

North Eastern Regional Power Committee

MINUTES OF THE 128th OPERATION COORDINATION

SUB-COMMITTEE MEETING OF NERPC

Date : 19/01/2017 (Thursday)
Time : 10:00 hrs
Venue : "Hotel Nandan", Guwahati.

The List of Participants in the 128th OCC Meeting is attached at **Annexure - I**

Shri P.K. Mishra, Member Secretary, NERPC welcomed all the participants to the 128th OCC meeting. He noted the presence of participants from all the utilities except NHPC. Member Secretary congratulated everyone for making the OCC forum a success. He also thanked all the organizations for attending the meeting in large numbers in view of the felicitation of retiring members.

Thereafter, Member Secretary requested Shri B. Lyngkhoi, Director/SE(C&O) to take up the agenda items for discussion.

A. CONFIRMATION OF MINUTES

CONFIRMATION OF MINUTES OF 127th MEETING OF OPERATION SUB-COMMITTEE OF NERPC.

The minutes of 127th meeting of Operation Sub-committee held on 14th December, 2016 at Guwahati were circulated vide letter No. NERPC/SE (O)/OCC/2016/4556-4591 dated 26th December, 2016.

Item No. D.27:

Recorded: "DGM(AM), NERTS informed that for one-and-half breaker scheme the tie breakers should always be in service. In case it is required to isolate any feeders/generators, disconnectors are to be kept open. OTPC agreed."

Modification by OTPC:

"OTPC representative response to forum was OTPC will see the possibility to keep TIE in service as our TIE breaker cannot be in service if respective generation is not available, OTPC agrees to see possibility at their end."

Views of NERLDC

If all the bays of the dia are available then these bays should be taken into service so that dia can be complete. OTPC is requested to follow this guideline.

The Sub-committee confirmed the minutes of 127th OCCM of NERPC with the above modifications as no further comments/observations were received from the constituents.

ITEMS FOR DISCUSSION

B.1. ACTION TAKEN:

DIFFERENCE IN ACTUALS VS LGBR:

Energy Requirement:

Name of State	Oct16 (actual)	Oct16 (LGBR)	Nov16 (actual)	Nov16 (LGBR)	Dec16 (actual)	Dec16 (LGBR)
Ar. Pradesh	63.04	73	58.87	68	62.50	68
Assam	834.99	816	706.25	714	685.17	714
Manipur	64.22	85	62.19	88	70.84	95
Meghalaya	149.79	185	136.75	195	144.88	210
Mizoram	40.17	46	42.74	46	48.88	48
Nagaland	68.16	74	59.82	68	62.99	71
Tripura	131.88	133	53.00	112	58.81	122
NER	1352.26	1412	1119.62	1291	1134.05	1328

Energy Availability:

Name of State	Oct16 (actual)	Oct16 (LGBR)	Nov16 (actual)	Nov16 (LGBR)	Dec16 (actual)	Dec16 (LGBR)
Ar. Pradesh	61.67	67	57.73	52	61.39	54
Assam	812.85	648	694.49	567	669.55	580
Manipur	61.72	95	60.66	81	69.56	76
Meghalaya	149.79	209	136.75	150	144.88	138
Mizoram	38.90	54	41.52	48	47.66	44
Nagaland	66.71	71	58.56	55	61.77	54
Tripura	130.59	225	51.96	211	58.14	224
NER	1322.23	1370	1101.68	1163	1112.96	1171

Demand:

Name of State	Oct16 (act)	Oct16 (LGBR)	Nov16 (act)	Nov16 (LGBR)	Dec16 (actual)	Dec16 (LGBR)
Ar. Pradesh	128	143	127	132	131	132
Assam	1673	1513	1531	1508	1388	1518
Manipur	145	163	152	179	161	184
Meghalaya	300	415	312	425	310	430
Mizoram	95	95	97	95	97	101
Nagaland	130	140	128	135	127	135
Tripura	284	321	266	275	230	260
NER	2466	2790	2377	2749	2245	2760

It has been observed that there is considerable difference in case of Manipur, Meghalaya and Tripura. Previous OCC forums had requested that states may check the reasons for such variation as to whether due to forecasting error or other reasons, and intimate.

Deliberation of the sub-Committee:

After detailed deliberation it was concluded that as per presentation by SLDC Meghalaya on 18.01.2017 the main reason for deviation from LGBR figures is the unreliable forecast given by OA consumers. The drawal of OA consumers has been found to be vacillating and this has resulted in the deviation for 2016-17. Members appreciated the analysis of SLDC Meghalaya and requested to keep higher tolerance in forecast for 2017-18. Manipur and Tripura were requested to intimate the reasons for deviation by next OCC meeting.

The Sub-Committee noted as above.

Action: MSPCL, TSECL.

2. IMPLEMENTATION OF PROJECTS FUNDED FROM PSDF:

State	Protection System	ADMS	CAPACITOR INSTALLATION
Arunachal Pradesh	Approval from the Govt. is awaited	DPR will be submitted soon to CEA & NLDC	Study is in progress and the same will be submitted to NERPC for approval
Nagaland	LOAs already completed and works is likely to be completed by 30.09.2017	DPR will be submitted soon to CEA & NLDC	DPR will be submitted soon to CEA & NLDC
Mizoram	By Mar'17 all LOAs would be issued.	DPR will be submitted soon to CEA & NLDC	DPR will be submitted soon to CEA & NLDC
Manipur	By June'17 all LOAs would be issued.	DPR will be submitted soon to CEA & NLDC	DPR preparation stage
Tripura	By June'17 all LOAs would be issued.	DPR will be submitted soon to CEA & NLDC	-
Assam	By June'17 all LOAs would be issued.	DPR will be submitted soon to CEA & NLDC	
Meghalaya	LOA for 20 Cr. Tender for 20 Cr. Additional LOA for 10Cr. by 31.01.17 Remainder by Mar'17	DPR to be prepared	DPR to be prepared.

The Sub-Committee noted as above.

3. Reasons For Demand - Supply Gap And Its Variation:

It was deliberated in the 4th NPC meeting that monthly power supply position prepared & published by CEA based on the data furnished by the states reflected shortages in almost all the states. However, a number of those states intimated adequate availability of power. This meant that the deficit/shortage in such states was actually not the deficit in true sense but demand-supply gap due to reasons other than shortage of power. The other reasons for the demand-supply gap could be inadequate availability of power, transmission constraint, distribution constraint, financial constraint, etc. The reason for demand-supply gap needed to be clearly mentioned to reflect true picture of power supply position in different states and also to invite attention of various agencies including policy makers to the specific problem areas in the power sector for suitable solution.

After deliberation it was decided in the meeting that all the RPCs would advise the states in their respective regions to intimate broad break-up of demand-supply gap due to various reasons, or at least, the main reason(s) for demand-supply gap in each month.

In 126th OCCM, S.E.(C&O),NERPC informed the forum that as per communication received from GM Division CEA, unscheduled load shedding and scheduled load shedding for peak demand met instance is to be provided. Accordingly, all the constituents & NERLDC were requested to indicate the latter from November, 2016 onwards. The forum requested DoP Ar. Pradesh, MSPCL and DoP Nagaland to submit the shortfall figures periodically.

In 127th OCCM, S.E.(C&O), NERPC once again requested the SLDCs to indicate breakup of short fall figures clearly. He requested NERLDC to provide the breakup in monthly reports clearly and highlight the cases where not provided.

NERLDC expressed that differences are coming up on account of several reasons, and proper accounting of captive load and generation is to be done by SLDCs. In case the captive power consumption is not included, the overall demands met of the states are reflecting less than actual. All SLDCs were requested to check and reflect the captive generation figures in their daily operational reports.

NERPC will circulate the Installed Capacity figures compiled by them for ratification by all.

Deliberation of the sub-Committee:

S.E.(C&O), NERPC stated that currently no CPP figures are being received by NERPC. This is leading to improper shortfall calculation in monthly Power Supply Position. Also shortfall figures are not being classified as scheduled load shedding, unscheduled load shedding or shortfall due to system constraints. He requested all SLDCs to kindly clarify the above in their daily report to NERLDC, in order to avoid improper reporting further on.

The Sub-Committee noted as above.

Action: All SLDCs.

4. Long Outage of Important Grid Elements:

Name of the Element	Name of Utility	Status
63MVAR Reactor at Byrnihat	MePTCL	SE, MePTCL informed that the matter is still being pursued with CGL.
400KV 80MVAR Bus Reactor At Palatana	OTPC	On 13.01.17 GM(C&M) has intimated BHEL to complete work within 31.01.17 or work would be given to other agency.

The Sub-Committee noted as above.

Action: MePTCL, OTPC.

B.2. OPERATIONAL PERFORMANCE AND GRID DISCIPLINE DURING DECEMBER, 2016

As per the data made available by NERLDC, the grid performance parameters for December, 2016 are given below:

NER PERFORMANCE DURING DECEMBER, 2016

States	Energy Met (MU)		w.r.t. Nov,16 % inc (+) /dec (-)	Energy Reqr. (MU)		w.r.t. Nov,16 % inc (+) /dec (-)	% inc (+) /dec (-) of energy reqr vs met. In Dec,16
	Dec-16	Nov-16		Dec-16	Nov-16		
Ar. Pradesh	61.39	57.73	6.34	62.50	58.87	6.17	-1.78
Assam	669.55	694.49	-3.59	685.17	706.25	-2.98	-2.28
Manipur	69.56	60.66	14.67	70.84	62.19	13.91	-1.81
Meghalaya	144.88	136.75	5.95	144.88	136.75	5.95	0.00
Mizoram	47.66	41.52	14.79	48.88	42.74	14.37	-2.50
Nagaland	61.77	58.56	5.48	62.99	59.82	5.30	-1.94
Tripura	58.14	51.96	11.89	58.81	53.00	10.96	-1.14
Region	1112.96	1101.68	1.02	1134.05	1119.62	1.29	-1.86

States	Demand Met (MW)		w.r.t. Nov,16 % inc (+) /dec (-)	Demand in (MW)		w.r.t. Nov,16 % inc (+) /dec (-)	% inc (+) /dec (-) of Demand vs met. In Dec,16
	Dec-16	Nov-16		Dec-16	Nov-16		
Ar. Pradesh	129	127	1.57	131	127	3.15	-1.53
Assam	1389	1524	-8.86	1388	1531	-9.34	0.07
Manipur	157	151	3.97	161	152	5.92	-2.48
Meghalaya	310	312	-0.64	310	312	-0.64	0.00
Mizoram	96	96	0.00	97	97	0.00	-1.03
Nagaland	127	126	0.79	127	128	-0.78	0.00
Tripura	231	266	-13.16	230	266	-13.53	0.43
Region	2223	2314	-3.93	2245	2377	-5.55	-0.98

REGIONAL GENERATION & INTER-REGIONAL EXCHANGE IN MU

AVERAGE FREQUENCY (Hz)

Month---->	Dec-16	Nov-16
Total Generation in NER (Gross)	1197.89	1180.98
Total Central Sector Generation (Gross)	844.02	947.74
Total State Sector Generation (Gross)	205.76	233.24
Inter-Regional Energy Exchange		
(a) NER-ER	177.63	33.07
(b) ER-NER	36.39	460.46
(c)NER-NR	18.34	401.67
(d)NR-NER	323.55	52.14
© Net Import	163.97	77.85

Month---->	Dec-16	Nov-16
	% of Time	% of Time
Below 49.9 Hz	11.22	9.28
Between 49.9 to 50.05 Hz	69.95	72.20
Above 50.05 Hz	19.26	18.50
Average	50.00	50.00
Maximum	50.31	50.27
Minimum	49.67	49.99

Sr. Engineer, NERLDC while presenting the grid performance in December 2016 also presented a report on the voltage profile. It was noted that in important 400kV nodes like Bongaigaon, Balipara, Biswanath-Chariali, Ranganadi, Misa, Azara and Byrnihat the voltage was greater than 420kV for more than 20% of the time. The forum viewed the situation as alarming and felt that all reactors under outage are to be put in service immediately.

