compliance/status report to NRPC.	Updated status awaited from NTPC (NR-HQ), HVPNL, Chandigarh and J&K
6.	Status of FGD installation vis-à-vis installation plan at identified TPS	List of FGDs to be installed in NR was finalized in the 36 th TCC (special) meeting dt. 14.09.2017. All SLDCs were regularly requested since 144 th OCC meeting to take up with the concerned generators where FGD was required to be installed. Further, progress of FGD installation work on monthly basis is monitored in OCC meetings.	<p>Updated status for the month of September 2019 has been received from Rajasthan, Haryana and UP. All states/utilities are requested to update status on monthly basis.</p> <p>Compiled status on FGD installation is enclosed at Annexure-A.2.4.</p> <p>CEA has asked to submit phasing plan for following units commissioned after 31.03.2018:</p> <ul style="list-style-type: none"> • Unit#5 of Tanda TPP • Unit#6 of Chhabra TPP Ext. <p>Rajasthan and NTPC NR are requested to submit phasing plan for aforementioned units.</p>

7. Reactive compensation at 220 kV/ 400 kV level

Sl. No.	Owner	Substation	Reactor	Updated Status
1.	POWERGRID	Kurukshetra	500 MVar TCR	Anticipated commissioning: Jan-Mar'2021
2	DTL	Peeragarhi	1x50 MVar at 220 kV	Under Tendering, expected to be commissioned by Mar'2021
		Mundka	1x125 MVar at 400 kV	
			1x25 MVar at 220 kV	
		Harsh Vihar	2x50 MVar at 220 kV	Under Financial Concurrence PR created
		Electric Lane	1x50 MVar at 220 kV	
	Bamnauli	2x25 MVar at 220 kV	Under Tendering	
	Indraprastha	2x25 MVar at 220 kV		
3.	Punjab	Dhuri	1x125 MVar at 400 kV	Tendering process to be restarted.
			1x25 MVar at 220 kV	
		Nakodar	1x25 MVar at 220 kV	Anticipated commissioning: Mid 2021
4.	PTCUL	Kashipur	1x125 MVAR at 400kV	Funding issues
5.	Rajasthan	Akal	1x25 MVar	PSDF funding sanctioned. Under tendering
		Bikaner	1x25 MVar	
		Suratgarh	1x25 MVar	
		Barmer	1x25 MVar	Response awaited from TEGS of PSDF.
		Jodhpur	1x125 MVar	

Annexure-A2.1

Sl. No.	Substation	Downstream network bays	Commissioning status of S/s / Transformer	Planned 220 kV system and Implementation Status
1	400/220kV, 3x315 MVA Samba	2 nos. bays utilized under ISTS. Balance 4 nos. to be utilized	Commissioned (1 st & 2 nd – Mar'13 3 rd – Oct'16) Bays - Mar'13	<ul style="list-style-type: none"> LILO of 220 kV Bishnha – Hiranagar D/c line. Target completion - Nov, 2019 <ul style="list-style-type: none"> 220 kV D/c Samba (PG) – Samba (JKPDD) approved in 1st NRSCT.
2	400/220kV, 2x315 MVA New Wanpoh	6 Nos. of 220 kV bays to be utilized	Commissioned in Jul'14 Bays-Jul'14	<ul style="list-style-type: none"> 220 kV New Wanpoh - Mirbazar D/c line. 220 kV Alusteng - New Wanpoh Line.
3	400/220 kV, 2x315 MVA Parbati Pooling Station (Banala)	2 Nos. of 220 kV bays to be utilized.	Commissioned in Dec'17	220 kV Charor- Banala D/c line (18 km). Charged from Banala end and Telemetry issue at Charor (expected to be resolved by 30th Sep, 2019).
4	400/220kV, 2x500 MVA Kurukshetra (GIS)	8 nos. of 220 kV bays to be utilized	Commissioned in Mar'17.	<ul style="list-style-type: none"> LILO of one circuit of Kaul-Pehowa 220 kV D/c line at Bhadson (Kurukshetra). Commissioned on 07.03.2019 LILO of one circuit of Kaul-Bastara 220 kV D/c line Bhadson(Kurukshetra). Commissioned on 27.06.2019 220kV D/c Bhadson (Kurukshetra) – Salempur with HTLS conductor equivalent to twin moose. P.O. issued on 15.10.18. Contract agreement signed on 30.11.18. Likely date of completion is 30.04.2020.
5	400/220 kV, 2x315 MVA Dehradun	Out of 6 bays, only two bays used. Balance 4 bays to be utilised.	Commissioned in Jan'17	<ul style="list-style-type: none"> 220 kV Dehradun-Jhajra line. Target completion: Nov 2021

Annexure-A2.1

Sl. No.	Substation	Downstream network bays	Commissioning status of S/s / Transformer	Planned 220 kV system and Implementation Status
6	Shahjahanpu, 2x315 MVA 400/220 kV	Partially utilized. Balance 5 Nos. of 220 kV bays to be utilized.	Commissioned in Jun/Sep'14	<ul style="list-style-type: none"> Shahjahanpur-Hardoi Commissioned Shahjahanpur-Azimpur D/C line is planned, expected by Dec, 2020 220 kV D/C Shahjahanpur-Gola line expected by Dec, 2020
7	Hamirpur 400/220 kV 2x 315 MVA Sub-station (Augmentation by 3x105 MVA ICT)	2 nos. bays utilized under ISTS. Balance 6 nos to be utilized	1 st -Dec'13, 2 nd – Mar'14 & 3 rd Mar'19. 4 bays-Dec'13, 2 bays-Mar'14 2 bays-Mar'19	<ul style="list-style-type: none"> 220 kV D/C Hamirpur-Dehan line. <p>Target completion – Dec, 2020</p>
8	Kaithal 400/220 kV 1x 315 MVA Sub-station	July 2017 (Shifting of transformer from Ballabhgarh)	Commissioned	<ul style="list-style-type: none"> 220 kV Kaithal(PG)-Neemwala D/c line. <p>Target completion - 30.04.2020.</p>
9	Sikar 400/220kV, 1x 315 MVA S/s	2 Nos. of 220 kV bays	Commissioned	RVPNL clarified that survey is yet to be carried out, which may finalize the requirement of cable as there is a possibility to carry out work without cable.
10	Bhiwani 400/220kV S/s	6 nos. of 220kV bays	Commissioned	<ul style="list-style-type: none"> 220kV Bhiwani (PG) - Isherwal (HVPNL) D/c line. <p>Target completion – Nov, 2020</p>
11	Jind 400/220kV S/s	6 nos. of 220kV bays	Commissioned	<ul style="list-style-type: none"> LILO of both circuits of 220kV D/c Narwana – Mund line at Jind (PG). <p>Target completion – Nov, 2020</p>

Annexure-A2.1

Sl. No.	Substation	Downstream network bays	Commissioning status of S/s / Transformer	Planned 220 kV system and Implementation Status
12	400/220kV Tughlakabad GIS (10 no of 220kV bays)	4x 500	Commissioned	<ul style="list-style-type: none">• RK Puram – Tughlakabad (UG Cable) 220kv D/c line. Scheme will be revised Target completion – March 2023• Okhla – Tughlakabad 220kv D/c line.• Mehrauli – Tughlakabad 220kv D/c line.• BTPS – Tughlakabad 220kv D/c line.• Commissioned.• Masjid Mor – Tughlakabad 220kv D/c line. Target completion – Dec, 2021.
13	400/220kV Kala Amb GIS (TBCB) (6 nos. of 220kV bays)	7x105	Commissioned (Jul'17)	HPSEBL has planned one no. of 220kV D/c line from Kala Amb 400/220kV S/s to 220/132kV Kala Amb S/s. Details for remaining 4 nos. of line bays may be provided. Target completion – Dec, 2021

1. Uttar Pradesh

- a. Information (self-certification) received till September 2019
- b. Information reported for 18 circles/areas (Azamgarh, Gorakhpur, Basti, Ghazipur, Prayagraj, Lucknow, Sultanpur, Gonda, Shahjahanpur, Jhansi, Aligarh, Agra, Meerut, Muzaffarnagar, Greater Noida, Moradabad, Noida and Ghaziabad)
- c. Following issues have been reported by concerned official:
 - Relay of 9 feeders of 220kV S/s Azamgarh is defective
 - Defective relay of 9 feeders of 132kV Hasari since June 2016
 - Defective relay of 7 feeders of 132kV Lalitpur since March 2015
 - Defective relay of 10 feeders of 132kV Orai since July 2015
 - Defective relay of 3 feeders of 220kV Orai since July 2016
 - Defective relay of 7 feeders of 132kV Deoband
- d. Agra has reported 49.6 Hz as 3 Nos. of UFR setting.
- e. Sultanpur has reported 47.9 Hz as 2 Nos. of UFR setting.
- f. Some feeders reported by Gorakhpur, Basti, Ghazipur, Prayagraj, Aligarh and Moradabad are having both UFR and df/dt relays.
- g. Feeder visibility at SLDC is negligible.

2. Rajasthan

- a. Information (self-certification) received till June 2019
- b. Information reported for 2 circles/areas (Jaipur and Kota).
- c. Reported feeder visibility at SLDC is 15% for Jaipur and NIL for Kota.

3. Delhi

- a. Information (self-certification) received till September 2019
- b. 34 feeders (11/33/66kV) having UFR with 48.4 Hz setting.
- c. 100% feeder visibility at SLDC is reported.

4. Punjab

- a. Screenshots of feeder-wise load relief in respect of UFR (86 Nos.) & df/dt (94 Nos.) relays submitted on 13.09.2019.
- b. Information (self-certification) received till June 2019

- c. Information reported for 5 circles/areas (Bhatinda, Ludhiana, Jalandhar, Amritsar and Patiala).
- d. Some feeders reported by Bhatinda and Ludhiana are having both UFR and df/dt relays.

5. Haryana

- a. Information (self-certification) received till September 2019
- b. Information reported for 3 circles/areas (Dhulkote, Karnal and Rohtak).
- c. Visibility of 36.4% feeders of Dhulkote at SLDC level is reported
- d. Some feeders reported by Karnal and Rohtak are having both UFR and df/dt relays.

6. Himachal Pradesh

- a. Information (self-certification) received till September 2019
- b. Information reported for Hamirpur circle only.
- c. 4 reported feeders are having both UFR and df/dt.
- d. One df/ft relay setting (132kV Amb-I&II of 220kV Nehri S/s) is reported as 0.25 Hz/sec.

7. BBMB

- a. Information (self-certification) received till September 2019
- b. Many reported feeders are having both UFR and df/dt.

Developer	Name of Project	Sector (State / Central / Private)	State	Region	Unit No.	Unit Capacity (MW)	Date of Commissioning	Age in years	Whether FGD installed (Y/N)	Whether FGD space available (Y/N)	Whether FGD planned (Y/N)	Feasibility Study Started (Y/N)	Feasibility Study Completed (Y/N)	Tender Specifications Made (Y/N)	NT issued (Y/N)	Bids Opened (Y/N)	Big Opening Date (DDMM/YYYY)	Bids Awarded (Y/N)	Regulator Petition Cleared (Y/N)	%Progress of FGD Installation	FGD Commissioned (Y/N)	FGD working satisfactorily (Y/N)	FGD Phasing Plan for Implementation (DDMM/YYYY)	Current Status & remarks	Last updated on
Rosa Power Supply Company Ltd.	ROSA TPP	Private	UP	NR	I	300	12-03-2010	9.67	N	Y	Y	Y	Y	Y	Y	Y	29-03-2019	Y	N	0	N	N	NA	Pending in UPERC for in-principle approval of capital cost for installation of FGD.	04-06-2019
Rosa Power Supply Company Ltd.	ROSA TPP	Private	UP	NR	II	300	30-06-2010	9.37	N	Y	Y	Y	Y	Y	Y	Y	29-03-2019	Y	N	0	N	N	NA	Pending in UPERC for in-principle approval of capital cost for installation of FGD.	04-06-2019
Rosa Power Supply Company Ltd.	ROSA TPP	Private	UP	NR	III	300	01-01-2012	7.87	N	Y	Y	Y	Y	Y	Y	Y	29-03-2019	Y	N	0	N	N	NA	Pending in UPERC for in-principle approval of capital cost for installation of FGD.	04-06-2019
Rosa Power Supply Company Ltd.	ROSA TPP	Private	UP	NR	IV	300	01-04-2012	7.62	N	Y	Y	Y	Y	Y	Y	Y	29-03-2019	Y	N	0	N	N	NA	Pending in UPERC for in-principle approval of capital cost for installation of FGD.	04-06-2019
Lalitpur Power Generation Company Ltd.	Lalitpur Super Thermal Power Project	Private	UP	NR	I	660	26-03-2016	3.63	N	Y	Y	Y	Y	N	N	N	NA	N	N	0	N	N	NA	Petition was filed on 16.11.2017 with UPERC for approval for capital cost for installation of FGD and other associated system. UPERC vide their order dt. 18.12.2017 directed LPGCL to approach CEA to decide specific optimum technology, associated cost and major issues to be faced for installation of different system. CEA suggested technology & associated cost in Feb'19. Again petition filed in UPERC on 21.05.2019 for in-principle approval of capital cost.	04-06-2019
Lalitpur Power Generation Company Ltd.	Lalitpur Super Thermal Power Project	Private	UP	NR	II	660	08-01-2016	3.84	N	Y	Y	Y	Y	N	N	N	NA	N	N	0	N	N	NA	Petition was filed on 16.11.2017 with UPERC for approval for capital cost for installation of FGD and other associated system. UPERC vide their order dt. 18.12.2017 directed LPGCL to approach CEA to decide specific optimum technology, associated cost and major issues to be faced for installation of different system. CEA suggested technology & associated cost in Feb'19. Again petition filed in UPERC on 21.05.2019 for in-principle approval of capital cost.	04-06-2019
Lalitpur Power Generation Company Ltd.	Lalitpur Super Thermal Power Project	Private	UP	NR	III	660	01-04-2016	3.61	N	Y	Y	Y	Y	N	N	N	NA	N	N	0	N	N	NA	Petition was filed on 16.11.2017 with UPERC for approval for capital cost for installation of FGD and other associated system. UPERC vide their order dt. 18.12.2017 directed LPGCL to approach CEA to decide specific optimum technology, associated cost and major issues to be faced for installation of different system. CEA suggested technology & associated cost in Feb'19. Again petition filed in UPERC on 21.05.2019 for in-principle approval of capital cost.	04-06-2019
Mea Usha Negan (P) Ltd. (JV of NTPC and UPRVUNL)	Mea Thermal Power	Central	UP	NR	I	660	30-04-2019	0.53	N	Y	Y	Y	Y	Y	Y	Y	20-07-2018	Y	N		N	N	19-06-2021	Channel - Excavation started on 30.05.2019	04-06-2019
Mea Usha Negan (P) Ltd. (JV of NTPC and UPRVUNL)	Mea Thermal Power	Central	UP	NR	II	660	-	-	N	Y	Y	Y	Y	Y	Y	Y	20-07-2018	Y	N		N	N	19-12-2021		04-06-2019
Prayagraj Power Generation Company Ltd.	Prayagraj Thermal	Private	UP	NR	I	660	29-02-2016	3.70	N	Y	Y	Y	Y	N	N	N	-	N	N	0	N	N	-	Feasibility report cleared by CEA. Tariff petition being filed to UPERC. Tender specification is under preparation by M/s TCE.	27-04-2019
Prayagraj Power Generation Company Ltd.	Prayagraj Thermal	Private	UP	NR	II	660	10-09-2016	3.17	N	Y	Y	Y	Y	N	N	N	-	N	N	0	N	N	-	Feasibility report cleared by CEA. Tariff petition being filed to UPERC. Tender specification is under preparation by M/s TCE.	29-04-2019
Prayagraj Power Generation Company Ltd.	Prayagraj Thermal	Private	UP	NR	III	660	26-05-2017	2.46	N	Y	Y	Y	Y	N	N	N	-	N	N	0	N	N	-	Feasibility report cleared by CEA. Tariff petition being filed to UPERC. Tender specification is under preparation by M/s TCE.	29-04-2019
Lanco Anpara Power Ltd.	Anpara C	Private	UP	NR	I	600	10-12-2011	7.93	N	Y	Y	Y	N	N	N	N	NA	N	N	0	N	N	01-08-2022	Affidavit with petition is filed by Lanco Anpara Power Ltd with UPERC seeking in-principle approval for capital cost to be incurred for the installation of FGD and SCR system. UPERC called for hearing in December 2017, in which LANPL requested the commission to consider the additional capital cost for installation of FGD and SCR be considered under change in law as per the provisions of PPA. UPERC has given an order stating that LANPL to approach CEA to decide specific optimum technology, associated cost in installation of FGD & SCR. UPERC granted liberty to file petition by Lanco Anpara Power Ltd after obtaining approval of CEA on technology & cost related aspects of FGD & SCR. After meetings with Member(TE), LANPL was asked by CEA to submit feasibility report with options available in the market & technology selected along with cost. To meet the above, LANPL appointed M/s Black & Veatch as consultant for Air Quality and Control System (AQCS) for preparing the feasibility report. With the present technologies available for reducing the emissions, Wet Lime Stone FGD system for SO2 control is recommended by Black & Veatch. The Feasibility report is under final stage of completion. As soon as the Feasibility Report is final, LANPL will submit the same to CEA for vetting and approval.	04-06-2019
Lanco Anpara Power Ltd.	Anpara C	Private	UP	NR	II	600	18-01-2012	7.82	N	Y	Y	Y	N	N	N	N	NA	N	N	0	N	N	01-08-2022	Affidavit with petition is filed by Lanco Anpara Power Ltd with UPERC seeking in-principle approval for capital cost to be incurred for the installation of FGD and SCR system. UPERC called for hearing in December 2017, in which LANPL requested the commission to consider the additional capital cost for installation of FGD and SCR be considered under change in law as per the provisions of PPA. UPERC has given an order stating that LANPL to approach CEA to decide specific optimum technology, associated cost in installation of FGD & SCR. UPERC granted liberty to file petition by Lanco Anpara Power Ltd after obtaining approval of CEA on technology & cost related aspects of FGD & SCR. After meetings with Member(TE), LANPL was asked by CEA to submit feasibility report with options available in the market & technology selected along with cost. To meet the above, LANPL appointed M/s Black & Veatch as consultant for Air Quality and Control System (AQCS) for preparing the feasibility report. With the present technologies available for reducing the emissions, Wet Lime Stone FGD system for SO2 control is recommended by Black & Veatch. The Feasibility report is under final stage of completion. As soon as the Feasibility Report is final, LANPL will submit the same to CEA for vetting and approval.	04-06-2019
NTPC	Singrauli Sh-1 Units	Central	UP	NR	1,2,3,4,5	200			N	Y	Y	Y	Y	Y	Y	Y		N		0.00%	N	N			05-07-2019
NTPC	Singrauli Sh-2 Units	Central	UP	NR	6,7	500			N	Y	Y	Y	Y	Y	Y	Y		N		0.00%	N	N			05-07-2019
NTPC	Rihand Sh-1 Units	Central	UP	NR	1,2	500			N	Y	Y	Y	Y	Y	Y	Y		N		0.00%	N	N			05-07-2019
NTPC	Rihand Sh-2 Units	Central	UP	NR	3,4	500			N	Y	Y	Y	Y	Y	Y	Y		N		Not started yet	N	N			05-07-2019
NTPC	Rihand Sh-3 Units	Central	UP	NR	5,6	500			N	Y	Y	Y	Y	Y	Y	Y		N		Not started yet	N	N			05-07-2019
NTPC	Unchahar Sh-1 Units	Central	UP	NR	1,2	210			N	Y	Y	Y	Y	Y	Y	Y		N		0.00%	N	N			05-07-2019
NTPC	Unchahar Sh-2 Units	Central	UP	NR	3,4	210			N	Y	Y	Y	Y	Y	Y	Y		N		0.00%	N	N			05-07-2019
NTPC	Unchahar Sh-3 Units	Central	UP	NR	5	210			N	Y	Y	Y	Y	Y	Y	Y		N		0.00%	N	N			05-07-2019
NTPC	Unchahar Sh-4 Units	Central	UP	NR	6	500			N	Y	Y	Y	Y	Y	Y	Y		N		Not started yet	N	N			05-07-2019
NTPC	Tanda Sh-1 Units	Central	UP	NR	1,2,3,4	110			N	N	N	N	N	N	N	N		N		Not Feasible	N	N			05-07-2019
NTPC	Tanda Sh-2 Units	Central	UP	NR	5,6	660			N	Y	Y	Y	Y	Y	Y	Y		N		Not started yet	N	N			05-07-2019
LALITPUR POWER GENERATION COMPANY LTD (LPGCL)	LALITPUR SUPER THERMAL POWER PROJECT (3X660MW)	PRIVATE	UP	NR	I	660	26-03-2016	3.63	N	Y	Y	Y	Y	N	N	N	NA	N	N	0	N	N	NA	Petition was filed on 16.11.2017 with UPERC for approval capital cost for installation of FGD and other associated system. UPERC vide their order dt. 18.12.2017 directed LPGCL to approach CEA to decide specific optimum technology, associated cost and major issues to be faced for installation of different system. CEA suggested technology and associated cost in Feb 2019. Again petition filed in UPERC on 21 May 2019 for in-principle approval of capital cost. Ist hearing is scheduled in this matter on 03-09-2019	30/08/2019
		PRIVATE	UP	NR	II	660	08-01-2016	3.84	N	Y	Y	Y	Y	N	N	N	NA	N	N	0	N	N	NA		
		PRIVATE	UP	NR	III	660	01-04-2016	3.61	N	Y	Y	Y	Y	N	N	N	NA	N	N	0	N	N	NA		
JAYPEE	Prayagraj Thermal Power Plant	Private	UP	NR	1	660	29-02-2016	3.70	N	Y	Y	Y	Y	N	N	N	N	N	N	0	N	N	N		28/08/2019
					2	660	10-09-2016	3.17	N	Y	Y	Y	Y	N	N	N	N	N	N	0	N	N	N		28/08/2019
					3	660	26-05-2017	2.46	N	Y	Y	Y	Y	N	N	N	N	N	N	0	N	N	N		28/08/2019

UFR, df/dt defense scheme in Northern Region
Video Conferencing between NRLDC and Uttar Pradesh-SLDC offices
Discussion Points

Date: 04.11.2019

- **AVAILABILITY OF DATA:**
 - Name of the feeders was not updated in the SCADA mapping. Analog data and digital data were not available for most of the main feeders that's why healthy remote end of higher voltage level or ICT data was mapped as a main feeder. Name and SCADA data of alternate feeders was mapped for next highest voltage level.
 - NRLDC representative suggested to revise the mapping with actual feeder name and respective details.

- **REMOTE END DATA POINTS:** Remote end of the feeder covered under UFR and df/dt was also not mapped in SCADA display. UP SLDC informed that remote end of feeders is at 33kV. RTU is not installed at 33kV station.

