



सत्यमेव जयते

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

संख्या: NRPC/OPR/106/01/2019/11607-11648

दिनांक: 03.10.2019

विषय: उत्तर क्षेत्रीय विद्युत समिति की प्रचालन समन्वय उप-समिति की 163^{वीं} बैठक का कार्यवृत्त |

Subject: Minutes of 163rd OCC meeting of NRPC.

उत्तर क्षेत्रीय विद्युत समिति की प्रचालन समन्वय उप-समिति की 163^{वीं} बैठक 17.09.2019 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 |

163rd meeting of the Operation Co-ordination Sub-Committee of NRPC was held on 17.09.2019. The Minutes of this meeting has been uploaded on the NRPC website <http://www.nrpc.gov.in>. Any comments on the minutes may kindly be submitted within a week of issuance of the minutes.

संलग्नक: यथोपरि

(सौमित्र मजूमदार)

अधीक्षण अभियंता (प्रचालन)

सेवा में,

प्रचालन समन्वय उप-समिति के सभी सदस्य

Minutes of the 163rd meeting of the Operation Coordination Sub-Committee (OCC) of NRPC

163rd meeting of OCC of NRPC was held on 17.09.2019 at NRPC Secretariat, New Delhi. The list of participants of the meeting is attached at **Annexure-I**.

PART-A: NRPC

1. Confirmation of Minutes

The minutes of the 162nd OCC meeting which was held on 13.08.2019 and 14.08.2019 at NRPC Secretariat, New Delhi were issued vide letter of even number dated 30.08.2019.

Sub-Committee confirmed the minutes of the 162nd OCC meeting.

2. Review of Grid operations of August 2019

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

Sub Committee was informed that there are variations (i.e. > 5.0%) in the Anticipated Vis-à-vis Actual Power Supply Position (Provisional) for the month of August, 2019 in terms of Energy Requirement for Delhi, UT of Chandigarh, Punjab, Rajasthan, Jammu & Kashmir & Uttarakhand and in terms of Peak Demand for Punjab, J&K and Rajasthan.

Reasons for variation and comments submitted by the utilities are as under:

Delhi informed that intermittent rain and thunder storm in Delhi and adjoining areas is the reason for variation and only 0.38% growth in energy consumption with respect to previous year.

Punjab representative stated that variation is due to the flooding when flood gates were opened.

Uttarakhand representative stated that the reason for the variation would be submitted in a written reply.

Rajasthan informed that the variation of in peak and energy demand is due to the stronger monsoon (*about 40% excess monsoon witnessed*) than expected.

2.2. Power Supply Position for NCR:

2.2.1. 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 August is placed on NRPC website (<http://nrpc.gov.in/operation-category/power-supply-position>).

2.3. The highlights of grid operation during August 2019 are as follows:

2.3.1. Frequency remained within the IEGC band for **72.67%** of the time during August 2019, which is lower than that of last year during same month (August 2018) when frequency (within IEGC band) remained 80.37% of

- the time.
- 2.3.2. Utilities were requested to take necessary action to improve the frequency regime viz. by not changing abruptly the loads at block boundaries and assuring primary response from the generators.
 - 2.3.3. Maximum and minimum load for the region during August 2019 were 61,367 MW (12.08.2019 at 23:00 hrs) and 35,555 MW (18.08.2019 at 09:00 hrs).
 - 2.3.4. The average Thermal generation in August 2019 was 568.74 MU/day, which decreased by 2.88 MU/Day with respect to the corresponding month in the previous year.
 - 2.3.5. The average Hydro generation in August 2019 was 357.54 MU/day, which increased by 21.41 MU/day with respect to the corresponding month in previous year.
 - 2.3.6. The average Renewable generation in August 2019 was 48.72 MU/day, which decreased by 0.75 MU/day with respect to the corresponding month in previous year. All utilities were requested to send the data for renewable generation regularly.
 - 2.3.7. The average Nuclear generation in August 2019 was 29.63 MU/day, which increased by 2.66 MU/day as compared to corresponding month in previous year.
 - 2.3.8. Long outages of generating Units were discussed in detail and the same is placed at **Annexure-II (A)**.
 - 2.3.9. Long outages of transmission lines were discussed in detail and the same is placed at **Annexure-II (B)** and all constituents were requested to revive the elements under long outages at the earliest.
 - 2.3.10. The new elements charged were discussed and the list is attached at **Annexure-II (C)**.

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 October 2019 was discussed on 16.09.2019 at NRPC Secretariat, New Delhi.

3.2. Outage Programme for Transmission Elements.

The maintenance programme for Generating Units for the month of October 2019 was discussed on 16.09.2019 at NRPC Secretariat, New Delhi.

4. Planning of Grid Operation

4.1. Anticipated Power Supply Position in Northern Region during October 2019

- 4.1.1. **Delhi SLDC** informed that Peak availability for Delhi will be 5150 MW in place of 5970 MW.
- 4.1.2. **Haryana SLDC** informed that state's anticipated requirement will be 4650 MU in place of 4450 MU and peak requirement will be 8160 MW in place

of 7860 MW.

- 4.1.3. **HP SLDC** informed that state's anticipated availability will be 845 MU and requirement will be 847 MU in place of 1000 MU and 845 MU respectively. Further, peak requirement will be 1540 MW and availability will be 1534 MW in place of 1500 MW and 1970 MW, respectively.
- 4.1.4. **UP SLDC** informed that their peak demand will be 20,700MW in place of 19,500 MW.

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

Citing the deliberations held in the 160th and 161st OCC meeting, all SLDCs were requested to ensure following the MERIT order despatch and regularly fill the details on the portal and report any deviation in this regard on the portal itself.

SLDCs were also requested to deliberate the issue in their internal OCC meetings. UP SLDC and Delhi SLDC informed that issue is being discussed in their monthly OCC meetings.

6. Reactive compensation at 220 kV/400kV level

In the 38th TCC & 41st NRPC dt. 27th & 28th February 2018, following elements in NR were approved:

- a) 500 MVar TCR at 400 kV bus at Kurukshetra S/S of POWERGRID.
- b) 30 Nos. of 220 kV bus reactors and 18 nos. of 400 kV bus reactors, subject to availability of space.

6.2 POWERGRID:

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

POWERGRID representative informed that internal issues of M/s TCIL have been resolved and the proposal is being placed for Board's approval before award of contract.

6.3 DTL:

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

S. No.	Sub Station	Voltage level (kV)	Reactor (MVar)	Updated Status (as on 05.08.19)
1	Peeragarhi	220	1x50	PRs for reactors at Peeragarhi, Mundka and Harsh Vihar have been approved and forwarded to procurement department.
2	Mundka	400	1x125	
		220	1x25	
3	Harsh Vihar	220	2x50	
4	Electric Lane	220	1x50	Under financial concurrence
5	Bamnauli	220	2x25	PR raised.
6	Indraprastha	220	2x25	Under financial concurrence

S. No.	Sub Station	Voltage level (kV)	Reactor (MVar)	Updated Status (as on 05.08.19)
TOTAL			450	

6.4 PSTCL:

PSTCL informed that Tender enquiries of reactors dropped due to little competition. Only 2 No. tenders were received for 400KV reactors and no tender received for 220KV reactors. Agenda is being submitted to BODs of PSTCL for relaxing the qualifying criteria for new tender enquiries to be floated.

6.5 Uttarakhand:

125 MVar reactors at Kashipur: Representative of Uttarakhand informed that PSDF funding has been declined. It was requested to share the communication for PSDF funding with NRPC Sectt.

6.6 Rajasthan:

The updated status is placed below:

Item	Background	Status
3 Nos. each of 25 MVar (220 kV) reactors for Akal, Bikaner & Suratgarh.	-	PSDF funding sanctioned. Tendering under process.
1 No. of 25 MVar (220 kV) reactor for Barmer & 125 MVar (400 kV) reactor for Jodhpur, included in 450 MVar (13x25 + 1x125 MVar) proposal	Revised DPR for 450 MVar approved Reactor after separating STATCOM was submitted vide letter dt. 12.10.2018 to POSOCO for approval.	RVPN informed that the approval of TESSG has not been obtained yet as was informed in the previous meeting. Also, there were some more clarifications sought by TESSG which have already been responded on 01.08.2019

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

- 7.1. Rajasthan representative informed that complete data, except for 11kV, has been shared with CPRI. The data for 11kV would be shared separately by DISCOMs.
- 7.2. Representative of Uttarakhand mentioned that requisite data was submitted through email; however, he was requested to submit the same as it is untraceable. HP, UP, J&K and Uttarakhand were requested to expedite the submission of final data.

8. Phase nomenclature mismatch issue with BBMB and interconnected stations

- 8.1. SE (O), NRPC informed the committee that in accordance with the deliberations done in the meeting held on 13.08.2019 and format attached at Annexure-III of minutes of 162nd OCC meeting, data hasn't been received from any utilities except BBMB.
- 8.2. Rajasthan informed that they have collected data for 8 circles out of 26 and

complete data would be shared at the earliest. UP stated that data would be shared by the end of the month. Punjab informed that information has been submitted and no phase mismatch has been noticed.

8.3. Other utilities were advised to submit the above information in the prescribed format by 30.09.2019.

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

The detail of the updated status as discussed in the 163rd OCC meeting is placed at the corresponding agenda point of **Annexure-III**.

10. Status of FGD installation vis-à-vis installation plan at identified TPS

10.1. Rajasthan, UP, Punjab, Haryana have submitted the information. Other utilities were requested to share the updated status as per the format decided in OCC meeting. Further, it was agreed that updated status will be forwarded to TPRM Division, CEA.

11. System Protection Scheme (SPS) in NR

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

UP informed that logic for SPS has been finalized by UP SLDC and is being implemented. The testing of revised logic has been planned on 30.09.2019.

11.2. SPS for Kawai – Kalisindh - Chhabra generation complex

Rajasthan submitted the comments on the points highlighted in 162nd OCC which were agreed by NRLDC/ NRPC. However, preparation of generic PSS/E models with the help of OEM (M/s BHEL) is being pursued.

OCC advised Rajasthan to implement the revised logic at the earliest.

12. Automatic Demand Management System

12.1. As decided in 162nd OCC meeting, a presentation by BRPL i.e., DISCOM of Delhi was held in meeting in order to sensitise the members on the issue of implementation of ADMS.

12.2. Representative of BRPL highlighted that there are two types of load shedding scheme i.e., condition based and frequency based which are developed using SPL (Spider Programming Language). As per the SPL logic, trip command is sent to the breaker of a feeder which is to be opened. The detailed presentation is attached at **Annexure-IV**.

12.3. All the utilities were advised 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.

13. Status of implementation of recommendations of Enquiry Committee on grid disturbances on 30th & 31st July 2012

13.1. The status of information received in this regard is as under:

Submitted			Not Submitted
NTPC (NCR) (19.08.2018)	POSOCO	SJVNL (NJHPS: 01.05.2019 RHPS: 08.05.2019)	HVPLN
BBMB (24.07.2018)	NHPC (07.02.2018)	Delhi (01.04.2019)	Himachal Pradesh
Punjab (16.07.2018)	HPGCL (Panipat TPS) (17.07.2018)	Uttar Pradesh (13.08.2019)	NTPC (NR-HQ)
Rajasthan (13.06.2018)	NPCIL (RAPS: 17.07.2018) (NAPS: 25.07.2018)		Jammu and Kashmir
THDC (18.07.2018) (19.07.2018)	POWERGRID (NR-1: 16.11.2018 NR-2: 13.07.2018 NR-3: 01.04.2019)		UT of Chandigarh

NTPC representative informed that they have already submitted the information in respect of NTPC (NR-HQ). It was informed that information submitted corresponds to only one point and it was requested to share the complete information at the earliest.

HP, HVPLN, J&K and Chandigarh were requested to submit status at the earliest so that the information could be forwarded to NPC, CEA.

14. Cyber Security Preparedness Monitoring

14.1. Based on the detailed presentation given by Chief Information Security Officer (CISO), MoP in the 37th TCC and 40th NRPC meeting, all utilities were requested to monitor actions being taken in regard to the following points and report the status:

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

The updated status on aforementioned cyber security action points was enclosed as Annexure-IV(A) of 163rd OCC agenda.

All utilities were requested to update the status.

14.2. In the 156th OCC meeting, it was mentioned that inherent vulnerability in the ICT infrastructure or website or web applications shall be accessed and remedial action thereon shall be taken by all utilities by conducting Vulnerability Assessment & Penetration Test (VAPT) of their respective ICT infrastructure, websites and web applications. The updated status of VAPT and cyber security audit is enclosed as Annexure-IV(B) of 163rd OCC agenda.

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

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

15.1. Ministry of Railways has accorded high priority to railway electrification projects for reducing dependence on fuel based on crude oil and enhancing energy security of nation. However, progress of ongoing transmission line and substation works, being executed by SEBs (Annexure-VI of the MoM of 160th OCC meeting), is not matching with the targets for railway sections planned to be commissioned on electric traction. State-wise detail in respect of NR is as under:

Sl. No.	State	Tr. Line to be expedited		Contract to be awarded		Estimate awaited	
		(original target)	(updated status)	(original target)	(updated status)	(original target)	(updated status)
1	UP	19	-	5	-	1	-
2	Haryana	5	-	2	-	-	-
3	Punjab	1	-	2	-	2	-
4	Rajasthan	5	4* completed	5	1** completed	7	***
5	J&K	1	-	-	-	-	-

* 1 no. railway end pending due to demarcation in Army area.

** 2 nos. proposals withdrawn by Railways, 1 No. under progress, 1 No. route to be revised by Railways.

*** 3 Nos. proposals withdrawn by Railways, 2 Nos. A&FS pending and 2 Nos. works under progress.

15.2. In the 159th OCC meeting, HVPN has submitted the status (Annexure VI of minutes) of the ongoing works for railway traction substations.

15.3. In the 161st OCC meeting, Punjab representative informed following status:

Sr. No.	Name of Electrification Project	Name of Grid Substation	Status (as provided in the agenda)	Latest Status
1	Rohtak-Bathinda-Lehra Mohabbat	Talwandi	Tr. Line to be expedited	Completed & energized.
2	Jakhal-Dhuri-Ludhiana	Chhajli	Contract to be awarded	Land acquisition for construction of bays is in process by PSPCL
3	Jakhal-Dhuri-Ludhiana	Sandhaur		60 % work completed
4	Hisar-Bathinda-SuratGarh	Bathinda	Estimate awaited	No information available with the concerned offices. Railway to clarify.
5	Hisar-Bathinda-SuratGarh	Yet to be finalised		

15.4. UP submitted the information as under:

Lines to be expedited	Contracts to be awarded	Estimates awaited
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Original	19	5	1
Present status	<ul style="list-style-type: none"> • 13 lines energized / charged • 2 work in progress (Oct 19) • 1 forest clearance awaited • 2 PTCC clearance awaited • 1 work stopped due to non-payment of crop compensation 	<ul style="list-style-type: none"> • 3 work started (expected completion – Oct 19) • 1 location of coordinates – awaited • 1 Tender under process 	<ul style="list-style-type: none"> • Meeting dt. 11.03.2019 with Rly authorities – Line needs to be dropped.

15.5. In 163rd OCC meeting, it was agreed that compiled information of all states will be submitted to Railways by NRPC Sectt. Further, members also highlighted issues like frequent tripping of line of Railways, lack of response and payment issue of Railways and requested that concerned officials from Railways may be asked to attend OCC meetings regularly.

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

16.1. It was informed that DO letter regarding status and progress of this long pending issue has been sent to power secretaries of respective states. MS, NRPC expressed concern regarding slow progress in this issue and stressed to resolve this issue at the earliest.

16.2. Rajasthan informed that feeder details of df/dt relay have been submitted. The details of UFR / df/dt feeders have been received from Punjab and UP.

16.3. It was agreed that NRLDC will have a meeting with each SLDCs through Video Conferencing to resolve the issue at the earliest. NRLDC was requested to make a schedule of meetings with each SLDC, so that notice for the meeting can be issued at the earliest.

17. Requirement of certificate under CEA (Measure relating to Safety and Electric Supply) Amendment regulations – 2015, clause 43 (Agenda by POWERGRID)

17.1. Representative of POWERGRID informed that NRLDC has raised an issue seeking requirement of certificate from Electrical Inspector, before issuing charging code to any existing bay after shutdown for replacement of its defective equipment under regular maintenance or upgradation work.

17.2. It was highlighted that certificate from Electrical Inspector is required only for addition or alteration as per the clause 43 (7) of CEA (*Measure relating to Safety and Electric Supply*) amendment Regulations 2015 and it is a tedious task for transmission licensee as well as electrical inspectors to submit certificates to RLDC for replacing items like CB, CT, CVT, isolator, etc.

17.3. OCC deliberated and opined that inspection and certification of each smaller replaced equipment like CT, CVT, CB, Isolator etc in a large network pose practical difficulty for transmission licensee as well as electrical inspectors.

17.4. Further, OCC forum requested Chief Engineer, CEI Division, CEA to clarify whether replacement of CT, CVT, CB, Isolator, etc. require mandatory inspection & certification as per section 43(7) of CEA (*Measure relating to Safety and Electric Supply*) amendment Regulations 2015. In this regard, CE, CEI Division, CEA

informed that any change of equipment including replacement is covered under the aforesaid regulations.

17.5. Accordingly, it was decided that a letter may be sent to CEI Division, CEA for considering appropriate amendment in the aforesaid regulation.

18. Shutdown Co-ordination Software and Real-time Operation Management Software (OMS) (Agenda by UPSLDC)

18.1. Representative of UPSLDC requested that a provision may be made in the subject OMS such that the transmission licensee i.e., the owner for the shutdown should remain involved for the purpose of making indent for the subject shutdown; as is being provided in case of CTU/PGCIL/NTPC which will be forwarded by SLDC to NRLDC with their comments.

18.2. NRLDC informed that OMS has been developed considering the present scenario for seeking approval of shutdown. He stressed that there will be communication with only one level such as SLDC for States, RTMC for PGCIL respective stations for NTPC etc. He stated that SLDC should be responsible for making indent of subject shutdown.

18.3. Hence, it was decided that current provision in OMS will be continued against the request of UPSLDC.

19. Calibration of the Solar energy meter is required in every five years (Agenda by NTPC)

19.1. Representative of NTPC informed that in reference to M/s Core Carbon communication dated 25.07.2019, calibration of energy meter is needed for 10 MW Solar Plant, Unchahar, from PGCIL as plant was commissioned on 31.03.2014

19.2. It was decided that POWERGRID and NTPC will bilaterally resolve the issue of calibrating the solar energy meter. Further, if any issue arises it may be discussed at NRPC forum.

20. Issues related to Dadri-Thermal plant (Agenda by NTPC)

20.1. Representative of NTPC highlighted Commercial operation issues (related to Schedule, SCED, ramp rate etc.) and technical issues related to continuous operation of all Stage-I units on technical minimum load through a presentation attached as **Annexure–V(A) & (B) respectively**. It was requested that necessary steps may be taken up to resolve the issues.

21. Submission of information in respect of projected RE generation

21.1. In accordance with MoM of 1st meeting of the committee on “Renewable Energy Generation data management” held in CEA on 10.07.2019, utilities were requested to submit the data of projected commissioning dates of RE generating stations.

21.2. It was decided that SLDCs will submit the data of commissioning dates of all

1. Winter Preparedness 2019-20

NRLDC representative stated that Northern region experiences large variation in demand during different seasons. Demand of Northern region starts to decrease from mid-October and remains on the lower side till February. Due to this low demand, low line loadings, high voltages are a common phenomenon. There are several challenges faced by utilities during this time which were discussed in the meeting:

i. Large difference in peak and off-peak hours' demand and morning and evening steep ramp up in demand

During winter, Northern region load is less in comparison to Summer and Monsoon period. There is also huge difference in peak and other than peak hour load in winters compared to summer and monsoon. Due to less load and large variation in peak and other than peak hours' load, inadvertent change in voltage and frequency have been experienced. To avoid frequency, voltage and line loading excursions, following was suggested in the meeting:

- a. Demand forecast and ramp forecast
- b. Ramping of generation to commensurate with load ramp
- c. Load generation balancing/Portfolio management
- d. Optimization of Hydro resources (usage for peaking requirement)
- e. Avoid sudden connection/disconnection of large load (Staggering of load group)

Rajasthan was once again asked to stagger load near 04:00hrs and 22:00hrs as it seems there is sudden disconnection/connection of load during this time.

