



सत्यमेव जयते

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

संख्या: NRPC/OPR/106/01/2019/1896-1937

दिनांक: 01.03.2018

विषय: उत्तर क्षेत्रीय विद्युत समिति की प्रचालन समन्वय उप-समिति की 156 वीं बैठक का कार्यवृत्त
Minutes of 156th OCC meeting of NRPC.

उत्तर क्षेत्रीय विद्युत समिति की प्रचालन समन्वय उप-समिति की 156 वीं बैठक 12.02.2019 को आयोजित की गयी थी। उक्त बैठक का कार्यवृत्त उत्तर क्षेत्रीय विद्युत समिति की वेबसाइट <http://www.nrpc.gov.in> पर उपलब्ध है। यदि कार्यवृत्त पर कोई टिप्पणी हो तो कार्यवृत्त जारी करने के एक सप्ताह के अन्दर इस कार्यालय को भेजें।

156th meeting of the Operation Co-ordination Sub-Committee of NRPC was held on 12.02.2019. The Minutes of this meeting have been up-loaded on the NRPC web-site <http://www.nrpc.gov.in>. Any comments on the minutes may kindly be submitted within a week of issuance of the minutes.

संलग्नक: यथोपरि

Sd/-

(सौमित्र मजूमदार)
अधीक्षण अभियंता (प्रचालन)

सेवा में,
प्रचालन समन्वय उप-समिति के सभी सदस्य

Minutes of the 156th Meeting of the Operation Coordination Sub-Committee (OCC) of NRPC.

156th meeting of OCC of NRPC was held on 12.02.2019 at NRPC Secretariat, New Delhi. The list of participants of the meeting is attached at Annexure-A

MS, NRPC welcomed all the members of the sub-committee to the 156th OCC meeting. In his opening remarks, he highlighted following points:

- i) As winter was coming to an end and power demand is expected to increase in coming months, MoP has issued few O.M. for compliance of following :

“It has been decided that in view of expected increased power demand in the next few months upto monsoons, all Pithead generation and consequently coal and rake supply (as needed) should be maximized immediately for meeting the needs of current year/next few months and all pit head plants be given full priority in coal and rake allotment for full PLF irrespective of their ACQ/FSA, in this period. Central and state government plants should be given more responsibility and must be encouraged and facilitated to gear up their generation to provide uninterrupted power at appropriate price to consumers. Further, imported coal-based plants are also advised to have adequate stocks to meet demand.”

- ii) CERC vide order dated 31.01.2019 in petition no. 02/SM/2019 (Suo-Motu) has directed POSOCO to implement pilot on Security Constrained Economic Despatch for ISGS pan India. He stated that it's a modified scheduling procedure which is similar to generator bucket filling. The draft detailed procedure to be prepared and submitted to CERC for its approval. He requested all the utilities to submit comments, if any to NRPC/NRLDC at the earliest. He informed that one day workshop would be conducted on SCED at NRPC sect. He requested all the DISCOMs to attend the same. He further requested POSOCO to give presentation on the SCED.

PART-A: NRPC

1. Confirmation of Minutes

The minutes of the 155th OCC meeting held on 16.01.2019 and 17.01.2019 at New Delhi were issued vide letter of even number dated 06.02.2019.

Comments on the minutes were received from NTPC (**Annexure-1**). It was clarified that the naming of Annexure-2D in the minutes was inadvertently missed and the same was already placed on Page 69-71 of the minutes of 155th OCC. Regarding the agenda No. 21, MS, NRPC clarified in the meeting that NTPC was required to submit the details of instances where merit order violations have taken place.

Sub-Committee confirmed the minutes of the 155th OCC meeting without any modification.

2. Review of Grid operations of January 2019

2.1. Anticipated vis-à-vis Actual Power Supply Position (Provisional) January 2019.

Sub Committee was informed that there are much variations (i.e. > 5.0%) in the Anticipated vis-à-vis Actual Power Supply Position (Provisional) for the month of January 2019 in terms of Energy Requirement for HP, J&K, Punjab, Uttarakhand & UP and in terms of Peak Demand for J&K, Punjab & UP.

Punjab

Decrease in demand in terms of MW to the extent of 6049 MW in actual against anticipations of 6760 MW and decline in demand in terms of MU to the extent of 3402 MU in actual against anticipations of 3600 MU attributes to rain in Jan 2019 and thereby leading to decrease in decline of consumption in agricultural sector.

Himanchal Pradesh:

Increase in demand in terms of MU to the extent of 901 MU in actual against anticipations of 838 MU attributes to abrupt changes in weather condition.

Uttar Pradesh:

Decline in demand in terms of MU to the extent of 8645 MU in actual against anticipations of 11160 MU and decline in demand in terms of MW to the extent of 14928 MW in actual against anticipations of 17500 MW attributes to mild weather during Jan-2019.

Uttarakhand:

Decrease in demand in terms of MU to the extent of 1192 MU in actual against anticipations of 1290 MU attributes to sudden changes in weather condition.

The Sub-Committee requested all SLDCs to furnish the provisional and final power supply position in prescribed formats by 2nd and 15th day of the month respectively in compliance to the provision 5.3 of IEGC.

2.2. Power Supply Position for NCR:

The Sub-Committee was informed that the 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 December/2018 is placed on NRPC website www.nrpc.gov.in/operation-category/power-supply-position.

2.3. The highlights of grid operation during December, 2018 are as under:

- Frequency remained within the IEGC band for 70.24% of the time during January 2019, which is more than that of last year during same month (January 2018) when frequency (within IEGC band) remained 77.94% of the time. The maximum and minimum frequencies recorded were 50.25 Hz (22.01.2019 at 02:00 hrs) and 49.62 Hz (01.04.2019 at 07:30) respectively.
- Utilities were requested to take necessary action to further improve the frequency regime viz. by not changing abruptly the loads at block boundaries and assuring primary response from the generators.
- Maximum and minimum load for the region during January 2019 were 48582 MW (15.01.2019 at 18:25 hrs) and 21353 MW (22.01.2019 at 04:05 hrs).
- The average consumption, of the Northern Region, for January 2019, decreased by 2.46% (22.44 MU per day) with respect to the corresponding month in previous year.
- The average Thermal generation in January 2019 decreased by 0.66% (4.08 MU/Day) with respect to the corresponding month in previous year. The details are enclosed at **Annexure 2A**.
- The average Hydro generation in January 2019 increased by 14.11 MU/day with respect to the corresponding month in previous year.
- The average Renewable generation in January 2019 increased by 22.06 MU/Day with respect to the corresponding month in previous year. All utilities were requested to send the data for renewable generation regularly. The reason for the

increase was highlighted as capacity addition, better sunshine & wind. Also, it was added that the telemetry of renewable had improved.

- The average nuclear generation in January 2019 was decreased by 4.07 MU/day per day as compared to corresponding month in previous year.
- The net Average Inter-Regional import decreased by 10.51 MU/day during the month of January 2019, as compared to the corresponding month in previous year.
- The net Average Import from WR decreased by 14.24 MU/day during January 2019 as compared to corresponding month in previous year.
- The net Average Import from ER increased by approximately 19.93 MU/day during January 2019 as compared to corresponding month in previous year.
- The net Average Import from NER was approximately 16.63 MU/day during January 2019.
- The transmission losses are depicted at **Annexure 2B**.
- The STOA summary for January 2019 is placed at **Annexure 2C**.
- The outages of generating Units were discussed in detail and the same is placed at **Annexure 2D**.
- Long outages of transmission lines were discussed & all constituents were requested to revive the elements under long outages at the earliest (**Annexure 2E**).
- The new elements charged were discussed and the list is attached at **Annexure 2F**
- Total outages during January 2019 were 908 including Planned S/D (505) and Forced S/D (Trippings-289+Emergency S/D-114).

3. Maintenance Programme of Generating Units and Transmission Lines

3.1. Maintenance Programme for Generating Units.

The maintenance programme for Generating Units for the month of March, 2019 was discussed on 11.02.2019 at NRPC Secretariat, New Delhi. The approved outages of generating units as per deliberations held in OCC has been issued vide letter of even no. dated 25.02.2019.

3.2. Outage Programme for Transmission Elements.

The maintenance programme for Transmission Elements for the month of March, 2019 was discussed on 11.02.2019 at NRPC Secretariat, New Delhi. The approved outages of generating units as per deliberations held in OCC has been issued vide letter of even no. dated 25.02.2019.

4. Planning of Grid Operation:

4.1. Anticipated Power Supply Position in Northern Region for March, 2019 as per LGBR for 2018-19

Anticipated Power Supply Position in Northern Region for March, 2019 is placed at Annexure 4.

5. Information about variable charges of all the generating units in the Region.

All SLDCs were requested to confirm if the process of Scheduling was being done as per Merit Order Despatch and in case of variations, the reasons may please be furnished.

6. Reactive compensation at 220 kV/400 kV level

6.1 In the 38th TCC & 41st NRPC following elements in NR were approved:

- a) 500 MVAR TCR at 400 kV bus at Kurukshetra S/S of Powergrid.
- b) 30 no. 220 kV bus reactors at 220 kV sub-stations and 18 no. 400 kV bus reactors at 400 kV sub-stations subject to the availability of space.

POWERGRID:

500 MVAR TCR at Kurukshetra: Award placed in January 2019 with completion schedule of 22 months.

DTL:

The updated status of the reactors as received from DTL is placed below:

S.No.	Bus Name	Voltage level (kV)	Reactor (MVAR)	Plg. Status
1	Peeragarhi	220	1x50	PR No 1100002017 Raised.
2	Mundka	400	1x125	Scheme is being placed before BOD,DTL for approval
		220	1x25	
3	Harsh Vihar	220	2x50	Board preamble sent for financial vetting & approval. Scheme shall be placed before BOD,DTL.
4	Electric Lane	220	1x50	Feasibility report received from SS&LM division and site revisited. Accordingly, the Scheme is under preparation.
5	Bamnauli	220	2x25	Under financial concurrence
6	Indraprastha	220	2x25	Under financial concurrence
TOTAL			450	

DTL was requested to pre-pone the commissioning schedule before the onset of winter of 2020.

PSTCL:

PSTCL representative stated that for 400 kV bus reactor at Dhuri substation and 220 kV bus reactors at Dhuri and Nakodar substations, the Technical bids has already been opened and Price bids were put on hold due to pending PSDF approval.

As per the conditions of PSDF funding, it was decided that the LOA would be placed only after approval for PSDF funding. However, the delay in obtaining the PSDF funding approval has delayed the tendering process and the Bidders were now refusing to extend their Bid validity which could lead to jeopardizing the whole process only because of delay in approval of PSDF funding.

Uttarakhand:

125 MVAR reactors at Kashipur: Technical bids have been opened and are under evaluation.

Rajasthan:

Item	Background	Status
3 Nos. each of 25 MVAR (220 KV) reactors for Akal, Bikaner & Suratgarh.	DPR submitted for PSDF funding on 27.04.2018. Reply to the observations of NLDC submitted on 28.07.2018	Approved in the Monitoring Committee of PSDF. Minutes of the Monitoring Committee meeting to be issued.
1 No. of 25 MVAR (220 kV) reactor for Barmer & 125 MVAR (400 kV) reactor for Jodhpur, included in 450 MV A (13x25+1x125 MVA) proposal	Revised DPR for 450 MVAR Reactor after separating STATCOM was submitted vide letter dtd. 12.10.2018 to POSOCO for approval.	Clarifications has been sought by Techno-Economic Sub Group of PSDF from Rajasthan.

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

38th TCC & 41st NRPC meeting: NRPC approved that the capacitor requirement study of NR shall be conducted at 11/33 kV level from CPRI so as to obtain the true requirement of capacitor for FY 2019-20.

7.1. 39th TCC and 42nd NRPC approved the Techno Commercial offer of CPRI of **Rs. 32 lakhs (Rs. 20 lakhs for previous study and Rs. 12 lakhs for additional assignment) excluding taxes** for conducting the capacitor study. In the meeting the format for data submission was shared with the members and they were requested to ensure timely submission of the data so that the study may be carried out in the stipulated time frame.

7.2. In the **150th OCC meeting**, members expressed concerns on the nature of the format and submitted that the format being lengthy would require some time for better understanding the format and submission of data accordingly.

- 7.3. To address the concerns of the members of OCC forum, in the **151st OCC meeting**, representative of CPRI made a detailed presentation explaining the format in the meeting and based on the inputs received from the members, the format has been revised and sent to the respective SLDC's through e-mail dated 24.09.2018. CPRI has also shared a video of the presentation explaining the format uploaded on Youtube at <https://youtu.be/QTxx7owPF3g>.
- 7.4. Members were also requested to initially fill the data format for any one 220 kV or 132 kV substation and send it to CPRI (manoharsingh@cpri.in) to check its suitability for utilization in carrying out the study and further action.
- 7.5. **152nd OCC meeting:** No progress has been made so far in submission of data. All the utilities were again requested to make all out efforts to submit the data so that study can be completed within the time.
- 7.6. **40th TCC & 43rd NRPC meeting:** Members were again requested to expedite submission of the data to CPRI in the format prescribed for studies to be conducted for Capacitor requirement in NR for the year 2019-20.
- 7.7. **153rd OCC meeting:** MS, NRPC expressed his concerns as no data in the specified format has been received from any of the state even for a single substation which was desired to verify its suitability for utilization in carrying out the capacitor study.

Representative of Haryana stated that they had submitted data to which the representative of CPRI replied that the data submitted by Haryana was not in the format as decided in the 151st OCC meeting which was forwarded to all the utilities via e-mail dated 24.09.2018.

Representative of Rajasthan SLDC stated that the load data at 11 kV substations was not being maintained. Therefore, it was not possible for them to furnish the same.

EE (O), NRPC and representative of JVVNL stated that the load data was maintained at 11 kV sub-station and the same may be made available.

Representative of Rajasthan SLDC stated that the same would be verified and the data shall be submitted at the earliest.

- 7.8. The issue of non-submission of data for system study of capacitor requirement in NR for the year 2019-20 has been taken up with the highest management of DISCOMs, STUs and SLDCs. The letter regarding the same dated 06.11.2018 is enclosed at Annexure – Agenda item no 7 of the Agenda of the 154th OCC meeting, for reference.
- 7.9. **154th OCC meeting:** SE (O) stated that the matter is being pursued with the top management of the DISCOMs (refer Annexure – Agenda item no 7 of the Agenda of the 154th OCC meeting). He stated that all SLDCs should take up the issue with their respective DISCOMs for submission of the data as desired at the earliest.
- 7.10. **155th OCC meeting:** MS, NRPC stated that the sample data as received from most of the utilities were not in line as per the requirement of CPRI and the same has also been informed through mail by CPRI to the respective utilities. He further stated that due to non-availability of data in proper format, the study could not be performed and low voltage profile issue may be encountered in future.

Representative of DTL stated that they have incorporated the changes as suggested by CPRI and has again submitted the same to CPRI. Once approved, DTL would start compiling data for their whole network and submit the same to CPRI.

- 7.11. **156th OCC meeting:** All utilities were advised to expedite the collection of data, in the absence of which the study may not be got conducted.

8. Phase nomenclature mismatch issue with BBMB and interconnected stations

- 8.1. The Protection Sub-Committee while discussing multiple elements tripping at 400/220/132kV Dehar HEP of BBMB in its 34th meeting held on 21.04.2017 recommended inter-alia that BBMB should modify phase sequencing at Dehar as Y-B-R instead of R-Y-B. The issue was further deliberated in the 138th OCC meeting held on 23.08.2017, wherein it was observed that phases at BBMB end has inadvertently been marked as outlined below:

Phase of the grid	Corresponding nomenclature of the phase at BBMB end
R Phase	B Phase
Y Phase	R Phase
B Phase	Y Phase

BBMB was asked to rectify the phase nomenclature at their end accordingly.

- 8.2. However, BBMB raised concern that the issue could not be resolved in one go, as coordination would be required from all the concerned utilities to carry out this activity and requested NRPC to form a committee comprising of BBMB and its partner states, utilities with which BBMB has interconnection, NRPC Secretariat and POWERGRID for the same. NRPC in its 41st meeting held on 28th February, 2018 approved the proposed formation of the committee and advised BBMB to resolve the issue within six months.
- BBMB drew a draft action plan which was duly deliberated by the Committee in its 1st meeting held on 04.06.18. The action plan was circulated to all the concerned utilities for - their comments and concurrence. The execution of the action plan was tentatively planned during month of November-December, 2018.
- 8.3. HPSEB and PSTCL agreed with action plan, however, PSTCL was of the view that 400 kV Dehar-Rajpura line is owned by PGCIL and hence the work is to be executed by them. Comments on the action plan were also received from NTPC and POWERGRID. BBMB has agreed with the comments from NTPC and has given their reply on the comments of POWERGRID.
- 8.4. The reply of BBMB vis-à-vis the comments of POWERGRID were deliberated in the 151st OCC meeting wherein members were of the view that reply of BBMB was generally in order. However, POWERGRID representative stated that the matter pertains with NR-I and NR-II region of POWERGRID and final decision regarding the same is to be taken up at the level Executive Directors of respective regions.
- 8.5. Accordingly, the matter was taken up vide letter of even number dated 07.10.2018 for POWERGRID consent to the action plan. However, reply of the same is still awaited.
- 8.6. **152nd OCC meeting:** POWERGRID representative assured that the issue will be resolved with BBMB.
- 8.7. SE (O) requested POWERGRID to give their consent at the earliest so as that the BBMB could execute the work in the upcoming months of November & December as per the decision of NRPC.

- 8.8. 40th TCC & 43rd NRPC meeting:** In the meeting POWERGRID stated that they have reservation regarding the action plan submitted by BBMB, as for a single circuit line it may not be optimal plan to change the Jumper configuration in view of requirement for long shut down & material. He further stated that a similar issue was encountered in Rajasthan wherein same problem was mitigated for a Double circuit line. MS NRPC had requested POWERGRID to submit all their reservations in writing, highlighting the issues which may be encountered at the time of implementation of above. In the meeting it was stressed that the work should be completed in the lean period of November-December 2018
- 8.9. 153rd OCC meeting:** POWERGRID updated that the site visit is planned shortly to resolve the issue. As desired in the 43rd NRPC meeting POWERGRID submitted all their reservations in writing (Annexure 8 of MoM of 153rd OCC meeting). Further MS NRPC requested POWERGRID to resolve the matter immediately so that the work can be done by BBMB in the lean period. BBMB representative also requested for the same as once the clearance from POWERGRID is received thereafter the matter has to be approved by their Protection Committee.
- 8.10. 154th OCC meeting:** POWERGRID submitted the details (Annexure-8 of the minutes) of the issues/ difficulty which would be faced while completing the phase nomenclature mismatch work. POWERGRID intimated that the site visit had been done by their site officials.
- MS, NRPC stated that the rectification of the phase nomenclature mismatch issue work is very important and it should be completed during the lean period.
- 8.11.** After deliberations it was decided that a joint visit by POWERGRID, BBMB, NRLDC and NRPC would be conducted on 15/01/2019 so as to figure out the difficulties that would be faced in order to rectify the issue as listed out by POWERGRID.
- 8.12. 155th OCC meeting:** Due to the schedule of OCC meeting on 16th and 17th January, the visit could not be carried out. In the meeting, it was decided that the same may be tentatively done on 23rd and 24th January 2019.
- 8.13. 156th OCC meeting:** BBMB and POWERGRID were advised to mutually decide the date and conduct the visit at the earliest.
- 9. Follow up of issues from previous OCC Meetings – Status update** The detail of the updated status of Agenda items as discussed in the 156th OCC meeting is enclosed at **Annexure 9**.
- 10. Status of FGD installation vis-à-vis installation plan at identified TPS.**
- 10.1.** The updated status of FGD installation is attached at **Annexure-10**.
- 11. LVRT compliance by wind generators.**
- 11.1.** The CEA (Technical Standards for Connectivity to the Grid) Amendment Regulations, 2013 stipulates that wind generating stations connected at voltage level of 66 kV and above shall remain connected to the grid when voltage at the interconnection point on any or all phases dips up to specific levels and for specific periods. LVRT is the capability of the generating unit to operate through the periods of lower grid voltage by boosting the terminal voltage of the point of connection of the wind machine when there is a fault at the remote location so that transient stability support is provided.

- 11.2.** CERC has already directed all WTGs of capacity equal to or more than 500kW except Stall Type WTGs to implement LVRT, after the issue of necessary regulation/clarification by CEA. CERC has also desired that all WTGs of capacity equal to or more than 500 KW except 'Stall Type WTGs' to comply with LVRT, for which SERCs may consider to allow the cost of retrofitting WTGs with LVRT under the provision of 'Change in Law' in the respective PPAs. With regard to monitoring of the installation and performance of LVRT installed on existing WTGs, CERC has directed SLDCs to prepare quarterly reports and submit it to RPCs. RPCs are directed to validate the reports submitted by SLDCs in consultation with RLDCs and report any deficiency and non-compliance to the Commission in accordance with law.
- 11.3.** Many wind generations operate without LVRT/FRT feature thereby adversely responding at low voltage either due to high load condition at wind pockets or any fault condition in different parts of the grid and becomes a source for grid incident. The installed capacity having LRVT, their setting is not uniformly matching with the provisions of the Central Electricity Authority (Technical standards for connectivity to the Grid) Regulation, 2007 as amended from time to time.
- 11.4.** As LVRT are not installed in many of the wind turbines in State of Rajasthan, the issue is being regularly raised in the various meetings of NRPC and OCC so far without any result. In 38th TCC/41st NRPC meeting, NRPC directed Rajasthan to issue a notice to all the LVRT non-compliant wind generators specifying a time period within which they need to get the LVRT compliance beyond which they would be constrained to deny scheduling to these generators. In 145th OCC meeting, RRVPNL intimated that MNRE had directed WTG manufacturers to apply for LVRT testing by 15.03.2018 along with the submission of an affidavit for CEA Technical standards compliance and submission of Bank Guarantee of Rs. 1 Crore per model (to be returned after the submission of certificate of compliance to CEA Technical standards).
- 11.5.** In 148th OCC meeting, SLDCs were requested to issue notice to all Wind generators who have not done the needful compliance. Rajasthan SLDC representative confirmed that needful had been done. In the 149th OCC meeting, Rajasthan representative intimated that a meeting of wind turbine manufacturers was held on 05.07.2018 by RRVPNL to sort out the issue of LVRT. It was also informed that 638 generators are LVRT complaint & 106 do not require as per the regulation and 2641 generators need to be LVRT compliant. The capacity of generators that are non-compliant is 3019 MW. It was also informed that the cost of installing LVRT is about Rs. 25-40 lakh per generator for which the generators will have to make arrangements. Subsequently, meetings with WTGs were held on 23.07.2018 and 09.10.2018 by RRVPNL. It was informed that M/S Suzlon and Inox have filed a petition for waiver of installation of LVRT on account of the additional cost involved. Further, in a meeting held on 23.10.2018 in NRPC Secretariat with the WTGs to explore GSS/PSS level solution like STATCOM and other alternatives. WTGs were requested to take up for "Pass-through tariff" under "change in law" with SERC. CEA representative proposed that SLDCs may file a petition with respective SERC indicating problem being faced by the WTGs in LVRT installation. In the 154th OCC meeting, Representative of Rajasthan SLDC informed that petition to be filled to SERC was put up for approval; but the management decided that matter may be taken up by the STU in view of the provision of B.3 of CEA (Technical Standards for Connectivity to the Grid) Amendment Regulations, 2013. SLDCs were requested in the 155th OCC meeting to comply with the CERC order on the LVRT issue by submitting quarterly report.
- 11.6.** In the 156th OCC meeting, it was again requested to SLDCs to submit quarterly reports on installation & performance of LVRT on existing WTGs to NRPC, as per the order dt. 05.01.2016 of CERC.

12. System Protection Scheme (SPS) in NR

12.1. Revised System Protection Scheme (SPS) for 765 kV Agra-Gwalior line:

154th OCC meeting: POWERGRID representative informed that modifications related to CB ON/OFF status have been completed at both Agra and Gwalior end. He told that DTPC installation has been completed and the end to end testing has also been done for 20 links out of 21. He further stated that end to end testing is remaining only for Bhiwadi-Heerapura-Bhilwara-Chittorgarh link. He further requested the concerned states to terminate the links at the designated feeder on which the load shedding is required to be done. He told that end connections with Trip relay of the feeder to be done States. He assured that as targeted, the mock testing can be carried out in 01/2019. Representative of NRLDC requested POWERGRID to coordinate with states and keep NRPC/NRLDC in loop for early completion of the scheme. MS NRPC requested POWERGRID to coordinate with nodal officers of the concerned states for early termination of the links at their end.

In **155th OCC meeting**, POWERGRID representative stated that the cable has already been laid down to the Protection panel in all substations and only the terminal connection needs to be done which has to be done by the utility concerned. Once the terminal connections are done, mock testing of the scheme can be done. Delhi, Haryana, Rajasthan, Punjab and UP were advised to expedite. POWERGRID was requested to coordinate with nodal officers of the concerned states for early termination of the links at their end.

POWERGRID was advised to pursue with the concerned utilities and get the work done at the earliest so that mock testing of the scheme may be conducted in the first week of February 2019.

156th OCC meeting: POWERGRID representative informed that states were intimated via e-mail to arrange for terminating the tripping wire to respective feeders. He told that only Delhi has confirmed the termination of tripping wire. He further stated that it was coordinated with all nodal officers. Haryana, Rajasthan, Punjab and UP were requested to expedite the termination of the tripping wire to respective feeders.

POWERGRID was again requested to follow up with the concerned utilities for early completion of scheme so that mock testing of the scheme may be conducted in the February 2019.

12.2. SPS for ICTs at 765 kV Unnao sub-station:

153rd OCC meeting: UPRVUNL updated that the work is under progress. BHEL they intimated has given a list of MAX-DNA Hardware to be procured by department. The offer stands received and procurement is under process. He further added that BHEL is developing the software logic of the SPS. As on date it is expected that the work would be completed by December 2018

154th OCC meeting: UPRVUNL updated that all the hardware required has been arranged at site. BHEL Engineer will be available at site from 22/12/2018 to finalize the design of logic in 15 days. Thereafter implementation will be done in next 7-8 days. The implementation of logic is expected to be completed by 1/2019.

155th OCC meeting: UPRVUNL in its letter dated 15.01.2019 has intimated that all the hardware required has been arranged at site. BHEL engineer will be available in the 3rd week of January. The design of SPS logic is under process with BHEL and the implementation of SPS is expected to be completed by January 2019.

156th OCC meeting: UPRVUNL in its letter dated 11.02.2019 has intimated that all hardware has been arranged at site. The BHEL engineer will be available w.e.f. 20th Feb 2019 to 24th Feb, 2019. The SPS implementation is expected to be completed by Feb, 2019.

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

In 152nd OCC meeting: RRVPNL representative submitted a letter from SE (Procurement-I), RVPN, Jaipur Annexure-XII of the MOM of the 152nd OCC meeting, vide which it has been intimated that the Technical specification for implementation of Automatic load shedding scheme under SPS for Kawai Kalisindh generation complex is under approval. Further, it was intimated that the contract will be awarded within 4-5 months and complete implementation of above scheme may take further 6-7 months. SLDC Rajasthan representative confirmed that Chhabra STPS units have also been wired to the SPS.

155th OCC meeting: RRVPNL representative stated that the tender would be floated by the end of February 2019.

156th OCC meeting: Rajasthan vide letter dated 06.02.2019 has requested to review SPS scheme for Kawai – Kalisindh - Chhabra generation complex upon commissioning of 400 kV CTPP-Anta feeder. The agenda has been deliberated in detail at point no. 1 Part-B NRLDC.

13. Automatic Demand Management System

13.1. 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 overdrawal from the grid. The responsibility for the implementation of the same has been entrusted on SLDCs/ SEB/ DISCOMs.

13.2. 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. **RLDCs were also directed to submit the report in this regard to the commission by 31.08.2016.**

13.3. The issue of implementation of ADMS in NR is being deliberated regularly in the OCC meetings. The status of implementation of ADMS in states of NR is:

State/ Utility	Status
Punjab	Not fully implemented. At SLDC level, remote tripping for 96 locations is operational. At 11 kV feeder level, ADMS is to be implemented by Distribution Company.
TPDDL	Fully implemented.
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 132 kV feeders under ADMS is operational. For the down below network, issue taken up with the DISCOMs.
Haryana	Not implemented.

- 13.4.** In the 156th OCC meeting representative of Haryana SLDC and Haryana DISCOM were not sure about the responsibility for implementing the ADMS scheme to which it was clarified that according to the IEGC clause 5.4.2 (d), it was the joint responsibility of SLDC/SEB/DISCOMs for the implementation of ADMS scheme.
- 13.5.** All the utilities were requested to expedite the implementation of ADMS so as to avoid any action by the commission under Section 142 of the Electricity Act for non-compliance of IEGC.
- 14. Status of implementation of recommendations of Enquiry Committee on grid disturbances on 30 & 31.7.2012**
- 14.1.** The utilities are again requested to update the information as per the letter enclosed at Annexure 14 to the agenda. In 155th OCC meeting, it was informed that in 8th NPC meeting held on 30th Nov, 2018 the non-submission of this information was highlighted and a serious concern was shown regarding the same. The status of information received is as followed:

Submitted		Not Submitted	
NTPC (NCR)	POSOSCO	Uttar Pradesh	Delhi
BBMB	NHPC	Himachal Pradesh	UT of Chandigarh
Punjab	HPGCL (Panipat TPS)	SJVNL	Jammu and Kashmir
Rajasthan	NPCIL	NTPC (NR-HQ)	
THDC	POWERGRID (NR-1 & NR-2)	POWERGRID (NR-3)	

156th OCC meeting: It was highlighted that it is a long pending issue and reminder letter has already been sent which is attached at annexure-14 of agenda of 156th OCC meeting. Utilities were again requested to share the updated status.

15. Planning, procurement and the deployment of Emergency Restoration System.

The updated status as per the 155th OCC meeting is enclosed as Annexure –15.

The guidelines have been issued vide which the Ministry of Power has directed that for 5000 ckt kms minimum 2 numbers of ERS are required (Annexure 16 of the MOM of the 150th OCC meeting).

In the **155th OCC meeting**, MS, NRPC advised BBMB to procure ERS for their system to which BBMB replied that the decision has already been taken in the full board that partner states will provide ERS to BBMB, whenever needed. MS, NRPC stated that if such a stance has been taken by the partner states, the partner states shall procure 1 additional set each, to be provided to BBMB whenever they require.

156th OCC Meeting: Representative of BBMB stated that regarding the proposal for procuring one additional ERS set by each partner state of BBMB, the communication has already been done with the concerned and their reply on the same was awaited for further action.

16. Cleaning and Replacement of porcelain insulators

All transmission licensees in the Northern Region were requested since 148th OCC Meeting to plan insulator replacement work from September 2018 onwards. The meeting

for cleaning and replacement work of conventional insulator was held on 15.10.2018 and the minutes of the meeting was issued vide letter dated 12.11.2018. All utilities were requested to stick to the timeline as brought out in the meeting to mitigate fog related trippings during winter season and to ensure proper submission of data regarding progress of the cleaning/ replacement work in line with the discussions held in the meeting.

In the 156th OCC meeting, it was intimated that a web based online application (<http://nrpc.gov.in/portal>) has been made functional on NRPC website, wherein transmission licensees can regularly fill up their respective data pertaining to cleaning & replacement of porcelain insulators. This online application can facilitate generation of centralized and consolidated report. Demonstration of the application was given to the participants. It was intimated that requisite login ID and password may be furnished to the transmission licensees by NRPC; thereafter, online data may be furnished by respective transmission licensee.

All transmission licensees of Northern Region were requested to submit cleaning & replacement of porcelain insulators related data on online application after the receipt of their respective login ID and password.

17. Cyber Security Preparedness Monitoring

A. In the 37th TCC and 40th NRPC meeting Chief Engineer (IT), CEA & CISO, MoP gave a detailed presentation on potential cyber threats for power sector along with cyber incidences and shared the desired action points to counter cyber threat. All utilities were also requested to monitor actions being taken in regard to the following points and report the status:

- a. Appointment of organization-wise Chief Information Security Officers and its status.
- b. Identification of organization-wise Critical Infrastructure and its status.
- c. Preparation of organization-wise Crisis Management Plan and its status.
- d. Status of Cyber Security Mock Drill activity in coordination with CERT-In.
- e. Status of Training / Workshops on Cyber Security organized / participated by power sector entities.
- f. Status of action taken on CERT-In / NCIIPC advisories.

In the 156th OCC meeting, all utilities were requested to furnish updated status of the aforementioned points to NRPC so the compiled information may be submitted to CISO, MoP.

POWERGRID intimated that draft Crisis Management Plan (CMP) for Transmission sector has been prepared and has been submitted for approval. **POWERGRID was requested to share the draft Crisis Management Plan (CMP) for Transmission sector with CISO, MoP.**

B. In the 156th OCC meeting it was mentioned that inherent vulnerability in the ICT infrastructure or website or web applications may invite attackers to carry out malicious activities and exploit the targeted organization. In this regard it is necessary for all utilities to conduct Vulnerability Assessment & Penetration Test (VAPT) of their respective ICT infrastructure, websites and web applications for proper assessment and remedial action thereafter.

NHPC vide e-mail dated 19.02.2019 has intimated that as a Pilot location, the auditing of IT infrastructure of IT&C Division and VAPT of Two Power Stations namely Chamera-II and Teesta-V Power Stations have already been done in NHPC. For the above works the work order was placed to M/s TCG Digital Solution Pvt. Ltd. Kolkata on 31.10.2018. The Audit/VAPT of IT&C Division, CO, Teesta-V and Chamera-2

Power Station completed on 15/12/2018. The final report has also been submitted by the Firm on 31.12.2018. The compliance of the observations is under progress.

All utilities were requested to intimate NRPC about the status of VAPT conducted in their respective organization and VAPT plan for the future.

18. Requirement of Data for the GIS based Energy map being developed by Energy division of NITI Aayog.

In the 156th OCC meeting it was intimated that IT Division, CEA being the nodal agency has been collecting GIS related data for the Energy Map to be developed by ISRO under the direction of Niti Aayog. The Energy Portal has been developed by ISRO with the available data. Remaining data may be uploaded / updated by respective stakeholder. The demonstration of the Portal may be given by IT Division, CEA in the next OCC meeting. Thereafter, nomination of Nodal Officers from SLDCs and POWERGRID for data updation may be sought.

19. TTC assessment considering temperature dependent rating of lines/terminal equipment

For conducting studies in PSSE for assessment of inter control area transfer capability, POSOCO considers thermal ratings of lines as specified in CEA's 'Manual on Transmission Planning criteria- 2013' considering ambient temp. of 45°C for terminal equipment ratings of both ends of the lines.

As there is a scope for considering temperature adjusted thermal ratings for these lines in the PSSE studies, NRCE has decided to finalize the methodology for computation of TTC/ATC/TRM taking into a/c variation in thermal capability of lines wrt variation of ambient temp.

Therefore, POSOCO is in the process of populating the temp. adjusted thermal ratings in these lines in the PSSE study case.

All STUs and transmission licensees are requested to furnish terminal equipment ratings at all lines at 400kV and above for fully implementing the temp adjusted TTC to ensure that there is no gap in security assessment. The matter is under regular follow up since 152nd OCC meeting, **only HVPNL has submitted the data (Annexure-19) so far.**

All other STUs and transmission licensees were requested for expeditious submission of information.

20. Expediting Construction of 132 kV supply for railway traction substation for railway electrification projects in states in NR region.

Ministry of Railways has accorded high priority to railway electrification projects for reducing dependence on imported petroleum based fuel thereby enhancing energy security of nation. However, it is observed progress of ongoing transmission line and substation works being executed by SEBs is not matching with the targets for railway sections planned to be commissioned on electric traction. It is found that the work of transmission line for 31 traction sub stations (UP 19, Haryana 5, Punjab 1, and Rajasthan 5 & J&K 1) is yet to be completed. Further tender for transmission line work for 14 traction sub stations(UP 5,Haryana 2,Punjab 2, Rajasthan 5) is yet to be awarded and estimate for 10 traction sub stations(UP 1,Punjab 2, Rajasthan 7) are yet to be received by Railways from respective SEBs. The details are enclosed at Annexure – Agenda item no 20 of the Agenda of the 154th OCC meeting.

154th OCC meeting: SE(O) stated that early commissioning of transmission line works and substation across the nation is required, so as to harness full potential of electrification.

Members were requested to take up the matter with concerned utilities to expeditious completion of the transmission line works and substation and regularly update the progress of the work in monthly OCC meeting.

156th OCC meeting: All utilities were again requested to update as per the Annexure-20 of the agenda of the meeting.

21. Problem of excessive vibrations in GTs of Rihand Stage – III and Vindhyachal Stage-IV during operation of Rihand - Dadri HVDC, on monopole mode with ground return.

148th OCC meeting:

NTPC representative highlighted as under:

- Shifting of 2x500MW Rihand Stage-III units (Unit# 5&6) from NR Grid to WR Grid through Vindhyachal Pooling Station was successfully done on 28th Nov' 17 with coordination in real time between POSOCO, NTPC and POWERGRID (WRTS-II).

- With Rihand stage-III units connected to Vindhyachal Pooling Station, problem of excessive vibrations in GTs of Rihand stage III (and Vindhyachal Stage-IV also) has been observed whenever Rh- Dadri HVDC is run on single pole in ground return mode. The observations during the period 27th Nov'17 to 5th March'18 at Rihand is enclosed in the attached sheet (ANNEXURE AA of the Additional Agenda OCC 148th Meeting).
- The issue was briefly discussed in the 142nd OCC Meeting against agenda point no 18 and where it was decided that system study was required to be done to further deal with this problem. Previous experience of NTPC in this regard was also sought which was subsequently provided to NRLDC by Rihand station.
- It is apparent that DC current passes through these GTs during above situation which is detrimental for the GTs and which may lead to their failure.
- It is therefore requested that a solution may kindly be arrived to deal with the above situation at the earliest.

The issue was deliberated in light of the discussions held earlier in the 142nd OCC meeting NTPC was requested to check transducer at Vindhyachal end as there was huge mismatch in MVAR and also get assessment of earthing system at Rihand done. Further it was decided that as per decision in the 38th TCC & 41st NRPC meeting the committee will look into resolving the issue.

Nominations from CEA, CTU/ POWERGRID, NTPC, POSOCO were received and the first meeting of the committee (Minutes attached at Annexure -Agenda item no. 21) was held prior to the 152nd OCC meeting.

154th OCC: NTPC and POWERGRID was again requested to submit all the information as requested during 1st meeting of the committee at the earliest.

155th OCC Meeting:

NTPC informed that all the relevant information has been submitted on seo-nrpc@nic.in. POWERGRID was again requested to submit the information as desired in the first meeting of the committee.

156th OCC Meeting:

POWERGRID was again requested to submit the information as desired in the first meeting of the committee (Minutes attached at Annexure 21 of the agenda).

22. Sudden load connection/ disconnection by Rajasthan state control area.

NRLDC vide letter dated 29.01.2019 (Annexure-22 of the agenda) has raised the issue of sudden connection of load at 1100 Hrs and 2200 Hrs (~700 – 1200 MW) and sudden disconnection of load at 0400 Hrs and 1700 Hrs (~500 – 1000 MW) in the Rajasthan control area.

Rajasthan was advised to connect/ disconnect load in a staggered manner so as to avoid any severe impact on the grid.

23. A) Mismatch between SLDC data & SEM data (Agenda by UHBVN)

B) AA1. Mis-match of SEM and SCADA Data -Undue financial liabilities to PSPCL. (Agenda by PSPCL)

Representative of PSPCL stated that because of the difference in the SEM and SCADA data they are being forced to face heavy financial penalty even without any fault. The number of zero crossing violations as per SCADA data (based on which real time operation are made) and that as per the SEM data (based on which billing is done) are not in consonance with each other because of which the utilities are being penalized for no fault. For Punjab from 01.01.2019 to 20.01.2019 the number of Zero crossing violations as per the SCADA data were 35, however, as per SEM data it was 167.

Because of non-availability of proper information PSPCL (also other utilities) were not able to prevent undue financial liabilities to their exchequer.

He stated that the issue of mismatch of SEM and SCADA data was already reported to CERC in 2016-17, POWERGRID was also made aware of the fact and the same was also deliberated in various other forums, however, no remedy has been provided to that effect and now because of the mismatch the states are being penalized.

In the absence of correct data, how the fact can be claimed that grid is being managed securely. The non-availability of correct data represents the situation in which all the concerned grid operators are blindfolded.

Representative of UP also informed about the issue of mismatch of number of zero crossing violations between SCADA and SEM data. For a specified period the number of zero crossing violations as per SCADA data was 10 and 49 as per SEM data.

Representative of NRLDC proposed that for the case of Punjab SEM vs SCADA data accuracy verification exercise could be done line by line so as to resolve the issue and improve the accuracy.

Representative of Punjab stated that, till the time the issue of accuracy of SCADA vs SEM data was not resolved, Punjab may be penalized for zero crossing violations as per the SCADA data as that was the only data available to them in real time through which their sincerity in maintaining the schedule could be ascertained. All other billing may be continued to be made with the SEM data.

MS, NRPC stated that such a decision could not be made at NRPC level and was out of the purview of NRPC. Regulations were already issued and now improvement in the system was the only resort.

Representative of POWERGRID stated that the utilities may follow the practice as adopted by UP wherein they have brought the SEM data to their control room and was controlling the zero crossing violations with it.

Haryana representative also stated that their DISCOMs were also in the process of adopting the same, however, till the time all SEM data was not available, the penalty due to zero crossing violations may be imposed based on SCADA data.

MS, NRPC stated that all the utilities shall give their proposals in writing to NRPC Secretariat and the same shall be forwarded to CERC.

On the issue of having a dead band because of the mismatch in SCADA and SEM data, MS, NRPC informed that the same was proposed to CERC to which it has replied that in case of having a dead band, zero crossing by the utilities could not be ascertained. He requested all the utilities to write to CERC highlighting their issues and suggestions, if any, with a copy to NRPC.

24. FRAS/ Inverse FRAS Scheduling regarding (Agenda based on letter from SJVN)

Representative of POSOCO intimated that the concern of SJVN has already been taken into account and the scheduling of NJHPS and Rampur HPS was being done proportionately. SJVN representative stated that the same may again be verified as the scenario (on the day of meeting) was not in consonance with the statement of POSOCO representative.

POSOCO representative assured that the same would be verified and got rectified if there were any discrepancy observed.

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

The UFR and df/dt mapping is mandatory as per Hon’ble CERC regulation. The issue has been discussed in various OCC, NRPC-TCC meetings.

In 136th OCC meeting it was discussed 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.

In 137th OCC meeting, MS NRPC once again reiterated that mapping of UFR has to be done in the SCADA of SLDC & NRLDC for better visibility of relay status and feeder load relief and emphasized upon the importance of digital breaker status of feeders in such defense schemes. In 140th, 143th, 146th and 151st OCC meeting, all the state utilities were requested to correct the SCADA UFR, df/dt displays as per the comments. The defense schemes are extremely important schemes to avert any major contingency. Hence, State utilities should make all possible efforts to strengthen the same.

States	UFR	df/dt	Status as per the 151 st OCC meeting	Remarks	Data Availability
J&K	No	No			
UP	Yes	Yes	<p>Following are provided since last status:</p> <ul style="list-style-type: none"> Feeder wise planned load relief in df/dt. Alternate feeder details in UFR display. Total planned relief in df/dt display. 	<p>Following yet to be provided:</p> <ul style="list-style-type: none"> Feeder-wise planned load relief of UFR. Telemetry of feeders (Partial details available). Alternate feeder details in df/dt display (Partial details available for UFR). Total planned relief in UFR display. (Stage wise) Total actual relief. (Stage Wise) 	Very Poor
Haryana	Yes	Yes	<p>Following are provided since last status:</p> <ul style="list-style-type: none"> Stage-2, 3 of df/dt included in display. Feeder wise planned load relief. Alternate feeder details. Total actual relief in UFR. 	<p>Following yet to be provided:</p> <ul style="list-style-type: none"> Telemetry of feeders (Partial details available). Telemetry of alternate feeders not available. Calculation of total actual relief in df/dt seems incorrect. 	Poor

Delhi	Yes	Yes		<p>Following yet to be provided:</p> <ul style="list-style-type: none"> Total of actual analog data of MW and alternate feeders. Data suspected for most of the digital and Analog value at NRLDC display but available at SLDC display. 	Poor
HP	Yes	Yes	<p>Following are provided since last status:</p> <ul style="list-style-type: none"> Segregation of stage wise load. Alternate feeder details include for most of the feeders. Partial telemetry of feeders. 	<p>Following yet to be provided:</p> <ul style="list-style-type: none"> Telemetry of feeders (Partial data available). Alternate feeder details in UFR (a few not available). 	Poor
Uttarakhand	No	No			
Punjab	Yes	Yes		<p>Following yet to be provided:</p> <ul style="list-style-type: none"> Complete telemetry of feeders. Alternate feeders' details. Digital Status of all the feeders 	Poor
Rajasthan	Yes	Yes	<p>Following are provided since last status:</p> <ul style="list-style-type: none"> UFR display provided. 	<p>Following yet to be provided:</p> <ul style="list-style-type: none"> Analog value and digital data not available in UFR display (only alternate feeder details provided) 	Very Poor

156th OCC: Utilities were again requested to submit the progress on details tabulated above at the earliest and correct/provide the SCADA UFR, df/dt displays as per the comments.

26. Issue of High Voltage at BBMB Rohtak road (Agenda by TPDDL)

Tata Power DDL was facing high voltage from BBMB Rohtak Road. In the 156th OCC meeting BBMB representative informed that the Tap Position has been changed and the high voltage issue has been resolved.

27. Presentation by NLDC on “Pilot on Security Constrained Economic Dispatch (SCED) of Inter-State Generating Station (ISGS) Pan India”

Presentation is attached at **Annexure-27**.

28. Certification of Non-ISTS line for inclusion in PoC charges for hydro rich States (Agenda by HPPTCL)

In consideration of the issue raised by HPPTCL in the meeting, MS, NRPC stated that as the certification for the FY 2018-19 has already been done as per the approved methodology and therefore, no retrospective changes could be made to that effect.

However, HPPTCL was advised to sit with NRLDC and work out a case study of HP for FY 2018-19 considering the data for all 04 quarters of 2018-19 and to present its finding to a committee to be formulated, if required, to review the already approved methodology.

HPPTCL and HP-SLDC was also advised to provide modeling data viz. new elements and generators timely to NRLDC/ NRPC so that same can be modeled before performing simulation studies. HPPTCL was asked to provide modeling data as required by NRLDC at the earliest so that studies may be carried out by NRLDC/NRPC.

SE (O), NRPC in the meeting pointed out a factually incorrect claim made by HPPTCL in the agenda item wherein it was mentioned that no representative of HP had participated in the 32nd TCC and 36th NRPC meeting. However, it was informed that the said meeting was chaired by the representative of HP only. All utilities were advised to frame the agenda points with factually correct information.

Representative of ADHPL in the meeting and also vide letter dated 15.02.2019 (**Annexure-28**) raised the issue that as per the agenda item HPPTCL has mentioned that Phozal substation evacuates 55 MW hydro power (peak) in summer months. In peak generation time i.e. summer months, 28 MW power from Baragaon SHEP (24 MW + 20% overload) & 27 MW power from SHEPs connected to HPSEBL system is evacuated, whereas, in winter season 2-3 MW power from Baragaon SHEP is injected in Phojal substation which also caters 11-15 MW peak load drawl of HPSEBL on Naggar feeder. However, HPPTCL has signed an Interim Power Transmission Agreement with ADHPL in 2016 to facilitate the transmission of 24 MW power from Kanchanjunga HEP and drawl of 11.4 MW of power for HPSEBL which works out to **35.4 MW** of power only.

Therefore, ADHPL has stated that there is a need to correct the agreement for balance 31 MW being evacuated from HPSEBL system by using the ADHPL dedicated transmission line and the payments of all the outstanding amounts shall also be made.