NERLDC also mentioned that on real time, NERLDC is monitoring all the system parameters and requests the constituent of NER who are violating these parameters to take corrective action as per Operating Procedures of NER. NERLDC is also sending Reports on Voltage Deviation Index, Frequency Deviation Index and System Reliability on daily, weekly & monthly basis to all the Power Utilities of NER for taking corrective action as per Operating Procedures of NER, if required.

ITEMS FOR DISCUSSION

C.1 Status of Generating Units, Transmission Lines in NER:

During 128th OCC meeting, the status as informed by NTPC, NEEPCO, POWERGRID, DoP Ar. Pradesh and DOP, Nagaland is as follows:

SN	Items	Status as given in 128 th OCC Meeting	Status as given in 126 th OCC Meeting
a. New Projects			
1	Trial operation and CoD of Unit -II of Bongaigoan TPS of NTPC	Synchronization & CoD by 31.03.2017	Synchronization by January, 2017 & CoD by 31.03.2017
2	400/220kV, 2x315 MVA ICT of NTPC at Bongaigaon	1st 315 MVA ICT - To be charged within 21.01.17 2nd 315 MVA ICT - Not yet received at site	January, 2017
3	Trial operation and CoD 36MW STG of Monarchak GBPP of NEEPCO	Subject to gas availability	December, 2016 (subject to gas availability)
4	Kameng HEP of NEEPCO two units (2 x 150 MW) Next two units (2x150 MW)	Unit #1 Oct'17 Unit #2 Nov'17 Unit #4 Dec'17	Unit #1 Oct'17 Unit #2 Nov'17 Unit #4 Dec'17
5	Pare HEP of NEEPCO (2 x 55 MW)	Unit #1 July'17 Unit #2 Aug'17	Unit #1 July'17 Unit #2 Aug'17
6	400 kV D/C Silchar - Melriat line of PGCIL	June, 2017.	June, 2017.
7	220kV Rangia - Salakati of AEGCL	June 2017	December, 2016
8	132kV Monarchak – Surjamaninagar D/C of TSECL	July, 2017	March, 2017
9	400/132 kV, 2nd 125 MVA ICT at Pallatana	Synchronized on 08.10.2016 COD expected by 31.01.2017	Synchronized on 08.10.2016 COD expected by 25.12.2016
10	132kV Pasighat – Aalong of Ar. Pradesh	January, 2017.	December, 2016.

11	132kV Doyang- Wokha	Doyang end bay work complete. Line to be charged at mutually agreeable date.	December, 2016.
12	220 kV, 20 MVAR Line Reactor& bay at AGBPP on 220 kV NewMariani – AGBPP line	NEEPCO site not ready (hydrant and fire extinguisher) Trial operation by 31.01.17.	15.12.2016 -test charged 20.12.2016 - CoD
13	132kV Surjamaninagar Bay at OTPC	31.08.2017	31.08.2017
14	400kV D/C Balipara – Kameng	March 2017.	March 2017.
15	RHEP 80 MVAR Bus Reactor	Tendering in process.	Tendering in process.
16	SLDCs (Ar. Pradesh, Manipur, Mizoram, Nagaland)	Manipur – Jan'17, Mizoram-Feb'17, Nagaland-Building ready and handed over, AP-Complete Building handover not done.	Manipur - Dec'16, Mizoram- Jan'17, Nagaland-handover of building by Dec'16, AP- Work started.
17	400/220 kV 315 MVA ICT-II at Bongaigaon	Manufacturing stage	Manufacturing stage
18	220/132 kV, 2x160 MVA ICTs at Balipara	By 31 st August 2017(LOA date).	By 31 st August 2017(LOA date).
19	220/132 kV, 1x160 MVA ICT with GIS Bay at Kopili	By 31 st August 2017(LOA date).	By 31 st August 2017(LOA date).
20	400/132 kV, 1x315 MVA ICT-III at Silchar	December, 2017(LOA date).	December, 2017(LOA date).
21	Replacement of 2x315 MVA ICTs with 2x500 MVA ICTs at Misa (PG)	December, 2017(LOA date).	December, 2017(LOA date).
22	400 kV Silchar – Misa D/C	Under TBCB	Under TBCB
23	1x125 MVAR Bus Reactor at 400 kV at Balipara	December, 2017(LOA date).	December, 2017(LOA date).
24	1x125 MVAR Bus Reactor at 400 kV Bongaigoan	December, 2017(LOA date).	December, 2017(LOA date).
25	Bays at Hailakandi & 132V Silchar-Hailakandi	March, 2017.	March, 2017.
b. Elements under breakdown/ upgradation			
26	63MVAR Reactor at Byrnihat of Me.PTCL	As recorded in item B.1.(4)	Forum requested MeECL& PGCIL to jointly discuss with CGL.

27	Up-gradation of 132 kV Lumshnong-Panchgram line	DPR preparation stage	Reports given to be analyzed by MePTCL.
28	Switchable line Reactors at 400kV Balipara & Bongaigoan	Procurement works underway. Both to be completed by 31.03.17	Balipara - Oct'16 Bongaigaon - Dec'16.
29	PLCC Panels at Loktak end of Loktak - Ningthoukhong 132 kV feeder and Loktak - Rengpang 132 kV feeder	Work(s) have been included in tender for additional line of 132kV Loktak-Ningthoukhong	Work(s) have been included in tender for additional line of 132kV Loktak-Ningthoukhong
30	LILO of 132kV Ranganadi - Nirjuli at Pare of NEEPCO by PGCIL	Jan'17	Jan'17
31	LILO of 132kV Ranganadi - Itanagar (Chimpu) at Pare of Ar. Pradesh	Bay at Pare under construction Bay 1: completed Bay 2: March 2017	Bay at Pare under construction Bay 1: December 2016 Bay 2: March 2017
32	400KV 80MVAR Bus Reactor at OTPC Palatana	As recorded in item B.1.(4)	OTPC informed there has been no response from BHEL. Forum suggested that OTPC initiate commercial action. By 31.12.2016

The Sub-committee noted as above.

C.2 Furnishing of UFR Report and status of Implementation:

As per recommendation of enquiry Committee, the status of installation of UFR in NER was already circulated earlier. It is gathered that, 18.5 MW quantum is yet to be implemented in Arunachal Pradesh & Manipur.

The 123rd OCC forum decided that monthly report is not being furnished. As per clauses of relevant regulations, and Order of Hon'ble CERC in matter of Petition no. 113/MP/2014, NERLDC and NERPC are mandated to submit status of UFR operation and non-operation to CERC. SLDCs were thus requested to submit UFR operation details (feeder-wise quantum of load relief to be indicated) on monthly basis, and even if no UFR operated in particular month, it should indicated as NIL.

The 127th OCC forum requested all the SLDCs/state utilities to certify healthiness of the relays while submitting the UFR operation report monthly.

The latest status as informed by NERLDC in 128th OCC:

Arunachal Pradesh	Furnished for Oct'16
Assam	Furnished for Dec'16
Manipur	Furnished for Dec'16
Meghalaya	Furnished for Dec'16
Mizoram	Furnished for Dec'16
Nagaland	Furnished for Dec'16
Tripura	Furnished for Dec'16

The Sub-committee noted as above.

C.3 Load Forecast Error:

At present day-ahead hourly load forecast data on daily basis is being prepared by NERLDC based on the data sent by SLDCs. It has been observed that there is a huge difference between the forecasted load and the actual demand met.

A comparison between the forecasted load and the actual demand met of all the states of NER was circulated earlier.

In 126th OCCM, NERLDC displayed a comparison graph of one particular day in October, depicting the variations in Load forecast versus Actuals. The variations were quite significant, and even the diurnal trend of load was not being captured in the load forecasts. NERLDC requested all SLDCs to share the forecast methodology being followed, for improvement and bringing in accuracy in the forecasts.

In 127th OCCM, Sr. Engineer, NERLDC informed that high error in load forecast versus actual existed for the most of the NER states, and Manipur load forecast has been found to be the best amongst forecast of other SLDCs of NER. The forum requested MSPCL to kindly highlight through a brief presentation in next OCC meeting about the method followed by them to forecast load.

All SLDCs agreed to review their load forecast methodology and share with OCC forum.

Deliberation of the Workshop on 18/01/2017:

Meghalaya

- Meghalaya load forecasting is adopted from average day method in 15 minute time block based from historical data with appropriate load scaling and shifting technique (Normally stored from actual SCADA data)
- Average day forecast gives more accurate than other two methodologies viz Load shapes and similar day.

Challenges:

- Highly dependent on historical data/weather data forecast
- All techniques (Load shapes+Similar day+Average day) can be effectively used only if weather sensors are installed in all respective substations in the state incorporating with RTU.
- For Long term load forecasting – Appropriate Load growth and the planning indices are crucial.
- Dependent on RTU and strong communication with control centre

Manipur

- short term forecast (trends of past 4/5 days are taken into consideration)
- previous day actual drawal pattern

SLDC Manipur studies the loading pattern of the previous day and correspondingly makes changes in the next day forecast with consideration of various other factors such as load constraints of line, festival day load increment, etc.

Assam and Tripura intimated that they also have been following average day method based on actual figures of previous few days.

Deliberation of the sub-Committee:

The forum appreciated the efforts of AEGCL, MSPCL, MeECL and TSECL. Members felt that forecasting tool of SCADA-EMS is to be used in the long run, once all RTUs are reporting. However for the time being, all States should keep on improving and fine tuning their respective methodologies so as to arrive at more accuracy.

The Sub-Committee noted as above.

Action: All States.

D. NEW ITEMS

D.1 Generation Planning (ongoing and planned outages)

NEEPCO/NHPC may kindly intimate the availability for hydro stations:

Generating Station	Units running	MW	MU	Reservoir
Khandong	2		8.03	710.65
Kopili-II	1			
Kopili	4		77.62	602.23
Ranganadi	3		Subject to inflow	

Doyang	3		18	317.4
Loktak	3		117.5	768.01
AGBPP	-	-	-	-
AGTPP	-	-	-	-

Hydro planning

The outage of other generating stations may be approved considering the present level water level in reservoirs.

Deliberation of the sub-Committee:

The forum unanimously objected to OTPC availing shutdown in the lean season inspite of repeated requests not to do so. S.E.,SLDC, Meghalaya stated that OTPC has deceived their beneficiaries repeatedly by not adhering to the shutdown programme.

The Committee discussed and approved the proposed shutdown by Generating Stations and the same is given in Annexure – D.2 (along with trans-element).

D.2 Outage Planning Transmission elements

It was agreed in the 99th OCC meeting that shutdown will be availed only after approval is given by the OCC forum. It was also agreed that deferment/revision of outages elements other than already approved in OCC will be henceforth put/displayed in the website of NERPC (under Operational Activities/OCC Approved shutdown) as per CERC regulations/ CEA guidelines etc for ensuring smooth & secure grid operation.