NRLDC representative stated that except Uttarakhand and HP all other states are regularly sharing load forecast data with NRLDC. However, forecast error is still on the higher side even after continuous efforts from all states and needs further improvement. Details attached as Annexure-VI

ii. High voltage during less demand period especially during night hours of winter

High voltages have become common phenomenon during winter and it becomes more severe during night hours when load of the major states of NR

is almost ~40-50% of day time load. Various studies and solutions have been deliberated in various OCC/TCC meetings and were once again deliberated:

- a. Monitoring of Reactive power resources through SCADA displays for optimal use of reactive resources
 - Updated SCADA displays for Bus reactor status and voltage
 - Displays for Line reactor that can be used as Bus Reactor (BR) and its real time status
 - Displays for HVDC filter bank, SVC, STATCOMs etc.
 - Displays for Generator real time response vis-à-vis capability curve comparison to explore the margin available

Regarding telemetry of temperature and humidity data, NR-3 representative informed that they have taken up the matter with substations under their jurisdiction and same would be attended before winter. All other utilities were also asked to check and improve telemetry of temperature and humidity from substations to control centers. This data as being stored in servers would also be useful in future for research and other tool development.

- b. Line Reactor switched as Bus reactor -Real Time Issues:

NRLDC representative stressed that line reactor that can be switched as bus reactor couldn't be utilized during real time operation due to various issues i.e. lack of trained manpower during hours of need, non-availability of manpower (in case of un-manned substations), inadequate switching arrangement etc.. Trained and adequate manpower shall be ensured at all control centers especially during night hours for carrying out the switching operation i.e. opening of EHV line, switching of LR as BR, taking line back in service during morning hours etc.

Moreover, many line especially connecting hydro stations in the hilly region are opened on voltage regulation during night hours. Thus, it is required that such lines are taken in service within short time during morning hours to ensure peaking requirement from hydro generators.

MS NRPC asked utilities to make sure that they ensure adequate and trained manpower at control centers where such requirement would be there. POWERGRID informed that additional manpower would be provided on all the critical substations during winter months.

- c. Dynamic response by Generators

NRLDC representative highlighted that is seen that even after reiterating need for reactive power absorption by generators during winter months in several OCC meetings; in general, generators (specially state owned) are not absorbing MVAR as per their capability curves. Co-ordinated efforts from all utilities are required to minimize high voltages during winter months.

MS NRPC asked utilities to make sure that they ensure generators are providing dynamic response as per their capability curve and grid requirements.

d. Tap optimization

NLDC/NRLDC carries out tap optimization studies at 765/400 & 400/220kV level on the basis of Simulation studies, Real time scatter plots of HV & LV side of ICTs, NRPC Reactive power account, etc. It was requested to all the SLDCs also to carry out the same exercise at 220kv and below ICTs to minimize the reactive power exchange from HV to LV Grid. Moreover, utilities were also requested to share present tap positions of ICTs under their jurisdiction so that requirement of tap change could be studied by NRLDC.

MS NRPC mentioned that this exercise is very important and asked RLDC/SLDCs to carry out tap optimization studies and utilize it for better voltage control.

e. Synchronous condenser operation

In 156th OCC meeting, MS, NRPC 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. 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. However, TCC (42nd TCC & 45th NRPC) suggested that if any hydro generator is showing inability for synchronous condenser operation then its written submission will suffice (a separate certificate from OEM need not be submitted to NRPC/ NRLDC). Present status available with NRLDC is attached as **Annexure-VII**.

MS NRPC asked all utilities to update the status of respective station regarding their ability to operate in condenser mode and submit either the trial schedule or written submission plant wise with relevant reasons in case of any issues in operating in condenser mode.

iii. Tripping of EHV line during fog/ Smog conditions

It has been observed since long that many EHV line tripped during winter (last year nearly 30 trippings were reported due to weather condition e.g. fog/smog. Various actions have been deliberated in previous OCC/TCC meeting to effectively reduce such tripping are as:

- Locate the fog dominate area and line crossing these location:
It has been decided that line which has been tripped frequently during winter in such weather conditions should be analyzed and checked whether insulator cleaning or polymer replacement is to be done.

- Based on above list, prioritize the insulator cleaning and polymer replacement beforehand so that any unusual tripping can be avoided during winters

Status of polymer replacement of line was enclosed as Annexure in agenda, members were requested to update and share the schedule for insulator cleaning and insulator replacement if any.

NRLDC representative said that real time fog can be monitored using Satellite images which is available at all the control centers. A case study was presented to the members wherein there were trippings in Punjab state on 25.12.2019 and real-time fog monitoring through Satellite pictures clearly suggested dense fog over Punjab control area. Thus, monitoring of fog in real-time at control centers would help to assess areas where there is possibility of trippings due to bad weather conditions.

Apart from above, it needs to be made sure that defence mechanism is healthy i.e. ensuring all SPS healthy, protection system intact, monitoring of df/dt & UFR etc; and telemetry especially of MVA_r of Generator etc. is available and reliable.

2. Issues related to grid operation:

a. Backing down by Rajasthan (15 Aug'2019): NRLDC representative stated that on 15th Aug 2019, there was continuous under drawl in Northern region and frequency continued to remain on the higher side i.e. above 50.05Hz throughout the morning hours. NRLDC continuously asked Rajasthan to maintain their drawl as per schedule and back down internal generation. However, Rajasthan had carried out backing down of RE (must-run) generation (details attached as Annexure in agenda). NRLDC once again asked Rajasthan to back down thermal generation instead of solar and wind generation.

Rajasthan was requested to share the reasons for the same and provide reasons why renewable backing/curtailment was done whereas thermal generation backing was possible. Rajasthan representative stated that there was rain in most parts resulting in less demand and less drawl from the grid. Although they had backed down/ shut units at Kota, Suratgarh and Chhabra, same was not sufficient and as a result they had to curtail renewable generation.

NRLDC representative asked whether units were brought to technical minimum or not. Rajasthan representative informed that Kalisindh, Chhabra and Adani backed down by 28% whereas KTPS and STPS units backed down only 20%, thus impact was not so much visible.

UP representative informed that generators under their jurisdiction are backing down to 55%.

MS NRPC advised Rajasthan to take up the matter with state regulatory commission so that backing down is achieved to required levels. NRLDC representative added that with large scale renewable generation being integrated in the grid in Rajasthan, flexibility requirement from thermal

generations is very much essential, thus Rajasthan must take up the matter with appropriate authority at the earliest.

- b. Charging of 400kV Kirori-Jind line:** On 29 Aug 2019, NRLDC issued charging code for charging of 400kV Kirori-Jind # 2. However, line was still not being charged due to lack of coordination between HVPNL and POWERGRID staff. CPCC NR-1 vide email at 11:36 pm reported that since Jind is remotely operated Substation so, subject line may not be charged during night without getting clearance from Jind maintenance staff and shall be taken up in morning. Line was subsequently charged on 30Aug 2019 at 14:57 hrs after obtaining written clearance from HVPNL officials.

POWERGRID representative stated that since HVPNL representative did not give written clearance from HVPNL (owner of element is HVPNL), there was delay in charging.

Similar issues were encountered at 400/220kVMandola substation when emergency shutdown of 220kV lines at Mandola substation was to be availed by DTL. Such events of lack of coordination between utilities resulting in delayed charging of lines/ timely shutdown of transmission elements are big challenge to safe and secure grid operation. Utilities need to make sure that such events shall not happen in future.

NRLDC vide letter NRLDC/SO-1/151 dated 06.09.2019 (attached as **Annexure-5 of agenda**) has communicated regarding re-occurrence of such issues at unmanned POWERGRID substations and requested for actions in this direction.

MS NRPC and NRLDC representative mentioned that such instances should not happen in future and there is need for coordination between utilities and one utility shall confirm clearances from their end without delay.

- c. Low voltages at Bhadla (high solar):** NRLDC representative stated that large amount of solar generation has been/ is being commissioned near Bhadla area in Rajasthan. Evacuation of this solar generation is being facilitated by 400/220kV Bhadla (Rajasthan) and 765/400/220kV Bhadla (POWERGRID) substations. In real time, however, it is being observed that at time of high solar generation in this pocket, voltages at 400/220kV Bhadla (Rajasthan), 400/220kV Bhadla (POWERGRID), etc. are on lower side (even below 380kV at around 12:00hrs).

Amended Central Electricity Authority (Technical Standards for Connectivity to the Grid) (Amendment) regulations, 2019 notified on 6th Feb 2019 states that:

“ (i) The distribution licensee and bulk consumer shall provide adequate reactive compensation to compensate reactive power requirement in their system so that they do not depend upon the grid for reactive power support.

(ii) The power factor for distribution system and bulk consumer shall be within ± 0.95 ; ”

However, it is being observed that solar generators in the area both stated owned and IPPs connected at Bhadla (Raj) and Bhadla (PG) are not absorbing/generating MVar as per grid voltages. Similar situation is seen for wind

generators near Akal area leading to non-compliance by solar and wind generators.

Rajasthan SLDC was asked to take up the matter with state owned renewable generators.

Rajasthan SLDC representative informed that they have discussed matter with renewable generators at Bhadla and they are absorbing MVAR as per requirement. However, reactors at Bhadla(PG) are not being taken out of service during day hours resulting in low voltages near Bhadla area.

NRLDC representative informed that reactors at Bhadla are being taken in/out of service as per grid requirements; moreover, SCADA data at Bhadla (Raj) suggested that although active power is being injected to the grid, reactive power is being drawn from the grid resulting in low voltages. Plots depicting the same were also presented in the meeting and Rajasthan was asked to confirm dynamic response from renewable generators.

d. Prolonged outage of transmission elements

Transmission elements under prolonged outage were discussed in meeting:

S. No	Element Name	Voltage Level	Owner	Outage		Reason / Remarks	Discussion in 163 rd OCC meeting
				Date	Time		
1	Jaisalmer_2-Barmer(RS) Ckt-1	400 kV	RRVPNL	11/5/2019	21:34	Tower collapsed2 tower collapse in 11.05.2019 and 4 towers collapsed on 16.05.2019	NA
2	Jaisalmer_2-Barmer Ckt-2	400 kV	RRVPNL	11/5/2019	21:34		NA
3	Gorakhpur(PG)-Motihari(DMTCL) 1	400 kV	PGCIL	13/8/2019	22:04	E/SD due to Soil erosion at tower no.132 near Gandak river bank	NA
4	Gorakhpur(PG)-Motihari(DMTCL) 2	400 kV	PGCIL	13/8/2019	22:05		NA
5	Bhilwara 315 MVA ICT-1	400/220 kV	RRVPNL	12/5/2019	23:42	Oil leakage in Transformer	NA
6	Agra(UPPTCL) 500 MVA ICT 2	400/220 kV	UPPTCL	5/8/2019	17:35	DGA test failed. Transformer to be repaired.	NA
7	FACT at BLB in	400 kV	PGCIL	2/7/2016	10:20	Y-Phase	NA

	KnP-BLB Line					current imbalance	
8	FSC of Balia-I at Lucknow	400 kV	PGCIL	29/11/2017	13:30	E/SD due to Hot Spot on Isolator	NA
9	FSC (40%) of Kanpur-II at Ballabgarh(PG)	400 kV	PGCIL	16/3/2019	14:39	Fire in B-Ph FSC at Ballabgarh end.	NA
10	400 kV 63 MVAR Line Reactor of Jaipur (S) line at RAPP C	400 kV	RAPPTCL	17/5/2019	9:30	Emergency SD taken by RAPP C to attend oil leakage in Reactor.	NA
11	+/- 150 MVAR STATCOM 1 at Lucknow II PG	400 kV	PGCIL	17/7/2019	15:03	Due to failure of 3x173 MVA, 400/38.5kV Coupling Transformer at LKO.	Jan'20 as informed in 162nd OCC
12	+/- 150 MVAR STATCOM 2 at Lucknow II PG	400 kV	PGCIL	17/7/2019	15:03		
13	400 kV Bus sectionalizer Bay/CB (4-3252) between Bus-2 & Bus-4 at Dadri TH	400 kV	NTPC	3/8/2019	19:28	To attend bus bar protection alarm.	NA
14	400 kV CB (352) of Mundka ckt-2 at Bawana	400 kV	DTL	7/9/2019	20:59	E/S/D.To attend the CB Closing problem	NA
15	Chamera III(NHPC)-Chamera pool(PG) 2	220 kV	PGCIL	14/5/2019	11:56	Rerouting of 5 towers under progress	Nov'19 as informed in 162nd OCC
16	Chamera 3 HEP 220kV Bus 1	220 kV	NHPC	14/5/2019	11:56	During shifting of Chamera pool-2 line from 220 kV Bus-2 to BUS-1 at Chamera 3 GIS. CB got damaged.	Jan'20 as informed in 162nd OCC

3. Reliability issues in the grid:

NRLDC representative highlighted issues observed during the last one-month time:

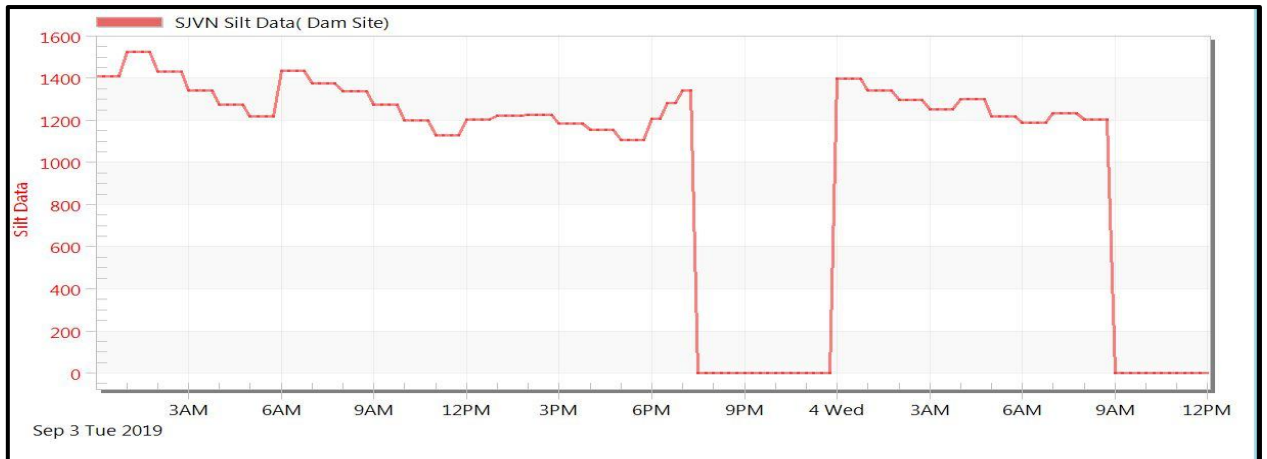
- **Punjab:** ATC/TTC limits of Punjab state control area were revised to 6400/7000 MW based on simulation studies suggesting N-1 non-compliance at 400/220kV Amritsar, Rajpura, Muktsar ICTs. On managing loading at these ICTs, next severe contingency would be N-1 of 400/220kV Ludhiana, Nakodar and Makhu ICTs. New 500MVA ICT has been commissioned at Muktsar hence, removing constraint at Muktsar. With arrival of monsoon in Punjab, demand has not been extremely high. Loading at Amritsar and Rajpura ICTs is above N-1 contingency limits while that of Ludhiana and Nakodar ICTs is close to N-1 contingency limit.
- **Uttar Pradesh:** Demand of Uttar Pradesh continued to remain high (maximum being in range of 20000-22000MW) during last 30 days. N-1 non-compliance was observed at 400/220kV Sarnath ICTs. Apart from this, UP to confirm MVAR telemetry data from Bara and actions taken to correct telemetry of Bara Unit 3. 500MVA ICT-2 at Agra(UP) is out since 05.08.2019 resulting in N-1 non-compliance at Agra(UP).
- **Haryana:** TTC/ ATC limits were initially assessed by NRLDC as 7500MW/ 6900MW respectively with N-1 non-compliance at 400/220kV Dipalpur and Panipat ICTs. In real-time also under import of 6000-7000MW, loading of Sonipat, Kabulpur and Panipat (BBMB) ICTs are high (close to N-1 limits) while that of Dipalpur is even above N-1 contingency limits for considerable duration.
- **Delhi:** As per studies carried out by Delhi SLDC and NRLDC, TTC and ATC limit was assessed as 6800MW and 6500MW. Simulation studies suggested N-1 non-compliance at 400/220kV Mundka and Harsh vihar ICTs. In real time at time of high loadings, N-1 non-compliance was observed at Bamnauli and Mundka ICTs.
- **Rajasthan:** N-1 non-compliance at Akal and Bhadla ICTs. Under N-1 contingency of ICT at Akal or Bhadla, there could be generation loss of the order of 1000-1300MW, which is severe contingency in grid resulting in large scale frequency excursions (dip). Thus, there is need for SPS design to trip some generation in case of tripping of one ICT at these stations and antecedent loading of ICTs being higher than N-1 contingency limit. Further, Rajasthan SLDC was requested to share latest ATC/TTC assessment carried out by them for 2019-20 winter.

These issues were also highlighted by NRLDC in 161st and 162nd OCC meeting and Rajasthan SLDC was requested to plan SPS for the same. Rajasthan SLDC was asked to present actions being taken/ planned.

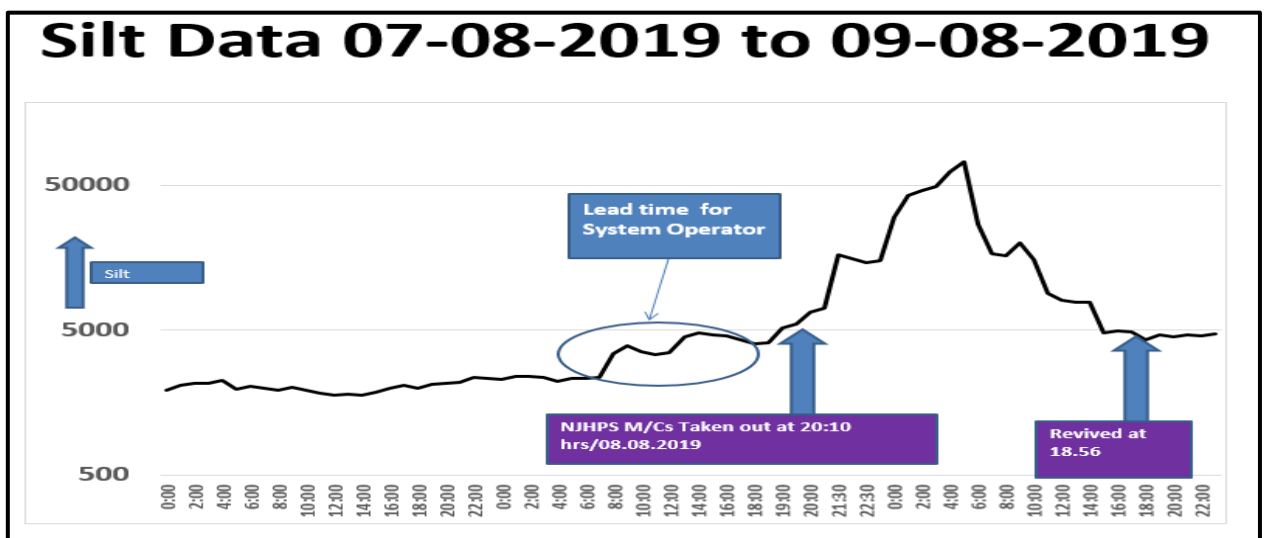
4. Near Real-Time monitoring of silt data

NRLDC representative stated that it was decided in 160th OCC meeting that Nathpa Jhakri will submit the real time silt measurement data to NRLDC through FTP. This data will be helpful for real time system operation in view of frequent

hydro generation outage due to silt. Now, the PPM number is being punched directly from the site/control room at NRLDC server providing silt measurement at NRLDC control room. Trend of sample data available at NRLDC for 3rd Sep 2019 is shown below:



Sample data of 07-08-2019 to 09-08-2019 shown below suggests that there is some lead-time (varying from few hours to several hours) available with system operators to accommodate outage of hydro generators on account of high silt level.