AA. 2 Augmentation of Transformation capacity at Tanakpur (agenda based on letter from PSPA-II)

Representative of NHPC in the meeting stated that as per the deliberations of 6th JSC meeting, the action on interim arrangement at Tanakpur Power Station shall be taken by CEA and POWERGRID, and NHPC cannot make any comments on the same. There was no clarity about the responsibility for implementation of the Interim arrangement of utilizing the spare transformer viz. cost of transfer of spare transformer from Sitarganj to Tanakpur, responsibility for commissioning etc.

In view of the same, NHPC argued that the necessary clarification in this regard shall be made by CEA/PGCIL as per the deliberations of 6th JSC.

Further, NHPC informed that one no. 3-Phase CT of rating approx. 600/1 Amp (5-core) shall also be required along with 100 MVA Transformer as an interim arrangement. The rating of existing CT installed with existing Transformer is approx. 200/1Amp (5-core) corresponding to the existing Transformer of 50MVA. Since, the Transformer is being replaced with 100MVA capacity so the existing CT also to be replaced with the higher

capacity corresponding the 100MVA Transformer. Therefore, POWERGRID may also be requested to arrange one no. CT of rating 600/1amp (5-core) as an interim arrangement.

NHPC was requested in the meeting to take up the matter expeditiously with CEA and POWERGRID regarding the interim arrangement.

PART-B: NRLDC

1. Review of SPS schemes of Kawai-Kalisindh-Chhabra-Chhabra SC complex

NRLDC stated that SPS for Kawai-Kalisindh-Chhabra complex has been recommended in 122nd OCC & approved in 34th TCC-38th NRPC meeting, however, till date only partial SPS has been implemented by SLDC, Rajasthan. This issue has been highlighted in various previous OCC/TCC meetings also, still, the implementation of complete scheme as approved in OCC/TCC meeting is awaited.

Apart from above, in view of recently commissioned/Synchronized Chhabra SC generation of 1320 MW (2 units of 660 MW each) and associated transmission lines i.e. 400kV Chhabra SC-Anta, 400kV Anta-Kota and to be commissioned 400kV Chhabra SC-Chhabra interconnector, review of SPS for entire complex seems necessary for reliability & security of this large generating complex of ~5000 MW. Though, the connectivity of Chhabra & Chhabra SC has improved, however entire complex is still being evacuated through only following network:

- i. 765kV Anta-Phagi I & II
- ii. 400kV Chhabra-Bhilwara
- iii. 400kV Chhabra-Hindaun
- iv. 400kV Anta-Kota
- v. 400/220kv Single ICT at Kalisindh &Chhabra of 315 MVA each (Operating in radial mode)

As the generation in this complex has further increased by ~ 1300 MW, loading of Phagi ICTs has increased and N-1 contingency of Phagi ICT would become critical. Loading of Phagi ICTs for past few days is enclosed in **Annexure-I**. It was also informed that earlier in various instances, many trunk lines nearby & connected to this complex were opened to control loading of Phagi ICTs however impact of opening of such large number of lines was observed to be inadequate. Hence, SPS considering N-1 compliance of 765/400kV Phagi ICT is also important till the commissioning of third ICT. SLDC, Rajasthan informed that third ICT is expected to be commissioned by 2020.

SLDC, Rajasthan representative informed that SLDC is also aware and has equal concern regarding security of Kawai-Kalisindh-Chhabra complex. SLDC, Rajasthan stated that these issues have also been sensitized within SLDC/RVPNL/RUNL. It was informed that a meeting has already been proposed in the coming week with generators & transmission agency for review of SPS for security & reliability of Kawai-Kalisindh-Chhabra-Chhabra SC complex in view of additional generation in the complex.

SLDC Rajasthan representative further stated that possible backing down of thermal generation at Kawai, Kalisindh and Chhabra Supercritical is only up to 28% of installed capacity. Further, during outage of one circuit of 765kV Anta-Phagi, 400kv Anta-Kota

needs to be made operational (Chhabra-Kota charged through tie bay at Anta) to reduce the loading on 400kV Kawai-Chhabra.

MS NRPC expressed concern regarding security of this generating complex and further emphasized the need of reliable SPS schemes of this important complex. It was informed that this generating complex of ~5000 MW is also connected to western region and therefore any outage in this complex can lead to grid insecurity. In view of above, following were directed to take fast action for review & implementation of SPS schemes:

- i. SLDC Rajasthan would organize internal meeting with RVPNL, RUNL, Kawai generator within a week to deliberate various aspects (generation backing down/ load shedding) under N-1/N-1-1 contingencies and review the SPS schemes.
- ii. NRLDC could also perform study with revised scenario and suggest generation backing down and load shedding required so that the same can be deliberated for final recommendation in consultation with all stakeholders.
- iii. MS, NRPC stated that final schemes would be further put up in NRPC/TCC meeting for approval.

2. Tripping of ICTs in Punjab on over-flux

NRLDC representative showed the statistics of recent ICT trippings in Punjab control area reportedly on over-flux since 30th Jan 2019 and enclosed in **Annexure-II**. The same was also communicated vide letter NRLDC/SO-II/TS-15/352-356 dated 07.02.2019.

It was also informed that consistent overvoltage is being experienced in Punjab control area since starting of winter. MVAR injection from LV to HV side in Punjab area has also been observed, plot is enclosed in **Annexure-III**. NRLDC informed that action plan for reactive power management or voltage regulation has already been discussed in various previous OCC/TCC meeting. Persistent high voltage in Punjab area indicated the inadequate actions for voltage regulation. It was stated that apart from switching off capacitor, switching on reactor, other resources should also be exploited for voltage regulation. Some of the desirable action that remain pending were as:

- i. Tap optimization at 220/132kV or 220/66kV or 220/33kV
- ii. Reactive power absorption by generating units
- iii. Utilization of line reactor as bus reactor when line is not in service
- iv. Synchronous condenser operation of generating units especially of hydro station in Punjab control area.
- v. Expedite planned reactor
- vi. Feedback to planner for reactor studies in this area.

It has been perceived that high voltage is prevailing in large area of Punjab /Haryana however, trippings are taking place in only PSTCL owned substations. In one instance, Abdullapur ICT-4 (POWERGRID) tripped on over-flux on 8-Feb-2019. POWERGRID explained that relay was ABB make, which has different setting however; the same has been checked and set as per recommendation.

ICT tripping in Punjab owned substation on over-flux therefore needs review for over-flux setting & time delay. It was mentioned that over-flux protection settings need to be set as suggested in Ramakrishna committee report. Thus, over-flux setting for trip and respective time delay needs to be checked at all stations especially those where trippings have taken place and needs to be revised as per requirement.

Punjab SLDC representative stated that communication in this regard has been shared to protection personnel of PSTCL. It was informed that setting of over-flux & time delay would be coordinated as per recommended practice.

MS, NRPC expressed concern over number of ICT trippings on over-flux and persistent high voltage in Punjab control area. It was requested to take appropriate action to review the over-flux setting so that such undesirable trippings can be avoided. It was suggested that Punjab may also take advice from POWERGRID for standard over-flux settings. NRPC also conveyed that such setting should be checked & reviewed at all stations especially before winter season as high voltages are anticipated and directed all the utilities to do the same at the earliest.

MS, NRPC strongly advocated for advance action to curb high voltage which was expected during winter. It was proposed that all utilities/State should take necessary action as suggested in previous OCC i.e. tap optimization at 220/132kV, 220/66kV & 220/33kV ICTs, MVAR absorption by generators and expedite already planned reactors, exploit synchronous condenser operation of generators, planning of new reactors etc. for effective voltage regulation. Punjab SLDC and other utilities agreed to take appropriate actions as suggested by OCC/TCC for voltage regulation.

3. Security Constrained Economic Dispatch (SCED) of Inter-State Generating Stations Pan-India

NRLDC representative stated that Hon'ble Commission Order in Petition No. 02/SM/2019 (Suo-Motu) dated 31st January, 2019, (<http://cercind.gov.in/2019/orders/02-SM-2019.pdf>) directed for Pilot on SCED of Inter-State Generating Stations (ISGS) Pan India.

The Central Commission observed that there is an overarching objective to optimize the scheduling and dispatch of the generation resources and reduce the overall cost of production of electricity without major structural changes in the existing system/framework. SCED is a desired step in the Indian grid operation towards optimization methodologies. SCED is an involved procedure requiring developing software, creating interfaces and establishing various protocols, information dissemination and streamlining settlement system etc.

Accordingly, the Commission directed for pilot of SCED for the Inter-State Generating Stations, on pilot basis, w.e.f. **01st April, 2019**.

A Detailed Procedure would be formulated by POSOCO in line with CERC directions that would contain the guidelines regarding operational aspects of SCED including scheduling, dispatch, accounting, settlement etc.

NLDC has sent communication vide its letter dated 4th Feb 2019 on above subject for stakeholder's awareness in implementing pilot basis for SCED. In presentation given by NRLDC/NLDC representative it was highlighted that:

SCED Energy Accounting

- To be incorporated by RPCs on weekly basis along with DSM RRAS, FRAS and AGC accounts
- SCED Schedules to be provided by NLDC through the RLDCs
- NLDC would indicate consolidated "National SCED Settlement Statement"
 - Schedules on account of SCED.
 - Payment and receipts to/from SCED Providers.

SCED Energy Settlement

- National Pool Account (SCED) to be operated by NLDC
- Settlement using variable charges declared under RRAS
- All payments shall flow from/to the National Pool Account (SCED)
 - For Increment in Scheduled Generation, SCED provider to be paid from the National Pool Account (SCED)
 - For Decrement in Scheduled Generation, SCED Provider to pay to National Pool Account (SCED)
- Compensation due to part load operation as certified by RPC in accordance with the provisions of IEGC.
- No retrospective settlement
- Any deviation settled as per CERC DSM Regulation

Implementation Actions

- Detailed Procedures to be issued by NLDC
- Freedom and choice of states to requisition from ISGS will remain intact. Schedules of the States/beneficiaries would not be changed to accommodate SCED and the beneficiaries would continue to pay the charges for the scheduled energy directly to the generator as per the existing practice
- NLDC to open a separate bank account - "National Pool Account (SCED)"
 - Savings obtained through SCED after settlement of all accounts of SCED would be recorded and maintained in the "National Pool Account (SCED)" by the NLDC.
 - The sharing of benefits/savings has been accepted in principle by the Commission. However, methodology of sharing shall be decided after the results of the pilot and the extent of savings are available.
- Web Based Energy Scheduling Software
- Batch processing of schedules
- Schedule data interchanges between the RLDCs/NLDC, synching of data
- Pre-processing & validation being sent to the SCED engine
- Core optimization (SCED) engine – development, testing and validation
- Output of SCED to be incorporated in the schedules
- Creation of a counterparty to SCED
- Augmentation of Communication infrastructure

During the OCC stakeholders agreed that they will go through the SCED order issued by Hon'ble Commission and detailed presentation given by NRLDC/NLDC and will give their feedback accordingly. MS NRPC stated that a stakeholder awareness program will be conducted on SCED in due course. OCC agreed for the same.

Presentation given by NLDC/NRLDC representative is attached as Annexure-27 (Part-A).

OCC appreciated the same.

4. Demand and Generation projections of Q1-2019-20 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. NLDC vide its letter dated 03.01.2019 had requested utilities to furnish Technical and commercial data for Apr'19-Jun'19 Q1 (2019-2020).

NRLDC representative stated that details have been received only from **NTPC, NHPC, SJVNL, BBMB, Haryana, Delhi & UP**. Other utilities were also requested to submit data as early as possible.

Amongst the utilities from which data was received following was decided:

- *Demand for Haryana, Delhi and UP to be taken as per data provided*
- *Generation for NTPC, NHPC, BBMB, SJVN except Kishenganga (to be finalised in validation committee meeting)*
- *Generation for Haryana to be taken as 3100MW.*

For utilities, those did not submit data, it was agreed that data will be finalised in validation committee meeting.

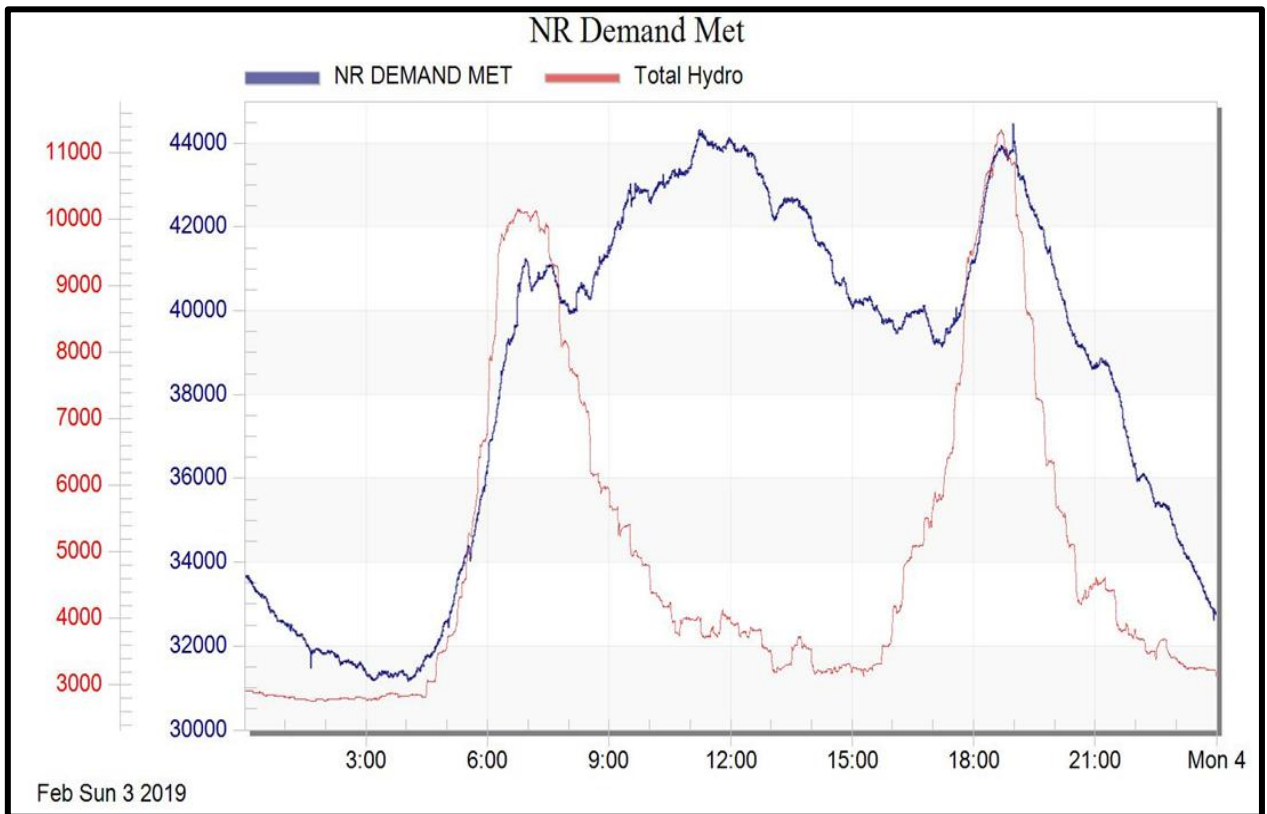
5. Hydro optimization during peak hours' demand

NRLDC representative shared that hydro generating station are known for high flexibility in generation & ramping based on water availability. It is therefore very important to utilize such resources carefully and effectively. In Northern region, Peak hours demand & its ramping is very high & steep during morning & evening hours. It is well known that peak hours' demand & load ramp rate also changes with seasonal pattern. During winter, morning & evening peak hours demand & load ramp rate is very high (45-50 MW/min for 2-3 hours) therefore generation ramping is also equally important to commensurate this load ramping. Further, it was clarified that peak hours demand is considered as peak hour demand of region as whole.

It was explained that to meet such high peak hour demand of region with high steep, quick & flexible generation is required. Therefore, hydro stations are best suited and opted for such peak hour requirement only as per water availability/storage. Hence, optimization of hydro resources for such peak hours demand needs to be done prudently.

Thus, as decided and agreed in previous meeting, ISGS hydro generating stations are normally scheduled based on regional peak hours' requirement. This practice is being

followed in Northern region since long with the consent of all beneficiaries for better system operation.



Recently, it has been observed that different states have requested for inter-state hydro scheduling as per state demand requirement, however this may not be feasible due to different consideration of all stakeholders. It was informed that during peak hours, market rates are also very high, therefore for certain period, states shall manage their requirement either through portfolio management or through energy market.

Uttar Pradesh SLDC informed that for certain duration, peak demand of state was not matching with region therefore asking for ISGS hydro schedule accordingly.

MS, NRPC further explained that hydro resources are flexible and quick for peak hours demand requirement having high ramping. It was advocated that hydro resources should be used optimally & effectively for benefits of all as whole. Peak hours demand would be considered for region as whole and not as per state demand requirement. It would help in gaining maximum benefits of hydro resources for all stakeholder and better system operation. Thus, ISGS hydro station would be schedule as per Northern region peak hours demand requirement. OCC suggested all the states to manage their portfolio accordingly.

OCC agreed for the same.

6. Grid connectivity of Kashmir region

NRLDC representative stated Srinagar-Leh Transmission System (SLTS) has been commissioned recently. It is charged at 220 kV level through Alstung – Drass – Kargil – Khalsti –Leh new transmission network along with 220/132/33 kV S/s at Alstung and

220/66 kV GIS S/S at Drass, Kargil, Khalsti, and Leh and dedicated to state by Hon'ble prime minister on 3rd Feb 2019.

Two hydro station of NHPC Nimoobazoo(3X15 MW) and Chutak (4X11 MW) which were operating since 2013 in isolation mode have also been synchronized with this new SLTS network at Leh and Kargil respectively. This network is to be synchronized with ISTS through 220 kV NewWanpoh, Wagoora-Ziankot-Alstung, etc. It has been observed that telemetry of above station & other relevant information is not available at SLDC J&K.

It was informed that RLDC has procedure in which all the necessary document & compliances (ensuring SLD, Telemetry, Metering etc.) are checked before connecting to the ISTS system. Same procedure has also been adopted by some states for first time element charging connected to state transmission system (STS). It was suggested that all the state should adopt certain procedure before connecting any new element to the grid.

Telemetry of above referred new transmission link in J&K is not available at RLDC/SLDC that means procedure has not been followed by respective state agencies.

In view of this, J&K PDD, POWERGRID and NHPC were suggested to:

- i. Ensure telemetry and relevant data information of all stations at SLDC/RLDC.
- ii. Share the likely date of synchronization of above transmission link with ISTS and further connectivity of 220kV at Ziankote.
- iii. Follow the procedure so that all the data & compliances are checked before connecting to Grid.

Apart from above, following are issues with SLDC, J&K:

- i. Load shedding: As per furnished data from J & K it seems that there is load shedding in the tune of 10-12 MU/day. However, Government of India has announced for 24X7 supply. J&K was requested to update.
- ii. It has been observed that due to lack of correspondence between SLDC, J&K/PDD & RLDCs, exchange of information couldn't be done at the need of time. Therefore, it was requested to share all the authorized contact details of all S/s control centers to NRLDC/NRPC for fast & reliable information flow.

MS, NRPC also expressed concern regarding unavailability of telemetry and inadequate information during first time element charging & connection to the grid. All were requested to adopt procedure and ensure telemetry, metering and information as per various compliances before connecting any new element to the grid.

OCC agreed for the same.

7. Reactive Power management in Northern Region:

Reactive power response of generating stations is being regularly discussed in OCC meetings. Reactive power response in respect of MVar vs Voltage and MW vs Voltage for **01.02.19-07.02.19** as per NRLDC SCADA data is enclosed in **Annexure-V**. Based on available data, it is observed that there are adequate 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.

MS NRPC expressed concern regarding high voltages prevailing in the grid and despite of continuous follow up of reactive response of generating stations, effective improvement is yet to seen. It was strongly conveyed that in view of high voltage, dynamic response from generator in line with capability curves is need of hour. Thus, following was agreed:

- i. As the generator reactive absorption seems inadequate and region is experiencing the high voltage, all the generators are directed to take appropriate action to improve its performance. It was informed that the generators shall report reasons for not being able to provide reactive power response as per capability curve.
- ii. It has been observed that majority of time, telemetry of MVAR and its sign was not reliable. After continuous follow up, telemetry has not been improved yet. The same issue was deliberated and decided that telemetry issues would be highlighted in upcoming NRPC/TCC meeting for further actions.
- iii. MS, NRPC also advocated the utilization of generating station especially hydro & gas as synchronous condenser mode for dynamic response in regulating the voltage. In view of high voltage in the region, it was suggested to exploit the available resources optimally. It was stated that all hydro generators are generally capable of running as synchronous condenser mode, therefore, all the hydro generators were directed to show the capability to operate in synchronous condenser mode and if any hydro generator is showing inability for the same, a certificate from OEM needs to be submitted to NRPC/NRLDC along with valid reasons.
- iv. OCC also advised NRLDC to operate Tehri & Chamera units as synchronous condenser mode frequently and as per grid requirement and report to OCC.

It was again 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 would also be assessed. All the respective agencies were requested to take immediate actions to improve the telemetry and reactive power response performance.

OCC agreed for the same.

8. Frequent forced outages of transmission elements

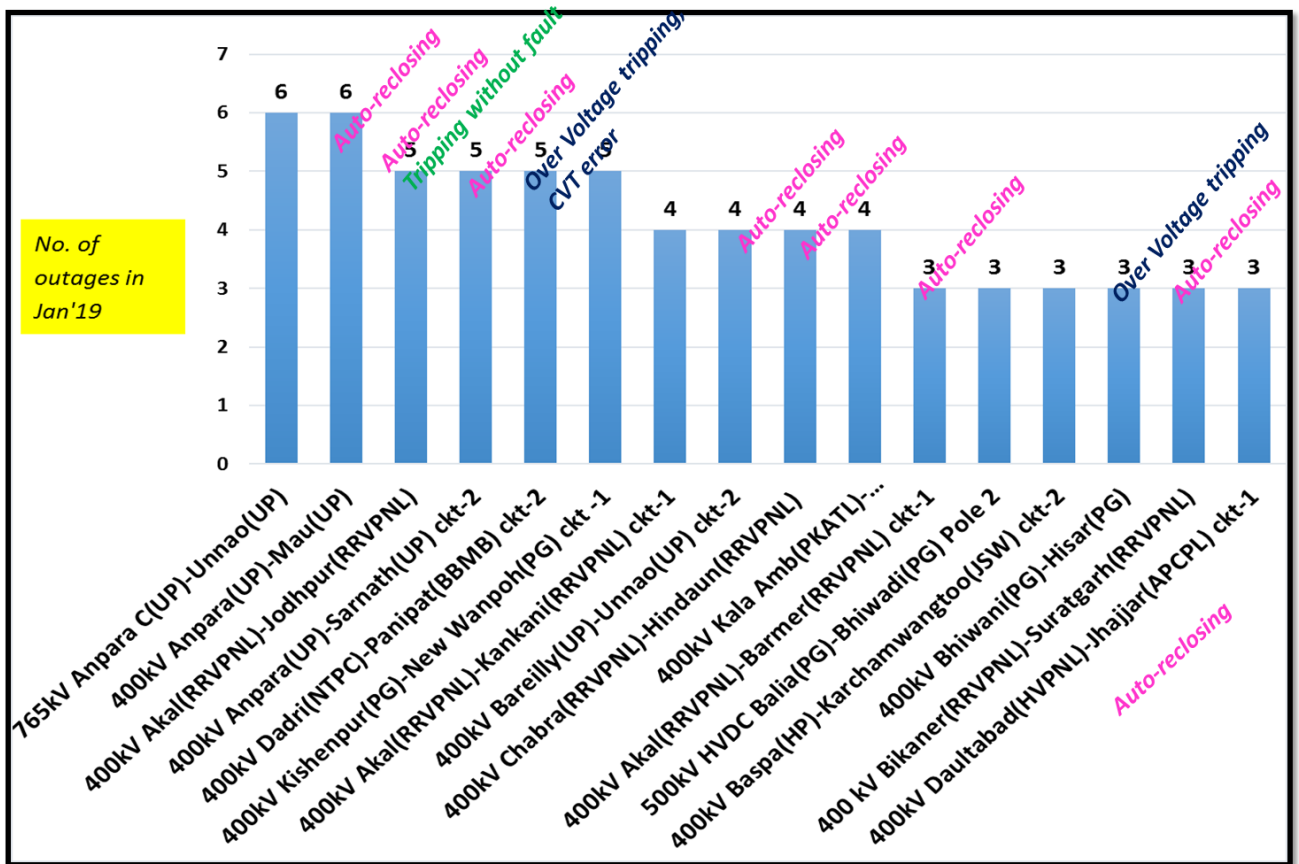
The following transmission elements were frequently under forced outages during the month of **Jan'19**:

S. NO.	Element Name	No. of forced outages	Utility/SLDC
1	765kV Anpara C(UP)-Unnao(UP)	6	UP
2	400kV Anpara(UP)-Mau(UP)	6	UP
3	400kV Akal(RRVPNL)-Jodhpur(RRVPNL)	5	Rajasthan
4	400kV Anpara(UP)-Sarnath(UP) ckt-2	5	UP
5	400kV Dadri(NTPC)-Panipat(BBMB) ckt-2	5	POWERGRID/NTPC/BBMB
6	400kV Kishenpur(PG)-New	5	POWERGRID

	Wanpoh(PG) ckt -1		
7	400kV Akal(RRVPNL)- Kankani(RRVPNL) ckt-1	4	Rajasthan
8	400kV Bareilly(UP)-Unnao(UP) ckt- 2	4	UP
9	400kV Chabra(RRVPNL)- Hindaun(RRVPNL)	4	Rajasthan
10	400kV Kala Amb(PKATL)-Karcham wangtoo(JSW) ckt-2	4	PKATL/JSW
11	400kV Akal(RRVPNL)- Barmer(RRVPNL) ckt-1	3	Rajasthan
12	500kV HVDC Balia(PG)- Bhiwadi(PG) Pole 2	3	POWERGRID
13	400kV Baspa(HP)-Karcham Wangtoo(JSW) ckt-2	3	HP/JSW
14	400kV Bhiwani(PG)-Hisar(PG)	3	POWERGRID
15	400 kV Bikaner(RRVPNL)- Suratgarh(RRVPNL)	3	Rajasthan
16	400kV Daultabad(HVPNL)- Jhajjar(APCPL) ckt-1	3	Haryana/APCPL

The complete details are attached at Annexure-6 of the Agenda. The frequent outages of such elements affect the reliability and security of the grid. For instance, tripping of 765kV Anpara C(UP)-Unnao(UP) lead to evacuation constraint for Anpara complex. Due to this, backing down of generation in the complex had to be done.

Utilities were requested to look into such frequent outages which also reduces reliability in the grid and share the remedial measures taken/being taken in this respect.



The following were the discussion on the trippings:

- 400 kV Anpara-Mau line has some clearance issue due to crossing of 33kV line, whenever line loading increases in the line. Height of 33kV line is being reduced to maintain clearance. Pole discrepancy setting in 400 kV Anpara-Mau line was 500ms instead of 1.5 second, it resulted into three phase of tripping of line before auto reclosing (1000ms). Pole discrepancy setting has been reviewed and corrected.
- NRLDC representative concerned about non-submission of information for multiple time single element tripping in last six month. Information is still pending from most of the NR utilities.
- UPPTCL representative informed that some of the action has been taken and some are pending, a consolidated report would be submitted within 15 days.
- Rajasthan representative also informed that remedial measures report of every tripping would be submitted within 15 days along with last six month tripping.
- 400 kV Dadri-Panipat ckt-2 tripped multiple times on over voltage protection. POWERGRID representative informed that CVT error was found in one of the phase at Dadri end and CVT has been replaced.

The remedial measures report was requested from all NR constituents but details were still awaited from all the involved utilities.

NRLDC representative once again requested all the constituents to share the report of last six month tripping and remedial measures taken by all the utilities for mitigation of such

tripping incidents. Members agreed to the same. All the remedial measures report needs to be submitted within 7 days.

9. Multiple element tripping events in Northern region in the month of Jan'19:

A total of **30** grid events occurred in the month of Jan'19 of which **12** were of GD-1 category. The preliminary report of all the events was issued from NRLDC. A list of all these events along with the status of details received by 02-Feb-19 was attached at Annexure-7 of the Agenda.

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

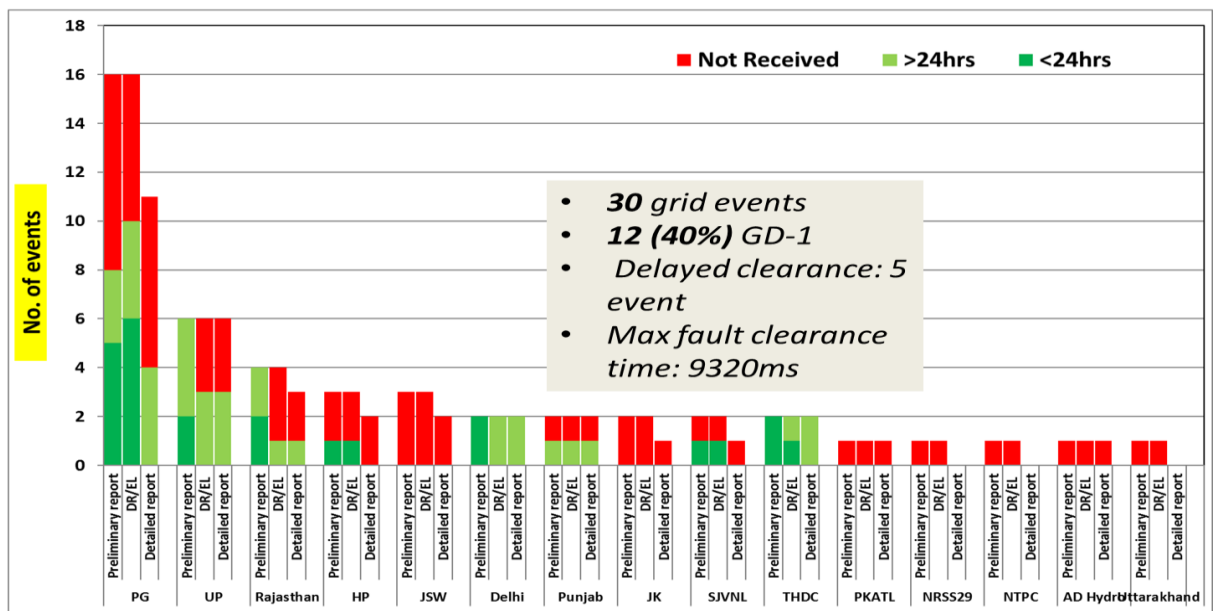
Maximum Fault Duration of **9320ms** (as per PMU data) was observed in the event of multiple element tripping at 220kV Shahjahanpur(UP) substation on 22nd Jan 2019 at 01:29hrs.

Delayed clearance of fault (more than 100ms for 400kV and 160ms for 220kV system) observed in total **5** events out of 30 events in the month.

NRLDC representative stated that the compliance of reporting details of events has improved but is still below the desired level. He showed the consolidated status of the reporting:

B.09 Grid Events (in Jan'19): Details Received Status

Note: Details received by 07-Feb-19 are considered



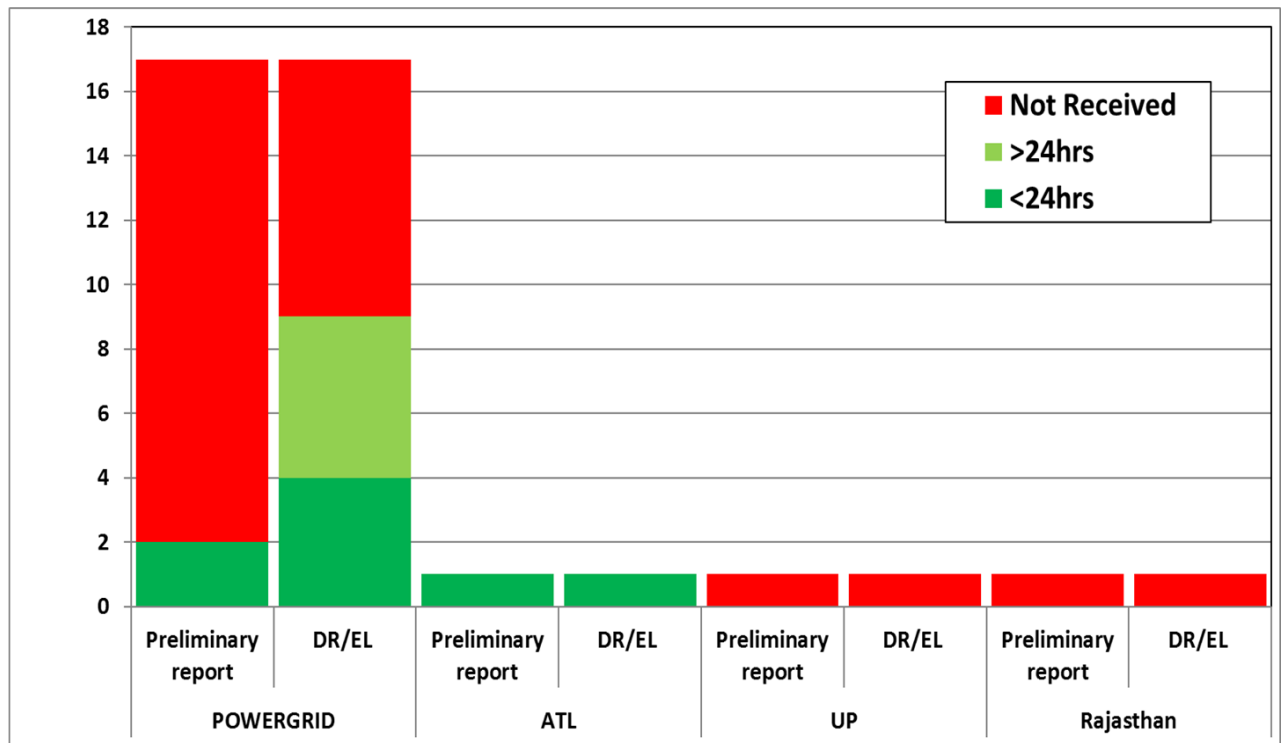
NRLDC representative also requested all the NR utilities to kindly calculate the energy loss in the incident and share the information to NRPC/ NRLDC in its report. Utilities agreed for the same.

10. Details of tripping of Inter-Regional lines from Northern Region for Jan'19:

A total of 20 inter-regional lines tripping occurred in the month of Jan'19. The list was attached at **Annexure-8** of the Agenda. 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.

Status of details received from the NR constituents showed to the members is as below:

B.10 IR Trippings (in Jan'19): Details Received status



NRLDC representative once again requested all the concerned utilities to kindly submit the Preliminary Report, DR/EL within 24hrs and also share the remedial measures report for tripping in last one year.

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

11. Mock black start exercise 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 are 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 schedule of mock exercise along with current status is as follows:

Hydro Power Stations:

Date	Revised Date	Name of stations	Remarks
24-Oct-18	NA	Malana-2	Exercise was not successful. It is proposed to carry out the exercise again with AD Hydro.
2-Nov-18	NA	Salal	Exercise carried out successfully. However, due to less load on account of bad weather, frequency kept on varying and island could not be synchronized with grid.
30-Nov-18	6-Dec-18	Sewa-2	NHPC confirmed. Date revised by J&K. Exercise was partially successful. Unit went under emergency stop twice.
3-Dec-18	NA	Chamera-1 & Chamera-2	Exercise was partially successful. Large variation in frequency observed in islanded operation with Chamera-1. Chamera-2 unit could not be able to synchronize to the island.
11-Dec-18	19-Dec-18	Parbati-3	Carried out successfully.
19-Dec-18	20-Dec-18	Koteshwar	Carried out successfully. 400kV Koteshwar-Koteshwar(PG)-1 tripped from Koteshwar(PG) end at first attempt during charging of Tehri ckt-1.
28-Dec-18	3-Jan-19	AD Hydro, Malana-2, Phojal (Kanchanjanga)	Exercise was partially successful. Island created and synchronized with AD Hydro. However, during blackstart, the AD Hydro running island collapsed while connecting Phojal (Kanchanjanga). Malana-2 couldn't be synchronized.
11-Jan-19	NA	Koldam	Exercise carried out successfully.
Yet to be carried out			
18-Oct-18	NA	Kishanganga (new plant)	NHPC reported to intimate date separately. It is proposed to carry out the exercise with Uri, L.Jhelum, Pampore and U. Sindh.
26-Oct-18	15-Jan-19	Dhauliganga	Revised date by NHPC
13-Nov-18	21-Jan-19	Nathpa Jhakri & Rampur	Revised date by SJVNL

16-Nov-18		*Uri-I, II HEP, Lower Jhelum HEP, Pampore GT's & Upper Sindh	To be carried out after 15-Dec-18 due to load management by J&K and shutdown of 400kV Amargarh-Uri-1 ckt-2.
19-Nov-18		Budhil	To be carried out after 15-Dec-18.
28-Nov-18		Chamera-3	To be carried out after 15-Dec-18 as per Chamera-3 request.
14-Dec-18		Bairasiul	As reported by NHPC, Power House shall be under complete shutdown since 01/10/2018 for R&M of power house.
4-Jan-19		Tehri	Exercise deferred on request of UP due to load management.
8-Jan-19		Karcham Wangtoo & Baspa	Exercise deferred on request of Haryana due to load management.

* Mock black-Start exercise not carried out during Year 2017-18.

NRLDC representative stated that this season also, the adherence to the schedule by the generating utilities is not much which has resulted into concentration of mock black start exercises in the latter part of the winter season. It was again requested to the utilities that any change in schedule to be informed well in advance.

NHPC representative stated that the collective black start exercise of Uri-I, II HEP, Lower Jhelum HEP, Pampore GT's & Upper Sindh HEP cannot be possible now as water inflow has been increased in Uri-1 & Uri-2 HEP.

In respect of Kishanganga HEP, he stated that as the plant is new, first mock exercise is planned in presence of OeM (BHEL). OeM is not confirming the date and requested to do the exercise in next winter. NHPC representative further requested to carry this exercise next year.

For Chamera-III, tentative date between 18-20th Feb'19 was suggested by NHPC.

For Dhauliganga HEP, 7th Feb 2019 was finalized in last OCC meeting and UP also agreed to manage the load. At the time of actual exercise, consent was not received from UP for load management.

SJVNL representative informed that revised date of mock exercise of Jhakri/Rampur HEP will be informed, as of now planned shutdown is going. Tentatively mock exercise will be occurred in Feb last or March first.

Mock black start exercise of Gas power stations viz. Auraiya, Dadri, Anta also to be carried out. In 153rd OCC meeting, NTPC informed that Procedure in line with Dadri GPS needs to be prepared for other gas stations as well.

As requested in 152nd, 153rd and 154th OCC meetings, SLDC's may also 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 are as follows along with status as informed in 154th OCC meeting:

S. NO.	Utility	Hydro Power Station	Installed Capacity(MW)	Tentative Date as reported by SLDC
1	J&K	Baglihar	3x150	
2		Baglihar stage-2	3x150	
3		Lower Jhelum	3x35	
4		Upper Sindh	2x11+3x35	
5	HP	Sainj	2x50	In coordination with NRLDC
6		Larji	3x42	Jan-19
7		Bhabha	3x40	
8		Malana -I	2x43	Jan-19
9		Baspa	3x100	To be clubbed with Karcham
10	Punjab	Anandpur Sahib	4x33.5	
11		Ranjit Sagar	4x150	
12	Rajasthan	Mahi-I&II	2x25+2x45	Mar-19
13		Rana Pratap Sagar	4x43	Mar-19
14		Jawahar Sagar	3x33	
15		Gandhi Sagar	5x23	
16		Dholpur GPS	3x110	Plant under outage
17		Ramgarh GPS	1x35.5+2x37.5+1x110	
18	UP	Rihand	6x50	Carried out in Aug-18. Report to be submitted
19		Obra	3x33	
20		Vishnuprayag	4x100	
21		Srinagar (Alaknanda)	4x82.5	
22	Uttarakhand	Gamma Infra	2x76+1x73	
23		Shravanti	6x75	
24		Ramganga	3x66	
25		Chibro	4x60	
26		Khodri	4x30	
27		Chilla	4x36	
28		Maneri Bhali-I&II	3x30+4x76	
29	Delhi	IP Extn GTs	6x30+3x30	
30		Pragati GPS	2x104.6+1x121.2	
31		Rithala	3x36	
32	Haryana	Faridabad GPS	2x137.75+1x156.07	Shared the procedure

During last winter, SLDCs had been requested to carry out mock drills and share their experiences. However, the information was received from HP (Sainj, Baspa) and

Rajasthan (only schedule of exercises) only. SLDCs were again requested to share the information and program for this year's mock black start exercises.

SLDCs were further requested to submit the reports of black start exercise in their respective control area and identify further generating stations/unit for black start exercise.

12. Frequency response characteristic:

Two FRC based events have occurred in the month of Jan-2019. Description of the events is as given below:

Table:

S. No.	Event Date	Time (in hrs)	Event Description	Starting Frequency (in Hz)	End Frequency (in Hz)	Δf
1	16-Jan-19	12:25hrs	There was a dropper flashover at 220kV GIS Bhadla substation. There was also tripping of 400kV Jodhpur-Bhadla, 400kV Merta-Bhadla, 400kV Bhadla-Bikaner 1&2. Solar Generation loss around 1400MW as reported by Rajasthan SLDC.	49.965	49.916	- 0.049
2	23-Jan-19	06:25hrs	400KV Jhakri-Panchkula 1, 400KV Jhakri-Rampur 1 tripped due to bus bar protection operated at NJPC during charging of 400KV Jhakri-Karcham 1. Consequently, 925 MW generation loss occurred at both Jhakri and Rampur.	49.961	49.921	- 0.040

The Hon'ble CERC approved procedure has already been shared with all concerned during previous OCC meetings. FRC observed for each state control area for the events is tabulated below:

States	16-Jan-19 Event		23-Jan-19 Event	
	FRC	Remarks	FRC	Remarks
PUNJAB	48%		-29%	
HARYANA	66%		83%	
RAJASTHAN	447%	Generation loss in this control area	0%	
DELHI	-58%		10%	
UTTAR PRADESH	-11%		6%	
UTTARAKHAND	-23%		159%	
CHANDIGARH	90%	Small Control area	-1206%	Small Control area, increase in schedule
HIMACHAL PRADESH	42%		-296%	Increase in schedule
JAMMU & KASHMIR	43%		-212%	Increase in schedule
NR	100%	Generation loss in NR Region	74%	Generation loss in NR Region

FRC calculation of ISGS stations based on NRLDC SCADA data is tabulated below:

Generator	FRC (16-Jan-19 event)	FRC (23-Jan-19 event)	Generator	FRC (16-Jan-19 event)	FRC (23-Jan-19 event)
Singrauli TPS	-13%	56%	Salal HEP	No generation	50%
Rihand-1 TPS	2%	11%	Tanakpur HEP	0%	0%
Rihand-2 TPS	-82%	33%	Uri-1 HEP	152%	89%
Rihand-3 TPS	-71%	-7%	Uri-2 HEP	-62%	204%
Dadri-1 TPS	-2%	61%	Dhauliganga HEP	No generation	44%
Dadri -2 TPS	36%	125%	Dulhasti HEP	94%	-343%
Unchahar TPS	0%	550%	Sewa-II HEP	No generation	0%
Unchahar stg-4 TPS	0%	22%	Parbati-3 HEP	No generation	No generation
Jhajjar TPS	79%	174%	Jhakri HEP	No generation	Suspect SCADA data
Dadri GPS	No generation	No generation	Rampur HEP	No generation	-374%
Anta GPS	0%	163%	Tehri HEP	83%	0%
Auraiya GPS	No generation	No generation	Koteswar HEP	0%	16%
Narora APS	0%	0%	Karcham HEP	Suspect SCADA data	103%
RAPS-B	0%	0%	Malana-2 HEP	Suspect SCADA data	Suspect SCADA data
RAPS-C	35%	19%	Budhil HEP	0%	No generation
Chamera-1 HEP	No generation	209%	Bhakra HEP	2%	-5%
Chamera-2 HEP	-115%	-25%	Dehar HEP	No generation	13%
Chamera-3 HEP	No generation	No generation	Pong HEP	-6%	-12%
Bairasiul HEP	No generation	No generation	Koldam HEP	No generation	328%
			AD Hydro HEP	No generation	No generation

FRC calculation of major state generators based on NRLDC SCADA data is tabulated below:

Generator	FRC (16-Jan-19 event)	FRC (23-Jan-19 event)	Generator	FRC (16-Jan-19 event)	FRC (23-Jan-19 event)
PUNJAB			UP		
Ropar TPS	No generation	No generation	Obra TPS	3%	147%
L.Mohabbat TPS	13%	No generation	Harduaganj TPS	Suspect SCADA data	Suspect SCADA data
Rajpura TPS	11%	0%	Paricha TPS	-1%	9%
T.Sabo TPS	0%	-80%	Rosa TPS	0%	40%
Goindwal Sahib TPS	147%	81%	Anpara TPS	5%	-8%
Ranjit Sagar HEP	12%	No generation	Anpara C TPS	35%	152%
Anandpur Sahib HEP	-13%	No generation	Anpara D TPS	-2%	1%
HARYANA			Bara TPS	1%	-16%
Panipat TPS	25%	-12%	Lalitpur TPS	0%	No generation
Khedar TPS	187%	No generation	Meja TPS	No generation	No generation
Yamuna Nagar TPS	No generation	No generation	Vishnuprayag HEP	Suspect SCADA data	Suspect SCADA data
CLP Jhajjar TPS	-7%	38%	Alaknanda HEP	No generation	48%
Faridabad GPS	0%	33%	Rihand HEP	102%	-21%
RAJASTHAN			Obra HEP	-13%	-12%
Kota TPS	Suspect SCADA data	11%	UTTARAKHAND		
Suratgarh TPS	-87%	26%	Gamma Infra GPS	-14%	967%
Kalisindh TPS	-9%	7%	Shravanti GPS	Suspect SCADA data	Suspect SCADA data
Chhabra TPS	No generation	No generation	Ranganga HEP	Suspect SCADA data	Suspect SCADA data
Chhabra stg-2 TPS	Error in SCADA data	99%	Chibra HEP	No generation	No generation
Kawai TPS	146%	54%	Khodri HEP	No generation	No generation
Dholpur GPS	No generation	No generation	Chilla HEP	-12%	-23%
Mahi-1 HEP	0%	-8%	HP		
Mahi-2 HEP	No generation	No generation	Baspa HEP	-2%	No generation
RPS HEP	24%	8%	Malana HEP	No generation	No generation
JS HEP	20%	-21%	Sainj HEP	No generation	No generation
DELHI			Larji HEP	Suspect SCADA data	Suspect SCADA data
Badarpur TPS	No generation	No generation	Bhabha HEP	Suspect SCADA data	No generation
Bawana GPS	-46%	-45%	Giri HEP	Suspect SCADA data	No generation
Pragati GPS	-40%	-17%	J&K		
			Baglihar-1&2 HEP	-10%	-8%
			Lower Jhelum HEP	No generation	No generation

In line with the decisions taken during various OCC meetings, the time and date of the FRC events were e-mailed to respective utilities.

Details were received from UP and NHPC till OCC meeting date.