Furnishing request of shut down of the element, which was approved by NERPC, by Indenting Agency (ISTS licensees/STUs/Generating Companies) to NERLDC: Planned shutdown approved by NERPC shall be considered for implementation by NERLDC on D-3 basis. If an outage is to be availed on say 10th of the month, the shutdown availing agency would reconfirm to NERLDC on 7th of the month by 10:00 Hr. This practice is necessary to ensure optimal capacity utilization and the time required for associated system study/coordination by/amongst RLDC/NLDC.

In 124th OCCM, SE(C&O) strongly opined that constituents should inform to NERPC/NERLDC in case shutdown is not avail as approved in the OCC meeting and should mention clearly the reason for not availing the shutdown. The full list of shutdown would be placed in the next OCC by NERLDC so that proper record can be made in future for generating units as well as transmission lines. All constituents endorsed the view of SE(C&O).

Deliberation in the meeting

S.E.(C&O),NERPC stated that OCC approved shutdowns are not being availed and also shutdown requests after OCC approval are being sent repeatedly by different utilities. He stressed that this practice is highly undesirable and no shutdown request after OCC approval would be entertained except in dire emergencies.

The sub-Committee discussed and approved the proposals received from the constituents regarding transmission elements and generating units for January, 2017 - February, 2017 and the same has already been uploaded in website of NERPC.

D.3 Estimated Transmission Availability Certificate (TAC) for the month of September & October, 2016:

NETC and POWERGRID have submitted the outage data for the month of September & October, 2016. So the attributability of outage of the said elements may please be finalized.

The forum once again advised NETC&POWERGRID to submit data in a time bound manner as decided previously.

The Sub-Committee noted as above.

D.4 Furnishing of Technical and Commercial data for computation of PoC Charges and Losses for Q1 of 2017-18 (April 2017 – June 2017):

In the 3rd Validation Committee meeting for PoC application period Oct'15-Dec'15, held on 30th September 2015, at NLDC conference Hall, CERC had proposed a methodology for ratification of projected data at RPC form.

In line with the decision in the Validation Committee meeting, Members may please submit generation, demand and YTC data for Q1 of 2017-18..

Deliberation in the meeting

NERLDC requested all the utilities may submit PoC data (Including YTC data of Assam, Meghalaya and Tripura) for Q1 of 2016-17 by 31.01.2017.

The Sub-Committee noted as above.

Action: All utilities.

D.5 Assessment of Total Transfer Capability (TTC), Transmission Reliability Margin (TRM) and Available Transfer Capability (ATC) by SLDC on respective Inter-State Transmission Corridor

Updated PSSE Base Cases have been mailed to all the SLDCs on 04.01.17. All SLDCs are requested to assess the Total Transfer Capability (TTC), Transmission Reliability

Margin (TRM) and Available Transfer Capability (ATC) for the month of February'17 using these cases, and submit the study cases and results to NERLDC by 20th January, 2017.

NERLDC has assessed the state control area wise, state subsystem wise and group of control-area wise TTCs for NER Grid, on behalf of SLDCs of NER. The study results conducted by NERLDC will be shown during the meeting.

SLDCs are requested to check the TTC of their control areas as computed by NERLDC and issue comments, if any by 20th January, 2017.

If no comments received from any states, TTC, ATC & TRM figures of State control area and group of control areas as assessed by NERLDC will be considered as final **and may be uploaded on website.**

As per discussions in 122nd OCC meeting of NERPC, all SLDCs of NER may host the assessed TTC / ATC / TRM figures on their website for information dissemination.

Deliberation in the meeting

NERLDC informed the forum that NERLDC has assessed the state control area wise, state subsystem wise and group of control-area wise TTCs for NER Grid, on behalf of SLDCs of NER for February'17 and the results were already mailed to all the SLDCs on 05.01.17. They also presented the same results to the forum and requested all SLDCs to check the TTC of their control areas as computed by NERLDC and issue comments, if any by 20th January, 2017. NERLDC requested all SLDCs to host TTC/ATC figures on their respective websites.

S.E.(C&O), NERPC stated that TSECL is yet to submit PSSE laptops to NERPC. AGM, NERLDC informed that workshops on 'PSSE' & 'Restoration Procedure of NER Grid' would be conducted by NERLDC in the months of February & March, 17 respectively and all the utilities agreed upon the same. Sr. Manager, TSECL informed that the laptops and dongles would be returned during the workshop only. S.E.(C&O),NERPC requested all the SLDCs to submit names of designated officials for using PSSE laptops so that the same can be redistributed in the course of the workshop.

The Sub-Committee noted as above.

Action: All SLDCs/RLDC.

D.6. Certification of open cycle generation of AGBPP for FY 15-16:

As per methodology decided in 87th OCC meeting and modus operandi decided in 19th & 20th CCM the open cycle generation of AGBPP for FY 15-16 is to be certified. Accordingly it is requested of NERLDC to kindly verify "the generator operation in OC mode due to some fault and problem is resolved in a reasonable time, with DC revision". After verification by NERLDC, certification would be done by NERPC.

In 126th OCC the forum requested NERLDC/NERPC to complete the procedure and present the certification in next OCC meeting, so that members may ratify.

In 127th OCCM, Manager, NERLDC informed that the verification for FY 15-16 is under process. He also suggested that the exercise be made periodical so that no backlogs remain. S.E.(C&O), NERPC welcomed the suggestion and requested NEEPCO to submit the outage data monthly.

Deliberation in the meeting

S.E.(C&O),NERPC intimated the forum that the verification for FY15-16 has been received from NERLDC. The final certification would be presented in next OCC/CCM for ratification by members. Sr. Manager, NEEPCO informed that outage details are being submitted quarterly. SE(C&O), NERPC requested NEEPCO to submit the details monthly.

The Sub-committee noted as above.

Action: NERLDC/NERPC/NEEPCO.

D.7. Renovation and Modernization of Umiam Stage-III HEP (2 x 30 Mw)

In line with the policy for taking up Renovation & Modernization (R & M) of old hydroelectric power plants initiated by the Ministry of Power, Government of India, MeECL has decided to take up R & M of Umiam Stage-III HEPP (2 x 30 Mw) commissioned in 1979, considering the aggravated condition of the power plant.

In 126th OCCM, S.E., MePGCL informed that Umiam Stage-III has already completed its useful life having been in service for 37 years since commissioning. He requested that R&M cost be funded from PSDF.

S.E.(C&O),NERPC informed that R&M of power plants are not specifically funded from PSDF under PSDF regulations. However they may be funded under extraordinary Cl.4.1.(e). He requested MePGCL to submit the proposal at the earliest so that the matter may be followed up with NLDC/CERC.

Deliberation in the meeting

S.E.(O), NERPC informed that NERPC would take up with CEA and apprise members of the status in the next meeting.

The Sub-committee noted as above.

Action: MePGCL/NERPC/CEA.

D.8 Reporting of commissioned transmission elements for TARANG App.

TARANG (Transmission App for Real Time Monitoring and Growth) Mobile App & Web Portal has been developed by REC Transmission Projects Company Ltd (RECPTL) for progress monitoring of transmission systems on Pan-India basis, which was launched by Hon'ble Minister of State for Power on 17th August 2016. The app can be downloaded on smartphones or be accessed through its website (www.tarang.website). As part of the responsibility charter, POSOCO has been assigned the responsibility to update the systems under operation in the 'Completed Transmission Systems' section of the app.

In order to provide this information to the Ministry of Power, it is requested to provide the details of commissioning of transmission elements in respective state for each month by the 3rd day of the next month to NERLDC.

In 126th OCCM, Sr. Engineer, NERLDC emphasized the need for furnishing this data for TARANG app devised by Ministry of Power, Govt. of India for information to the public. It was also mentioned that during recent visit to Guwahati on 11.11.2016, the same was emphasized by Joint Secretary (Power). NERLDC requested all utilities to submit the data to: nerldcso2@posoco.in by 3rd of every month for the previous month.

In 127th OCCM, Sr. Engineer, NERLDC informed that whatever elements have been commissioned in previous month need to be mailed to NERLDC by 3rd of every month. DGM, SLDC, AEGCL requested that respective transmission utilities may be approached for the required data. DGM(MO),NERLDC clarified that the details of any EHV commissioned elements within a State are supposed to be available with SLDCs, so there should not arise any difficulty in this regard.

It was agreed that SLDCs would furnish the data.

Deliberation in the meeting

NERLDC informed that even if no elements have been commissioned in the preceding month then a NIL report is to be submitted to NERLDC. NERLDC also informed that

the updated Power Map and Grid Maps of all the states of NER will be circulated and all utilities are requested to give comments on the same.

The Sub-committee noted as above.

Action: All SLDCs.

D.9. Installation of DAS to monitor FRC for generators:

In continuation to discussions in 125th OCC meeting on this matter, and letter from ED-NLDC dtd. 10th October'16, it is requested that all generators may take urgent action to ensure Primary response as per stipulation [As per Sec.1(4) of Part-II of CEA's Grid Connectivity standards, 0-10% droop for hydro generator governors ; 3-6% droop for Thermal generator governors].

Also, as per Section 11.2.(i) of CEA's Technical Standards for Construction, all generating stations must store important analog data in 1 seconds interval.

NEEPCO has informed that AGTPP and Ranganadi HEP have properly working DAS, that are capable of storing Machine side data like Voltage, frequency, Active power generation, Reactive power generation, Line currents, etc. Also, it was confirmed in last OCC that DAS at AGBPP is installed but not time-synchronized.

All generating stations may confirm that their governors are properly tuned for giving primary response as per regulations.

Also, NEEPCO may intimate the status of installation of DAS for their remaining generating stations.

In 126th OCCM, Sr. Manager, NEEPCO informed that all their plants have DAS installed. AGM(SO-I),NERLDC clarified that in case of oscillations/ disturbance response of generators(in ms) cannot be captured by SCADA due to low resolution of data.

NERLDC requested NEEPCO to ensure that all their installed DAS are time synchronized and data during events is not lost. Also, the resolution of data of DAS to be checked by NEEPCO and ensured that at least 1 sec resolution data is available.

In 127th OCCM, Sr. Engineer, NERLDC once again reiterated that DAS is required for analyzing response of governors and their absence severely impairs calculation of FRC. Sr. Manager, NEEPCO informed that installation of DAS in case of old generating units of Kopili, Khandong and Doyang involves huge financial involvement. He assured that management would be apprised of the requirement and any decision taken in this regard would be informed to the forum.

Deliberation in the meeting

NERLDC informed that on 23.12.2016, at 0127 hrs, all 400 kV lines from Kishenpur substation (Northern Region) except 400 kV Moga -Kishenpur II tripped which led to complete Valley (Kashmir) system collapse. Total Load Loss in J&K was about 1200 MW and Generation loss was of about 250 MW. All the generators primary response characteristics are required. In this respect NERLDC requested all generating utilities to provide time stamped MW, MVAR, Voltage and frequency data from 01:20Hrs to 01:30 Hrs of 23.12.2016. NERLDC also informed that the format was mailed to all the generators on 26th Dec'16.

The Sub-committee noted as above.

Action: All generating utilities.

D.10. Electricity Demand Patterns of all states of NER for 2008-2016

A report has been prepared by POSOCO for analysis of Demand Patterns of years 2008-2016 periods. Based on the report, patterns can be identified for meeting the demand in respect of time of day, day of year, evening / morning peak, seasons, etc.