NRLDC representative stated that if such data could be made available from Powari near Karcham Wangtoo generator, then this data could be useful for both Karcham as well as Nathpa Jhakri.

MS NRPC appreciated the efforts of NRLDC and Nathpa Jhakri and highlighted that other hydro stations may also take actions to provide this near-real time silt measurement to control centers (RLDCs/SLDCs) as this would help them gain some lead-time for better tackling of hydro generator outage on silt. NRLDC also requested NHPC, SJVNL and other Hydro Power Stations to explore the possibility of automatic silt measurement which can be integrated through data loggers and information can be transmitted via

OFC/Satellite to Control centres. Such automatic system may provide advance warning of higher level of silt.

5. Station-wise list of Hot spares of Transformers and Reactors

NRLDC representative highlighted that as deliberated in 162nd OCC meeting, CERC vide their communication dated 06th July 2019, has advised POSOCO to collect details about availability of Hot Spare units installed in various stations on quarterly basis from all ISTS licensees. NLDC communication regarding above and station-wise list of hot spares submitted by POWERGRID as sample was attached in Annexure of 162nd OCC agenda.

Even after deliberating the issue in 162nd OCC meeting, no information regarding above is received from any of the utilities after the meeting. It was once again requested that data as per enclosed format may please be shared with NRLDC, so that same may be forwarded to NLDC. The data was also requested vide email dated 19.07.2019, however, feedback has only been received from Adani Transmission. ***Other utilities were also requested to share the required data.***

6. Frequent forced outages of transmission elements

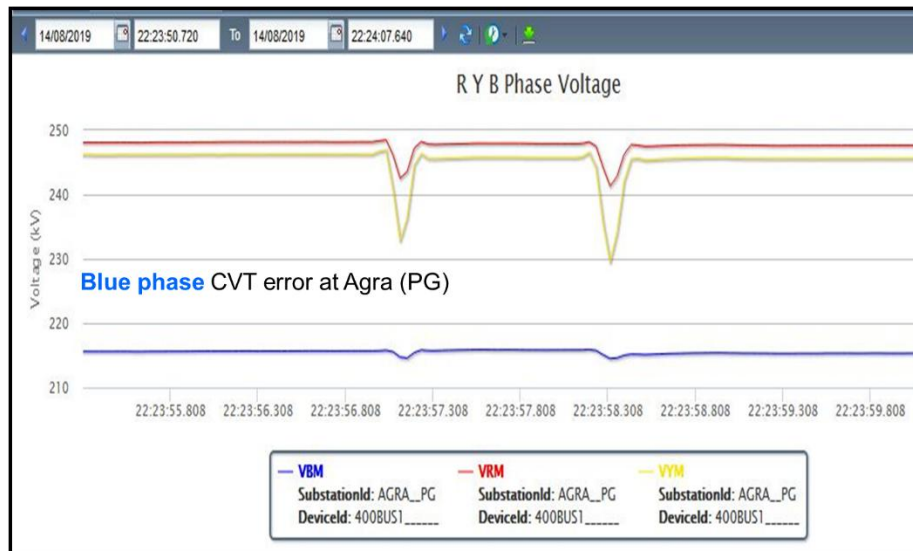
The following transmission elements were frequently under forced outages during the month of **Aug'19**:

S. NO.	Element Name	No. of forced outages	Utility/SLDC
1	400kV Fatehabad(UP)-Mathura(UP) ckt-2	5	UP
2	220kV Gopalpur(DTL)-Mandola(PG) ckt-1	5	Delhi/POWERGRID
3	220kV Kishenpur(PG)-Ramban(JK)	4	J&K/POWERGRID
4	400kV Agra(UP)-Fatehabad(UP) ckt-1	3	UP

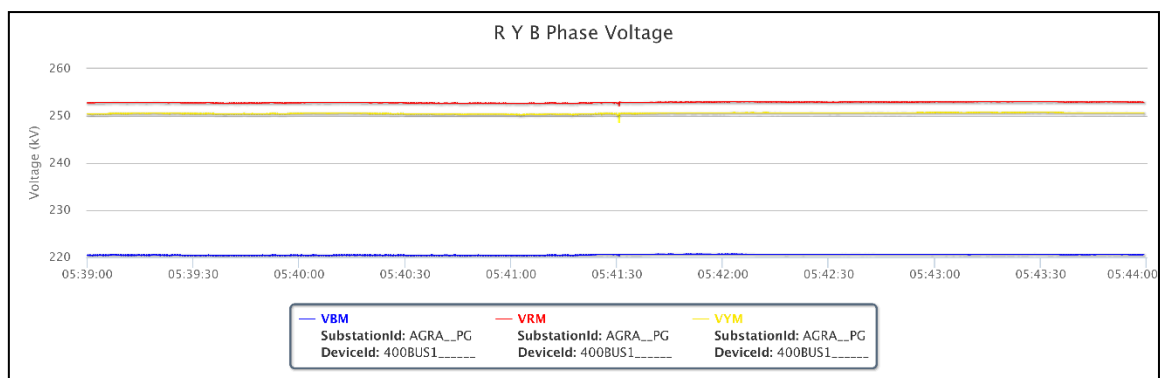
The complete details are attached at **Annexure-B6** of Agenda. The following was discussed in the meeting:

- *400kV Fatehabad(UP)-Mathura(UP) ckt-2 and 400kV Agra(UP)-Fatehabad(UP) ckt-1*: UP representative informed that tripping occurred due to flashover in polymer insulator. NRLDC representative pointed out that such large case of flashover in polymer insulator seem peculiar as these type of insulators are placed to avoid flashovers due to their lesser affinity towards pollution as compared to conventional porcelain insulators. UP was requested to examine the case on the basis of any similarity/peculiarity of nature of fault, Impact of fault on insulator; any activity leading to high pollution in affected area(s). UP representative agreed to look into the matter.
- *220kV Gopalpur(DTL)-Mandola(PG) ckt-1*: No information was available on the tripping. POWERGRID and DTL were requested to look into the multiple tripping of line and inform the corrective measures. POWERGRID, and UP representative agreed to check the tripping.

- **220kV Kishenpur(PG)-Ramban(JK):** POWERGRID representative informed that Earth fault is observed. However, the exact reason is not ascertained yet. The line belongs to J&K. Further, it is becoming difficult to establish the communication with Ramban end under *status quo*. The auto-reclosure feature at Ramban(J&K) end is not enabled. Therefore, the aforesaid feature is also turned off at Kishnepur(PG) end as well. NRLDC representative requested POWERGRID to look into the trippings again and try to establish communication with J&K officials to ascertain the reason of these large no. of trippings. POWERGRID representative agreed for the same.
- **CVT error at 400kV Agra(PG):** NRLDC representative showed the following plot:



He informed that as per PMU data (Shown above), it seems that there is CVT error in Blue-phase of 400kV Bus-1 CVT at Agra(PG). POWERGRID representative stated that recently a CVT has been replaced at Agra(PG). However, a recent random time PMU plot of 27-Sep-19 (Shown below) also indicates that error still persist.

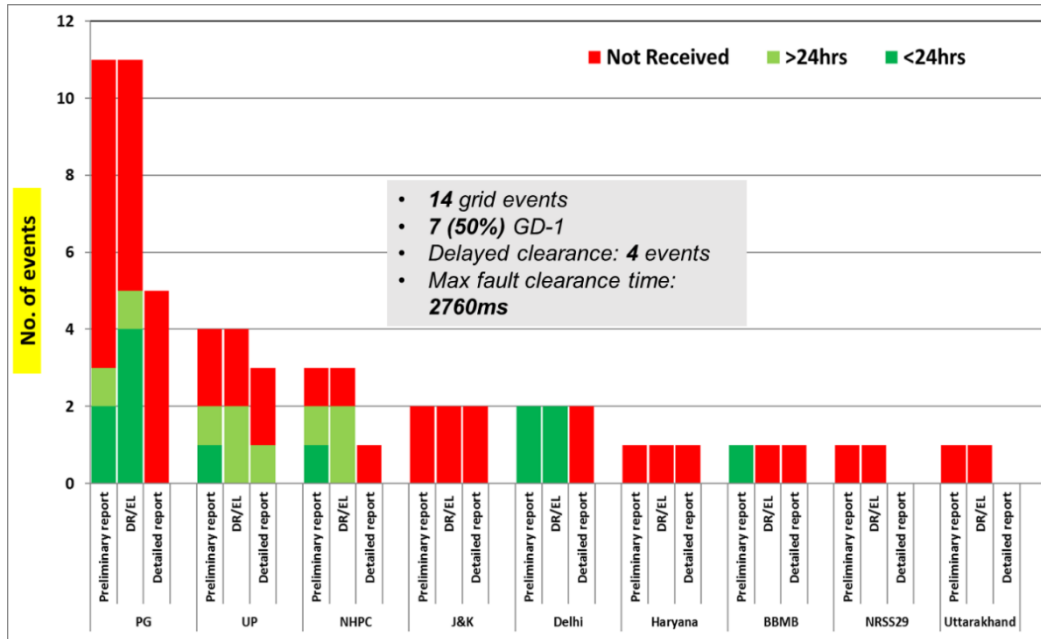


POWERGRID representative were requested to look into any such possibility and get the CVT calibrated or replaced. POWERGRID representative agreed for the same.

7. Multiple element tripping events in Northern region in the month of Aug'19:

A total of **14** grid events occurred in the month of Aug'19 of which **7** are of GD-1 category. The preliminary report of all the events were issued from NRLDC. A list of all these events along with the status of details received by 05-Sep-19 is attached at **Annexure-B7** of Agenda.

NRLDC representative showed the following status of receipt of details:



He emphasized that though persistent discussions/follow-up in various OCC/PCC meetings is in place, the compliance of the regulations was still much below the desired level.

Among the events, maximum Fault Duration was **2760ms** observed in the event of tripping at Moradabad(UP) on 02nd Aug 2019 at 13:03hrs. UP representative informed that there was fault in 220kV Moradabad-Rampur. CB didn't operate as trip coil was burnt. LBB protection was out due to maintenance. As a result, ICTs at Moradabad(UP) also tripped. As remedial measures, trip coil was replaced and LBB protection was enabled. Further, time synchronization was not proper in DRs which have also been told to rectify. NRLDC representative requested that UP SLDC to get the information about any such critical protection outage to better plan and monitor the system.

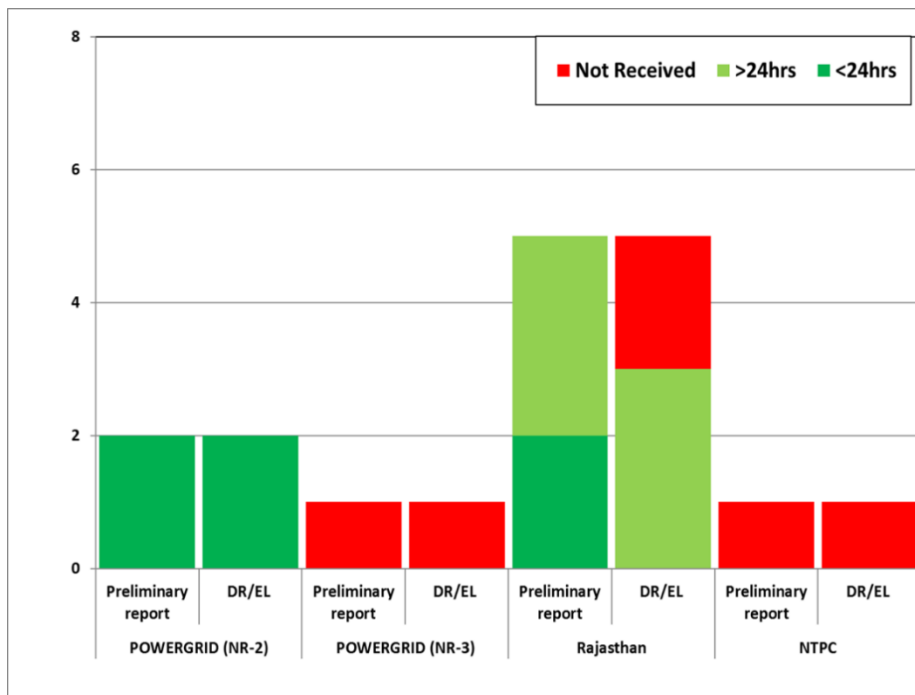
Delayed clearance of fault (more than 100ms for 400kV and 160ms for 220kV system) observed in total **4** events out of 13 grid events experiencing fault.

Members were requested to provide timely details of the grid events along with remedial measures. Members agreed for the same.

8. Details of tripping of Inter-Regional lines from Northern Region for Aug'19:

A total of **10** inter-regional lines tripping occurred in the month of Aug'19. The list is attached at **Annexure-B8** of Agenda. Out of 10 number of trippings, 3 tripping

incidents are related to HVDC system. The status of receipt of preliminary reports, DR/EL within 24hrs of the event was shown as below:



The following was discussed in the meeting:

220kV Auraiya(NTPC)-Malanpur(MPPTCL): NRLDC representative stated that the issue of non auto-reclosure of line is long pending. NTPC representative informed that the line is of MPPTCL. The relays have been purchased and would be installed by Nov'19 end.

HVDC Champa-Kurukshetra: POWERGRID representative stated that the 16-Aug-19 tripping occurred due to malfunction. Further, other trippings were also due to malfunction or software (updates) / hardware issues (Optical CTs replacement). He also stated that in upcoming shut down, all software / hardware related issues would be taken care of.

HVDC Vindhyachal BtB block-2: POWERGRID representative informed that malfunction of PRD of converter transformer operated. The same is being checked.

NRLDC representative once again requested for timely submission of details and analysis of event for better real time system operation. Members agreed for the same.

9. Frequency response characteristic:

One FRC based event occurred in the month of **Aug-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	21-Aug-19	00:02hrs	400kV Dikchu -Rangpo tripped from Rangpo end only. Consequently, 400kV Teesta III- Dikchu also tripped resulting in total black out at 400kV Dikchu and 400kV Teesta III, generation loss of 1364 MW of Teesta III-1260MW and Dikchu-104 MW.	49.930	49.843	0.087

The following FRC observed for state, generator control areas was presented:

States	PUNJAB	HARYANA	RAJASTHAN	DELHI	UTTAR PRADESH	UTTARAKHAND	CHANDIGARH	HIMACHAL PRADESH	JAMMU & KASHMIR	NR
FRC	29%	-114%	-3%	0%	47%	5%	6%	15%	46%	12%
Remarks		Demand inc. following inc. in schedule								

FRC calculation of ISGS stations based on NRLDC SCADA data:

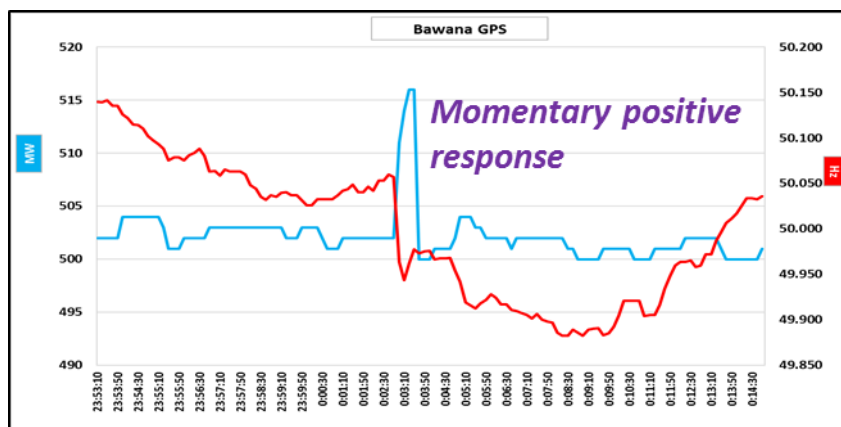
Generator	FRC	Comments	Generator	FRC	Comments
Singrauli TPS	1%	Delayed response observed	Uri-1 HEP	-1%	
Rihand-1 TPS	Suspect SCADA data		Uri-2 HEP	0%	
Rihand-2 TPS	Suspect SCADA data		Dhauliganga HEP	Suspect SCADA data	
Rihand-3 TPS	12%		Dulhasti HEP	0%	
Dadri-1 TPS	20%		Sewa-II HEP	Suspect SCADA data	
Dadri -2 TPS	25%		Parbati-3 HEP	11%	
Unchahar TPS	-6%		Kishnganga HEP	1%	
Unchahar stg-4 TPS	30%		Jhakri HEP	15%	
Jhajjar TPS	Inc. in schedule		Rampur HEP	0%	
Dadri GPS	-11%	Delayed response observed	Tehri HEP	-9%	
Anta GPS	No generation		Koteswar HEP	Dec. in schedule	
Auraiya GPS	Dec. in schedule		Karcham HEP	56%	
Narora APS	0%		Malana-2 HEP	0%	
RAPS-B	11%		Budhil HEP	Suspect SCADA data	Momentary inc. in gen. observed
RAPS-C	2%		Bhakra HEP	-3%	
Chamera-1 HEP	4%		Dehar HEP	2%	
Chamera-2 HEP	0%		Pong HEP	12%	
Chamera-3 HEP	13%		Koldam HEP	3%	
Bairasiul HEP	No generation		AD Hydro HEP	0%	
Salal HEP	-2%	Momentary inc. in gen. observed	Sainj HEP	-2%	
Tanakpur HEP	Suspect SCADA data				

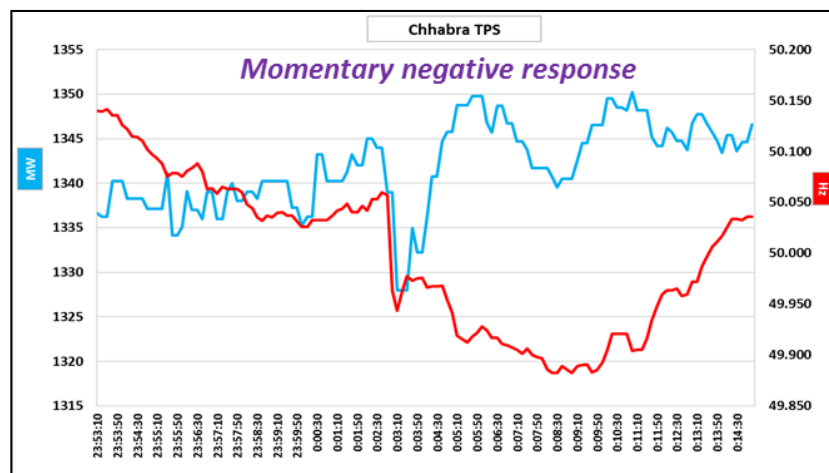
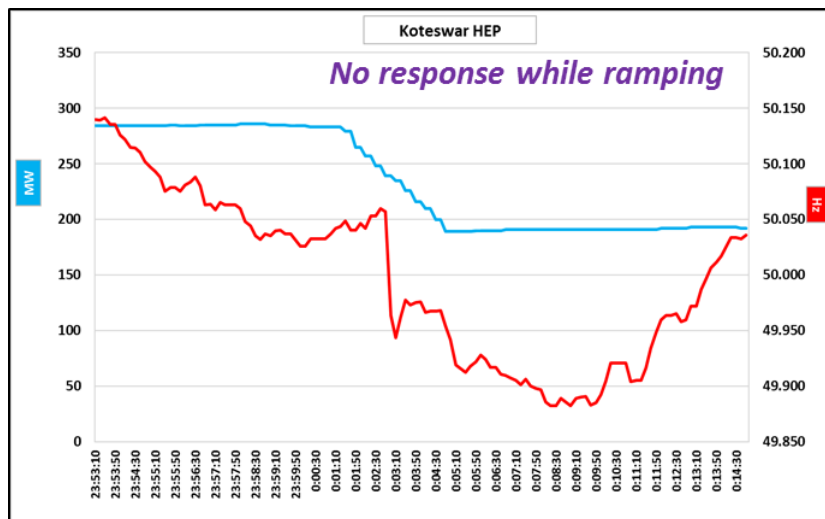
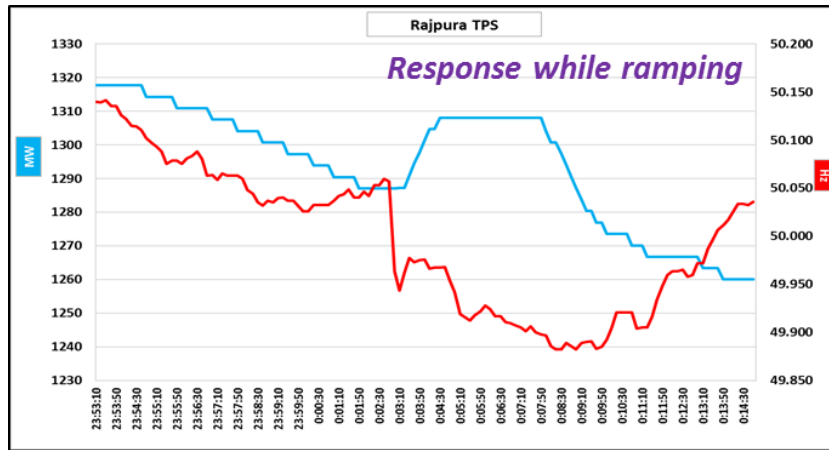
FRC calculation of major state generators based on NRLDC SCADA data:

Generator	FRC	Comment	Generator	FRC	Comment
PUNJAB			UP		
Ropar TPS	No generation		Obra TPS	12%	
L.Mohabbat TPS	No generation		Harduaganj TPS	4%	
Rajpura TPS	24%		Paricha TPS	10%	
T.Sabo TPS	15%		Rosa TPS	8%	
Goindwal Sahib TPS	No generation		Anpara TPS	-1%	
Ranjit Sagar HEP	24%		Anpara C TPS	seems dec. in schedule	
HARYANA			Anpara D TPS	16%	
Panipat TPS	No generation		Bara TPS	-11%	
Khedar TPS	No generation		Lalitpur TPS	6%	
Yamuna Nagar TPS	No generation		Meja TPS	seems dec. in schedule	
CLP Jhajjar TPS	15%		Vishnuprayag HEP	Suspect SCADA data	
Faridabad GPS	0%		Alaknanda HEP	-3%	
RAJASTHAN			Rihand HEP	No generation	
Kota TPS	7%		Obra HEP	No generation	
Suratgarh TPS	-7%		UTTARAKHAND		
Kalisindh TPS	Suspect SCADA data		Gamma Infra GPS	-3%	
Chhabra stg-2 TPS	-25%		Shravanti GPS	-8%	
Kawai TPS	seems dec. in schedule		Ramganga HEP	Suspect SCADA data	
Dholpur GPS	No generation		Chibra HEP	4%	
Mahi-1 HEP	3%		Khodri HEP	No generation	
Mahi-2 HEP	No generation		Chilla HEP	8%	
RPS HEP	No generation		HP		
JS HEP	18%		Baspa HEP	-5%	
DELHI			Malana HEP	Suspect SCADA data	
Bawana GPS	-11%	<i>Momentary inc. in gen. observed</i>	Larji HEP	Suspect SCADA data	
Pragati GPS	51%		Bhabha HEP	11%	
			Giri HEP	No generation	
			J&K		
			Baglihar-1&2 HEP	4%	
			Lower Jhelum HEP	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. Constituents may submit the FRC of their control areas for both the events and reason of poor response, if observed.

NRLDC representative showed following peculiar case of FRC events observed:





The following were discussed:

- Momentary positive response from Bawana CCGT.
- The low response by unit #3 of Sewa-2 as compared to other two units, was also pointed out in 158th OCC meeting and again observed in above event.
- Rajpura showed response while ramping down as well. Other generating utilities were also encouraged to show response even while ramping.
- No response was observed from koteswar HEP while ramping down.

- Tehri HEP response was 4% as reported. Tehri representative stated that the margin for primary response was not there. NRLDC representative stated that as per 5th amendment of IEGC, margin to be kept for providing primary response.
- Momentary negative response from Chabra TPS.
- Harduaganj TPS reported wide mode of operation of turbine control valve. However, again as per regulations Valve Wide Operation (VWO) to be avoided.

Constituents were requested to look into the above aspects among others and submit the reason for not providing the response and corrective actions taken / to be taken for improved response. Constituents agreed on the same.

10. Mock black start exercises in NR:

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

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

The summary/schedule of mock black start exercise of ISGS hydro stations carried out in previous season as tabulated below was also presented:

S. No.	Proposed Date	Revised Date	Generating station	Remarks
1	24-Oct-18	NA	Malana-2	Exercise was not successful. It is proposed to carry out the exercise again with AD Hydro.
2	02-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 synchronised with grid.
3	30-Nov-18	06-Dec-18	Sewa-2	NHPC confirmed. Date revised by J&K. Exercise was partially successful. Unit went under emergency stop twice.
4	03-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 synchronise to the island.
5	11-Dec-18	19-Dec-18	Parbati-3	Carried out successfully.
6	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.

7	28-Dec-18	03-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.
8	04-Jan-19	22-Feb-19	Tehri	Mock black start exercise was successful. Mock exercise started at 11:00AM with 250MW Unit-4 of Tehri HEP and load at Shatabadi nagar (UP). Mock exercise completed by 13:25hrs
9	11-Jan-19	NA	Koldam	Exercise carried out successfully.
Not carried out				
10	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.
11	26-Oct-18	07-Feb-19	Dhauliganga	Revised date by NHPC
12	13-Nov-18	21-Jan-19	Nathpa Jhakri & Rampur	Revised date by SJVNL
13	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.
14	19-Nov-18		Budhil	To be carried out after 15-Dec-18.
15	28-Nov-18	15-Mar-19	Chamera-3	Exercise was not successful as unit tripped three times during mock testing on different region. After multiple unsuccessful attempt mock exercise was differed for later date.
16	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.
17	08-Jan-19		Karcham Wangtoo & Baspa	Exercise deferred on request of Haryana due to load management.

He further stated that out of 17 planned exercises only 9 were carried out. In addition, there was change in scheduled date in 8 out of 18 planned exercises. Thus, a large percentage of exercises were re-scheduled due to reasons like load not being available, plant personnel not ready, coordination problem among other reasons. **Constituents were requested to adhere to the finalized schedule of mock exercises during the season.**

Therefore, the schedule of mock exercise dates for different hydro & Gas power station is proposed. The power stations may confirm and inform to all the concerned persons of control centre/ substations to facilitate the exercise.

The following schedule was proposed for the Mock Black start exercises:
Hydro Power Stations:

Date	Name of stations
15-Oct-19	*Budhil
22-Oct-19	*Dhauliganga
25-Oct-19	*N. Jhakri and Rampur
31-Oct-19	*Bairasiul
05-Nov-19	Sewa-2
08-Nov-19	*Karcham and Baspa
15-Nov-19	*Uri-I, II HEP, Lower Jhelum HEP, Pampore GT's, Upper Sindh and Kishanganga
19-Nov-19	Parbati-3 and *Sainj
21-Nov-19	Salal
26-Nov-19	*Chamera-3
28-Nov-19	Koteshwar
10-Dec-19	Chamera-1 and 2
12-Dec-19	Malana-2, AD Hydro and Phozal
27-Dec-19	*Tehri
02-Jan-20	Koldam

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

Mock Black start procedure circulated during last exercise/ previous year may be used. The unit selection may be changed from the one taken during last year exercise.

Gas Power Stations:

Date	Name of stations
09-Oct-19	*Anta GPS
04-Dec-19	*Auraiya GPS
19-Dec-19	*Dadri GPS

* Mock Black start exercise not carried out during Year 2017-18, procedure to be developed.

As informed by Bawana GPS, it does not have black start capability.

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

S. NO.	Utility	Hydro Power Station	Installed Capacity(MW)
1	J&K	Baglihar	3x150
2		Baglihar stage-2	3x150
3		Lower Jhelum	3x35
4		Upper Sindh	2x11+3x35

5		Larji	3x42
6		Bhabha	3x40
7		Malana -I	2x43
8		Baspa	3x100
9	Punjab	Anandpur Sahib	4x33.5
10		Ranjit Sagar	4x150
11	Rajasthan	Mahi-I&II	2x25+2x45
12		Rana Pratap Sagar	4x43
13		Jawahar Sagar	3x33
14		Gandhi Sagar	5x23
15		Dholpur GPS	3x110
16		Ramgarh GPS	1x35.5+2x37.5+1x110
17	UP	Rihand	6x50
18		Obra	3x33
19		Vishnuprayag	4x100
20		Srinagar (Alaknanda)	4x82.5
21			
	Uttarakhand	Gamma Infra	2x76+1x73
22		Shravanti	6x75
23		Ramganga	3x66
24		Chibro	4x60
25		Khodri	4x30
26		Chilla	4x36
27		Maneri Bhali-I&II	3x30+4x76
28	Delhi	IP Extn GTs	6x30+3x30
29		Pragati GPS	2x104.6+1x121.2
30		Rithala	3x36
31	Haryana	Faridabad GPS	2x137.75+1x156.07

NRLDC representative further stated that during last winter, SLDCs had been requested to carry out mock drills and share their experiences. However, the report of such exercises was not received.

The following was submission from UP and Delhi SLDCs in this respect:

- UP representative informed that rihand Hydro blackstart was last carried out on 26-Aug-18.
- Delhi representative informed that Pragati and Rihala stations don't have blackstart capability.

SLDCs were again requested to provide complete information of last year's state generating station mock drills and program for this year's mock black start exercises.

Members were requested to confirm the schedule by the end of September'19.

Additional discussion:

11. Online inertia estimation at control centres

NRLDC representative stated that it is well known that large amount of renewable generation is being integrated in the grid at rapid pace. With large scale renewable generation in service at a time, conventional generation needs to be backed down

List of participants in the 163rd OCC meeting held on 17th September 2019, New Delhi

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Long Outage of Generating Units

Annexure - II (A)

SL. No	Station Name	Location	Owner	Unit No	Capacity	Reason	Outage		Outage duration (in days)
							Date	Time	
1	RAPS-A	RAJASTHAN	NPC	1	100	Subject to regulatory clearance . Unit is to be decommissioned.	09-10-04	22:58	5455
2	Giral (IPP) LTPS	RAJASTHAN	RRVUNL	1	125	Bed materials leakage.	11-07-14	8:20	1893
3	Giral (IPP) LTPS	RAJASTHAN	RRVUNL	2	125	Boiler tube leakage	27-01-16	15:27	1328
4	Paricha TPS	UP	UPRVUNL	1	110	R & M Work	02-07-16	17:30	1171
5	Obra TPS	UP	UPRVUNL	12	200	R & M Work	24-09-18	17:26	357
6	Bairasiul HPS	HP	NHPC	2	60	Renovation and Modernization of the plant	15-10-18	10:02	336
7	Pong HPS	HP	BBMB	2	66	Renovation and Modernization of the plant.	14-02-19	8:00	214
8	Bhakra-L HPS	HP	BBMB	3	108	Renovation and Modernisation of unit(capacity enhancement from 108 to 126 MW)	01-04-19	9:20	168
9	Obra TPS	UP	UPRVUNL	13	200	R & M Work	14-04-19	13:01	155
10	Paricha TPS	UP	UPRVUNL	5	250	GT protection issue	16-04-19	3:27	153
11	Kalisindh TPS	RAJASTHAN	RRVUNL	2	600	Turbine problem.	21-07-19	14:08	57
12	Singrauli STPS	UP	NTPC	5	200	For major overhauling work .	06-08-19	22:24	41
13	Chamera-II HPS	HP	NHPC	2	100	Turbine problem.	07-08-19	3:54	40
14	Chamera-II HPS	HP	NHPC	1	100	Turbine problem.	07-08-19	8:58	40
15	Dadri-II TPS	UP	NTPC	2	490	Tripped due to rotor problem & subsequently taken under annual maintenance.	14-08-19	0:30	33
16	Rihand-II STPS	UP	NTPC	2	500	Taken out due to high turbine vibration	17-08-19	11:24	30

SL. No	Element Name	Type	Voltage Level	Owner	Outage		Outage duration (days)	Reason / Remarks
					Date	Time		
1	FACT at BLB in Knp-BLB Line	FACTS	400 kV	PGCIL	02-07-16	10:20	1171	Y-Phase current imbalance
2	FSC of Balia-I at Lucknow	FSC	400 kV	PGCIL	29-11-17	13:30	656	E/SD due to Hot Spot on Isolator
3	FSC (40%) of Kanpur-II at Ballabgarh(PG)	FSC	400 kV	PGCIL	16-03-19	14:39	184	Fire in B-Ph FSC at Ballabgarh end.
4	Jaisalmer_2-Barmer(RS) Ckt-1	Line	400 kV	RRVPL	11-05-19	21:34	128	Tower collapsed 2 tower collapse in 11.05.2019 and 4 towers collapsed on 16.05.2019
5	Jaisalmer_2-Barmer Ckt-2	Line	400 kV	RRVPL	11-05-19	21:34	128	Tower collapsed 2 tower collapse in 11.05.2019 and 4 towers collapsed on 16.05.2019
6	Bhilwara 315 MVA ICT-1	ICT	400/220 kV	RRVPL	12-05-19	23:42	127	Oil leakage in Transformer
7	Chamera 3 HEP 220kV Bus 1	BUS	220 kV	NHPC	14-05-19	11:56	125	During shifting of Chamera pool-2 line from 220 kV Bus-2 to BUS-1 at Chamera 3 GIS. CB got damaged.
8	Chamera III(NHPC)-Chamera pool(PG) 2	Line	220 kV	PGCIL	14-05-19	11:56	125	During shifting of Chamera pool-2 line from 220 kV Bus-2 to BUS-1 at Chamera 3 GIS.Line isolator and Circuit Breaker of line 2 got damaged at Chamera3 GIS.
9	400 kV 63 MVAR Line Reactor of Jaipur (S) line at RAPP C	Line Reactor	400 kV	RAPPTCL	17-05-19	9:30	122	Emergency SD taken by RAPP C to attend oil leakage in Reactor.

SL. No	Element Name	Type	Voltage Level	Owner	Outage		Outage duration (days)	Reason / Remarks
					Date	Time		
10	+/- 150 MVAR STATCOM 2 at Lucknow II PG	STATCOM	400 kV	PGCIL	17-07-19	15:03	61	Due to failure of 3x173 MVA, 400/38.5kV Coupling Transformer at LKO.
11	+/- 150 MVAR STATCOM 1 at Lucknow II PG	STATCOM	400 kV	PGCIL	17-07-19	15:03	61	Due to failure of 3x173 MVA, 400/38.5kV Coupling Transformer at LKO.
12	400 kV Bus sectionalizer Bay/CB (4-3252) between Bus-2 & Bus-4 at Dadri TH	BAY/CB	400 kV	NTPC	03-08-19	19:28	44	To attend bus bar protection alarm.
13	Agra(UPPTCL) 500 MVA ICT 2	ICT	400/220 kV	UPPTCL	05-08-19	17:35	42	oil DGA test failed. Transformer to be repaired.
14	Gorakhpur(PG)-Motihari(DMTCL) 2	Line	400 kV	PGCIL	13-08-19	22:05	34	E/SD due to Soil erosion at tower no.132 near Gandak river bank
15	Gorakhpur(PG)-Motihari(DMTCL) 1	Line	400 kV	PGCIL	13-08-19	22:04	34	E/SD due to Soil erosion at tower no.132 near Gandak river bank
16	Baghpat(PG)-Muradnagar New(UP)	Line	220 kV	UPPTCL	21-08-19	8:25	26	SD taken by UPPTCL for LILO of line at Mandola Vihar sub stn.
17	400 kV Tie BAY/CB (4-1752) of Unit-5 at Dadri TH	BAY/CB	400 kV	NTPC	24-08-19	11:30	23	facilitate CT replacement work & other associated work like GRP testing etc during overhauling of Unit-6
18	400 kV Main BAY/CB (4-1852) of Unit-6 at Dadri TH	BAY/CB	400 kV	NTPC	24-08-19	11:30	23	facilitate CT replacement work & other associated work like GRP testing etc during overhauling of Unit-6

Si. No.	Type of transmission element	Total No
1	220kV lines	08
2	1500 MVA ICTs	03
3	500 MVA ICTs	03
4	315 MVA ICTs	03
5	150 MVA Power Transformer	02
6	125 MVA Power Transformer	02
7	240 MVAR Line Reactor	01
8	80 MVAR Line Reactor	01
Total New Elements charged		23

Transmission Lines
(220kV line– 93 ckt. Km)

S. No.	Name of element	Voltage Level (in kV)	Line Length (In km)	Conductor Type	Owner	Remarks	Actual date & time of charging (Synchronized)	
							Date	Time
1	200kV Bhadla(PG)-Bhadla(PSS Saurya)-Dc-2 bay no (207) & 207(PG) end	220	9.05	Al-59 single zebra	Suarya		26.08.2019	17:55
2	220kV Bhadla(PG)-Mahoba Solar UP-S/C bays no 205 at Bhadla(PG) & 204 at MSUPPL	220	15.353	Single Zebra	MSUPPL		02.08.2019	12:58
3	220kV Meerut(PG)-Partapur-S/C bays no 218 at Meerut(PG) & 201 at Partapur	220	27.78	Single Zebra	UPPTCL		07.08.2019	15:52
4	220kV TPREL-Bhadla(PG) S/C line along with associated bays no 201 at TPREL & 217 at Bhadla(PG)	220	40.34	Single Zebra	TPREL		31.08.2019	13:36

LILO of Transmission Lines
(220kV Lines- 22 ckt. Km)

S.No.	Name of element	Voltage Level (in kV)	Line Length (In Km) before LILO	Line Length (In Km)	LILO Line Length (In Km)	Conductor Type	Agency/ Owner	Actual date & time of charging(Synchronized)	
								Date	Time
1	220kV Ghazipur-Noida Sec 20 bay no 81 at Noida Sec 20 { LILO of 220kV Ghazipur-BTPS(DTL) at Noida Sec20 }	220	17.5	3.97		Single Zebra/Dear	UPPTCL	08.08.2019	19:15
2	220kV BTSP-Noida Sec 38A(UP) bay no 203 at Sec 38A { LILO of 220kV Sec 20-BTPS(DTL) at Noida Sec 38A }	220	13.51	11.349	1.45	Single Zebra/Dear	UPPTCL	08.08.2019	17:02
3	220kV Baghpat(PG)-Mandola Vihar along with associated bays no 202/204 { LILO of 220kV Baghpat(PG)-Muradnagar New at Mandola Vihar }	220	41	34.15	10	Single Zebra	UPPTCL	23.08.2019	16:24
4	220kV Muradnagar New(UP)-Mandola Vihar along with associated bays no 205/202 { LILO of 220kV Baghpat(PG)-Muradnagar New at Mandola Vihar }	220	41	27	10	Single Zebra	UPPTCL	22.08.2019	17:37

ICT
(ICT Capacity Addition - 5865 MVA)

S.No.	Name of element	Voltage Level	Transformation Capacity (in MVA)	New/replacement /augmentation	Agency/ Owner	Remarks	Actual date & time of charging (on load)	
							Remarks	Date
1	500 MVA ICT at Muktsar	400/220/33	500	New	PSTCL		28.08.2019	15:26
2	1500 MVA at Bhadla(PG)	765/400/33	1500	New	PGCIL		03.08.2019 & 07.08.2019	18:25 & 11:58
3	1500 MVA at Bhadla(PG)	765/400/33	1500	New	PGCIL		20.08.2019	16:56
4	1500 MVA ICT-3 at Bhadla(PG)	765/400/33	1500	New	PGCIL		21.08.2019	17:43
5	150 MVA ICT-1 at MSUPPL	220/33	150	New	MSUUPPL		02.08.2019	15:07
6	150 MVA ICT-2 at MSUPPL	220/33	150	New	MSUUPPL		03.08.2019	14:09
7	315 MVA ICT-2 at Aligarh	400/220/33	315	Old	UPPTCL		30.08.2019	18:05
8	75 MVA Transformer-1 at TPREL	220/33	125	New	TPREL		31.08.2019	13:36
9	75 MVA Transformer-2 at TPREL	220/33	125	New	TPREL		31.08.2019	17:00