- **ANALOG AND DIGITAL DATA:**
 - The following points were discussed among others:
 - Non-availability of analog/digital data of most of the main feeders for all the UFR stages and some of the df/dt main feeders.
 - Analog (MW value) and digital data of alternate feeder yet to be added.
 - Remote end feeder telemetry to be tabulated.
 - Total stage wise sum of planned and actual load relief also to be mapped in both UFR and df/dt stages.
 - UP SLDC informed that to obtain adequate relief during actual incident more no. of feeders are designated to provide relief. RLDC suggested for mapping of these feeders also in SCADA display.
 - UP SLDC informed the following about RTU telemetry:
 - Some of the 220kV sub-stations have already telemetered but wiring was not done for 33 kV feeders.
 - For remaining 220/132kV or 132/33kV stations, scheme is under progress tentatively be completed within 3 years

- RLDC suggested SLDC-UP to segregate the 33kV based locations of UFR and df/dt relays in following three stages:
 1. Where already RTU installed at 132kV or 220 kV stations, wiring of 33kV feeders to RTU to be done. The work targeted to be completed within three months.
 2. Where new RTUs installed at 220kV stations, 33kV and above feeders covered under UFR and df/dt to be wired on priority basis.
 3. Where new scheme to be implemented for remaining location of 220kV & 132kV stations, expedite the scheme and also cover the remaining 33kV and above feeders at least those covered under UFR, df/dt scheme and SPS.
- RLDC suggested SLDC-UP to expedite the scheme to cover all the UFR, df/dt and SPS location for visibility to the operators. As per Hon'ble CERC order dated 23rd Dec'13 in petition no 221/MP/2012 has ordered as follows:
 - *“(c) UFRs and df/dt relays also be mapped on the SCADA system of each state so that they can be monitored from SLDC/NRLDC.*
 - *(d) All STUs and SLDCs to map/network the UFR and df/dt on their SCADA system.”*
- **DEFENSE SCHEME RELATED DETAILS:**
 - Complete updated list of feeders identified for UFR and df/dt (stage wise information) based load relief along with nature of load (radial/ non radial) to be provided.
 - It was suggested to Uttar Pradesh SLDC to calculate quarterly average of actual load of each feeder mapped in UFR and df/dt, further calculate the yearly average and cross verify the designed load relief figure with yearly average value.
- **RELAY SPECIFIC DETAILS:**
 - **A format as attached at Annexure A.1 was shared in the meeting and SLDC was requested to provide the following relay specific details:-**
 - Source of frequency measurement for UFR, df/dt relay are viz. positive sequence, phase-to-neutral, phase-to-phase.
 - Different timings viz. measurement time, operational time, feeder tripping time etc.

- **LESS ACTUAL RELIEF:** Lower actual load relief observed from NRLDC SCADA data. NRLDC told SLDC to review the same. SLDC-UP informed that they would review individual feeder wise details and verify it in 10days.
- **NODAL OFFICER:** It was agreed that two nodal officers would be identified for UFR, df/dt relay related communication with SLDC. The details like contact, e-mail etc of the same would be shared.
- **FREQUENCY OF CHECKING:** Updation and checking of UFR, df/dt relays is continuous process. In first week of every month SLDC shall verify the planned load relief and compare it with desired load relief and take actions accordingly. SLDC shall also check the monthly RTU data availability (in %). SLDC shall submit the monthly feedback report to NRPC/ NRLDC.

Format of UFR, df/dt relay specific information to be furnished by constituents

S.No.	Substation name/ Voltage level (in kV)	Feeder Name (along with voltage level)	Relay Make & Model	Stage/ Setting	Source of Frequency for relay (positive sequence, phase-to- neutral, phase-to- phase; bus, feeder)	Relay Measurement time	Delay	Relay Operational time (Relay Measurement time + Delay)	Feeder tripping time (Relay Operational time + Other*)
1.									
2.									
.									
.									
e.g.	220kV Naraina	33kV Khyber lane-1	.....	UFR: 49.2Hz	220kV Naraina bus-1, positive sequence voltage (say)	100ms (say)	50ms (say)	150ms (say)	180ms (say)

*Time from Start of measurement till the final tripping of feeder including signal transmission, Trip coil pickup, Circuit Breaker opening etc.

Definition of few terms w.r.t above format:

Condition:

- For UFR, the **condition** for operation of relay is frequency being less than the **threshold value** of 49.2, 49.0, 48.8 or 48.6 Hz based on respective stage.
- Similarly for df/dt relay, **condition** is frequency going being than the **threshold value** of 49.9Hz and Rate of fall of frequency (df/dt) going beyond 0.1Hz, 0.2Hz or 0.3Hz as per different stages.

Relay Measurement Time:

- Time taken by relay to calculate the **condition**.
- After elapsing of this time a decision on tripping or non-tripping based on **condition** being met, would be taken. Different algorithms could be there for calculation. The following are few of the examples:
 - Calculating the **condition** based on a number of samples. **Condition** needs to be met for all the samples for a pre-defined samples (Say, 10 samples). In such a scenario,
 - **Calculation time**= Time taken for one sample x No. of pre-defined samples
 - Calculating the **condition** based on large sample time.
 - Other algorithms. For instance in MicoM P92x152 relay the following is the calculation algorithm for df/dt:
 - **df/dtcycles.nb** = 3 (can be set/changed)
 - **df/dtValidat.nb** = 2 (can be set/changed)
 - **df/dtcycles.nb**: Number of instantaneous df/dt measurements viz. df/dt1, df/dt2 and df/dt3. Average of these values are calculated and compared with the **threshold value**. $df/dtAvg = (df/dt1 + df/dt2 + df/dt3) / 3$.
 - **df/dtValidat.nb**: Number of Average values to be calculated and compared with the **threshold value** viz. df/dt Avg1, df/dt Avg2.
 - For relay to operate, both the average values viz. df/dt Avg1 and df/dt Avg2 needs to be more than the **threshold value**.

Delay:

- Any **delay** in operation of relay.
- This **delay** is not affecting the decision of the relay.
- It is only delaying the decision.

Relay Operational time:

- The summation of **Calculation Time + Delay**.

UFR, df/dt defense scheme in Northern Region
Video Conferencing between NRLDC and Haryana-SLDC offices

Discussion Points

Date: 05.11.2019

- **AVAILABILITY OF DATA:** Name of the feeders was properly updated in the SCADA mapping but analog and digital data was not available for some of the main feeders. Name and SCADA data of alternate feeders was also mapped.
- **REMOTE END DATA POINTS:** Haryana SLDC informed that remote end of feeders is at 66kV. Most of the remote end data is not available
- **ANALOG AND DIGITAL DATA:**
 - The following points were discussed among others:
 - Analog & digital data partially available for main feeders. Stage wise summation is not ok for UFR and df/dt mapping.
 - Analog & digital data of many of the main and analog data of alternate feeder was suspected.
 - UFR & df/dt relay field status (enable or disable) has already been mapped in SCADA for some of the locations.
 - Some of the feeders showing reverse direction of MW value.
 - Summation of alternate feeder data also to be done
 - Remote end feeder telemetry to be tabulated.
 - It was observed that some of the feeders were mapped in both UFR & df/dt scheme.
 - SLDC-Haryana representative informed that they would take corrective actions for availability of Analog and digital data in SCADA display of UFR and df/dt. Approved Target date: 30th Nov 2019.
 - NRLDC suggested following to SLDC-Haryana:
 - Summation of main feeders shall be properly checked and corrected.
 - Stage wise summation of alternate feeders shall be done in SCADA.
 - Digital status of all the main feeders was suspected and same needs to be improved.

- All the UFR & df/dt relay field status (enable or disable) shall be mapped in SCADA and data should also be available with SLDC.
- Plan for telemetry of remote end of 66kV stations.
- **DEFENSE SCHEME RELATED DETAILS:**
 - Complete updated list of feeders identified for UFR and df/dt (stage wise information) based load relief along with nature of load (radial/ non radial) to be provided.
 - It was suggested to Haryana SLDC to calculate quarterly average of actual load of each feeder mapped in UFR and df/dt, further calculate the yearly average and cross verify the designed load relief figure with yearly average value.
- **RELAY SPECIFIC DETAILS:**
 - **A format as attached at Annexure A.1 was shared in the meeting and SLDC was requested to provide the following relay specific details:-**
 - Source of frequency measurement for UFR, df/dt relay are viz. positive sequence, phase-to-neutral, phase-to-phase.
 - Different timings viz. measurement time, operational time, feeder tripping time etc.
- **LESS ACTUAL RELIEF:** Lower actual load relief observed from NRLDC SCADA data. NRLDC told SLDC to review the same. SLDC-Haryana informed that they would review individual feeder wise details and verify it in 10days.
- **NODAL OFFICER:** It was agreed that two nodal officers would be identified for UFR, df/dt relay related communication with SLDC. The details like contact, e-mail etc of the same would be shared.
- **FREQUENCY OF CHECKING:** Updation and checking of UFR, df/dt relays is continuous process. In first week of every month SLDC shall verify the planned load relief and compare it with desired load relief and take actions accordingly. SLDC shall also check the monthly RTU data availability (in %). SLDC shall submit the monthly feedback report to NRPC/ NRLDC.

Format of UFR, df/dt relay specific information to be furnished by constituents

S.No.	Substation name/ Voltage level (in kV)	Feeder Name (along with voltage level)	Relay Make & Model	Stage/ Setting	Source of Frequency for relay (positive sequence, phase-to- neutral, phase-to- phase; bus, feeder)	Relay Measurement time	Delay	Relay Operational time (Relay Measurement time + Delay)	Feeder tripping time (Relay Operational time + Other*)
1.									
2.									
.									
.									
e.g.	220kV Naraina	33kV Khyber lane-1	.....	UFR: 49.2Hz	220kV Naraina bus-1, positive sequence voltage (say)	100ms (say)	50ms (say)	150ms (say)	180ms (say)

*Time from Start of measurement till the final tripping of feeder including signal transmission, Trip coil pickup, Circuit Breaker opening etc.

Definition of few terms w.r.t above format:

Condition:

- For UFR, the **condition** for operation of relay is frequency being less than the **threshold value** of 49.2, 49.0, 48.8 or 48.6 Hz based on respective stage.
- Similarly for df/dt relay, **condition** is frequency going being than the **threshold value** of 49.9Hz and Rate of fall of frequency (df/dt) going beyond 0.1Hz, 0.2Hz or 0.3Hz as per different stages.

Relay Measurement Time:

- Time taken by relay to calculate the **condition**.
- After elapsing of this time a decision on tripping or non-tripping based on **condition** being met, would be taken. Different algorithms could be there for calculation. The following are few of the examples:
 - Calculating the **condition** based on a number of samples. **Condition** needs to be met for all the samples for a pre-defined samples (Say, 10 samples). In such a scenario,
 - **Calculation time**= Time taken for one sample x No. of pre-defined samples
 - Calculating the **condition** based on large sample time.
 - Other algorithms. For instance in MicoM P92x152 relay the following is the calculation algorithm for df/dt:
 - **df/dtcycles.nb** = 3 (can be set/changed)
 - **df/dtValidat.nb** = 2 (can be set/changed)
 - **df/dtcycles.nb**: Number of instantaneous df/dt measurements viz. df/dt1, df/dt2 and df/dt3. Average of these values are calculated and compared with the **threshold value**. $df/dtAvg = (df/dt1 + df/dt2 + df/dt3) / 3$.
 - **df/dtValidat.nb**: Number of Average values to be calculated and compared with the **threshold value** viz. df/dt Avg1, df/dt Avg2.
 - For relay to operate, both the average values viz. df/dt Avg1 and df/dt Avg2 needs to be more than the **threshold value**.

Delay:

- Any **delay** in operation of relay.
- This **delay** is not affecting the decision of the relay.
- It is only delaying the decision.

Relay Operational time:

- The summation of **Calculation Time + Delay**.

UFR, df/dt defense scheme in Northern Region
Video Conferencing between NRLDC and Punjab-SLDC offices

Discussion Points

Date: 06.11.2019

- **AVAILABILITY OF DATA:** Name of the feeders was properly updated in the SCADA mapping but analog and digital data was not available for many of the feeders. Name and SCADA data of alternate feeders was not mapped where main feeder data was available.
- **REMOTE END DATA POINTS:** Punjab SLDC informed that remote end of feeders is at 66 kV. RTU is not installed at most of the 66kV station.
- **ANALOG AND DIGITAL DATA:**
 - The following points were discussed during meeting:
 - Analog & digital data is partially available for main feeders.
 - Some of the feeders showing reverse direction of MW value.
 - Analog (MW value) and digital data of alternate feeder for all main feeder yet to be added. Summation of alternate feeder data also to be done.
 - Mapping of UFR & df/dt status in view of relay status at field enable or disable.
 - Total designed load relief of each stage of UFR and df/dt was almost similar to stipulated load relief.
 - Punjab SLDC informed the following about RTU telemetry:
 - RTU would be installed at 100% of the 220 & 132kV station till December-2020.
 - Installations on 220 & 132kV stations having UFR and df/dt relays would be done on priority
 - No telemetry available at 66kV remote end sub-stations.
 - NRLDC suggested following to SLDC-Punjab:
 - Despite of availability of main feeder data, Mapping of all the alternate feeders shall be done in SCADA.
 - UFR & df/dt relay field status (enable or disable) shall be mapped in SCADA and data should also be available with SLDC.

- Designed load relief should have at least 1.4 times of the target load relief to achieve the actual target. Other states are doing the same practice.
 - Plan for telemetry of remote end of 66kV stations.
- **DEFENSE SCHEME RELATED DETAILS:**
 - Complete updated list of feeders identified for UFR and df/dt (stage wise information) based load relief along with nature of load (radial/ non radial) to be provided.
 - It was suggested to Punjab SLDC to calculate quarterly average of actual load of each feeder mapped in UFR and df/dt, further calculate the yearly average and cross verify the designed load relief figure with yearly average value.
 - **RELAY SPECIFIC DETAILS:**
 - **A format as attached at Annexure A.1 was shared in the meeting and SLDC was requested to provide the following relay specific details:-**
 - Source of frequency measurement for UFR, df/dt relay are viz. positive sequence, phase-to-neutral, phase-to-phase.
 - Different timings viz. measurement time, operational time, feeder tripping time etc.
 - Punjab earlier submitted the details attached as Annexure A.2 Further details in desired format needs to be submitted.
 - **LESS ACTUAL RELIEF:** Lower actual load relief observed from NRLDC SCADA data. NRLDC told SLDC to review the same. SLDC-Punjab informed that they would review individual feeder wise details and verify it in 10days.
 - **NODAL OFFICER:** It was agreed that two nodal officers would be identified for UFR, df/dt relay related communication with SLDC. The details like contact, e-mail etc of the same would be shared.
 - **FREQUENCY OF CHECKING:** Updation and checking of UFR, df/dt relays is continuous process. In first week of every month SLDC shall verify the planned load relief and compare it with desired load relief and take actions accordingly. SLDC shall also check the monthly RTU data availability (in %). SLDC shall submit the monthly feedback report to NRPC/ NRLDC.

Format of UFR, df/dt relay specific information to be furnished by constituents

S.No.	Substation name/ Voltage level (in kV)	Feeder Name (along with voltage level)	Relay Make & Model	Stage/ Setting	Source of Frequency for relay (positive sequence, phase-to- neutral, phase-to- phase; bus, feeder)	Relay Measurement time	Delay	Relay Operational time (Relay Measurement time + Delay)	Feeder tripping time (Relay Operational time + Other*)
1.									
2.									
.									
.									
e.g.	220kV Naraina	33kV Khyber lane-1	.....	UFR: 49.2Hz	220kV Naraina bus-1, positive sequence voltage (say)	100ms (say)	50ms (say)	150ms (say)	180ms (say)

*Time from Start of measurement till the final tripping of feeder including signal transmission, Trip coil pickup, Circuit Breaker opening etc.

Definition of few terms w.r.t above format:

Condition:

- For UFR, the **condition** for operation of relay is frequency being less than the **threshold value** of 49.2, 49.0, 48.8 or 48.6 Hz based on respective stage.
- Similarly for df/dt relay, **condition** is frequency going being than the **threshold value** of 49.9Hz and Rate of fall of frequency (df/dt) going beyond 0.1Hz, 0.2Hz or 0.3Hz as per different stages.

Relay Measurement Time:

- Time taken by relay to calculate the **condition**.
- After elapsing of this time a decision on tripping or non-tripping based on **condition** being met, would be taken. Different algorithms could be there for calculation. The following are few of the examples:
 - Calculating the **condition** based on a number of samples. **Condition** needs to be met for all the samples for a pre-defined samples (Say, 10 samples). In such a scenario,
 - **Calculation time**= Time taken for one sample x No. of pre-defined samples
 - Calculating the **condition** based on large sample time.
 - Other algorithms. For instance in MicoM P92x152 relay the following is the calculation algorithm for df/dt:
 - **df/dtcycles.nb** = 3 (can be set/changed)
 - **df/dtValidat.nb** = 2 (can be set/changed)
 - **df/dtcycles.nb**: Number of instantaneous df/dt measurements viz. df/dt1, df/dt2 and df/dt3. Average of these values are calculated and compared with the **threshold value**. $df/dtAvg = (df/dt1 + df/dt2 + df/dt3) / 3$.
 - **df/dtValidat.nb**: Number of Average values to be calculated and compared with the **threshold value** viz. df/dt Avg1, df/dt Avg2.
 - For relay to operate, both the average values viz. df/dt Avg1 and df/dt Avg2 needs to be more than the **threshold value**.

Delay:

- Any **delay** in operation of relay.
- This **delay** is not affecting the decision of the relay.
- It is only delaying the decision.

Relay Operational time:

- The summation of **Calculation Time + Delay**.

Annexure-A.2



Nitin Yadav <yadavnitin06@gmail.com>

Fwd: Mapping of UFR and df/dt - Punjab

Rajiv Porwal <rajivporwal@gmail.com>

Tue, Sep 19, 2017 at 6:01 PM

To: Nitin Yadav <yadavnitin.06@gmail.com>, ANKIT GUPTA <ankitinfo6@gmail.com>, Naresh Ram <naresh.ram256@gmail.com>

Cc: ashok rajan <rajanashok.fbd@gmail.com>, Jayantika Singh <jayantika.law@gmail.com>, Kavita Parihar <kavita.posoco@gmail.com>, Suruchi Jain <surujain03@gmail.com>, riza naqvi <riza.naqvi@gmail.com>, Gaurav Malviya <malviya.gaurav85@gmail.com>

Pl update our data base and also keep for APTEL cases (file).

rgds

Rajiv Porwal

----- Forwarded message -----

From: **Deputy Director PC** <ddpc_pseb@rediffmail.com>

Date: Tue, Sep 19, 2017 at 4:27 PM

Subject: Mapping of UFR and df/dt - Punjab

To: SEONRPC <seo-nrpc@nic.in>, NRLDC SO-II <nrldcso2@gmail.com>, Rajiv Porwal <rajivporwal@gmail.com>, daman jain <dkj2009@yahoo.co.in>

Cc: soniagvij456 <soniag.vij456@gmail.com>

Sir,

Please find the attached information in compliance to 139th OCC Agenda Item no. 35 - Mapping of UFR and DF/DT:

- 1. Source of frequency measurement for DF/DT and UFR relays is phase-to-neutral positive sequence and three phase PT voltage from 220KV PT's.**
- 2. Computational time for measurement of rate of change of frequency in DF/DT relays is 8 to 10 cycles and in case of UFR relays, it is 4 to 5 cycles.**

This is for your information and further necessary action please.

Regards

O/o S.E./SLDC (Op)

PSTCL, PATIALA

UFR, df/dt defense scheme in Northern Region
Video Conferencing between NRLDC and Rajasthan-SLDC offices

Discussion Points

Date: 07.11.2019

- **AVAILABILITY OF DATA:** Name of the feeders and alternate feeders was properly updated in the SCADA mapping but analog data and digital data was not available for most of the main feeders in UFR (Under Frequency Relay) mapping. Digital data status was not available for most of the df/dt (Rate of change of frequency) mapping.

- **REMOTE END DATA POINTS:** Rajasthan SLDC informed that remote end data of feeders at 33kV is not available because RTU is not installed at 33kV stations.

- **ANALOG AND DIGITAL DATA:**
 - The following points were discussed during meeting:
 - Non-availability of analog/digital data of main feeders.
 - Total actual load relief & designed load relief of each stage of df/dt was less than the target load relief.
 - Summation of MW value of alternate feeder was not matching with the value.
 - Mapping of UFR & df/dt status in view of relay status at field enable or disable.
 - It was observed that the designed load relief was higher than the stipulated load relief. Rajasthan SLDC informed that to obtain adequate load relief during actual incident more number of feeders are designated to provide relief and the same are also mapped in SCADA.
 - Rajasthan SLDC informed the following about RTU telemetry:
 - Available in 90% of 220/132kV sub-station.
 - Available for few 132/33kV sub-stations.
 - No telemetry available at 33kV sub-stations.
 - Data telemetry of all 132/33 kV sub-station will be available by February-2020 after completion of OPGW project.
 - New scheme for installation of RTU for all 132kV stations is under progress and would be completed before Feb-2020. After completion of

the project data telemetry would be available for all the UFR & df/dt locations.

- RLDC suggested SLDC-Rajasthan for mapping of UFR & df/dt relay field status (enable or disable) in SCADA and availability of data to SLDC.
- RLDC also suggested SLDC-Rajasthan to segregate the 33kV based locations of UFR and df/dt relays in following two stages:
 1. Where already RTU is installed at 132kV and above sub-stations, wiring of 33kV feeders to RTU should be completed within three months.
 2. Where new scheme for all 132kV stations is to be completed before Feb-2020, scheme should be expedited and it should also cover the remaining 33kV feeders come under UFR, df/dt scheme, UVLS, SPS and other defense mechanism.

○ **DEFENSE SCHEME RELATED DETAILS:**

- Complete updated list of feeders identified for UFR and df/dt (stage wise information) based load relief along with nature of load (radial/ non radial) to be provided.
- It was suggested to Rajasthan SLDC to calculate quarterly average of actual load of each feeder mapped in UFR and df/dt, further calculate the yearly average and cross verify the designed load relief figure with yearly average value.
- Rajasthan representative informed that updation of both the defense scheme (UFR & df/dt relay) is under discussion with Discoms and will be finalized in 2 months. Further changes will be implemented within 4 months.

○ **RELAY SPECIFIC DETAILS:**

- **A format as attached at Annexure A.1 was shared in the meeting and SLDC was requested to provide the following relay specific details:-**
 - Source of frequency measurement for UFR, df/dt relay are viz. positive sequence, phase-to-neutral, phase-to-phase.
 - Different timings viz. measurement time, operational time, feeder tripping time etc.

- **LESS ACTUAL RELIEF:** Lower actual load relief observed from NRLDC SCADA data for rate of change of frequency (df/dt). NRLDC told SLDC to review the same. SLDC-Rajasthan informed that they would review individual feeder wise details and verify it in 10days.
- **NODAL OFFICER:** It was agreed that two nodal officers would be identified for UFR, df/dt relay related communication with SLDC. The details like contact, e-mail etc of the same would be shared.
- **FREQUENCY OF CHECKING:** Updation and checking of UFR, df/dt relays is continuous process. In first week of every month SLDC shall verify the planned load relief and compare it with desired load relief and take actions accordingly. SLDC shall also check the monthly RTU data availability (in %). SLDC shall submit the monthly feedback report to NRPC/ NRLDC.