UP details of 16th Jan 2019:

Sr No	Particulars	Dimension	ANPARA-A (3X210MW)	ANPARA-B (2X500MW)	ANPARA-D (2X500MW)	OBRA-B (5X200MW)	PARICHAHA-B (2X210MW)	PARICHAHA-C (2X250MW)	HARDUAGAN (2X250MW)	LALITPUR (3X660MW)	BARA (3X660MW)
1	Actual net interchange immediately before the disturbance	MW	458.441	877.928	959.4891	528.4733	375.2137	231.0106	455.901	-3.556	1111.663
2	Actual net interchange immediately after the disturbance	MW	460.085	877.7241	959.1804	528.7902	375.892	231.0106	454.475	-3.556	1111.33
3	Change in Net Interchange (2 - 1)	MW	1.644	-0.204	-0.309	0.317	0.678	0.000	-1.426	0.000	-0.333
4	Generation Loss (+) / Load Throw off (-) during the Event	MW	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
5	Control Area Response (4-3) (ΔP)	MW	-1.644	0.204	0.309	-0.317	-0.678	0.000	1.426	0.000	0.333
6	Frequency before the Event	HZ	49.964	49.964	49.964	49.964	49.964	49.964	49.964	49.964	49.964
7	Frequency after the Event	HZ	49.917	49.917	49.917	49.917	49.917	49.917	49.917	49.917	49.917
8	Change in Frequency (7-6)	HZ	-0.047	-0.047	-0.047	-0.047	-0.047	-0.047	-0.047	-0.047	-0.047
9	Frequency Response Characteristic (5 / 8)	MW/HZ	34.937	-4.332	-6.558	6.733	14.410	0.000	-30.295	0.000	-7.075
10	Ideal generator response assuming 5% droop.....40% per Hz (40% of Row 1) (P Ideal gen)	MW/Hz	183.376	351.171	383.796	211.389	150.085	92.404	182.360	-1.422	444.665
11	Percentage ideal response	%	19.052	-1.234	-1.709	3.185	9.601	0.000	-16.613	0.000	-1.591

Sr No	Particulars	Tanda(4X110)	VISHNUPRAYAG (4X110MW)	ALAKH NANDA (4X82MW)	ANPARA-C LANCO (2X600MW)	ROSA-I (2X300MW)	ROSA-II (2X300MW)	RIHAND-Hydro (6X50MW)	OBRA-H (3X33MW)	KHARA-H (3X24MW)	UP
1	Actual net interchange immediately before the disturbance	414.5943	75	0.230876	1111.889	277.3686	-4.45814	141.8479	51.01486	20	4533.886
2	Actual net interchange immediately after the disturbance	415.2645	75	0.23092	1119.517	277.3686	-4.45814	144.67	51.13249	20	4493.461
3	Change in Net Interchange (2 - 1)	0.670	0.000	0.000	7.628	0.000	0.000	2.822	0.118	0.000	-40.425
4	Generation Loss (+) / Load Throw off (-) during the Event	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
5	Control Area Response (4-3) (ΔP)	-0.670	0.000	0.000	-7.628	0.000	0.000	-2.822	-0.118	0.000	-40.425
6	Frequency before the Event	49.964	49.964	49.964	49.964	49.964	49.964	49.964	49.964	49.964	49.964
7	Frequency after the Event	49.917	49.917	49.917	49.917	49.917	49.917	49.917	49.917	49.917	49.917
8	Change in Frequency (7-6)	-0.047	-0.047	-0.047	-0.047	-0.047	-0.047	-0.047	-0.047	-0.047	-0.047
9	Frequency Response Characteristic (5 / 8)	14.238	0.000	0.001	162.057	0.000	0.000	59.962	2.499	0.000	858.827
10	Ideal generator response assuming 5% droop.....40% per Hz (40% of Row 1) (P Ideal gen)	165.838	30.000	0.092	444.756	110.947	-1.783	56.739	20.406	8.000	1813.554
11	Percentage ideal response	8.586	0.000	1.012	36.437	0.000	0.000	105.680	12.247	0.000	47.356

UP details of 23rd Jan 2019:

Sr No	Particulars	Dimension	ANPARA-A (3X210MW)	ANPARA-B (2X500MW)	ANPARA-D (2X500MW)	OBRA-B (5X200MW)	PARICHHA-B (2X210MW)	PARICHHA-C (2X250MW)	HARDUAGAN J(2X250MW)	LALITPUR (3X660MW)	BARA (3X660MW)
1	Actual net interchange immediately before the disturbance	MW	185.740	879.178	960.2139	345.5767	215.3453	145	251.768	-2.365	352.3745
2	Actual net interchange immediately after the disturbance	MW	185.733	877.759	960.3474	353.723	215.6542	145	262.88	-2.365	351.6529
3	Change in Net Interchange (2 - 1)	MW	-0.007	-1.419	0.134	8.146	0.309	0.000	11.112	0.000	-0.722
4	Generation Loss (+) / Load Throw off (-) during the Event	MW	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
5	Control Area Response (4-3) (ΔP)	MW	0.007	1.419	-0.134	-8.146	-0.309	0.000	-11.112	0.000	0.722
6	Frequency before the Event	HZ	49.947	49.947	49.947	49.947	49.947	49.947	49.947	49.947	49.947
7	Frequency after the Event	HZ	49.920	49.920	49.920	49.920	49.920	49.920	49.920	49.920	49.920
8	Change in Frequency (7-6)	HZ	-0.027	-0.027	-0.027	-0.027	-0.027	-0.027	-0.027	-0.027	-0.027
9	Frequency Response Characteristic (5 / 8)	MW/HZ	-0.260	-53.426	5.026	306.713	11.630	0.000	418.373	0.000	-27.169
10	Ideal generator response assuming 5% droop.....40% per Hz (40% of Row 1) (P Ideal gen)	MW/Hz	74.296	351.671	384.086	138.231	86.138	58.000	100.707	-0.946	140.950
11	Percentage ideal response	%	-0.350	-15.192	1.309	221.885	13.502	0.000	415.436	0.000	-19.275

Sr No	Particulars	Tanda(4X110)	VISHNUPRAY AG (4X110MW)	ALAKHNAND A (4X82MW)	ANPARA-C LANCO (2X600MW)	ROSA-I (2X300MW)	ROSA-II (2X300MW)	RIHAND- Hydro (6X50MW)	OBRA-H (3X33MW)	KHARA-H (3X24MW)	UP
1	Actual net interchange immediately before the disturbance	260	60	161.4604	964.3939	147.4308	-4.45814	175.207	49.81322	20.78073	4832.873
2	Actual net interchange immediately after the disturbance	260	60	162.7009	987.8604	148.3493	-4.45814	174.63	50.10915	20.80114	4775.588
3	Change in Net Interchange (2 - 1)	0.000	0.000	1.241	23.467	0.918	0.000	-0.575	0.296	0.020	-57.285
4	Generation Loss (+) / Load Throw off (-) during the Event	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
5	Control Area Response (4-3) (ΔP)	0.000	0.000	-1.241	-23.467	-0.918	0.000	0.575	-0.296	-0.020	-57.285
6	Frequency before the Event	49.947	49.947	49.947	49.947	49.947	49.947	49.947	49.947	49.947	49.947
7	Frequency after the Event	49.920	49.920	49.920	49.920	49.920	49.920	49.920	49.920	49.920	49.920
8	Change in Frequency (7-6)	-0.027	-0.027	-0.027	-0.027	-0.027	-0.027	-0.027	-0.027	-0.027	-0.027
9	Frequency Response Characteristic (5 / 8)	0.000	0.000	46.706	883.528	34.582	0.000	-21.645	11.142	0.768	2156.815
10	Ideal generator response assuming 5% droop.....40% per Hz (40% of Row 1) (P Ideal gen)	104.000	24.000	64.584	385.758	58.972	-1.783	70.083	19.925	8.312	1933.149
11	Percentage ideal response	0.000	0.000	72.317	229.037	58.641	0.000	-30.885	55.919	9.245	111.570

NHPC details of 16th Jan 2019:

1) Event: On 16.01.2019 at 12:25hrs, there was a dropper flashover at 220kV GIS Bhadla substation. There was also tripping of 400kV Jodhpur-Bhadla, 400kV Merta-Bhadla, 400kV Bhadla-Bikaner 1&2. Solar Generation loss around 1400MW as reported by Rajasthan SLDC.

During the event RGMO / FGMO applicable, NHPC power stations in NR, Chamera-I, Chamera- III, Dhauliganga & Sewa-II power stations were in stop condition. During the event, the actual net interchanges data of NRLDC and same data recorded at said power stations are tabulated below.

S No	Power Station	As per NRLDC actual interchanges at the time of event (MW)		As per NHPC actual interchanges at the time of event (MW)		Remarks
		Before	After	Before	After	
1)	Chamera-I	0	0	0	0	No Generation
2)	Chamera-III	0	0	0	0	No Generation
3)	Dhauliganga	0	0	0	0	No Generation
4)	Sewa-II	0	0	0	0	No Generation

NHPC details of 23rd Jan 2019:

2) Event: On 23rd Januray 2019, at 06:37 Hrs 400KV Jhakri-Panchkula 1, 400KV Jhakri-Rampur 1 tripped due to bus bar protection operated at NJPC during charging of 400KV Jhakri-Karcham 1. Consequently, 925 MW generation loss occurred at both Jhakri and Rampur.

During the event RGMO / FGMO applicable, NHPC power stations in NR, Chamera-I, Chamera- III, Dhauliganga & Sewa-II power stations were feeding the Grid. During the event, the actual net interchanges data of NRLDC and same data recorded at said power stations are tabulated below.

S No	Power Station	As per NRLDC actual interchanges at the time of event (MW)		As per NHPC actual interchanges at the time of event (MW)		Remarks
		Before	After	Before	After	
1)	Chamera-I	340	351	---	---	---
2)	Chamera-III	0	0	161.54	162.53	Revised response as per below
3)	Dhauliganga	286	288	---	---	---
4)	Sewa-II	129	129	131.19	131.34	Revised response as per below

1) Chamera-III PS: As per data recorded at power station before the time of event two units (rated capacity: 77 MW each) were Feeding load 161.54 MW approx. to the Grid. During the event the two units responded positively and station load increased from 161.54 MW to 162.53 MW (load trend enclosed). Accordingly revised FRC calculations are as under:

Sr No	Particulars	Dimension	NRLDC	Chamera-III
1	Actual Net Interchange before the Event	MW	0	161.54
2	Actual Net Interchange after the Event	MW	0	162.53

3	Change in Net Interchange (2 - 1)	MW	0.00	0.99
4	Generation Loss (+) / Load Throw off (-) during the Event	MW	0	0
5	Generator Response (4-3)	MW	0.00	-0.99
6	Frequency before the Event	HZ	49.96	49.96
7	Frequency after the Event	HZ	49.92	49.92
8	Change in Frequency (7-6)	HZ	-0.04	-0.04
9	Frequency Response Characteristic (5 / 8)	MW/HZ	0	25
10	Ideal generator response @ 5% droop setting (i.e. MW/Hz per unit)	MW/Hz	0.0	64.6
11	Percentage ideal response	%	No generation	38%

2) Sewa-II PS: As per data recorded at power station before the time of event all the three units (rated capacity: 40 MW each) were Feeding load 131.19 MW approx. as per schedule to the Grid. During the event all the units responded positively and station load increased from 131.19 MW to 131.34 (load trend enclosed). Accordingly revised FRC calculations are as under:

Sr No	Particulars	Dimension	NRLDC	Sewa-II
1	Actual Net Interchange before the Event	MW	129	131.19
2	Actual Net Interchange after the Event	MW	129	131.34
3	Change in Net Interchange (2 - 1)	MW	0.00	0.15
4	Generation Loss (+) / Load Throw off (-) during the Event	MW	0	0
5	Generator Response (4-3)	MW	0.00	-0.15
6	Frequency before the Event	HZ	49.96	49.96
7	Frequency after the Event	HZ	49.92	49.92
8	Change in Frequency (7-6)	HZ	-0.04	-0.04
9	Frequency Response Characteristic (5 / 8)	MW/HZ	0	4
10	Ideal generator response @ 5% droop setting (i.e. MW/Hz per unit)	MW/Hz	51.6	52.5
11	Percentage ideal response	%	0%	7%

The following were discussed during the meeting:

- As per UP FRC details, it was observed that the response was not adequate and was very less than ideal response. NRLDC representative requested UP to look into the poor response of generators and advise the generators for improvement.
- As per NHPC details, it was observed that response of Chamera-III was only 38% for 23-Jan-19 event. NRLDC representative requested NHPC for improvement in response.
- NRLDC representative requested Rajasthan for correct information of load loss and generation loss for the incident of 16th Jan 2019 which would be helpful in calculating the correct FRC figure of that control area and region.
- Other constituents were requested to submit the FRC of their control areas for both the events and reason of poor response, if observed.

Subject: **Correction in MOM of NRPC 155th OCC MOM - Reg.**
To: seo-nrpc <seo-nrpc@nic.in>
Cc: ms-nrpc <ms-nrpc@nic.in>, RN Pandey <rnpandey02@ntpc.co.in>

Date: 08/02/19 10:21 AM
From: Shailesh Dheman <shaileshdheman@ntpc.co.in>

Dear Sir/Madam,

NRPC 155th OCC MOM have been published at NRPC web site. Following discrepancies needs to be corrected suitably :

At Agenda 2.3, mentioned Annexure 2D is missing in MOM - please upload the same so that outages of generating units can be checked.

In respect of Agenda 22 (Display of Open Cycle Schedules at NRLDC web site and Open Cycle Certification by RPC-Agenda BY NTPC, the following is mentioned in last para :

"MS, NRPC asked NTPC to submit the details of instances where merit order violations have taken place and NRLDC/NLDC may submit the reasons for the the same would be discussed in the next meeting"

whereas it details of merit order violations were asked from NRPC secretariate and NRLDC and not from NTPC.

Kindly incorporate above corrections so that MOM can be confirmed.

सादर

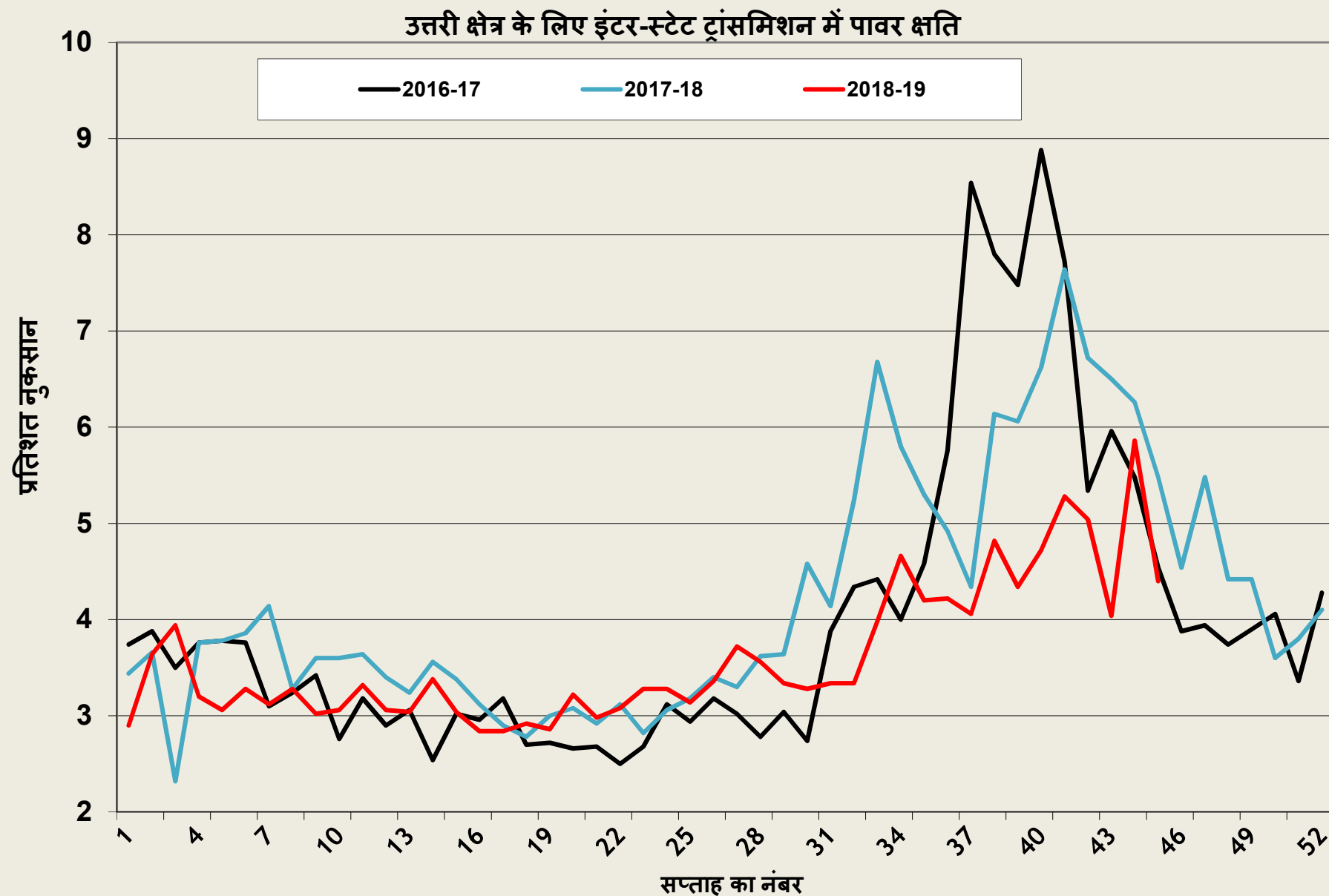
शैलेश धीमन

(उप महाप्रबन्धक)

प्रचालन सेवार्ये - आर सी सी

नोएडा

ट्रांसमिशन में पावर क्षति



एस.टी.ओ.ए (STOA) का सारांश जनवरी -2018 बनाम जनवरी -2019



'ट्रांसेक्शन टाइप' के आधार पर वर्गीकृत

अनुमोदनों की संख्या

	जनवरी -2018	जनवरी -2019
अगले दिन का (DA)	130	441
आकस्मिक (Contingency)	60	146
पहले आओ पहले पाओ (FCFS)	38	38
अग्रिम (AD)	20	22
कुल	248	647

ऊर्जा स्वीकृत (एम.यू.)

अगले दिन का (DA)	47.63	232.30
आकस्मिक (Contingency)	19.80	55.63
पहले आओ पहले पाओ (FCFS)	596.24	332.88
अग्रिम (AD)	818.97	1035.50
कुल	1482.64	1656.31

अंतः/अंतर-क्षेत्रीय लेन-देन के आधार पर वर्गीकृत

अनुमोदनों की संख्या

	जनवरी -2018	जनवरी -2019
अंतः (Intra) क्षेत्रीय	168	252
अंतर (Inter) क्षेत्रीय	80	395
कुल	248	647

ऊर्जा स्वीकृत (एम.यू.)

अंतः (Intra) क्षेत्रीय	1432.44	1273.56
अंतर (Inter) क्षेत्रीय	59.47	382.76
कुल	1482.64	1656.31

Long Outage of Generating Units

SL. No	Station Name	Location	Owner	Unit No	Capacity	Reason	Outage		Remarks
							Date	Time	
1	RAPS-A	RAJASTHAN	NPC	1	100	Subject to regulatory clearance . Unit is to be decommissioned.	9/10/2004	22:58	
2	Bairasiul HPS	HP	NHPC	3	60	For renovation and Modernisation of the plant	15-10-2018	9:11	
3	Bairasiul HPS	HP	NHPC	2	60	For renovation and Modernisation of the plant	15-10-2018	10:02	
4	Bairasiul HPS	HP	NHPC	1	60	For renovation and Modernisation of the plant	15-10-2018	10:14	
5	Parbati III HEP	HP	NHPC	3	130	For repair & maintenance of HRT alongwith pressure shafts & drafts tubes	20-12-2018	0:00	
6	Parbati III HEP	HP	NHPC	1	130	For repair & maintenance of HRT alongwith pressure shafts & drafts tubes	20-12-2018	0:00	
7	Parbati III HEP	HP	NHPC	2	130	For repair & maintenance of HRT alongwith pressure shafts & drafts tubes	20-12-2018	0:00	
8	Parbati III HEP	HP	NHPC	4	130	For repair & maintenance of HRT alongwith pressure shafts & drafts tubes	20-12-2018	0:00	
9	Paricha TPS	UP	UPRVUNL	1	110	R & M Work	2/7/2016	17:30	
10	Rosa TPS	UP	ROSA	1	300		15-11-2018	12:00	
11	Pong HPS	HP	BBMB	2	66	Repair and Replacement of draft tube gates.	28-03-2018	16:20	
12	NAPS	UP	NPC	1	220	Planned Bi-annual shutdown	28-12-2018	22:04	
13	Giral (IPP) LTPS	RAJASTHAN	RRVUNL	1	125	Bed materials leakage.	11/7/2014	8:20	
14	Giral (IPP) LTPS	RAJASTHAN	RRVUNL	2	125	Boiler tube leakage	27-01-2016	15:27	
15	Bara PPGCL TPS	UP	Jaypee	2	660	Unit tripped due to emergency stop valve damaged.	15-09-2018	14:04	
16	Obra TPS	UP	UPRVUNL	12	200	Tripping details awaited.	24-09-2018	17:26	
17	Guru Gobind Singh TPS (Ropar)	PUNJAB	PSEB	5	210	Problem in GT.Details awaited.	14-12-2018	7:15	
18	RGTPP(Khedar)	HARYANA	HPGCL	1	600	Ash hopper problem.	18-12-2018	11:30	

SL. No	Element Name	Type	Voltage Level	Owner	Outage		Reason / Remarks
					Date	Time	
1	Lucknow 315 MVA ICT	ICT	400/220 kV	PGCIL	25-01-2019	10:00	For replacement of this ICT with new 500MVA, 440/220kV ICT at LKO PG
2	400 kV 50 MVAR Line Reactor (Non-Switchable) of Bhadla(RVPNL) ckt 1 at Ramgarh 400 (RRVPNL)	Line Reactor	400 kV	RRVPNL	10-12-2018	12:00	General maint work.
3	400 kV Bus coupler Main CB (424) of Bus 1& 2 at Anpara B UP	BAY/CB	400 kV	UPPTCL	21-01-2019	12:30	For replacement of faulty CB at Anpara B. CB is faulty from 02.01.19
4	50 MVAR (400kV) Bus Reactor at Moradabad (UP)	Bus Reactor	400 kV	UPPTCL	23-01-2019	10:29	For Dismantling, shifting, gasketreplacement, erection & commissioningof 50 MVAR Bus Reactor & Associatesworks in same station.
5	Vindhyachal HVDC BtB Block 2	HVDV Station	500 kV HVDC	PGCIL	26-11-2017	14:55	Differential protection operated.
6	Akal 500 MVA ICT 4	ICT	400/220 kV	RRVPNL	5/8/2018	16:00	ICT burnt
7	Akal 315 MVA ICT 2	ICT	400/220 kV	RRVPNL	22-08-2018	22:55	ICT burnt.
8	Panki 240 MVA ICT 1	ICT	400/220 kV	UPPTCL	6/10/2018	15:49	ES/D. To attend abnormal heating at bottom cover bolt.
9	FACT at BLB in Knp-BLB Line	FACTS	400 kV	PGCIL	2/7/2016	10:20	Y-Phase current imbalance
10	FSC (50%) of Koteswar Pool -2 at Meerut (PG)	FSC	400 kV	PGCIL	14-07-2017	19:22	Fire in Y-ph unit
11	FSC of Balia-I at Lucknow	FSC	400 kV	PGCIL	29-11-2017	13:30	E/SD due to Hot Spot at Isolator
12	FSC (40%) of Fatehpur-II at Mainpuri(PG)	FSC	400 kV	PGCIL	5/8/2018	0:10	Minimum oil protection operated. Presently out due to Low current.
13	Bairasuil(NHPC)-Pong(BBMB)	Line	220 kV	PGCIL	15-10-2018	10:50	for renovation & modernization. shutdown for 6 months
14	Bairasiul(NHPC)-Jassure(HPSEB)	Line	220 kV	PGCIL	15-10-2018	12:16	for renovation & modernization. shutdown for 6 months

Transmission Lines (400kV – 134 ckt. Km)

S.No.	Name of element	Voltage Level (in kV)	Line Length (In Km)	Conductor Type	Agency/ Owner	Location	SCM/CEA/CTU/NRPC Meeting minutes	Remarks	Actual date & time of charging	
									Date	Time
1	400kV DC Barmer-Jaisalmer-1 and associated bays no 407A, 407B & 407T at Jaisalmer and 404A,404B,404T at Barmer	400	116.98	Twin Moose	RRVPNL	RRVPNL	39th SCM page no 92, Annexure-VI	Charged from Barmer end only	28.01.2019	13:56
2	400kV DC Barmer-Jaisalmer-2 and associated bays no 408A, 408B & 408T at Jaisalmer and 403A,403B,403T at Barmer	400	116.98	Twin Moose	RRVPNL	RRVPNL	39th SCM page no 92, Annexure-VI	Charged from Barmer end only	28.01.2019	15:59

LILO of Transmission Lines (132kV – 6.2 ckt. Km)

S.No.	Name of element	Voltage Level (in kV)	Original Line Length (In Km)	Line Length (In Km)	LILO Line Length (In Km)	Conductor Type	Agency / Owner	Location	SCM/CEA/CTU/NRPC Meeting minutes	Remarks	Actual date & time of charging(No Load/Antitheft)	
											Date	Time
1	132kV Ambala RD II-Bhagwanpur { LILO of 132kV Ambala RD I-Bhagwanpur line at Ambala RD II}	132	35.851	6.449	6.249	Single panthar	UPPTCL	UP	40th SCM	Charged from Ambala Rd II end only	31.01.2019	18:35

ICT

(Capacity Addition - 500 MVA)

S.No.	Name of element	Voltage Level	Transformation Capacity (in MVA)	New/replacement /augmentation	Agency/ Owner	Location	Actual date & time of charging (no load)		Actual date & time of charging (on load)	
							Date	Time	Remarks	Date
1	500 MVA ICT along with associated bays no 404 & 224 at Unchahar Stage IV	400/220/33	500	New	NTPC	UP			16.01.2019	13:21

Bus Reactor

(Capacity Addition – Bus Reactor 205 MVAR)

S. No.	Name of element	Voltage Level (kV)	Transformation Capacity (in MVAR)	New/ replacement /augmentation	Make	Agency/ Owner	Remarks	Actual date & time of charging	
								Date	Time
1	80 MVAR Bus Reactor along with associated bays no 406,405 at Unchahar Stage IV	400	80	New	BHEL	NTPC		19.12.2018	19:50
2	125 MVAR Bus Reactor at Paricha Ext through TBC	400	125	New	BHEL	UP		22.12.2018	18:05

Bus Reactor

(Capacity Addition –Line Reactor 200 MVAR)

1	765kV, 3*50 MVAR Line reactor of Mainpuri line at Unnao and associated bay no 707 at Unnao	765	150	New	TBEA	UP		25.01.2018	21:15
2	50 MVAR Switchable line reactor at Chabra CTPP of Hinduan line (bay no 407R)	400	50	New	ABB	RRVPL		13.01.2019	14:23

Bays Charging details

S.No.	Name of element	Type	Voltage Level (in kV)	Agency/ Owner	SCM/CEA/CTU/NRPC Meeting minutes	Remarks	Actual date & time of charging	
							Date	Time
1	Tie bay no 402T of 400kV Ajmer-Bhilwara-2 at Ajmer	bay	400	RRVPNL			21.01.2019	17:08
2	400kV bays no 406A & 406T of Bhinmal line-1 at Barmer	bay	400	RRVPNL	39th SCM page no 92, Annexure-VI		31.01.2019	15:57 & 15:58
3	220kV bay no 211 of Chandigarh-1 at Panchkula	bay	220	PGCIL	31st &36th SCM page no 4, point no 1.1.2		30.01.2019	15:55
4	220kV bay no 214 of Chandigarh-2 at Panchkula	bay	220	PGCIL	31st &36th SCM page no 4, point no 1.1.2		30.01.2019	15:56

Annexure-4

State		MU	MW
		Mar-19	Mar-19
Chandigarh	Availability	125	305
	Requirement	115	235
	Surplus/Shortfall (MU)	10	70
	Surplus/Shortfall (%)	8.7%	29.8%
Delhi	Availability	3490	5800
	Requirement	2080	4100
	Surplus/Shortfall (MU)	1410	1700
	Surplus/Shortfall (%)	67.8%	41.5%
Haryana	Availability	5580	8360
	Requirement	3700	7536
	Surplus/Shortfall (MU)	1880	824
	Surplus/Shortfall (%)	50.8%	10.9%
Himachal Pradesh	Availability	1030	2200
	Requirement	880	1620
	Surplus/Shortfall (MU)	150	580
	Surplus/Shortfall (%)	17.0%	35.8%
Jammu & Kashmir	Availability	990	2070
	Requirement	1570	2570
	Surplus/Shortfall (MU)	-580	-500
	Surplus/Shortfall (%)	-36.9%	-19.5%
Punjab	Availability	5169	7930
	Requirement	3900	7120
	Surplus/Shortfall (MU)	1269	810
	Surplus/Shortfall (%)	32.5%	11.4%
Rajasthan	Availability	8960	12551
	Requirement	6510	11089
	Surplus/Shortfall (MU)	2450	1461
	Surplus/Shortfall (%)	37.6%	13.2%
Uttar Pradesh	Availability	10943	16870
	Requirement	11377	17000
	Surplus/Shortfall (MU)	-434	-130
	Surplus/Shortfall (%)	-3.8%	-0.8%

	(%)		
Uttarakhand	Availability	1010	1760
	Requirement	1130	2000
	Surplus/Shortfall (MU)	-120	-240
	Surplus/Shortfall (%)	-10.6%	-12.0%
Total NR	Availability	37297	56086
	Requirement	31262	49300
	Surplus/Shortfall (MU)	6035	6786
	Surplus/Shortfall (%)	19.3%	13.8%

SNO	Description of Agenda point	Details	STATUS UPDATED
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 Northern Region. 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 available was attached as Annexure 9/1 of the Agenda. Punjab & DTL updated status. All other utilities were requested to update HVPNL- A committee has been constituted for submitting recommendations to procure/ install the Automatically Switched type or Conventional type of capacitor banks at existing as well as upcoming S/Stns. In future and the committed shall review the Techno-Economic analysis of both types (manual & automatic) of capacitor banks.
2	Sub-stations likely to be commissioned in next 6 months.	All the concerned states were requested to submit the details of the downstream network associated SPECIFICALLY with THESE POWERGRID substations along with the action plan of their proposed/approved networks.	The details of the substations of Power Grid and their required downstream network were enclosed as Annexure 9/2 of the Agenda. PSTCL updated as under: Moga-Mehalkalan 220 KV D/C line work has been completed. Expected date of commissioning of line is 31.01.2019 All other concerned utilities were requested to update regularly and ensure that the work is completed expeditiously. HVPNL- Down the line HVPNL lines /Sub stations from PGCIL stations HVDC Jind, Kurukshetra, Bhiwani & 315 MVA ICT at 400 KV Kaithal stations
3	Progress of installing new capacitors and repair of defective capacitors	The available up to date status of installation of new capacitors and revival of defective capacitor by the State constituents is enclosed as ANNEXURE 10/3 OF THE AGENDA OF THE 146TH OCC MEETING.	Information received in the 1/2019 from Uttarakhand , UP, Rajasthan & Haryana is enclosed at Annexure9/3. All other states were requested to update. HVPNL- For replacement of defective capacitor cells a PO has been placed upon M/s BHEL on Dt.31.10.2018 (HDP-2371) for supply of 530 no. 200KVAR capacitor cells and the supply is expected shortly.
4.	Healthiness of defence mechanism:	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	Information from for period ending September 2018 has not been received from Punjab, Delhi, Rajasthan the same may please be submitted.

	Self-certification	certify specifically, in the report that “ <i>All the UFRs are checked and found functional</i> ”.	The information of period ending 9/2018 from Punjab, DTL stand submitted. Rajasthan was requested to update. The information ending 12/2018 was submitted by BBMB and all others were requested to submit. HVPNL- upto September’2018 the necessary confirmation has been supplied by the concerned field offices.
5	Strengthening of Intra-State transmission system	Also all SLDCs are requested to give half yearly feedback ending 6/2018 in the month of 7/2018 to STU regarding bottlenecks, constraints and overloading in the State transmission network for proper transmission planning PTCUL, Punjab ,Delhi & Rajasthan have submitted the information ending 6/2018 & that send submitted to concerned office.	UPPTCL has submitted the information ending 12/2018. ALL other SLDCs were requested to give half yearly feedback ending 12/2018 in the month of 1/2019 to STU regarding bottlenecks, constraints and overloading in the State transmission network for proper transmission planning
6	Mapping of Feeders in SCADA	In the 141 st OCC meeting members were informed about the “Compendium of SPS in NR” (<i>Annexure-9 of the MOM</i>) which was released in the 40 th NRPC meeting. All the utilities were requested to go through the compendium and identify feeders concerning their state and map the same in SCADA. 150th OCC meeting: MS NRRPC stated that as per the Compendium of SPS in NR” which was released in the 40 th NRPC meeting. All the utilities are requested to go through the compendium and identify feeders concerning their state and map the same in SCADA. This document is available on NRLDC & NRPC website. NRLDC representative added that it is very important that the feeders should be mapped in SCADA. It was stated that this issue will be discussed in the Test committee meeting also. The matter under discussion in subsequent meetings but no further update	All states except Punjab & Rajasthan were requested to update. HVPNL-SCADA wing has made provisions in the database as well as associated displays at control centre. The work at RTU locations is yet to be carried out to complete the SCADA mapping.

State-wise Emergency Restoration system in NR #				
Transmission Licensee	Requirement of Total no of ERS in State	Number of ERS available in state	No of ERS to Be Procured	Remark if Any
POWERGRID		2 sets of 400 kV & 2 sets 765 kV	-	-
DTL		2 sets	-	-
PSTCL		2 sets	-	-
UPPTCL		2 sets	-	-
PTCUL			2 sets	DPR under finalization
HVPN			2 sets	Under tendering
RRVPN			2 sets	NIT floated
HPPTCL			2 sets	Matter under consideration regarding funds availability
PDD J&K		2 sets	-	-
BBMB		0	0	##
Sterlite*				

*Sterlite has an arrangement with M/s Supreme, Kolkata to provide the ERS services as and when required and are in the process of procurement of their own.

Data as available with NRPC Sectt.

In the 155th OCC meeting, MS, NRPC advised BBMB to procure ERS for their system to which BBMB replied that the decision has already been taken in the full board decision of BBMB that the partner states will provide ERS to BBMB whenever needed.

MS, NRPC stated that if such a stance has been taken by the partner states, the partner states shall procure 1 additional set each to be provided to BBMB whenever they require.

Annex. - V.

S.No.	Name of Line	Circuit ID	Tower Configuration(S /C or D/C)	Line Length (in km)	Type of conductor	O&M by	Agency at		Thermal Capability of Breaker and Isolators	Thermal Capability of Other SwitchGears such as CT, PT, etc.	Thermal Capability of Line
							End-I	End-II			
4. 400KV HVAC Transmission Line											
G. HVPNL											
1	CLP Jhajjar -Dhanonda	1	D/C	20	Twin Moose	KT Jhajjar	CLP Jhajjar	HVPNL	2000A @ 50 DEG C	2500A@50 DEG C	728A @ 40 DEG AMBIENT TEMPERATURE
2	CLP Jhajjar -Dhanonda	2	D/C	20	Twin Moose	KT Jhajjar	CLP Jhajjar	HVPNL	2000A @ 50 DEG C	2500A@50 DEG C	728A @ 40 DEG AMBIENT TEMPERATURE
3	CLP Jhajjar- Kabulpur	1	D/C	35	Quad Moose	KT Jhajjar	CLP Jhajjar	HVPNL	3150 A @ 50 deg C	3000 A @ 50 deg C	714 A @ 50 deg C ambient temp
4	CLP Jhajjar- Kabulpur	2	D/C	35	Quad Moose	KT Jhajjar	CLP Jhajjar	HVPNL	3150 A @ 50 deg C	3000 A @ 50 deg C	714 A @ 50 deg C ambient temp
5	Deepalpur-Kabulpur	1	D/C	64	Quad Moose	KT Jhajjar	KT Jhajjar	KT Jhajjar	3150 A @ 50 deg C	3000 A @ 50 deg C	714 A @ 50 deg C ambient temp
6	Deepalpur-Kabulpur	2	D/C	64	Quad Moose	KT Jhajjar	KT Jhajjar	KT Jhajjar	3150 A @ 50 deg C	3000 A @ 50 deg C	714 A @ 50 deg C ambient temp
7	Dhanoda-Daultabad	1	D/C	73	Quad Moose	HVPNL	HVPNL	HVPNL	2000A @ 50 DEG C	2500A@50 DEG C	728A @ 40 DEG C AMBIENT TEMP
8	Dhanoda-Daultabad	2	D/C	73	Quad Moose	HVPNL	HVPNL	HVPNL	2000A @ 50 DEG C	2500A@50 DEG C	728 A @ 40 Deg C AMB. TEMP.
9	Gurgaon-Daultabad	1	D/C	24	Quad Moose	HVPNL	POWERGRID	HVPNL	3150 A @ 50 deg C	2000 A @ 50 deg C	714A each conductor@ 50 deg C ambient temp
10	Gurgaon-Daultabad	2	D/C	24	Quad Moose	HVPNL	POWERGRID	HVPNL	3150 A @ 50 deg C	2000 A @ 50 deg C	714A each conductor@ 50 deg C ambient temp
11	Jhajjar-Daultabad	1	D/C	64	Twin Moose	HVPNL	APCPL	HVPNL	3150 A @ 50 deg C	2000 A @ 50 deg C	714A each conductor@ 50 deg C ambient temp
12	Jhajjar-Daultabad	2	D/C	64	Twin Moose	HVPNL	APCPL	HVPNL	3150 A @ 50 deg C	2000 A @ 50 deg C	714A each conductor@ 50 deg C ambient temp
13	Khedar-Fathehabad	1	D/C	40	Twin Moose	HVPNL	HPGCL	POWERGRID	3150 A @ 50 deg C	3000 A @ 50 deg C	714 A @ 50 deg C ambient temp
14	Khedar-Kirori	1	D/C	6	Twin Moose	HVPNL	HPGCL	HVPNL	3150 A @ 50 deg C	3000 A @ 50 deg C	714 A @ 50 deg C ambient temp
15	Khedar-Kirori	2	D/C	6	Twin Moose	HVPNL	HPGCL	HVPNL	3150 A @ 50 deg C	3000 A @ 50 deg C	714 A @ 50 deg C ambient temp
16	Jind Kirori 1	1	D/C	50	Twin Moose	HVPNL	PGCIL	HVPNL	3150 A @ 50 deg C	3000 A @ 50 deg C	714 A @ 50 deg C ambient temp
17	Jind Kirori 2	2	D/C	50	Twin Moose	HVPNL	PGCIL	HVPNL	3150 A @ 50 deg C	3000 A @ 50 deg C	714 A @ 50 deg C ambient temp
18	Khedar-Nuhiawali	1	D/C	114	Twin Moose	HVPNL	HPGCL	HVPNL	2000 A @ 45 deg C	2000A @ 45 deg C	1670A @ 45deg C Ambient temp.
19	Nuhiawali-Fathehabad	1	D/C	78	Twin Moose	HVPNL	HVPNL	POWERGRID	2000 A @ 45 deg C	2000A @ 45 deg C	1670A @ 45deg C Ambient temp.



सत्यमेव जयते

भारत सरकार

Government of India

विद्युत मंत्रालय

Ministry of Power

उत्तर क्षेत्रीय विद्युत समिति

Northern Regional Power Committee

No: NRPC/OPR/106/01/2018/

Dated: 26.11.2018

To: Members of the Committee (As per List)

Subject: **Minutes of first meeting of the committee formed for examining the Problem of excessive vibrations in GTs of Rihand Stage – III and Vindhyachal Stage-IV during operation of Rihand - Dadri HVDC on monopole mode with ground return on 16.10.2018- reg.**

The first meeting of the committee constituted for examining the Problem of excessive vibrations in GTs of Rihand Stage – III and Vindhyachal Stage-IV during operation of Rihand - Dadri HVDC in monopole mode with ground return was held on 16.10.2018 at NRPC Secretariat along with 152nd OCC meeting

The minutes of the meeting are enclosed herewith for information and necessary action at your end.

PGCIL and NTPC are requested to furnish the information sought in the meeting expeditiously to this office via e-mail seo-nrpc@nic.in.

(Bhanwar Singh Meena)
Executive Engineer (O), NRPC

List of Nominated members of Committee

S. No.	Name of Officer	Name of the Organisation
1.	Sh. M. A. K. P. Singh, MS	NRPC
2.	Sh. Vikram Singh, Director (GM Div.)	CEA
3.	Sh. A. Sensharma, AGM (AM)	POWERGRID/CTU
4.	Sh. S. K. Sudhakar, AGM (EMD)	Rihand STPS
5.	Sh. R. K. Porwal, DGM (SO)	NRLDC
6.	Sh. Debashish Ghosh, AGM (EMD)	Vindhyachal STPS

Minutes of first meeting of the committee formed for examining the Problem of excessive vibrations in GTs of Rihand Stage – III and Vindhyachal Stage-IV during operation of Rihand - Dadri HVDC on monopole mode with ground return on 16.10.2018

The first meeting of the committee constituted for examining the Problem of excessive vibrations in GTs of Rihand Stage – III and Vindhyachal Stage-IV during operation of Rihand - Dadri HVDC in monopole mode with ground return was held on 16.10.2018 at NRPC Secretariat along with 152nd OCC meeting.

Representative of NTPC briefed the members about the problems being encountered in the GTs of Rihand Stage – III and Vindhyachal Stage-IV during monopole operation of Rihand - Dadri HVDC. He stated that the problem of excessive vibrations was observed since the Unit # 5 & 6 of Rihand Stage - III are connected to the Western Region bus through the Vindhyachal Pooling Station. He further stated that during the monopole operation of HVDC Rihand-Dadri if one of the unit out of two units of Stage III is under shutdown, the intensity of vibrations in the GT of the running increases. Similar problem was also being observed in the GT of Vindhyachal Stage-IV units.

NTPC and POWERGRID has performed some test to simulate the operation of monopole operation in ground return mode on HVDC Rihand – Dadri and observed vibrations in the various GTs of Rihand Stage-III. Based on the study they have reached to a consensus that under monopole operation of HVDC Rihand - Dadri in ground return mode, the power flow should be restricted to 300 MW to restrict the vibrations within limit. At the time of testing, both the units of Vindhyachal Stage-IV were running. Representative of POWERGRID stated that during this test only one unit at Rihand Stage-III was running. In case both the units are under operation, the power flow may go up to 600 MW as the DC current through the GTs will get distributed for the acceptable limits of vibration.

NTPC representative stated that as the testing was done only for a single machine, the power flow limit cannot be commented upon for the situation when both the units are under shutdown and the HVDC is in monopole operation in ground return mode. Similar testing may be done so as to arrive at a figure of power flow which does not lead to significant amount of vibrations in the GTs.

Director, GM Division, CEA shared two instances where SSR has been reported very prominently. The first case was of Manitoba Hydro, Canada. Canada and USA are connected through an HVDC link and because of switching operation in HVDC, the rotor of one of the unit of Manitoba hydro got damaged due to SSR. The other case was of KSK Mahanadi Power Project where also SSR was observed as some line was LILOed in its vicinity. KSK Mahanadi had appointed IIT, Mumbai that has conducted study so as to provide solutions to reduce these SSR vibrations. He stated that such type of study may be required to be conducted by some academician for the excessive vibrations being encountered at Rihand Stage-III. He, further

stated that it was also the responsibility of PGCIL to get the study conducted, if in the vicinity of their line any such vibrations are reported to them.

MS, NRPC queried that if it was already planned that the Stage-III would be connected to WR bus, whether such vibration analysis was done beforehand by CTU or not.

PGCIL representative stated that the same is to be confirmed from their study group. There would have been some study carried out at the time of connecting Stage-III to NR and thereafter to WR. He stated that it was a strange phenomenon as when Stage-III was connected to NR no such vibrations were observed and now the vibrations are being reported when it is connected to WR bus for which it was actually planned. He stated that the above study report would be shared with the committee for analysis.

Representative of NRLDC stated that if there are some oscillations being observed due to SSR on the mechanical side, the same should reflect on the electrical side also, which was not the case here as no SSR vibrations were observed neither in the PMU data nor in the DR. Thus, he stated that these may not be due to SSR.

PGCIL representative stated that they are planning shutdown of one pole of Rihand-Dadri in the last week of October or first week of November 2018. The vibration measurements could be done during the shutdown period.

NRLDC representative requested PGCIL to share with the committee, the report of any study conducted before shifting Rihand Stage-III to WR either by PGCIL or by the study group of PGCIL regarding the ground return impedance. PGCIL representative stated that such kind of a study/ review may be done as the system (HVDC Rihand – Dadri) is under service since past 30 years and many generator has come into service during this time like Sasan, Singrauli, Anpara, Obra in and around the Rihand complex.

NTPC representative further stated that whenever the ground return operation of an HVDC is planned, such type of study would have been conducted well in advance before they are commissioned.

POWERGRID representative stated that many elements / generator have come around the area later and it was not intended that the ground currents should go in to any of the element. Till now such kind of problem was never observed and now that the same is being reported a study may got conducted to examine the ground return impedance in and around Rihand complex.

NTPC representative stated that ground current in an HVDC monopole operation complete its path through the earth electrode at the two ends. There may have been some deterioration in the earth electrode because of which the ground current is taking some other path or the resistivity of the earth would have also changed.

SE (O) expressed that the resistivity of the earth and the health of earth electrode also needs to be verified and taken into account.

NRLDC representative stated that the reason as to why the DC current was more in the Stage-III GTs and less in stage-I & II also needs to be looked into. Any difference in the resistivity of the two areas should also be verified.

NTPC representative stated that the vibrations were observed not only in Stage-III but also in Stage-IV of Vindhyachal STPS. He stated that such vibrations are being observed in Vindhyachal Stage-IV since past one and a half years. However, its severity has increased since Rihand Stage-III got connected to WR bus. On the query of NRLDC about the data of DC current recorded in Vindhyachal Stage-IV when the vibrations were initially observed, NTPC representative stated that at that instance no such measurement was done as they were not aware of the actual cause of vibrations in the GTs. However, the data has been recorded since vibrations were observed in Rihand Stage-III and were shared with POSOCO.

NTPC was requested to share the data with the committee also.

Director, GM Division, CEA queried NTPC about whether rotor of some of its generators at Rihand had been damaged and replaced in past to which representative of NTPC replied negatively and stated that some problem in the exciter was reported in the past but nothing was reported in the rotor side. MS, NRPC requested NTPC to clarify the same from Rihand station.

PGCIL representative requested NTPC to collect the DC current capability of the GTs installed at Rihand from the OEM and the same be shared with the members of the committee.

NTPC representative stated that restriction of power flow on the HVDC link was the only solution to which members replied negatively stating that it was not an economic solution. On pursuance of NTPC, members suggested NTPC to back down their generation rather than reducing power flow on HVDC. NTPC representative stated that there was sufficient power evacuation corridor available for evacuation of their generation and there was no need for them to back down.

MS, NRPC stated that before inviting any academician to the committee, it was necessary to share all the data with the committee members so that the same may be analyzed. NTPC and PGCIL stated that the same would be submitted within a week.

MS, NRPC queried NTPC, whether they had communicated or had some discussions with the GTs OEM as the vibrations were being observed in the new GTs only. NTPC representative stated that it was not an issue of any defect in GTs as when the Stage-III of Rihand is connected to NR bus, there were no such vibrations observed.

PGCIL representative stated that the limiting values of vibrations in all the GTs and that recorded during monopole operation needs to be submitted by NTPC to the committee.

NTPC representative stated that if the data submitted by them is not found to be sufficient, the test may be conducted again and the data shall be shared with the committee.

PGCIL representative stated that the measurements for vibrations shall be taken at the points on the GTs as specified by the manufacturer and compared accordingly.

MS, NRPC requested PGCIL to share the study carried out by them based on which Dedicated Metallic return was opted in HVDC Champa-Kurukshetra.

Regarding the condition of earth electrodes at the two ends, PGCIL representative informed that there has not been any significant corrosion and it may not be the reason for vibrations due to DC currents in the GTs.

Ms, NRPC queried NTPC that whether such vibrations was also observed at Sasan to which NTPC representative stated that the same would be verified with Sasan and reported to the committee.

NTPC and PGCIL was requested to submit all the information as brought out in the meeting at the earliest to the committee members for study before the next meeting.



PROUD TO BE INDIAN
PRIVILEGED TO BE GLOBAL

February 15, 2019

To,

The Member Secretary
Northern Regional Power Committee
18-A, Shaheed jit Singh Marg
Katwaria Sarai
New Delhi



Sub: Agenda Item No. 28 in OCC meeting No. 156 at NRPC on 12.02.2019 of HPPTCL for Certification of Non-ISTS Line for inclusion in PoC charges for Hydro rich States

Dear Sir,

We refer to the above agenda item submitted by HPPTCL during the OCC meeting held on 12.02.2019 which stated for: **“Certification of Non-ISTS line for inclusion in PoC charges for hydro rich States”**.