Bus Reactor

(Capacity Addition –Bus Reactor 320 MVAR)

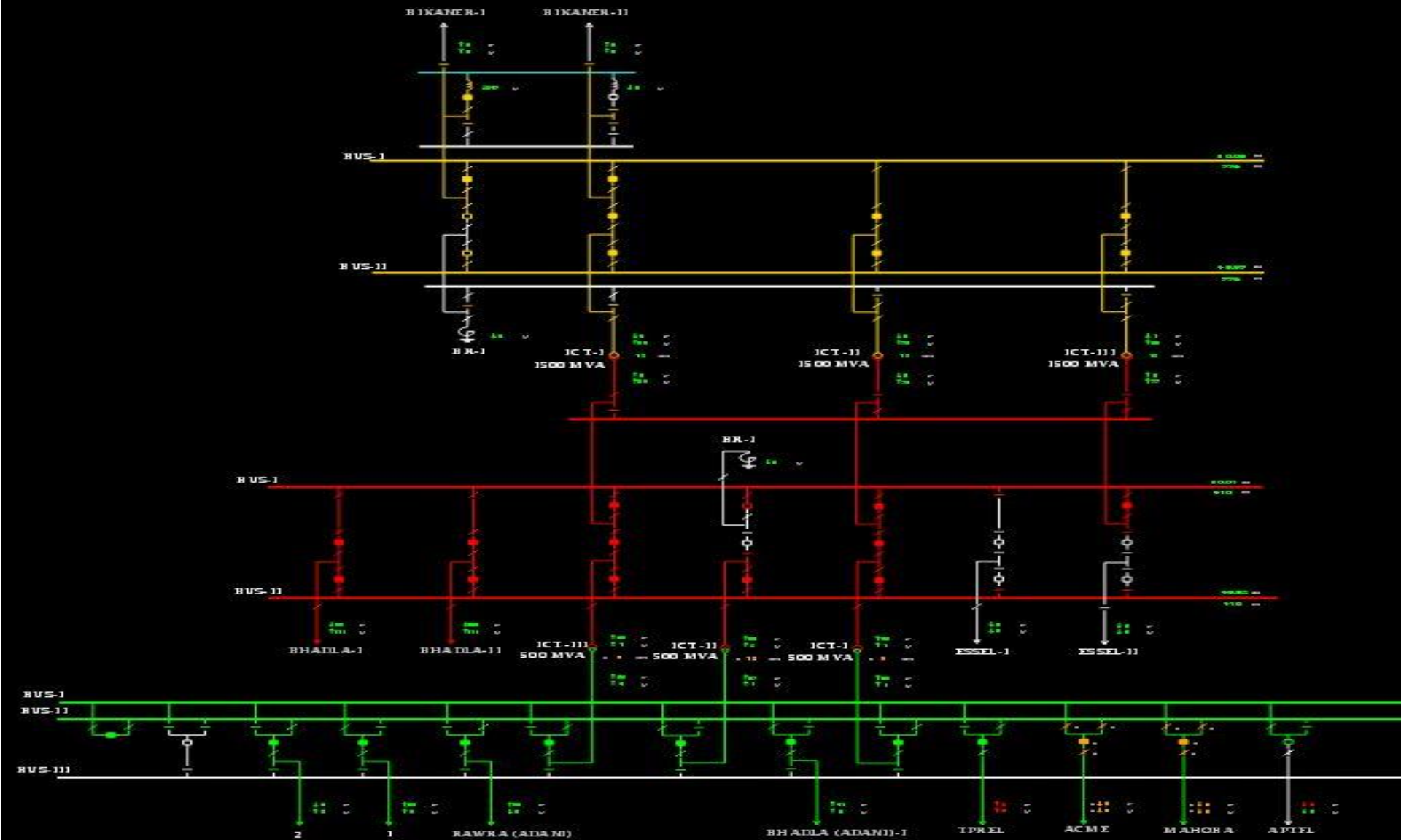
S. No.	Name of element	Voltage Level (kV)	Transformation Capacity (in MVAR)	New/ replacement /augmentation	Type	Agency/ Owner	Remarks	Actual date & time of charging	
								Date	Time
1	240 MVAR Bus Reactor at Bhadla(PG)	765	240	New	Bus Reactor	PGCIL		11.08.2019	14:23
2	80 MVAR Bus Reactor-2 at Chhabra SCTPS	400	80	New	Bus Reactor	RRVPNL		26.08.2019	12:38

Solar Generation (Capacity Addition - 200 MW)

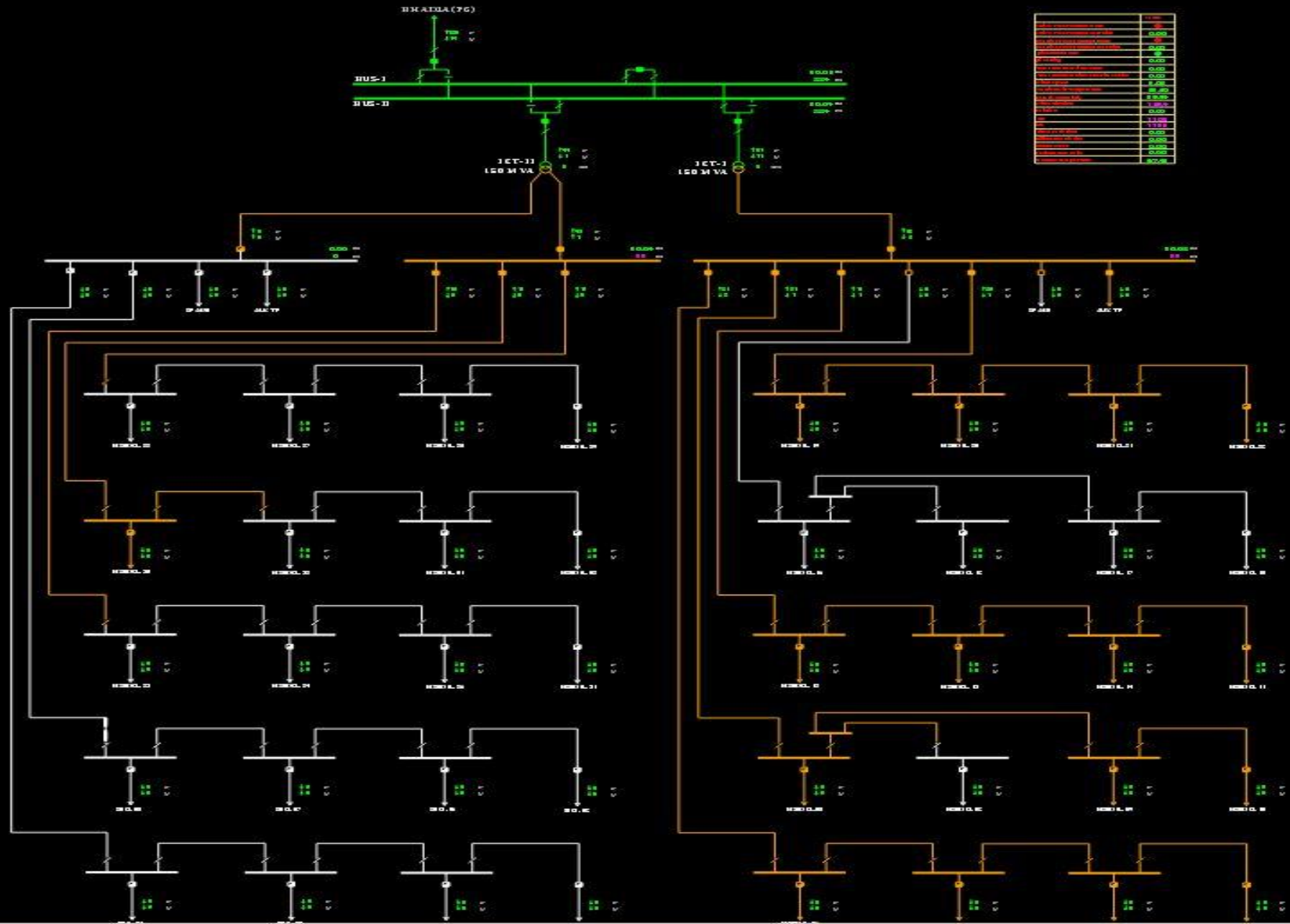
S. No.	Name of element	Voltage Level	Installed Capacity (in MW)	Fuel Type	Make (Inverter & IDT)	Inverter Capacity & No	IDT Capacity & No	Feeder Capacity & No	Agency/ Owner	Actual date & time of charging		COD
										Date	Time	
1	100 MW Mahoba Solar UP Pvt. Ltd at Bhadla	33kV	200	Solar	Hauwei & ORNAT	90KW*11 10	6.25MW* 4	25MW*4	MSUUPL			06.08.2019
								Feeder No 304 (Blk No 19,20,21,25)		02.08.2019	16:15	
								Feeder No 305 (Blk No 16,15,17,18)		03.08.2019	15:18	
								Feeder No 306 (Blk No 11,12,13,14)		03.08.2019	17:13	
								Feeder No 308		03.08.2019	18:44	
2	100 MW Mahoba Solar UP Pvt. Ltd at Bhadla	33kV	200	Solar	Hauwei & ORNAT	90KW*11 13	6.25MW* 4	25MW*4	MSUUPL			21.08.2019
								Feeder No 307 (Blk No 19,20,21,25)		19.08.2019	18:27	
								Feeder No 310 (Blk No 5,8,9,10)		21.08.2019	13:27	
								Feeder No 311 (Blk No 11,12,13,14)		21.08.2019	13:43	
								Feeder No 312 (Blk No 23,24,26,31)		24.08.2019	11:078	

BHADLA (PG)

Stat Expl Gensum Company
2 . 9 . 19 15 : 9 : 16



BHADLA(MSUPPL ADANI)



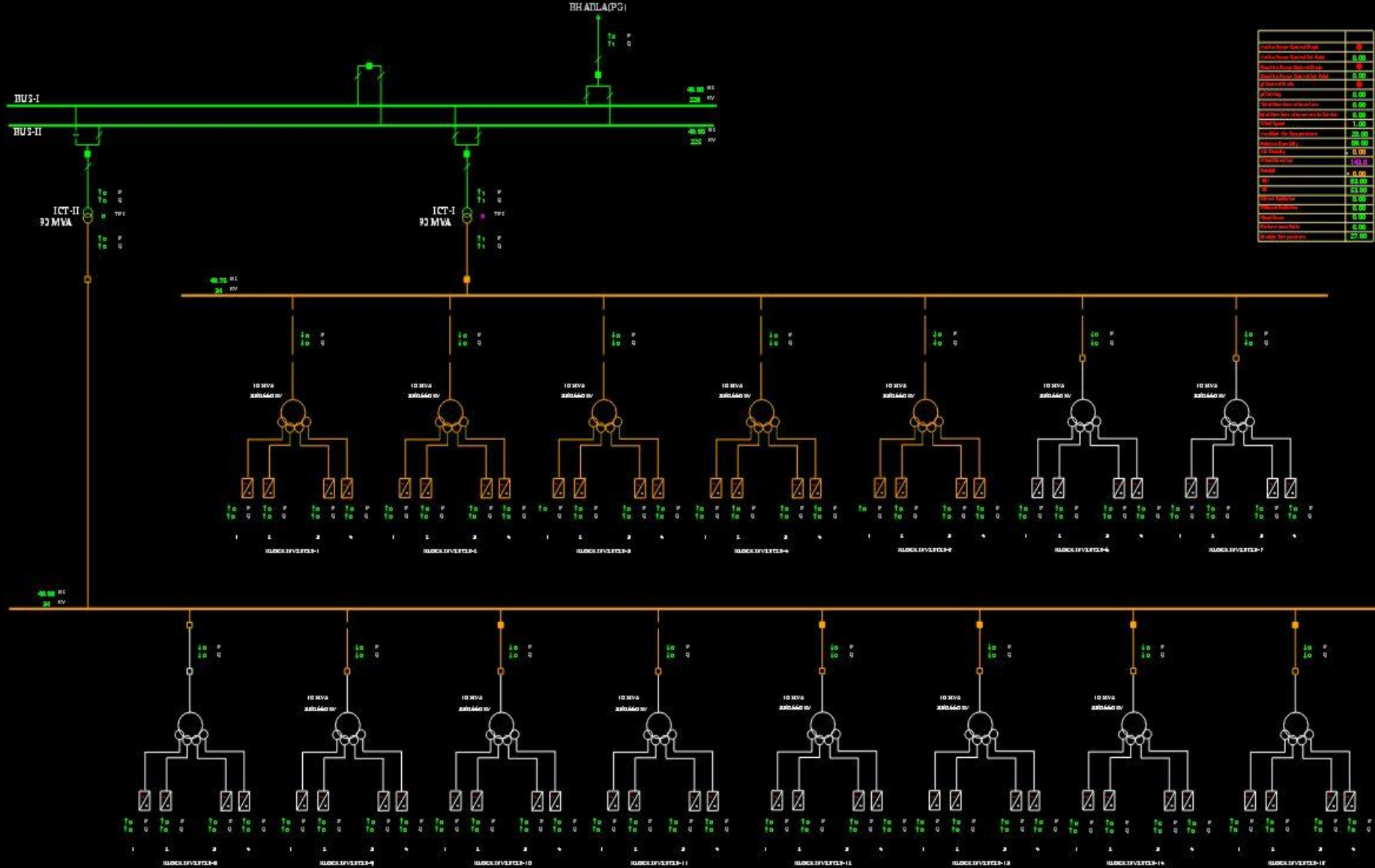
Solar Generation
(Capacity Addition - 130 MW)

S.No.	Name of element	Voltage Level	Installed Capacity (in MW)	Fuel Type	Make (Inverter & IDT)	Inverter Capacity & No	IDT Capacity & No	Feeder Capacity & No	Agency/ Owner	SCM	Actual date & time of charging	COD
											Date	
1	150 MW Tata Power Renewable Energy Ltd at Bhadla	33kV	150	Solar	TMEIC & DANISH	2.5MW*3 2	10MW*8	80 MW Feeder No 1(Block No 1 to 8)	TPREL	Ist SCM Connectivity transmission system for grant of Stage-II Connectivity agreed for grant in the 14th Connectivity/LTA meeting of NR held on 17/08/2018: Table: 2	31.08.2019	30.08.2019
							10 MW*7	80 MW Feeder No 2(Block No 1 to 7)			31.08.2019	

BHADLA(TATA POWER)

TPREL

Stat	Expl	Gen	Sum	Company
2	9	19	15	10 8



Follow up issues from previous OCC meetings

Sl. No.	Agenda point	Details	Status
1	Monitoring of schemes funded from PSDF (<i>Agenda by NPC</i>)	The latest status of the schemes for which grant has been sanctioned from PSDF for the schemes in NR. Utilities are requested to expedite implementation of the schemes and submit information of physical as well as financial progress in the prescribed format by first week of every month on regular basis to Member Convener, PSDF Project Monitoring Group (AGM, NLDC and POSOCO) with a copy to NPC Division.	The available status of Schemes Submitted by the entities for funding from PSDF was attached as Annexure-III/1 of the agenda of 160 th OCC meeting. The updated status from Rajasthan was received via email dated 13.08.2019. UP submitted status dated 05.08.2019. Delhi submitted updated data on 14.08.2019. The updated status for the month of August – 19 has been received from Delhi and Punjab. All other states were requested to update the status of the schemes to be funded from PSDF.
2	Sub-stations likely to be commissioned in next six months.	All the concerned states were requested to submit the details of the downstream network associated specially with POWERGRID substations along with the action plan of their proposed/approved networks.	The updated details of the substations of POWERGRID and their required downstream network was placed at Annexure-V/2 of the agenda note. UP and Haryana submitted the updated information on 13.8.2019. Other utilities were requested to update the status.
3	Progress of installing new capacitors and repair of defective capacitors	Information regarding installation of new capacitors and repair of defective capacitors is to be submitted to NRPC Secretariat.	Information received from Uttarakhand (August 2019), Rajasthan (up to July 2019), UP (up to August) & Haryana (up to June 2019). All other states were requested to update.

4.	Healthiness of defence mechanism: Self-certification	Report of Mock exercise for healthiness of UFRs carried out by utilities themselves on quarterly basis is to be submitted to NRPC Secretariat and NRLDC. All utilities were advised to certify specifically, in the report that <i>"All the UFRs are checked and found functional"</i> .	The information of period ending March 2019 received from UP, Delhi and Rajasthan and for period ending June 2019 received from Haryana, UP and Delhi . All others are requested to submit information.
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Automatic Demand Management System

17th Sep 2019

BSES Rajdhani Power Ltd.

BRPL Profile

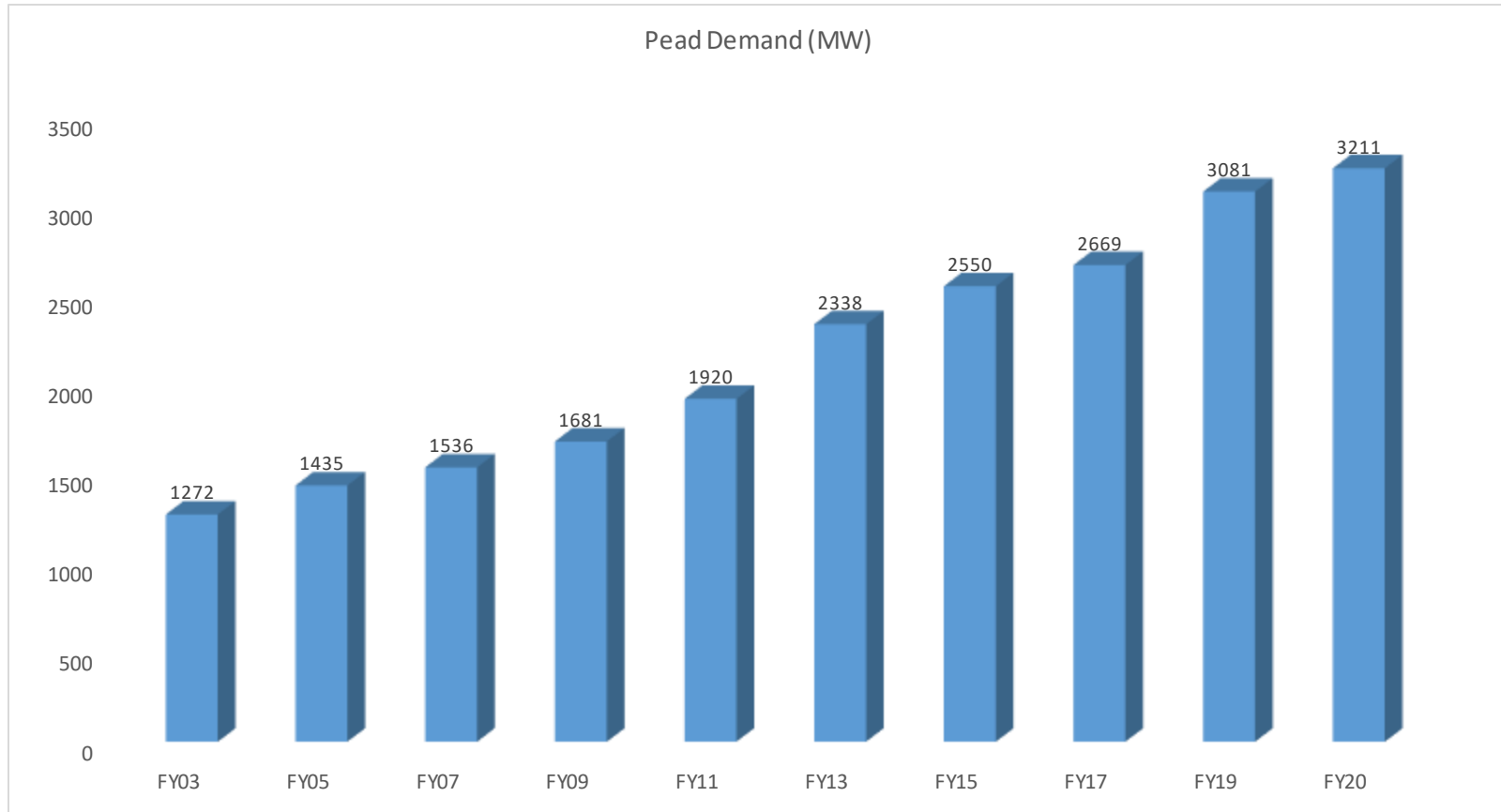


Parameters	Unit	BRPL
Distribution Area	Sq. km	750
No. of customers	Million	2.55
Customer Density	Cons./sq km	3400
Max System Demand	MW	3211
Annual Billed energy FY18	MUs	13300
AT&C Loss FY18	%	8.06