Format of UFR, df/dt relay specific information to be furnished by constituents

S.No.	Substation name/ Voltage level (in kV)	Feeder Name (along with voltage level)	Relay Make & Model	Stage/ Setting	Source of Frequency for relay (positive sequence, phase-to- neutral, phase-to- phase; bus, feeder)	Relay Measurement time	Delay	Relay Operational time (Relay Measurement time + Delay)	Feeder tripping time (Relay Operational time + Other*)
1.									
2.									
.									
.									
e.g.	220kV Naraina	33kV Khyber lane-1	.....	UFR: 49.2Hz	220kV Naraina bus-1, positive sequence voltage (say)	100ms (say)	50ms (say)	150ms (say)	180ms (say)

*Time from Start of measurement till the final tripping of feeder including signal transmission, Trip coil pickup, Circuit Breaker opening etc.

Definition of few terms w.r.t above format:

Condition:

- For UFR, the **condition** for operation of relay is frequency being less than the **threshold value** of 49.2, 49.0, 48.8 or 48.6 Hz based on respective stage.
- Similarly for df/dt relay, **condition** is frequency going being than the **threshold value** of 49.9Hz and Rate of fall of frequency (df/dt) going beyond 0.1Hz, 0.2Hz or 0.3Hz as per different stages.

Relay Measurement Time:

- Time taken by relay to calculate the **condition**.
- After elapsing of this time a decision on tripping or non-tripping based on **condition** being met, would be taken. Different algorithms could be there for calculation. The following are few of the examples:
 - Calculating the **condition** based on a number of samples. **Condition** needs to be met for all the samples for a pre-defined samples (Say, 10 samples). In such a scenario,
 - **Calculation time**= Time taken for one sample x No. of pre-defined samples
 - Calculating the **condition** based on large sample time.
 - Other algorithms. For instance in MicoM P92x152 relay the following is the calculation algorithm for df/dt:
 - **df/dtcycles.nb** = 3 (can be set/changed)
 - **df/dtValidat.nb** = 2 (can be set/changed)
 - **df/dtcycles.nb**: Number of instantaneous df/dt measurements viz. df/dt1, df/dt2 and df/dt3. Average of these values are calculated and compared with the **threshold value**. $df/dtAvg = (df/dt1 + df/dt2 + df/dt3) / 3$.
 - **df/dtValidat.nb**: Number of Average values to be calculated and compared with the **threshold value** viz. df/dt Avg1, df/dt Avg2.
 - For relay to operate, both the average values viz. df/dt Avg1 and df/dt Avg2 needs to be more than the **threshold value**.

Delay:

- Any **delay** in operation of relay.
- This **delay** is not affecting the decision of the relay.
- It is only delaying the decision.

Relay Operational time:

- The summation of **Calculation Time + Delay**.

TRIP REPORT FOR ± 800 kV HVDC of NEA 800 Link

	Date: 16.09.2019 Fault location: Line Fault between APD & BNC
--	--

Background:

Pole-1,2,3&4at Agra& their complementary pole -1 & 2 at BNC & pole-3 & 4 at APDwere running in normal direction with a total of 1900 MW on NEA link (500 MW from BNC to Agra and 1400MW from APD to Agra).The Pole-1, 2, 3 &4allat BNC, APD and Agra end tripped on DC Line Fault betweenBNC and APD. Power Flow after fault was zero.

	Power Flow Status				Power Flow Direction
	BEFORE	AFTER	BEFORE	AFTER	
	BNC Pole-1: 250MW	BNC Pole-1: 0 MW	Agra Pole-1: 461MW	Agra Pole-1: 0MW	Normal
	BNC Pole-2: 250MW	BNC Pole-2: 0MW	Agra Pole-2: 461MW	Agra Pole-2: 0MW	
	APD Pole-3: 700MW	APD Pole-3: 0 MW	Agra Pole-3: 462 MW	Agra Pole-3: 0MW	
	APD Pole-4: 700MW	APD Pole-4: 0MW	Agra Pole-4: 466MW	Agra Pole-4: 0MW	
TOTAL	1900	0	1850	0	

Event Description:

The Pole-1,2,3 & 4 at Agra were running in normal direction with 500 MW from BNC to Agra and 1400 MW from APD to Agra. At 13:00:56:0280 a Line Fault occurred simultaneously in Line-1 & 2 between BNC & APD section about 1615.4 km from Agra end. This line fault was detected by HVDC Control Systems at Pole-1 & 2 at BNC and Pole-3& 4 at APD. As soon as this line fault was detected control system went into restart mode to clear the fault & to prevent outage of NEA Link. It is to be noted that this type of restart mode is used worldwide to minimize the outages of HVDC link due to line faults. As soon as control system went in to restart mode both rectifiers at APD & BNC initiated order down which caused brief interruption of power flow and reduction of DC line voltage for 250ms so that the fault could be cleared. It is to be noted that if fault does not get cleared in first restart attempt then a 2nd restart attempt at 300ms & a 3rd restart attempt at 250ms with reduced DC line voltage will be attempted. NEA HVDC link being multi -terminal i.e. three station viz. BNC, APD, & AGR require telecommunication link between these three stations to be healthy for successive restart attempts. On 16.09.2019 it was observed that when first restart attempt was being carried out by control systems of APD & BNC telecom between these three stations becomes faulty momentarily at 13:00:56:6100 due to this successive restart of Agra-APD could not take place by isolating APD-BNC section as per control system logics and complete NEA link tripped after first unsuccessful restart.

TRIP REPORT FOR ±800kV HVDC of NEA 800 Link

Protective action:

- Initiated Order down from PCP1.FOS1
- Initiated Order down from PCP2.FOS2
- Line fault indication in Station 1, Pole-1
- Line fault indication in Station 1, Pole-2
- Pole Telecommunication Not OK
- Station 2 Pole-4 Limited
- Protection Indication from PCP4.FOS2
- Station 2 Pole-3 Limited
- Protection Indication from PCP3.FOS2
- Separate Mode entered
- Protection Indication from PCP1.FOS1
- Station 1 Pole 1 Tripped
- Protection Indication from PCP1.FOS2
- Station 1 Pole 2 Tripped

Corrective Action Taken so far

NEA- HVDC link being highly critical link between NER, ER & NR so its outage is being taken very seriously by Powergrid and every step is taken to mitigate its further outages; hence this incident was discussed with ABB on urgent basis during the meeting held at POWERGRID CC-Engg on 24.12.2019 for a probable technically feasible solution to reduce such outages in futures. After rigorous brainstorming with ABB it was decided that every possibility must be explored to clear the line fault between BNC & APD section in the very first restart attempt. In line with the above it was proposed to give more time to clear fault between APD & BNC section. Likewise following new setting for restarts attempts are deployed in control system.

Revised	Previously
1 st Restart – 300ms	200ms
2 nd restart – 400ms	250ms
3 rd restart -300ms	200ms

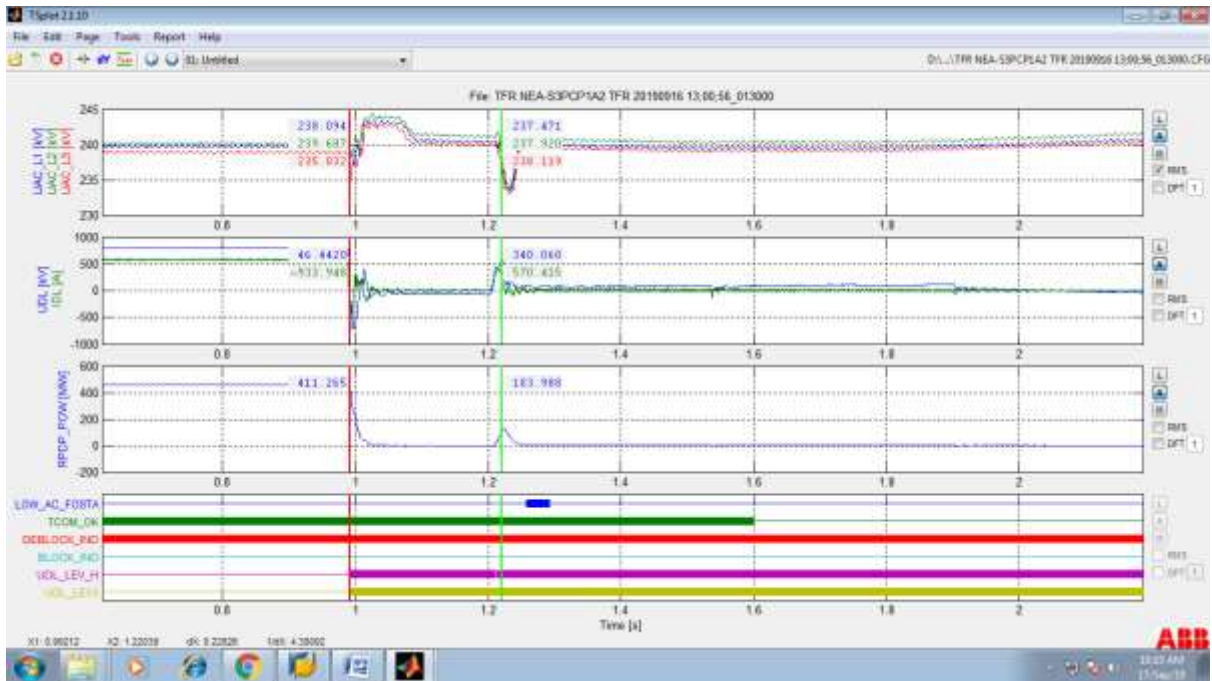
Increasing de-ionization time for restart attempts will increase the possibility of clearing of fault and hence will have greater chance of sustaining NEA HVDC Link.

Attachments:

Event List and TFR has been attached below.

TFR Details Station 3 -Pole Control Computer, PCP1A2 at 13:00:56

TRIP REPORT FOR ±800kV HVDC of NEA 800 Link

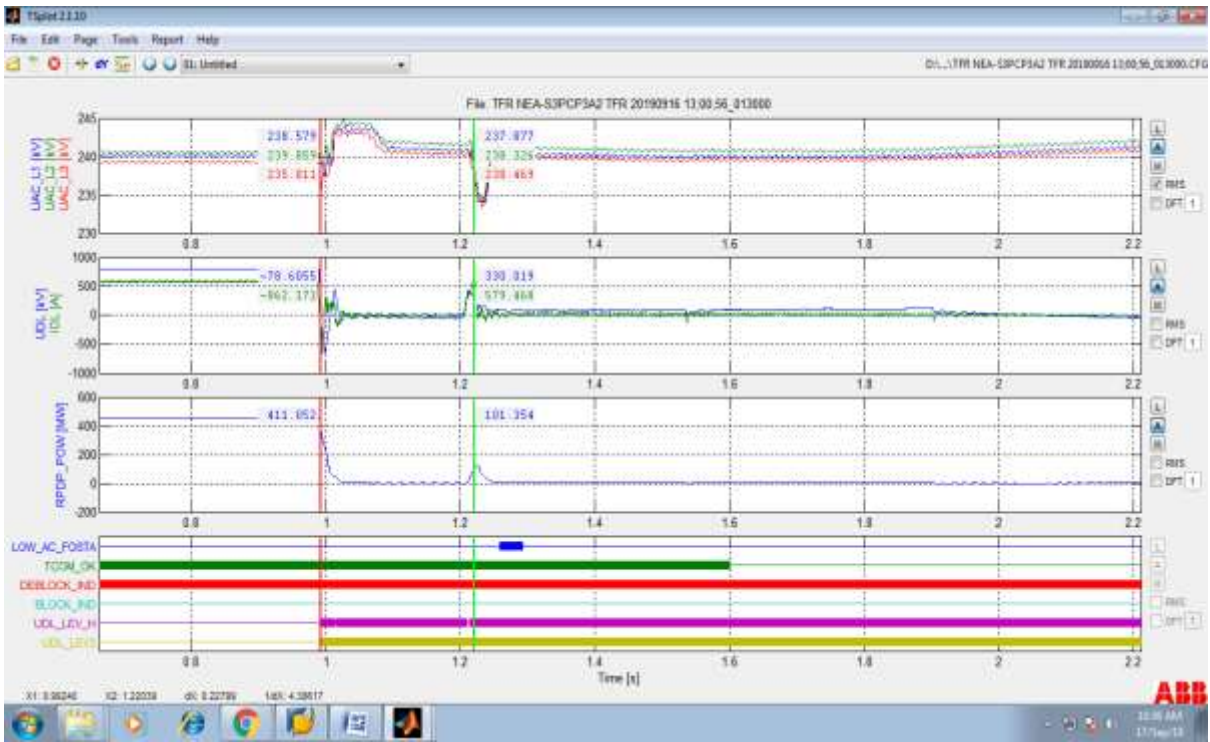


Station 3 - Pole Control Computer, PCP2A2

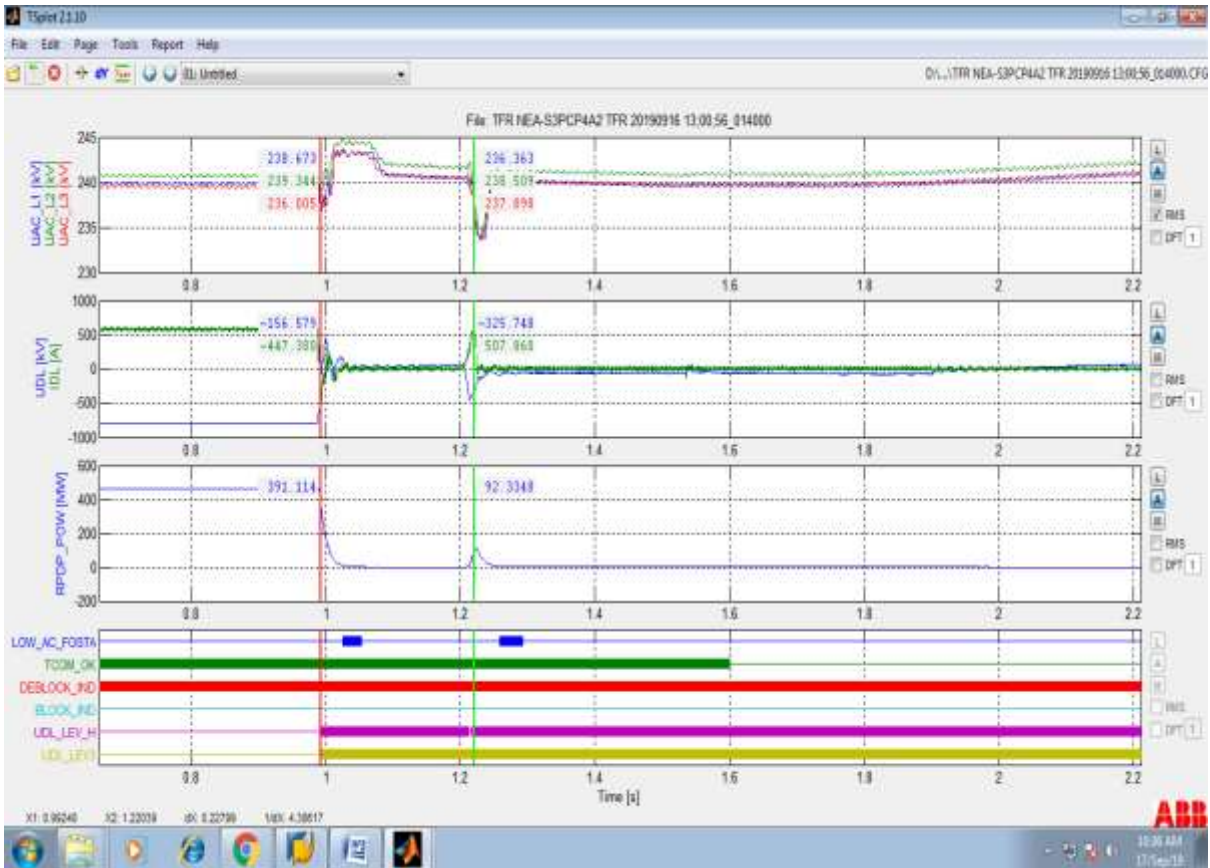


Station 3 , Pole Control Computer, PCP3A2

TRIP REPORT FOR ±800kV HVDC of NEA 800 Link

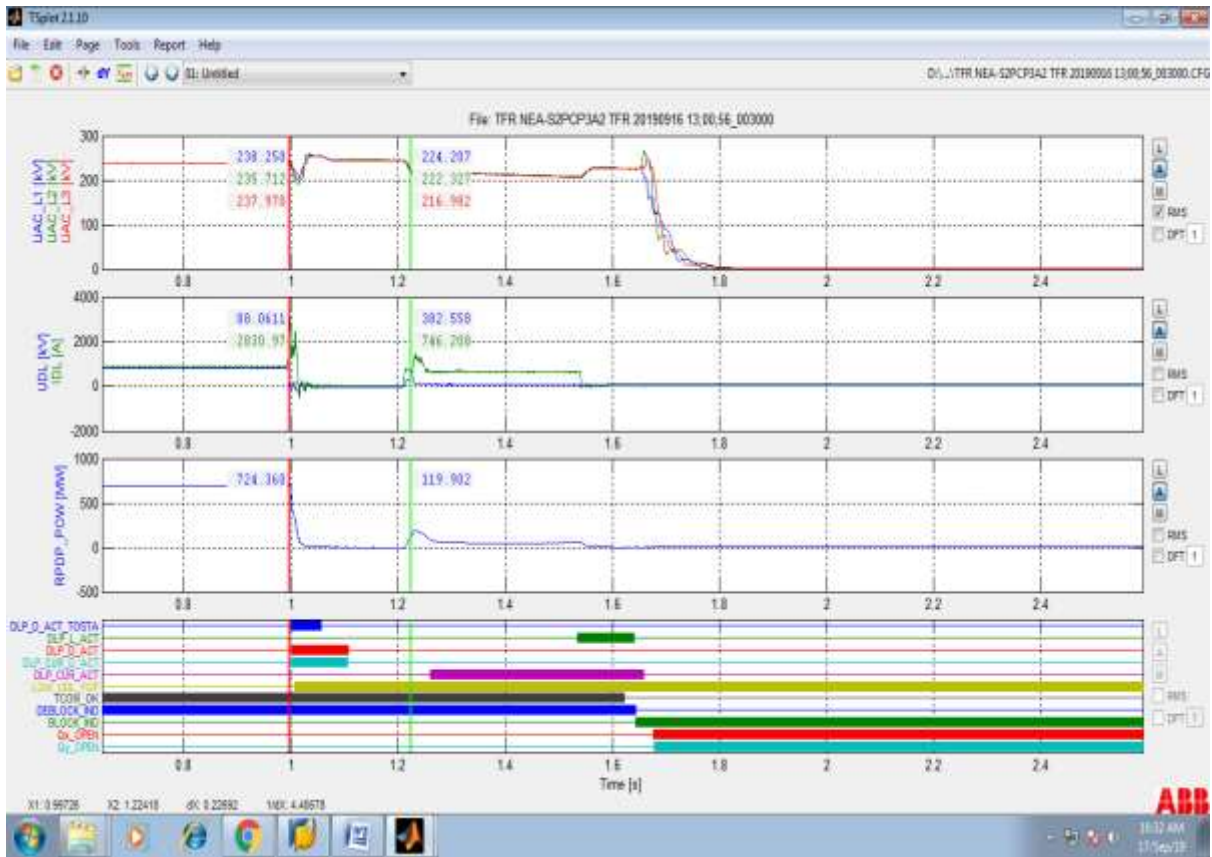


Station 3 , Pole Control Computer,PCP4A2

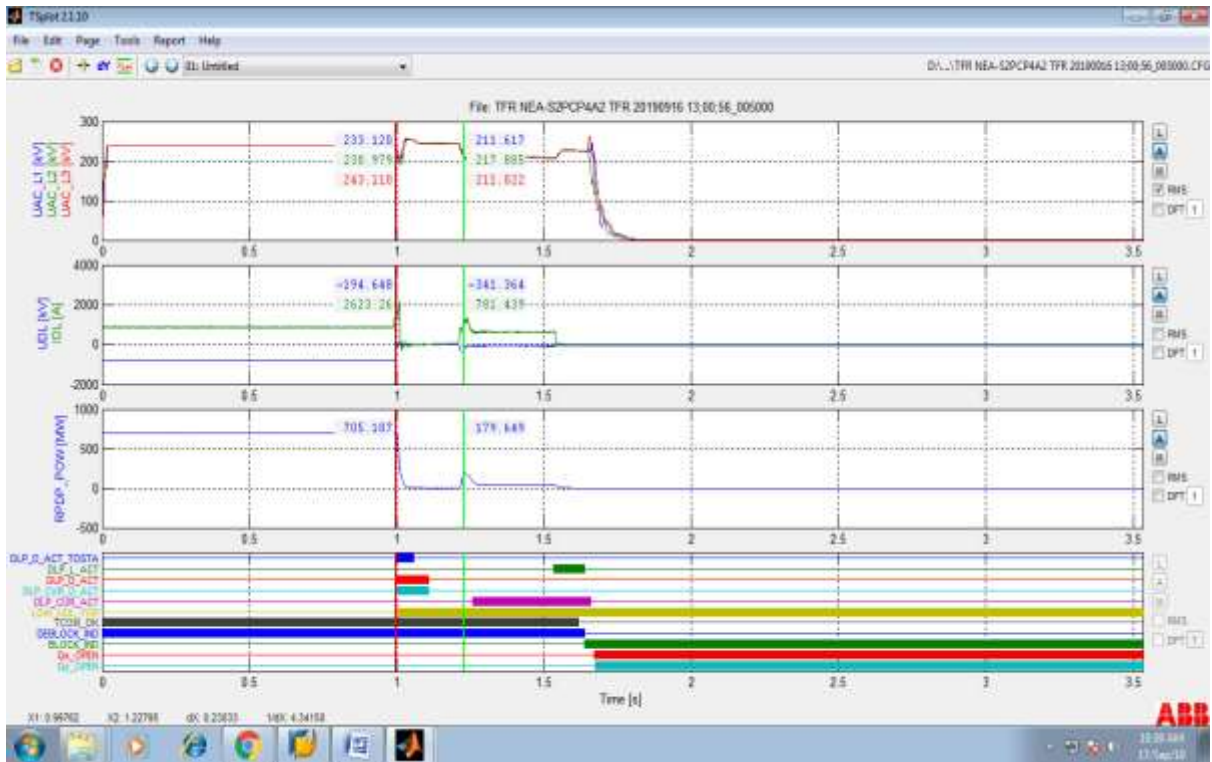


Station 2, Pole Protection Computer PCP3A2

TRIP REPORT FOR ±800kV HVDC of NEA 800 Link



Station 2, Pole Protection Computer PCP4A2



TRIP REPORT FOR ±800kV HVDC of NEA 800 Link

Event List

Screenshot of the top portion of the Event List software. The window title is 'CONSOLE LOGS' and 'MASTER CONTROL ACCESS'. It displays a table of system events with columns for 'EventDate', 'EventTime', 'Event', 'EventCategory', 'EventSeverity', 'EventInfo', 'EventStatus', and 'EventAction'. The events listed include various power system disturbances and control actions, such as 'N3502 AC RL TRIP', 'N3503 AC RL TRIP', and 'N3504 AC RL TRIP'.