The report has been mailed to all the states of NER on 17th Nov'16. It is requested that concerned persons of states may go through the report and mark their comments in respect of the specific state-wise pattern observed in meeting demand. This would help identifying constraints / characteristics of load / others in states of NER. Any specific inputs like local holiday, festivals etc may please be mentioned as mapped with the profile of Demand met.

Mapping of the load patterns is required in respect of the following parameters:

- a. Constraints in power drawal from ISTS system due to congestion / constraint in ISTS lines.
- b. Constraints in power drawal from ISTS system due to congestion / constraint in Intra-State lines
- c. Constraints in load serving by DISCOM on account of non-adequate Distribution Transformation capacity, leading to chopping-off of Peak Demands, Low power availability due to Financial Constraints of DISCOM / Regulation of Power Supply, etc.
- d. Disturbance in state on account of militancy, etc. leading to poor growth of economy Imposition of Demand restriction by DISCOM to reduce AT&C losses. Political decisions in state leading to high growth / decay of demand Prevailing Climatic conditions.

- e. Human behavior like early riser, Office closing and starting times, etc., Type of loads
– Residential (Lighting, Heating, Air-conditioning etc), Commercial (Heavy industry requiring constant power supply, etc.), Tariff mechanism of states = Time of use, etc. Availability of Peak Load / Base Load plants in state Etc.

For getting constraints in meeting load or characteristics of load, report may be forwarded to concerned persons in DISCOM for comments. All the comments may be compiled together by SLDC and send to NERLDC via email to nerldc@yahoo.co.in.

In 127th OCCM, Sr. Engineer, NERLDC gave a detailed presentation which is attached in **Annexure- D.19**. After detailed deliberation it was decided that SLDCs would analyze the observations from Long-term demand analysis of states of NER Grid, based on presentation by NERLDC and report of NLDC, in consultation with all stakeholders of SLDCs including DISCOMs. The SLDCs would give a short presentation in next OCC meeting presenting their observations.

Deliberation in the workshop on 18/01/2017

Meghalaya

- Per Capita consumption declining trend from FY13 onwards due to decrease in industrial production over the year.
- Demand has not increased substantially over the years owing to fact that some of the key industries have either closed down or shifted to CPP/OA.
- Due to geographical features of the state (i.e. location, accessibility, and weather) along with current tariff levels play a significant role in determining the current and future demand.
- The future demands have been derived by estimating the urban and rural household consumption after taking into account the growth in number of electrified households on the one hand and the growth in average consumption per household on the other hand.
- Daily Load curves show that irrespective of seasonal variation, there is peaking in the evening hours only which is attributed to the fact that there is substantial impact of domestic load in the evening.
- Consistently seen a variation in minimum and maximum demand across the year i.e. from about 150 MW to more than 300 MW whereas the average/base demand is about 200 MW only.
- Adoption of various energy efficiency measures like energy efficient lighting (use of LEDs), adopting demand side management initiatives like introduction of Pre-

Paid metering system, etc., would also help in reducing to some extent the peak demand of the state.

Manipur

- Exponentially increasing trend of Maximum, Average, Minimum demand ; with much higher growth in Maximum demand
- No growth from 2008-2013
- High increase in YoY Maximum demand seen in 2015-16 and 2014-15, compared to previous years [Growth in Transmission & Transformation capacity]
- High growth rate in Energy consumption since 2014 onwards
- High growth potential
- Morning Peak visible in all months [*Indicates people of Manipur are early riser*]
- Typical trend: Morning and Evening Peak magnitudes are close in all months. In February, Morning Peak is almost similar to Evening Peak.
- Highest demand met in October-December [*Likely effect of festive season and cold weather*]
- Maximum demand is 90 percent higher than Average, and Minimum demand is 90 percent lower than average
- High difference between Peak and Lean indicates the load is mostly residential.
- Periods of severely low demand exist in Night hours till around 4 a.m.
- Ramp rates in Morning and Evening Peaks increased to a large extent in 2015-16 [*Maximum difference on YoY basis being in May, June, December-March*]
- Low growth rate during 2008-13 due to (1)Transmission Capacity Constraint (2)Installed Capacity Constraints (3)Load Shedding Routine
- HIGH GROWTH RATE DURING 2014-2016 due to
 - INCREASED IN IMPORT CAPACITY WITH SILCHAR 400kV DOUBLE CKT LINE
 - POWER FOR ALL (24/7HR UNINTERRUPTED SUPPLY)
 - R-APDRP SCHEME TIMELY COMPLETION
 - Unbundling of electricity dept. into MSPCL and MSPDCL
 - Significant growth in MSPCL and MSPDCL [manpower growth & company regulation : considerable improvement in maintenance]
- REDUCTION IN MAX DEMAND IN NOV. 2016 COMPARE TO NOV. 2015
 - Prepaid installation increased [coverage of 80-90% consumers]
 - Disconnection of consumers with outstanding dues.
 - Power theft drive
 - Increased use of UG cable
 - Replacement of existing LT cables with ABC cable

- AT&C losses reduction
- Almost 24/7Hr AVAILIBITY OF POWER SUPPLY TO ALL CONSUMER [uniformly distributed consumption]
- Load forecast as per anticipated power supply scenario of Manipur state (w.r.t 19th EPS) projected peak Demand of 357 MW during year 2019-20. The growth can be attributed to:
 1. railway traction consumption
 2. Rural electrification
 3. Industrial consumption

Tripura

- Not remarkable increase in peak demand due to implementation of DSM and replacement of Sodium vapor Street light by LED.
- Loss reduction through implementation of R-APDRP, Part-A & Part-B i.e. introduction of Computerized MBC, reduction of LT Distribution system by new & augmentation of sub-stations. Replacement of conductor, UG cable & Arial Bunch Conductor.
- Vigil action against theft of power, hook line etc.
- Tripura is ensuring daily power supply to consumer (Rural & Urban) 22.5 hours
- Occasional power cut occurred only due to outage of power system as well as congestion in inter & intra State.
- Tripura is selling its surplus power only.
- Morning peak visible only during winter period (October – February) due to Domestic consumers are using Room & water heater and also using light due to inadequate Sun light.
- Evening peak touches maximum during Puja (October) and goes down from November (beginning of winter) due to 88% on consumer are in Domestic in nature.
- A notch in Demand met is seen in Early Morning hours mainly due to all street lights are switch off and Domestic consumers are also switch off their fans & lights
- Day peak visible in March to May morning & day peak is similar :
- Morning Peak Demand - drought season i.e. all the Agricultural & Domestic Load.
- Day Peak Demand - Extreme hot i.e. AC & Fan Load.
- Evening Peak – Always higher than morning & day peak.
- Minimum Demand in January is due to extreme winter.

- Maximum Demand is 90% higher than average while minimum demand is 70% lower than the average - High volatility in demand is mainly due to 88% of consumers are in Domestic in nature and very less Industrial Load.
- Peaking Hydro Load Plants are not possible due to very less Hydro potential.
- Solar - Tripura is planning for 6 MW Solar PV Project at Gandacherra and 4 MW Solar PV at Agartala (Smart City). Grid connected Rooftop Solar PV project are also planned. 3 MW Solar Off-Grid has already been installed by TREDA.
- Load Factor steadily reducing due to Domestic consumers are using energy efficient appliances.

Deliberation in the meeting

The forum appreciated the efforts of MSPCL, MeECL and TSECL. Members requested remaining utilities to mail their comments to NERLDC within 31.01.2017.

The Sub-committee noted as above.

D.11. Finalization of the Annual Load Generation Balance Report (LGBR) for Peak as well as Off-peak scenarios and the Annual outage plan for 2017-18 by 31.12.16 as per IEGC

As per IEGC, each SLDC shall submit LGBR for its control area, for peak as well as off-peak scenario, by 31st October for the next financial year, to respective RPC Secretariat. The annual plans for managing deficits/surpluses in respective control areas shall clearly be indicated in the LGBR submitted by SLDCs.

As per IEGC, all SEBs/STUs, Transmission Licensees, CTU, ISGS, IPPs, MPPs and other generating stations shall provide to the respective RPC Secretariat their proposed outage plan in writing for the next financial year by 31st October of each year. These shall contain identification of each generating unit/transmission line/ICT etc., the preferred date for each outage and its duration and where there is flexibility, the earliest start date and latest finishing date.

For performing system studies, load forecasting, outage management and various other activities, it is necessary that LGBR report for the upcoming Financial Year is available beforehand. All entities are requested to furnish their details to NERPC for finalization of LGBR.

For purpose of system studies, it is requested that Demand Figures of states for the months of April'17, May'17, and June'17 be indicated to NERLDC.

In 127th OCCM, it was decided that the utilities would submit their figures at the earliest to NERPC.

NERLDC intimated that for computation of TTC/ATC figures on 5 months ahead basis, the LGBR figures as indicated by NERPC are required. To facilitate TTC calculations, the forum was requested to submit figures for April'17, May'17 and June'17 at the earliest to NERLDC.

Deliberation in the meeting

After detailed deliberation it was decided that all state utilities would submit their figures at the earliest to NERPC.

NERLDC again requested the forum to submit figures for May'17 and June'17 at the earliest to NERLDC for calculation of TTC/ATC figures on 5 month ahead basis.

The Sub-committee noted as above.

Action: NERPC, All SLDCs.

D.12. Status of reactors under outage in NER Grid

400 kV Nodes in NER Grid are experiencing high voltage during Off-Peak hours. As per information available with NERLDC, the following reactors are under outage:

63 Mvar Line Reactor of 400 kV Balipara - Bongaigaon III line at Bongaigaon is under out since 12.11.16.

400 kV, 50 Mvar Bus Reactor at Misa is under outage since 03.12.16.

400 kV, 63 Mvar Bus Reactor at Byrnihat is under outage since 09.12.14

400 kV, 80 Mvar Bus Reactor at Palatana is under outage since 15.03.16

200 kV, 2x12.5 Mvar Bus Reactor at Samaguri is under long outage.

132 kV, 2x2 Mvar Bus Reactor at Dharmanagar is under long outage.

It is requested to inform the status of restoration of the above reactors at the earliest.

Apart from the above reactors, it is also requested to provide commissioning status of the following reactors:

20 Mvar Line Reactor of 220 kV AGBPP - New Mariani (PG) line at AGBPP

Conversion of line Reactors of 400 kV Balipara - Bongaigoan I & II lines at Balipara and Bongaigaon to Bus reactors (4 Nos.)

400 kV, 1x125 Mvar Bus Reactor at Balipara

400 kV, 1x125 Mvar Bus Reactor at Bongaigaon.

400 kV, 1x80 Mvar Bus Reactor at Ranganadi.

220 kV, 1x31.5 Mvar Bus Reactor at Mokokchung (PG).

In view the Critical voltage profile of NER Grid in Off-Peak hours, it is suggested no shutdown of Reactors in NER Grid shall be availed unless in case of Emergency.

In 127th OCCM, DGM (AM), NERTS informed the following:

400kV 50 MVAR Bus Reactor at Misa is under gasket replacement and filtration will be brought back in service shortly.

400kV, 63 MVAR, Balipara – III Line reactor at Bongaigaon suffered winding failure and required to be sent to factory for repair. Out of two spare reactors for Biswanath-Chariali one would be shifted to Bongaigaon to restore Balipara-III Line Reactor.