The agenda item states that:

- HPPTCL has constructed 220/33 kV, 80/100 MVA GIS Substation at Phojal along with LILO of 220 kV D/C Allain Duhangan HEP-Nalagarh transmission line at Patlikul. The substation was constructed to evacuate the power of Kathi, Baloot, Phojal, Kukri Kesta Galang (totaling to app. 21 MW) and Baragaon (24 MW) SHEPs.
- HPPTCL had filed the tariff petition before CERC for approval of transmission tariff for 2016-17 vide petition no. 244/MP/2017. CERC directed HPPTCL to obtain the Certificate from RPC stating that the instant asset is an interstate transmission line which was taken up by HPPTCL with NRPC. CERC rejected the petition in the absence of the Certificate vide order dated 08.10.2018.
- NRPC in its meetings held on 29.10.2018 and 30.10.2018 reported that average utilization of this line to 36.55% and denied the Certification.

A. Submission of HPPTCL

In the meeting, HPPTCL has further stated that the agenda is to declare the Phojal Substation and associated transmission line as ISTS on the following grounds:

- Network used by NRLDC for study was different from actual use. NRLDC simulated the Phozal Sub-station as load bus having 11 MW Load in both summers and winters.
- Phojal sub-station evacuates 55 MW of Hydro power in peak in summer months. In peak generation time i.e. summer months, 28 MW power from Baragaon SHEP (24 MW+20 overload) and 27 MW power from SHEPs connected to HPSEBL system is evacuated.
- This entire power from Phozal is being evacuated using the ADHPL-Nalagarh Dedicated Transmission Line and this system also caters 11-15 MW peak load drawl of HPSEBL on Naggar feeder.

AD Hydro Power Limited

Corporate Office :

Bhilwara Towers, A-12, Sector-1
Noida - 201 301 (NCR-Delhi), India
Tel. : +91 120 4390300 (EPABX)
Fax : +91 120 4277841, 4277842
Website : www.injbhilwara.com

Site & Regd. Office :

Prini, Tehsil Manali
Distt. Kullu - 175 143 (H.P.), India
Tel. : +91 1902 250183-84, 253171 (EPABX)
Fax : +91 1902 251798
Website: www.adhydropower.com

Corporate Identification Number: U40101HP2003PLC026108

*pick portion to be
recorded in occ
minutes.*

श्री अशोक दुबे

SE (operation)

Sh. Akshay Dubey, AEE(O)

19/2/19

B. Observations of ADHPL

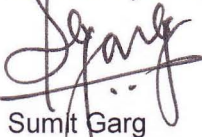
In this regard, ADHPL submits that:

1. The ADHPL-Nalagarh Transmission Line is a dedicated Transmission Line.
2. The Phozal substation of HPPTCL is connected to the ADHPL-Nalagarh Transmission Line.
3. During the meeting in CEA for the approval of the sub-station after commissioning, it was agreed that the connectivity arrangement of the sub-station with ADHPL Dedicated Transmission Line by LILO in one circuit is an interim arrangement only so that the small hydro generations is not bottled up. Various minutes of meetings with CEA in this regard are attached as **Annexure-1 and-2**.
4. ADHPL-Nalagarh Dedicated Transmission Line does not fulfill the the planning criteria prescribed in Indian Electricity Grid Code for ISTS system. Relevant Regulations 3.5 is attached for reference as **Annexure- 3**.
5. ADHPL Dedicated Transmission Line has already lost the N-1 criteria and is not capable of taking enough power for transmission. CEA has already recorded the fact in its minutes of meeting dated 04.02.2013. Copy of the minutes are enclosed as **Annexure-4**.
6. The issue of terms for the use of the dedicated transmission line is subjudice before CERC pursuant to the order of the Hon'ble Supreme Court of India.
7. In the meanwhile HPPTCL signed the Interim Power Transmission Agreement with ADHPL in 2016 to facilitate the transmission of 24 MW power from Kanchanjunga HEP and drawl of 11.4 MW of power for HPSEBL which works out to 35.4 MW of power only.
8. Therefore, there is a need to correct the agreement for balance 31 MW being evacuated from HPSEBL system by using the ADHPL dedicated transmission line and make the payments of all the outstanding amounts.

In view of the above it is requested that while declaring the Phozal sub-station, its effect on ADHPL- Nalagarh Dedicated Transmission Line may kindly be studied.

Thanking you
Yours Faithfully

For A D Hydro Power Limited



Sumit Garg
(Sr. General Manager-Commercial)

How? SLD?

Annexure - 1.



भारत सरकार / Government of India
विद्युत मंत्रालय / Ministry of Power
केन्द्रीय विद्युत प्राधिकरण / Central Electricity Authority
विद्युत प्रणाली योजना एवं परियोजना मूल्यांकन प्रभाग - I
Power System Planning & Project Appraisal Division-I
सेवा भवन आर के पुरम नई दिल्ली-110066



Sewa Bhawan, R. K. Puram, New Delhi-110066

[ISO: 9001:2008]

No. S/G/2016-PSP&PA-I/182 -185

Date: 15/2/2016

1. Managing Director, HPP/TCL, Barowalias, Khalini, Shimla-171004
2. COO. CTU (Planning), PGCIL, Saudamini, Plot No. 2, Sector - 29, Gurgaon -122 001
3. ED, POSOCO, 18-A, Shaheed Jeet Singh Sansanwal Marg, Katwaria Sarai, New Delhi - 110016
4. AD Hydro Ltd., Bhilwara Towers, A-12, Sector 1, NOIDA-201301


Subject: Meeting on the issue of construction of 100 MVA, 33/220 kV sub station at Phojal by LILO of one circuit of 220 kV Prini-Nalagam D/C line of M/S ADHPL

Madam/Sir,

The minutes of the meeting held on 11.02.2016 in CEA to discuss the issue of construction of 100 MVA, 33/220 kV sub station at Phojal by LILO of one circuit of 220 kV Prini-Nalagam D/C line of M/S ADHPL is enclosed herewith.

आपका विश्वसी/ Yours faithfully,

Encl. as above


(चन्द्र प्रकाश/ Chandra Prakash) 15/2/2016
निदेशक/ Director

Copy to:

PPS to Member (PS), CEA

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Minutes of the meeting held by Member (PS), CEA on 11.02.2016 to discuss the issues related to construction of Phojal sub-station by HPPTCL.

List of participants is attached at Annexure - I.

Member (PS), CEA welcomed the participants and requested to express their views. Director (Plg), HPPTCL stated that the issues of LILO at Phojal was discussed with ADHydro who is the owner of ADHydro - Malana 220kV D/C line. He also stated that HPPTCL have already agreed to the conditions stipulated by ADHydro to carry out LILO at Phojal.

The representative of ADHydro stated that ADHydro Nalagarh 220 kV D/C line is dedicated line and they have first right of use in case of n-1 outage condition. Further, the incremental loss in the transmission line has to be born by HPPTCL. He further stated that ADHydro has already communicated other legal, engineering, operational, commercial, scheduling and regulatory issues to HPPTCL and they have already agreed to the LILO by HPPTCL subject to agreement on these issues.

AGM, CTU (Plg) stated that the LILO arrangement would be subject to the outcome system studies, regulatory issues and scheduling, etc.,

Director (Plg), HPPTCL stated that the substation is being created to pool power from small HEPs in the area. One of the HEPs, namely Badagaon (24 MW) has already been commissioned last year and they are asking for deemed generation. Therefore, there is pressure to evacuate this generation as well as other generation totalling to around 45 MW. He requested that due to urgent need for the evacuation of power from these HEPs, in-principle approval for construction of Phojal substation may be given subject to the issues highlighted by CTU. On the issue of contingency condition, he stated that HPPTCL is constructing 220 kV D/C transmission line from Chahaur to Banala (Panarsa/Parvati) pooling station.

After deliberations it was decided that CTU would examine regulatory issues and carry out system studies within a week raised by them after which meeting would be held on 22.02.2016 to finalise the proposal.

Meeting ended with thanks to the chair.

Annexure-1

List of participants in the Meeting to discuss the issue of construction of 100 MVA, 33/220 kV sub station at Phojal by LILLO of one circuit of 220 kV Prini-Nalagam D/C line of M/S ADHPL, in the office of Member (PS) held on 11-02-2016 in CEA

Sl. No. No.	Name Shri/Smt/Ku.	Designation
<u>CEA</u>		
(1)	S.D.Dubey	- Member (Power System) – in chair
(2)	K.K. Arya.	- Chief Engineer (PSP&PA-I)
(3)	Chandra Prakash	- Director (PSP&PA-I).
(4)	Priyam Srivastava	- Assistant Director (PSP&PA-I)

POWERGRID

(5)	Mukesh Khanna	- AGM (CTU-Plg)
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HPPTCL

(6)	S.K. Sharda	- Director (Plg.)
(7)	Sandeep Sharma	- DGM (Plg.)
(8)	A.K. Khanotia	- DGM (CRM)
(9)	D.P. Sharda	- Legal Consultant

ADHydro

(10)	V.D. Bhatia	- V.P. (Operation)
(11)	Sumit Garg	- Sr. GM
(12)	Praveen Kumar	- GM (Elec)



भारत सरकार / Government of India
विद्युत मंत्रालय / Ministry of Power
केन्द्रीय विद्युत प्राधिकरण / Central Electricity Authority
विद्युत प्रणाली योजना एवं परियोजना मूल्यांकन प्रभाग - I
Power System Planning & Project Appraisal Division-I
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Sewa Bhawan, R. K. Puram, New Delhi-110066
वेबसाइट / Website: www.cea.nic.in



[ISO: 9001:2008]

No. 8/G/PSP&PA-2015 /

Dated 4th March, 2016

To,

1. Managing Director, HPPTCL, Barowalias, Khalini, Shimla-171004
2. COO, CTU (Planning), PGCIL, Saudamini, Plot No. 2, Sector - 29, Gurgaon -122 001
3. ED, POSOCO, 18-A, Shaheed Jeet Singh Sansanwal Marg, Katwaria Sarai, New Delhi -110016
4. AD Hydro Ltd., Bhilwara Towers, A-12, Sector 1, NOIDA-201301

Subject: Minutes of the meeting on the issue of construction of 100 MVA, 33/220 kV substation at Phojal by LILO of one circuit of 220 kV Prini-Nalagarh D/C line of M/S ADHPL

Sir/Madam,

Please find attached minutes of the meeting taken by Member (PS), CEA on 1.3.2016 on the above subject.

Encl: As above

Yours faithfully,


(Chandra Prakash)
Director 4/3/2016

List of participants is attached at Annexure.

Member(PS), CEA welcomed the participants. CE(PSP&PA-I) stated that during the last meeting held on 11.02.2016, it was decided that CTU would examine the regulatory issues and carry out the system studies. He requested CTU to express their views.

AGM, CTU (Plg) informed that presently AD Hydro and Malana-II HEPs, with total capacity of about 300 MW are being evacuated through AD Hydro 220 kV D/C to Nalagarh. Under N-1 condition, the capacity of this line being about 200 MVA, requires backing down of the generation. Also, considering this aspect a separate transmission system had been planned and is under implementation which involves injection of Malana-II Power at Parbati Pooling station and disconnecting it with AD Hydro line. He further stated that regarding the regulatory aspect, as the line is not an ISTS line and being state matter, they have no objection for LILO of the line at Phojal.

Managing Director, HPPTCL stated they are constructing 220 kV D/C transmission line from Chahaur to Banala (Panarsa/Parvati) pooling station which would likely to be commissioned by March, 2017. He further stated that they are also planning a 220kV line from Phojal to Chauhar and would be completed in next three years.

While discussing the commissioning schedule of Chauhar – Banala 220 kV line of HPPTCL, Powergrid stated that 400/220 kV transformers at Banala are expected during mid 2016 and delay in commissioning of Chauhar – Banala 220 kV line of HPPTCL would result into non-utilisation of the ICTs. It was also stated that HPPTCL during the 36th Standing Committee Meeting of Power System planning of Northern Region held on 13.7.2015 had informed that the commissioning of Chauhar – Banala 220 kV line of HPPTCL is October, 2016 and HPPTCL was requested to match with the commissioning of ICTs.

AGM, NRLDC stated that presently AD Hydro and Malana-II HEPs are scheduled as per the direction of Hon'ble APTEL at Nalagarh S/S (ISTS point). Hence, if HPPTCL is connected at Phojal by LILO of Purni– Nalagarh 220 kV D/C line, the modalities like scheduling, loss – allocation etc., have to be specified. He opined that as the line is dedicated, a qualified coordinating agency (QCA) would be ideally suited to carry out scheduling, loss allocation, etc., to be provided at Nalagarh ISTS point for coordination with NRLDC.

Director (PSP&PA-I), CEA stated that Bada Gaon HEP (24 MW) has already been commissioned. Phojal (16 MW) and other small HEPs would be commissioned by the end of 2016. To evacuate these small HEPs, it would be prudent that HPPTCL may have to follow the arrangements de-lined between AD Hydro and Malana-II HEPs. This would give comfort to the small HEP developers so that their generation would not be bottled up.

After deliberations, the following was decided:

1. LILO of one circuit of Pirmi–Nalagarh 220 kV D/C line at Phojal was agreed as an interim arrangement only so that the small hydro generations is not bottled up.
2. HPPTCL would file an affidavit before CERC to follow the formula as applicable to the AD Hydro and Malana – II HEPs for scheduling, loss allocation etc. among them i.e. AD Hydro, Malana-II and 40 MW being injected at Phojal by HPPTCL.
3. HPPTCL shall be responsible for managing the schedules of the small HEPs at the proposed Phojal substation of HPPTCL and would give the consolidated schedule etc. to NRLDC.

Meeting ended with thanks to the chair.

Annexure

List of participants

Sl. No. No.	Name Shri/Smt	Designation
<u>CEA</u>		
1.	S.D. Dubey	- Member (PS)
2.	K.K. Arya.	- Chief Engineer (PSP&PA-I)
3.	Chandra Prakash	- Director (PSP&PA-I)
4.	Manjari Chaturvedi	- Deputy Director (PSP&PA-I)
5.	Priyam Srivastava	- Assistant Director (PSP&PA-I)
POWERGRID		
1.	Mukesh Khanna	- AGM(CTU-Planning)
HPPTCL		
1.	ER. S.L. Sharma	- MD
2.	Sandeep Sharma	- DGM (Plg)
3.	A.K. Khanotia	- DGM (C&M)
4.	S.K. Sharda	- Director, Shimla
5.	D.P. Sharda	- Legal Consultant
NRLDC		
1.	D.K. Jain	- Add GM
2.	Rajeev Porwal	- DGM
ADHPL		
1.	V.D. Bhatia	- VP (Operation)
2.	Praveen Giri	- GM

3.5 Planning Criterion

General Philosophy

(a) The planning criteria are based on the security philosophy on which the ISTS has been planned. The security philosophy may be as per the Transmission Planning Criteria and other guidelines as given by CEA. The general policy shall be as detailed below:

i) As a general rule, the ISTS shall be capable of withstanding and be secured against the following contingency outages

a. without necessitating load shedding or rescheduling of generation during Steady State Operation:

- Outage of a 132 kV D/C line or,
- Outage of a 220 kV D/C line or,
- Outage of a 400 kV S/C line or,
- Outage of single Interconnecting Transformer, or
- Outage of one pole of HVDC Bipole line, or one pole of HVDC back to back Station or
- Outage of 765 kV S/C line

b. without necessitating load shedding but could be with rescheduling of generation during steady state operation-

- Outage of a 400 kV S/C line with TCSC, or
- Outage of a 400kV D/C line, or
- Outage of both pole of HVDC Bipole line or both poles of HVDC back to back Station or

- Outage of a 765kV S/C line with series compensation.

- ii) The above contingencies shall be considered assuming a pre-contingency system depletion (Planned outage) of another 220 kV D/C line or 400 kV S/C line in another corridor and not emanating from the same substation. The planning study would assume that all the Generating Units operate within their reactive capability curves and the network voltage profile are also maintained within voltage limits specified.
- (b) The ISTS shall be capable of withstanding the loss of most severe single system infeed without loss of stability.
- (c) Any one of these events defined above shall not cause:
 - i. Loss of supply
 - ii. Prolonged operation of the system frequency below and above specified limits.
 - iii. Unacceptable high or low voltage
 - iv. System instability
 - v. Unacceptable overloading of ISTS elements.
- (d) In all substations (132 kV and above), at least two transformers shall be provided.
- (e) CTU shall carry out planning studies for Reactive Power compensation of ISTS including reactive power compensation requirement at the generator's /bulk consumer's switchyard and for connectivity of new generator/ bulk consumer to the ISTS in accordance with Central Electricity Regulatory Commission (Grant of Connectivity, Long-term Access and Medium-term Open Access in interstate Transmission and related matters) Regulations, 2009.
- (f) Suitable System Protection Schemes may be planned by NLDC/RLDC in consultation with CEA, CTU, RPC and the Regional Entities, either for

enhancing transfer capability or to take care of contingencies beyond that indicated in a (i) above.

3.6 Planning Data

Under this Planning Code, the Regional entities/STUs/State Generating Companies/ IPPs/licensees are to supply data in accordance with the detailed procedures mentioned in the Central Electricity Regulatory Commission (Grant of Connectivity, Long-term Access and Medium-term Open Access in inter-State Transmission and related matters) Regulations, 2009.

3.7 Implementation of Transmission Plan

The actual program of implementation of transmission lines, Inter-connecting Transformers, reactors/capacitors and other transmission elements will be in accordance with the detailed procedures mentioned in the Central Electricity Regulatory Commission (Grant of Connectivity, Long-term Access and Medium-term Open Access in inter-State Transmission and related matters) Regulations, 2009.

PART-4

CONNECTION CODE

4.1 Introduction

CTU, STU and Users connected to, or seeking connection to ISTS shall comply with Central Electricity Authority (Technical Standards for connectivity to the Grid) Regulations, 2007 which specifies the minimum technical and design criteria and Central Electricity Regulatory Commission (Grant of Connectivity, Long-term Access and Medium-term Open Access in inter-State Transmission and related matters) Regulations, 2009.

4.2 Objective

The objective of the code is as given below:



भारत सरकार / Government of India
विद्युत मंत्रालय / Ministry of Power
केन्द्रीय विद्युत प्राधिकरण / Central Electricity Authority
प्रणाली योजना एवं परियोजना मूल्यांकन विभाग /
System Planning & Project Appraisal Division
सेवा भवन, आर के पुरम / Sewa Bhawan, R.K. Puram
नई दिल्ली / New Delhi - 110 066
वेबसाइट / Website : www.cea.nic.in



[ISO: 9001. 2008]

No. 1/9/SP&PA-1/2/

Dated: 04/02/2013-

As per list enclosed-

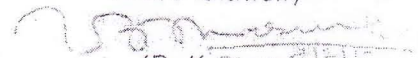
Sub: Minutes of the 31st Standing Committee meeting on Power System Planning of Northern Region held on 2nd January 2013

Sir,

The 31st meeting of the Standing Committee on Power System Planning of Northern Region was held on 02.01.2013 at POWERGRID, Gurgaon. The minutes of the meeting has been uploaded on CEA website . www.cea.nic.in (path to access - wing specific document /power system related reports / standing committee on power system planning / northern region).

The minutes of the connectivity and long term open access meeting held on 02.01.2013 shall be given separately and uploaded shortly.

Yours faithfully


(B. K. Sharma) 15

Director (SP&PA)

List of Addresses-

<p>1 - Member Secretary NRPC 18-A Shajeed Jeet Singh Sansanwal Marg, Katwaria Sarai, New Delhi - 110016 (Fax-011-26865206)</p>	<p>7. Director (Transmission) UPPTCL, Shakti Bhawan Exin, 3rd floor, 14, Ashok Marg, Lucknow - 226001 (Fax-0522-2288410)</p>	<p>13. Development Commissioner (Power), Civil Secretariat, JAMMU - 180001 Fax-0191-2545447, 2530265)</p>
<p>2. Director (Projects) NTPC, NTPC Bhawan, Core 7, Scope complex- 6, Institutional Area, Lodhi Road, New Delhi - 110003 (Fax-011-24361018)</p>	<p>8. Director (Projects) PTCUL, Urja Bhawan, Campus, Kanwali Road Dehradun- 248001. Uttarakhand (Fax-0135-2763431)</p>	<p>14. Member (Power) BBMB, Sector-19 B Madya Marg, Chandigarh-160019 (Fax-0172-2549857)</p>
<p>3. Director (Technical) NHPC Office Complex, Sector - 33, NHPC, Faridabad - 121003 (Fax-0129-2277941)</p>	<p>9. Director (Operations) Delhi Transco-Ltd. Shakti Sadan, Kotla Marg, New Delhi - 110002 (Fax-011-23234640)</p>	<p>15. Chief Engineer (Transmission) NPCIL, 9-S-30 Vikram Sarabhai Bhawan, Anushakti Nagar, Mumbai - 400094 (Fax-022-25993570, 25563350)</p>
<p>4. Director (Projects) POWERGRID, Saudamini, Plot no. 2, Sector - 29, Gurgaon-122001 (Fax-0124-2571932)</p>	<p>10. Director (Technical) Punjab State Transmission corporation Ltd. (PSTCL), Head Office The Mall Patiala - 147001 (Fax-0175-2304017)</p>	<p>16. Chief Engineer (Operation) Ministry of Power, UT Secretariat, Sector-9 D Chandigarh - 161009 (Fax-0172-2637880)</p>
<p>5. Director (Technical) RRVNL, Vidyut Bhawan, Jaipur Pin - 302005. Fax 0141-2740794</p>	<p>11. Director (Technical) HVPNL Shakti Bhawan, Sector -6 Panchkula - 134109 (Fax-0172-2560640)</p>	<p>17. Managing Director, HP Power Transmission Corporation Ltd. Barowalia, Khalini, SHIMLA-171002 (Fax-0177-2623415)</p>
<p>6. Director (Technical) HPSEB Ltd. Vidyut Bhawan, SHIMLA-171004 (Fax-0177-2813554)</p>	<p>12. Director (Technical) THDC Ltd. Pragatipuram, Bypass Road, Risnikesh- 249201 Uttaranchal (Fax-0135-2431519)</p>	

Minutes of 31st Standing Committee Meeting on Power System Planning of Northern Region held on 2nd January 2013 at POWERGRID, Gurgaon

List of participants is enclosed

Member (PS), CEA welcomed the participants of 31st Standing Committee Meeting of Power System Planning of Northern Region and thanked them for their presence in the meeting. He asked Director (SP&PA), & CTU to take up the agenda items for discussion

1. Confirmation of minutes of 30th Standing Committee Meeting held on 19.12.2011

Director (SP&PA) stated that Minutes of 30th meeting were uploaded on CEA website and intimation in this regard was sent to members vide CEA letter no. 1/9/SP&PA-12/ dated 20/1/12. He mentioned that the observation of RRVPN regarding LILO of an existing ISTS line for providing connectivity to new generation project, has been included in the agenda and would be discussed later in the meeting along with the other agenda issues.

Regarding NLDC observation on adequacy of interim arrangement agreed for evacuation of unit -I of Rihand-III (2x500 MW) TPS under N-1 contingency, Director (SP&PA), CEA informed that minutes clearly indicate that agreed system is adequate for evacuation of unit-1 generation under normal operating conditions only.

Director (Projects), Powergrid stated that NTPC must provide proper SPS on Rihand Generation station to take care of N-1 contingency. NTPC agreed for the same.

NTPC requested that Rihand-III may be treated on par with other ISGS generation in Singrauli-Rihand generation complex and schedule of all generations may be done proportionately. Members agreed to the request.

NLDC had also observed that augmentation of ICTs at Ludhiana and Moga would result in transformation capacity of more than 1000 MVA at both substations and new substations should be planned instead of augmenting ICTs at existing substations. In this regard, Member (PS), CEA mentioned that augmentation of transformation capacity is more than 1000MVA at certain locations due to non-availability of land and due to high concentrated load growth in this area.

As no other comment was received from members, the minutes of 30th Standing Committee meeting were confirmed.

2. Reliability of Power Supply to J&K

Director (SP&PA), CEA stated that presently the power supply to the Valley is through Kishenpur-Wagoora 400kV D/c, Kishenpur-Pampore 220kV D/c and Udhampur-Pampore 132kV D/c and there was a complete collapse of power supply to

Kashmir Valley on 6th & 7th Jan. 12 due to heavy snowfall and breakdown / tripping of all three existing links between Jammu region & Kashmir valley.

In this regard, PDD, J&K informed that all the existing and under construction lines are routed through Udhampur – Batote – Banihal- Peerpanjal pass. The common corridor of existing transmission lines is highly prone to snow storms, landslides and other natural calamities making power supply to the Kashmir valley very vulnerable. Last year the valley was plunged into darkness for 72 hours due to one such snow storm. Further PDD, J&K representative also stated that power supply to Jammu and Kashmir is basically through 400/220 kV Kishenpur substation and there is immediate need for providing an alternate route for transfer of power from Jammu region to Kashmir valley. In addition, PDD J&K had informed that high load growth is anticipated in northern part of Kashmir and to cater to projected loads, a 400/220 kV substation at Amargarh (in North Kashmir area) may be planned.

Keeping above in view following transmission system was proposed:

- Jullandhar – Samba 400 kV D/c
- Samba – Amargarh 400 kV D/c
- LILO of both circuits of Uri – Wagoora 400 kV D/c line at Amargarh
- Establishment of 2x315 MVA (7x105 MVA), 400/220 kV GIS S/s at Amargarh

PDD, J&K proposed that the new 400 kV D/c line may be routed through a different corridor i.e. via Akhnoor, Rajouri and Mogul Road. This would have dual benefit i.e. the line would be constructed through a different corridor which is away from the existing line corridor as well when the demand in Akhnoor / Rajouri increases, the new 400 kV substation can be established by LILO of proposed 400 kV Samba – Amargarh line.

Director (SP&PA), CEA informed that as decided during the 30th SCM, a committee comprising of CEA, POWERGRID, NHPC, PDD J&K and JKSPDC visited J&K to assess the feasibility of transmission corridors for evacuation of power from the generation projects located in Chenab valley. The committee also looked into the feasibility of implementing a new transmission corridor through Moghul Road. It was observed that a wild life sanctuary located near Shopian is enroute of the Moghul Road. Further, the mountains have loose rocks and construction would be difficult.

Member (PS), CEA mentioned that the proposed transmission works would be implemented through Tariff Based Competitive Bidding (TBCB) route. He requested PDD, J&K to extend all the possible assistance to the implementing agency.

PDD, J&K assured that they would provide all the necessary assistance and support for obtaining requisite clearances from J&K Government.

RVPN stated that the proposed scheme should be implemented by PDD, J&K. Director (projects), POWERGRID explained that the proposed scheme is necessary to provide reliable feed to J&K from the grid and therefore members may consider this scheme under ISTS. He also mentioned that keeping in view the difficulties in construction of the 400 kV Samba –Amargarh D/c, the scheme may be taken up in two parts for ease of execution. He further stated that Amargarh was close to Uri and getting corridor for LILO would be difficult. Accordingly it was agreed that multi-circuit towers would be used near Amargarh substation for LILO work and new line termination.

It was discussed and decided that considering the above works to be implemented through Tariff Based Competitive Bidding route it would be taken as a system strengthening scheme of NR as given below:

NRSS-XXIX

- LILO of both circuits of Uri – Wagoora 400 kV D/c line at Amargarh
- Establishment of 7x105 MVA, 400/220 kV GIS substation at Amargarh
- Jullandhar – Samba 400 kV D/c
- Samba –Amargarh 400 kV D/c routed through Akhnoor & Rajouri

Members agreed with the above proposal.

3. Delinking of RAPP – Shujalpur 400 kV D/c line with RAPP 7&8 generation RAPP

Director (SP&PA), CEA stated that RAPP – Shujalpur 400 kV D/c line was approved as the associated transmission system of RAPP-7&8 in the 29th SCM held on 29/12/10. After the grid collapse of July 2012, it was observed that strengthening of West – North interconnections are required to be taken up on priority. As such it is proposed to delink RAPP – Shujalpur 400kV D/c line from RAPP 7&8 generation for its early implementation.

RRVNL informed that RAPP/Kota area already experiences high voltages and addition of lines without generator may further aggravate the high voltage problem.

24

these lines. four (4) nos. 400 kV bays are to be constructed at 400/220 kV Kashipur substation of PTCUL. These transmission lines are under construction whereas the MOU for construction of 400 kV bays at 400/220 kV Kashipur sub-station could not be finalized till date in spite of regular interactions with PTCUL. It was further informed that PTCUL had proposed that the bays may be constructed by POWERGRID and 15% of total cost may be paid to them as supervision charges.

POWERGRID stated that the entire works of design, engineering, procurement & erection of above bays at Kashipur S/s will be done by POWERGRID and as such PTCUL should not ask for any charges for this work.

Member (PS), CEA advised PTCUL not to ask for any overhead charges for the line terminating bays to be implemented under ISTS scheme by POWERGRID, as the scheme is for the benefit of State. He further mentioned that PTCUL may modify its practices to be followed for the ISTS system planned in the state to this effect. PTCUL agreed for the same.

POWERGRID also informed that 400 kV D/c Bareilly-Kashipur & 400 kV D/c Kashipur-Roorkee line sections are in advanced stage of construction and implementation of bays at Kashipur may take some time and therefore proposed to directly, connect Bareilly-Kashipur 400 kV D/c & Kashipur-Roorkee 400 kV D/c line sections, temporarily bypassing Kashipur till the time, bays at Kashipur are implemented. With the commissioning of bays at Kashipur LILO of the line at Kashipur would be taken up.

Members agreed for the above proposal.

6. Evacuation of Power from Malana-II

Director (SP&PA), CEA stated that the evacuation of power from Malana-II HEP was planned by LILO of one circuit of AD HEP - Nalagarh 220 kV D/c line of M/s AD Hydro at 220/132kV Chhaur substation of M/s Everest Power Pvt. Ltd.(EPPL) and power from generation project was to be injected at Chhaur S/s through a 132 kV D/c line. Further, AD HEP - Nalagarh 220 kV D/c line is not adequate for reliable evacuation of power from both the projects especially under contingency condition. In the 30th Standing Committee Meeting of Northern Region, it was agreed to construct a 220 kV D/c line from 220/132kV Chhaur to Parbati Pooling Station enabling injection of power from Malana-II HEP at Parbati Pooling Station (ISTS). From Parbati Pooling Station, power can be evacuated over ISTS system. It was also decided to provide 2 nos. of 400/220 kV, 315 MVA ICTs (7x105 MVA single phase units) alongwith 4 nos. of 220 kV line bays (2 bays for M/s EPPL and 2 bays for HPPTCL)

He further mentioned that HPPTCL had informed that only one 220 kV line could be constructed from Chhaur to Parbati Pooling Station due to ROW constraints and HPPTCL also intends to inject about 170 MW power from Small HEPs at Chhaur substation for its further transfer to Parbati Pooling station. As such, HPPTCL proposed that they would construct the 220kV D/c line from Chhaur substation to Parbati Pooling station for which funds are also being tied up with ADB. Further, HPPTCL would also take up the ownership of 132/220 kV Chhaur S/s from M/s EPPL to make it a part of their STU system.

Member (PS), CEA enquired HPPTCL about the expected commissioning schedule of the above 220kV line. HPPTCL informed that the same would be ready by 2015.

POWERGRID stated that Malana-II generation is directly connected to ISTS grid, for which Long Term Open Access has been processed and granted by CTU. In case this line is constructed by HPPTCL (STU), the direct connectivity of Malana-II with ISTS would be lost and M/s EPPL would have to bear STU charges in addition to PoC charges.

Member (PS) stated that under proposed proposal Malana-II would be treated as State-embedded generator and would have to pay applicable charges accordingly. He enquired M/s EPPL for their consent to the above proposal.

M/s EPPL informed that they are agreeable to the proposal and they would sort out all commercial issues with HP.

While finalizing the proposal it was also decided that 400/220 kV, 2x315 MVA ICTs (7x105 MVA single-phase units) along with the associated bays and 2 nos. of 220 kV line bays would be provided at Parbati pooling station (PG) under ISTS scheme and since it is augmentation work in existing switchyard of POWERGRID S/s, the same would be carried out by POWERGRID.

Members agreed to the above proposal.

7. LILO of Gladini - Hiranagar S/c line at Samba 400/220 kV substation

POWERGRID stated that 220 kV Samba - Jammu (Gladini) S/c line was implemented as a part of Salal transmission system (ISTS) and subsequently, LILO of this line at Hiranagar was carried out by PDD J&K at their cost. POWERGRID informed that PDD J&K intends to LILO Gladini - Hiranagar section of this line at 400/220 kV Samba substation of POWERGRID for meeting load requirement of the area. As this line is a part of ISTS system, therefore the proposal to LILO Gladini - Hiranagar section of the line at 400/220 kV Samba substation of POWERGRID was put up to Standing Committee for consideration.

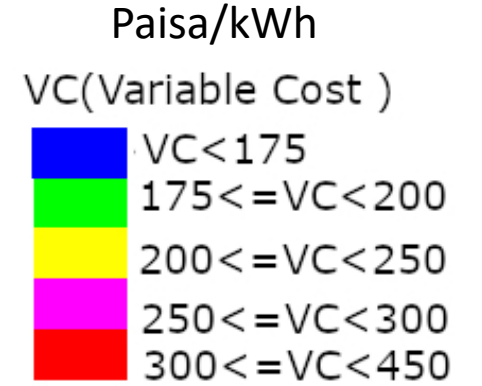
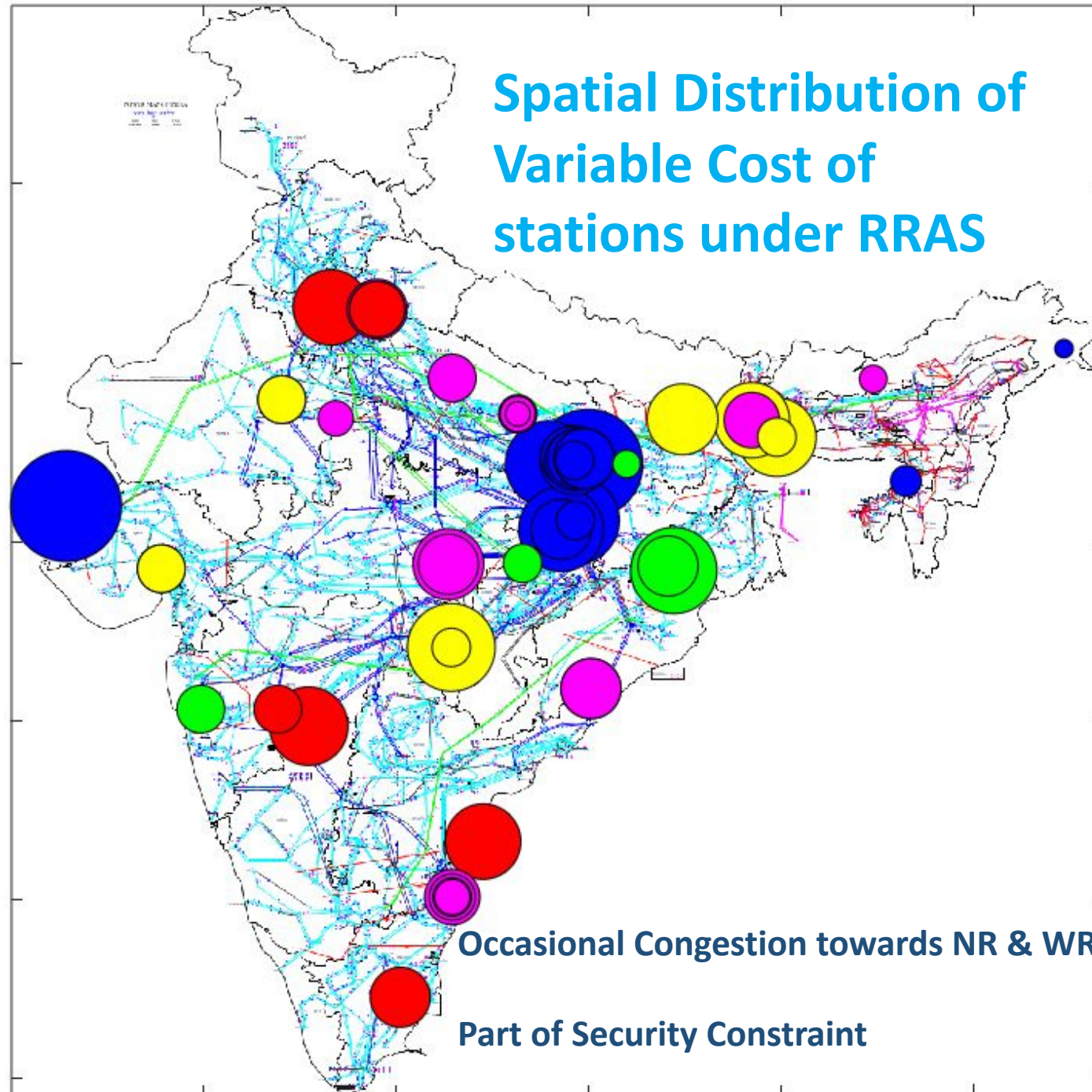
Members agreed to the proposal.



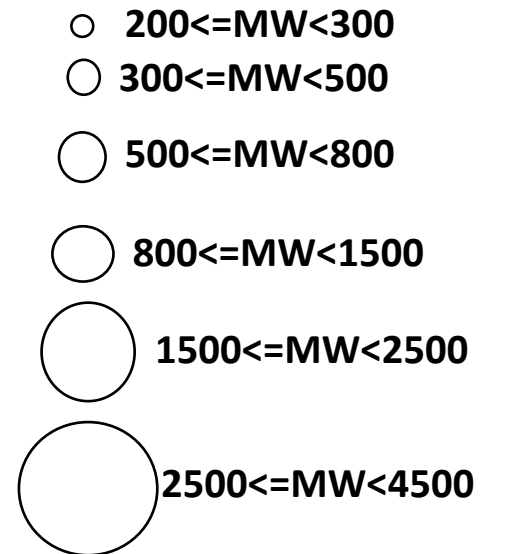
Introduction
of
Security Constrained Economic Despatch
in
Indian Power System

Implementation of Pilot w.e.f 01st April, 2019

Spatial Distribution of Variable Cost of stations under RRAS



Installed Capacity (MW)

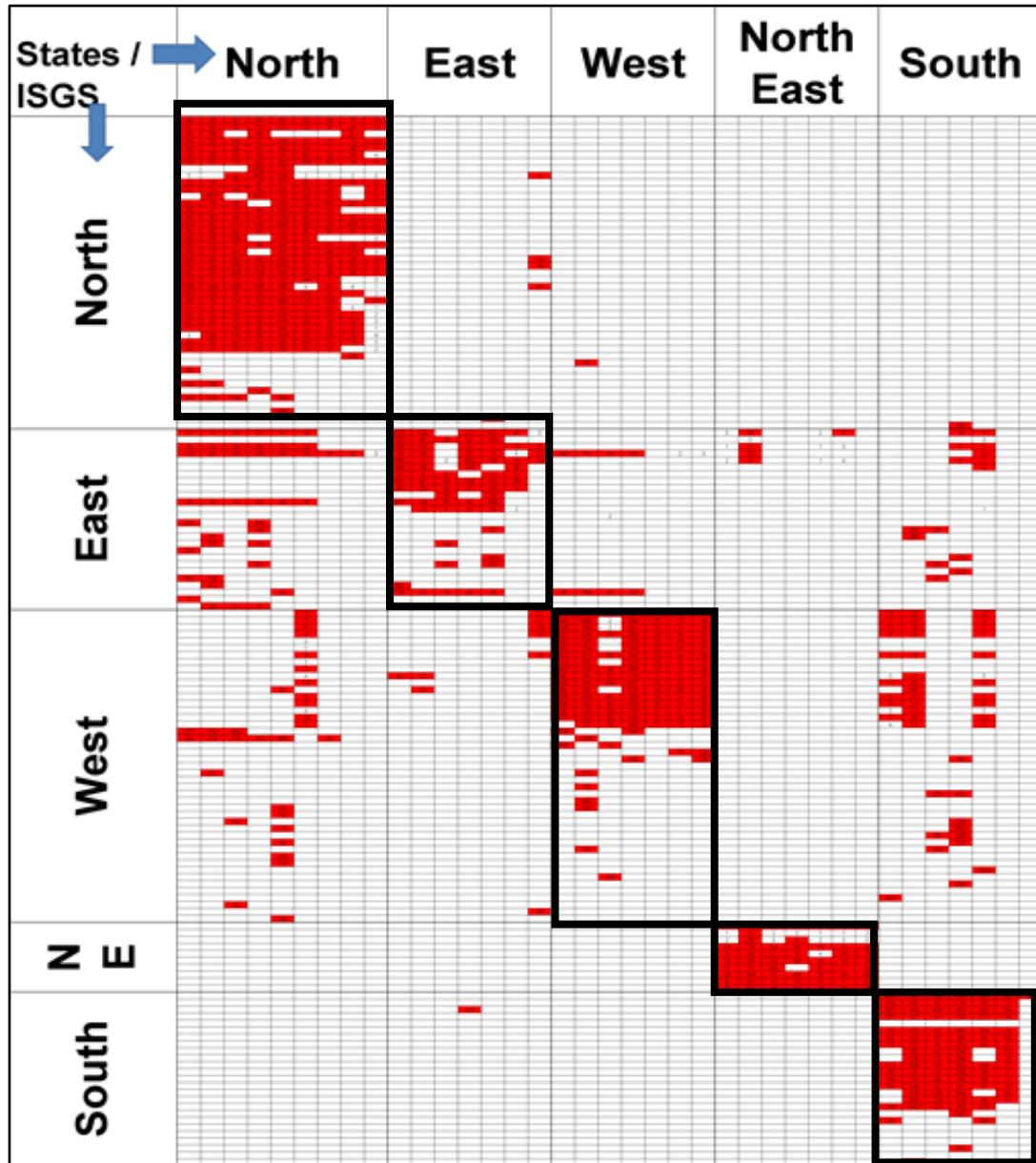


Occasional Congestion towards NR & WR

Part of Security Constraint

RRAS: Reserves Regulation
Ancillary Service

Complexity of Allocations to Beneficiaries Portfolio



Composition of Allocation Matrix

- ~150 Plants (Inter-State)
- 36 States/UTs
- Approx. half a Million contracts/day (~ 150x 36 x 96)

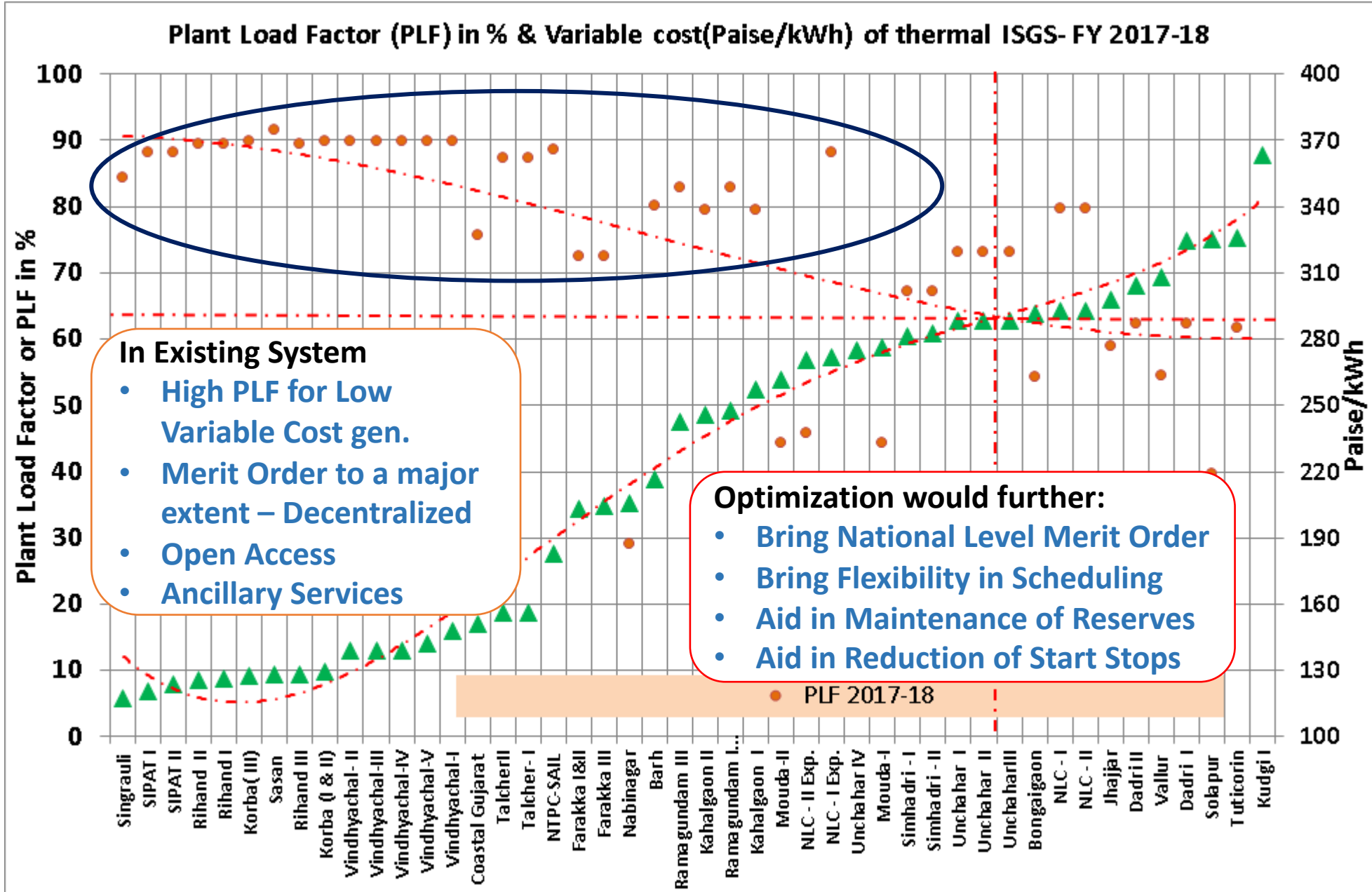
Need for Optimization

- **Fragmented allocation**
- **Savings in Total Production Costs**
- **Harness Flexibility from Rigid Contracts**