Continuation of the Event List software screenshot, showing the lower portion of the event log. The interface shows 'CONSOLE LOGS' and 'MASTER CONTROL ACCESS' with a power level of '1454 MW'. The table continues with event entries, including trip reports for 'N3505 AC RL TRIP' and 'N3506 AC RL TRIP', as well as 'N3507 AC RL TRIP' and 'N3508 AC RL TRIP'. The events are color-coded by severity, with red indicating critical events and yellow for warnings.

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FINAL REPORT

Sub: Consultancy Assignment for Analysis and Submitting the Report on Transformers and Reactors (89 Nos.) of POWERGRID by CPRI, Bangalore

Ref: No. SRTS-II/C&M/WC-2183/LOA-2051/2019/3212 dated 20.03.2019

Date: 04.07.2019

Condition Assessment of Panipat ICT R Phase

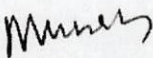
Make: TELK, Equipment Sl. No. 140053-1, Rating: 400/220/33 kV, 150 MVA, Phase: 1 Phase
 Year of Manufacturing: 1983 (36 Years old)

The diagnostic test data provided by POWERGRID have been analysed in detail and following are our observations:

1. IR values are normal and Tan delta values of windings moderately high.
2. Estimated moisture content in the solid insulation in 2.3% exceeding the maximum permissible range.
3. Tan delta values of the HV, IV and LV bushings are in normal range.
4. The oil test results (Specific Resistivity and Interfacial Tension) are beyond permissible limit.
5. DGA results indicate normal internal condition of the auto transformer.
6. Furan analysis shows high (1136 ppb) furan content indicating deterioration of solid insulation.
7. Review of maintenance and equipment history indicates no major maintenance in recent past. However one of its sister unit installed of the same bank has failed abruptly without any past record of abnormal behaviour.

Recommendations:

From the diagnostic test data it can be inferred that the condition of the autotransformer is critical. Considering the age of the equipment and for high system reliability, the unit is recommended for replacement.


 (K. P. MEENA)
 JOINT DIRECTOR/HoD (CDD)

FINAL REPORT

Sub: Consultancy Assignment for Analysis and Submitting the Report on Transformers and Reactors (89 Nos.) of POWERGRID by CPRI, Bangalore

Ref: No. SRTS-II/C&M/WC-2183/LOA-2051/2019/3212 dated 20.03.2019

Date: 04.07.2019

Condition Assessment of Panipat ICT Y Phase

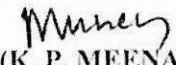
Make: TELK, Equipment Sl. No. 140053-2, Rating: 400/220/33 kV, 150 MVA, Phase: 1 Phase
Year of Manufacturing: 1983 (36 Years old)

The diagnostic test data provided by POWERGRID have been analysed in detail and following are our observations:

1. IR and Tan delta values are normal.
2. Estimated moisture content in the solid insulation is 2.1% exceeding the maximum permissible range.
3. Tan delta values of the HV, IV and LV bushings are in normal range.
4. The oil test results are satisfactory.
5. DGA results indicate normal internal condition of the auto transformer.
6. Furan analysis shows high (1172 ppb) furan content indicating deterioration of solid insulation.
8. Review of maintenance and equipment history indicates no major maintenance in recent past. However one of its sister unit installed of the same bank has failed abruptly without any past record of abnormal behaviour.

Recommendations:

From the diagnostic test data it can be inferred that the condition of the autotransformer is critical. Considering high furan content, the age of the equipment and for high system reliability, the unit is recommended for replacement.


(K. P. MEENA)
JOINT DIRECTOR/HoD (CDD)

Generation Projection (Jan 2020 - Mar 2020)																	
				Generation declared Commercial from 1st Apr'19 to 30th Sep'19					Generation declared/expected to be declared Commercial from 1st Oct'19 to 31st Dec'19								
Sl. No.	Entities	Region	Projections based on 3 Years Data	Bus Name	Unit No.	Installed Capacity	Gen. considered	Sub Total	Bus Name	Unit No.	Installed Capacity	Gen. considered	Sub Total	TOTAL	Comments From DICs /Others (if any)	Figure as per Comments/PoC Data	Projected Generation before normalization w.r.t projected All India Peak Demand
			(MW)			(MW)	(MW)	(MW)			(MW)	(MW)	(MW)	(MW)			(MW)
1	Uttar Pradesh	NR	9121	Meja	1	660	432	432	Tanda Stg-2	1	660	432	432	9985			9985
2	Delhi	NR	682											682			682
3	Haryana	NR	2762											2762			2762
4	Uttarakhand	NR	735											735			735
5	Punjab	NR	3939											3939			3939
6	Rajasthan	NR	9100	Chhabra SCTPP	6	660	432	864						9964			9964
				Suratgarh SCTPP	7	660	432										
7	Himachal Pradesh	NR	384											384			384
8	Jammu & Kashmir	NR	330											330			330
9	BBMB	NR	2165											2165			2165
10	Chandigarh	NR	0											0			0
11	Railways	NR	0											0			0
12	Dadri Thermal	NR	1410											1410			1410
13	Rihand	NR	2893											2893			2893
14	Singrauli	NR	1858											1858			1858
15	Unchahar	NR	1182											1182			1182
16	Auraiya	NR	134											134			134
17	Dadri CCPP	NR	458											458			458
18	NAPS	NR	387											387			387
19	Jhajjar	NR	1447											1447	As per data given by Jhajjar	1414	1414
20	DHAULIGANGA	NR	263											263			263
21	Tanakpur	NR	63											63			63
22	Koteshwar	NR	409											409			409
23	Tehri	NR	932											932			932
24	Anta	NR	248											248			248
25	RAAP B	NR	370											370			370
26	RAPP C	NR	452											452			452
27	AD Hydro	NR	125											125			125
28	Everest	NR	86											86			86

Generation Projection (Jan 2020 - Mar 2020)

				Generation declared Commercial from 1st Apr'19 to 30th Sep'19					Generation declared/expected to be declared Commercial from 1st Oct'19 to 31st Dec'19								
Sl. No.	Entities	Region	Projections based on 3 Years Data	Bus Name	Unit No.	Installed Capacity	Gen. considered	Sub Total	Bus Name	Unit No.	Installed Capacity	Gen. considered	Sub Total	TOTAL	Comments From DICs /Others (if any)	Figure as per Comments/PoC Data	Projected Generation before normalization w.r.t projected All India Peak Demand
			(MW)			(MW)	(MW)	(MW)			(MW)	(MW)	(MW)	(MW)			(MW)
29	Karcham Wangtoo	NR	958											958			958
30	Bairasul	NR	109											109			109
31	Chamera 1	NR	557											557			557
32	Chamera 2	NR	306											306			306
33	Chamera 3	NR	184											184			184
34	Naptha Jhakri	NR	1594											1594			1594
35	Lanco Budhil	NR	56											56			56
36	DULHASTI	NR	389											389			389
37	Salal	NR	533											533			533
38	Sewa-II	NR	131											131			131
39	URI I HPS	NR	443											443			443
40	URI II HPS	NR	217											217			217
41	Sree Cement	NR	265											265			265
42	Parbati III	NR	145											145			145
43	Rampur HEP	NR	445											445			445
44	KOLDAM	NR	864											864			864
	Rosa Power	NR															0
	Kishanganga	NR	248											248			248
	Sainj HEP	NR	74											74			74
	Bhadla Solar	NR_RJ													As per last quarter	250	250
	TOTAL		49452											51180			51397

Note:

1. Projections are based on monthly maximum injection in the last 3 years from actual metered data.
2. Generation forecast has been done based on the following criteria
 - (i) If there is an increasing trend then last year average generation has been considered
 - (ii) Otherwise average of past three year average generation has been considered
3. In case of new generators where past data was not available following has been assumed
 - (i) 0.8 plf for hydro generators
 - (ii) 0.7 plf for thermal generators.
 - (iii) 0.3 plf for gas stations

DEMAND FORECAST USING PAST 3 YEARS DATA (Jan 2020 - Mar 2020)														Data given by DICs	Comments
	2016-17			2017-18			2018-19			1	2	3	4		
	Jan-17	Feb-17	Mar-17	Jan-18	Feb-18	Mar-18	Jan-19	Feb-19	Mar-19	2016-17 Average	2017-18 Average	2018-19 Average	Projected Demand for (Jan2020 - Mar 2020) before normalization		
Chandigarh	213	217	214	242	235	232	258	194	223	215	236	225	236		
Delhi	4,168	3,882	4,139	4,464	3,946	3,766	4,472	4,386	4,016	4,063	4,059	4,291	4,366		
Haryana	6,815	6,556	6,668	6,940	7,120	6,815	7,078	6,946	6,544	6,680	6,958	6,856	7,008		
Himachal Pradesh	1,492	1,479	1,499	1,594	1,555	1,494	1,686	1,679	1,683	1,490	1,548	1,683	1,766		
Jammu & Kashmir	2,140	2,098	2,033	2,319	2,199	2,162	2,463	2,433	2,397	2,090	2,227	2,431	2,590		
Punjab	6,120	6,475	6,536	6,260	6,277	6,687	6,309	5,719	6,618	6,377	6,408	6,215	6,172		
Rajasthan	10,348	10,332	9,859	11,564	11,449	10,723	12,921	12,650	11,885	10,180	11,245	12,485	13,609		
Uttar Pradesh	14,344	14,133	16,110	14,989	15,015	15,223	14,928	14,908	16,220	14,862	15,076	15,352	15,586		
Uttarakhand	2,037	1,973	1,843	2,149	2,134	1,886	2,216	2,182	2,002	1,951	2,056	2,133	2,229		

Notes

1. Projections are based on the past 3 years' monthly Peak Demand Met data available on the website of CEA
2. The above projections are being done for financial year 2019-2020 (Q4) i.e January 2020-March 2020
3. Projections are being done based on the forecast function available in MS Office Excel
4. CEA Reports can be accessed from the following links:
http://www.cea.nic.in/reports/monthly/powersupply/2019/psp_peak-01.pdf
http://www.cea.nic.in/reports/monthly/powersupply/2019/psp_peak-02.pdf
http://www.cea.nic.in/reports/monthly/powersupply/2019/psp_peak-03.pdf
http://www.cea.nic.in/reports/monthly/powersupply/2018/psp_peak-01.pdf
http://www.cea.nic.in/reports/monthly/powersupply/2018/psp_peak-02.pdf
http://www.cea.nic.in/reports/monthly/powersupply/2018/psp_peak-03.pdf
http://www.cea.nic.in/reports/monthly/powersupply/2017/psp_peak-01.pdf
http://www.cea.nic.in/reports/monthly/powersupply/2017/psp_peak-02.pdf
http://www.cea.nic.in/reports/monthly/powersupply/2017/psp_peak-03.pdf

Transformer Tap Optimization Study for Northern Region
6th November 2019
NRLDC, POSOCO



Objective: Tap changing studies of ICTs in Northern Region for maintaining healthy voltage profile at 400 & 765 kV level during the winter season of 2019-20.

Methodology:

1. Voltages at 765/400 and 400/220 kV stations were examined from SCADA data.
2. Reactive energy accounts issued by NRPC were examined to observe the MVAR injection at high voltage.
3. Present tap positions (Oct'19) were available from NR-1, NR-2, NR-3, and Rajasthan. These were incorporated in basecase.
4. Terminal voltage settings for generators were changed in basecase to match MVAR generations with real time (last winter).
5. Offline tap changing studies were carried out using PSSe software. Tap positions of 400/220kV ICTs were changed from present tap setting and changes in voltages/reactive power flow were observed.

Assumptions in Offline Studies:

1. Anticipated Load-Generation scenario of January 2020 is simulated in PSSe.
2. All major elements in Northern Region are considered to be in service.

S. No.	Name of State/Area	Load (MW)	Generation (MW)
1	Punjab	4378	2529
2	Haryana	4745	1639
3	Rajasthan	8244	5169
4	Delhi	2362	678
5	Uttar Pradesh	11360	5817
6	Jammu & Kashmir	1839	205
7	Uttarakhand	1727	663
8	Himachal Pradesh	1090	117
9	Chandigarh	173	-
Total NR		35919	16816+9674= 26490 States+Others=Regional

Observations:

1. High voltages observed as per SCADA data (2018-19):

S. No.	400/220 kV Substation	Nov'18		Dec'18		Jan'19		Average Nov18-Jan19	
		>410	>420	>410	>420	>410	>420	>410	>420
1	Suratgarh	100%	100%	99%	86%	100%	98%	100%	94%
2	Mahindergarh	100%	95%	100%	81%	99%	89%	100%	88%
3	CLP Jhajjar	99%	93%	99%	79%	100%	88%	99%	87%
4	Rajpura	100%	87%	99%	68%	99%	77%	99%	78%
5	Harshvihar	100%	77%	98%	65%	99%	72%	99%	71%
6	Makhu	100%	83%	99%	60%	100%	68%	100%	70%
7	Nakodar	100%	82%	99%	57%	99%	70%	100%	70%
8	Jind	100%	74%	100%	60%	100%	75%	100%	70%
9	Agra(PG)	84%	72%	98%	63%	99%	71%	94%	69%
10	Rampur	100%	71%	99%	56%	97%	69%	99%	65%
11	Sonepat	100%	77%	99%	51%	100%	66%	100%	65%
12	Nuhyawali	99%	69%	93%	48%	98%	75%	97%	64%
13	Jalandhar	100%	73%	99%	52%	98%	63%	99%	63%
14	Jhajjar	100%	66%	99%	56%	100%	62%	100%	61%
15	Bhiwani(BBMB)	99%	63%	98%	53%	99%	66%	99%	61%
16	Kabulpur	100%	67%	99%	52%	99%	62%	99%	61%
17	Nallagarh	100%	62%	99%	53%	98%	66%	99%	61%
18	CCGTB	100%	62%	98%	50%	98%	58%	98%	57%
19	Bhiwani(PG)	100%	63%	98%	46%	99%	61%	99%	57%
20	Agra(UP)	98%	63%	90%	49%	92%	57%	93%	56%
21	Maharanibagh	100%	57%	94%	44%	97%	59%	97%	53%
22	Malerkotla	100%	58%	99%	43%	99%	58%	99%	53%
23	Karcham	98%	56%	99%	42%	98%	59%	98%	52%
24	Abdullapur	100%	57%	98%	43%	97%	55%	98%	52%
25	Dadri Thermal	98%	49%	95%	45%	98%	57%	97%	50%
26	Muktsar	100%	76%	91%	20%	99%	54%	97%	50%
27	Fatehpur	99%	39%	100%	59%	99%	52%	99%	50%
28	Fatehabad	98%	47%	96%	34%	99%	66%	98%	49%
29	OBRA B	100%	0%	100%	77%	100%	70%	100%	49%
30	Koldam	100%	50%	98%	39%	98%	56%	98%	48%
31	Bawana	99%	52%	88%	36%	97%	51%	95%	46%
32	Mundka	96%	44%	99%	50%	97%	44%	97%	46%
33	Dadri	98%	50%	95%	39%	97%	48%	97%	46%
34	Paricha	92%	17%	100%	91%	80%	25%	91%	44%
35	Panchkula	98%	47%	96%	36%	95%	48%	97%	44%
36	Nathpa Jhakri	98%	45%	99%	35%	94%	51%	97%	44%
37	Dhanonda	99%	47%	94%	36%	95%	46%	96%	43%

38	Kirori	98%	15%	97%	15%	100%	99%	98%	43%
39	Amritsar	100%	52%	94%	30%	96%	42%	97%	42%
40	Dadri	92%	44%	94%	35%	97%	45%	94%	41%
41	Dehar	99%	47%	93%	35%	94%	39%	96%	40%
42	Dhuri	100%	59%	94%	25%	98%	35%	97%	40%
43	Allahabad	100%	25%	100%	44%	100%	47%	100%	39%
44	Panipat	94%	47%	81%	28%	92%	40%	89%	38%
45	Khedar	99%	31%	97%	23%	98%	60%	98%	38%
46	Meerut	95%	38%	89%	30%	93%	43%	92%	37%
47	Neemrana	95%	42%	75%	29%	89%	37%	86%	36%
48	Jhatikara	96%	36%	88%	31%	93%	39%	92%	36%
49	Bhiwadi	96%	44%	82%	32%	98%	27%	92%	34%
50	Parbati 3	98%	42%	97%	27%	90%	33%	95%	34%
51	Talwandi Saboo	100%	53%	97%	19%	100%	27%	99%	33%
52	Koteshwar	99%	50%	79%	22%	86%	24%	88%	32%
53	Kaithal	95%	33%	90%	26%	90%	35%	91%	32%
54	Ballabgarh	95%	40%	81%	22%	89%	32%	88%	31%
55	Koteshwar	98%	34%	91%	25%	94%	34%	94%	31%
56	Sikar	68%	37%	82%	29%	82%	27%	78%	31%
57	Gurgaon	88%	33%	74%	24%	86%	27%	83%	28%
58	Parbati Pool	96%	41%	92%	20%	39%	19%	76%	27%
59	Mandola	97%	32%	91%	21%	90%	25%	93%	26%
60	Muradnagar	38%	25%	32%	10%	96%	43%	55%	26%
61	Tehri	85%	19%	84%	22%	88%	34%	86%	25%
62	Patiala	99%	45%	76%	15%	85%	12%	87%	24%
63	Shree Cement	95%	28%	81%	16%	87%	27%	88%	24%
64	Manesar	88%	30%	80%	10%	85%	29%	84%	23%
65	Baspa	90%	26%	75%	14%	82%	23%	82%	21%
66	Chamba	83%	17%	81%	14%	83%	33%	82%	21%
67	Shahjhapur	97%	26%	94%	16%	91%	19%	94%	20%
68	Chamera 1	94%	12%	80%	15%	90%	29%	88%	19%
69	Kotputli	80%	26%	80%	18%	63%	11%	74%	19%

2. From Reactive Energy Accounts (NRPC website):

Area	Reactive energy injection at High Voltage (2018-19 winter)
UP	Mainpuri (PG), Rosa, Panki, Chinhat, Kanpur(PG)
Rajasthan	Hissar (BBMB), Khetri(BBMB), Heerapura, Jaipur-South (PG), Sikar
Delhi	Bamnoli, Bawana, Maharani Bagh, Mundka, Narela(BBMB), Narela
Haryana	Dipalpur, Fatehabad, Gurgaon (PG), Hissar, Rohtak Road (BBMB)

Area	Reactive energy injection at High Voltage (2018-19 winter)
Punjab	Gobindgarh, Jamsher, Amritsar(PG), Moga(PG), Sarna, Barnala, Ropar(BBMB)
HP	Jessore (BBMB)
J&K	-

3. Tap positions as on 01.11.2019 (details provided by utilities)

NR-1					
S.No	Voltage (KV)	Capacity (MVA)	Substation	Equipment ID	TAP POSITION
1	765/400	1500	Ajmer	ICT-1	12
2	765/400	1500	Ajmer	ICT-2	12
3	765/400	1500	Bhiwani	ICT-1	12
4	765/400	1500	Bhiwani	ICT-2	12
5	765/400	1500	Chittorgarh	ICT-1	12
6	765/400	1500	Chittorgarh	ICT-2	12
7	765/400	1500	Jhatikara	ICT-1	12
8	765/400	1500	Jhatikara	ICT-2	12
9	765/400	1500	Jhatikara	ICT-3	12
10	765/400	1500	Jhatikara	ICT-4	12
11	765/400	1500	Meerut	ICT-1	15
12	765/400	1500	Meerut	ICT-2	15
13	765/400	1500	Bikaner	ICT-1	12
14	765/400	1500	Bikaner	ICT-2	12
15	765/400	1500	Bhadla	ICT-1	12
16	765/400	1500	Bhadla	ICT-2	12
17	765/400	1500	Bhadla	ICT-3	12
18	400/220	500	Bagpat	ICT-1	9
19	400/220	500	Bagpat	ICT-2	9
20	400/220	315	Bahadurgarh	ICT-1	8
21	400/220	500	Bahadurgarh	ICT-2	8
22	400/220	315	Bassi	ICT-1	11
23	400/220	315	Bassi	ICT-2	11
24	400/220	500	Bassi	ICT-3	11
25	400/220	315	Bawana	ICT-2	9B
26	400/220	315	Bhinmal	ICT-1	9B
27	400/220	315	Bhinmal	ICT-2	9B
28	400/220	315	Bhiwadi	ICT-1	11
29	400/220	315	Bhiwadi	ICT-2	11
30	400/220	315	Bhiwadi	ICT-3	11

31	400/220	315	Bhiwani	ICT-1	9B
32	400/220	315	Bhiwani	ICT-2	9B
33	400/220	500	Ballabgarh	ICT-1	11
34	400/220	500	Ballabgarh	ICT-2	11
35	400/220	500	Ballabgarh	ICT-3	11
36	400/220	500	Ballabgarh	ICT-4	11
37	400/220	315	Dehradun	ICT-1	11
38	400/220	315	Dehradun	ICT-2	11
39	400/220	315	Gurgaon	ICT-1	9B
40	400/220	315	Gurgaon	ICT-2	9B
41	400/220	500	Gurgaon	ICT-3	9B
42	400/220	500	Gurgaon	ICT-4	9B
43	400/220	315	Hisar	ICT-1	9B
44	400/220	315	Hisar	ICT-2	9B
45	400/220	315	Hisar	ICT-3	9B
46	400/220	500	Jaipur(S)	ICT-1	9B
47	400/220	500	Jaipur(S)	ICT-2	9B
48	400/220	500	Jind	ICT-1	9B
49	400/220	500	Jind	ICT-2	9B
50	400/220	315	Kankroli	ICT-1	9B
51	400/220	315	Kankroli	ICT-2	9B
52	400/220	315	Kankroli	ICT-3	9B
53	400/220	315	Kota	ICT-1	9B
54	400/220	315	Kota	ICT-2	9B
55	400/220	315	Kotputli	ICT-1	9B
56	400/220	315	Kotputli	ICT-2	9B
57	400/220	315	Maharanibagh	ICT-1	9B
58	400/220	315	Maharanibagh	ICT-2	9B
59	400/220	500	Maharanibagh	ICT-3	9B
60	400/220	500	Maharanibagh	ICT-4	9B
61	400/220	500	Mandola	ICT-1	11
62	400/220	500	Mandola	ICT-2	11
63	400/220	500	Mandola	ICT-3	11
64	400/220	500	Mandola	ICT-4	11
65	400/220	500	Manesar	ICT-1	9B
66	400/220	500	Manesar	ICT-2	9B
67	400/220	315	Meerut	ICT-1	11
68	400/220	315	Meerut	ICT-2	11
69	400/220	315	Meerut	ICT-3	11
70	400/220	500	Meerut	ICT-4	11
71	400/220	315	Muzzafarnagar	ICT-1	11
72	400/220	500	Nimrana	ICT-1	9B
73	400/220	315	Nimrana	ICT-2	9B
74	400/220	315	Roorkee	ICT-1	11