Commissioning of 20 MVAR line reactor of 220kV AGBPP-New Mariani at AGBPP - would be completed by 20.12.2016

NERLDC expressed seriousness in outage of several reactors, and particularly when Lean hydro is ongoing. The matter of outage of Palatana reactor was discussed in detail. Presently voltage profile at Palatana is critical, and restoration is necessary. Palatana informed issues with BHEL in that they are not getting any reply from BHEL. The forum suggested OTPC should take up with BHEL in a 15 days time frame, and intimate what is the future course of action within 1 month to OCC forum. In case of delay by BHEL, OTPC should make arrangement for restoration by engaging 3rd party vendors.

Status of Restoration of other reactors:

400kV, 63 MVAR, Balipara – III Line reactor at Bongaigaon suffered winding failure and required to be sent to factory for repair. Out of two spare reactors for Biswanath-Chariali one would be shifted to Bongaigaon to restore Balipara-III Line Reactor. After repair of damaged reactor, the same would be replenished to BNC.

20 MVAR line Reactor at AGBPP => Expected by 20th Dec, 2016.

50 MVAR BR at Misa => Shutdown taken for additional 2 days for Gasket replacement. Will return to service shortly.

63 MVAR BR at Byrnihat => CGL yet to visit site although they accepted the offer. PG/MePTCL to follow up for early restoration.

2x12.5 BR at Samaguri => AEGCL to inform status in next meeting

6. 2x2 MVAR BR at Dharmanagar => TSECL to inform status in next meeting.

Deliberation in the meeting

Sr. Manager, TSECL informed that Bus reactor at Dharmanagar is under outage since 20 years back, the exact status of restoration and whether it should be altogether

removed from list of elements will be informed in next OCC meeting. DGM, SLDC, AEGCL informed that Samaguri reactor would be restored by 31.07.2017.

NERPC informed all the utilities that if any reactor is to be removed from the overall list of Reactive Power Capacity of NER it will be done only after getting decommissioning letter from CEA.

ACE, MePTCL also requested that since the reactor is very important from operational point of view for NER Grid and stated that since MePTCL do not have the capital to invest on repairing the 63MVA fault reactor at Byrnihat, he requested NERPC Secretariat to explore funding from PSDF.

SE(C&O) stated that they will look into the matter and requested MePTCL to send the proposal; however, MePTCL should go ahead with repairing for safety of the grid.

The Sub-committee noted as above.

Action: AEGCL/TSECL.

D.13. Comments on Staff Paper or Draft Regulations

Honourable CERC has notified the following Staff Paper or Draft Regulations: Staff Paper on National Open Access Registry vide public notice 25th November'16. It is available at http://www.cercind.gov.in/2016/draft_reg/SP.pdf.

The comments/suggestions of the stakeholders are invited on the above staff paper latest by 20.12.2016.

The 127th OCC forum requested NERPC to organize a special meeting cum workshop to discuss the draft as well as existing important regulations. The same was agreed to be convened by NERPC before next OCC. The workshop is to be held on 18.01.2017.

Deliberation in the meeting

A workshop was organised on 18.01.2017. The following topics were deliberated in detail in the meeting:

1. Amendments of IEGC(1st to 4th amendment) and draft 5th amendment.
2. CERC Staff Paper on Energy Storage.
3. Reserves in Power System.

DGM(MO),NERLDC gave presentations on the above topics which are attached in **Annexure D.13**. Members were requested to provide their valuable comments within 31.01.17. The forum further decided that a common reply would be drafted for the Region as a whole for submission to CERC.

The Sub-committee noted as above.

Action: All utilities/NERLDC/NERPC.

**D.14. Constraint in Bipolar Operation of +/- 800 kV HVDC Biswanath Chariali –
Agra:**

As communicated by NLDC, in case of operation of the HVDC Bipole BNC-Agra link for power flow in Agra-BNC direction, it is not possible to operate the Bipole link in Constant Power mode. In this scenario for operation in Agra-BNC direction, only constant current mode is possible wherein upon tripping of any pole, the other will not share load and the filters may also not disconnect.

During lean hydro (winter) months, NER may import power from NR through this Bipole link to relieve congestion of Eastern-Regional grid. In constant current mode operation, if the filter banks do not trip immediately after reduction of power flow through the link, the 400 kV Nodes in NER may experience severe overvoltage (due to low fault level of around 4000 MVA at 400 kV Biswanth Chariali) that may lead to tripping of the 400 kV lines from Biswanth Chariali, Ranganadi, Balipara, Bongaigaon, and trigger a major disturbance in NER.

Considering the importance of this link in operation of NER grid, NERTS may intimate the following:

- Issues related to operation of +/- 800 kV Agra-BNC bipole in Constant Power Mode
- Time required for disconnection of Filter Banks at BNC in case while running in Constant Current Mode, 1 Pole gets blocked / tripped?
- Maximum possible Power Flow in Agra to BNC direction (separately for different modes of operation)

In 127th OCCM, NERLDC explained that in case of power flow in Agra-BNC direction in Bipolar mode, the poles operated independently of each other and thus the cause of concern in grid operation, particularly in Lean Hydro season in NER. The matter was discussed at length. S.E.(C&O),NERPC concluded that POWERGRID to depute concerned person from Biswanath-Chariali HVDC to attend next OCCM for fruitful deliberation of agenda items pertaining to HVDC operation, and clarification of any queries of forum members.

Deliberation in the meeting

DGM(AM),NERTS informed that upon consultation with HVDC team it has been confirmed that operation in constant power mode with load sharing is possible. The

forum requested NERTS to conduct site visit to BNC for OCC members' familiarisation with HVDC operation. NERTS concurred. The forum again requested NERTS that concerned person from Biswanath-Chariali HVDC to attend next OCCM for fruitful deliberation of agenda pertaining to HVDC operation, and to clarify any queries of the members.

AGM, NERLDC expressed concerns about Non/improper operation of filters at BNC resulting in high voltage problems and on some occasions causing tripping of lines on over voltage. He requested for corrective actions by concerned authorities.

The Sub-committee noted as above.

Action: NERTS.

D.15 LFO in NER Grid from 09:20 Hrs on 08th Dec' 2016 at AGTPP.

A low frequency oscillation has been observed in NER Grid from around 09:20 Hrs on 08th Dec'16.

The beginning of oscillation coincides with beginning of Desynchronization process of AGTPP GT # 2 that was taken under Emergency Shutdown. Also, one lobe of continuous oscillation end coincides with the time of actual Desynchronization of AGTPP GT # 2.

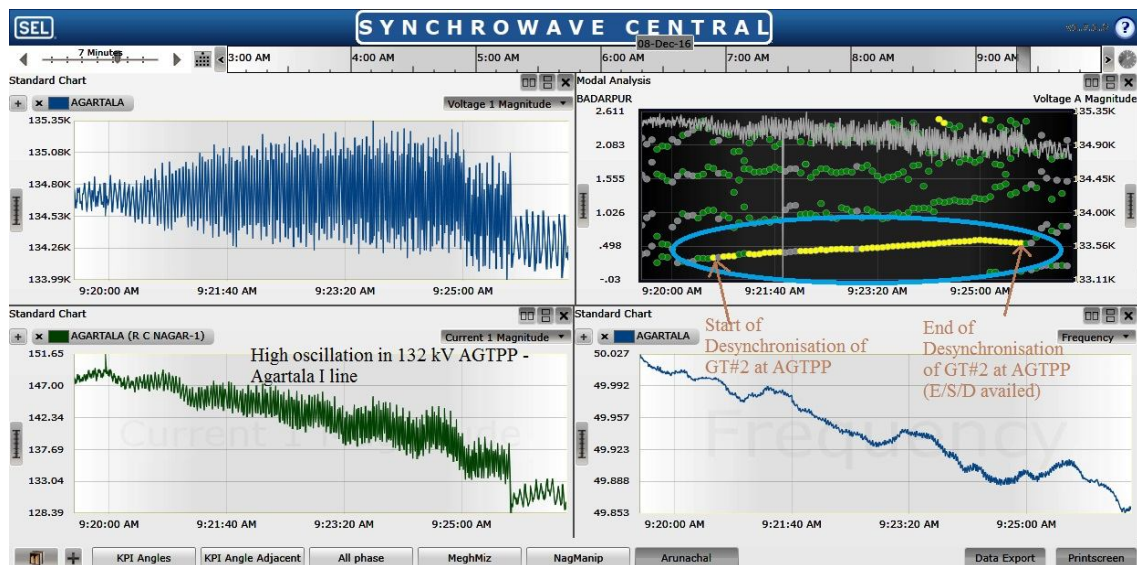
The oscillations are continuously going on near 132 kV Agartala bus, as observed from PMU, and are prominently in voltage. There is no significant effect on Active power / frequency. At present, there is about 5-6 A oscillation in current on 132 kV Agartala - AGTPP I line.

Considering the above situation and request from AGTPP; to bring down voltage from 136 kV (Which is normal) to 132 kV (Nominal); it is suspected that AVR's at units of AGTPP are acting in a manner leading to growth of oscillations.

It is also to be mentioned that Sustained Low Frequency oscillations around 0.4 Hz is being observed at 132 kV Agartala PMU over the last few days.

AGTPP is requested to view this matter seriously and check their terminal voltage, excitation currents, and also furnish to NERLDC the Event Logger from 09:15 Hrs of 8th Dec'16 onwards.

AGTPP, Palatana, Monarchak and TPGL is requested to provide data of 1 milli-second resolution of Terminal voltage of units / MW generation / MVAR generation.



In 127th OCCM, NERLDC explained the phenomenon of LFO, oscillation in Voltage, and requirement for seriousness in such matter. NERLDC requested all utilities to cooperate in this matter. It was noted that even after requests to AGTPP-Control Room and Sh. Joypal Roy, Sr. Manager (NEEPCO), data for analysis of LFO is not being received by NERLDC.

Sr. Manager (NEEPCO) informed that DAS is installed at AGTPP-Extension. NERLDC requested NEEPCO to furnish this data at the earliest corresponding to case of 08th December'16.

All generators were requested to remain alert in respect of reporting / monitoring of oscillations.

Deliberation in the meeting

MS, NERPC requested that agenda pertaining to Low Frequency Oscillations to be discussed in next Protection Sub- Group Committee Meeting.

The Sub-committee noted as above.

Action: NERPC.

D.16. Dedicated voice communication and Data channel:

Dedicated voice communication with Substations and Generating Stations needs to be checked daily. Currently in most of the stations only one link is installed. In some stations VOIP phones are out (NLDC, Doyang, Kathalguri etc). Redundant of links need to be established on priority. Details of status of voice communication are attached in **Annexure-D.29**.

SCADA data from KATHALGURI, DOYANG, KOPILI, KHANDONG, RANGANADI, ITANAGAR, ZIRO etc are out since long due to which Grid management activity is severely affected.

RTU Outage details are given below:

Sl. No.	Station Name	Date of Outage
1	Ranganadi	21.05.16
2	Ziro	07.08.16
3	Kopili	09.05.15
4	Doyang	24.01.15
5	Khandong	16.09.16
6	Khatalguri	25.07.16
7	Haflong	14.09.16
8	Itanagar	01.08.16

In 127th OCCM, Sr. Manager, NEEPCO informed the following:

RTU for RHEP is at tendering stage.

AGBPP RTU commissioned. By Jan 2017 data would be received at NERLDC subject to link restoration.

RTUs for Kopili, Khandong and Doyang in final stage of LOA.

NERTS and DoP Ar. Pradesh were requested to update the status by next OCC meeting.