JV between Govt. of Delhi (49%) and Reliance Infrastructure Ltd (51%)

BSES caters to 2/3rd of Delhi
 South & West Delhi by BRPL and Central & East Delhi by BYPL

BRPL Peak Load Growth



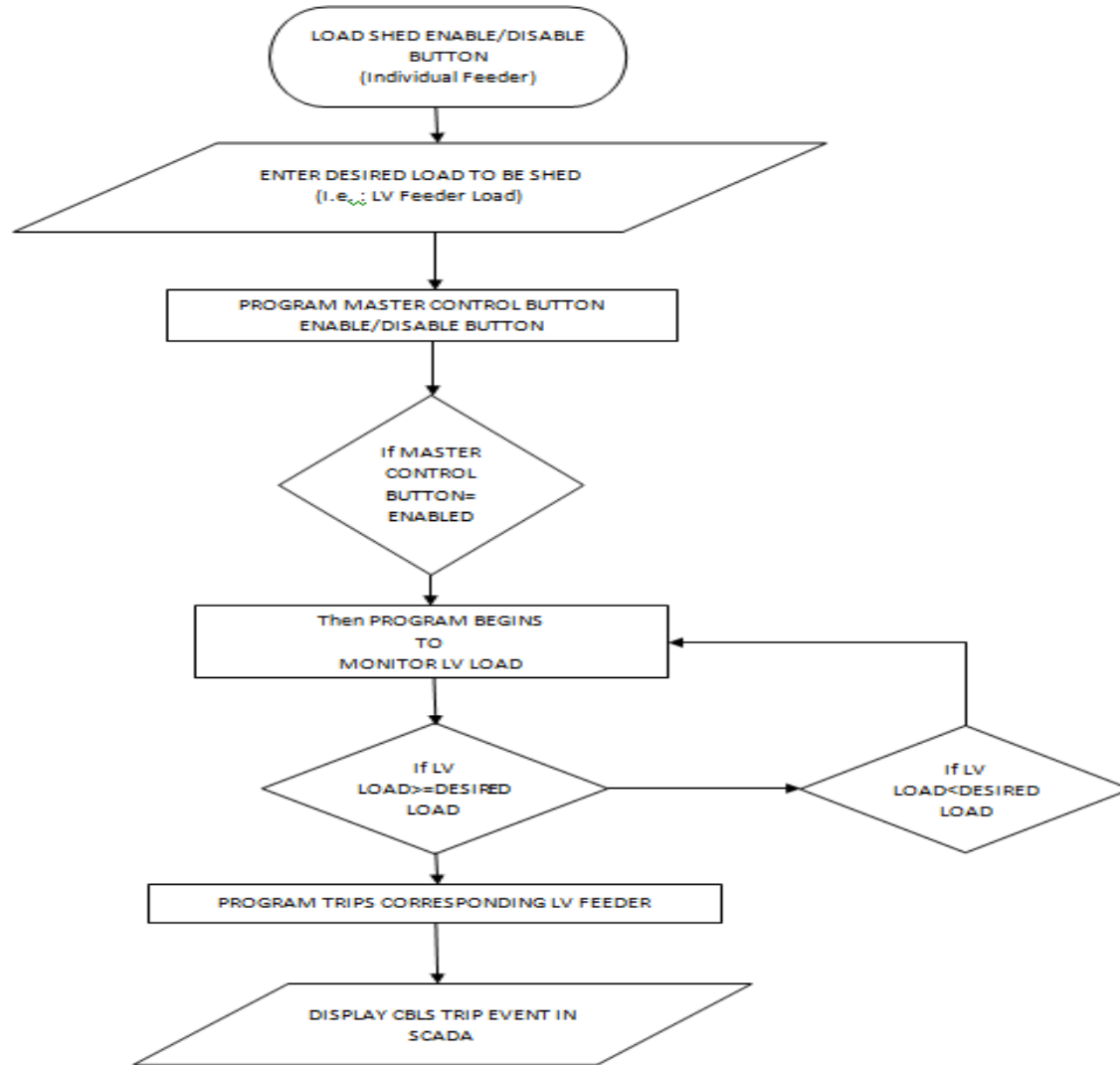
BRPL caters over 13,300 MUs with maximum demand of 3211 MW in summer of 2019. Reliability of power sold has been consistently improving over the years and has reached 99.9%.

CONDITION BASED LOAD SHEDDING SCHEME

WORKING

- The Load (Amps) on the equipment is monitored from the time when the program is started.
- The operator needs to set the desired current value at which the equipment breaker has to be tripped.
- The program developed through Spider Programming Language (SPL) monitors the present Load on the breaker continuously.
- When it reaches the desired value, a trip command is sent to the breaker and the breaker opens.

CONDITION BASED LOAD SHEDDING SCHEME



WS500 IMAGE

Master Control **On**

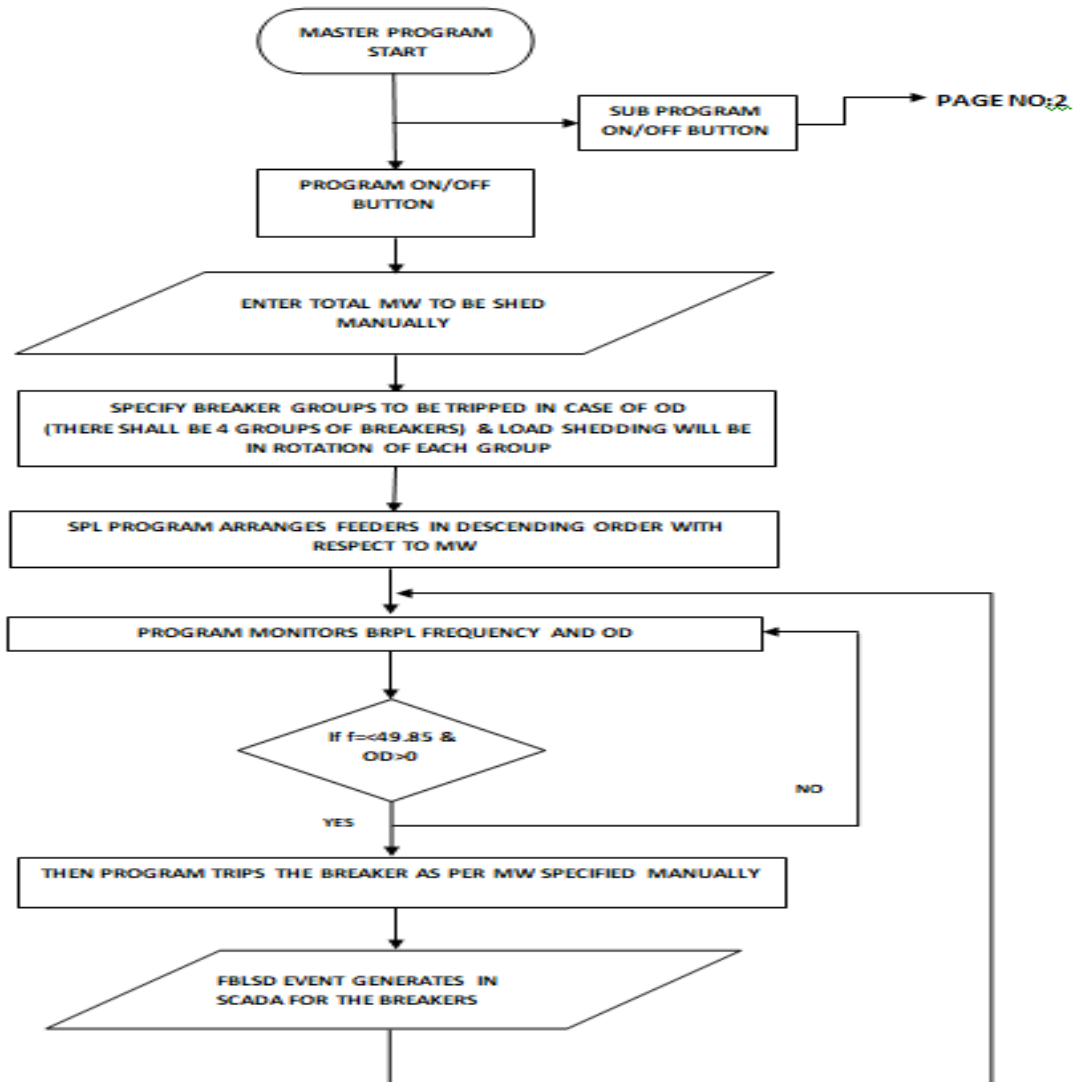
CONDITION BASED LOAD SHEDDING - SOUTH-3 CIRCLE

South 1 South 2 Page 2

S No	GRID	TRF.	Desired Load to Monitor(Amp)	Monitoring Enable /Disable	LV Breaker Load	11 Kv Feeder name	11 Kv Feeder Status
1.	Alaknanda	LV1	780	On	383	DDA SLUM	118
		LV2	1000	On	422	Deshbandhu	33
		LV3	1100	On	523	GALI NO 16 GOVINDPURI	126
2.	Balaji	LV1	1000	On	600	GIRI NGR S/S NO.2	53
		LV2	1000	On	752	OKHLA PHASE-3 S/STN 3	118
3.	Batra	LV1	1650	On	798	RMU BATRA GRID	108
		LV2	1250	On	471	DAKSHINPURI SS.2	105
		LV3	1600	On	845	D-BLK SANGAM VIHAR (NEW)	84
4.	D.C Saket	LV1	780	On	230	MADANGIRI 1	79
		LV2	780	On	442	LSC 1	77
		LV3	1000	On	668	DDA Gali No 20	102
		LV4	780	On	618	JAHANPANAHA 1	203
5.	Hudco	LV1	780	On	553	AV NAGAR 2	124
		LV2	780	On	434	HUDCO SS 6	31
		LV3	780	On	484	JAMROODPUR S/STN-3	123
6.	IGNOU	LV1	1000	On	574	NEB SARAI	89
		LV2	1000	On	395	MAIDANGARHI	55
7.	Malvia Nagar	LV1	1000	On	717	PUSHP VIHAR SS11	128
		LV2	1000	On	462	JJ KHANPUR	96
8.	Masjid Moth	LV1	780	On	540	CHIRAG DELHI	143
		LV2	780	On	373	SOAMI NAGAR	128
		LV3	800	On	172	W BLK GK 1	44
9.	Nehru Place	LV1	1000	On	756	D BANDU CLG	110
		LV2	1000	On	593	R BLK GK - 1	114
		LV3	1000	On	610	D BLK EOK	126
		LV4	1250	On	510	DEVIKA TOWER	105
10.	Okhla Phase-1	LV1	1000	On	851	HOT MIX PLANT	106
		LV2	1000	On	542	S/STN C OKHLA-1	96
		LV3	1000	On	539	S/S - 10 OKHLA -1	117
		LV4	1250	On	463	S/STN A OKHLA-1	95
11.	Okhla Phase-2	LV1	1000	On	571	S/S-1 F-2 PH-2	160
		LV2	1000	On	625	W- BLOCK OKHLA 2	98
		LV3	1290	On	881	S/S-4 OKHLA 2	123
12.	Pushp Vihar	LV1	780	On	431	DLF A1 F1	69
		LV2	780	On	432	CHIRAG DELHI KHATTA	81

FREQUENCY BASED LOAD SHEDDING

FREQUENCY BASED LOAD SHEDDING SCHEME-TO SHED OD



WORKING(MAIN PROGRAM)

- After the program is implemented the desired value of MW to be shed is entered manually by the operator.
- List of Breakers are specified in 4 groups.. Each group have 'n' number of breakers which is to be considered by SPL program during OD load scheme.
- Each group shall be operated in rotational manner in case of OD.
- The program schedules the specified breakers in descending order with respect to the current MW value.
- The desired frequency and OD value specified by the operator is being monitored by the program continuously.

-
- When the frequency and OD reaches the desired value, the program sums up the MW of the feeders listed in the descending order.
 - A group is selected by the SPL program from maximum MW to minimum MW so that their sum comes to the desired value specified by the operator.
 - The SPL program sends open command to the respective group of breakers and the breaker opens.

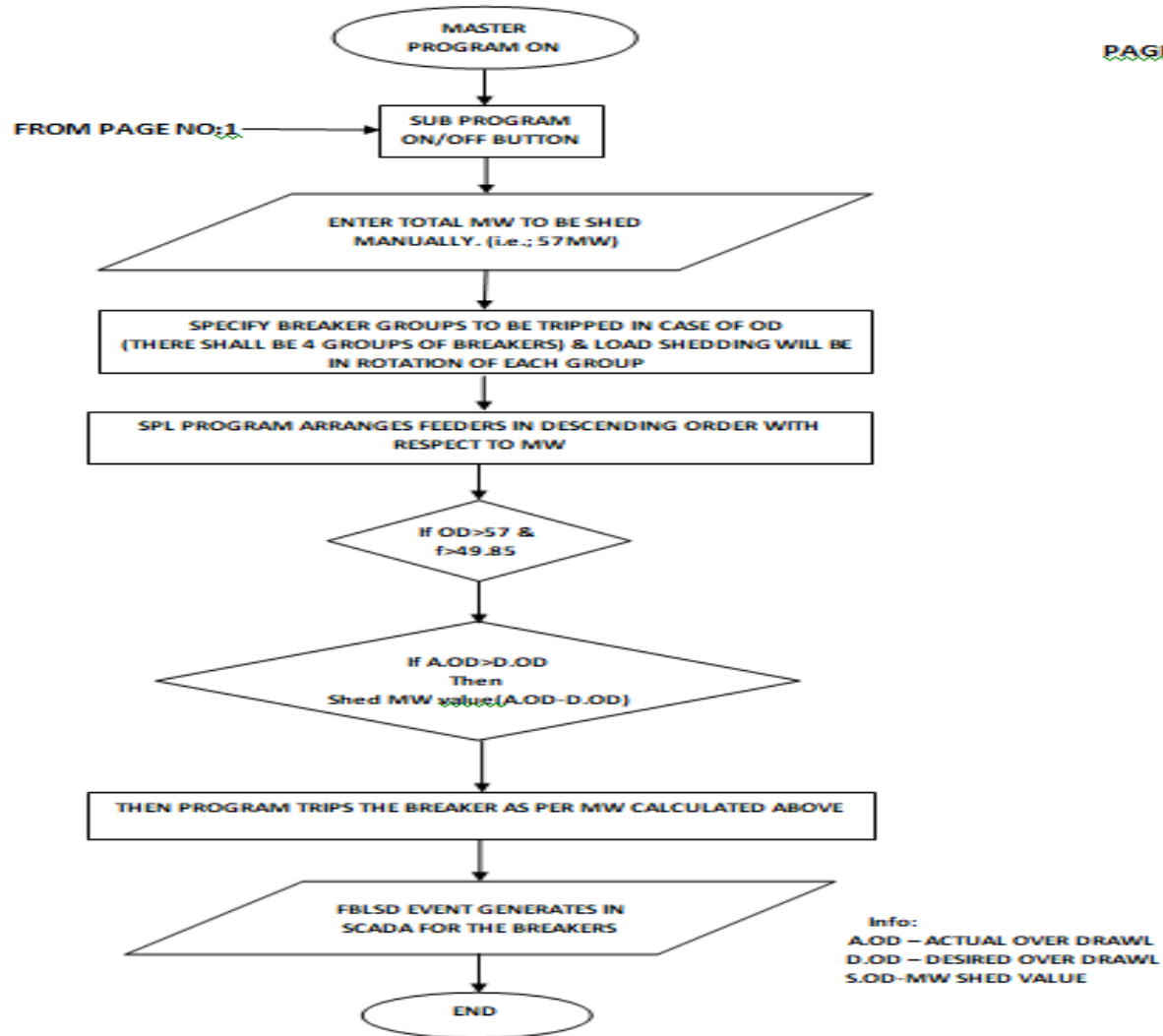
WS 500

WS500 Screen:

Frequency based Load Shedding																			
Execution Switch				Execution Time				Load to be Shed			Load Schedule		System Load						
Yes				12/10/2014 15:24:42				0.00			556.000		557.71						
Frequency Data						Load Sum													
Freq Source 1		Freq Source 1		Freq 1		Freq Source 2		Freq Source 2		Load Meas		Load Meas		Last Good		Last Good		Load Value	
Ext ID		Val		Priority		Ext ID		Val		Ext ID		Val		Value		Value Time		Selection	
PPGH	66	8712	FREQUENCY	49.77	0	KTNG	33	8990	FREQUENCY	49.76	AKDM	66	12083	ACTIVE POWER	0.00	0.00	12/10/2014	14:56:20	Realtime
										KHIC	66	9073	ACTIVE POWER	7256668.00	7256668.00	12/10/2014	15:24:42	Realtime	
										MAYU	66	9153	ACTIVE POWER	6517976.00	6517976.00	12/10/2014	15:24:47	Realtime	
										PPGH	66	8712	ACTIVE POWER	0.00	0.00	12/5/2014	10:53:03	Realtime	
										PPGH	66	8728	ACTIVE POWER	0.00	0.00	12/5/2014	10:53:03	Realtime	
										VIVH	66	9613	ACTIVE POWER	26981630.00	26981630.00	12/10/2014	15:24:44	Realtime	
										VIVH	66	9626	ACTIVE POWER	27175210.00	27175210.00	12/10/2014	15:24:40	Realtime	
										CBDS	33	8301	ACTIVE POWER	0.00	0.00	12/10/2014	13:49:24	Realtime	
										GEET	33	8690	ACTIVE POWER	0.00	0.00	12/7/2014	12:11:20	Realtime	
										GANG	33	8815	ACTIVE POWER	5329376.00	5329376.00	12/10/2014	15:23:58	Realtime	
										GANG	33	8808	ACTIVE POWER	7501403.00	7501403.00	12/10/2014	15:24:00	Realtime	
										KARK	33	9025	ACTIVE POWER	15942900.00	15942900.00	12/10/2014	15:24:48	Realtime	
										KARK	33	9041	ACTIVE POWER	-11580070.00	-11580070.00	12/10/2014	15:24:43	Realtime	
										PREE	33	9371	ACTIVE POWER	0.00	0.00	12/10/2014	14:46:34	Realtime	
										SHAK	33	9455	ACTIVE POWER	0.00	0.00	12/10/2014	10:18:34	Realtime	
										MDRY	33	9222	ACTIVE POWER	-4173024.00	-4173024.00	12/10/2014	15:24:50	Realtime	
										SMIN	33	9385	ACTIVE POWER	0.00 <	0.00			Realtime	
										KOND	66	9103	ACTIVE POWER	22322110.00	22322110.00	12/10/2014	15:24:38	Realtime	
										KOND	66	9101	ACTIVE POWER	0.00	0.00	12/10/2014	15:24:38	Realtime	
										PPGA	66	9299	ACTIVE POWER	-22419650.00	-22419650.00	12/10/2014	15:24:24	Realtime	
										VIVH	66	9621	ACTIVE POWER	0.00	0.00	12/10/2014	14:03:26	Realtime	
										GEET	33	8689	ACTIVE POWER	4456202.00	4456202.00	12/10/2014	15:24:31	Realtime	
										GEET	33	8693	ACTIVE POWER	8998342.00	8998342.00	12/10/2014	15:24:39	Realtime	
										KANG	33	8918	ACTIVE POWER	8403259.00	8403259.00	12/10/2014	15:24:44	Realtime	
										KANG	33	8920	ACTIVE POWER	8841516.00	8841516.00	12/10/2014	15:24:40	Realtime	
System Load Data			Over Drawl			Over Drawl			Over Drawl										
			Limit1			Limit2			Limit3										
			0.00			0.00			0.00										

FREQUENCY BASED LOAD SHEDDING SCHEME($f > 49.85, OD > 57$)

PAGE:2



WORKING(SUB PROGRAM)

- Manually Enter the total MW to be shed in case of abnormal OD condition.
- List of Breakers are specified in 4 groups. Each group have 'n' number of breakers which is to be considered by SPL program during OD load scheme.
- Each group shall be operated in rotational manner in case of OD.
- The SPL program schedules each group breakers in descending order with respect to their actual MW.
- The program monitors the BRPL OD and frequency continuously.