75	400/220	315	Roorkee	ICT-2	11
76	400/220	315	Saharanpur	ICT-1	10
77	400/220	315	Saharanpur	ICT-2	10
78	400/220	315	Sikar	ICT-1	9
79	400/220	315	Sikar	ICT-2	9
80	400/220	500	Sikar	ICT-3	9
81	400/220	315	Sonipat	ICT-1	9B
82	400/220	315	Sonipat	ICT-2	9B
83	400/220	500	Tughlakabad	ICT-1	9
84	400/220	500	Tughlakabad	ICT-2	9
85	400/220	500	Tughlakabad	ICT-3	9
86	400/220	500	Tughlakabad	ICT-4	9
87	400/220	500	Bhadla	ICT-1	9
88	400/220	500	Bhadla	ICT-2	9
89	400/220	500	Bhadla	ICT-3	9
NR-3					
S.No	Voltage (KV)	Capacity (MVA)	Substation	Equipment ID	TAP POSITION
1	765/400	1500	Agra	ICT-1	15
2	765/400	1500	Agra	ICT-2	15
3	765/400	1500	Fatehpur	ICT-1	17
4	765/400	1500	Fatehpur	ICT-2	17
5	765/400	1500	Lucknow(765KV)	ICT-1	14
6	765/400	1500	Lucknow(765KV)	ICT-2	14
7	765/400	1500	Ballia	ICT-1	15
8	765/400	1500	Ballia	ICT-2	16
9	765/400	1500	Bareilly(765KV)	ICT-1	9
10	765/400	1500	Bareilly(765KV)	ICT-2	9
11	765/400	1500	Varanasi(GIS)	ICT-1	12
12	765/400	1500	Varanasi(GIS)	ICT-2	12
13	765/400	1500	Kanpur(GIS)	ICT-1	12
14	765/400	1500	Kanpur(GIS)	ICT-2	12
15	765/400	1000	Orai	ICT-1	14
16	765/400	1000	Orai	ICT-2	14
17	400/220	315	Allahabad	ICT-1	11
18	400/220	315	Allahabad	ICT-2	11
19	400/220	315	Allahabad	ICT-3	11
20	400/220	315	Gorakhpur	ICT-1	11
21	400/220	315	Gorakhpur	ICT-2	11
22	400/220	315	Kanpur	ICT-1	9B
23	400/220	315	Kanpur	ICT-2	9B
24	400/220	500	Lucknow	ICT-1	9B
25	400/220	500	Lucknow	ICT-2	9B
26	400/220	315	Mainpuri	ICT-1	13
27	400/220	315	Mainpuri	ICT-2	13

28	400/220	315	Mainpuri	ICT-3	13
29	400/220	315	Fatehpur	ICT-1	9B
30	400/220	315	Fatehpur	ICT-2	9B
31	400/220	315	Sohawal	ICT-1	11
32	400/220	315	Sohawal	ICT-2	11
33	400/220	500	Sahjahanpur	ICT-1	9B
34	400/220	500	Sahjahanpur	ICT-2	9B
35	400/220	315	Agra	ICT-1	7
36	400/220	315	Agra	ICT-2	7
37	220/132	100	Raibareilly	ICT-1	9
38	220/132	200	Raibareilly	ICT-2	9
39	220/132	200	Raibareilly	ICT-3	9
40	220/132	100	Sitarganj	ICT-1	11
41	220/132	100	Sitarganj	ICT-2	11
42	220/132	100	Pithoragarh	ICT-1	7
43	220/132	100	Pithoragarh	ICT-2	7

NR-2

S.No	Voltage (KV)	Capacity (MVA)	Substation	Equipment ID	TAP POSITION
1	400/220	315	Abdullapur	ICT-1	11
2	400/220	315	Abdullapur	ICT-2	11
3	400/220	315	Abdullapur	ICT-3	11
4	400/220	315	Abdullapur	ICT-4	11
5	400/220	315	Amritsar	ICT-1	11
6	400/220	315	Amritsar	ICT-2	11
7	400/220	500	Amritsar	ICT-3	11
8	400/220	315	Banala	ICT-1	
9	400/220	315	Banala	ICT-2	
10	400/220	315	Chamba	ICT-1	9B
11	400/220	315	Chamba	ICT-2	9B
12	400/220	315	Dehar	ICT-1	9B
13	400/220	315	Fatehabad	ICT-1	13
14	400/220	315	Fatehabad	ICT-2	13
15	400/220	315	Fatehabad	ICT-3	13
16	400/220	315	Hamirpur	ICT-1	11
17	400/220	315	Hamirpur	ICT-2	11
18	400/220	315	Hamirpur	ICT-3	11
19	400/220	315	Jalandhar	ICT-1	11
20	400/220	315	Jalandhar	ICT-2	11
21	400/220	500	Jalandhar	ICT-3	11
22	400/220	315	Kaithal	ICT-1	11
23	400/220	315	Kaithal	ICT-2	11
24	400/220	315	Kaithal	ICT-3	11
25	400/220	315	Kishenpur	ICT-1	11
26	400/220	315	Kishenpur	ICT-2	11

27	400/220	315	Kishenpur	ICT-3	11
28	400/220	500	Kurukshetra	ICT-1	7
29	400/220	500	Kurukshetra	ICT-2	7
30	400/220	315	Ludhiana	ICT-1	11
31	400/220	315	Ludhiana	ICT-2	11
32	400/220	315	Ludhiana	ICT-3	11
33	400/220	500	Ludhiana	ICT-4	11
34	400/220	315	Malerkotla	ICT-1	11
35	400/220	315	Malerkotla	ICT-2	11
36	400/220	500	Malerkotla	ICT-3	11
37	400/220	500	Moga	ICT-1	11
38	400/220	250	Moga	ICT-2	11
39	400/220	500	Moga	ICT-3	11
40	400/220	315	Moga	ICT-4	11
41	765/400	1500	Moga	ICT-1	12
42	765/400	1500	Moga	ICT-2	12
43	400/220	315	Nallagarh	ICT-1	10
44	400/220	315	Nallagarh	ICT-2	10
45	400/220	315	Nallagarh	ICT-3	10
46	400/220	315	New Wanpoh	ICT-1	9B
47	400/220	315	New Wanpoh	ICT-2	9B
48	400/220	315	Patiala	ICT-1	11
49	400/220	315	Patiala	ICT-2	11
50	400/220	500	Patiala	ICT-3	11
51	400/220	450	Panipat	ICT-1	9B
52	400/220	315	Panchkula	ICT-1	11
53	400/220	315	Panchkula	ICT-2	11
54	400/220	500	Panchkula	ICT-3	11
55	400/220	315	Samba	ICT-1	9B
56	400/220	315	Samba	ICT-2	9B
57	400/220	315	Samba	ICT-3	9B
58	400/220	315	Wagoora	ICT-1	9B
59	400/220	315	Wagoora	ICT-2	9B
60	400/220	315	Wagoora	ICT-3	9B
61	400/220	315	Wagoora	ICT-4	9B

RRVNL

S.No	Voltage (KV)	Capacity (MVA)	Substation	Equipment ID	TAP POSITION
1	400/220	315	Bikaner	ICT-1	10
2	400/220	315	Bikaner	ICT-2	10
3	400/220	315	Barmer	ICT-1	12
4	400/220	315	Barmer	ICT-2	12
5	400/220	315	Babai	ICT-1	8
6	400/220	315	Babai	ICT-2	8
7	400/220	315	Ratangarh	ICT-1	14

8	400/220	315	Ratangarh	ICT-2	14
9	400/220	315	Ratangarh	ICT-3	14
10	400/220	500	Ramgarh	ICT-1	7
11	400/220	500	Ramgarh	ICT-2	7
12	400/220	500	Ramgarh	ICT-3	7
13	400/220	500	Bhadla	ICT-1	8
14	400/220	500	Bhadla	ICT-2	8
15	400/220	500	Bhadla	ICT-3	8
16	400/220	315	Ajmer	ICT-1	8
17	400/220	315	Ajmer	ICT-2	8
18	400/220	315	Bhilwara	ICT-1	Defective
19	400/220	315	Bhilwara	ICT-2	12
20	400/220	315	Hindaun	ICT-1	10
21	400/220	315	Hindaun	ICT-2	10
22	400/220	315	Merta	ICT-1	10
23	400/220	315	Merta	ICT-2	10
24	400/220	315	Chittorgarh	ICT-1	8
25	400/220	315	Chittorgarh	ICT-2	8
26	400/220	315	Akal	ICT-1	11
27	400/220	315	Akal	ICT-2	11
28	400/220	315	Akal	ICT-3	11
29	400/220	500	Akal	ICT-4	11
30	400/220	250	Heerapura	ICT-1	8
31	400/220	250	Heerapura	ICT-2	8
32	400/220	250	Heerapura	ICT-3	8
33	400/220	315	Heerapura	ICT-4	8
34	400/220	315	Jodhpur	ICT-1	7
35	400/220	315	Jodhpur	ICT-2	7
36	400/220	500	Kankani	ICT-1	7

4. Offline Study Results:

Based on present tap positions provided by utilities and scatter plots developed for October 2019 (as per data available at NRLDC), nodes were identified where there is need of tap change. Simulation studies were carried out for these nodes and impact of tap change at these nodes was studied. The present tap positions as per details provided by utilities were also incorporated in basecase. Results are presented below:

Table: Offline tap changing study results

S. No	Station (400/220kV)	BASECASE				CASE-1						
		Present Tap	400 kV Voltage	220 kV Voltage	Reactive Power Flow HV to LV	Modified Tap	400 kV Voltage	220k V Voltage	Reactive Power Flow HV to LV	Change in 400 kV voltage	Change in 220 kV voltage	Change in Reactive Power Flow HV to LV
			kV	kV	MVar		kV	kV	MVar	kV	kV	MVar
		A	B	C	D	E	F	G	H	F-B	G-C	H-D
1	Mainpuri(PG)	13	411.9	231.5	330.6	11(-2)	414.2	229.2	312.5	2.3	-2.3	-18.1
2	Fatehpur(PG)	9	421.1	228.4	72.4	11(+2)	420.3	230.8	148.7	-0.8	2.4	76.3
3	Agra(PG)	7	418.5	226.2	-33	9(+2)	417.7	227.6	57	-0.8	1.4	90
4	Bahadurgarh	8	418.3	228.7	-51	7(-1)	419.4	228.7	-118	1.1	0	-67
5	Bhiwadi	11	421.1	231.6	209.1	12(+1)	420.1	232.9	171	-1	1.3	-38.1
6	Lucknow(UP)	12	407.7	226.2	250	11(-1)	408.7	225.1	196.2	1	-1.1	-53.8
7	Daultabad	9*	417.2	229.2	2	11	415.8	231.3	149.6	-1.4	2.1	147.6
8	Nakodar	9*	422.3	230.7	31	11	420.9	232.8	107.2	-1.4	2.1	76.2
9	Panki	9*	415.6	225.5	71.5	11	414.8	227.2	156	-0.8	1.7	84.5
10	Bagpat	9	414.3	223.5	157	11	413	226.4	245.6	-1.3	2.9	88.6

* Tap position of these stations were not provided by respective utilities, it was assumed that presently tap is at nominal position

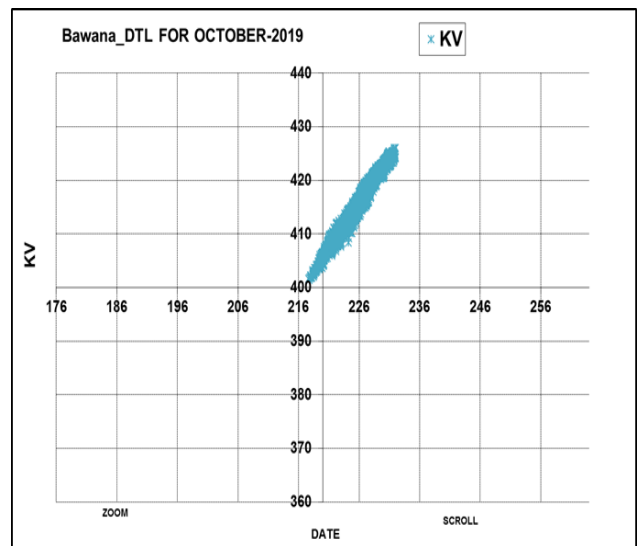
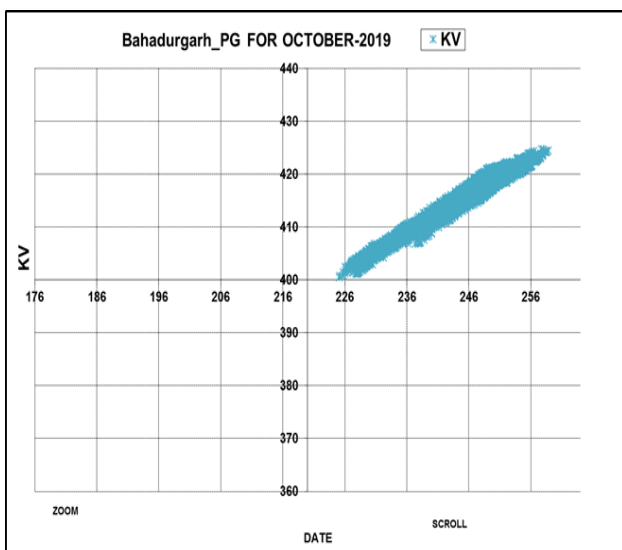
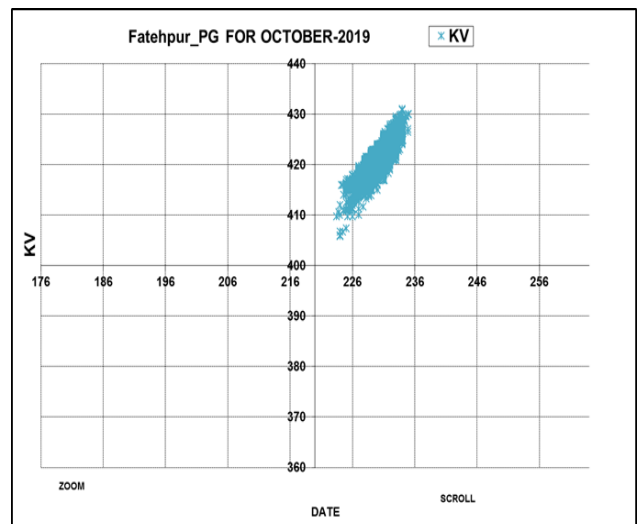
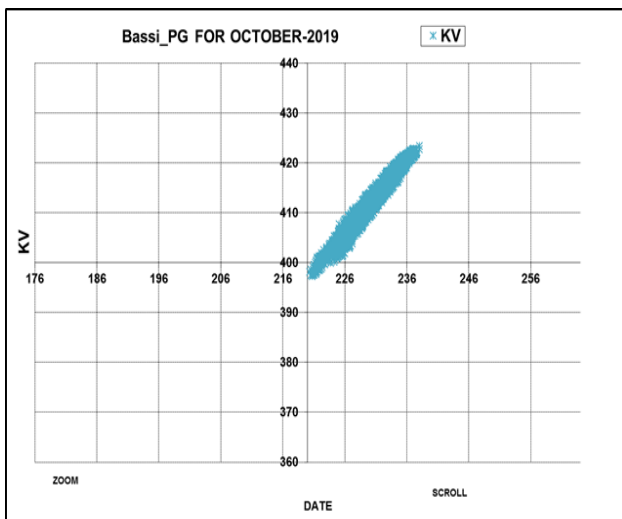
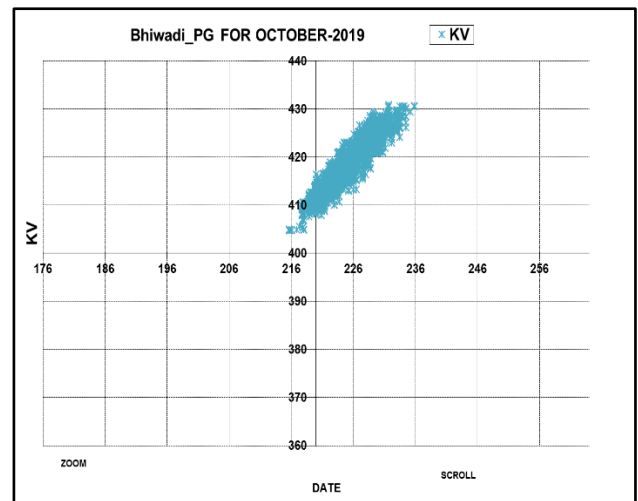
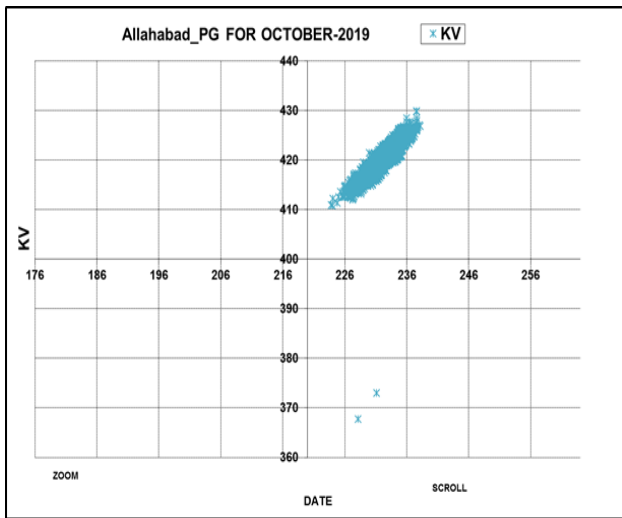
5. Suggestions/ Inference:

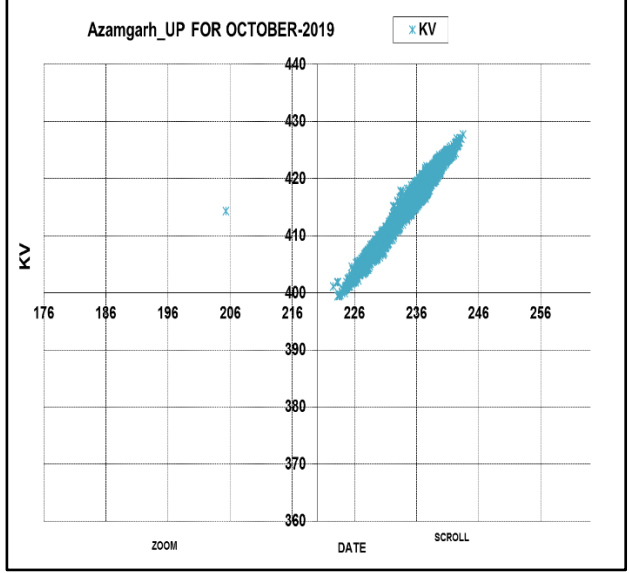
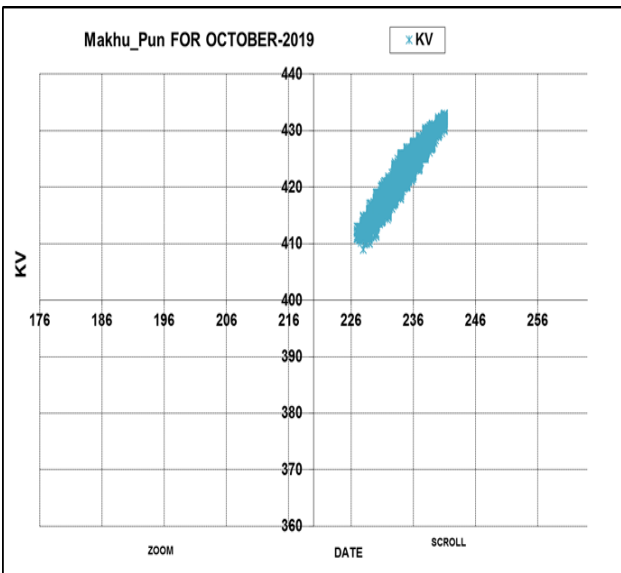
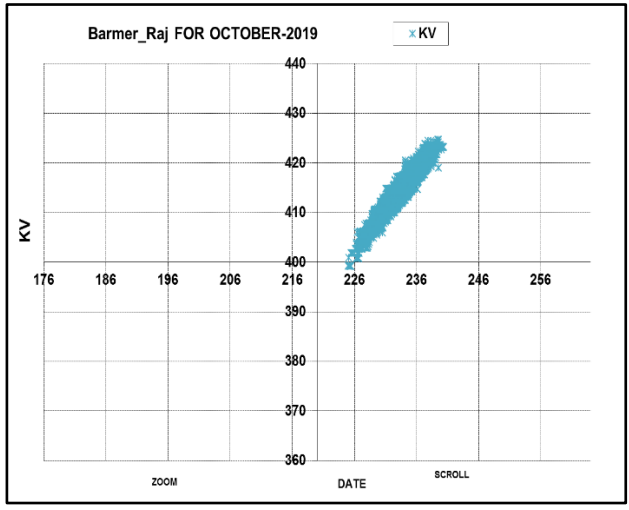
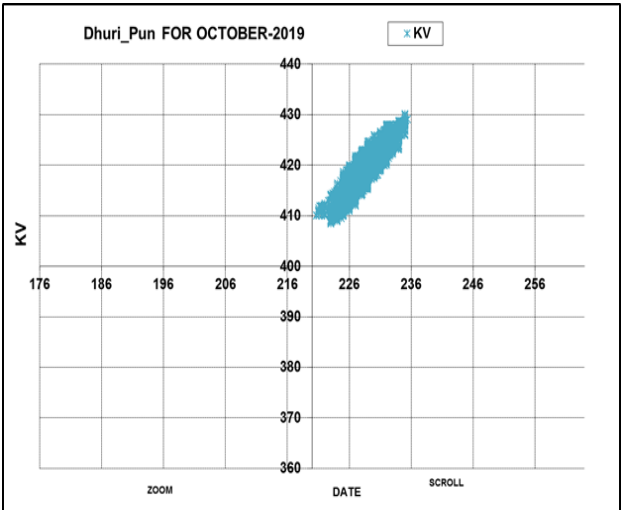
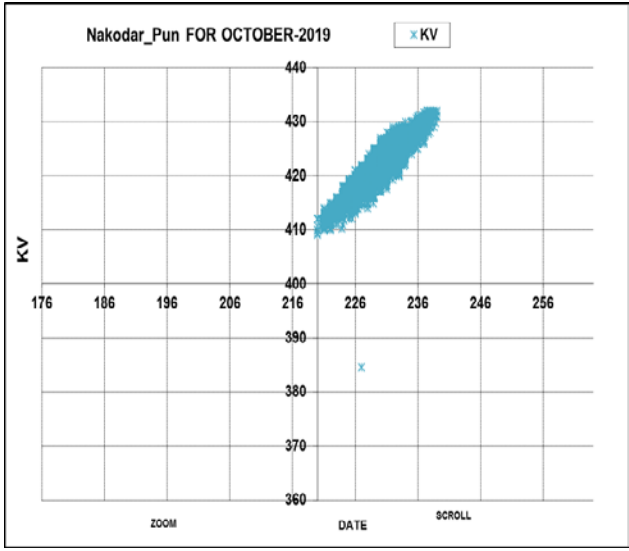
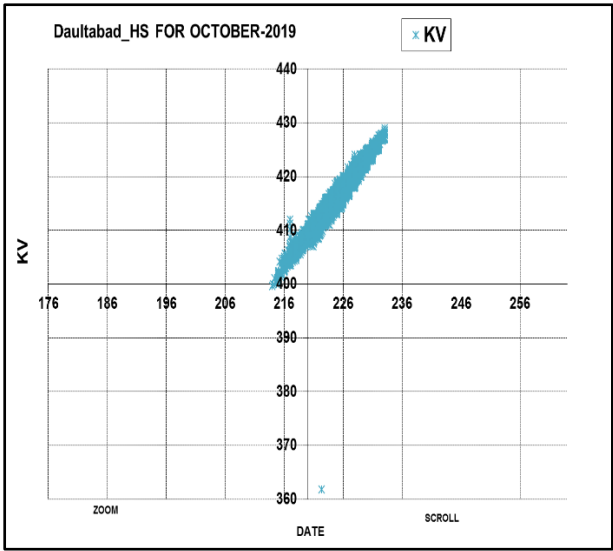
1. It can be observed that the voltages at many 400 kV and 765 kV Nodes remain high for 70 % of the time during winter season.
2. Available scatter plots for different nodes are attached as Annexure. Scatter plots of October 2019 and results obtained from simulation studies were used to recommend nodes for tap change exercise.
3. Considering the present tap positions of ICTs at different locations, it is recommended that the tap position of 400/220 kV ICTs at the following locations may be changed:

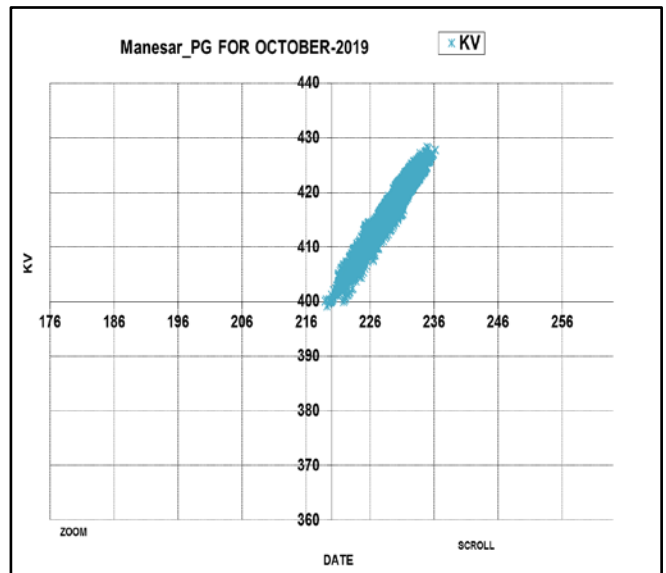
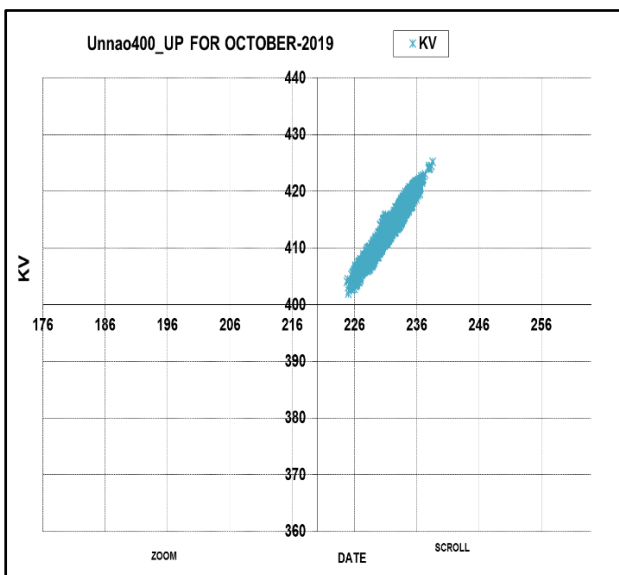
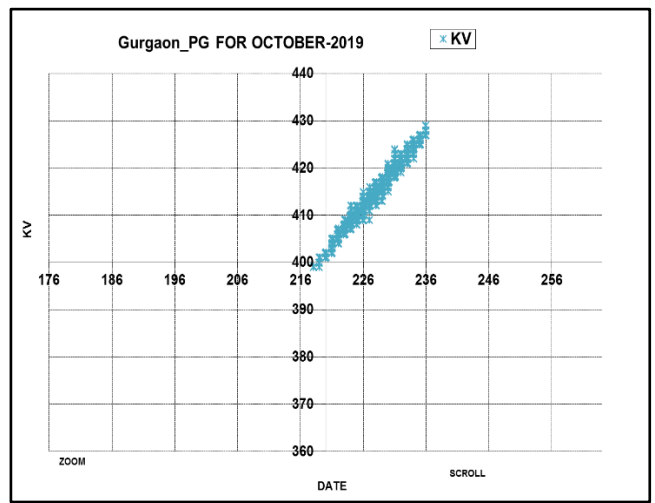
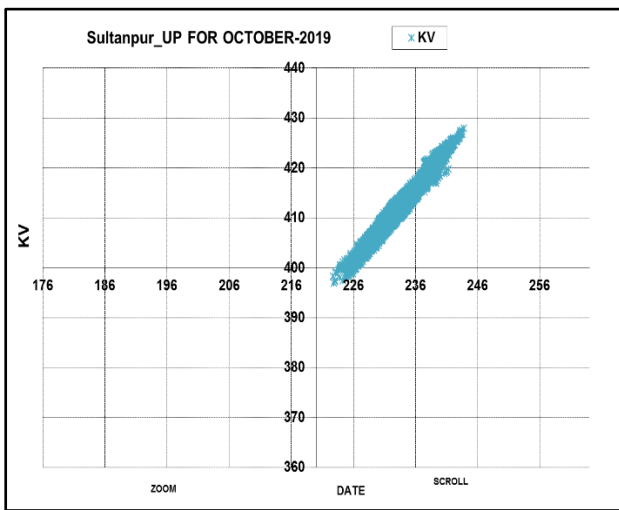
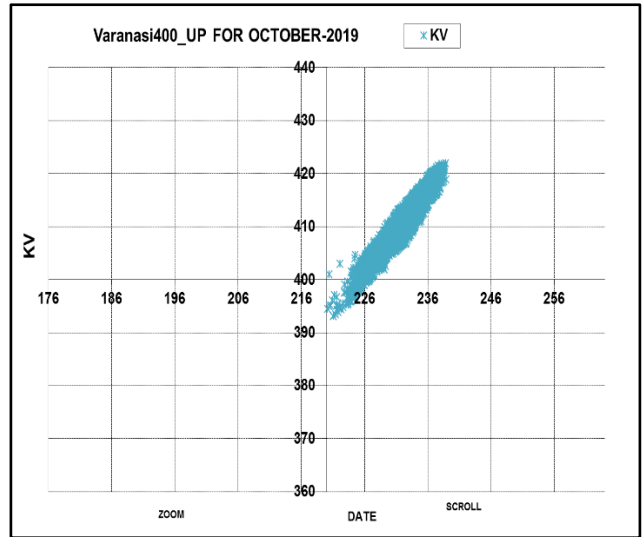
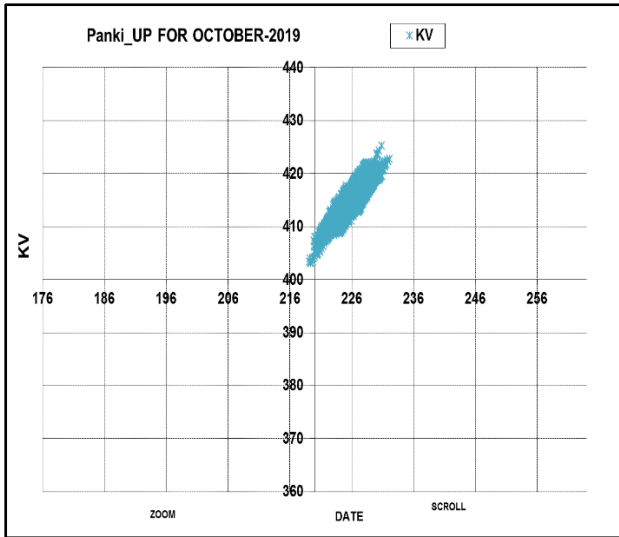
S. No	Station (400/220kV)	Present Tap Position	Suggested Tap Position
1	Mainpuri(PG)	13	11(-2)
2	Fatehpur(PG)	9	11(+2)
3	Agra(PG)	7	9(+2)
4	Bahadurgarh	8	7(-1)
5	Bhiwadi	11	12(+1)
6	Lucknow(UP)	12	11(-1)
7	Daultabad	9*	11
8	Nakodar	9*	11
9	Panki	9*	11
10	Bagpat	9*	11

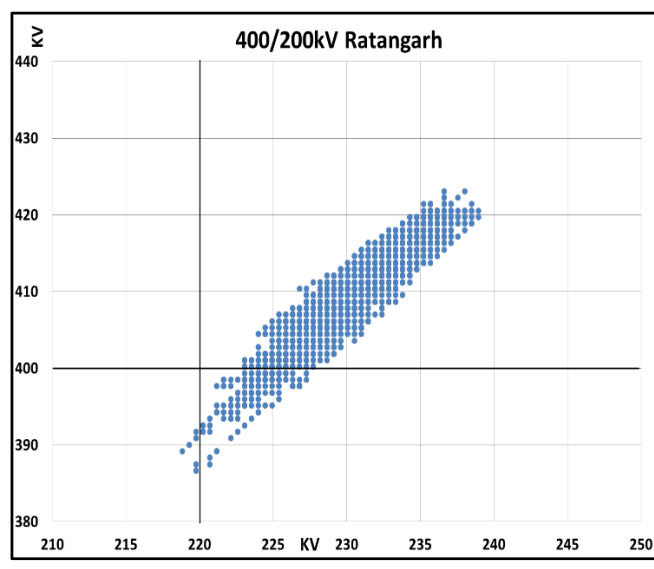
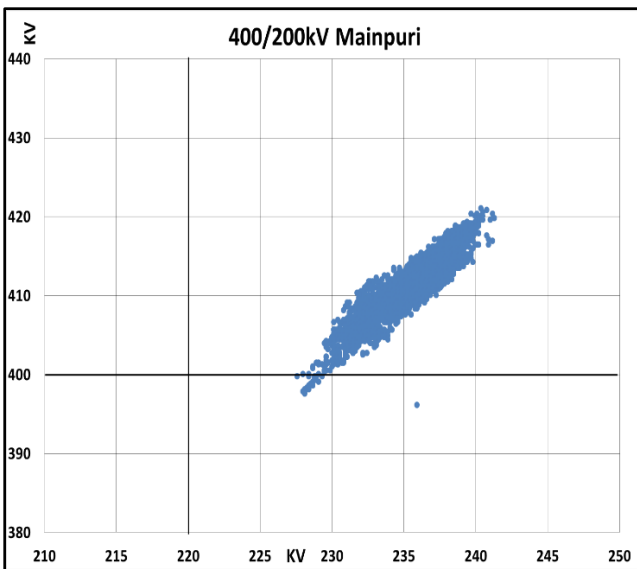
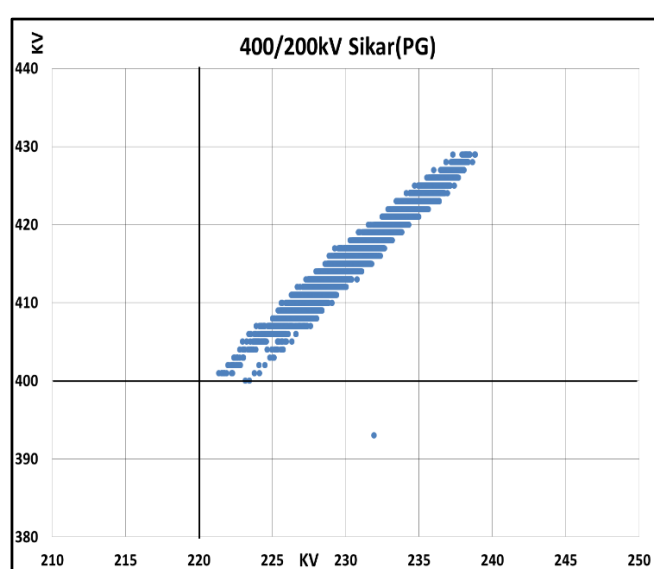
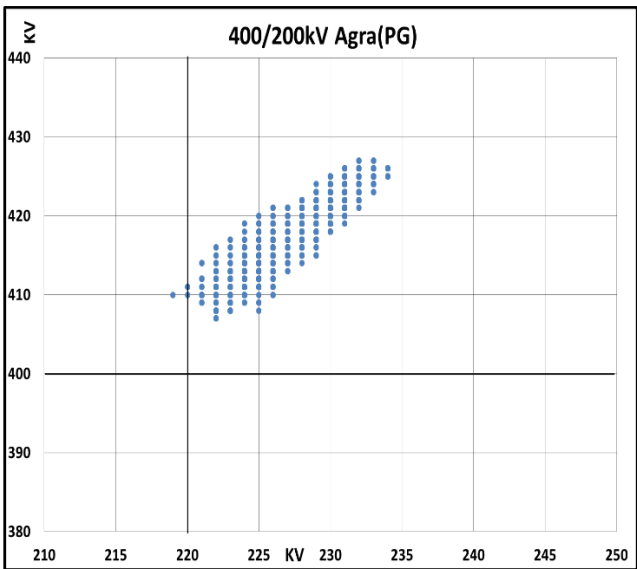
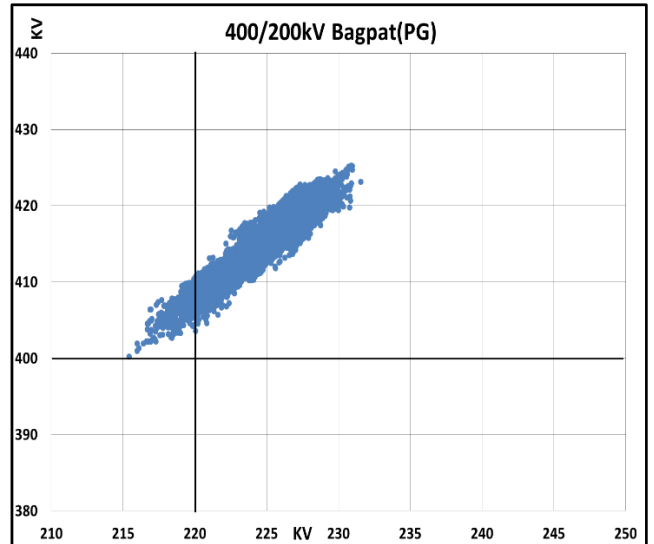
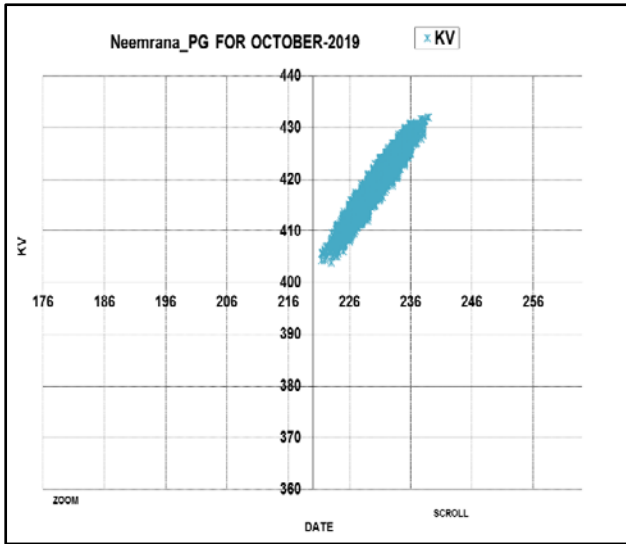
4. Apart from this tap positions of 765/400kV ICTs at Agra(PG), Fatehpur, Unnao(PG) may be reduced by 2 positions after consultation with NLDC.

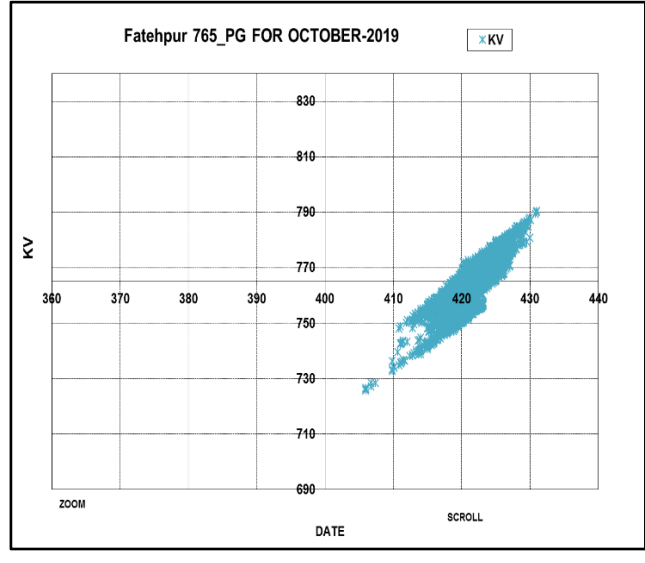
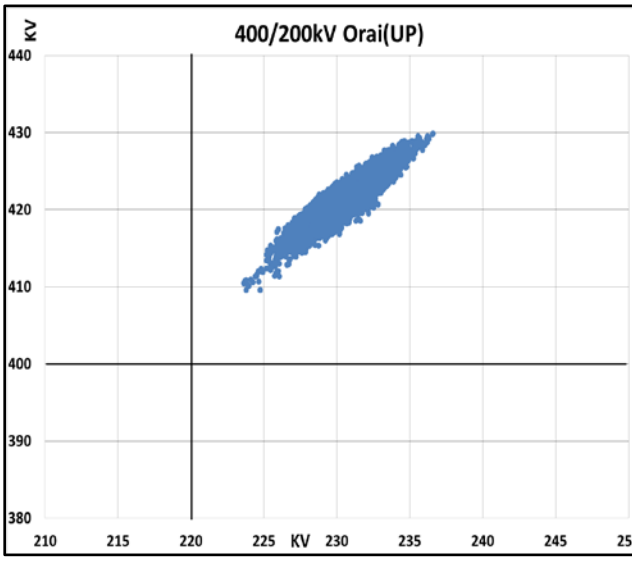
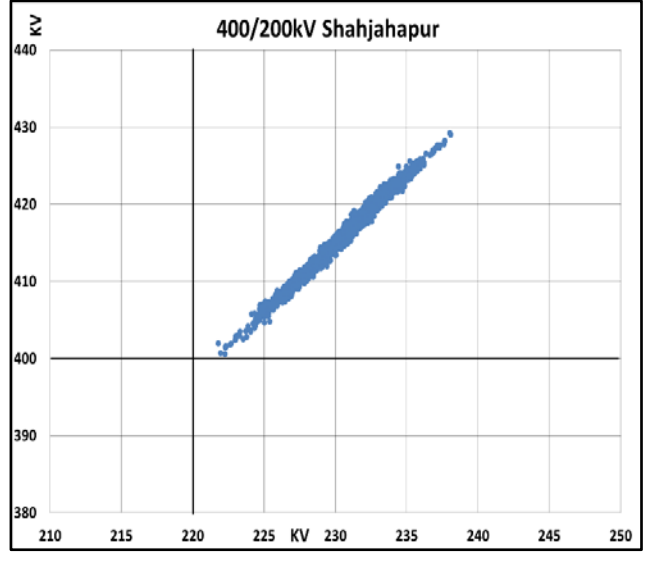
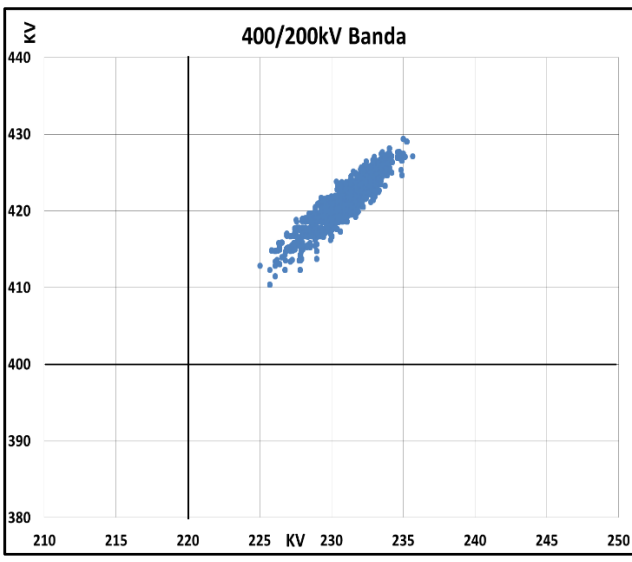
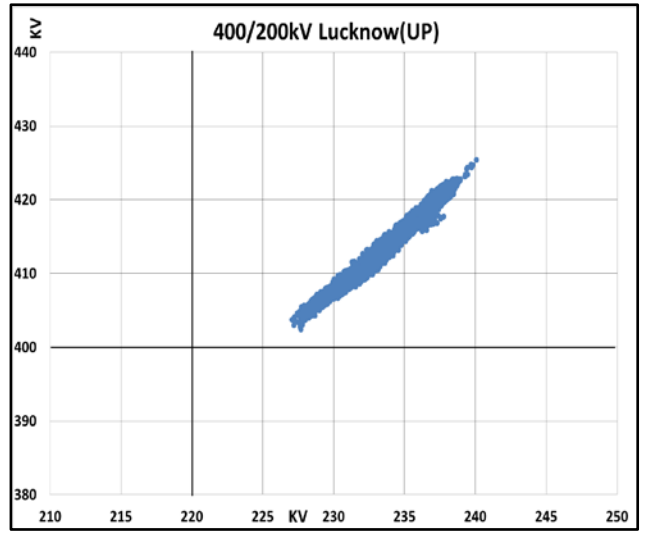
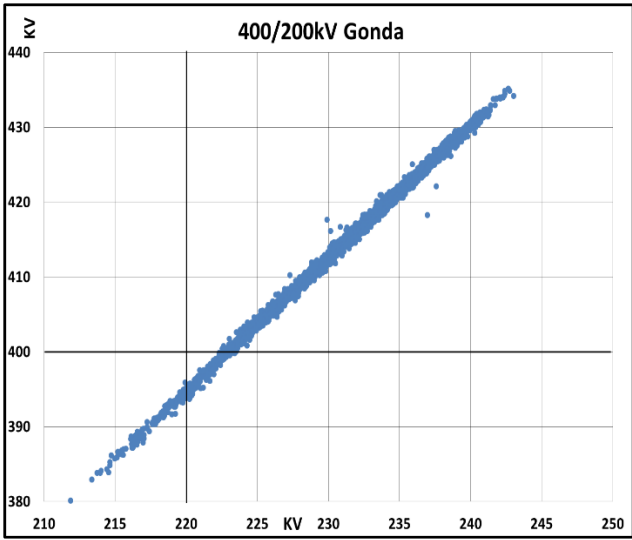
Annexure