Deliberation in the meeting

Sl. No.	Station Name	Status as informed in 128 th OCC
1	Ranganadi	Tendering stage for installation of RTU
2	Ziro	ABB has done site visit. Report awaited.
3	Kopili	LOA for installation of RTU placed on 30.12.2016
4	Doyang	LOA for installation of RTU placed on 30.12.2016
5	Khandong	LOA for installation of RTU placed on 30.12.2016
6	Kathalguri	Link working.
7	Haflong	PLCC panel shifted. Link yet to be established. Will be complete by 31.01.17.
8	Itanagar	Link available. Site check in service. DB to be updated by NERLDC

The Sub-committee noted as above.

Action: NEEPCO/NERTS/DoP Ar. Pradesh.

D.17. Strengthening of capacity of Khandong Bus as per grid requirement:

The normal life of 2x25MW Khandong Power Station is going to be completed in April'2019. We are in the process of R&M of the Power Station for life extension. Accordingly, order has been placed with M/s CPRI for field study and DPR preparation.

Though the generation from Khandong & Kopili Stage-II Power Station in peak hydro season is hardly 70MW and Khandong Bus is well equipped for evacuation of that quantum of energy. But In Kopili Power Station SY there is already one 220/132KV, 160MVA autotransformer is there and one more similar transformer is under installation. There are two 132KV lines from Khandong to Kopili. The new lines is having Zebra conductor and it is leant that the conductor of old line will also be changed to higher capacity.

As you are aware that Khandong SY is having double Bus with transfer facility and bus conductor is single Zebra and all the jack buses and jumpers are single panther.

In this scenario, NEEPCO may be informed whether any strengthening of Khandong Bus is required. Same shall be included in the scope of study and suitable decision shall be taken subject to the strength of the existing structures.

Deliberation in the meeting

DGM,AEGCL suggested that SC level for Khandong Bus needs to be calculated taking into consideration addition of 160MVA 220/132kV transformer at Kopili and HTLS conversion of 132kV Kopili-Khandong-II. The forum approved the suggestion.

The Sub-committee noted as above.

D.18. High voltage issues at 220 KV sides of Tinsukia and Namrup:

NRPP commissioning activities are going on and they are facing high voltage problem at 220 KV side which hampering the commissioning activities. As Kathalguri Generating Station is the only available source of voltage regulation. So, necessary action may be initiated in order to regulate the voltage for smooth running of commissioning activities of NRPP.

Deliberation in the meeting

Sr. Manager, NEEPCO stated that Bus Voltage at NEEPCO end varies from 231~234 kV. As requested, for testing purpose, NEEPCO tried to regulate the Bus voltage by absorbing Var by running units of AGBP. However, in the process, NEEPCO succeeded to reduce bus voltage only in the range of 2 to 3 kV. Representative of NEEPCO stated that it will not be possible to regulate 220 kV Grid Voltage by NEEPCO units

alone and it needs a comprehensive study of the total 220 kV Grid system of the upper Assam region to regulate as per requirement. Further NEEPCO informed that due to prevailing inadequate and rationing of gas supply by OIL, NEEPCO is operating only 4 (four) of its Gas Turbine units and situation likely to continue for another few months. However, there may be a slight improvement of Grid voltage once 20 MVAR line reactor for Kathalguri - New Mariani line at Kathalguri end get commissioned. NEEPCO requested house for a comprehensive study on the 220 kV Grid system of upper Assam region for a suitable solution.

Members also requested NERPC to explore options whether compensating device installation for the benefit of grid may be funded from PSDF.

AGM, NERLDC informed the forum that NERLDC had received letter No. AEGCL/CGM/SLDC/T-12/16/68 dated 31.12.16 regarding frequent tripping of 220 kV NRPP- Tinsukia line on Over Voltage at NRPP end. They replied back vide letter no. User_NE/2016-17/5 dated 09.01.17. NERLDC also conducted studies and AGBPP was requested to absorb Reactive Power as per their Capability Curve.

The Sub-committee noted as above.

Action: NERPC.

D.19. Delay in flow of information about curtailment of URS requisition of power from NTPC ER:

NERLDC assured AEGCL that the problem would be mitigated after commissioning of WBES for NER. Regarding WBES, AGM NERLDC informed that in the new software there might be a difference of 0.01 MW in very few blocks of entitlements compared to the entitlement computed through present software. He also explained the computation logics. These negligible differences have been accepted in RPC forums in some of the regions and the software is under implementation there. He requested the constituents of NER also to accept this difference for implementation of the New software. The constituents accepted the same and requested for early implementation.

The Sub-committee noted as above.

D.20. Restoration of 220 KV Tinsukia- Kathalguri real time SCADA Data:

After detailed deliberation the matter was referred to the next NeTEST meeting of NERPC.

The Sub-committee noted as above.

D.21. Overvoltage tripping of 220 kV Mariani – Mokokchung I & II lines due to error in Y-phase voltage measurement:

In the quarter from October'16 to December'16, there were multiple trippings of 220 kV Mariani – Mokokchung I & II lines on Stage-1 Overvoltage. The list of trappings of these lines are as follows:

Tripping of 220 kV Mariani – Mokokchung I & II lines from October'16 to December'16			
Sl. No.	Date and Time of tripping	End-1 (Mariani) Relay indications	End-2 (Mokokchung) Relay indications
1	06-10-2016 12:29	Over Voltage	Direct Trip Received
2	25-10-2016 02:59	Not Furnished	Over Voltage
3	26-10-2016 00:03	Over Voltage	Not Furnished
4	27-10-2016 23:19	Direct Trip Received	Over Voltage, Y phase, 1.10 pu
5	28-10-2016 23:11	No tripping	Over Voltage, Y phase, 1.10 pu
6	30-10-2016 00:42	Over Voltage	Direct Trip Received
7	30-10-2016 23:38	Direct Trip Received	Over Voltage, Y phase, 1.10 pu
8	31-10-2016 22:34	Direct Trip Received	Over Voltage, Y phase, 1.10 pu
9	01-11-2016 23:02	Direct Trip Received	Over Voltage, Y phase, 1.10 pu
10	02-11-2016 22:39	Direct Trip Received	Over Voltage, Y phase, 1.10 pu
11	04-11-2016 04:13	Over Voltage	Over Voltage, Y phase, 1.10 pu
12	05-11-2016 21:27	Direct Trip Received	Over Voltage, Y phase, 1.10 pu
13	13-11-2016 21:59	Over Voltage	Direct Trip Received

14	14-11-2016 21:34	Over Voltage	Direct Trip Received
15	15-11-2016 23:01	Direct Trip Received	Over Voltage, Y phase, 1.10 pu
16	17-11-2016 01:59	Over Voltage	Over Voltage, Y phase, 1.10 pu
17	19-11-2016 04:01	Over Voltage	Over Voltage, Y phase, 1.10 pu
18	20-11-2016 22:20	Direct Trip Received	Over Voltage, Y phase, 1.10 pu
19	28-11-2016 00:15	Direct Trip Received	Over Voltage, Y phase, 1.11 pu
20	28-11-2016 22:48	Direct Trip Received	Over Voltage, Y phase, 1.12 pu
21	30-11-2016 01:00	Direct Trip Received	Over Voltage, Y phase, 1.12 pu
22	05-12-2016 23:51	Direct Trip Received	Over Voltage, Y phase, 1.12 pu

From the Disturbance recorders pertaining to above trippings, it has been observed that tripping of the lines occurred due to Overvoltage in Y-phase at 220 kV Mokokchung (PG) in almost all cases with voltage persisting at around 140 kV (Y Ph-E) while the other 2 phase voltages were 4-5 kV below the Y Ph-E.

It is suspected that the multiple tripping of these lines are on account of error in CVT in Y-phase at Mokokchung end, and is preventable upon action by POWERGRID for rectification.

NERTS was emailed in this regard on 20th December'16, but no reply has been received.

The multiple tripping of 220 kV Mariani (PG) – Mokokchung (PG) I and outage of 220 kV Mariani (PG) – Mokokchung (PG) II since 12.07.16 has decreased the reliability of Mokokchung area of Nagaland. Presently both the circuits are out since 26-12-16.

Deliberation in the meeting

DGM(AM), NERTS informed that the agenda should be first discussed in Protection Sub-Group Committee Meeting. All members agreed.

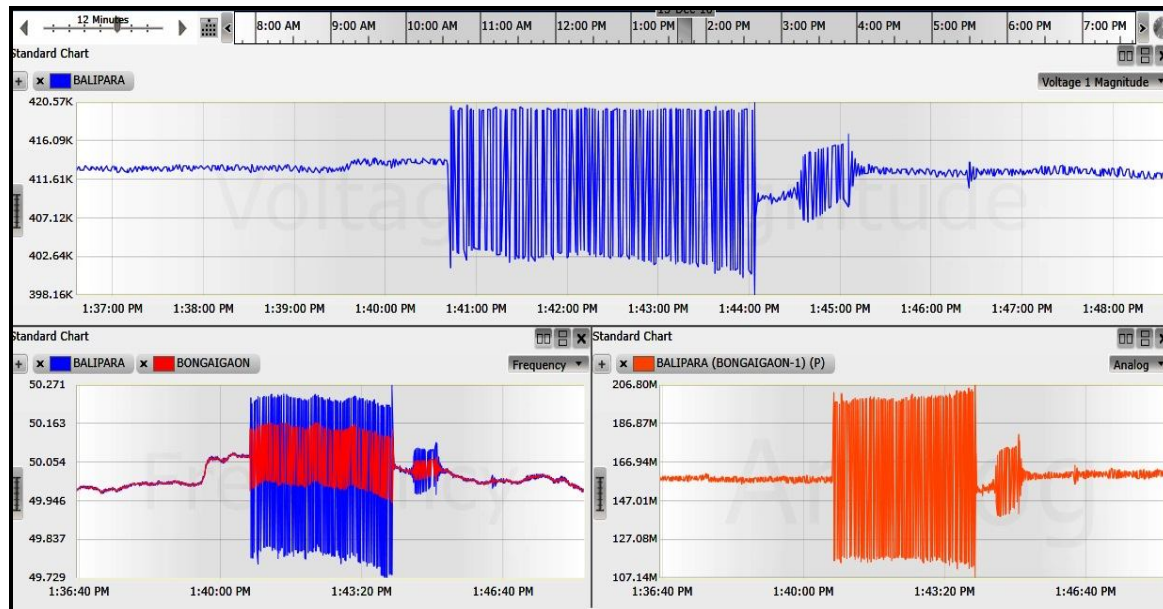
The Sub-committee noted as above.