-
- If Actual OD (A.OD) is greater than the Desired OD (D.OD) and the frequency (f) is greater than 49.85, the difference between the A.OD and D.OD is calculated and the obtained value (S.MW=MW to be Shed) of MW will be shed by the program in rotational manner of breaker groups.
 - The program sums up the MW of the each group specified from top and when it reaches the value i.e.(A.OD-D.OD=S.MW), it sheds the corresponding breakers.
 - An FBLSD event for the breakers opened appears in SCADA.

Integrated Demand Side Scheduling Software

Apart from deviation in demand forecasting, OD / UD in real time also occurs due to :-

- supply side issues like tripping of major generating station.
- Extreme weather conditions.
- Unavailability/Down time of scheduling portal.

Hence, need for integrated demand side scheduling software.

Real time Market

With increased footprint of renewable (but being infirm in nature):-

- Real time market need to be in place in order to avoid jerk in the system due to sudden outage of renewable generation.
- Fast ramping stations need to be in healthy condition to cater to the system requirements.

Queries

- Is shedding linked with frequency or based on real time OD values?
- Real time SCADA measurement varies wrt ABT Data. Are we working towards making the ABT Data available online in real time?

Thank You

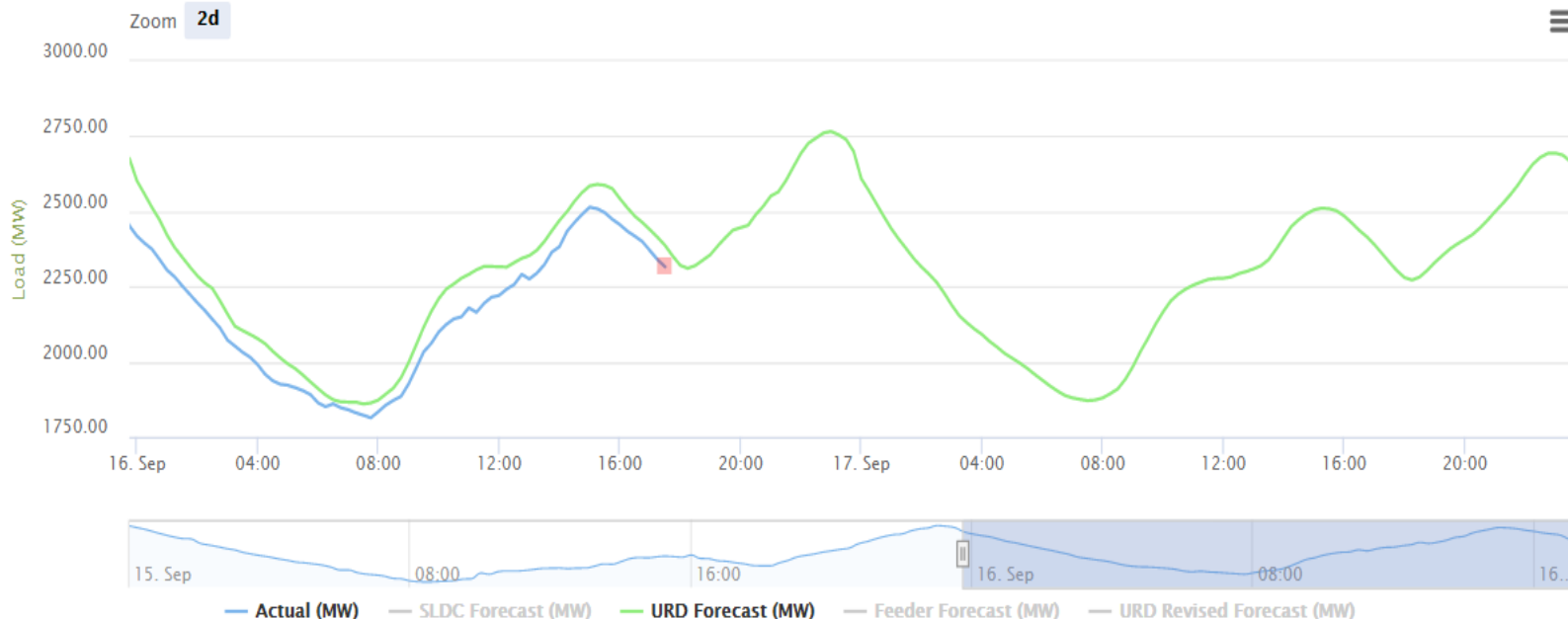
BSES Rajdhani Power Ltd.

Demand Forecasting

Demand Forecasting at BRPL is being done through use of Machine Learning and Artificial Intelligence tools. The forecasting engine gathers the load series, time derivatives of this load series as well as external parameters, i.e. weather to capture normal and peak behaviour.

Dashboard - Day Ahead Demand Forecasting

Day Ahead Load Forecast vs Actual Load for Date 17-09-2019



Forecast Reports

Day Ahead Demand Forecasting MAPE achieved ~ 4%

Dashboard – Intraday Scheduling

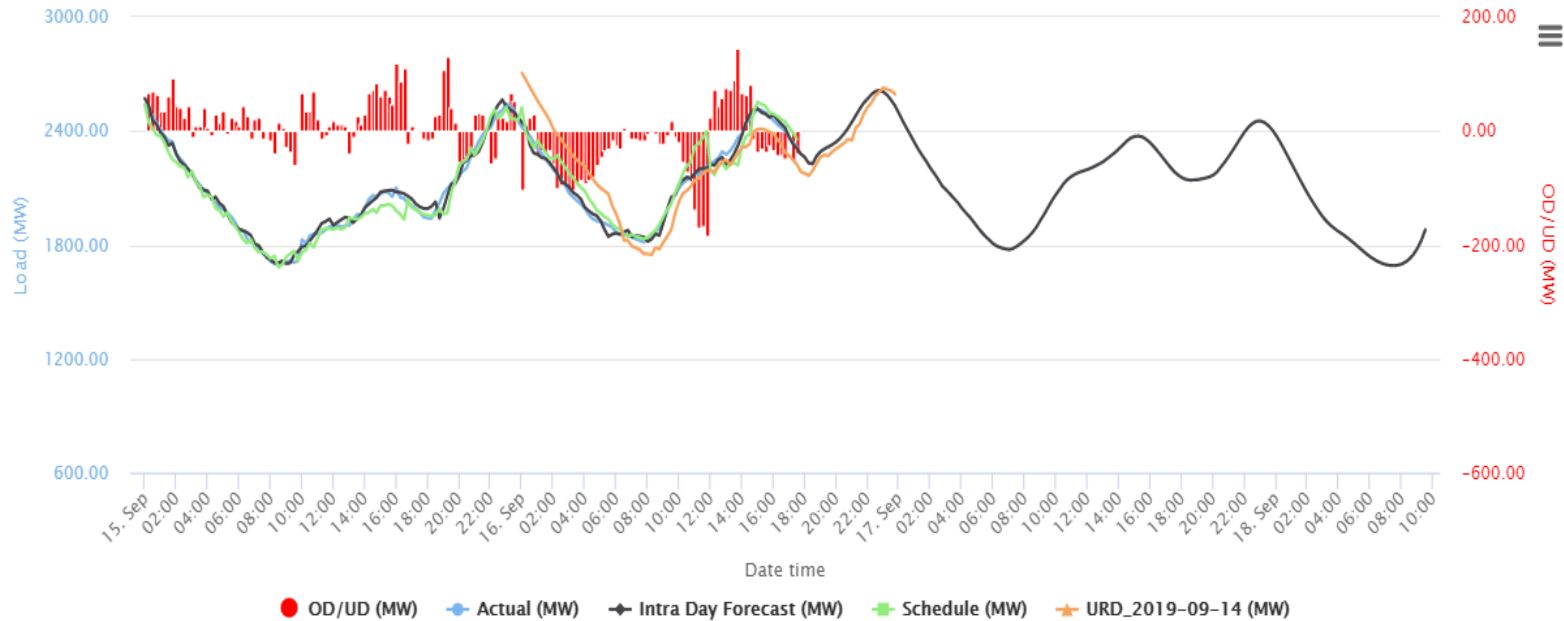
153

153

2019-09-14

Intra-Day Load Forecast vs Actual Load for Date 16-09-2019


Download




Scheduling MAPE achieved < 3%

Commercial operation issues (related to Schedule, SCED, Ramp rate etc)

Presented by:
Rajesh chaurasiya
NTPC-Dadri



→ Peaks and valleys of SG in the subsequent blocks, leads to either over or under generation.

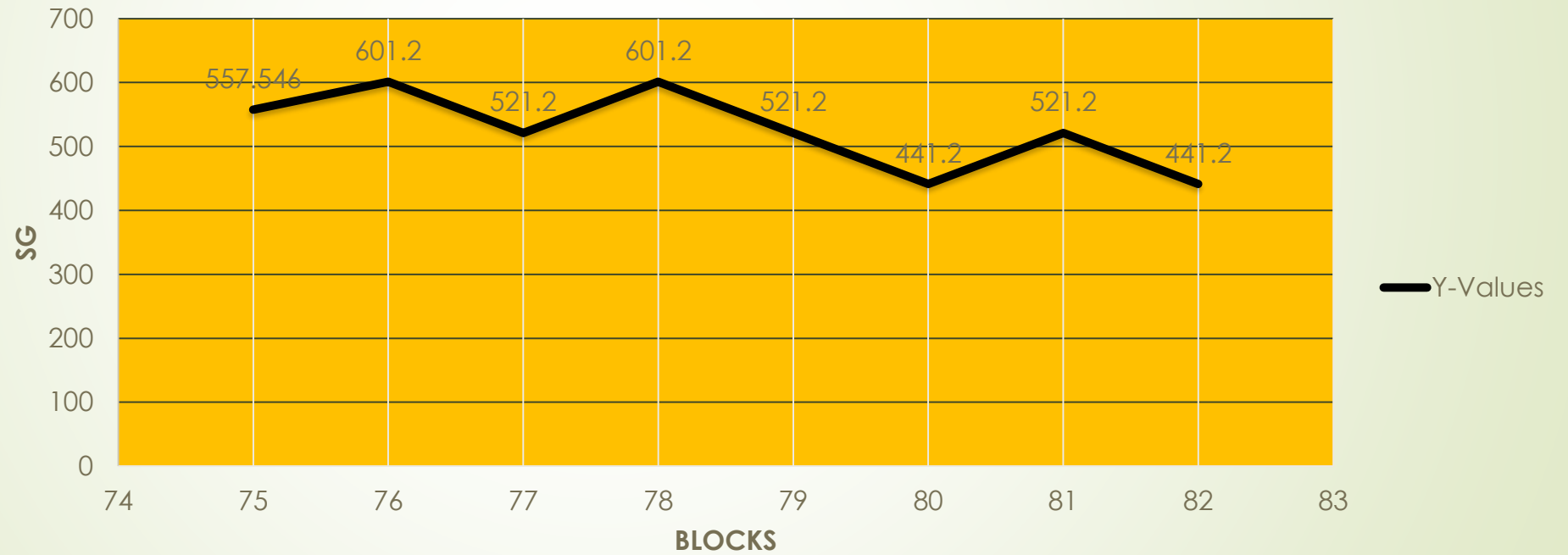


PEAKS AND VALLEYS-EXAMPLE

03.09.2019		Stage-1			
BLOCK	TIME	SG	RRAS	SCED	NET SG
75	18:30-18:45	693.076	0	-210.19	557.546
76	18:45-19:00	729.096	0	-167.22	601.2
77	19:00-19:15	768.6	0	-247.4	521.2
78	19:15-19:30	768.6	0	-167.4	601.2
79	19:30-19:45	768.096	0	-247.4	521.2
80	19:45-20:00	768.096	0	-327.4	441.2
81	20:00-20:15	767.096	0	-247.4	521.2
82	20:15-20:30	762.2277	0	-327.4	441.2
	PEAK				
	VALLEY				

PEAKS & VALLEYS - EXAMPLE

PEAKS & VALLEYS



Month-August

Consecutive Peaks and valleys

DATE	STAGE-1	STAGE-2
1	1	3
2	1	1
3	1	2
4	1	2
5	2	2
6	1	1
7	0	2
8	2	1
9	3	1
10	0	1
11	3	3
12	4	2
13	2	2
14	2	1
15	0	0
16	0	3
17	2	0
18	3	2
19	1	3
20	3	3
21	2	2
22	1	4
23	2	3
24	1	4
25	2	3
26	4	0
27	1	0
28	4	2
29	5	0
30	2	2
31	2	2

TOTAL 58 57

GRAND TOTAL 115



- 
- ➔ Revision of SG within the running block, leads to either over or under generation.
- 

Revision of SG within running block- EXAMPLE

DATE	27.08.2019	STG-1	REVISION	127	TIME	14:50
BLOCK TIME		SG	RRAS	SCED	NET SG	
59	14:30-14:45	495.1661	55	-233.11	317.0561	
60	14:45-15:00	456.1661	34	0	490.1661	
61	15:00-15:15	514.1661	0	0	514.1661	
DATE	27.08.2019	STG-1	REVISION	128	TIME	14:52
BLOCK TIME		SG	RRAS	SCED	NET SG	
59	14:30-14:45	495.1661	55	-233.11	317.0561	
60	14:45-15:00	456.1661	34	-173.11	317.0561	
61	15:00-15:15	514.1661	0	-197.11	317.0561	
	INITIAL SG					
	REVISED SG					


REVISION WITHIN THE SAME BLOCK- AUGUST MONTH

DATE	BLOCKS IN STG-1	BLOCKS IN STG-2
18.08.2019	83	
27.08.2019	60	
TOTAL	2	


- 
- Revision of SG just before starting of Block through RRAS/SCED, where in the previous revision SG was increasing for upcoming block and since there is momentum to increase load, this sudden reduction of SG leads to over generation despite the best efforts put in.
- 

REVISION OF SG BEFORE STARTING OF BLOCK-EXAMPLE

DATE	30.07.2019	STG-2	REVISION	175TIME	20:06HRS
BLOCK TIME	SG	RRAS	SCED	NET SG	
8220:15-20:30	852.512284	0	-169.75	758.8	
8320:30-20:45	912.472284	0	0	928.55	
8420:45-21:00	895.182284	0	0	928.55	
DATE	30.07.2019	STG-2	REVISION	176TIME	20:23HRS
BLOCK TIME	SG	RRAS	SCED	NET SG	
8220:15-20:30	852.512284	0	-169.75	758.8	
8320:30-20:45	912.472284	0	-269.75	658.8	
8420:45-21:00	895.182284	0	0	928.55	
	INITIAL SG				
	REVISED SG				



➔ SG sometimes is given below technical minimum.





SG BELOW TECHNICAL MINIMUM-EXAMPLE

20.08.2019		Stage-1			
BLOCK	TIME	SG	RRAS	SCED	NET SG
	100:00-00:15	628.7471	0	-286.01	342.7371
	200:15-00:30	555.14	0	-286.01	269.13
	300:30-00:45	500.14	0	-286.01	214.13
	400:45-01:00	580.14	0	-286.01	294.13
	501:00-01:15	511.55	0	-286.01	225.54
20.08.2019		Stage-2			
BLOCK	TIME	SG	RRAS	SCED	NET SG
	100:00-00:15	367.6908	0	-162.64	205.3508
	200:15-00:30	349.6419	0	-162.64	187.3019
	300:30-00:45	349.6669	0	-162.64	187.3269
	400:45-01:00	399.6669	0	-162.64	237.3269
	501:00-01:15	414.3861	0	-162.64	252.0461

		Below Tech Min.
Stg-1	Tech min with 4 units	422
Stg-2	Tech min with one unit	255.5

SG BELOW TECHNICAL MINIMUM- AUGUST


DATE	BLOCKS IN STG-1	BLOCKS IN STG-2
01.08.2019		7,8
05.08.2019	52,57	56,57,58
10.08.2019	1,2,3,4	
14.08.2019	85	39,46,54,85
20.08.2019	1,2,3,4,5	1,2,3,4,5
21.08.2019	75	75
28.08.2019	32,33	
29.08.2019	4,5	
30.08.2019		52
TOTAL	17	16

- 
- ➔ NRLDC site/ link failure also leads to deviation in AG and SG as during link failure no SG is visible to generator and continue to run AG in reference to SG pre-failure block. But on revival of link SG changes suddenly to different value, leads to either over or under generation.
- 


NRLDC site/ link failure- EXAMPLE

On 27.08.2019, NRLDC site was not operational from 1430 to 1515hrs

Date	27.08.2019	Stage-1	Revision	131 TIME	15:18HRS		
Block No	Time Block	DC(MW)	SG(MW)	AGC AVG	SG+ AGC(M W)	AG(MW)	Frequency
59	14:30-14:45	576.45	312.94	0	312.94	312	49.83
60	14:45-15:00	576.45	314.05	0	314.05	333.48	49.86
61	15:00-15:15	576.45	313.87	0	313.87	333.01	49.92
62	15:15-15:30	576.45	557.83	0	558	302.64	49.87
	NRLDC Link Failure						
	NRLDC Link Revival						



➔ Inappropriate Ramp up and Ramp down of SG also leads to either over or under generation.



Inappropriate Ramp - EXAMPLE

20.08.2019		Stage-1			
BLOCK	TIME	SG	RRAS	SCED	NET SG
79	19:30-19:45	577.07	0	-154.34	422.73
80	19:45-20:00	600.07	0	-177.34	422.73
81	20:00-20:15	620.07	0	0	620.07
82	20:15-20:30	661.54	0	0	661.54
83	20:30-20:45	671.65	0	0	671.65
	Inappropriate Ramp				
	Allowed Ramp	20MW/block/unit (80MW/block)			

INAPPROPRIATE RAMP- AUGUST

DATE	PREVIOUS BLOCK(MW) IN STG-1	LATEST BLOCK(MW) IN STG-1	PREVIOUS BLOCK(MW) IN STG-2	LATEST BLOCK(MW) IN STG-2
13.08.2019	6 (413.85MW)	7 (637.98)	16(510.7MW)	17(643.07)
18.08.2019	95(422.73MW)	96(762.60MW)		
20.08.2019	5(225.54MW)	6(510.85MW)		
27.08.2019	96(333.98MW)	1(531MW)		
29.08.2019	5(415.73MW)	6(673.22)	5(325MW)	6(418.39MW)
TOTAL		5		2

SUMMARY OF PROBLEMS- AUGUST

STAGE	CONSECUTIVE PEAKS & VALLEYS	REVISION WITHIN THE BLOCK	SG BELOW TECHNICAL MINIMUM	NRLDC LINK FAILURE	INAPPROPRIATE RAMP
1	58	2	17	1	5
2	57	0	16		2
TOTAL	115	2	33	1	7



THANK YOU



NTPC DADRI



WELCOMES YOU ALL

NTPC Dadri- Technical constraints at continuous running of Units at minimum technical load

1. Equipment issues
2. Efficiency issues
3. Operational challenges due to SCED

EQUIPMENT ISSUES

1. Affecting the flexibility in Mill combination – Due to continuous minimum load operation lower mill combinations are not kept in service as it leads to very low steam parameters. Only preferred mill combinations are done.
2. Mill changeover in case of any Mill problem leads to over generation (against the grid discipline) due to flame disturbance risk at low fuel firing.
3. Scheduled preventive maintenance of mid-elevation Mills is constrained to avoid poor flame condition in split mill combination. This leads to poor performance of upper mills and consequent breakdown.
4. Other major equipment changeover like Boiler Feed pump is also risky at minimum load due to Drum level fluctuations.
5. Low steam pressure operation of turbine is done to keep the steam inlet valves open in normal range. This adversely affects the unit up ramp rate.
6. NTPC Dadri being a non-pit head plant receives variety of coal including imported coal leading to wide variation in specific coal consumption. This leads to flame instability at low load and sometimes oil support is also required to be taken for flame support.
7. Routine operations like Wall soot blowers and Long retractable soot blower operation are not recommended at minimum load as it may lead to flame disturbance. This leads to clinkering tendency in the boiler leading to risk of boiler tube leakage and subsequent tripping.