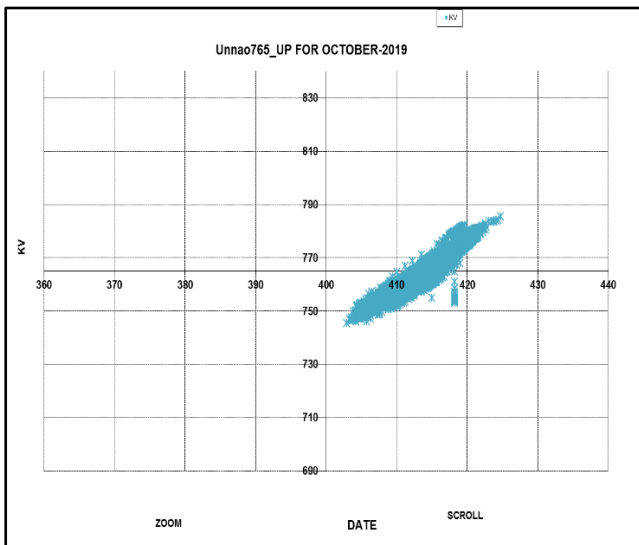
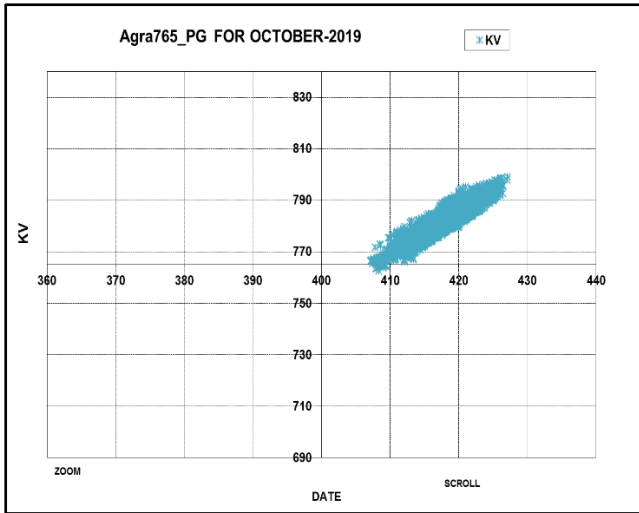




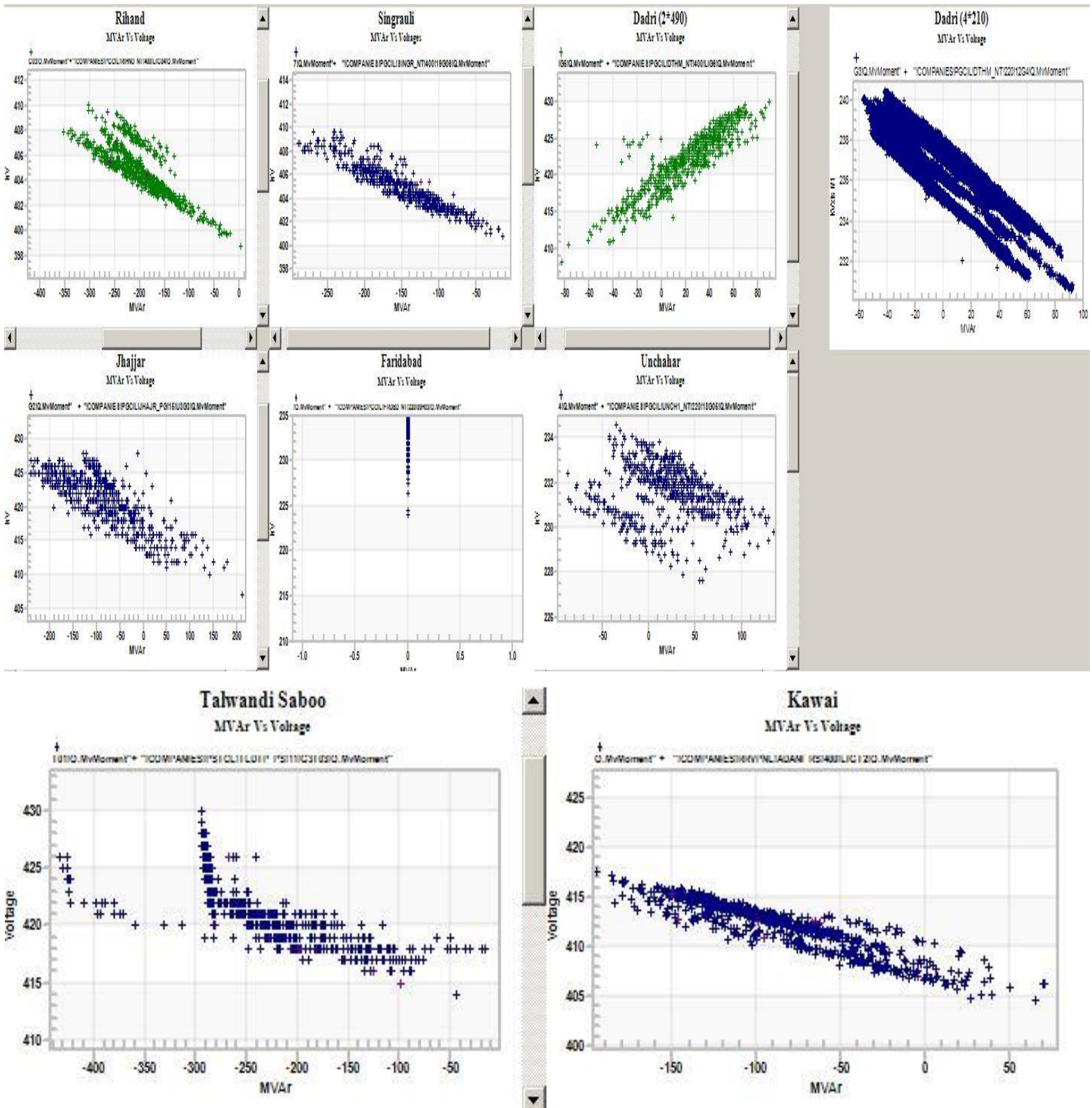


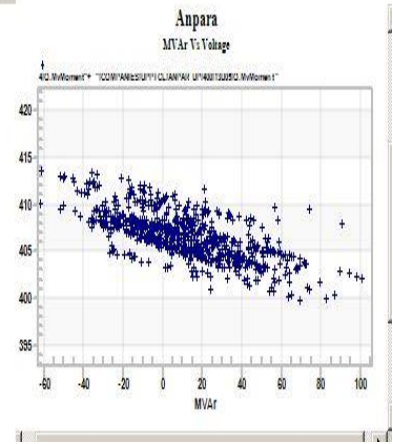
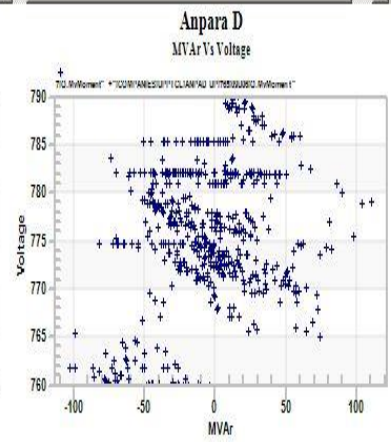
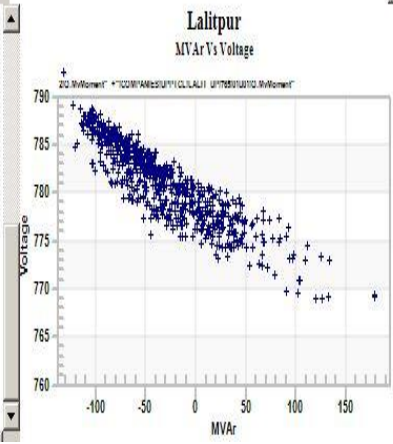
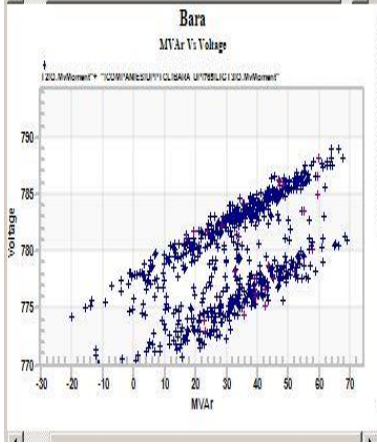
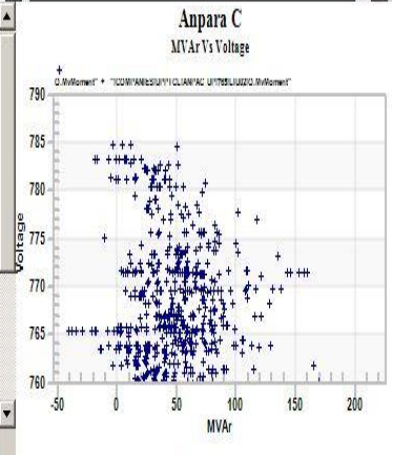
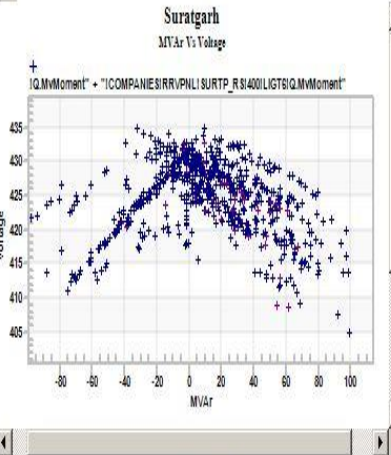
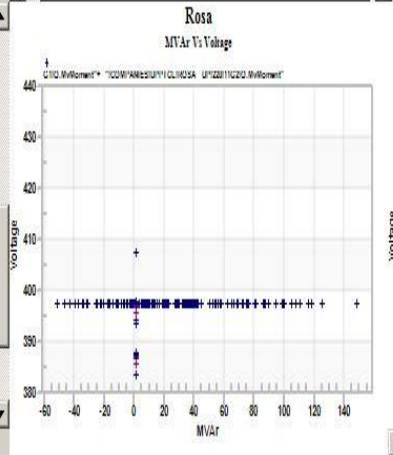
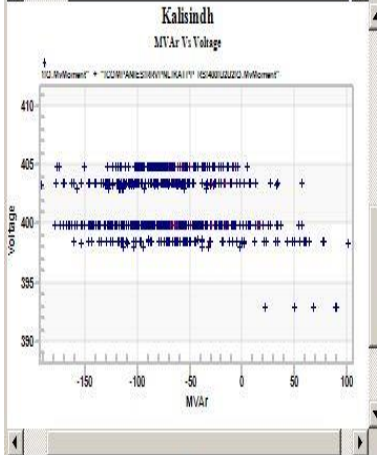
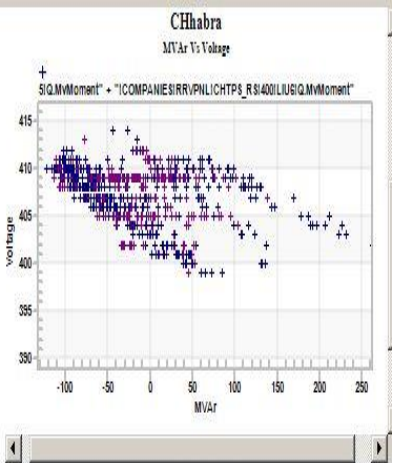
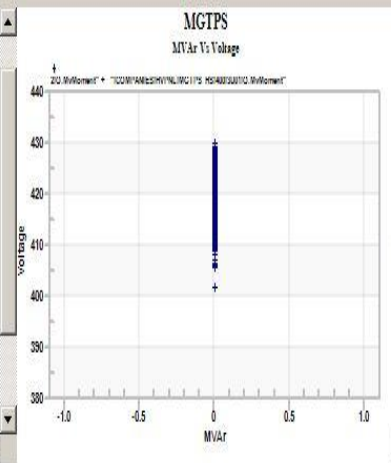
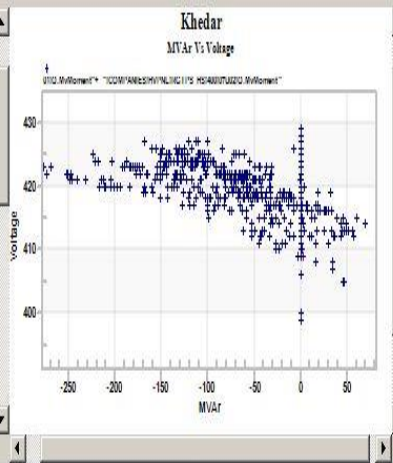
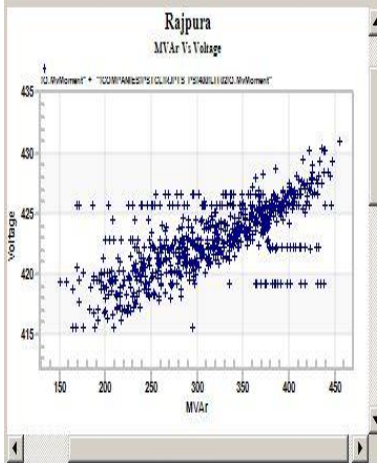






MVAR Performance of Generators





Annexure-B.4

S. NO.	Element Name	Outage Date	Outage Time	Reason/Remarks
1	400kV Muradnagar(UP)-Mathura(UP)	10-Oct-19	22:09	B-N fault, 59.3km from Mathura(UP) end. As per PMU, B-N fault occurred, successful autoreclosing is observed.
		13-Oct-19	02:01	B-N fault. As per PMU, B-N fault and unsuccessful auto-reclosing observed.
		14-Oct-19	05:24	B-N fault. As per PMU, B-N fault occurred, successful autoreclosing is observed.
		20-Oct-19	15:01	R-N fault, 19.9km from Mathura(UP) end. As per PMU, B-N fault and unsuccessful auto-reclosing observed.
		24-Oct-19	14:06	B-N fault. As per PMU, B-N fault occurred, no auto-reclosing observed.
		31-Oct-19	02:45	Y-N fault. As per PMU, Y-N fault and unsuccessful auto-reclosing observed.
2	400kV Anpara(UP)-Mau(UP)	1-Oct-19	12:50	B-N fault. As per PMU, B-N fault and unsuccessful auto-reclosing observed.
		5-Oct-19	17:56	Due To tripping Of 400kV Varanasi(PG)-Sarnath(UP) ckt-1. As per PMU, R-N fault occurred, no auto-reclosing observed.
		7-Oct-19	17:29	B-N fault, 132 Km from Mau(UP) end. As per PMU, B-N fault occurred, no auto-reclosing observed.
		8-Oct-19	15:20	B-N fault, 213 Km from Mau(UP) end. As per PMU, B-N fault occurred, no auto-reclosing observed.
		21-Oct-19	00:37	B-N fault. As per PMU, B-N fault and unsuccessful auto-reclosing observed.
3	400kV Suratgarh(RS)-Bikaner(RS) ckt-1	15-Oct-19	02:58	Y-B fault. As per PMU, No fault observed.
		19-Oct-19	17:33	R-N fault. As per PMU, Y-N fault occurred, no auto-reclosing observed.
		23-Oct-19	20:28	R-N fault. As per PMU, B-N fault occurred, no auto-reclosing observed.
		24-Oct-19	19:42	R-N fault. As per PMU, Y-N fault occurred, no auto-reclosing observed.
4	400kV Amritsar(PG)-Makhu(PS) ckt-1	25-Oct-19	17:34	R-N fault. As per PMU, multiple faults are observed.
		29-Oct-19	11:34	R-N fault. As per PMU, R-N fault and unsuccessful auto-reclosing observed.
		30-Oct-19	21:05	Over Voltage. As per PMU, No fault observed.
5	400kV Dadri(NT)-Mandola(PG)	3-Oct-19	12:27	DT received at Mandola(PG) end. As per PMU, No fault observed.
		8-Oct-19	00:49	DT received at Mandola(PG) end. As per PMU, No fault observed.
		9-Oct-19	12:20	DT received at Mandola(PG) end. As per PMU, No fault observed.
6	400kV Hindaun(RS)-Chhabra(RS)	5-Oct-19	02:54	B-N fault. As per PMU, Y-N fault occurred, no auto-reclosing observed.
		6-Oct-19	22:46	R-B fault. As per PMU, Y-B fault is observed.
		14-Oct-19	06:12	Distance Protection operated from Chhabra(Raj) end. As per PMU, Y-N fault occurred, no auto-reclosing observed.
7	400kV Muzaffarnagar(UP)-Ataur(UP)	1-Oct-19	17:05	R-N fault. As per PMU, No fault observed.
		12-Oct-19	20:11	B-N fault, 36Km from Muzaffarnagar(UP) end. As per PMU, B-N fault occurred, no auto-reclosing observed.
		24-Oct-19	11:21	R-N fault, 104.4Km from Ataur(UP) end. As per PMU, R-N fault occurred, no auto-reclosing observed.