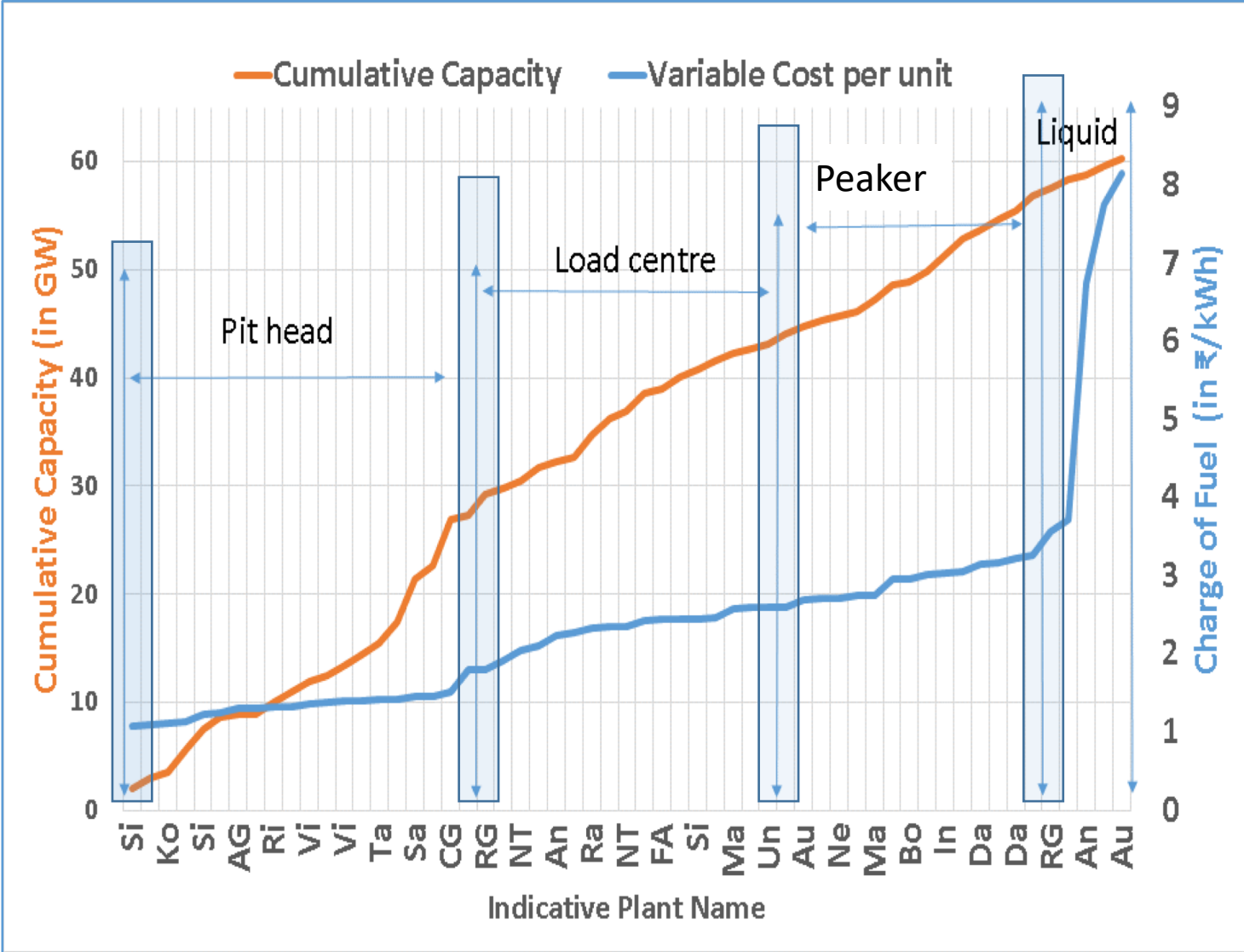
Ease of Implementation

- **Additional Inputs to Existing Multilateral Coordinated Scheduling System**

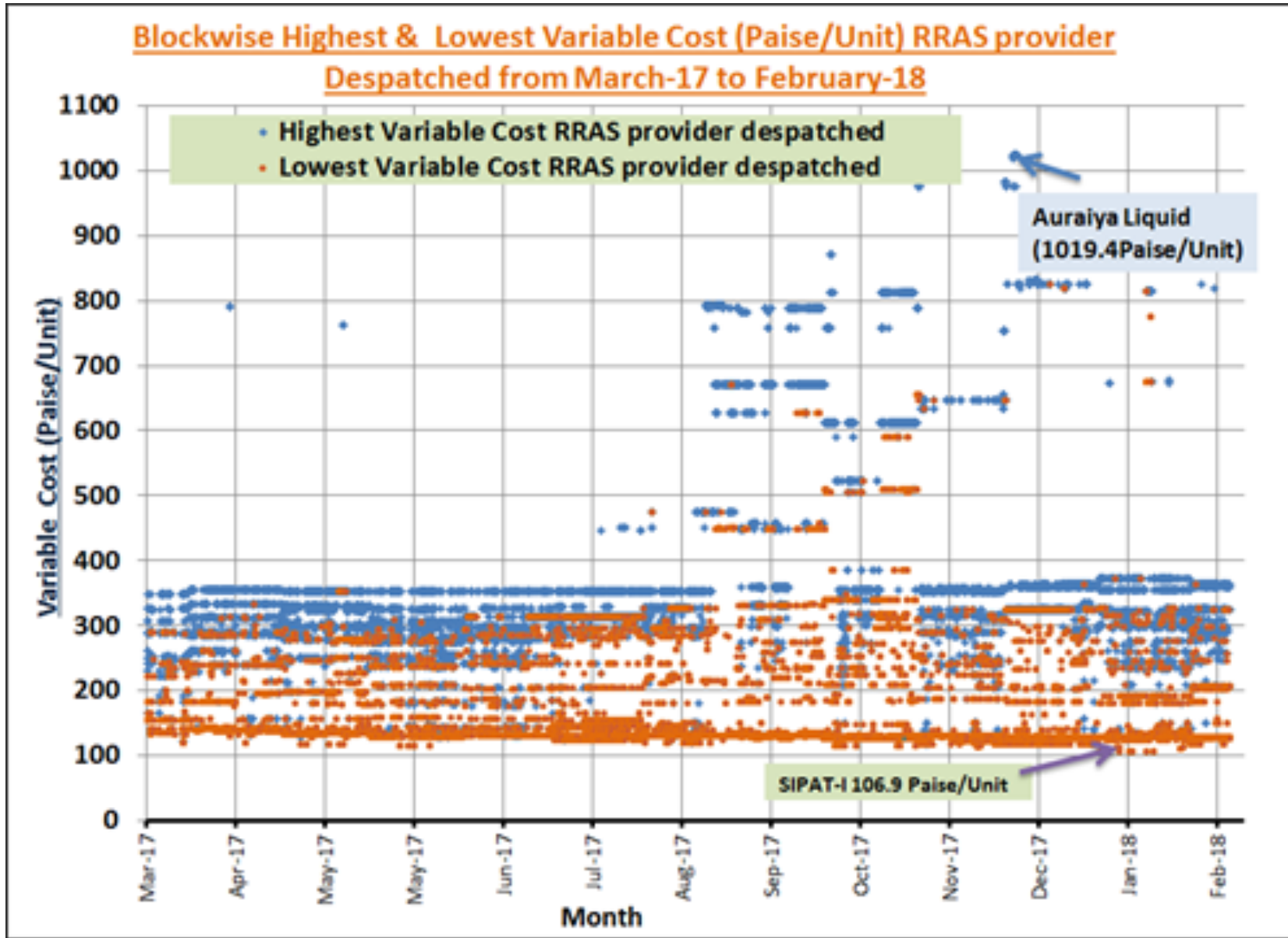
PLF & Variable Cost



Cumulative Installed Capacity of generation and Variable Cost per unit



Variable Cost of RRAS Provider



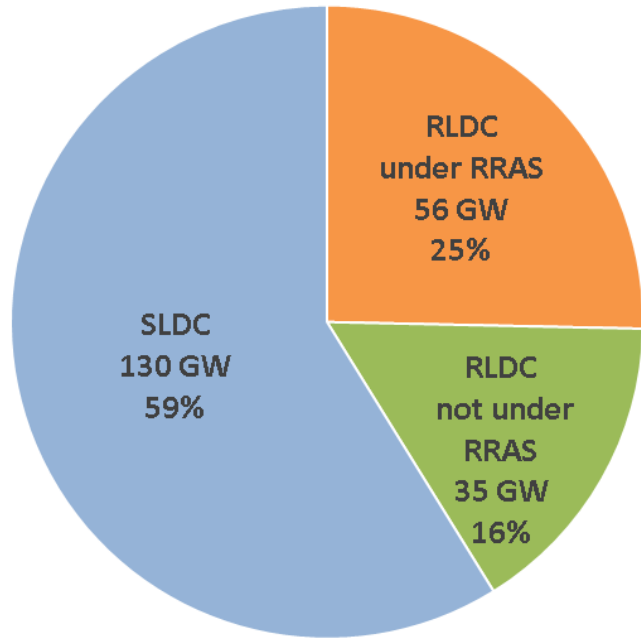
RRAS: Reserves Regulation Ancillary Service

Present Scope

All India Installed Thermal Capacity

■ RLDC - under RRAS
 ■ RLDC - not under RRAS
 ■ SLDC

All India
Total
Installed
Thermal
Capacity
221 GW



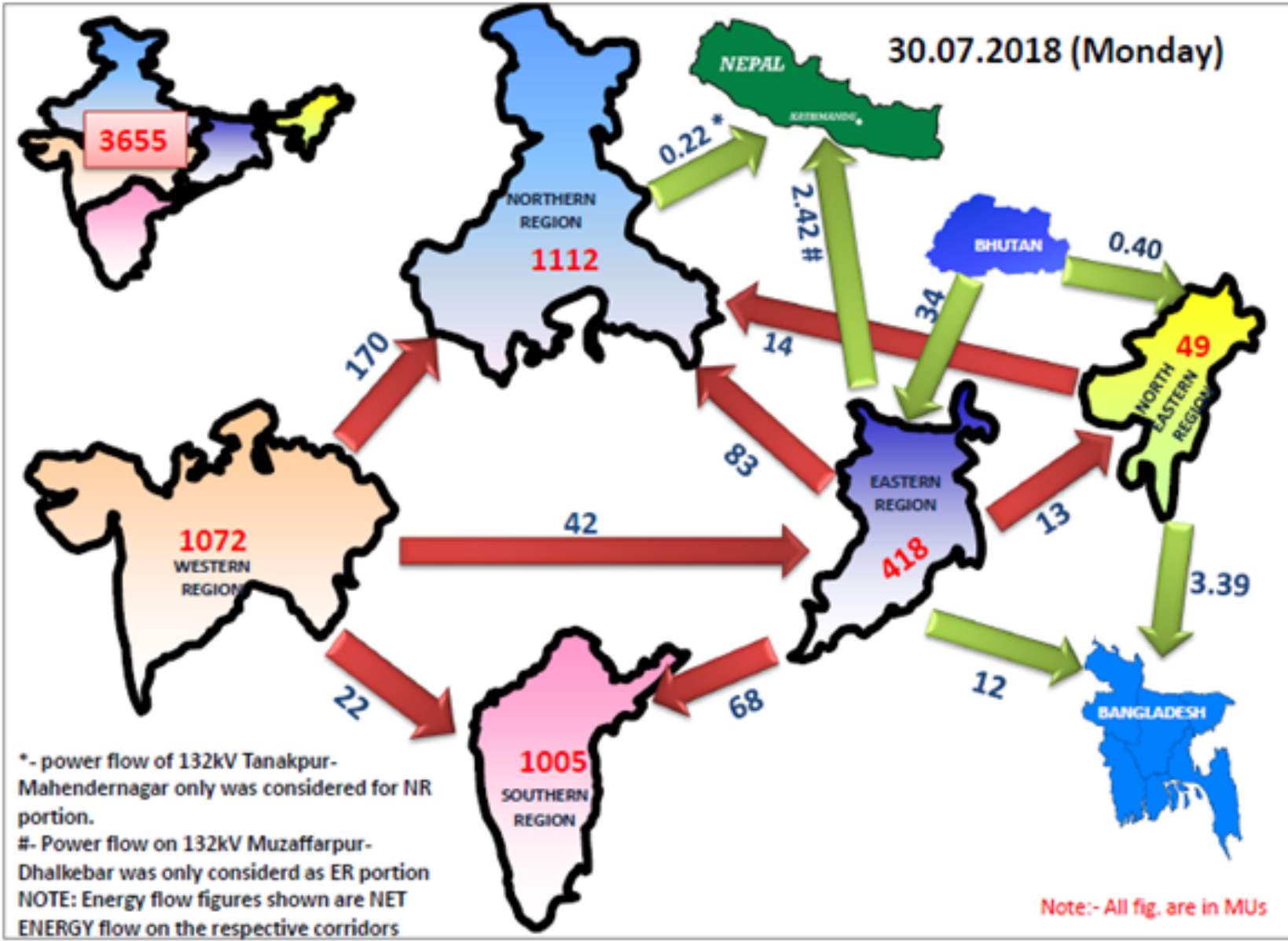
All India Thermal Generation	~ 954 BU / year
Thermal Generation under RRAS	343 BU/ year
% Energy from Plants under RRAS	36%
Weighted average variable charges of Plants under RRAS as per actual dispatch	₹ 1.99 / kWh
Total variable charges for thermal @ ₹ 1.99 /kWh	₹ 190116 crores
Total variable charges for thermal plants under RRAS	₹ 68405 crores (~ 36%)
2022 Thermal Energy as per GtG studies, 1050 BU / year	₹ 230000 crores

RRAS – Reserve Regulation Ancillary Services

GtG – Greening the Grid, USAID

SCED – Security Constrained Economic Dispatch

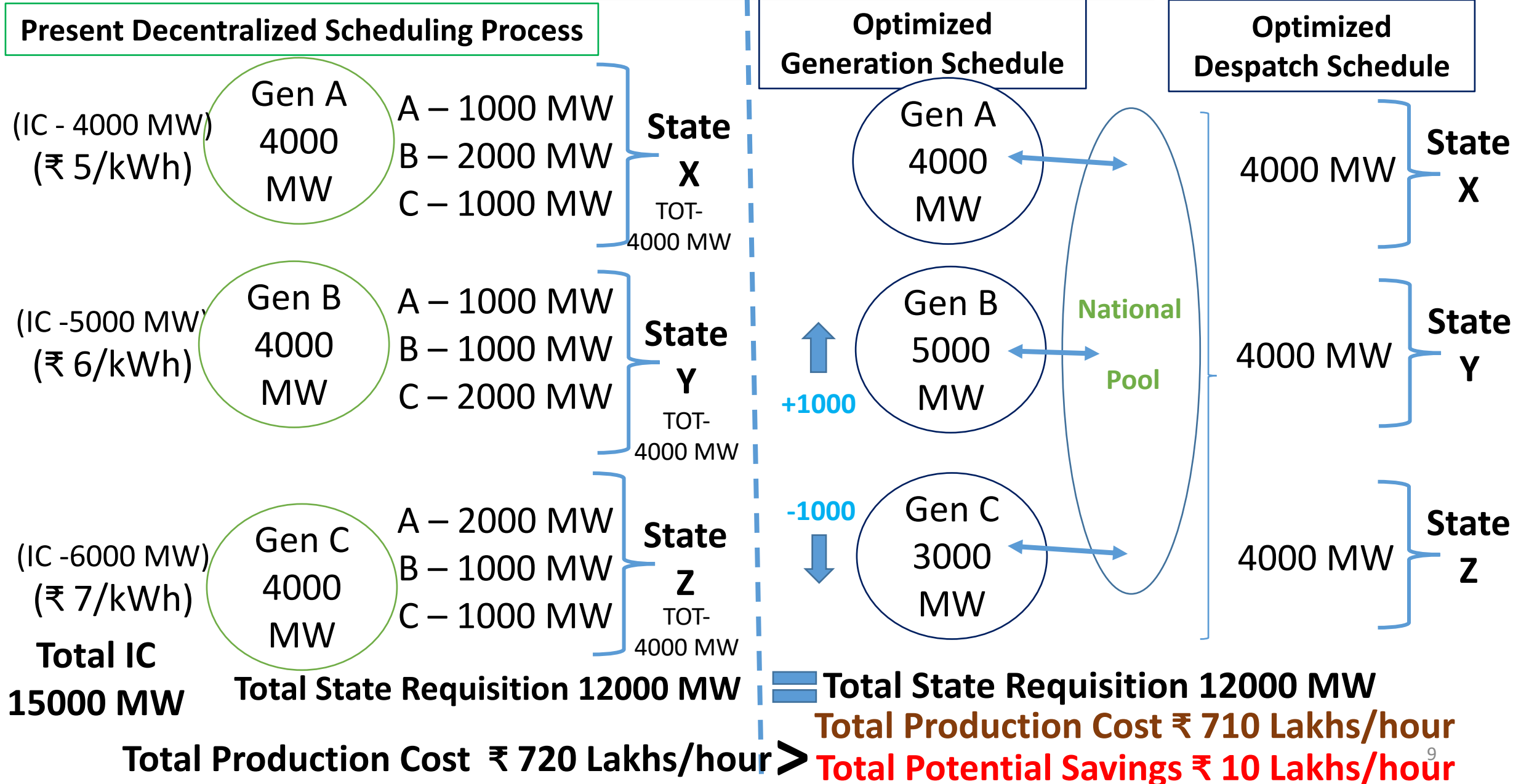
Inter Regional Power transfer



- Transfer Capability to be factored
- System Security
- Spatial distribution of generation
- Cheaper generation in WR
- Costly generation in NR & SR

Example

Thin Centralized Optimization Layer



Economic Despatch - Mathematical Formulation

Objective Function

- Minimize Pan India ISGS Variable Cost

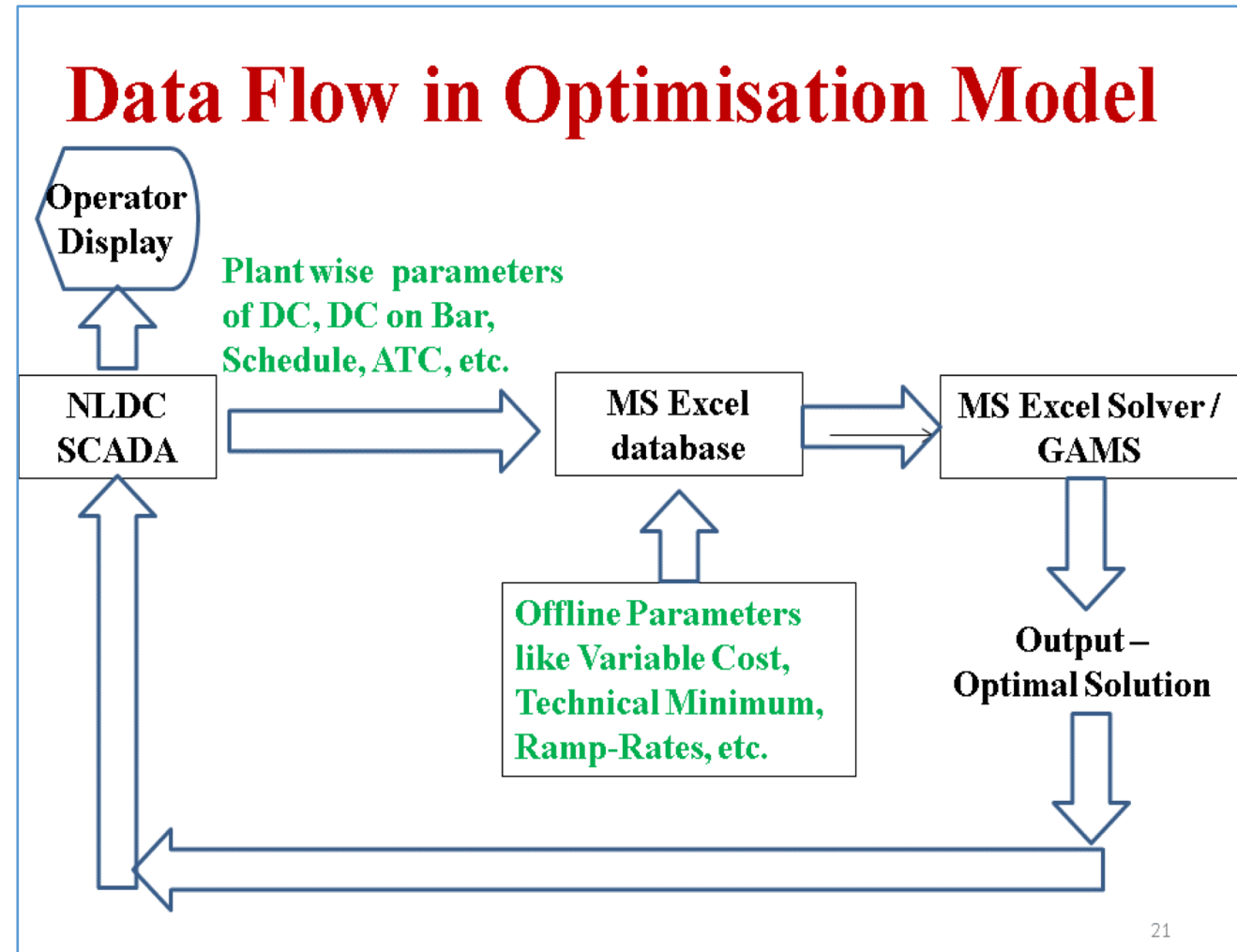
Subject to Constraints

- Meeting Total Requisition by States from ISGS
- Transmission Constraints (ATC)
- Technical Minimum of Plants
- Maximum Generation (DC-on-bar)
- Ramp up and down rate
- Factoring Spinning Reserves/Heat Rate

- Minimise $\sum_{i=1}^k C_i P_i$
 - k = total number of Plants
 - Where C_i is the variable per unit cost of the i^{th} Plant
 - P_i is the optimised scheduled power of the i^{th} Plant
- Subject to
 - $\sum_{i=1}^k P_i = \sum_{i=1}^k S_i$
 - $P_i \leq (\text{DC on bar})$
 - $P_i \geq P_{i,\text{min}}$
 - $P_{i,t} \leq P_{i,t-1} + \text{Ramp up rate}$
 - $P_{i,t} \geq P_{i,t-1} - \text{Ramp down rate}$
 - $\forall r \in R, \sum_r (P_{i,r} - S_{i,r}) \geq (\text{SCHIR}_r - \text{ATC}_r)$
 - S -is the scheduled power
 - t -represents current time of execution
 - R -represents each of the regions viz., North, East, West, South and North East
 - ATC -is the Available Transmission Capability of each region R
 - SCHIR -is the Scheduled Net Interchange of the region R
 - $P_{i,\text{min}}$ is the *technical minimum* for thermal power plants, considered 55% of DC on bar

Modelling for Economic Despatch – Process Flow

- RRAS implementation since April 2016
- The plant wise database for parameters were populated.
- Mathematical model was solved using the linear programming technique.
- General Algebraic Modeling System (GAMS) language and powerful commercial solvers like IBM CPLEX accessed through GAMS, was also used.
- Program executed every five minutes.
- All the input and output data archived.
- Data Analysis
- ~>50 man-months of efforts



Sample Snapshots – Economic Despatch...1

S. NO.	TYPE	PLANT NAME	REG.	INSTALLED CAPACITY	TOTAL (MW)	DC ON BAR (MW),	SCHEDULE (MW),	VAR. COST P/UNIT	OPT. SCH. (MW)	OPT.SAV. (LAKHS)	OPT.SCH. DIFF.(MW)
25	T	NABINAGAR TPP	E	1x250	250	228	167	191	228	1	61
26	G	NTPC GANDHAR	W	3x144+ 1x255	657	180	180	205	180	0	0
27	G	ANTA GPS	N	3x89 + 1x153	419	0	0	224	0	0	0
28	T	RAMAGUNDAM TPS-STG.-III	S	1x500	500	471	259	227	471	5	212
29	T	RAMAGUNDAM TPS-STG.-I, II	S	3x200+3x500	2100	1800	1078	233	1800	17	722
30	T	KAHALGAON STG-II	E	3x500	1500	1414	1365	236	1414	1	49
31	G	NTPC KAWAS	W	4x106 + 2x116	656	255	255	236	255	0	0
32	T	FARAKKA STG 1 AND 2	E	3x200 + 2x500	1600	1100	936	243	1100	4	164
33	T	FARAKKA STG-III	E	1x500	500	300	259	244	300	1	41
34	T	SIMHADRI-NTPC STAGE-I	S	2x500	1000	948	521	244	948	10	427
35	T	SIMHADRI-NTPC STAGE-II	S	2x500	1000	948	521	245	825	7	303
36	T	KAHALGAON STG-I	E	4x210	840	740	618	246	407	-5	-211
37	T	MAUDA-II	W	1x660	660	375	343	259	206	-4	-137
38	T	UNCHAHAH TPS-III	N	1x210	210	191	191	261	105	-2	-86
39	T	UNCHAHAH TPS-I	N	2x210	420	382	382	261	210	-4	-172
40	T	UNCHAHAH TPS-II	N	2x210	420	382	382	261	210	-4	-172
41	G	AURAIYA GPS	N	4x111+ 2x109	663	0	0	270	0	0	0
42	L	NEYVELI TPS-II (EXPN.)-NLC	S	2x250	500	185	124	271	102	-1	-22
43	L	NEYVELI TPS-I (EXPN.)-NLC	S	2x210	420	385	210	271	212	0	1
44	T	UNCHAHAH TPS-IV	N	1x500	500	0	0	275	0	0	0
45	T	MAUDA	W	2x500	1000	575	518	276	316	-6	-202
46	L	NEYVELI-II (ISGS)- NLC	S	7x210	1470	1256	723	296	691	-1	-32
47	T	BONGAIGAON	NE	1x250	250	455	350	297	250	-3	-100
48	T	DADRI STG-2	N	2x490	980	464	357	302	255	-3	-101
49	T	INDIRA GANDHI TPS JHAJJAR	N	3x500	1500	1421	1097	303	782	-10	-316
50	T	VALLUR NTECL	S	3X500	1500	933	513	306	513	0	0
51	G	DADRI GPS	N	4x130+ 2x154	830	200	181	316	110	-2	-71
52	T	NTPC SOLAPUR	W	2x660	1320	270	270	327	149	-4	-122
53	T	NTPL	S	2x500	1000	938	516	317	516	0	0
54	T	DADRI STG-1	N	4x210	840	769	632	323	423	-7	-209
55	G	RGPP L IR	W		664	540	482	357	297	-7	-185

Database Covering Regulated
Tariff Generating Plants available
pan-India

Real time Data

Plant-wise and Region-wise
Operator Display

Change from Positive to Negative

System Marginal Cost

Sample Snapshots – Economic Despatch...2

PLANT NAME		TOTAL (MW)	DC (MW), A	DC ON BAR (MW), B	SCHEDULE (MW), C	ACTUAL (MW), D	COLD RESERVE E=(A-B)	ACTUAL MARGIN F=(B-D)	TOTAL URS G=(A-C)	SMP (Optimised)	POSSIBLE UP H=(B-C)	REGUALTN DOWN I=[C-(J*B)]	RRAS APPLIED (VAE)	DEVTN. K=(D-C)	OPT. SCH. (MW) (L)	OP.COST. (LAKHS) (M)	PRE.COST (LAKHS) (N)	OPT.SAV. (LAKHS) (Q)	OPT.SCH. DIFF.(MW) (O)
NORTHERN REGION	43 UNITS	11282	9063	7884	7297	7182	1179	748	1766	245	587	2960	0	-125	6170	114	147	-33	-1127
EASTERN REGION	19 UNITS	7010	5968	5968	5432	5399	0	569	536	245	536	3001	0	-79	5635	121	117	4	203
WESTERN REGION	54 UNITS	23907	20057	20057	19327	19521	0	-309	189	245	189	8593	0	-246	18725	275	294	-19	-603
SOUTHERN REGION	32 UNITS	12290	10398	10398	6646	6886	0	3373	3752	245	3752	1139	0	428	8272	198	160	38	1626
NORTH-EASTERN REGION	18 UNITS	671	744	744	639	625	0	119	105	245	105	230	0	-12	539	11	14	-3	-100
ALL INDIA	167 UNITS	55160	46230	45051	39341	39612	1179	4501	6349		5170	15923	0	-34	39341	719	732	-12	0

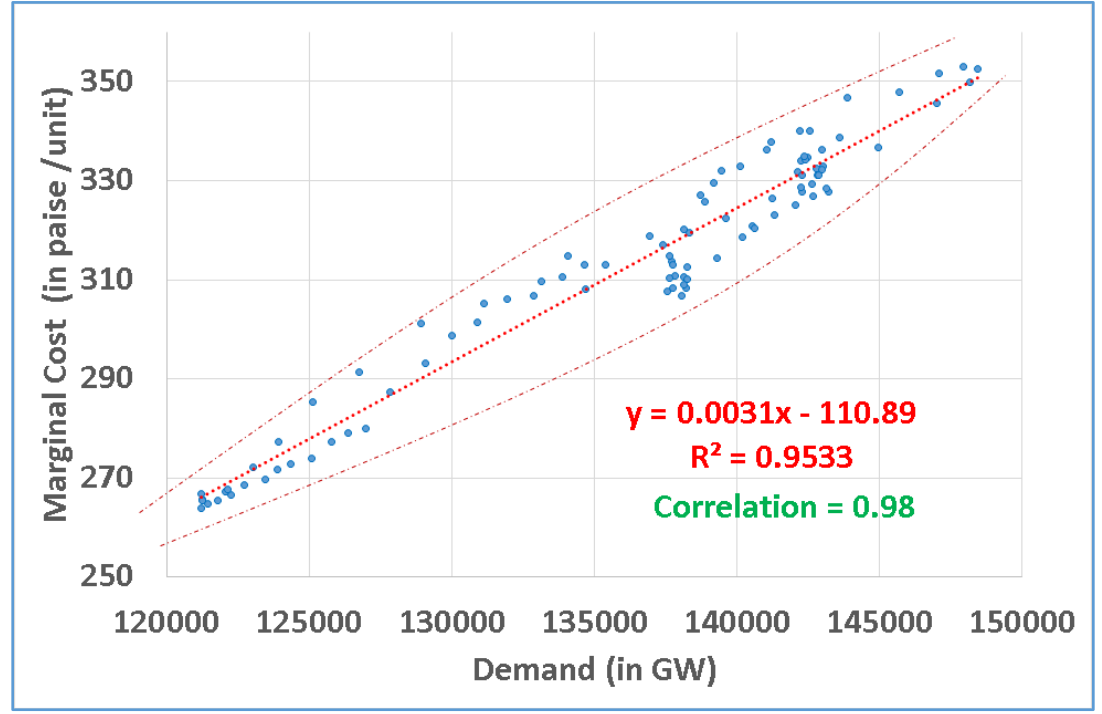
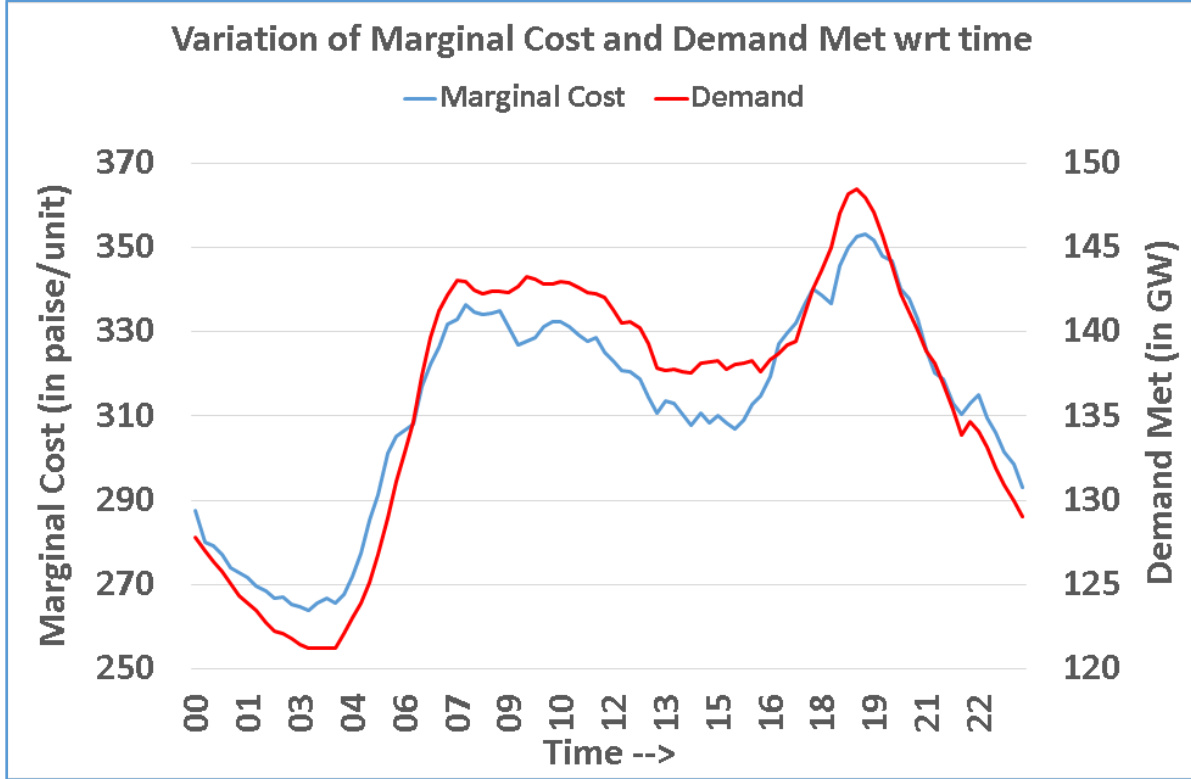
Regional Summary Display

Net Zero

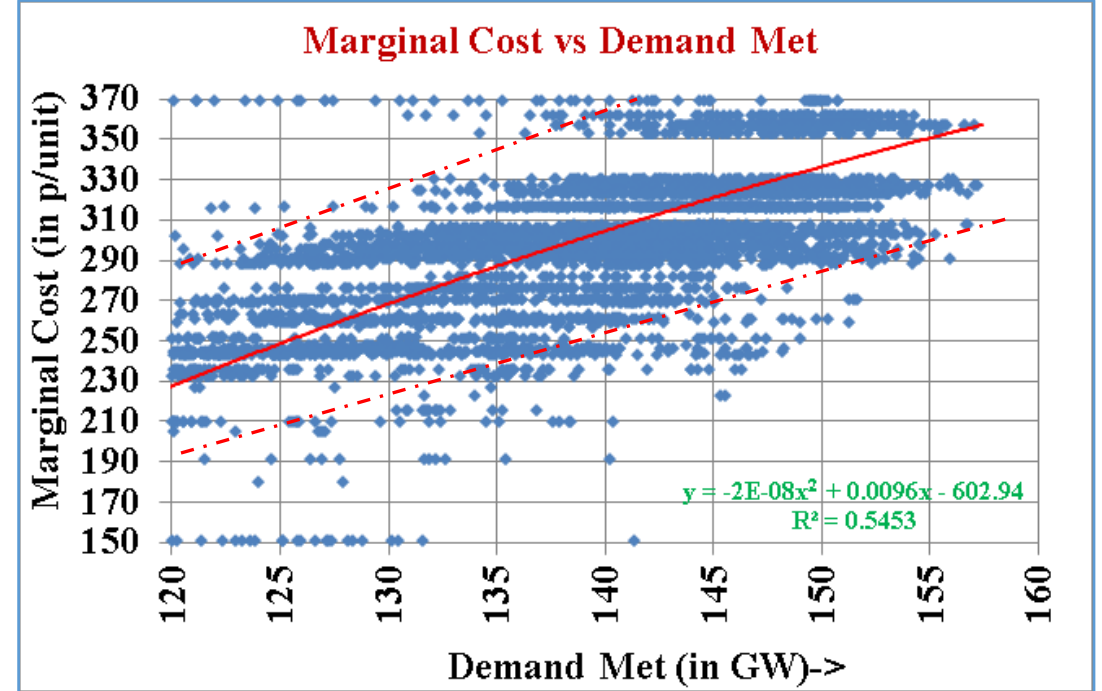
Pan-India Optimization Results at a Glance

Interstate Thermal Generation Plants	57 Nos
Thermal Units	167 Nos
Total Installed Capacity	55160 MW
Range of Scheduled Power in a day	32000 MW – 46000 MW
Variable Cost range	₹ 1.12 -8.15 / kWh
Marginal Price range	₹ 2-4 / kWh
Weighted Average Variable Cost	₹ 1.89 / kWh
Average Production Cost per day	₹ 186 Crores / day
Average Potential Savings per day	₹ 2.4 Crores / day
Production Cost that can be saved	~ 1% to 2% (~1.3%)

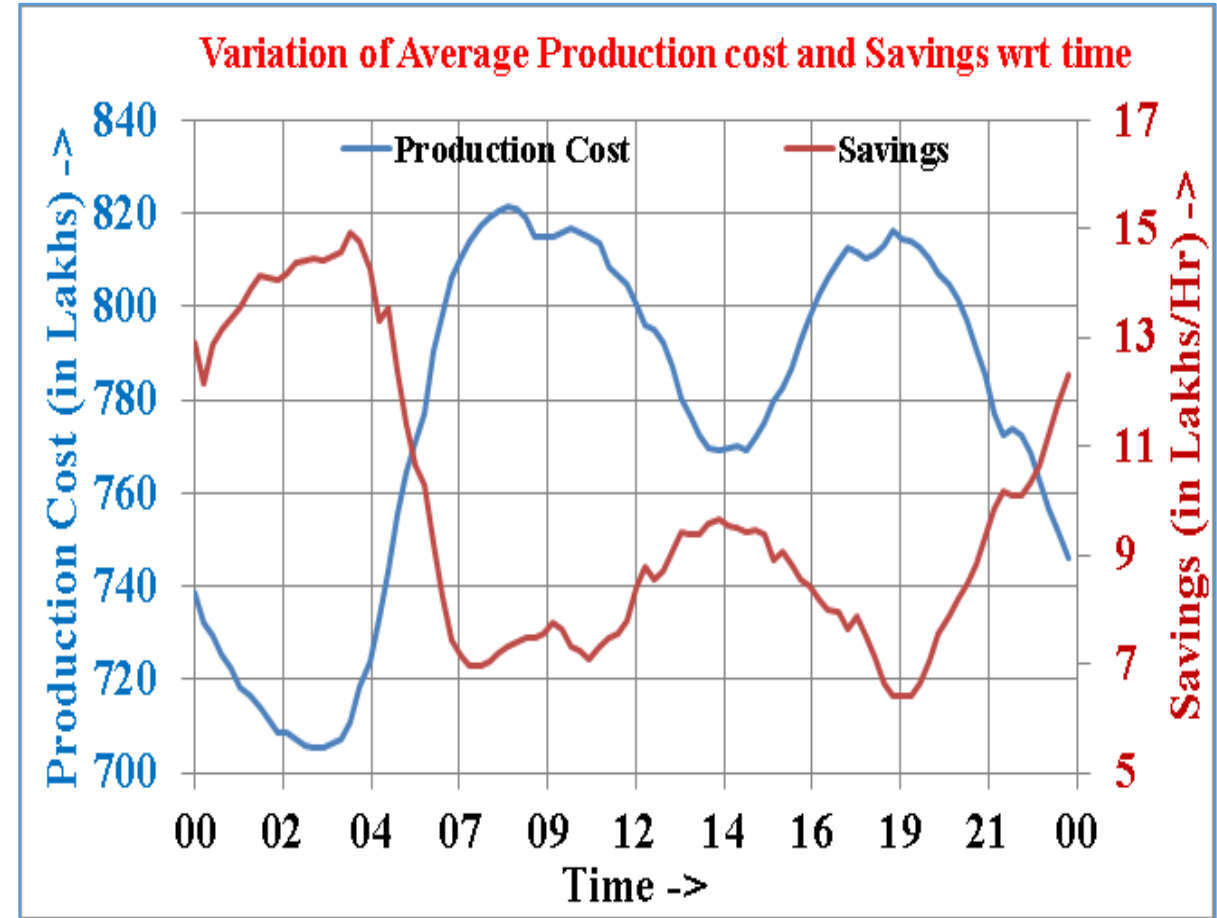
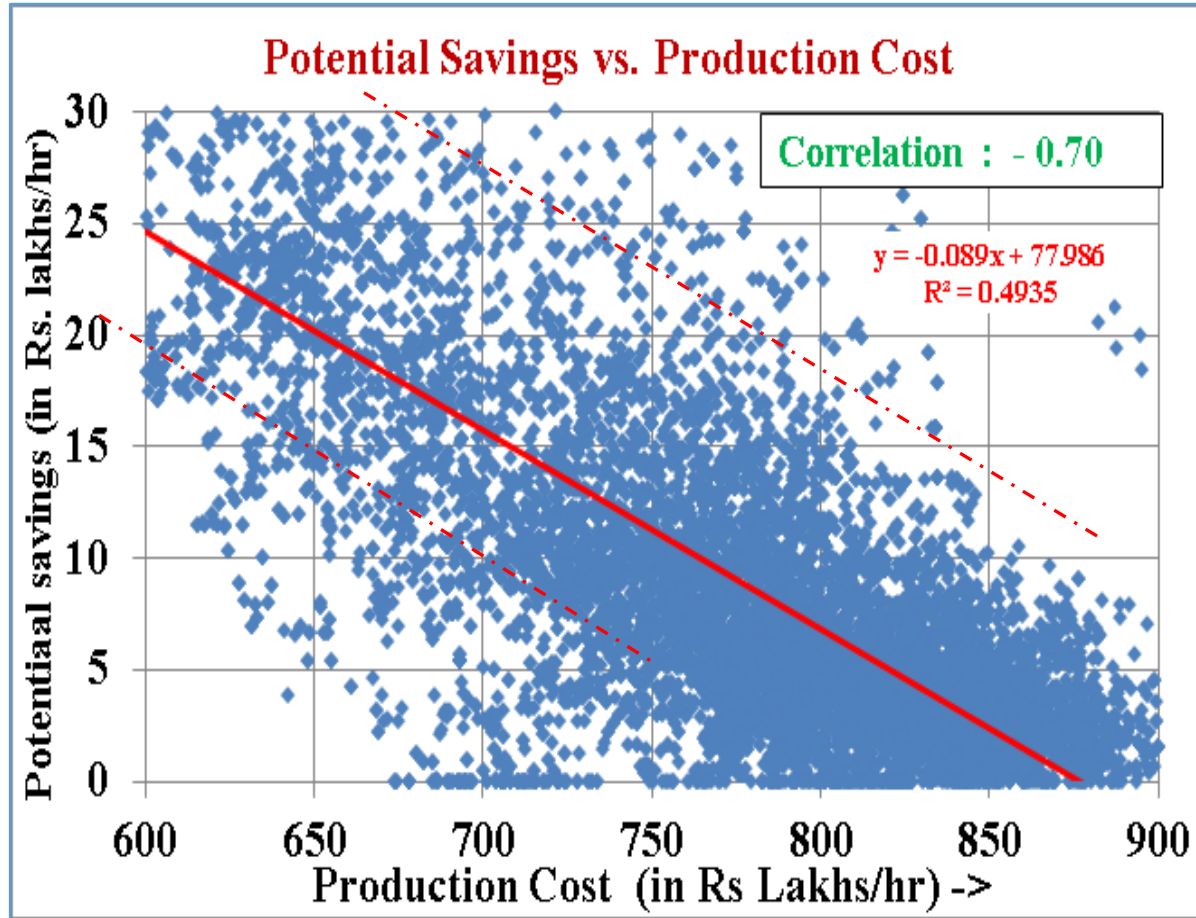
System Marginal Cost and Demand



- During periods of high demand Production Cost and System Marginal Cost are high

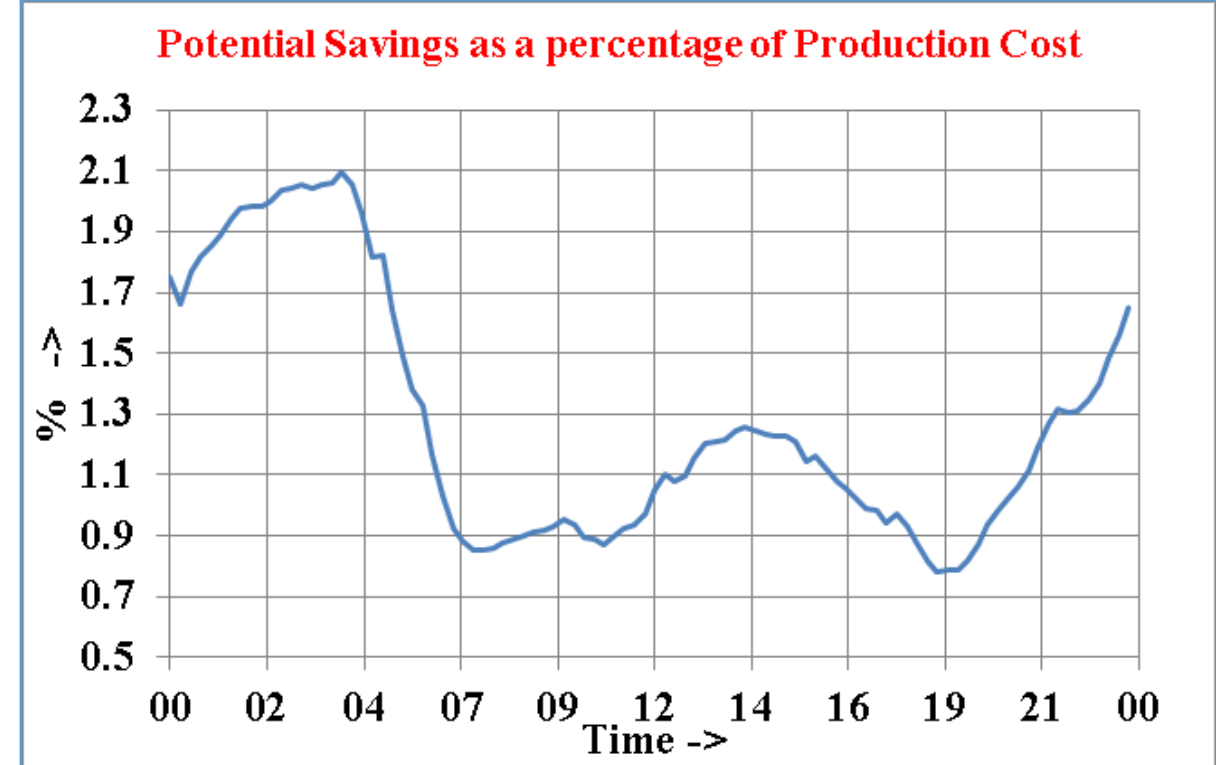
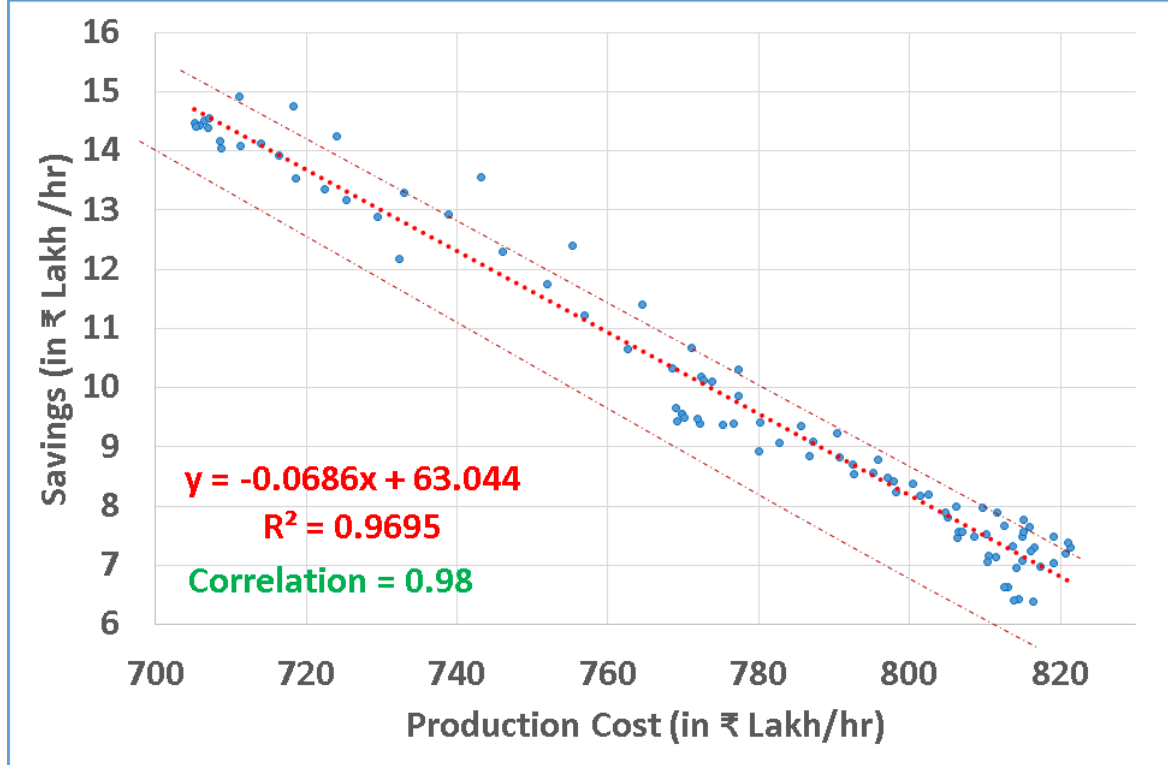