Action: NERPC

D.22. Severe Oscillation on +/- 800 kV HVDC Biswanath Chariali (NER) – Agra (NR) Bipole:

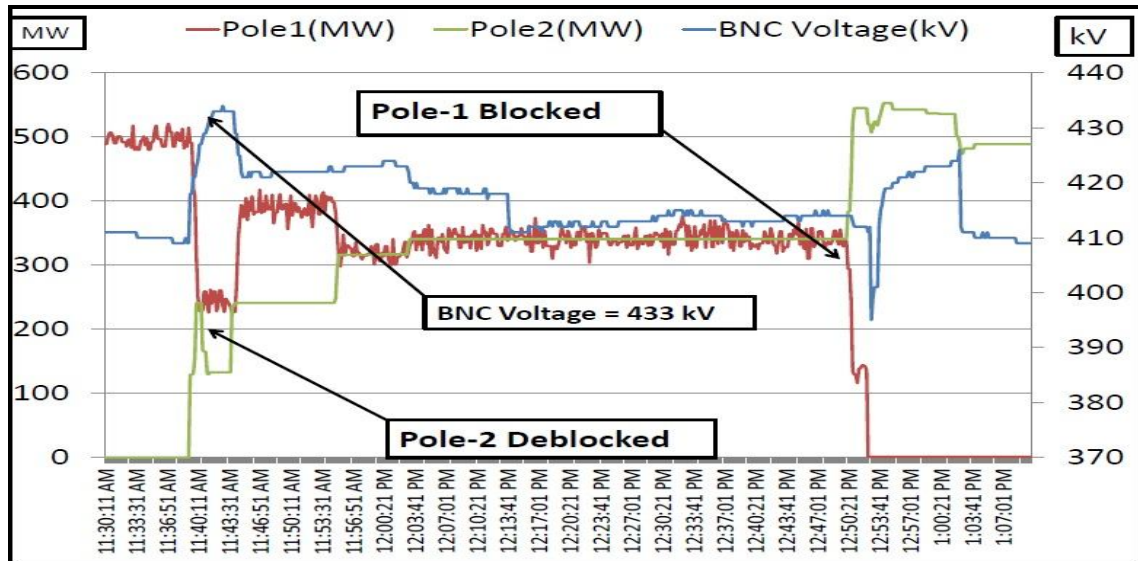
On 15th December'16 w.e.f. 1340 Hrs to 1345 Hrs, severe oscillation was observed on +/- 800 kV HVDC Biswanath Chariali (NER) – Agra (NR) link while under Bipolar operation in Current Control mode from Agra to Biswanath-Chariali.

During the period, flow on HVDC BiswanathChariali-Agra Pole-II was found to vary by about 200 MW, causing fluctuations in line flows at 400 kV Bongaigaon - Balipara line of nearly 100 MW / circuit. Oscillation of nearly 20 kV in voltage at 400kV Balipara, and nearly 0.4 Hz in frequency at Balipara was observed.



Information was requested from BNC vide emails from NERLDC dated 15th Dec, 18th Dec and 28th Dec'16.

Similarly on 05th January'17 at around 11:39 Hrs, oscillations have been recorded in active power at the time of deblocking of +/-800 kV HVDC BNC Agra for around 45 seconds. Pole-I was blocked at 1252 hrs on 05th January'17.



HVDC BNC was requested to submit report in respect of these 2 occasions, citing root cause, remedial measures taken, Sequence of events, etc. to enable secure operation of interconnected grid.

In spite of multiple follow-up with HVDC Biswanath-Chariali for looking into the matter of oscillation, there has been no response. Also, in matters of Grid events, response from HVDC Biswanath-Chariali has not been forthcoming, which is detrimental for integrated power system operation.

Deliberation in the meeting

MS, NERPC requested that agenda pertaining to Low Frequency Oscillations to be discussed in Protection Sub- Group Committee.

The Sub-committee noted as above.

D.23. Low Frequency Oscillations (LFOs) at 132 kV Agartala:

There have been several instances of Low Frequency oscillations as observed from PMU at 132 kV Agartala in the period from 1st October'16 to 11th January'17.

The area around 132 kV Agartala is rich in generation with nearby gas-based generation plants at Palatana CCGT (726 MW), AGTP-CC (130 MW), Monarchak GBP (101 MW), Rokhia GBP (63 MW) and Baramura GBP (42 MW).

Oscillation log from October'16 to December'16					
SN	Date	Starting Time	Duration	Mode of LFO	Remarks
1	10-Oct-16	17:28 Hrs	39 Hrs	0.4 Hz	-
2	04-Dec-16	22:11 Hrs	20 Hrs	0.4 Hz	-

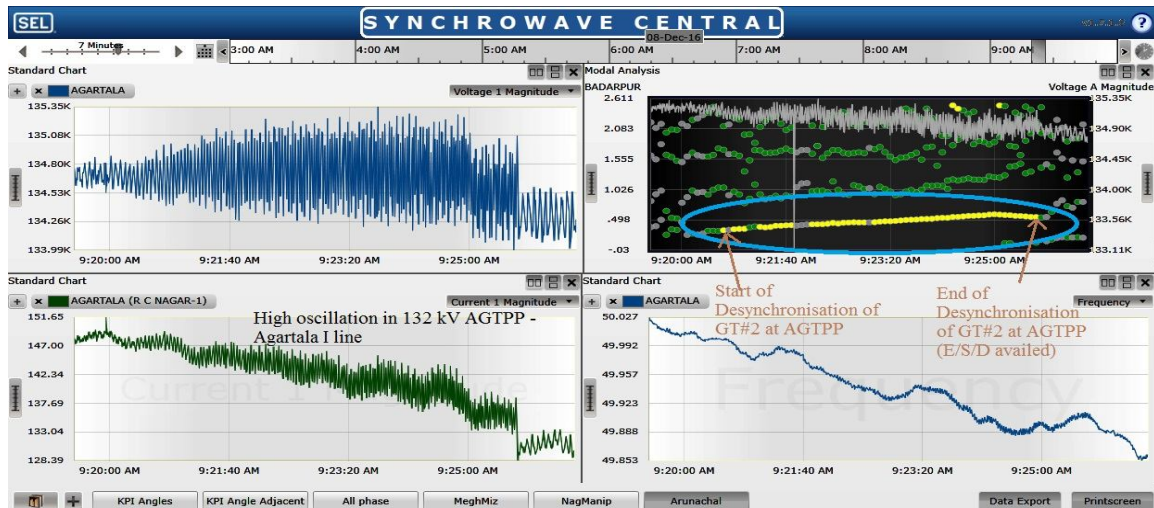
3	08-Dec-16	09:20 Hrs	10 Hrs	0.3 Hz	Oscillation during switching of Desynchronisation of AGTPP U#2 due to abnormality in fan
4	03-Jan-17	07:43 Hrs	3 Hrs	0.4 Hz	Oscillations started with tripping of AGTPP GT # 4
5	10-Jan-17	22:04 Hrs			At the same block (22:00 Hrs-22:15 Hrs), Kopili schedule was charged from 187 MW to 141 MW
6	11-Jan-17	23:23 Hrs			

On 3 particular instances, oscillations have been traced to have originated on account of switching events at AGTPP-CC of NEEPCO.

On 08th December'16 from 09:20 Hrs onwards, oscillation was seen prominently in Voltage at 132 kV Agartala PMU. No significant oscillation was observed in Active power / Frequency. In line current on 132 kV AGTPP - Agartala I line, an oscillation of nearly 5-6 A in magnitude was observed.

Upon investigation with data from PMU and SCADA-Sequence of Events, it was found that the oscillations started with de-synchronization of AGTPP GT # 2.

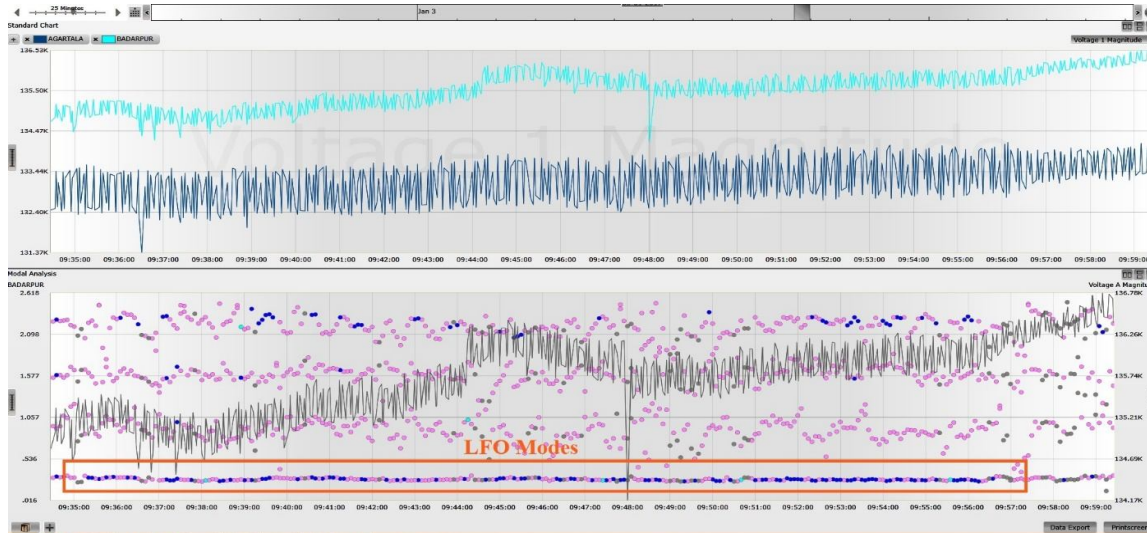
Considering the oscillation in voltage and request from AGTPP in real time to control voltage (although 132 kV Agartala voltage was around 136 kV, which is well within permissible voltage limits), it is suspected that oscillations occurred due to contribution of Automatic Voltage Regulator (AVR) of AGTPP units.



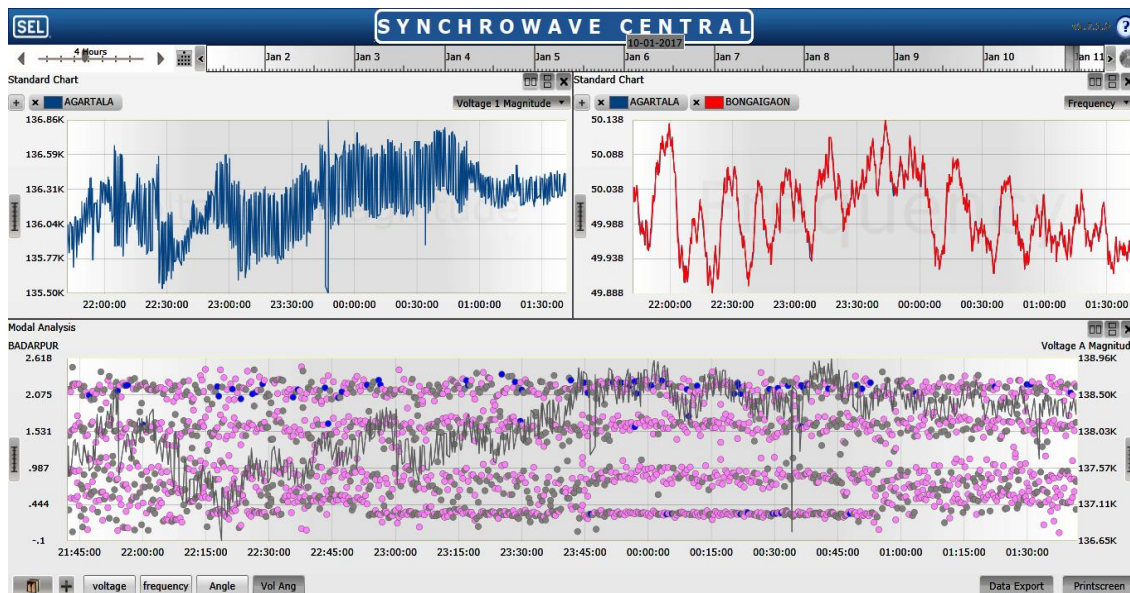
On 03rd January'17 from 07:43 Hrs onwards, oscillation was seen prominently in Voltage, at 132 kV Agartala PMU for a long duration of around 3 Hours.

Upon investigation, it was found that the oscillations started with tripping of AGTPP GT # 4.