EFFICIENCY ISSUES

1. Non adherence to wall blowing and LRSB schedule leads to soot deposition in the furnace causing slagging and poor heat transfer and adversely affects boiler efficiency.
2. Excess oxygen level kept is much higher to maintain minimum secondary air for flame stability at minimum load. It leads to dry flue gas losses in the boiler.
3. Due to minimum coal firing and 3 mill operation, steam parameters achieved are much lower than the design, leading to higher heat rate.
4. All auxiliaries are running with higher specific power as they are designed for full load operation. The problem has been addressed in ID fans by providing variable frequency drive but it is not possible for most of other equipments.
5. The turbines are throttle governing design which run efficiently at full load. Low load operations are resulting in throttling losses in turbines.
6. Running at low load is causing more than allowable difference in left and right side steam temperatures. This may cause long term damage to the machine leading to higher life time consumption of machines.
7. As man power is a national resource, running all the units at minimum load is resulting in consumption of more Man power/Mw generation compared to running fewer units at higher load.

Average value of important parameter

AVG DATA (Average till August 15 th)			Unit-1	Unit-2	Unit-3	Unit-4		Unit-5
PARAMETERS	Unit	Design Value	Parameter	Parameter	Parameter	Parameter	Design Value	Parameter
Generation	MW	210	123	124	125	126	490	321
MS Pr	KSC	150	108	107	114	116	170	162
MS Temp	Deg C	537	533	535	533	537	537	533
HRH Temp	Deg C	537	518	520	526	518	565	522
Feed Water Temp before ECO	Deg C	247	213	225	219	218	252	231
DFG Exit Temp	Deg C	136	125	132	129	130	125	125
Dry Flue Gas -Excess air at ECO O/L	%	3.54	4.35	5.45	4.74	5.00	3.54	3.8

Total Reserve Shutdown and Unit trip on Boiler problem

	2017-18	2018-19	2019-20 till Aug-19
Total Reserve shutdown	18	11	11
Unit trip due to Boiler & Aux problem including tube failure	6	9	4

Thank You

State Forecast – File Status August -2019

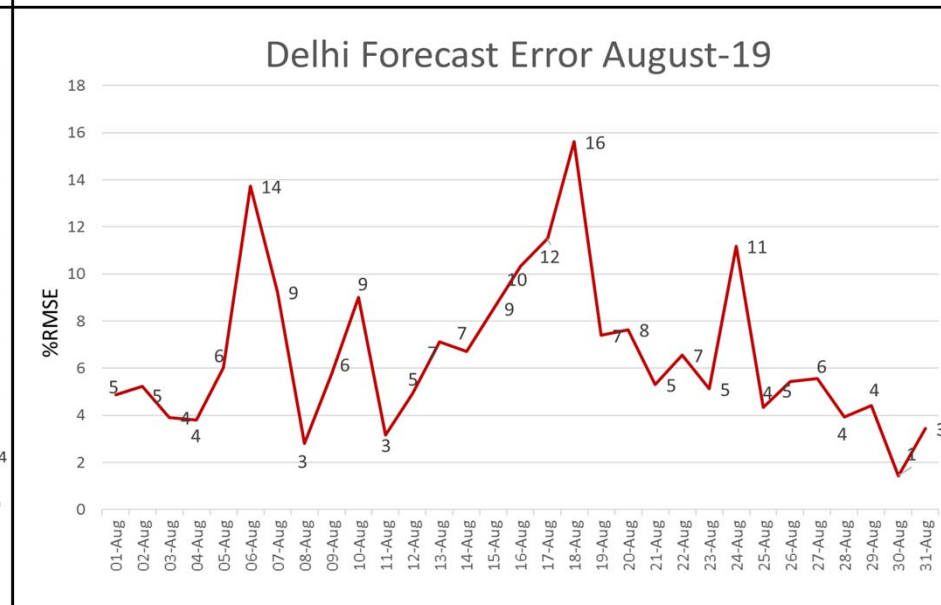
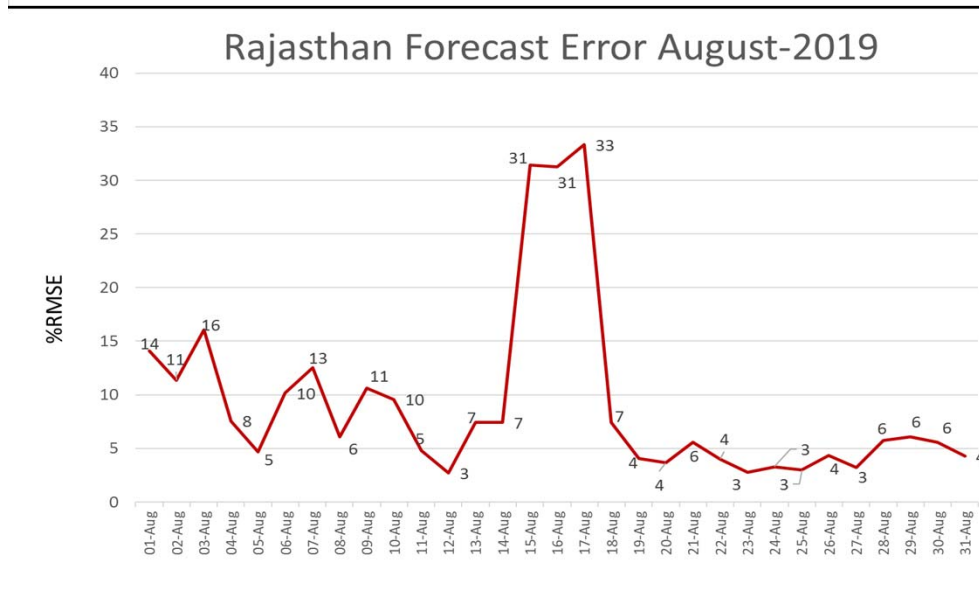
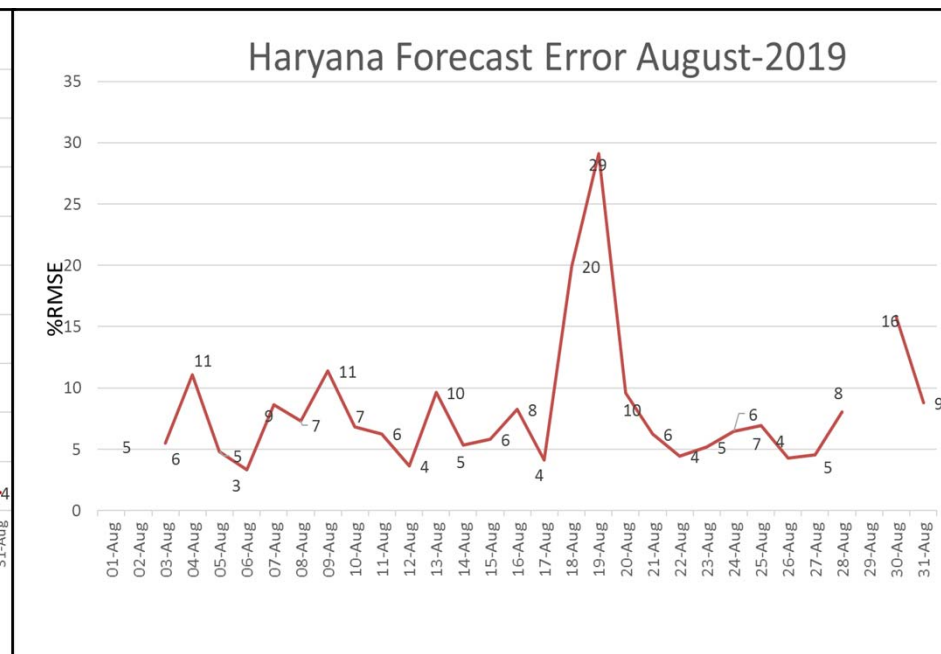
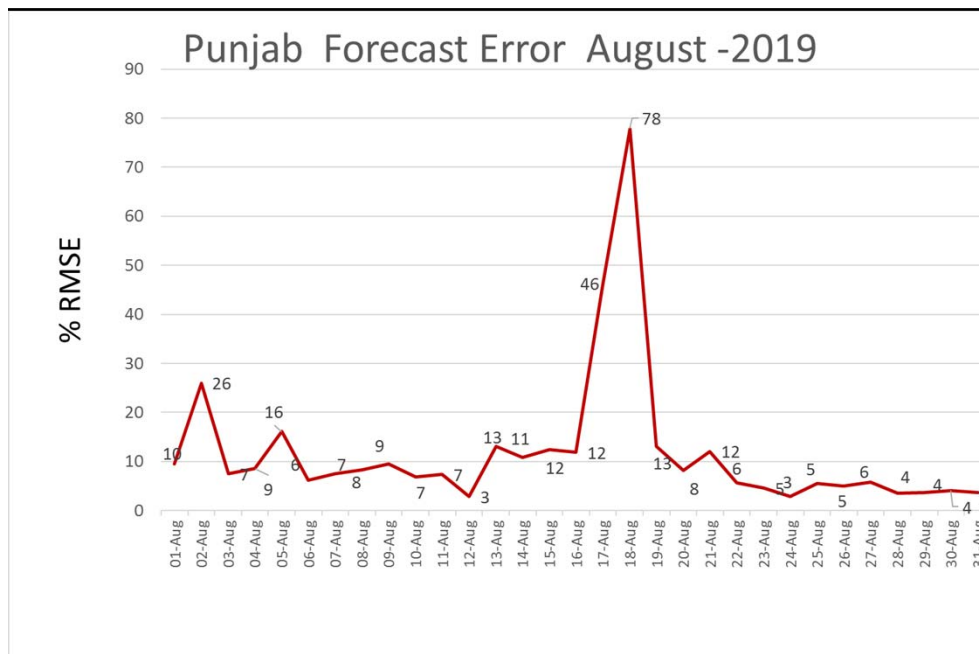


S. No.	State	Forecast File	
		Received	Not Received/ Remarks
1	Punjab	Yes	Uploaded but some day after 09:00 Pm and 11:00 PM
2	Haryana	Yes	Not received on 02 & 29 August 2019 and uploaded on same day on 13 and 27 august
3	Rajasthan	Yes	-
4	Delhi	Yes	
5	Uttar Pradesh	Yes	
6	Uttarakhand	Not regular	Uploaded on same day on 05,16,24 and 26 Aug 2019
7	Himachal Pradesh	Not regular	File not uploaded on 13.08.2019 and on 05,27, 29 and 30 uploaded on same day
8	Jammu & Kashmir	Yes	
9	Chandigarh	Yes	

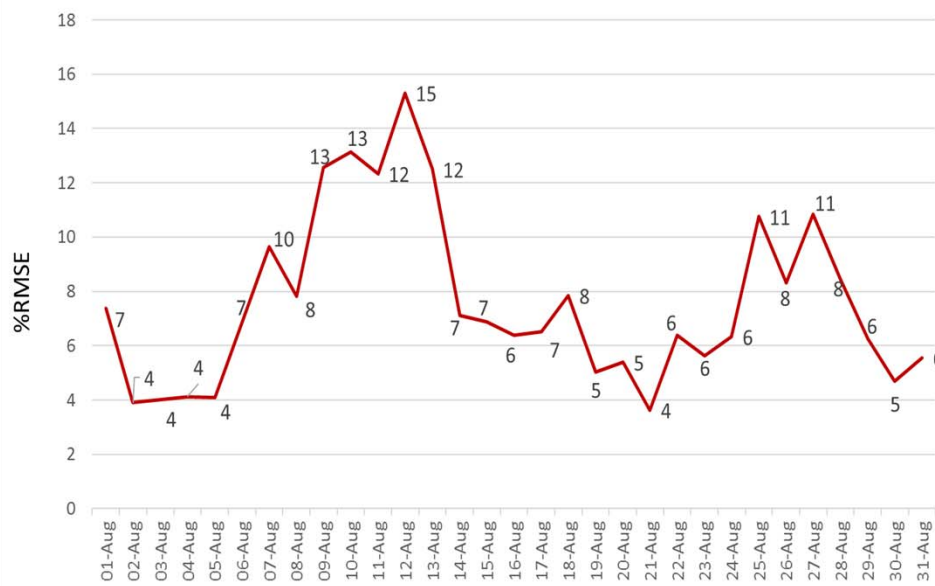
Each SLDC shall upload day ahead load Forecast File by 5:00 pm



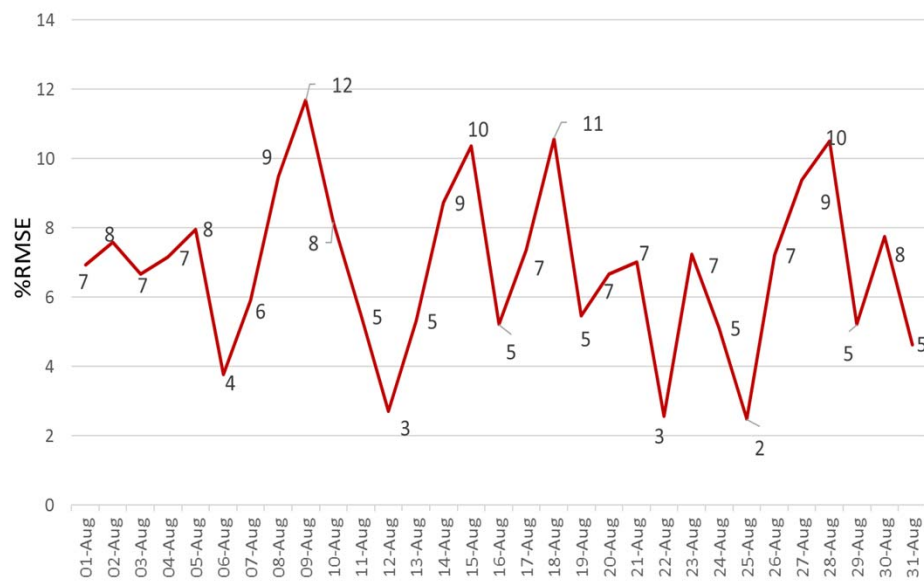
Load Forecast Error



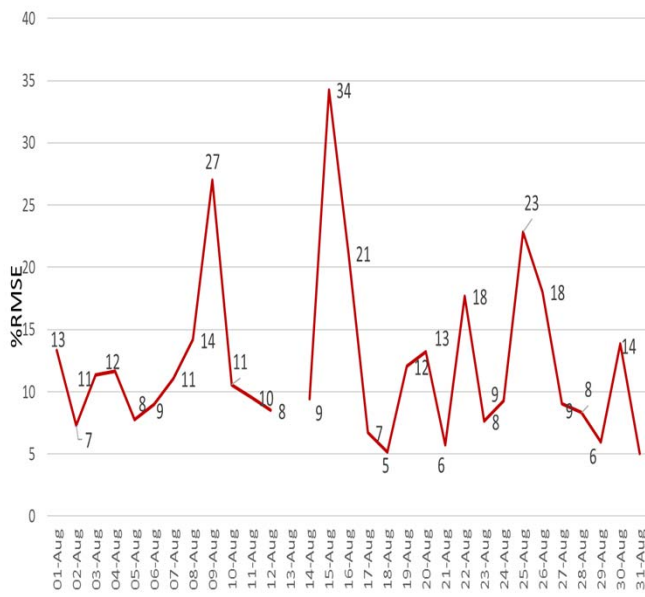
UP Forecast Error August-2019



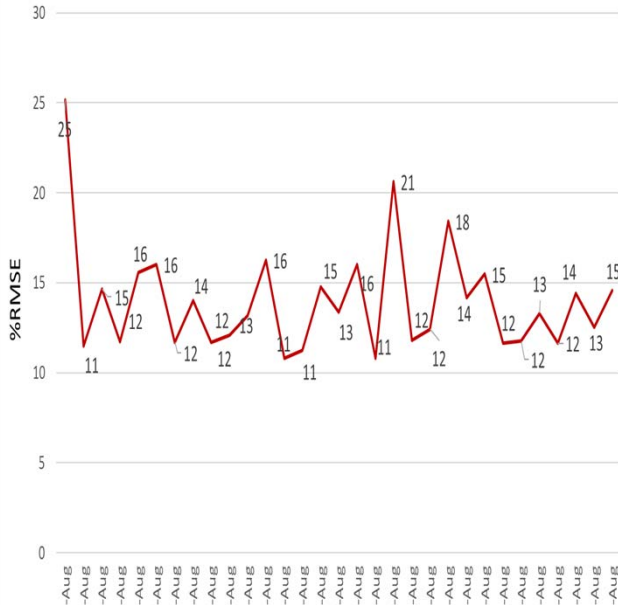
Uttarakhand Forecast Error August-19



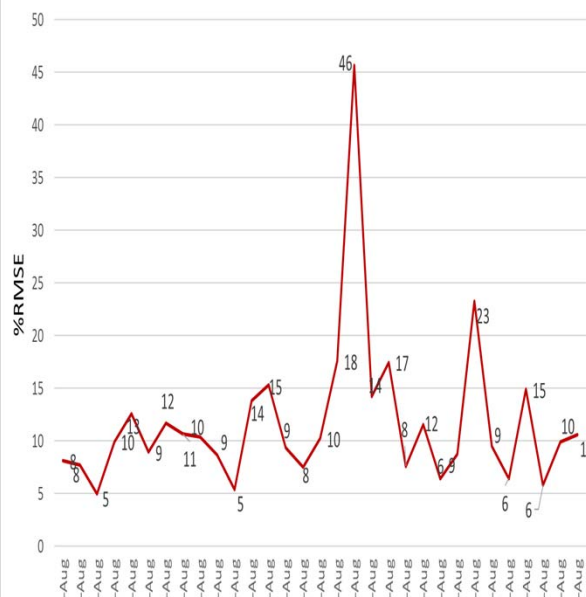
HP Forecast Error August-19



J&K Forecast Error August-19



Chandigarh Forecast Error August-2019



Annexure-VII

S.No.	Agency	Station trial tested	Status of other station/trial testing schedule	Remarks
1.	NHPC HEPs of NR	Chamera-1 Unit #2 and Chamera-2 unit #3	NHPC shared that synchronous condenser operation is possible only in Chamera-II HEP, other NHPC plants have design limitations	MoM of 42 nd TCC & 45 th NRPC meeting
2.	Tehri HEPs	Tehri Unit #1 & 2	Tehri Unit # 3 & 4	
3.	Punjab HEPs	OEM has confirmed capability of RSD to operate in condenser mode.	Punjab may update the plan for trial schedule	
4.	Rajasthan HEPs	Jawahar Sagar HEPs and Rana Pratap Sagar can't operate in synchronous condenser mode due to old age	SLDC Rajasthan may like to confirm	
5.	Uttar Pradesh HEPs		SLDC UP may like to confirm	
6.	Uttarakhand HEPS		SLDC Uttarakhand may like to confirm	
7.	Himachal Pradesh HEPs	Larji Unit #3	SLDC HP may update the status	
8.	Jammu & Kashmir HEPs		SLDC J&K may p update the status	
9.	BBMB HEPs	Pong HEPs	BBMB may update for other stations	
10.	NTPC Gas station	NTPC informed that due to clutch arrangement issue the gas stations Anta, Auraiya, Dadri, Bawana are not capable of running in Condenser mode.		(MoM of 139 th OCC)

11.	Delhi Gas station		Delhi may update regarding exploring of Old GTs for operation in condenser mode	
12.	Uttarakhand Gas stations	Shrvanti expressed its inability to operate in condenser mode	SLDC Uttarakhand may Update of other gas station	142 nd OCC

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NLDC	General Manager, NLDC, Fax: 011-26853488/26601079
Lanco APTL	Sh. Raj Kumar Roy, Director, Fax: 0124-2341627/4741024
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