Potential Savings ...1



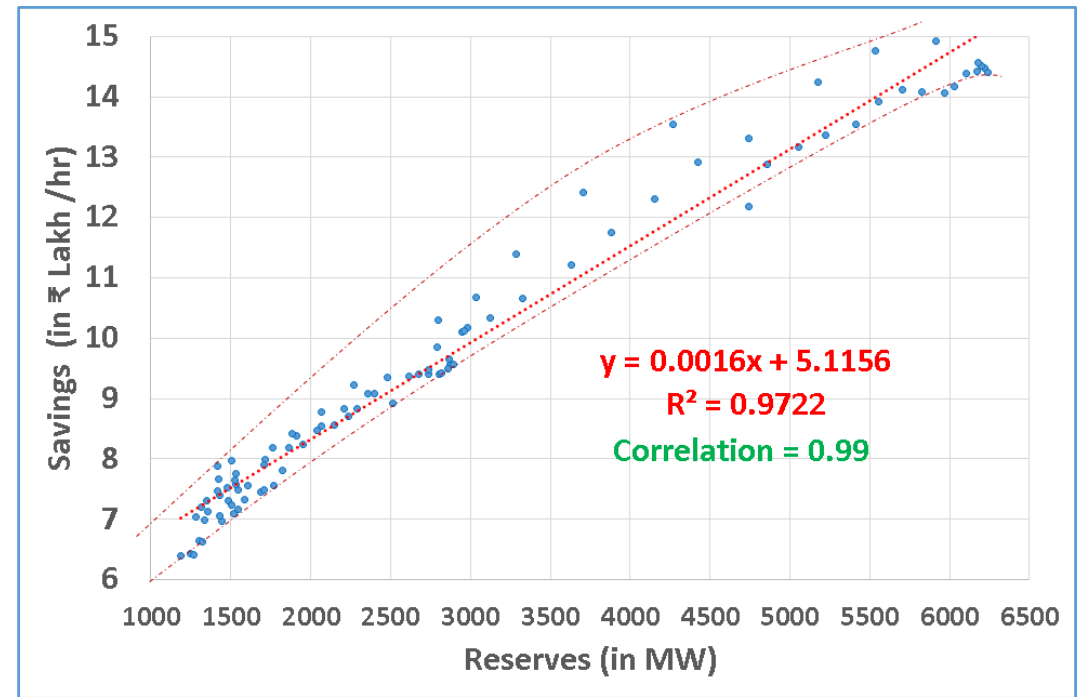
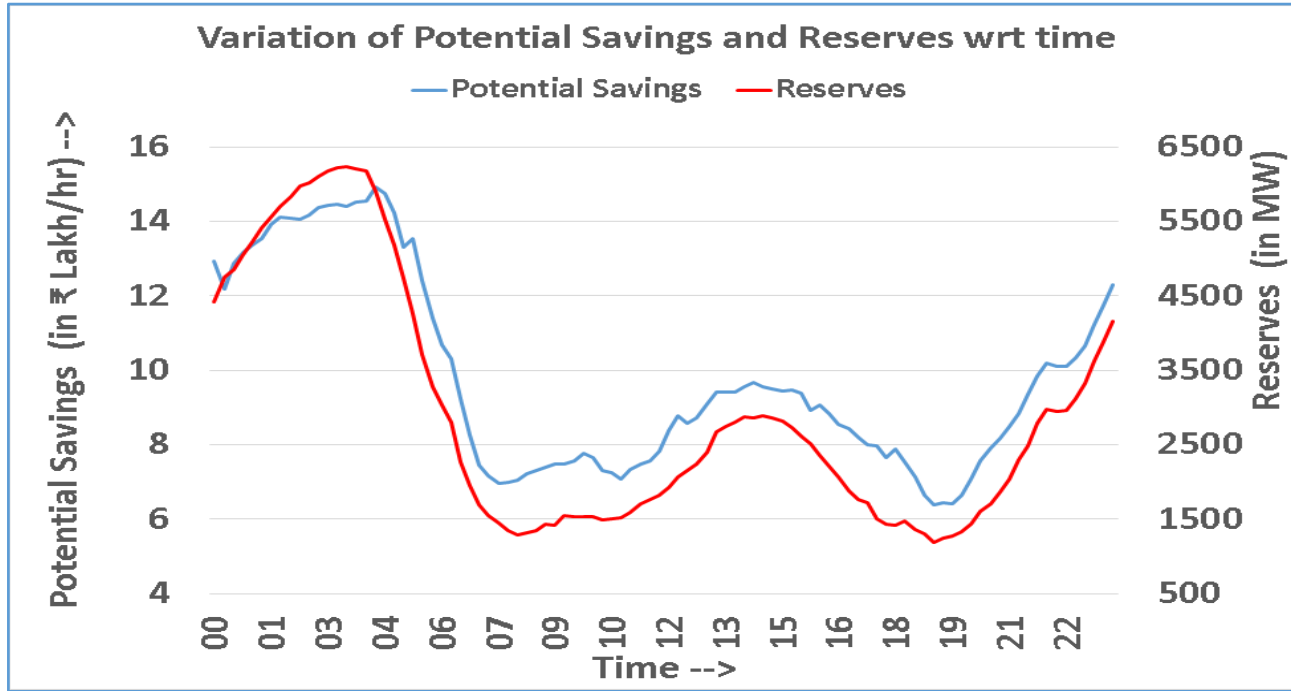
- Potential of savings inversely related to production cost
 - Possible Savings are the highest during off peak hours
- Compensation for increase in Net Heat Rate
 - Potential savings are slightly over estimated

Potential Savings ...2

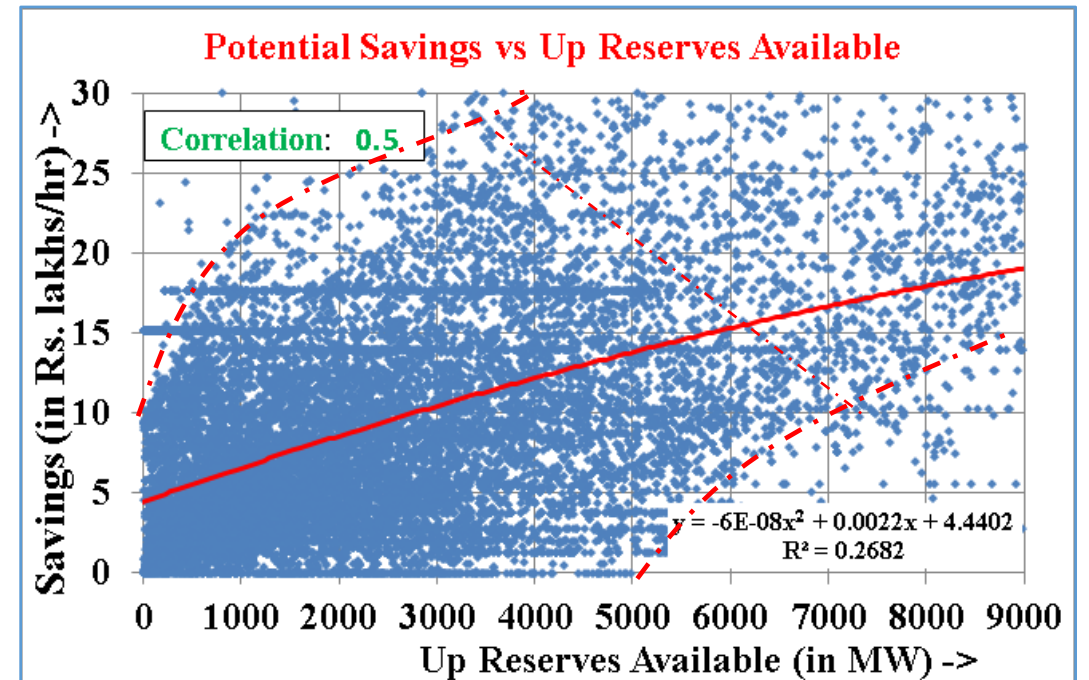


- Potential Savings is 1.3% of Production Cost
- Scope for incremental optimization and generating savings
 - Fragmented nature of allocations
 - Diversity
 - Decentralized scheduling
 - Transaction Cost

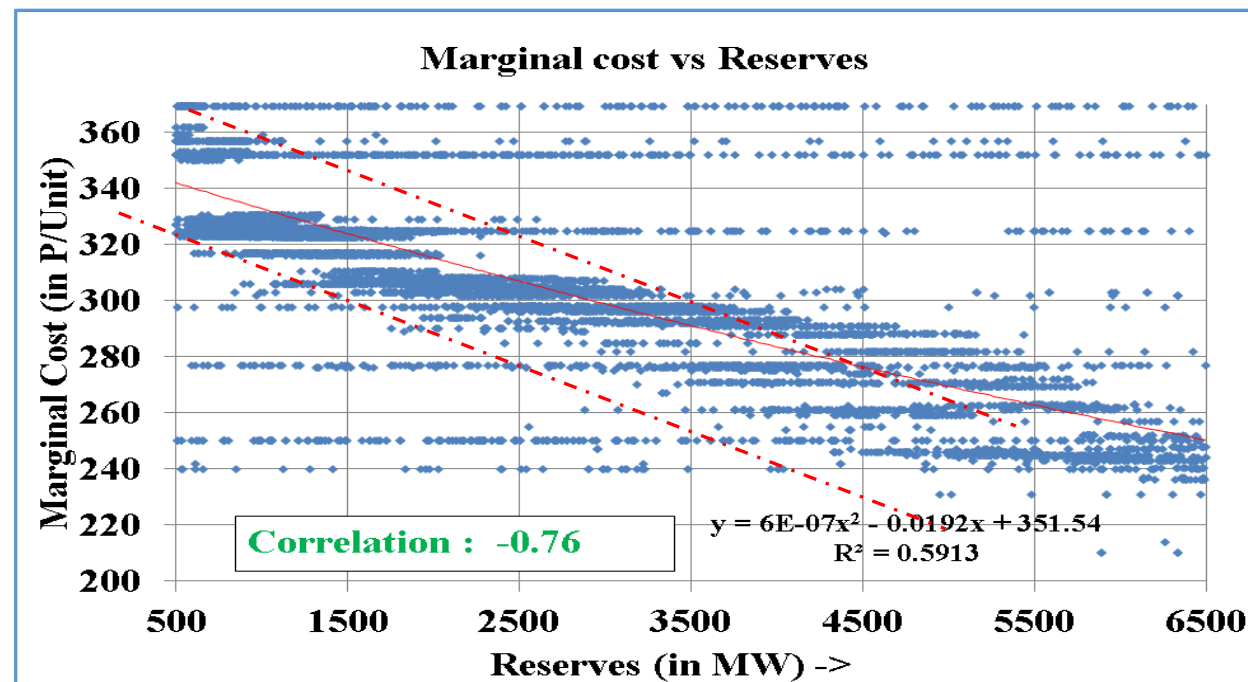
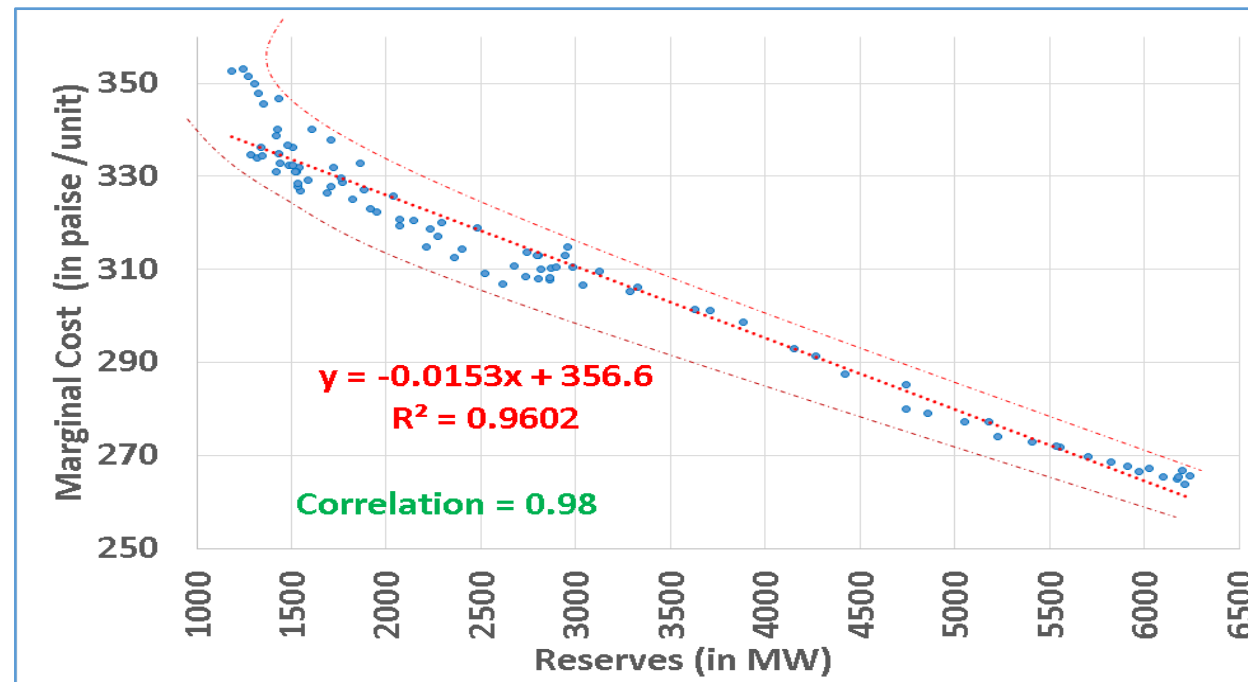
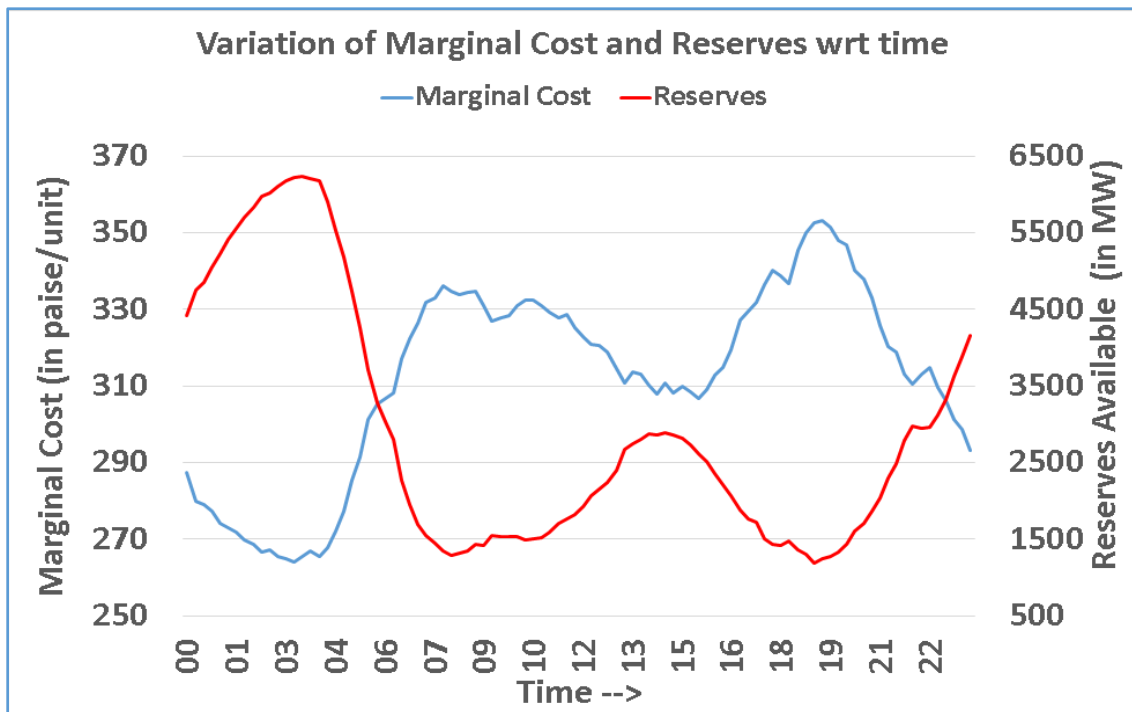
Potential Savings and Flexibility



- Diversity in off peak and peak demand in the same day
- Some units were operated at technical minimum of 55%
- Flexible power plants provide higher savings potential



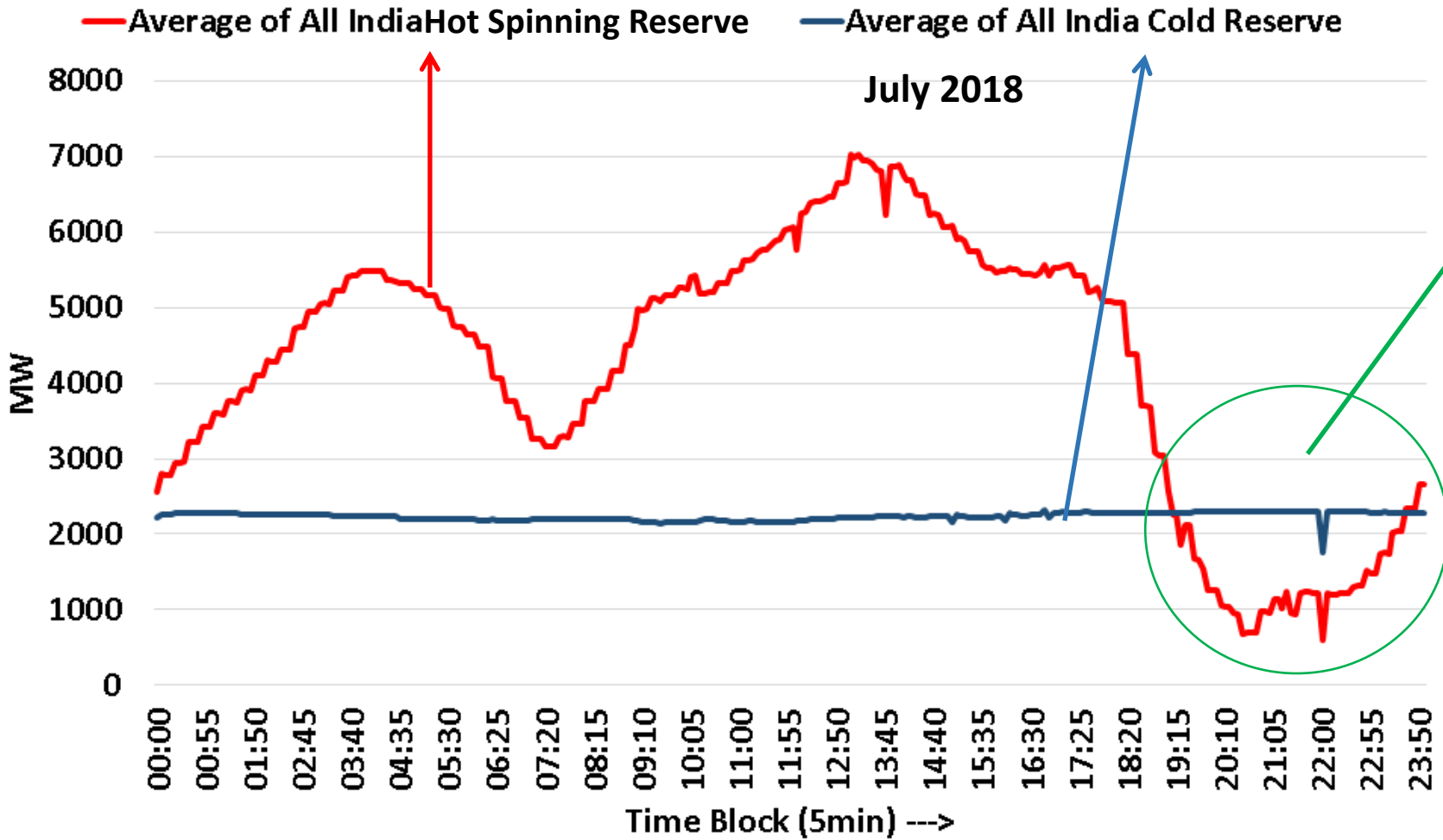
Spinning Reserve



- System Marginal Cost inversely proportional to spinning reserve available
- System Marginal Cost during peak demand is high and Reserve is close to nil
- **Mandate needed for Reserves in Grid Code**

Spinning (Hot) Reserve and Non Spinning (Cold) Reserve

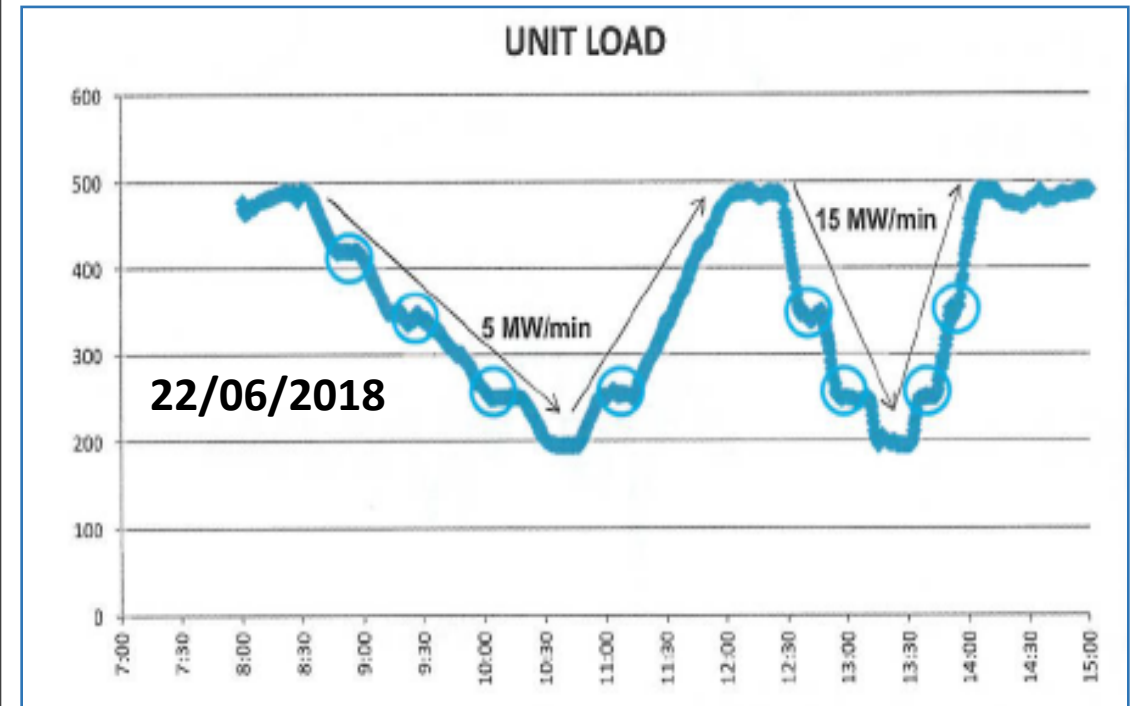
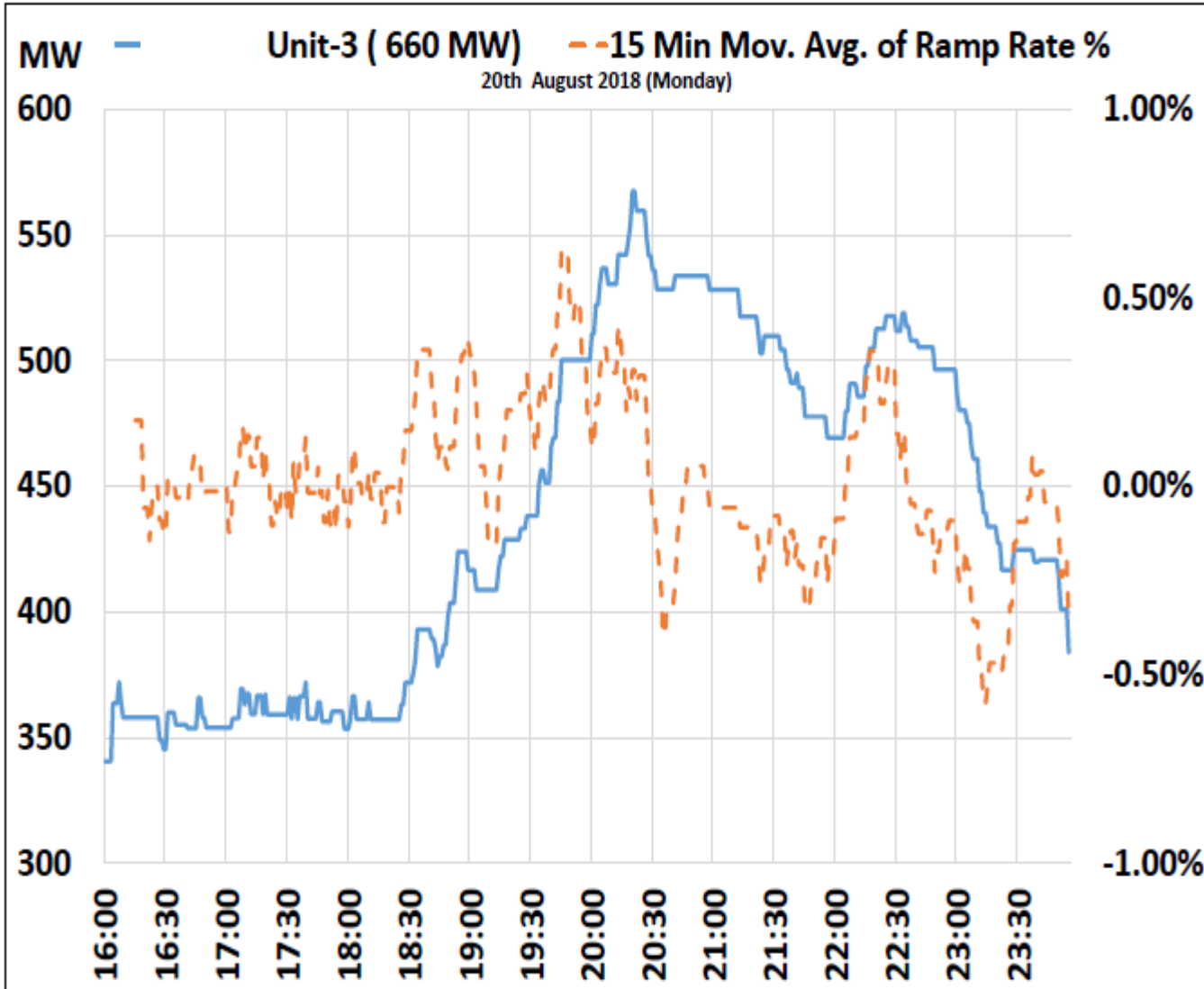
Block Wise Average Cold Reserves



- Cold Reserve = DC-DC Conbar
- Time of necessity
- Cold Start up time
- Out of Merit generation
 - For majority of the day

Unit Ramp Rate effect on SCED

- Relatively Slow Ramping observed for some units
- **Declared Ramp should be Honoured**
- Effects of non performance might be cumulative
- Dadri demonstrated 3%



Action till Date

POSOCO report on 'Security Constrained Economic Despatch pan India' submitted to Hon'ble CERC
03 August 2018

POSOCO Consultation paper on "Security Constrained Economic Dispatch (SCED) of Inter-State Generating Stations pan India" submitted to Hon'ble CERC
12 September, 2018

<https://posoco.in/download/consultation-paper-on-security-constrained-economic-dispatch-of-isgs-pan-india/?wpdmdl=19708>

Hon'ble CERC Order Petition No. 02/SM/2019 (Suo-Motu)
31st January 2019

MoP scheme on 'Flexibility in Generation and scheduling of thermal power stations to reduce the cost of power to the consumer'
30 August, 2018

<https://posoco.in/download/posocos-observations-on-comments-on-the-consultation-paper-on-sced/?wpdmdl=21606>

Stakeholder Consultation
28 September 2018 - 20 November 2018
(10 Nos. Responses)

**Operationalization
01 April 2019**

Participation in the Pilot

All the thermal Inter State Generating Stations (ISGS) that are regional entities and whose tariff is determined or adopted by the Commission for their full capacity.

Sl No	RRAS Provider Name	Region	Installed Capacity (MW)	Fixed cost (Paisa/kWh)	Variable cost (Paisa/kWh)	Ramp Up (MW/Block)	Ramp Down (MW/Block)	Technical Minimum (MW)
1	AGTPP - Agartala*	AR	130	172.1	159.8	8	8	70
2	AGBPP - Kathalguri	AR	291	199.5	214.8	34	34	264
3	BongaigaonGTPP	AR	250	271.42	301.9	15	15	138
Total Installed Capacity			AR	671				
Source-NERPC- http://www.nerpc.nic.in/Ancillary%20service.php								
4	Talcher STPS - I	ER	1000	96.4	158.4	48	48	518
5	Nabinagar Thermal Power Project	ER	500	242.6	180	40	40	275
6	Barh TPS	ER	1320	186.5	215.9	90	90	684
7	Kahalgaoon STPS - II	ER	1500	109.8	220.1	113	113	778
8	Farakka STPS - I & II	ER	1600	83.5	224.9	120	120	823
9	Farakka STPS - III	ER	500	150.4	225.5	38	38	259
10	Kahalgaoon STPS - I	ER	840	106.5	230.2	90	90	421
11	MTPS Stage-II	ER	390	234.9	248.8	30	30	195
Total Installed Capacity			ER	7650				
Source-ERPC- http://erpc.gov.in/as-3-formats								
12	Singrauli STPS	NR	2000	65.7	137.1	135	197	1400
13	Rihand TPS Stage - II	NR	1000	71.2	138.4	100	150	518
14	Rihand TPS Stage - I	NR	1000	85.8	140.6	100	150	507
15	Rihand TPS Stage - III	NR	1000	145.6	141.5	100	150	518
16	Uncharhar TPS Stage - IV	NR	500	165.1	284.3	35	35	275
17	Uncharhar TPS Stage - I	NR	420	109.6	307.2	30	30	210
18	Uncharhar TPS Stage - II	NR	420	101.3	307.2	30	30	210
19	Uncharhar TPS Stage - III	NR	210	136.4	307.2	15	15	105
20	Auraiya Gas Power Project GF	NR	663	64.2	322.6	138	138	356
21	Anta Gas Power Project GF	NR	419	71.7	325	225	225	225
22	Dadri Gas Power Project GF	NR	830	58.2	333.7	50	50	445
23	Dadri TPS Stage - II	NR	980	145	341.4	100	100	509
24	Indra Gandhi STPS	NR	1500	162.8	345.7	150	150	782
25	Dadri TPS Stage - I	NR	840	98.7	364.1	80	80	422
26	Anta Gas Power Project RF	NR	419	71.7	885.7	225	225	225
27	Dadri Gas Power Project RF	NR	830	58.2	890.9	50	50	445
28	Auraiya Gas Power Project RF	NR	663	64.2	934.7	138	138	356
29	Dadri Gas Power Project LF	NR	830	58.2	1240	50	50	445
30	Auraiya Gas Power Project LF	NR	663	64.2	1255.3	138	138	356
31	Anta Gas Power Project LF	NR	419	71.7	1271.6	225	225	225
Total Installed Capacity			NR	11782				
Source-NRPC- http://www.nrpc.gov.in/comm/ancillaryservices.html								

32	Talcher STPS - II	SR	2000	72.1	157.4	150	150	1037
33	NLC TPS - I Exp	SR	420	102.5	236.3	36	45	211
34	NLC TPS - II Exp	SR	500	234.7	236.8	36	27	248
35	Ramagundam STPS - III	SR	500	77.6	251.1	50	50	259
36	NLC TPS - I	SR	630	80.5	255.7	54	68	312
37	NLC TPS - II	SR	840	83.4	255.7	72	90	416
38	Ramagundam STPS - I & II	SR	2100	73.2	257.4	210	210	1078
39	Simhadri STPS - I	SR	1000	95.1	277.4	100	100	521
40	Simhadri STPS - II	SR	1000	153.3	277.9	100	100	521
41	NTPL - Tuticorin TPS	SR	1000	156.2	305.4	75	75	516
42	NTECL - Vallur TPS	SR	1500	178.4	373.2	113	113	770
43	Kudgi STPS I	SR	2400	155.2	385.2	180	180	1244
Total Installed Capacity			SR	13890				
Source- http://www.srpc.kar.nic.in/html/all_uploads.html								
44	SIPAT TPS Stg-I	WR	1980	131.54	116	90	90	1026
45	SIPAT TPS Stg-II	WR	1000	124.87	120.3	69	69	518
46	Korba STPS STG (III)	WR	500	139.6	129.7	30	30	256
47	Korba STPS STG (I & II)	WR	2100	68.9	131.5	135	135	820
48	Sasan Power Ltd	WR	3960	17	131.7	180	180	2400
49	Vindhyachal-III	WR	1000	105.5	140.2	70	70	518
50	Vindhyachal-II	WR	1000	70.1	140.6	70	70	518
51	Vindhyachal-IV	WR	1000	158	140.6	70	70	518
52	Vindhyachal-V	WR	500	168.65	141.2	35	35	256
53	Vindhyachal-I	WR	1260	86.4	150.1	90	90	631
54	Costal Gujarat Power Ltd	WR	4150	90.31	179.65	150	150	2090
55	Ratnagiri Gas & Power Pvt Ltd GF	WR	663.54	130	249.0	300	300	354
56	Gandhar Gas Power Project GF	WR	657.39	105.7	258.9	293	293	354
57	Kawas Gas Power Project GF	WR	656.2	85.4	262.5	208	208	352
58	NTPC-SAIL Power Company Pvt. Ltd	WR	500	172.5	264.5	30	30	250
59	Mouda STPP Stage-I	WR	1000	189.4	277	70	70	518
60	Mouda STPP Stage-II	WR	1320	142.2	283.4	70	70	686
61	Gandhar Gas Power Project NAPM	WR	657.39	105.7	288.1	293	293	354
62	Kawas Gas Power Project NAPM	WR	656.2	85.4	288.6	208	208	352
63	Ratnagiri Gas & Power Pvt Ltd IR	WR	540	130	407.0	300	300	288
64	RGPP-L-Maharashtra	WR	68	130	407.0	300	300	36
65	RGPP-L-Others	WR	32	130	407.0	300	300	17
66	Solapur Super Thermal Power Project	WR	660	215.6	418.9	30	30	343
67	Ratnagiri Gas & Power Pvt Ltd RF	WR	1122	130	465.0	300	300	354
68	Gandhar Gas Power Project RF	WR	657.39	105.7	739.2	293	293	354
69	Kawas Gas Power Project RF	WR	656.2	85.4	747.5	208	208	352
70	Kawas Gas Power Project LF	WR	656.2	85.4	1115.5	208	208	352
Total Installed Capacity			WR	23907				
Source- http://www.wrpc.gov.in/Commercial_rras_dat.asp?moe								
All India Total Installed Capacity				57901				

All thermal RRAS Providers would also participate in the SCED pilot.

The latest list of RRAS Providers is available at <https://posoco.in/download/rras-providers-rate-from-16th-jan19-to-15th-feb19/?wpdmdl=21301>

SCED Accounting & Settlement

SCED Energy Accounting

- To be incorporated by RPCs on weekly basis along with DSM RRAS, FRAS and AGC accounts
- SCED Schedules to be provided by NLDC through the RLDCs
- NLDC would indicate consolidated "National SCED Settlement Statement"
 - Schedules on account of SCED.
 - Payment and receipts to/from SCED Providers.

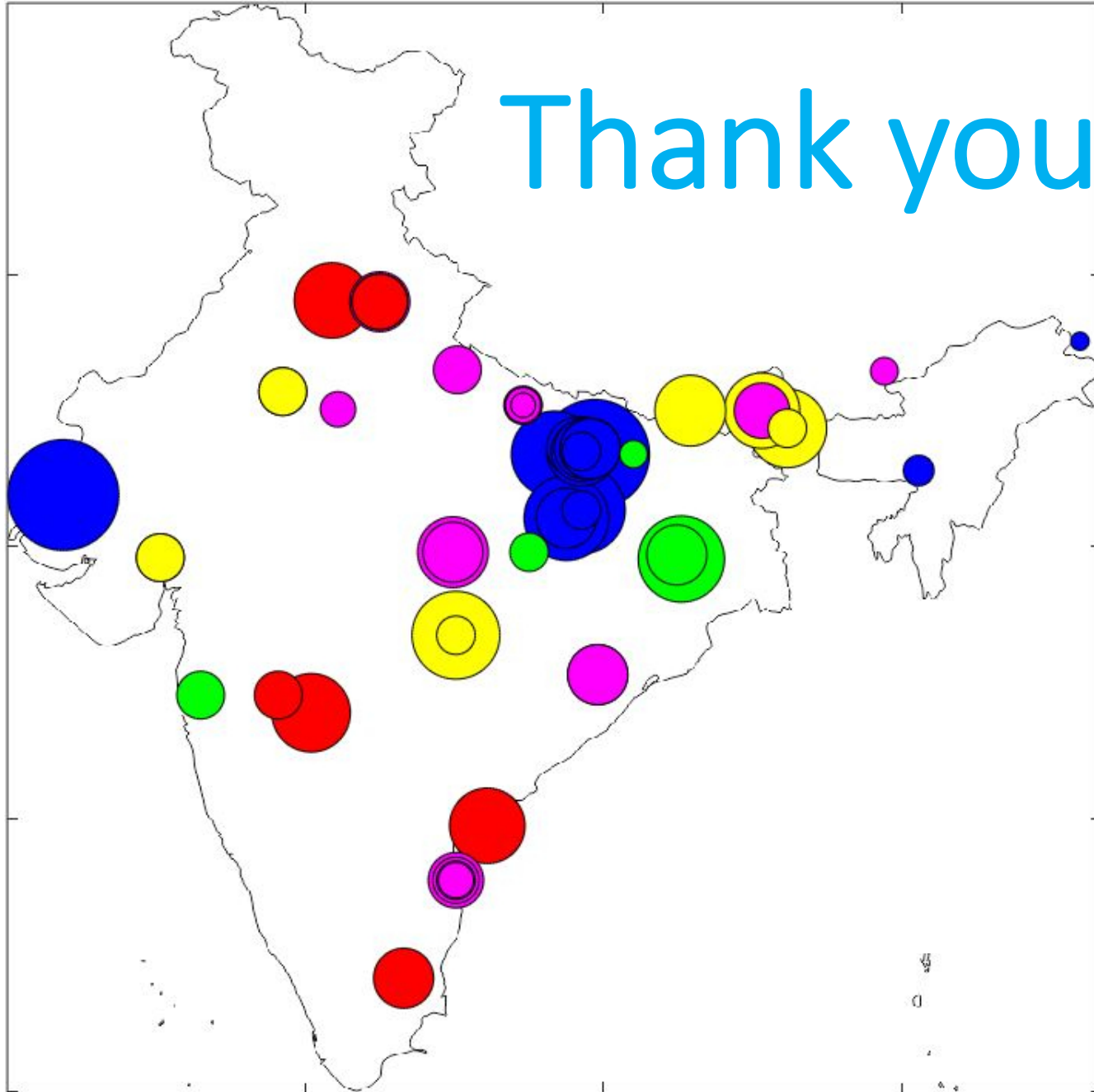
SCED Energy Settlement

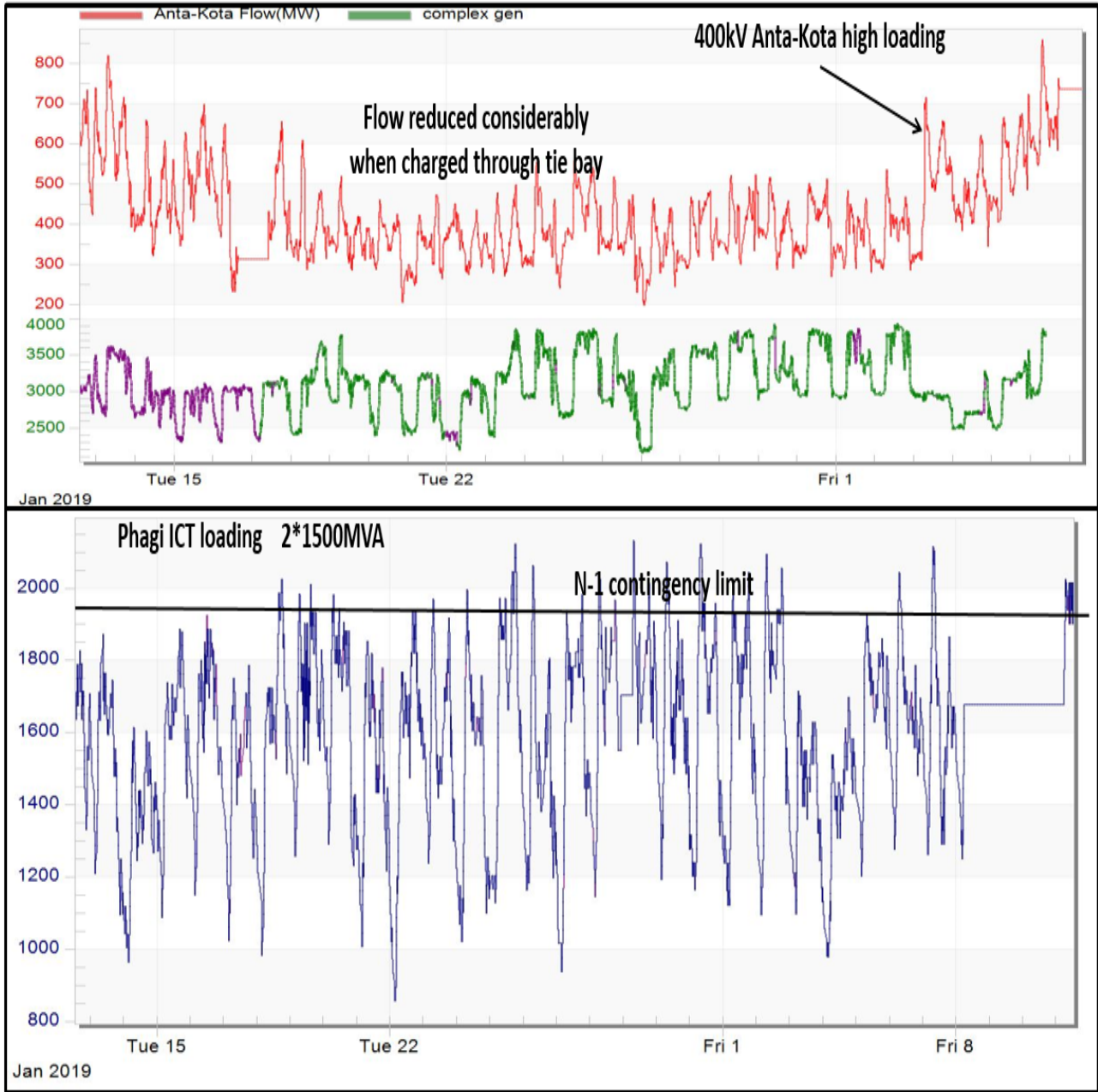
- National Pool Account (SCED) to be operated by NLDC
- Settlement using variable charges declared under RRAS
- All payments shall flow from/to the National Pool Account (SCED)
 - For Increment in Scheduled Generation, SCED provider to be paid from the National Pool Account (SCED)
 - For Decrement in Scheduled Generation, SCED Provider to pay to National Pool Account (SCED)
- Compensation due to part load operation as certified by RPC in accordance with the provisions of IEGC to be factored
- No retrospective settlement
- Any deviation settled as per CERC DSM Regulation

Implementation Actions

- Detailed Procedures to be issued by NLDC
- Schedules of the States/beneficiaries would not be changed and the beneficiaries would continue to pay the charges for the scheduled energy directly to the generator as per the existing practice
- NLDC to open a separate bank account - “National Pool Account (SCED)”
 - Savings obtained through SCED after settlement of all accounts of SCED would be recorded and maintained in the “National Pool Account (SCED)” by the NLDC.
 - The sharing of benefits/savings has been accepted in principle by the Commission. However, methodology of sharing shall be decided after the results of the pilot and the extent of savings are available.
- Web Based Energy Scheduling Software
 - Batch processing of schedules
 - Schedule data interchanges between the RLDCs/NLDC, synching of data
 - Pre-processing & validation being sent to the SCED engine
 - Core optimization (SCED) engine – development, testing and validation
 - Output of SCED to be incorporated in the schedules
- Creation of a counterparty to SCED
- Augmentation of Communication infrastructure