ANNEXURE B.5

S.No.	Region	Name of Elements (Tripped/Manually opened)	Owner/ Agency	Outage		Event (As reported)	Generation Loss(MW)	Load Loss(MW)	Category as per CEA Grid Standards	Energy Unreserved (in MU)	Preliminary Report receipt status			DR/EL receipt status			Detailed Report receipt status		Fault Clearance time (in ms)
				Date	Time						within 24hrs	after 24hrs	Not Received	within 24hrs	after 24hrs	Not Received	Received	Not Received	
1	NR	1) 220kV Bawana(DTL)-Kanjawala(DTL) ckt-1 2) 220kV Bawana(DTL)-Kanjawala(DTL) ckt-2	Delhi	3-Oct-19	13:24	220kV Bawana(DTL)-Kanjawala(DTL) ckt-1 & 2 tripped on operation of distance protection. As per PMU, B-N fault is observed in the system. In antecedent conditions, 220kV Bawana(DTL)-Kanjawala(DTL) ckt-1 & 2 carrying 51MW & 49MW respectively.		75	GD-1	0.01	Y(Delhi)				Y(Delhi)	Y(Delhi)	240ms		
2	NR	1) 400kV Sambhal(PG)-Amargah(NRSS29) ckt-1 2) 400kV Sambhal(PG)-Amargah(NRSS29) ckt-2	POWERGRID & NRSS29	3-Oct-19	16:59	400kV Sambhal(PG)-Amargah(NRSS29) ckt-1 & 2 tripped on B-N fault. As per PMU, multiple faultz(R-Y fault followed by Y-N & B-N fault) are observed in the system. In antecedent conditions, 400kV Sambhal(PG)-Amargah(NRSS29) ckt-1 & 2 carrying 67MW & 69MW respectively.			GI-2			Y(PG), Y(NRSS29)		Y(PG), Y(NRSS29)	Y(PG), Y(NRSS29)	80ms, 80ms & 80ms.			
3	NR	1) 765kV Lalitpur(UP)-Fatehabad(UP) ckt-1 2) 220kV Lalitpur(UP)-Jhansi(UP) ckt-1 3) 220kV Lalitpur(UP)-Jhansi(UP) ckt-2 4) 220kV Lalitpur(UP)-Lalitpur(UP) ckt-1 5) 220kV Lalitpur(UP)-Lalitpur(UP) ckt-2 6) 650MW Unit#1 at 765kV Lalitpur(UP) 7) 650MW Unit#2 at 765kV Lalitpur(UP)	UP	5-Oct-19	13:00	765kV Lalitpur(UP)-Fatehabad(UP) ckt-2 tripped on B-N fault at 1100hrs. During charging of 765kV Lalitpur(UP)-Fatehabad(UP) ckt-2, 765kV Lalitpur(UP)-Fatehabad(UP) ckt-1 tripped on DT received from Fatehabad(UP) end due to overvoltage at Fatehabad(UP) end. Due to SPS operation, Unit#2 tripped and Unit#1 comes on house load. As per PMU, No fault is observed in the system. In antecedent conditions, 765kV Lalitpur(UP)-Fatehabad(UP) ckt-1 carrying 631MW.	650		GD-1		Y(UP)		Y(UP)		Y(UP)	NA			
4	NR	1) 400kV Agra(UP)-Unnao(UP) 2) 400kV Agra(UP)-Fatehabad(765kV) ckt-1 3) 400kV Agra(UP)-Agra(PG)	UP	5-Oct-19	13:10	400kV Agra(UP)-Unnao(UP), 400kV Agra(UP)-Fatehabad(765kV) ckt-1 & 400kV Agra(UP)-Agra(PG) tripped on B-N fault. All lines tripped on operation of Zone2 protection. As per PMU, B-N fault with delayed clearance is observed. In antecedent conditions, 400kV Agra(UP)-Unnao(UP), 400kV Agra(UP)-Fatehabad(765kV) ckt-1 & 400kV Agra(UP)-Agra(PG) carrying 46MW, 40MW & 389MW respectively.		200	GD-1	0.56		Y(UP)		Y(UP)	Y(UP)	360ms.			
5	NR	1) 400kV Samath(UP)-Anpara(UP) ckt-1 2) 400kV Samath(UP)-Anpara(UP) ckt-2 3) 400kV Samath(UP)-Varanasi(PG) ckt-1 4) 400kV Samath(UP)-Varanasi(PG) ckt-2 5) 400kV Samath(UP)-Azamgarh(UP) 6) 315MVA ICT 2 at 400/220kV Samath(UP) 7) 500MVA ICT 2 at 400/220kV Samath(UP) 8) 315MVA ICT 3 at 400/220kV Samath(UP) 9) 400kV Anpara(UP)-Maui(UP)	UP & POWERGRID	5-Oct-19	17:54	400kV Samath(UP)-Varanasi(PG) ckt-1 CT busted at 400/220kV Samath(UP) caused the operation of Bus bar protection at Samath leading to multiple elements tripping at samath end. As per PMU, R-N fault is observed in the system. In antecedent conditions, 315MVA ICT 1, 500MVA ICT 2 & 315MVA ICT 3 at 400/220kV Samath(UP) carrying 148MW, 227MW & 150MW respectively.		450	GD-1	0.42		Y(UP), Y(PG)		Y(UP), Y(PG)	Y(UP)	80ms			
6	NR	1) 220kV Dohna(UP)-Rosa(UP) 2) 220kV Dohna(UP)-Bareilly(UP) ckt-1 3) 220kV Dohna(UP)-Bareilly(UP) ckt-2 4) 220kV Dohna(UP)-CB Ganj(UP) 5) 40MW Unit#1 at 220kV Tanakpur(NHPC) 6) 40MW Unit#2 at 220kV Tanakpur(NHPC) 7) 40MW Unit#3 at 220kV Tanakpur(NHPC)	UP & NHPC	6-Oct-19	19:06	Black out at Dohna(UP) occurred at 19:06 hrs due to sparking at ICT leading to a load loss of 150 MW. Load revived by 2338hrs after charging of 220kV Dohna(UP)-CB Ganj(UP). At the same time, All the three units (generating 98 MW) at 220kV Tanakpur(NHPC) also tripped due to heavy jerk. Total generation at 220kV Tanakpur(NHPC) revived by 2000hrs. As per PMU, three phase fault is observed in the system.	98	150	GD-1	0.68	Y(NHPC)	Y(UP)	Y(NHPC)	Y(UP)	Y(UP)	Y(NHPC)	320ms		
7	NR	1) 220kV Fatehpur(UP)-Fatehpur(PG) ckt-1 2) 220kV Fatehpur(UP)-Fatehpur(PG) ckt-2 3) 220kV Fatehpur(UP)-Unchahar(NTPC) ckt-1 4) 220kV Fatehpur(UP)-Unchahar(NTPC) ckt-2 5) 220kV Fatehpur(UP)-Allahabad Cantt(UP) 6) 220kV Fatehpur(UP)-Banda(UP) 7) 220kV Fatehpur(UP)-Sirathu(UP)	UP, POWERGRID & NTPC	6-Oct-19	23:35	Load loss of 200 MW in UP occurred after tripping of 06 Nos. of 220 KV lines from 220 KV Fatehpur(UP). Load revived after charging of lines from 0200 hrs 220 KV Fatehpur-Banda to 0200 hrs 220KV Fatehpur(UP)-Fatehpur(PG) ckt-2). As per PMU, Y-N fault is observed in the system. In antecedent conditions, 220kV Fatehpur(UP)-Fatehpur(PG) ckt-1 & 2 carrying 33MW each and 220kV Fatehpur(UP)-Unchahar(NTPC) ckt-1 & 2 carrying 70MW each.		200	GD-1	0.08		Y(UP), Y(PG)	Y(NTPC)	Y(PG)	Y(NTPC), Y(UP)	Y(UP)	240ms		
8	NR	1) 400kV Agra(PG)-Agra(UP) 2) 800kV HVDC Agra(PG)-BNC(PG) Pole-3 3) 1500MVA 765/400kV ICT 1 at Agra(PG) 4) 1500MVA 765/400kV ICT 2 at Agra(PG)	POWERGRID & UP	7-Oct-19	13:33	400kV Agra(PG)-Agra(UP) tripped due to blast in Y-phase LA at Agra(PG) end. At the same time, 800kV HVDC Agra(PG)-BNC(PG) Pole-3 also tripped. As per PMU, Y-N fault with unsuccessful autoreclosing is observed. In antecedent conditions, 1500MVA ICT 1 & 2 carrying 139MW & 137MW respectively, 400kV Agra(PG)-Agra(UP) carrying 175MW and 800kV HVDC Agra(PG)-BNC(PG) Pole-3 carrying 315MW.			GI-2			Y(PG), Y(UP)		Y(PG), Y(UP)	Y(PG)	80ms.			
9	NR	1) 400kV Anta(NTPC)-Kota(PG) 2) 400kV Kota(PG)-RAPP C ckt-2	POWERGRID, NTPC & NPCIL	10-Oct-19	7:26	400kV Anta(NTPC)-Kota(PG) tripped due to fire occurred in R-Ph wave trap at Kota(PG) end. At the same time, 400kV Kota(PG)-RAPP C also tripped. As per PMU, fluctuations observed in the R-phase voltage. In antecedent conditions, 400kV Anta(NTPC)-Kota(PG) & 400kV Kota(PG)-RAPP C ckt-2 carrying 870MW & 31MW respectively.			GI-2		Y(NPCIL)	Y(PG), Y(NTPC)	Y(NPCIL), Y(PG)	Y(NTPC)	Y(PG)	NA			
10	NR	1) 400kV Atau(UP)-Muzaffarnagar(UP) 2) 315MVA ICT 3 at 400/220kV Muzaffarnagar(UP) 3) 400kV Alankanda-Muzaffarnagar(UP)	UP	12-Oct-19	20:11	400kV Atau(UP)-Muzaffarnagar(UP) tripped on B-N fault, 30km from Muzaffarnagar end. At the same time, 315MVA ICT 3 & 400 KV Alankanda-Muzaffarnagar(UP) also tripped due to operation of Bus-bar protection at Muzaffarnagar. As per PMU, B-N fault is observed in the system. In antecedent conditions, 400kV Alankanda-Muzaffarnagar(UP) & 400kV Atau(UP)-Muzaffarnagar(UP) carrying 235MW & 89MW respectively.			GI-2		Y(UP)		Y(UP)	Y(UP)	80ms.				
11	NR	1) 220kV Hissar(PG)-Hissar IA(HVPLN) ckt-1 2) 220kV Hissar(PG)-Hissar IA(HVPLN) ckt-2	Haryana & POWERGRID	16-Oct-19	10:40	220kV Hissar(PG)-Hissar IA(HVPLN) ckt-1 & 2 tripped on operation of distance protection. As per PMU, No fault is observed in the system. In antecedent conditions, 220kV Hissar(PG)-Hissar IA(HVPLN) ckt-1 & 2 carrying 99MW & 102MW respectively.			GI-2			Y(PG), Y(Har)		Y(PG), Y(Har)	Y(PG), Y(Har)	NA.			
12	NR	1) 400kV Bus 1 at 400kV Jharkri(SIVNL) 2) 80MVAR Bus reactor at 400kV Jharkri(SIVNL) 3) 400kV Jharkri(SIVNL)-Karcham(SW) ckt-1 4) 400kV Jharkri(SIVNL)-Ranchhulal(PG) ckt-1 5) 400kV Jharkri(SIVNL)-Rampur(SIVNL) ckt-1 6) 250MW Unit#4 at Karcham(SW)	SIVNL, JSW & POWERGRID	17-Oct-19	12:58	B-phase bushing of the 80MVAR Bus reactor at 400kV Jharkri(SIVNL) blasted resulting in operation of Bus-bar protection of 400kV Bus 1 at Jharkri(SIVNL). It seems that 250MW Unit#4 at Karcham(SW) also tripped at the same time. As per PMU, B-N fault is observed in the system. In antecedent conditions, 400kV Jharkri(SIVNL)-Karcham(SW) ckt-1, 400kV Jharkri(SIVNL)-Panchkula(PG) ckt-1 & 400kV Jharkri(SIVNL)-Rampur(SIVNL) ckt-1 carrying 121MW, 71MW & 171MW respectively.	220		GD-1		Y(SIVNL)	Y(JSW), Y(PG)	Y(SIVNL)	Y(JSW), Y(PG)	Y(SIVNL)	80ms.			
13	NR	1) 220kV Sonapat(PG)-Mohana(HVPLN) ckt-2 2) 315MVA ICT 1 at 400/220kV Sonapat(PG)	Haryana & POWERGRID	17-Oct-19	13:55	315MVA ICT 1 at 400/220kV Sonapat(PG) on directional earth fault protection due to Fault at remote end (Between Mohana And Samalkha) which was not Cleared at Mohana end. 220kV Sonapat(PG)-Mohana(HVPLN) ckt-2 also tripped. As per PMU, Y-N fault with delayed clearance is observed. In antecedent conditions, 315MVA ICT 1 at 400/220kV Sonapat(PG) carrying 214MW.		100	GD-1	0.08		Y(PG), Y(Har)		Y(PG), Y(Har)	Y(PG)	1360ms.			
14	NR	1) 400kV Agra(UP)-Unnao(UP) 2) 400kV Unnao(UP)-Panki(UP)	UP	18-Oct-19	5:11	400kV Unnao(UP)-Panki(UP) tripped on R-N fault. At the same time, 400kV Agra(UP)-Unnao(UP) also tripped. As per PMU, R-N fault with no auto-reclosing is observed. In antecedent conditions, 400kV Unnao(UP)-Panki(UP) & 400kV Agra(UP)-Unnao(UP) carrying 127MW & 40MW respectively.			GI-2		Y(UP)		Y(UP)	Y(UP)	80ms.				

S.No.	Region	Name of Elements (Tripped/Manually opened)	Owner/ Agency	Outage		Event (As reported)	Generation Loss(MW)	Load Loss(MW)	Category as per CEA Grid Standards	Energy Unreserved (in MU)	Preliminary Report receipt status			DR/EL receipt status			Detailed Report receipt status		Fault Clearance time (in ms)
				Date	Time						within 24hrs	after 24hrs	Not Received	within 24hrs	after 24hrs	Not Received	Received	Not Received	
15	NR	1) 220kV Panipat(BBMB)-Narela(DTL) ckt-1 2) 220kV Panipat(BBMB)-Narela(DTL) ckt-3 3) 220kV Panipat(BBMB)-Panipat TPS(HVPLN) ckt-1 4) 220kV Panipat(BBMB)-Panipat TPS(HVPLN) ckt-3 5) 220kV Panipat(BBMB)-Panipat TPS(HVPLN) ckt-4 6) 220kV Panipat(BBMB)-Chajpur(HVPLN) ckt-1 7) 220kV Panipat(BBMB)-Chajpur(HVPLN) ckt-2 8) 220kV Panipat(BBMB)-Dhulkote(BBMB) ckt-1 9) 220kV Panipat(BBMB)-Pipil(BBMB) 10) 450MVA ICT 1 at 400/220kV Panipat(BBMB)	BBMB, Haryana & Delhi	19-Oct-19	4:14	Multiple elements tripped due to tripping of 220kV Bus-1 at 400/220kV Panipat(BBMB). As per PMU, R-N fault followed by Y-N fault is observed in the system. In antecedent conditions, 450MVA ICT 1 at 400/220kV Panipat(BBMB) carrying 152MW.		100	GD-1	0.64		Y(BBMB)	Y(Har), Y(Delhi)	Y(BBMB)	Y(Har), Y(Delhi)	Y(BBMB)		80ms & 80ms.	
16	NR	1) 220kV Jamalpur(BBMB)-Ganguwala(BBMB) ckt-1 2) 220kV Jamalpur(BBMB)-Jalandhar(BBMB) ckt-1 3) 220kV Jamalpur(BBMB)-Sangrur(BBMB) ckt-1 4) 220kV Jamalpur(BBMB)-Bhakra R(BBMB) ckt-1 5) 220kV Jamalpur(BBMB)-Dhandar(Pun) ckt-2 6) 100MVA 220/66kV ICT 1 at Jamalpur(BBMB) 7) 100MVA 220/66kV ICT 2 at Jamalpur(BBMB) 8) 100MVA 220/66kV ICT 3 at Jamalpur(BBMB) 9) 100MVA 220/132kV ICT 1 at Jamalpur(BBMB) 10) 100MVA 220/132kV ICT 3 at Jamalpur(BBMB) 11) 220kV Bus 1 at Jamalpur(BBMB)	BBMB & Punjab	19-Oct-19	12:18	Flash Of disks Of R-phase jumper Of 100MVA 220/132kV ICT 3 at Jamalpur(BBMB) occurred resulting in tripping of multiple elements. As per PMU, B-N fault is observed in the system. In antecedent conditions, 100MVA 220/66kV ICT 1, 2 & 3 at Jamalpur(BBMB) carrying 71MW, 71MW & 36MW respectively.		180	GD-1	1.01		Y(BBMB), Y(Pun)		Y(BBMB), Y(Pun)		Y(BBMB)		80ms.	
17	NR	1) 400kV Bus 2 at Nakodar(PSTCL) 2) 400kV Nakodar(PSTCL)-Rajpura TPS(PSTCL) ckt-1 3) 400kV Nakodar(PSTCL)-Makhu(PSTCL) ckt-2 4) 400kV Nakodar(PSTCL)-Jalandhar(PG)	Punjab & POWERGRID	21-Oct-19	14:05	400kV Bus 2 at Nakodar(PSTCL) tripped due to relay maloperation resulting in tripping of 400kV Nakodar(PSTCL)-Rajpura TPS(PSTCL) ckt-1, 400kV Nakodar(PSTCL)-Makhu(PSTCL) ckt-2 & 400kV Nakodar(PSTCL)-Jalandhar(PG). 400kV Bus 1 was already under shutdown for periodic maintenance. As per PMU, No fault is observed in the system. In antecedent conditions, 400kV Nakodar(PSTCL)-Rajpura TPS(PSTCL) ckt-1, 400kV Nakodar(PSTCL)-Makhu(PSTCL) ckt-2 & 400kV Nakodar(PSTCL)-Jalandhar(PG) carrying 238MW, 60MW & 186MW respectively.			GI-2			Y(PG), Y(Pun)		Y(PG), Y(Pun)		Y(Pun)		NA	
18	NR	1) 500MVA ICT 2 at 400/220kV Bannaull(DTL) 2) 500MVA ICT 3 at 400/220kV Bannaull(DTL)	Delhi	21-Oct-19	18:00	There is a Bus split arrangement at 400kV Bannaull because of commissioning of new Bus Bar Protection Scheme. The elements connected to 400kV Bus-1 were 400kV Tuglakabad Ckt-1, 400kV Jhatkara Ckt-I, 500MVA ICT - II & III. 500MVA ICT 2 & ICT 3 at 400/220kV Bannaull(DTL) due to relay maloperation while working on new Bus Bar Protection scheme. The load of 220kV Najalgarh, 220kV Papankalan-I, 220kV Papankalan-III & 220kV Naraina were running through 500MVA ICT-II & III. As per PMU, No fault is observed in the system. In antecedent conditions, 500MVA ICT 2 & ICT 3 carrying 236MW each.		379	GD-1	0.02		Y(Delhi)			Y(Delhi)		Y(Delhi)		NA
19	NR	1) 400kV Banala(PG)-Hamirpur(PG) 2) 400kV Banala(PG)-Parbati 3 HEP(NHPC) 3) 400kV Parbati 3 HEP(NHPC)-Sainj HEP(HP) 4) 400kV Parbati 2 HEP(NHPC)-Sainj HEP(HP) 5) 130MW Unit#2, #3 at Parbati 3 HEP(NHPC) 6) 50MW Unit#1, #2 at Sainj HEP(HP)	POWERGRID, NHPC & HP	21-Oct-19	18:29	400kV Banala(PG)-Hamirpur(PG) tripped on Y-N fault. Due to loss of the only evacuation line (400kV Banala-Hamirpur line) All units of Parbati complex tripped on Over speed. As per PMU, Y-N fault with no auto-reclosing is observed. In antecedent conditions, 400kV Banala(PG)-Hamirpur(PG) carrying 499MW & Parbati 3 HEP(NHPC) generating 352MW.		500	GD-1			Y(NHPC)	Y(PG), Y(HP)	Y(NHPC)	Y(PG), Y(HP)	Y(NHPC)	Y(PG)	80ms.	
20	NR	1) 220kV Dhauliganga(NHPC)-Pithoragarh(PG) 2) 220kV Dhauliganga(NHPC)-Bareilly(UP)	NHPC, POWERGRID & UP	23-Oct-19	11:35	220kV Dhauliganga(NHPC)-Pithoragarh(PG) tripped due to DT received at Pithoragarh end. At the same time, 220kV Dhauliganga(NHPC)-Bareilly(UP) tripped on overvoltage. As per PMU, B-N fault is observed in the system. In antecedent conditions, No generation was there in 220kV Dhauliganga(NHPC).			GI-2			Y(NHPC), Y(PG), Y(UP)		Y(NHPC), Y(PG), Y(UP)		Y(NHPC)		120ms.	
21	NR	1) 220kV Panipat(BBMB)-Narela(DTL) ckt-1 2) 220kV Panipat(BBMB)-Narela(DTL) ckt-2 3) 220kV Panipat(BBMB)-Narela(DTL) ckt-3 4) 220kV Panipat(BBMB)-Panipat TPS(HVPLN) ckt-1 5) 220kV Panipat(BBMB)-Panipat TPS(HVPLN) ckt-2 6) 220kV Panipat(BBMB)-Panipat TPS(HVPLN) ckt-3 7) 220kV Panipat(BBMB)-Panipat TPS(HVPLN) ckt-4 8) 220kV Panipat(BBMB)-Chajpur(HVPLN) ckt-1 9) 220kV Panipat(BBMB)-Dhulkote(BBMB) ckt-1 10) 220kV Panipat(BBMB)-Dhulkote(BBMB) ckt-2 11) 220kV Panipat(BBMB)-Pipil(BBMB) 12) 450MVA ICT 1 at 400/220kV Panipat(BBMB)	BBMB, Haryana & Delhi	23-Oct-19	17:56	Multiple elements tripped due to tripping of operation of Bus bar protection at 400/220kV Panipat(BBMB). As per PMU, B-N fault is observed in the system.		150	GD-1	0.10		Y(BBMB)	Y(Har), Y(Delhi)	Y(BBMB)	Y(Har), Y(Delhi)	Y(BBMB)		80ms.	
22	NR	1) 220kV Bairasul(NHPC)-Jassure(HP) 2) 220kV Bairasul(NHPC)-Pong(BBMB)	POWERGRID, NHPC, HP & BBMB	27-Oct-19	21:34	220kV Bairasul(NHPC)-Jassure(HP) & 220kV Bairasul(NHPC)-Pong(BBMB) tripped on three phase fault. As per PMU, No fault is observed in the system. In antecedent conditions, No generation was there in 220kV Bairasul(NHPC).			GI-2			Y(NHPC)	Y(HP), Y(BBMB)	Y(NHPC)	Y(HP), Y(BBMB)	Y(NHPC)		NA	

Northern Regional inter regional lines tripping for Sep-19

ANNEXURE-B.6

S. No.	Name of Transmission Element Tripped	Owner/ Utility	Outage		Load Loss/ Gen. Loss	Brief Reason (As reported)	Category as per CEA Grid standards	Restoration		# Fault Clearance Time (>100 ms for 400 kV and 160 ms for 220 kV)	*FIR Furnished (YES/NO)	DR/EL provided in 24 hrs (YES/NO)	Other Protection Issues and Non Compliance (inference from PMU, utility details)	Suggestive Remedial Measures	Remarks
			Date	Time				Date	Time						
1	132kV Rihand(UP)-Sonenagar(BS) (UP) Ckt-1	UP/BS	10-Oct-19	01:15	Nil	R-N fault.	NA			NA	NO	NO		Details of tripping yet to be received.	From PMU, No fault observed in the system
2	132 kV Sahupuri(UP)-Karamnasa(BS) (UP) Ckt-1	UP/BS	2-Oct-19	22:01	Nil	Line has already tripped.	NA	3-Oct-19	11:15	NA	NO	NO		Details of tripping yet to be received.	From PMU, No fault observed in the system
3	220kV Auraiya(NTPC)-Malanpur(MPPTCL)	NTPC/MP	26-Oct-19	22:51	Nil	Distance Protection.	NA	26-Oct-19	23:29	NO	NO	NO	No auto-reclosing observed.	Auto-reclosing feature of the line to be checked. Details of tripping yet to be received.	From PMU, Y-N fault observed and auto-reclosing not observed.
4	220kV Modak(RRVPNL)-Bhanpura(MPPTCL)	Rajasthan/MP	30-Oct-19	21:56	Nil	Earth Fault.	NA	30-Oct-19	23:55	NA	YES (After 24hrs)	NO			From PMU, No fault observed in the system
5	220kV Sahupuri(UP)-Pusaui(BS) UP ckt-1	UP/BS	2-Oct-19	19:36	Nil	Line Trip From Pusaui end Only At 19:03 Hr.	NA	2-Oct-19	22:33	NO	NO	NO		Details of tripping yet to be received.	From PMU, Y-N fault observed and unsuccessful auto-reclosing observed.
6	400kV Varanasi(PG)-Biharsharif(PG) ckt-2	POWERGRID	2-Oct-19	13:58	Nil	Y-N Fault , 5km from Varanasi(PG) end.	NA	2-Oct-19	15:35	NO	NO	NO		Details of tripping yet to be received.	From PMU, Y-N fault observed and unsuccessful auto-reclosing observed.
7	800kV HVDC Agra-BNC pole 2	POWERGRID	2-Oct-19	10:38	Nil	DC Line Faul b/w APD-BNC Section	NA			NA	YES	YES		Protection Co-ordiantion issue needs to be looked into as fault was in APD-BNC section	Information received from NR end. From PMU, No AC system fault observed.
8	800kV HVDC Agra-BNC pole 3	POWERGRID	7-Oct-19	13:33	Nil	Converter differential protection operated due to Y Phase LA blast Of 400kV Agra(PG)-Agra(up) Line.	NA	7-Oct-19	14:08	NO	YES	YES		Protection Co-ordiantion issue needs to be looked into as fault was not in converter differential zone	Information received from NR end. From PMU, Y-N fault with unsuccessful auto-reclosing is observed in AC system.
9	Vindhyachal HVDC BtB Block 1	POWERGRID	3-Oct-19	09:58	Nil	DC Over Current Protection Operated due To Disturbance In Western Side (NTPC Switch Yard).	NA	3-Oct-19	15:54	NA	NO	NO		Details of tripping yet to be received.	From PMU, No AC system fault observed.
10	Vindhyachal HVDC BtB Block 1	POWERGRID	13-Oct-19	10:39	Nil	DC Over Current Protection Operated.	NA	13-Oct-19	12:54	NA	YES (After 24hrs)	NO			Information received from NR end. From PMU, No AC system fault observed.
11	Vindhyachal HVDC BtB Block 2	POWERGRID	13-Oct-19	10:39	Nil	Outage of 400 kv ntpc/vstps - hvdc feeder#2 from ntpc/vstps end	NA	13-Oct-19	13:02	NA	YES (After 24hrs)	NO			Information received from NR end. From PMU, No AC system fault observed.

Fault Clearance time has been computed using PMU Data from nearest node available and/or DR provided by respective utilities (Annexure- II)

*Yes, if written Preliminary report furnished by constituent(s)

R-Y-B phase sequencing (Red, Yellow, Blue) is used in the list content.All information is as per Northern Region unless specified.

^^ tripping seems to be in order as per PMU data, reported information. However, further details may be awaited.

Reporting of Violation of Regulation for various issues for above tripping

1	Fault Clearance time(>100ms for 400kV and >160ms for 220kV)	1. CEA Grid Standard-3.e 2. CEA Transmission Planning Criteria
2	DR/EL Not provided in 24hrs	1. IEGC 5.2(r) 2. CEA Grid Standard 15.3
3	FIR Not Furnished	1. IEGC 5.9.6.a 2. CEA Grid Standard 12.2 (Applicable for SLDC, ALDC only)
4	Protection System Mal/Non Operation	1. CEA Technical Standard of Electrical Plants and Electric Lines: 43.4.A 2. CEA (Technical Standards for connectivity to the Grid) Regulation, 2007: Schedule Part 1. (6.1, 6.2, 6.3)
5	A/R non operation	1. CEA Technical Standard of Electrical Plants and Electric Lines: 43.4.C 2. CEA Technical Planning Criteria

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