Thank you

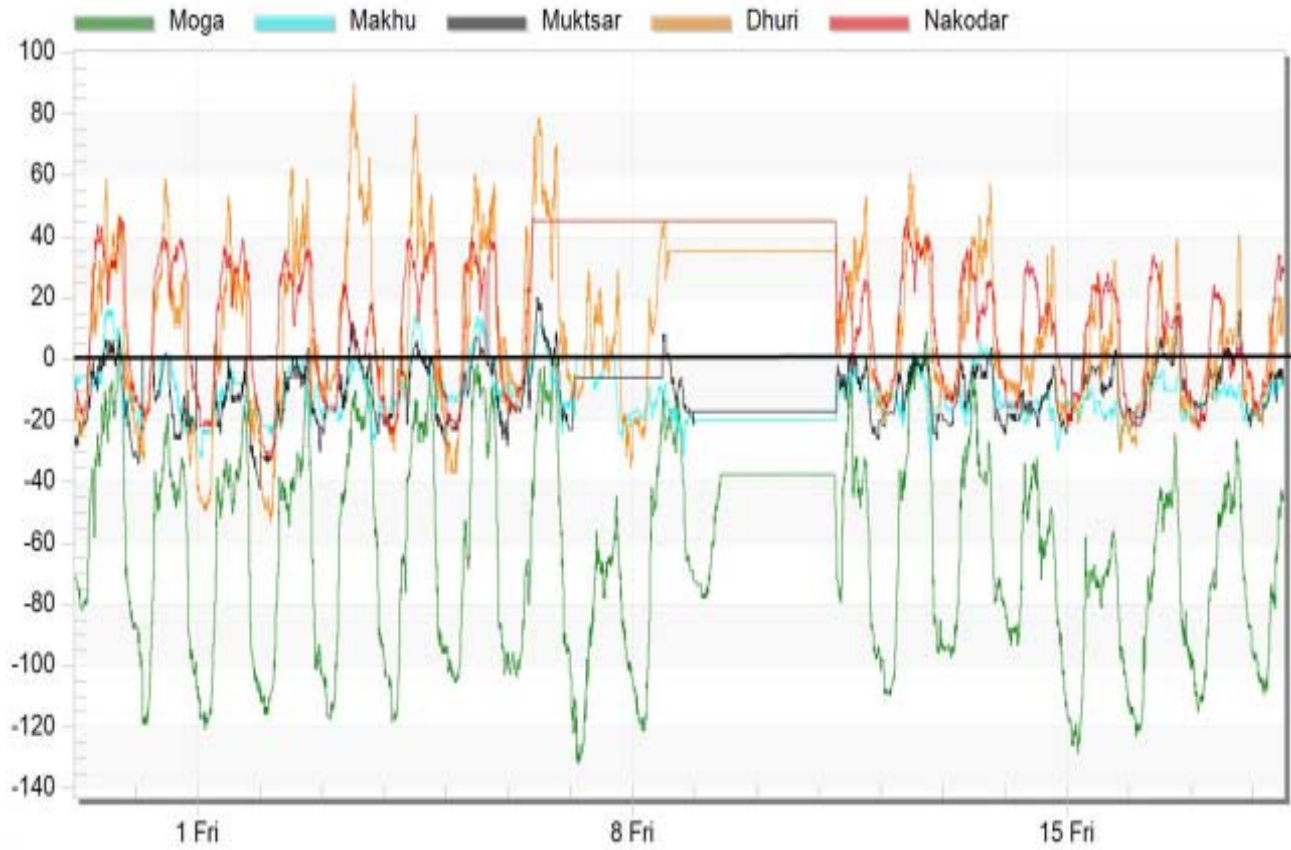




Recent Tripping of ICTs due to overflux

S.No.	Element	Voltage	Owner	Outage date	Time	Revival Date	Time	Reason
1	Abdullapur 315 MVA ICT 4	400-220 kv	PGCIL	8-2-2019	0:43	8-2-2019	6:06	Over fluxing.
2	Dhuri(400) 500 MVA ICT 1	400-220 kv	PSTCL	31-01-2019	3:24	31-01-2019	10:28	Over fluxing.
3	Dhuri(400) 500 MVA ICT 1	400-220 kv	PSTCL	3-2-2019	0:32	3-2-2019	8:50	Over fluxing.
4	Dhuri(400) 500 MVA ICT 1	400-220 kv	PSTCL	6-2-2019	20:06	7-2-2019	7:07	Over fluxing.
5	Dhuri(400) 500 MVA ICT 1	400-220 kv	PSTCL	8-2-2019	0:08	8-2-2019	7:47	Over fluxing.
6	Dhuri(400) 500 MVA ICT 1	400-220 kv	PSTCL	12-2-2019	1:50	12-2-2019	7:57	Over fluxing.
7	Dhuri(400) 500 MVA ICT 1	400-220 kv	PSTCL	15-02-2019	1:42	15-02-2019	7:04	Over fluxing.
8	Dhuri(400) 500 MVA ICT 1	400-220 kv	PSTCL	16-02-2019	2:46	16-02-2019	7:18	Over fluxing.
9	Dhuri(400) 500 MVA ICT 1	400-220 kv	PSTCL	17-02-2019	3:52	17-02-2019	7:55	Over fluxing.
10	Dhuri(400) 500 MVA ICT 1	400-220 kv	PSTCL	18-02-2019	3:57	18-02-2019	7:10	Over fluxing.
11	Makhu 315 MVA ICT 1	400-220 kv	PSTCL	31-01-2019	1:28	31-01-2019	9:16	Over fluxing.
12	Makhu 315 MVA ICT 1	400-220 kv	PSTCL	1-2-2019	1:52	1-2-2019	8:54	Over fluxing.
13	Makhu 315 MVA ICT 1	400-220 kv	PSTCL	3-2-2019	1:14	3-2-2019	10:41	Over fluxing.
14	Makhu 315 MVA ICT 1	400-220 kv	PSTCL	4-2-2019	3:06	4-2-2019	10:10	Over fluxing.
15	Makhu 315 MVA ICT 1	400-220 kv	PSTCL	6-2-2019	2:50	6-2-2019	12:13	Over fluxing.
16	Makhu 315 MVA ICT 1	400-220 kv	PSTCL	7-2-2019	23:42	8-2-2019	11:31	Over voltage.
17	Makhu 315 MVA ICT 1	400-220 kv	PSTCL	9-2-2019	3:55	9-2-2019	10:13	Over voltage.
18	Makhu 315 MVA ICT 1	400-220 kv	PSTCL	11-2-2019	1:43	11-2-2019	10:38	
19	Makhu 315 MVA ICT 1	400-220 kv	PSTCL	12-2-2019	1:15	12-2-2019	8:40	Over fluxing.
20	Makhu 315 MVA ICT 1	400-220 kv	PSTCL	13-02-2019	3:09	13-02-2019	8:40	Over fluxing.
21	Makhu 315 MVA ICT 1	400-220 kv	PSTCL	14-02-2019	4:51	14-02-2019	17:11	
22	Makhu 315 MVA ICT 1	400-220 kv	PSTCL	14-02-2019	22:57	15-02-2019	10:27	Over fluxing.
23	Makhu 315 MVA ICT 1	400-220 kv	PSTCL	16-02-2019	2:32	16-02-2019	11:05	Over fluxing.
24	Makhu 315 MVA ICT 1	400-220 kv	PSTCL	17-02-2019	2:28	17-02-2019	9:46	Over fluxing.
25	Makhu 315 MVA ICT 1	400-220 kv	PSTCL	18-02-2019	2:22	18-02-2019	7:56	Over fluxing.
26	Makhu 315 MVA ICT 2	400-220 kv	PSTCL	30-01-2019	2:26	30-01-2019	9:13	Over fluxing.
27	Makhu 315 MVA ICT 2	400-220 kv	PSTCL	31-01-2019	2:31	31-01-2019	12:09	Over fluxing.
28	Mukatsar 315 MVA ICT 1	400-220 kv	PSTCL	31-01-2019	2:37	31-01-2019	7:00	Over fluxing.
29	Mukatsar 315 MVA ICT 1	400-220 kv	PSTCL	31-01-2019	20:23	1-2-2019	6:41	Over fluxing.
30	Mukatsar 315 MVA ICT 1	400-220 kv	PSTCL	4-2-2019	3:13	4-2-2019	6:49	Over fluxing.
31	Mukatsar 315 MVA ICT 1	400-220 kv	PSTCL	6-2-2019	0:56	6-2-2019	8:00	Over fluxing.
32	Mukatsar 315 MVA ICT 1	400-220 kv	PSTCL	7-2-2019	0:25	7-2-2019	10:24	Over fluxing.
33	Mukatsar 315 MVA ICT 1	400-220 kv	PSTCL	7-2-2019	23:17	8-2-2019	10:39	Over fluxing.
34	Mukatsar 315 MVA ICT 1	400-220 kv	PSTCL	10-2-2019	2:56	10-2-2019	7:43	Over fluxing.
35	Mukatsar 315 MVA ICT 1	400-220 kv	PSTCL	11-2-2019	4:01	11-2-2019	10:23	Over fluxing.
36	Mukatsar 315 MVA ICT 1	400-220 kv	PSTCL	13-02-2019	4:00	13-02-2019	8:40	Over fluxing.
37	Mukatsar 315 MVA ICT 1	400-220 kv	PSTCL	15-02-2019	0:31	17-02-2019	9:51	Over fluxing.
38	Mukatsar 315 MVA ICT 1	400-220 kv	PSTCL	18-02-2019	3:33	*	*	Over fluxing.
39	Mukatsar 315 MVA ICT 2	400-220 kv	PSTCL	31-01-2019	1:59	31-01-2019	7:02	Over fluxing.
40	Mukatsar 315 MVA ICT 2	400-220 kv	PSTCL	31-01-2019	23:25	1-2-2019	6:41	Over fluxing.
41	Mukatsar 315 MVA ICT 2	400-220 kv	PSTCL	3-2-2019	0:52	3-2-2019	7:38	Over fluxing.
42	Mukatsar 315 MVA ICT 2	400-220 kv	PSTCL	4-2-2019	3:06	4-2-2019	8:46	Over fluxing.
43	Mukatsar 315 MVA ICT 2	400-220 kv	PSTCL	8-2-2019	3:46	8-2-2019	5:26	Over voltage.
44	Mukatsar 315 MVA ICT 2	400-220 kv	PSTCL	12-2-2019	1:36	12-2-2019	8:35	Over fluxing.
45	Mukatsar 315 MVA ICT 2	400-220 kv	PSTCL	15-02-2019	2:03	15-02-2019	6:30	Over fluxing.
46	Nakodar 315 MVA ICT 1	400-220 kv	PSTCL	6-2-2019	3:49	6-2-2019	6:48	Over fluxing.
47	Nakodar 315 MVA ICT 1	400-220 kv	PSTCL	7-2-2019	0:04	7-2-2019	5:48	Over fluxing.
48	Nakodar 315 MVA ICT 1	400-220 kv	PSTCL	12-2-2019	4:26	12-2-2019	8:34	Over fluxing.
49	Nakodar 315 MVA ICT 1	400-220 kv	PSTCL	15-02-2019	2:27	15-02-2019	11:47	Over fluxing.
50	Nakodar 315 MVA ICT 1	400-220 kv	PSTCL	18-02-2019	3:45	18-02-2019	6:59	Over fluxing.
51	Nakodar 315 MVA ICT 2	400-220 kv	PSTCL	7-2-2019	0:14	7-2-2019	5:49	Over fluxing.
52	Rajpura (400kv) 500 MVA ICT 3	400-220 kv	PGCIL	15-02-2019	4:05	15-02-2019	6:27	Over fluxing.

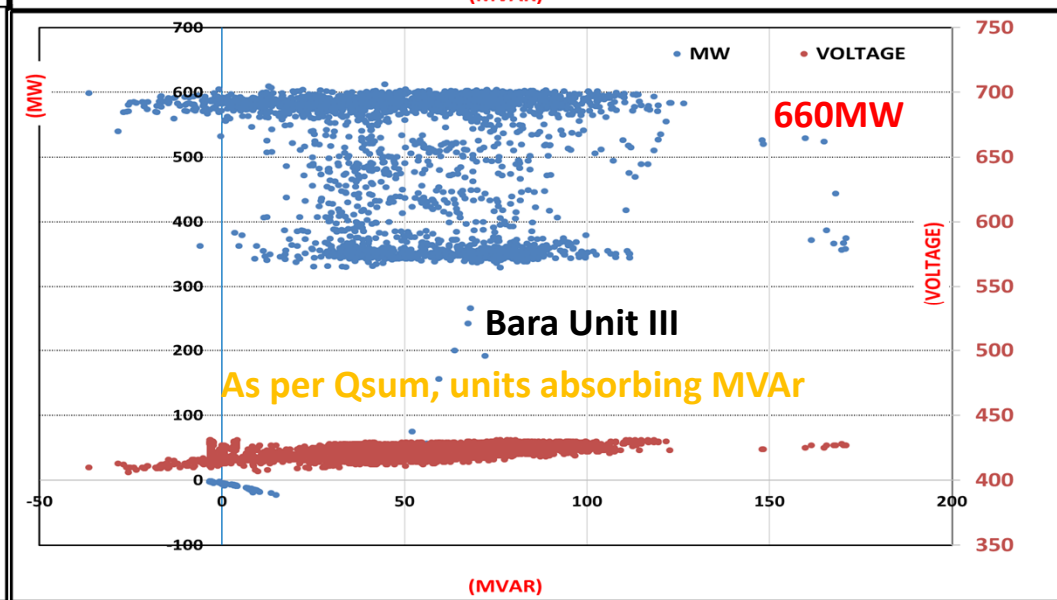
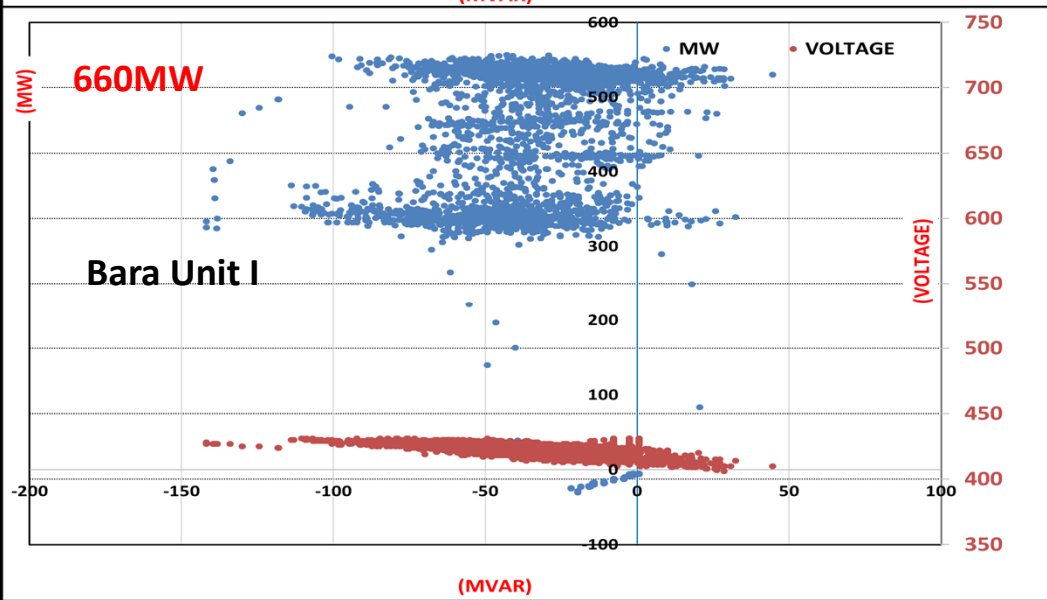
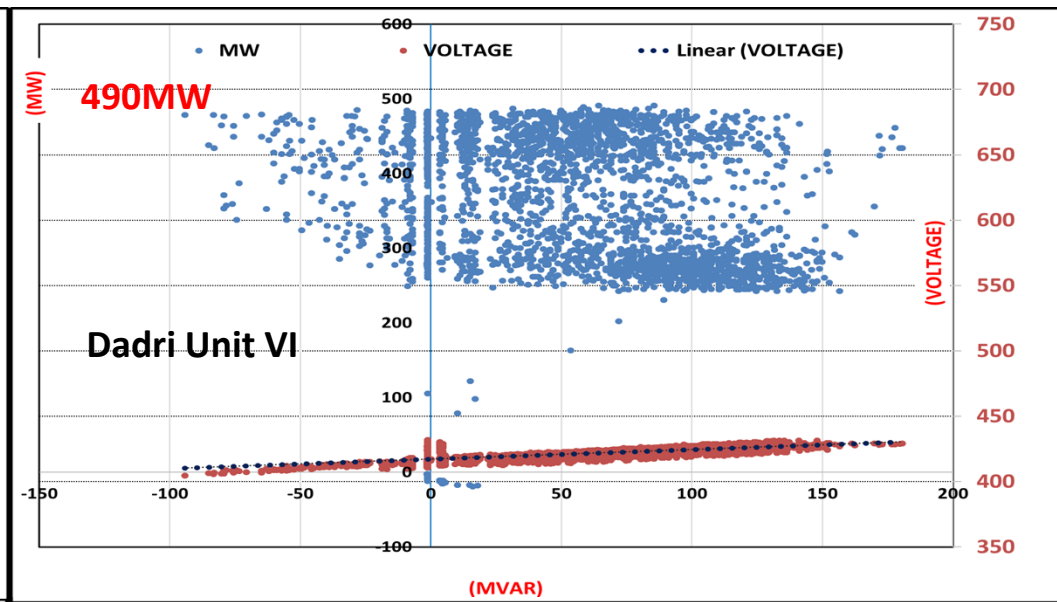
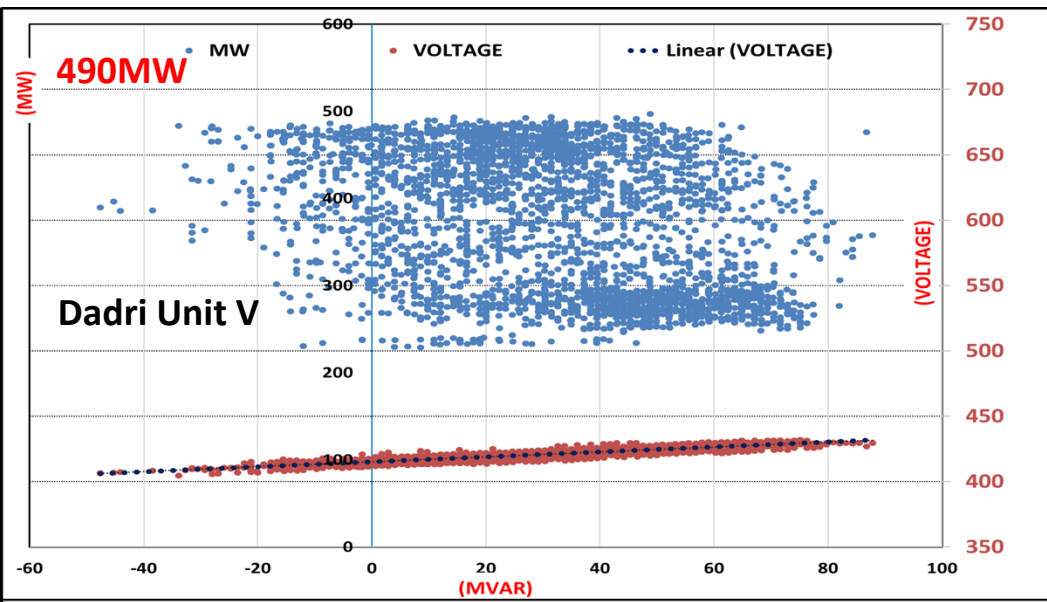
ICT MVAR FLOW 400 to 220

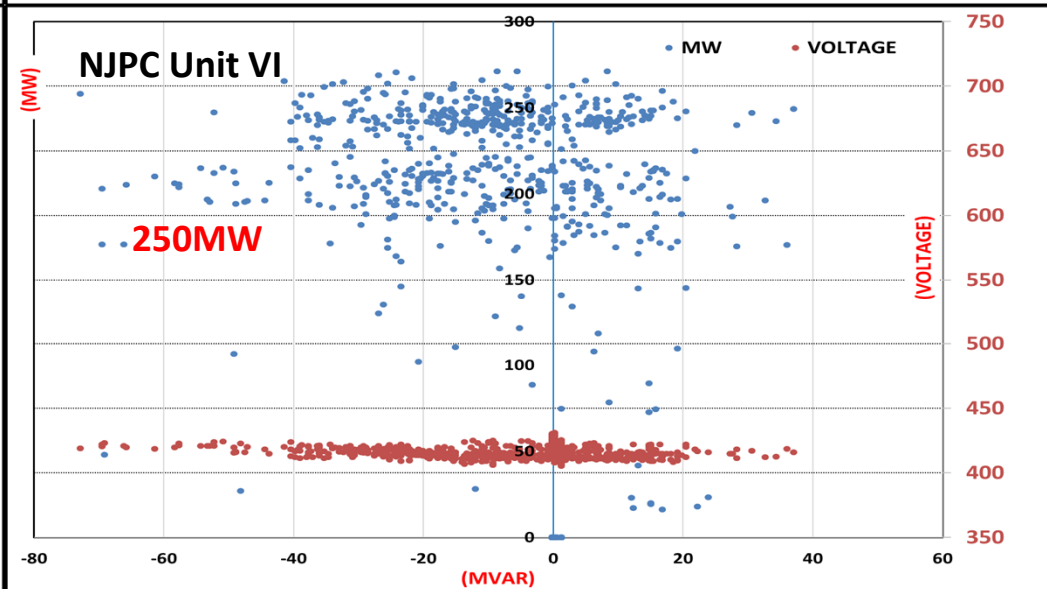
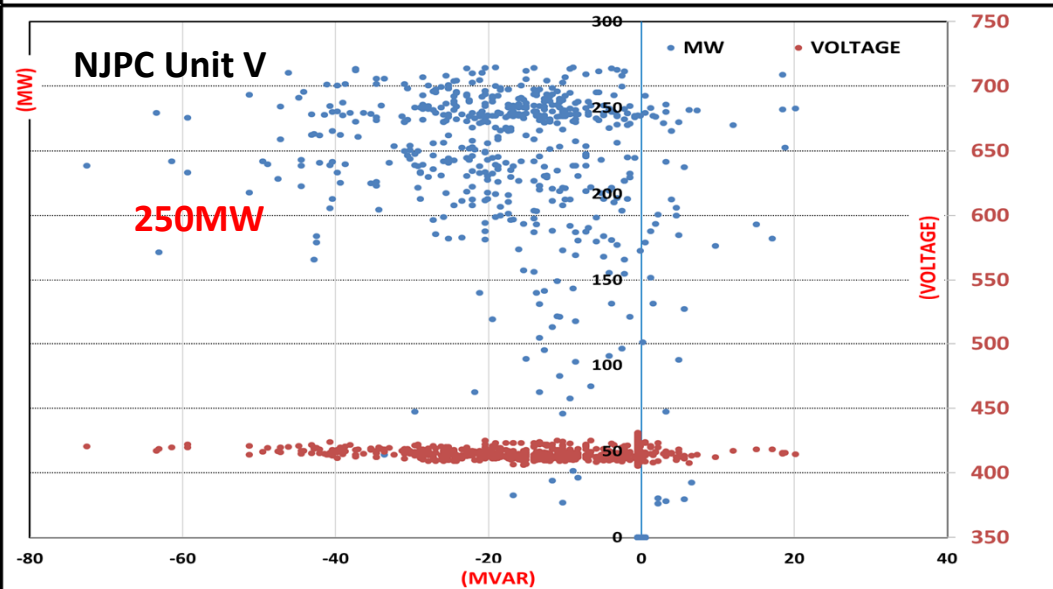
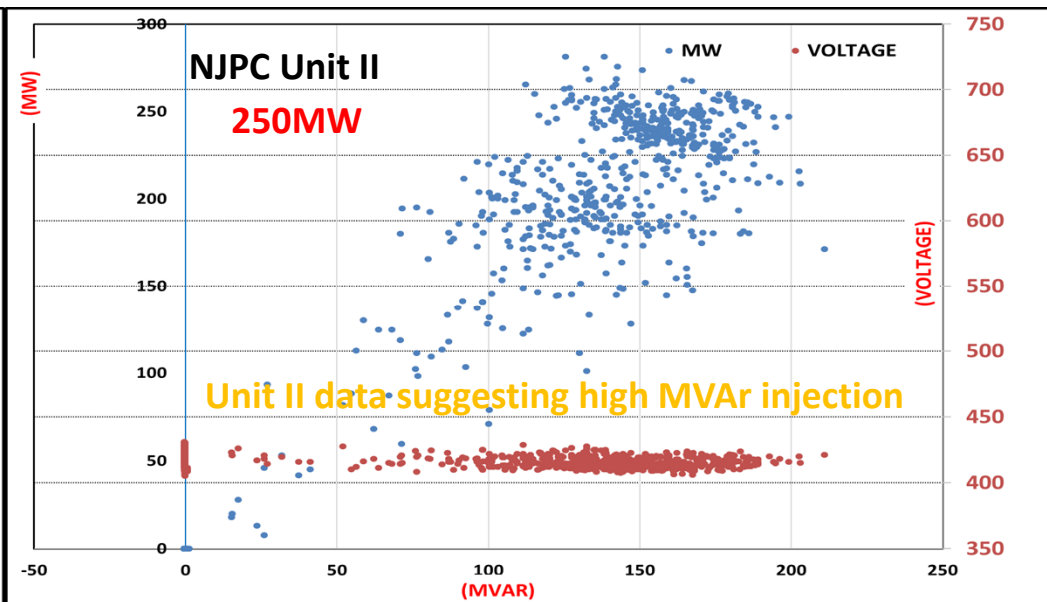
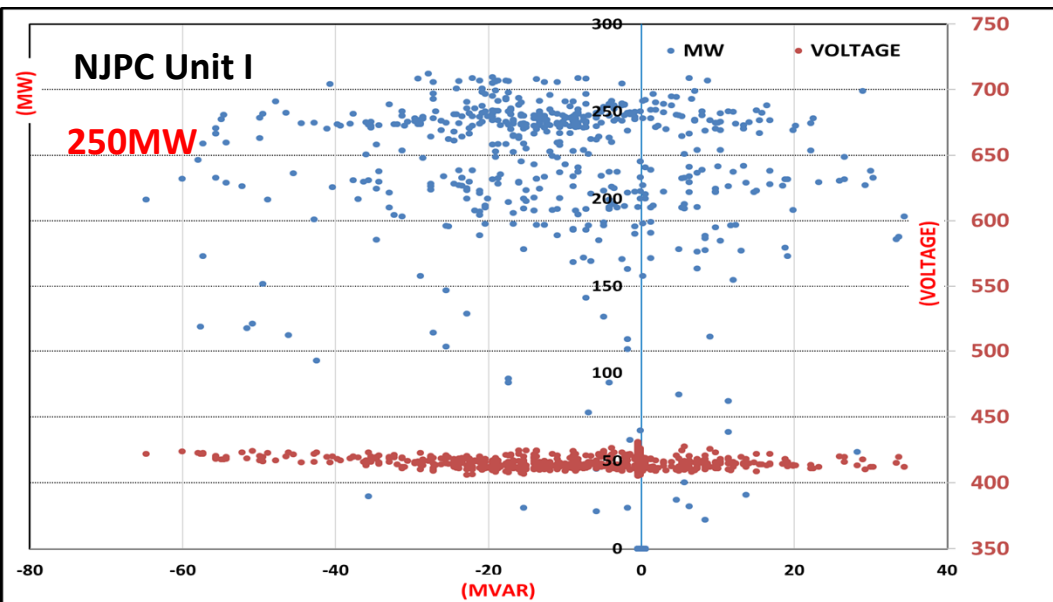


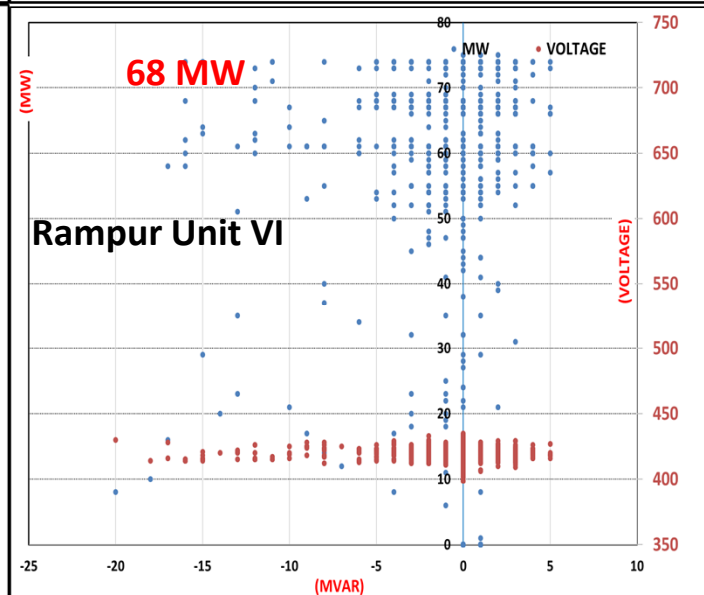
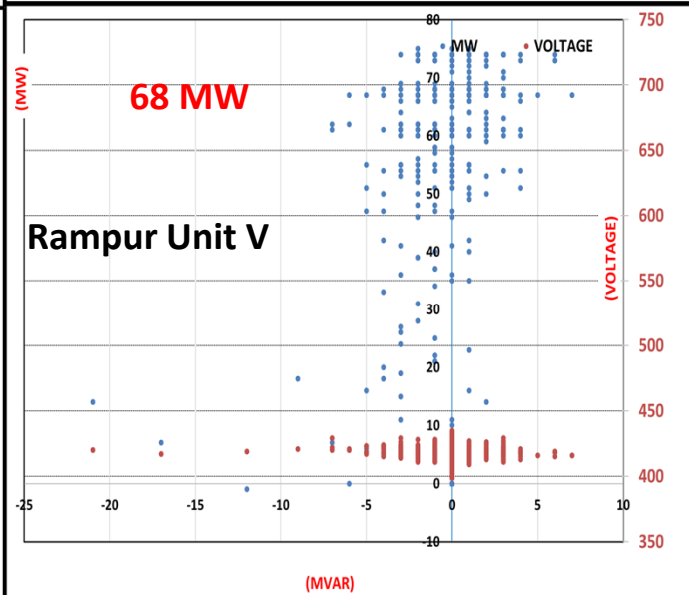
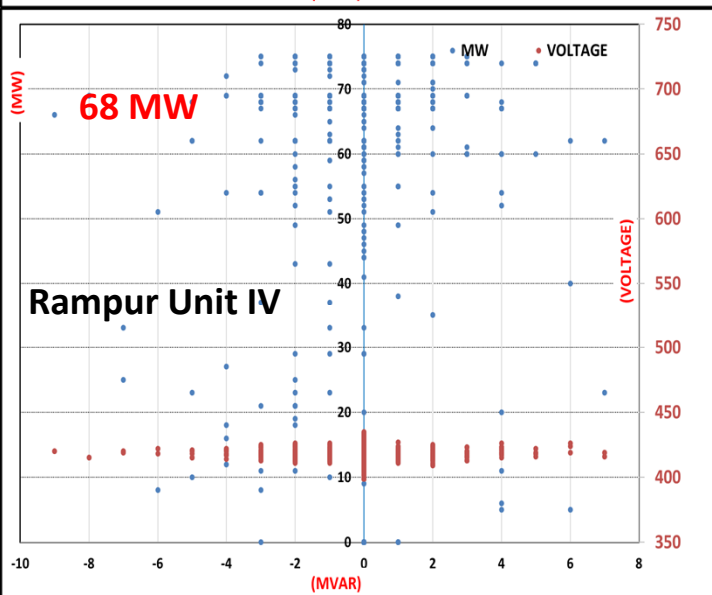
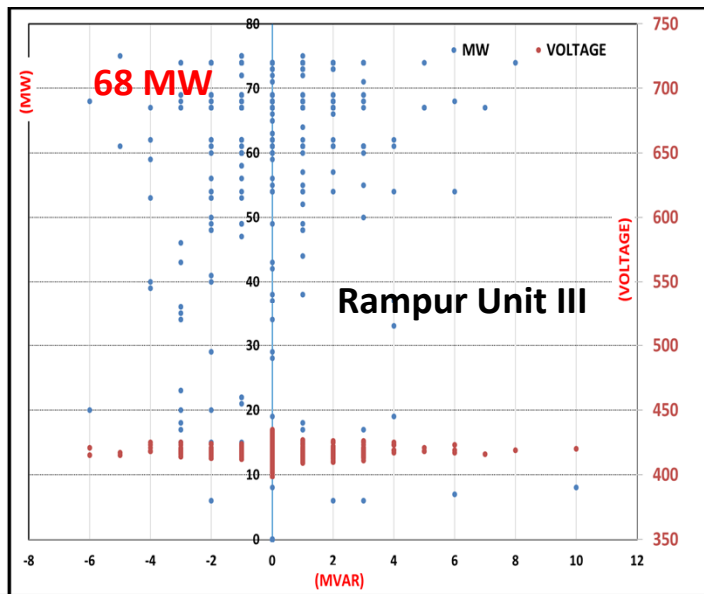
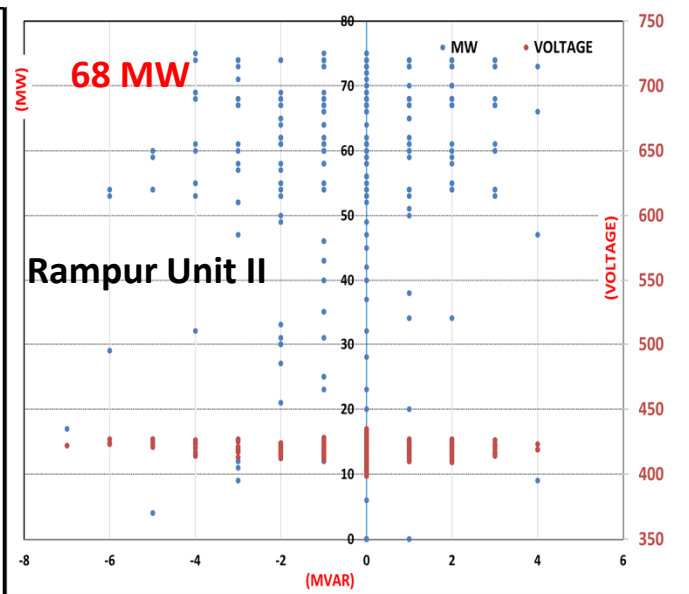
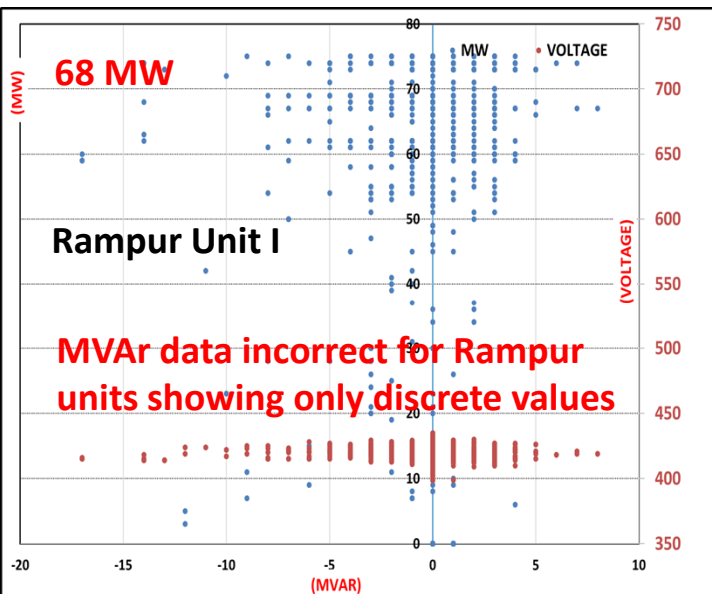
Feb 2019

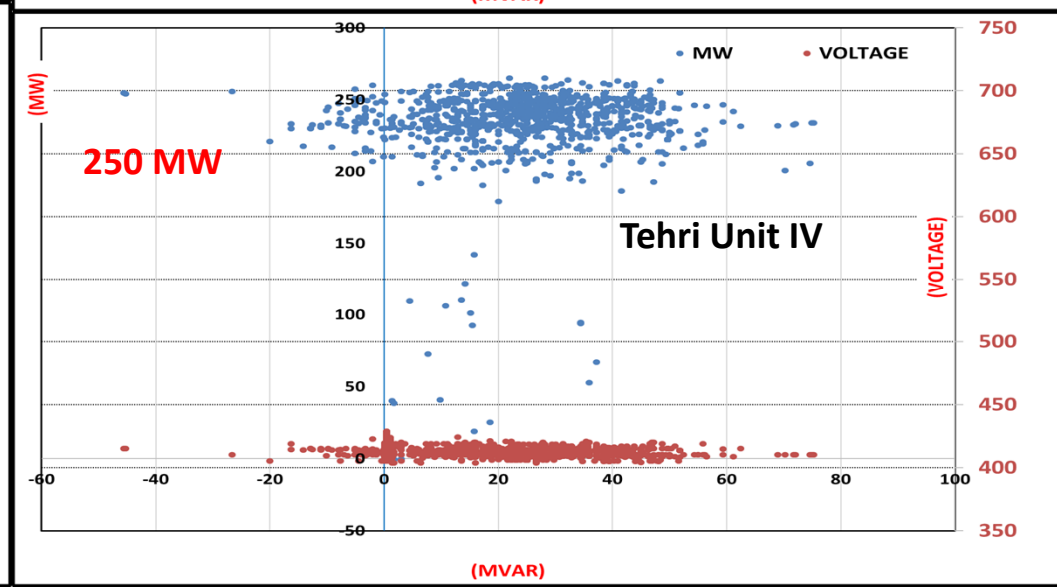
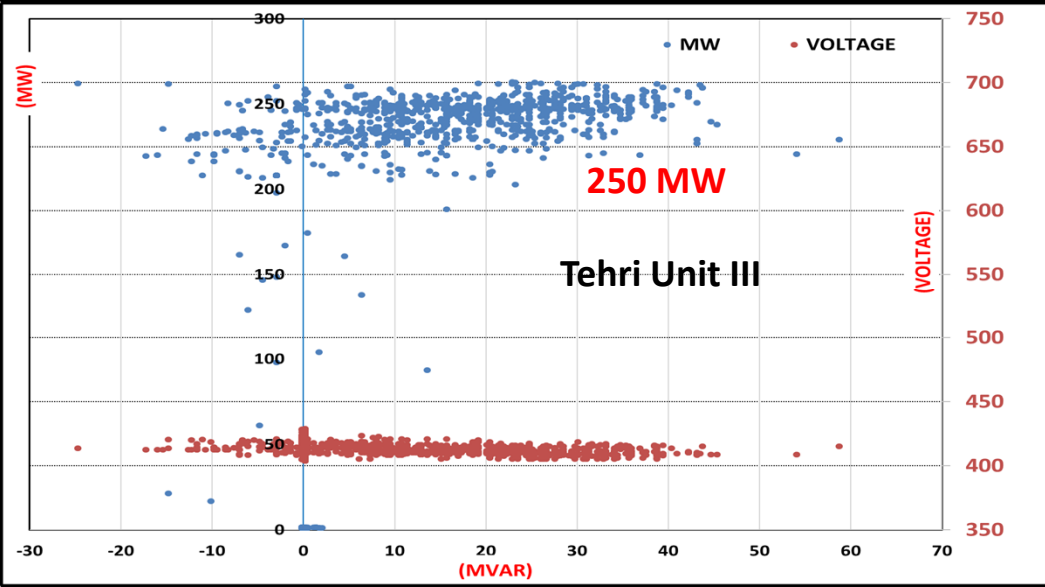
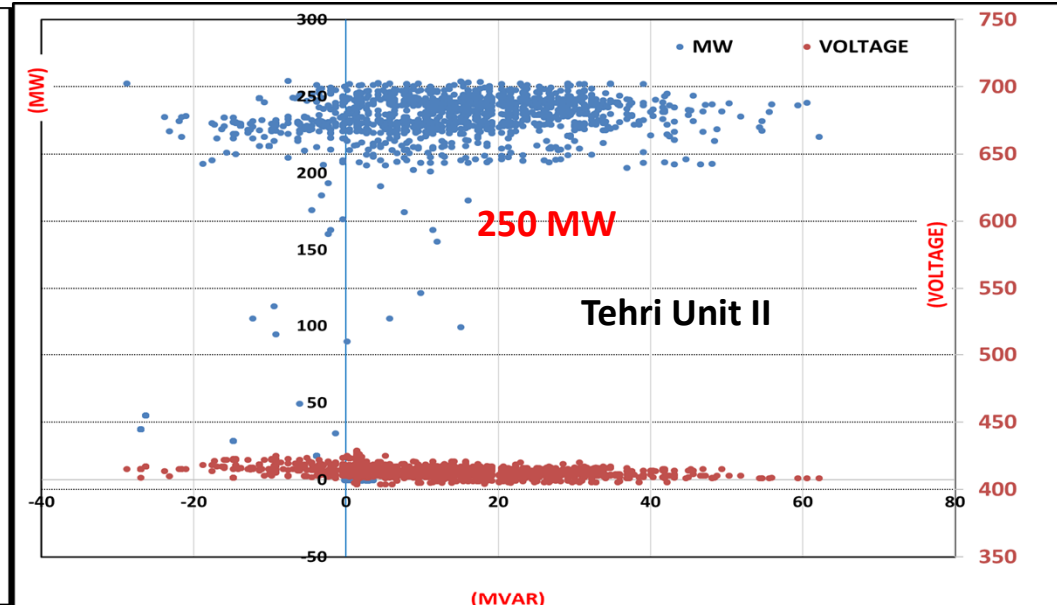
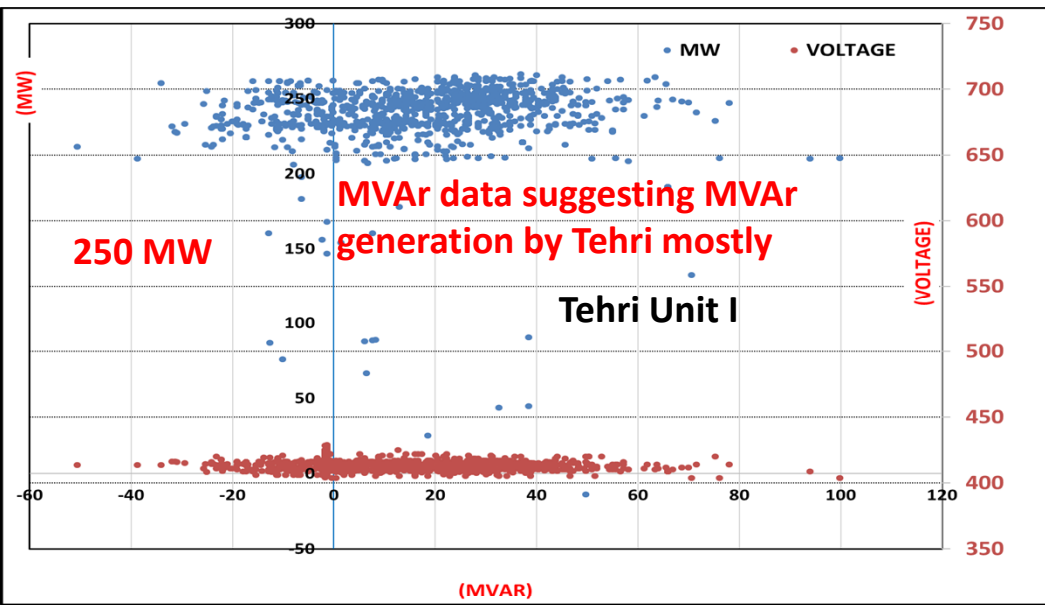
MVAR performance of generators (MVA_r vs Voltage and MVA_r vs MW)

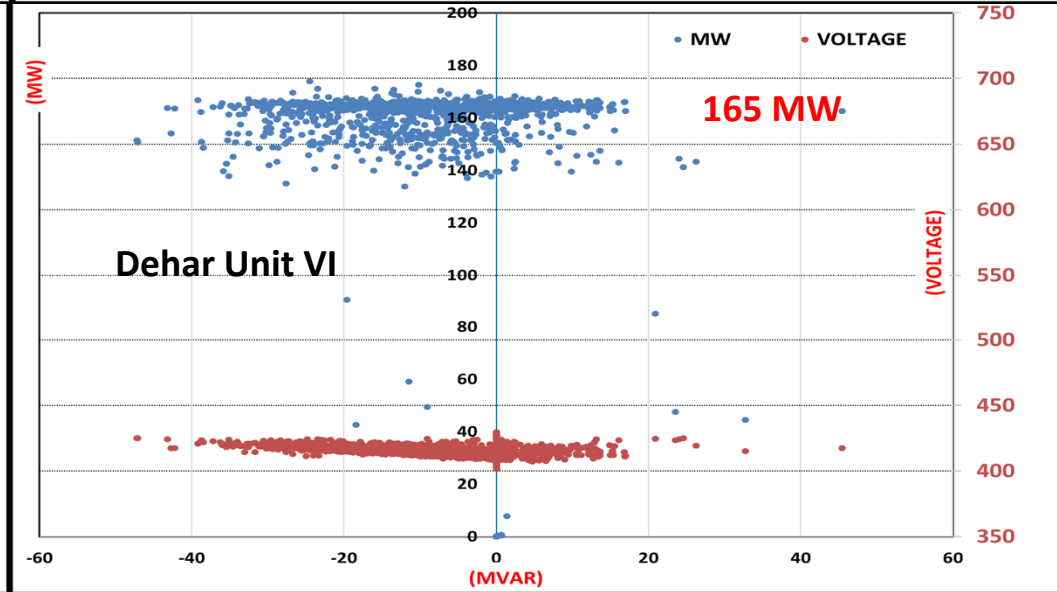
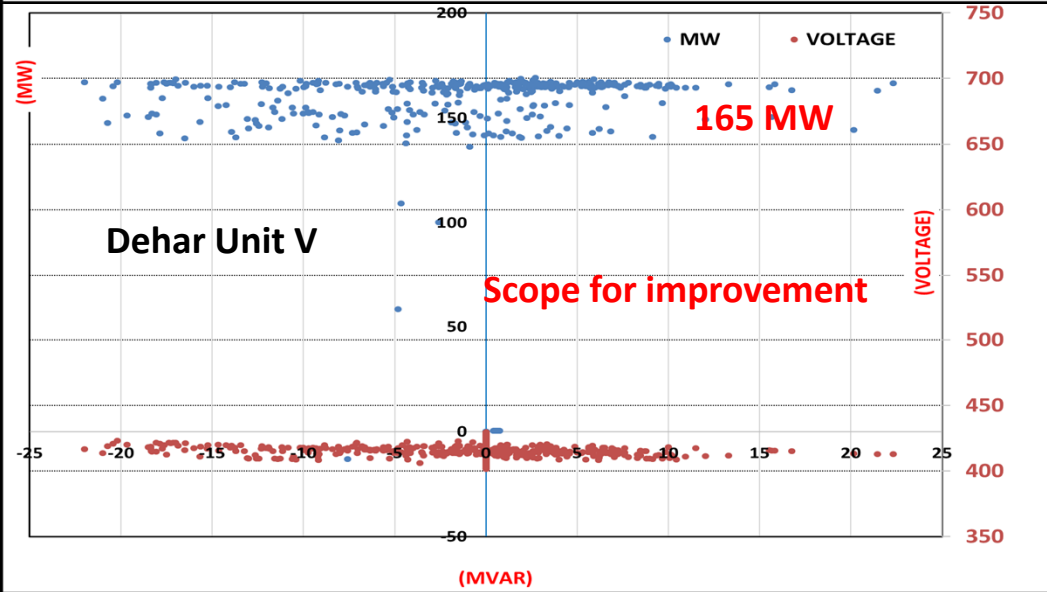
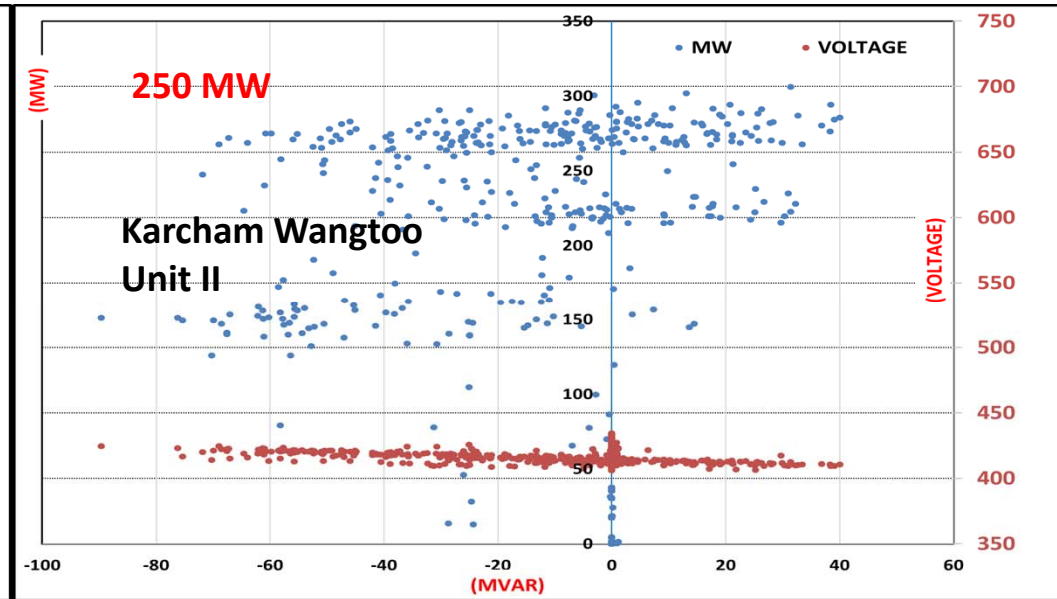
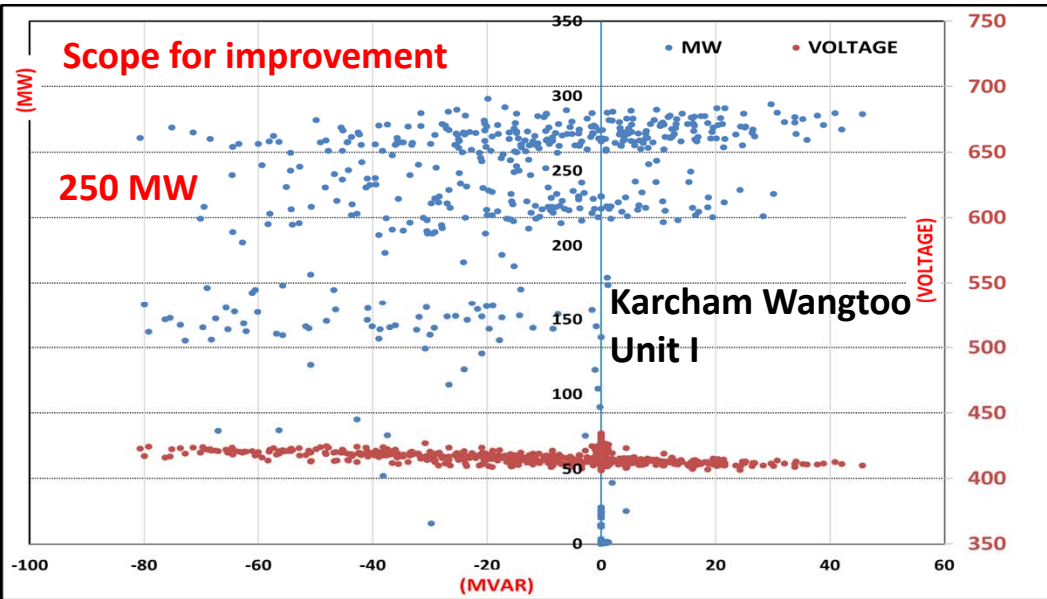
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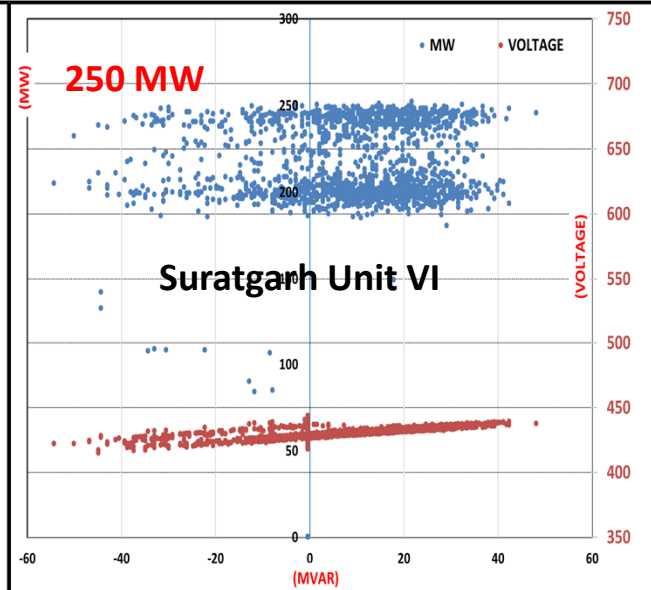
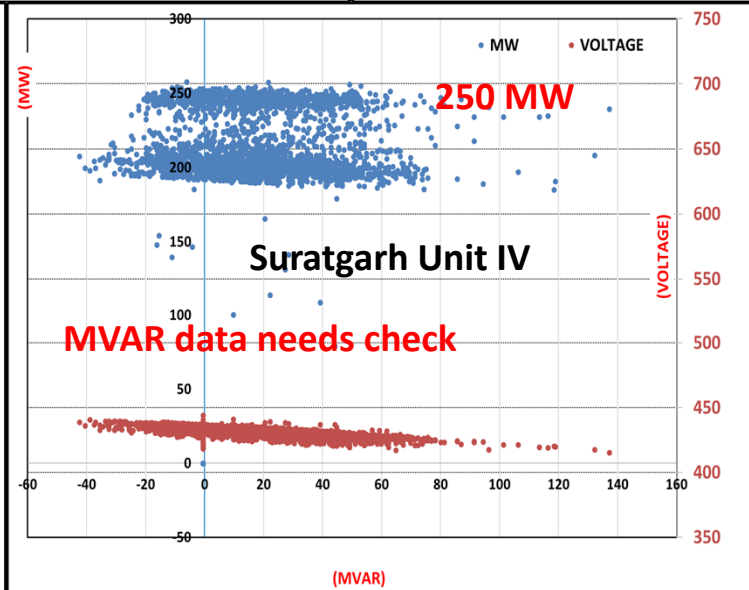
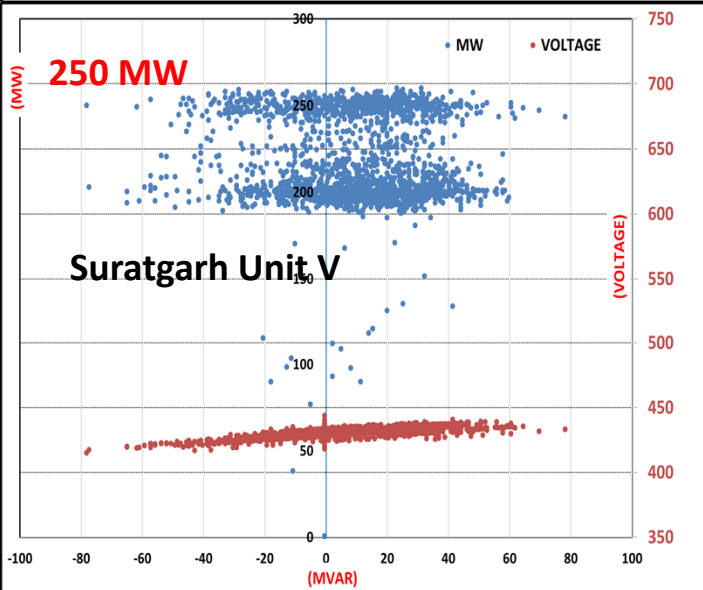
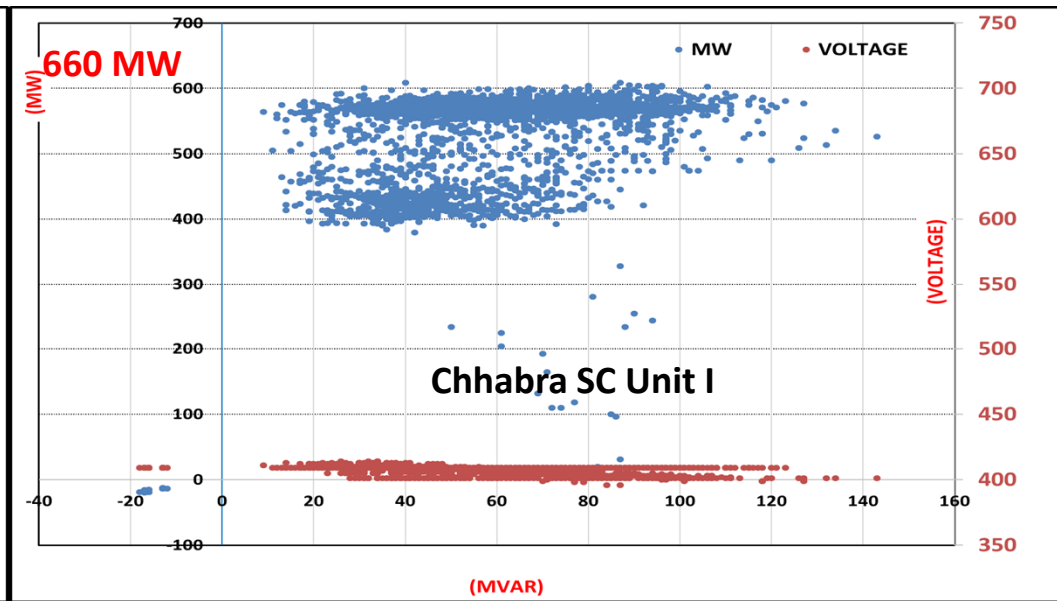
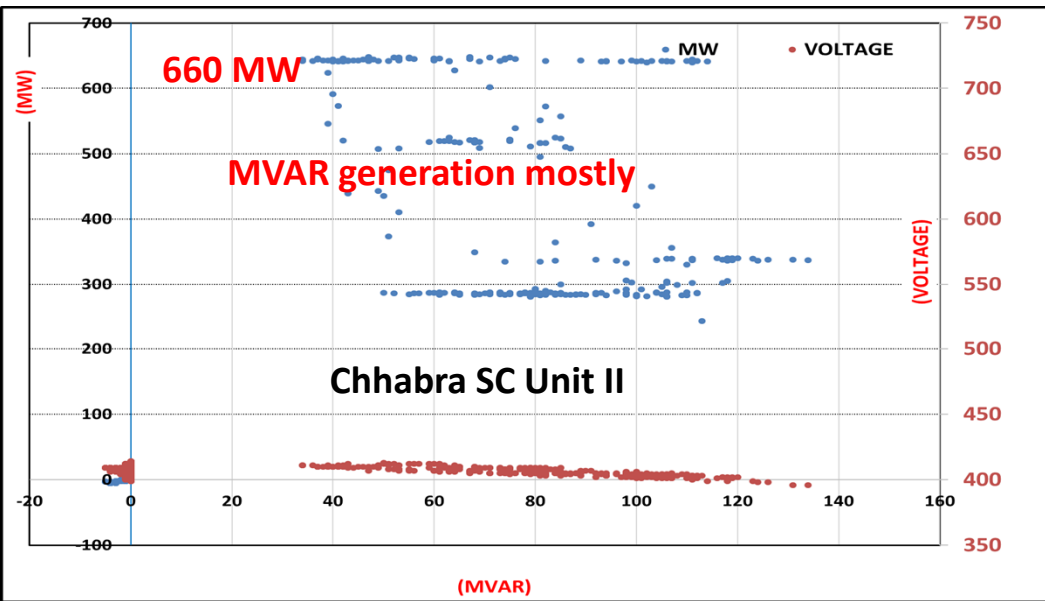


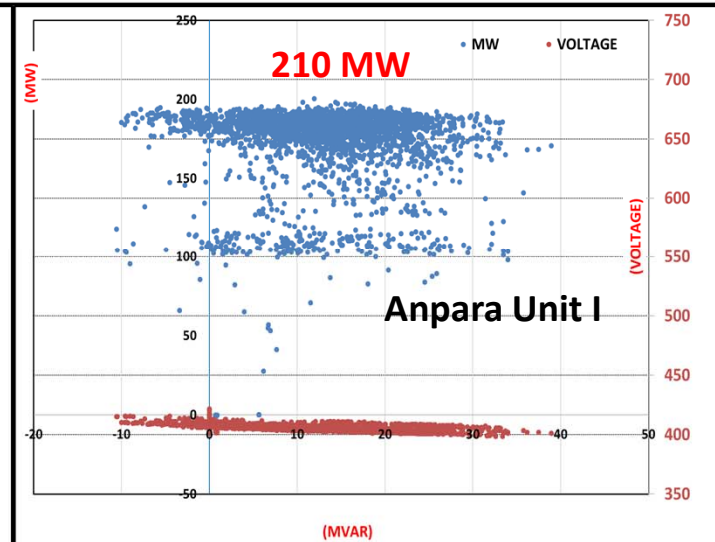
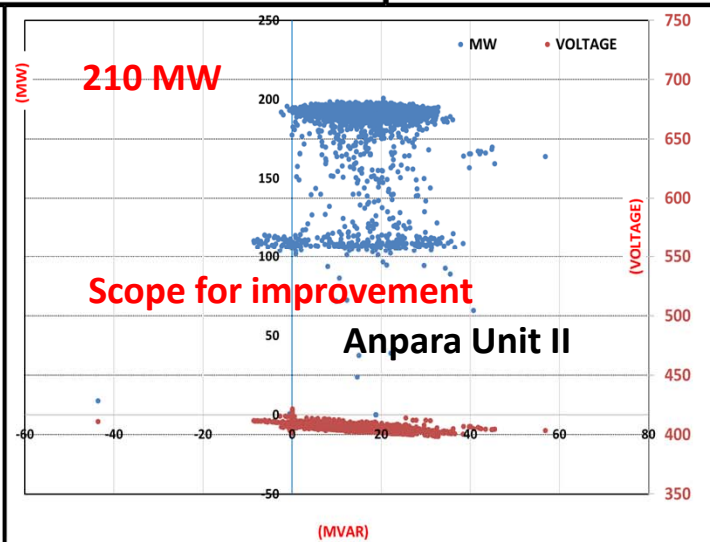
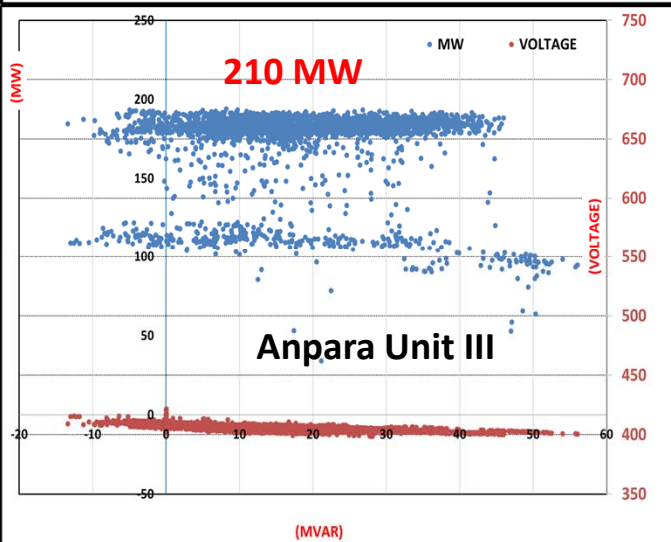
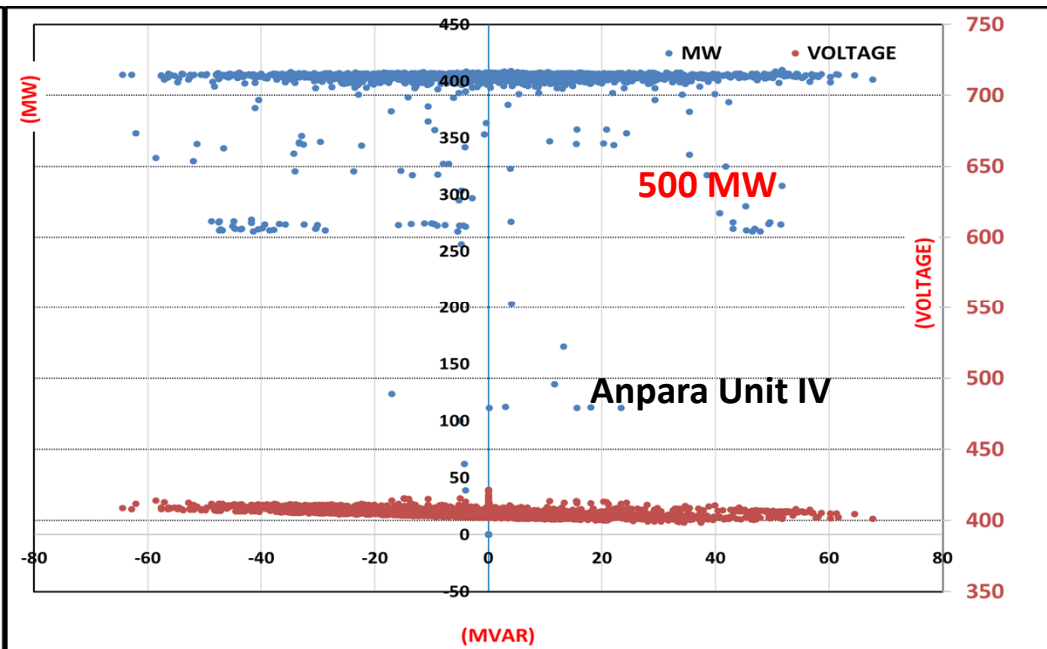
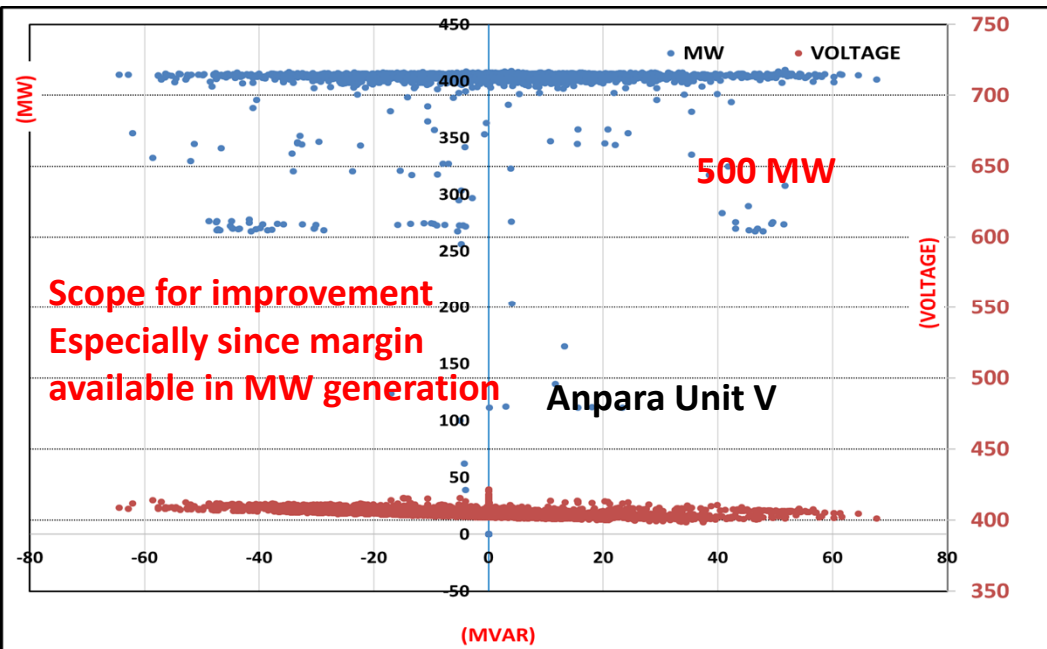


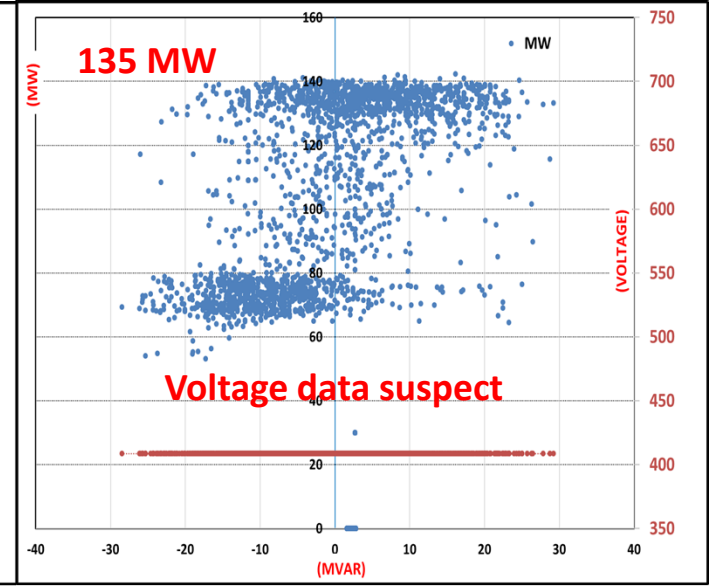
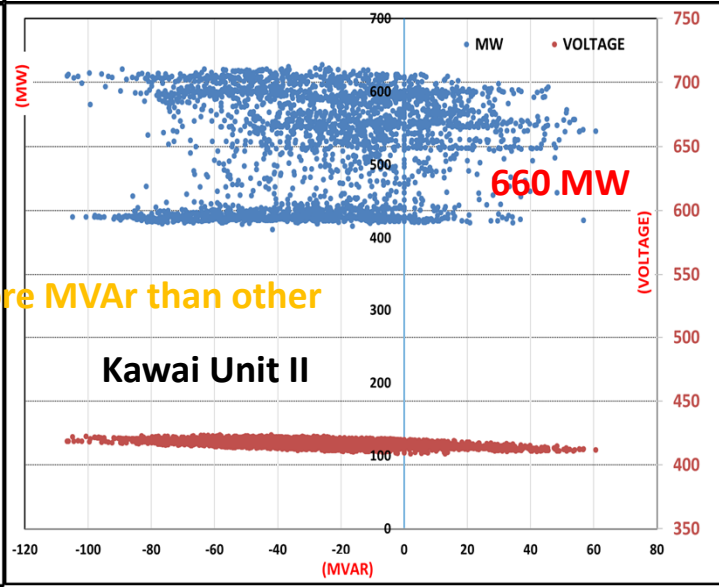
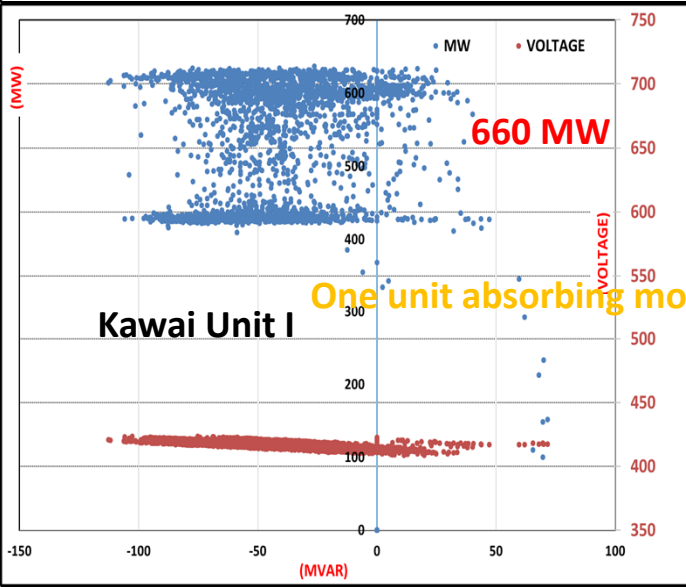
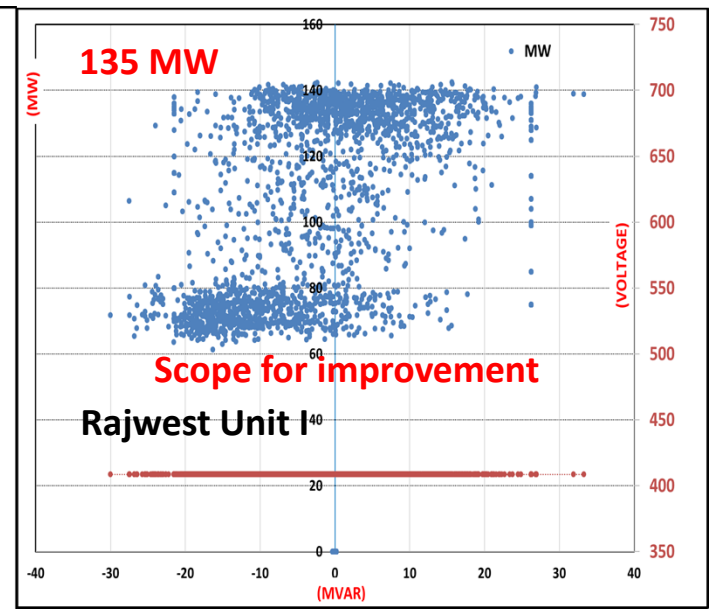
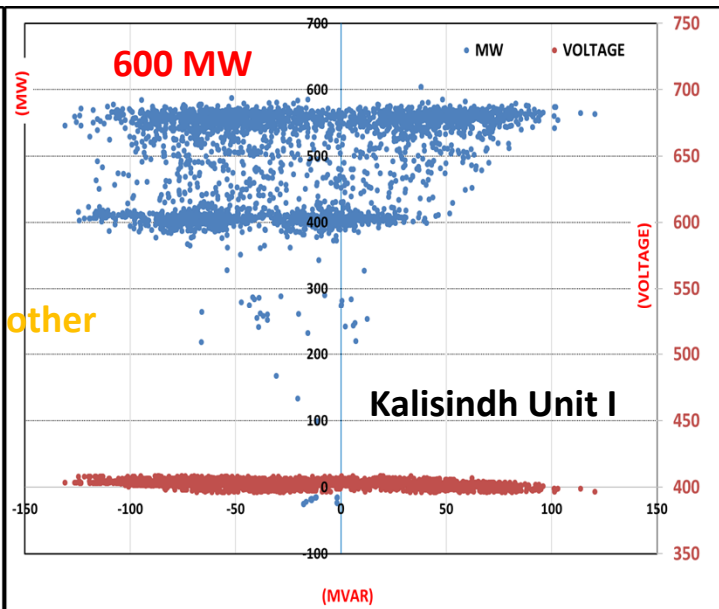
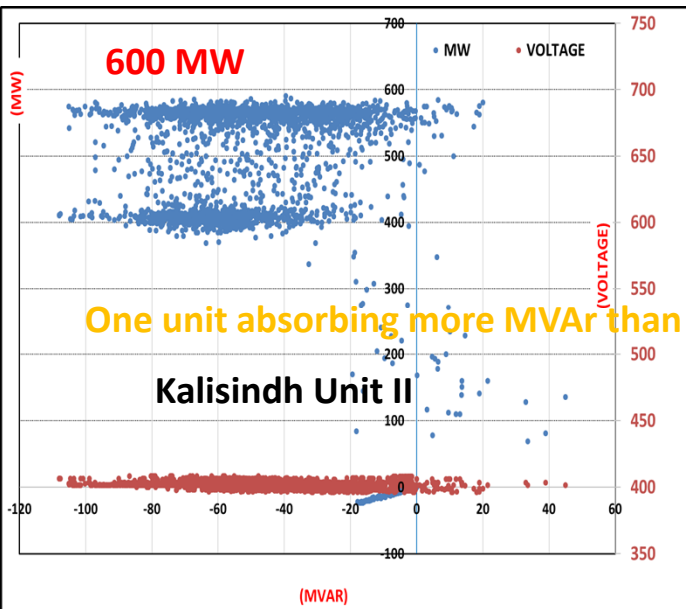


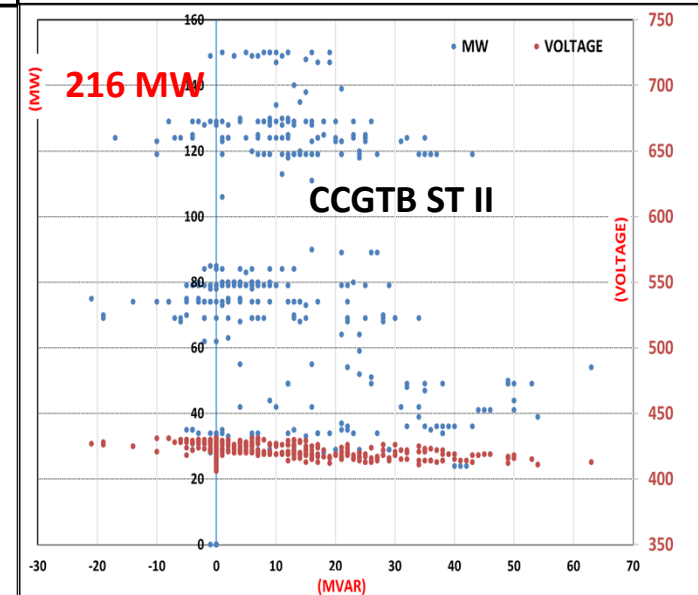
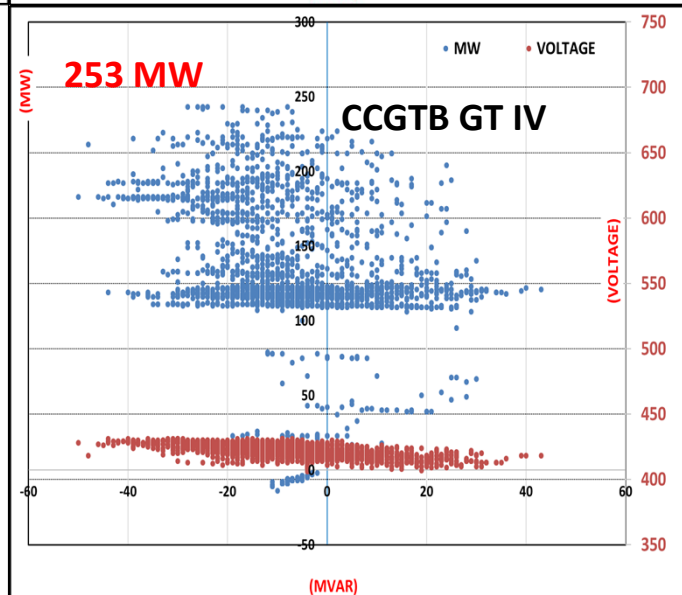
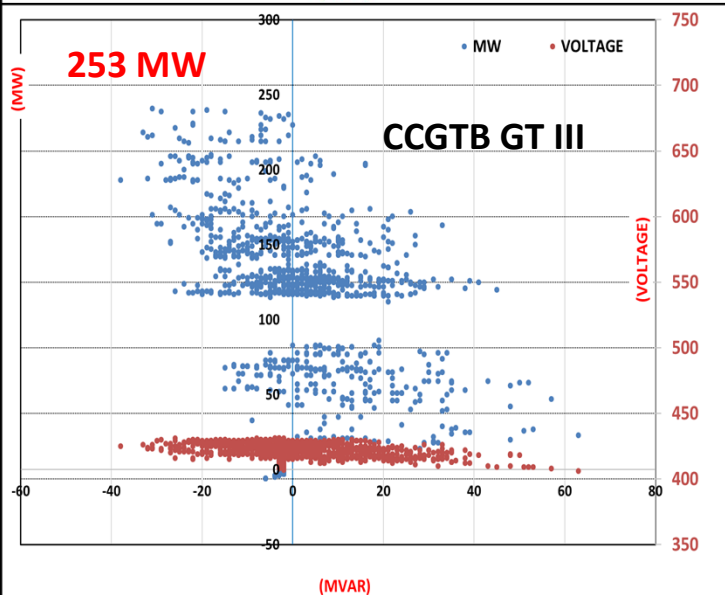
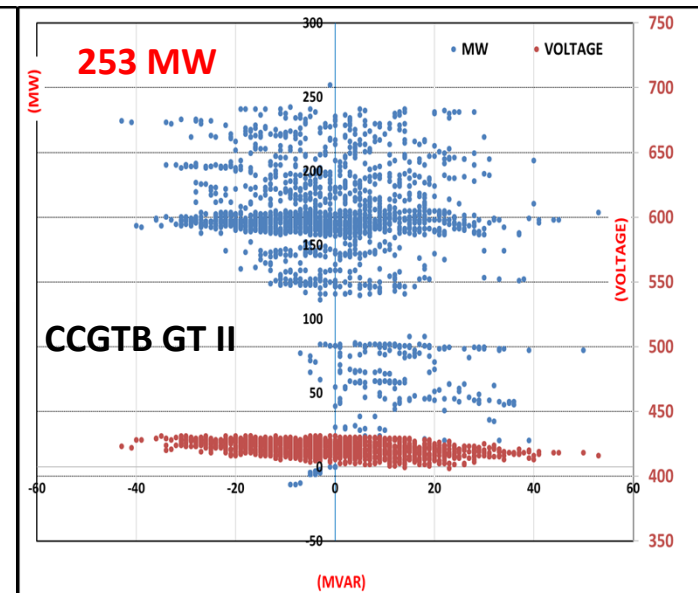
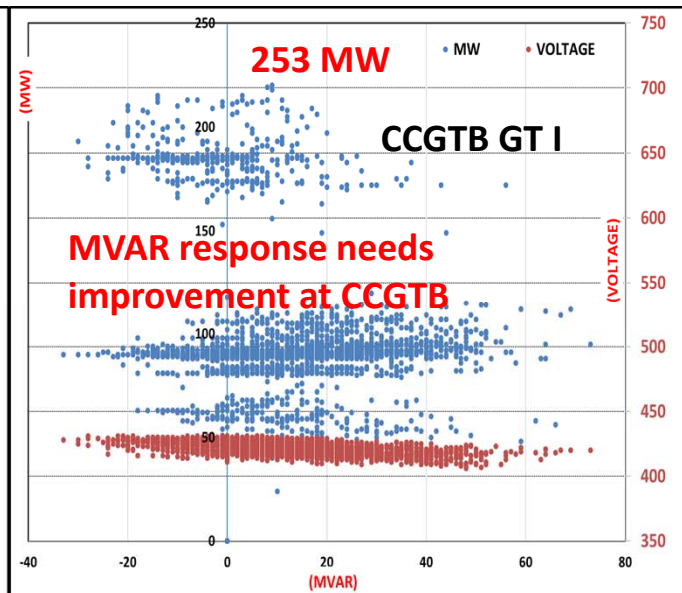
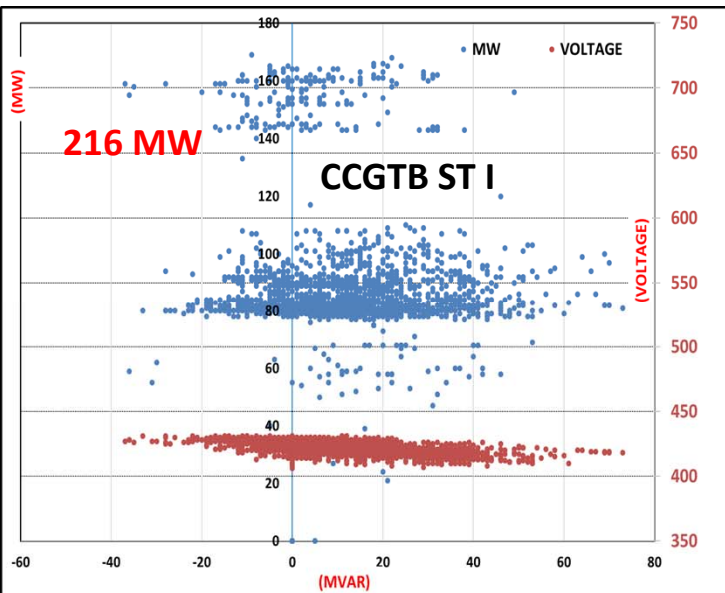


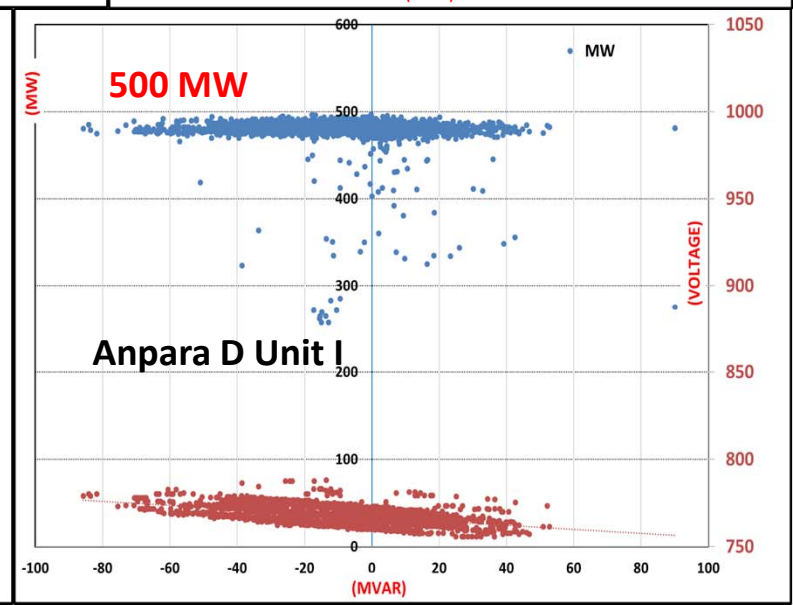
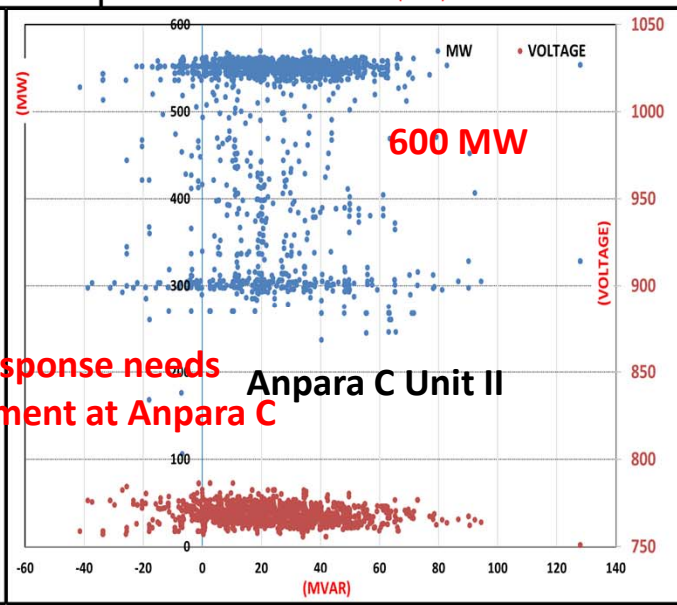
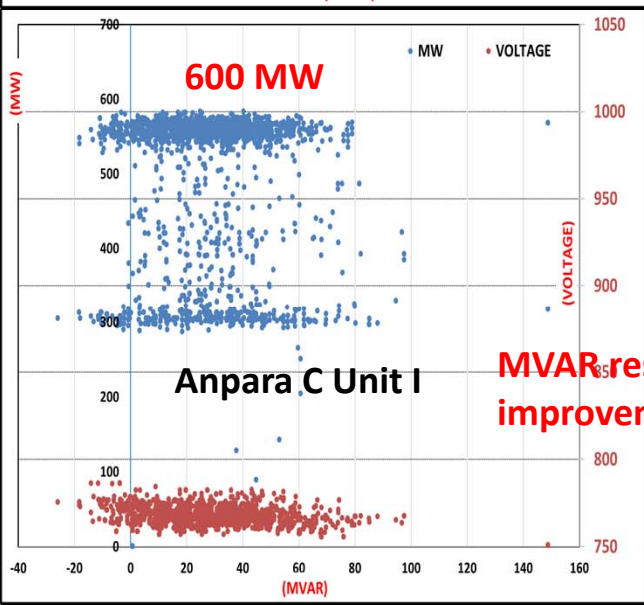
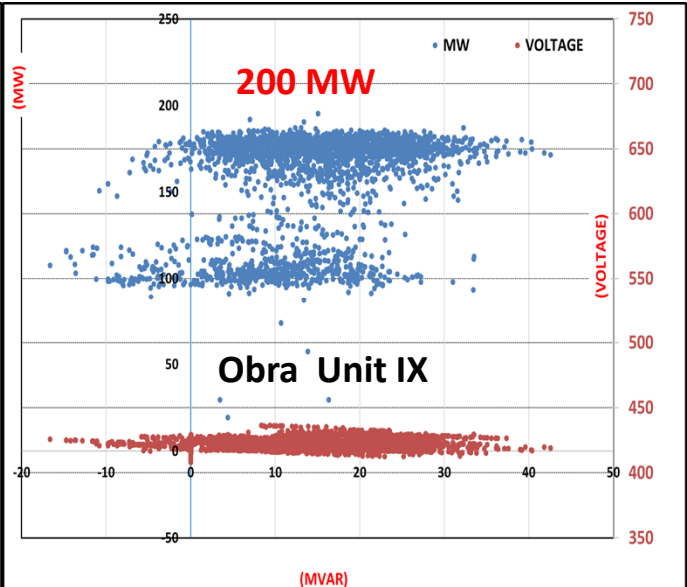
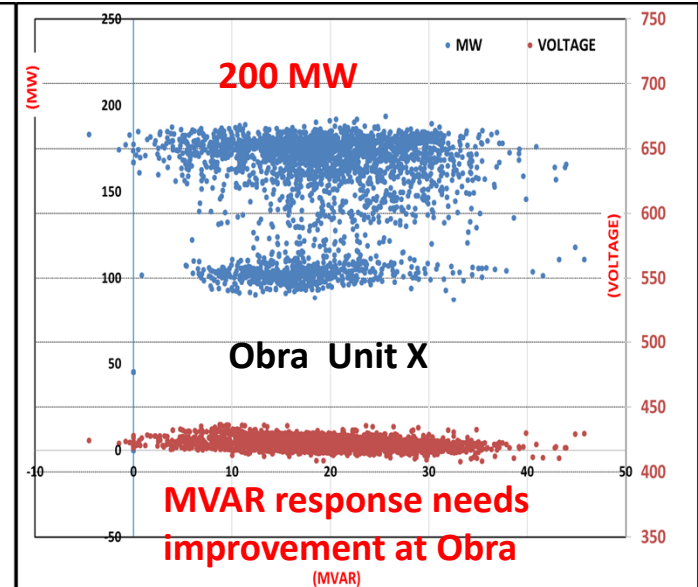
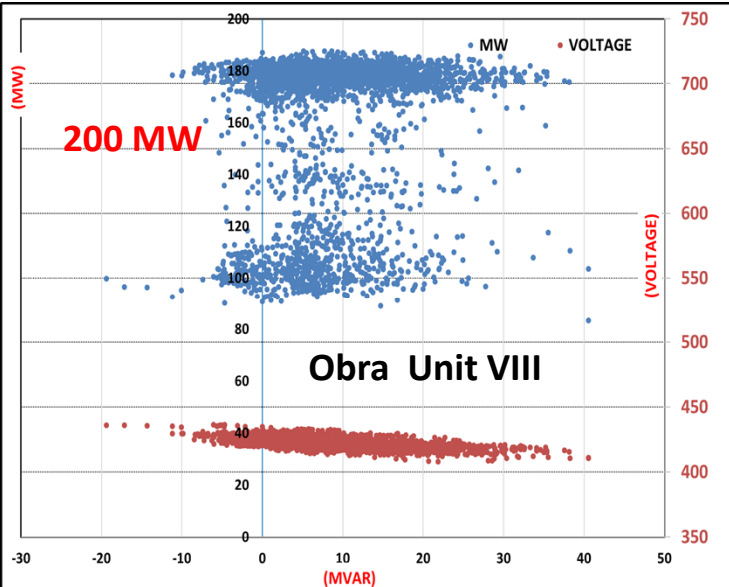


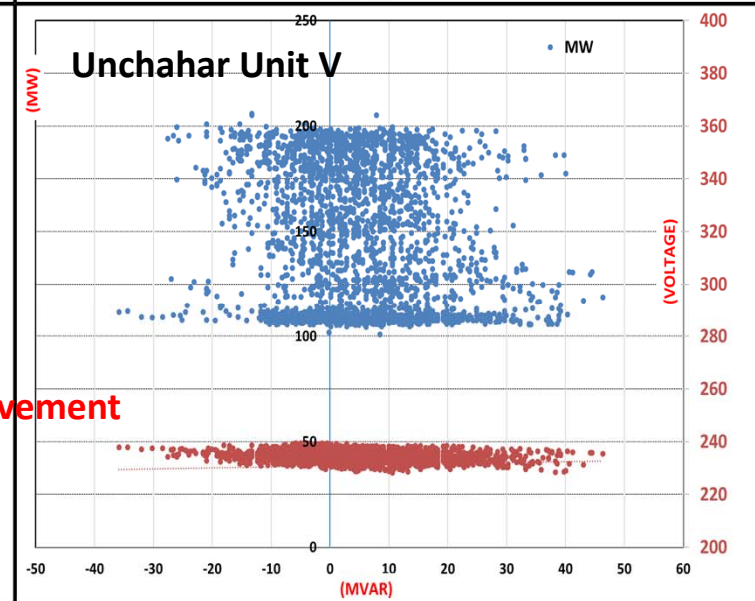
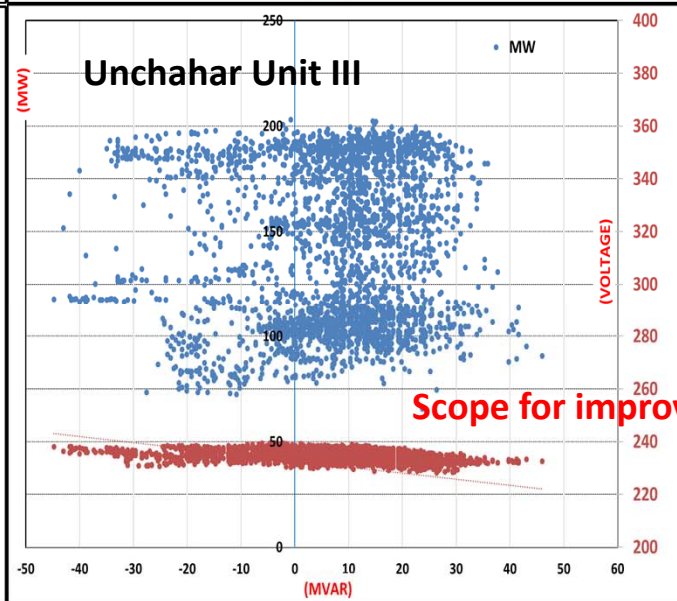
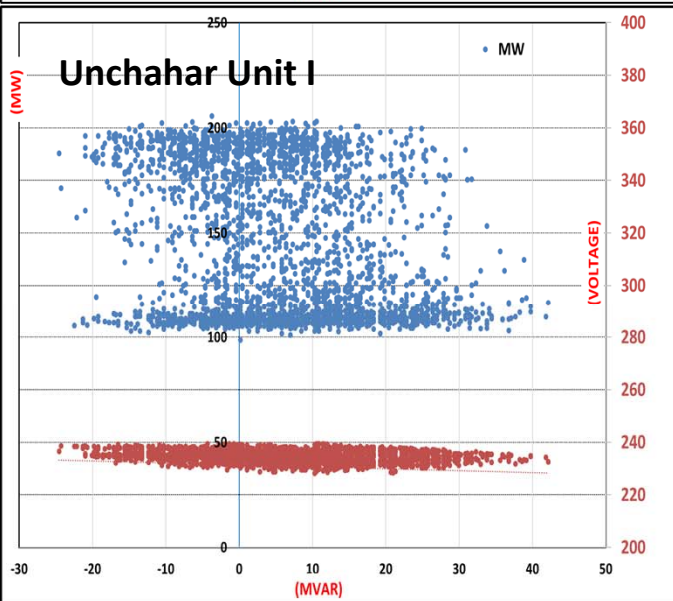
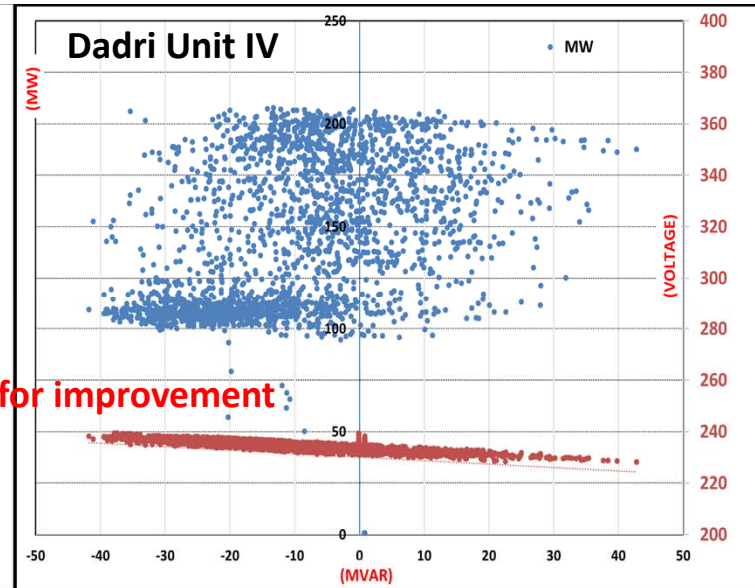
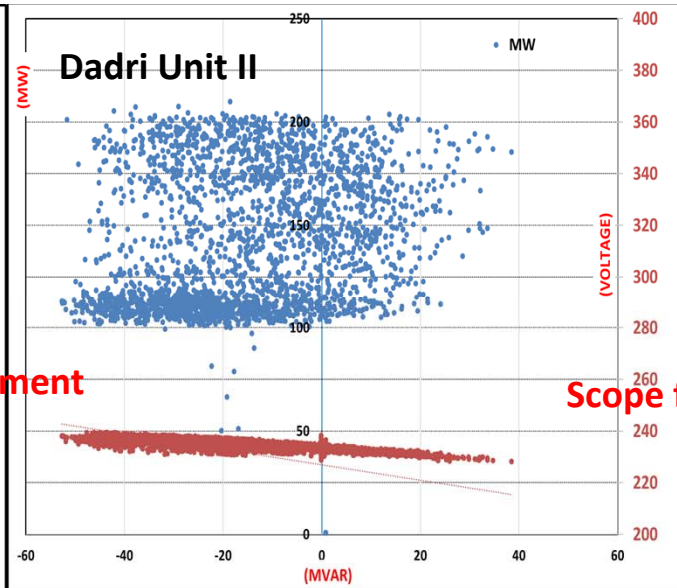
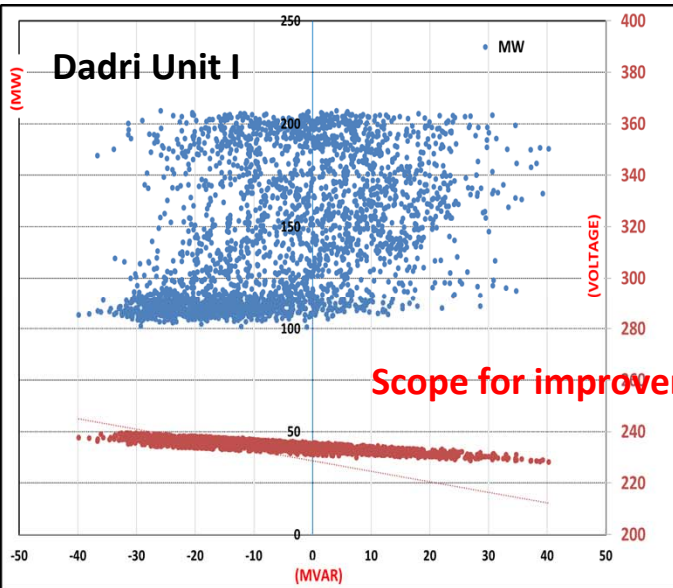












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