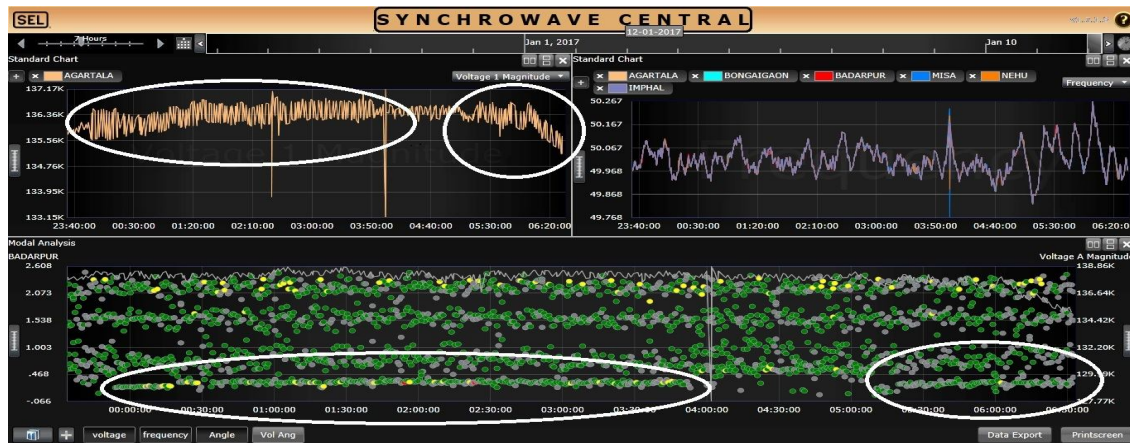
Considering that the mode of oscillation and nature of trigger was the same, it is also suspected due to action of AVR of the in-service AGTPP units.



On 10th January'17 from 22:04 Hrs onwards, oscillation was seen prominently in Voltage, at 132 kV Agartala PMU.



On 11th January'17 from 23:23 Hrs onwards, oscillation was seen prominently in Voltage, at 132 kV Agartala PMU.



Deliberation in the meeting

MS, NERPC requested that agenda pertaining to Low Frequency Oscillations to be discussed in Protection Sub- Group Committee.

The Sub-committee noted as above

Action - NERPC.

D.24. Frequent tripping of units of AGBPP (NEEPCO) due to tripping of Gas Compressor:

During the period from October'16 to December'16, there has been multiple tripping of units of Assam Gas Based Power Plant (AGBPP) of NEEPCO, resulting in lower availability of power for NER Grid. The list of trippings of units of AGBPP on account of tripping of Gas Compressor are listed below:

Sl. No.	Date of tripping	Time of tripping in Hrs	Unit tripped	Reason for tripping
1	15.10.2016	11:43	6	Due to tripping of GC # 2
2	15.10.2016	20:20	7	Due to tripping of GC#1 on valve sequence failed
3	15.10.2016	20:20	8	
4	16.10.2016	20:30	2	Due to tripping of GC # 3
5	16.10.2016	20:30	4	
6	16.10.2016	20:30	7	
7	17.10.2016	08:58	2	Due to tripping of GC#1
8	17.10.2016	08:58	7	
9	17.10.2016	08:58	3	
10	17.10.2016	08:58	4	
11	17.10.2016	08:58	8	
12	13.12.2016	00:56	2	Due to tripping of GC#3

13	13.12.2016	00:56	7	
14	16.12.2016	17:10	2	Due to tripping of GC#3
15	16.12.2016	17:10	4	
16	16.12.2016	17:10	7	
17	18.12.2016	08:17	2	Due to tripping of GC#3
18	18.12.2016	08:17	7	
19	23.12.2016	11:16	2	Due to tripping of GC#3
20	23.12.2016	11:16	7	
21	25.12.2016	11:42	4	Due to tripping of GC#2

Deliberation in the meeting

Sr. Manager, NEEPCO informed that due to microprocessor problem in circuitry of CR panel for GC#3 the problem is persisting, however this does not affect generation. The matter is being addressed locally and status would be intimated to the forum.

The Sub-committee noted as above.

Action: NEEPCO.

D.25. Periodic Inspection of UFRs installed in NER:

As per recommendation of Enquiry Committee, 400 MW UFR installation have been completed in North Eastern Region. However, during several Grid Disturbances in NER it has been observed that adequate amount of Load Relief could not be attained by UFRs.

As per Clause No. 5.2.(n) of Central Electricity Regulatory Commission (Indian Electricity Grid Code) Regulations, 2010, it has been stated that RPC Secretariat shall carry out periodic inspection of the under frequency relays and maintain proper records of the inspection.

As per Hon'ble Central Electricity Regulatory Commission Order dated 27.11.15 on Petition No. 113/MP/2014, it has also been stated that no information regarding periodic inspection of the UFRs by NERPC is available.

NERPC is requested to carry out periodic inspections of the Under Frequency Relays installed in NER.

Deliberation in the meeting

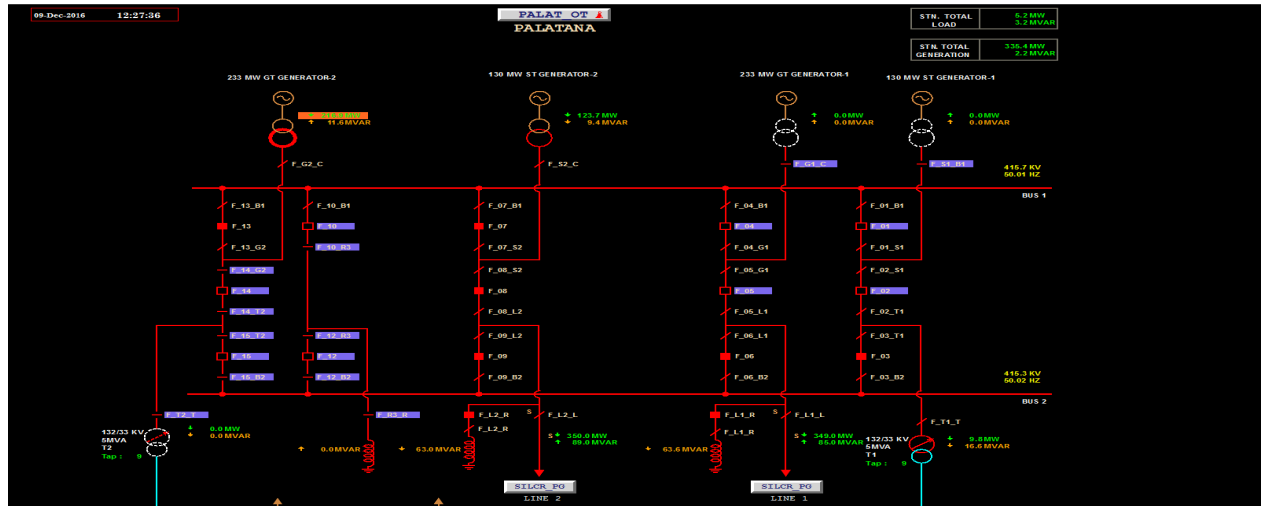
S.E.(C&O),NERPC informed that inspection team would be setup and UFR would be inspected periodically.

The Sub-committee noted as above.

Action: NERPC.

D.26. Incomplete Dia at 400 kV Palatana and islanding of Palatana generators on 07th December'16 and modification of SPS-1 related to unit tripping:

Units of Palatana CCGT (OTPC) tripped at 1155 hrs on 07.12.16 due to high frequency on account of islanding from rest of NER Grid. It was noted that OTPC, Palatana was keeping only one tie breaker closed between BUS 1 and BUS 2. So tripping of that tie CB led to isolation of Generator side bus and Line side bus.



As deliberated during, 127th OCC Meeting, OTPC, Palatana agreed to keep the tie breakers in service. However, as per email communication by OTPC dtd. 28.12.2016, several technical difficulties was cited in this matter. This would, however, compromise the reliability of NER Grid and may lead to recurrence of events of forced islanding of Palatana like that of 07th December'16.

In such case when all Dia will be closed but one or more generators are under outage at 400 kV Palatana, the SPS-1 related to load reduction may get affected if existing logic for SPS-1 does not take into account that all Circuit Breakers will be closed irrespective of unit outage.

It is to be ensured that in case of outage of any generators or ICTs, the SPS operation associated with the trippings of Palatana generators or ICTs should operate correctly.

Deliberation in the meeting

OTPC representative stressed that there is no provision for separate CB for Generating Unit. Even if all tie-breakers are kept closed at all times the entire protection scheme for the station would need to be revamped.

The forum requested NERPC to organize a separate meeting for Palatana related issues. NERPC agreed to the proposal.

The Sub-committee noted as above.

The forum felicitated Shri B.C. Bordoloi, CGM, SLDC, AEGCL, Shri K. Sarmah, DGM, AEGCL and Shri K. Goswami, DGM, APDCL on their contribution to various Sub-committees of NERPC and all members wished them success in their future endeavors after superannuation.

Date & Venue of next OCC meeting

It is proposed to hold the 129th OCC meeting of NERPC on second week of February, 2017. However, the exact date and venue will be intimated in due course.

The meeting ended with thanks to the Chair.

Annexure-I**List of Participants in the 128th OCC Meetings held on 19.01.2017**

SN	Name & Designation	Organization	Contact No.
1.	Sh. N. Perme, EE, SLDC	Ar. Pradesh	09436288643
2.	Sh. J. K. Baishya, DGM, SLDC	Assam	09435041494
3.	Sh. Dipesh Ch. Das, AGM, LDCOM	Assam	09954110254
4.	Sh. K. Sharma, DGM	Assam	-
5.	Sh. K. Goswami, DGM	Assam	-
6.	Sh. S. Goswami, DGM	Assam	-
7.	Sh. Bimal Ch. Borah, AGM, SLDC	Assam	09435119248
8.	Sh. I. Tahbildar, Dy. Manager, APDCL	Assam	09864799857
9.	Sh. Navajit Patir, Dy. Manager, SLDC	Assam	09707380294
10.	Sh. A.N. Dev Choudhury, AGM (Comml.)	Assam	09854120791
11.	Sh. Pranab Saha, DM, SLDC	Assam	09435561717
12.	Ms Roseleena Parveen, AM, APDCL	Assam	08011842597
13.	Ms Laishram Ritu, Manager, SLDC	Manipur	09612882984
14.	Ms Khoisnam Steela, Manager, SLDC	Manipur	08730831103
15.	Sh. R. Syiem, ACE (MePTCL)	Meghalaya	-
16.	Sh. F.E. Kharshiing, SE, SLDC	Meghalaya	09863066960
17.	Sh. H.F. Shangpliang, EE (Gen.)	Meghalaya	-
18.	Sh. B. Nikhla, EE, SD MePTCL	Meghalaya	-
19.	Sh. B. Wankhar, EE (MO)	Meghalaya	09436105914
20.	Sh. A.G. Tham, AEE MePTCL	Meghalaya	-
21.	Sh. A. Koch, AE, SLDC	Meghalaya	-
22.	Sh. Lalduhawma, EE, SLDC	Mizoram	09436144113
23.	Sh. A. Jakhalu, EE (Trans.)	Nagaland	09436002696
24.	Sh. Debabrata Pal, Sr. Manager (Comml.)	Tripura	09436500244
25.	Sh. J.C. Deka, Sr. Manager (E)	NEEPCO	09435339739
26.	Sh. D. Goswami, Sr. Manager (E/M)	NEEPCO	-
27.	Sh. S. Sarkar, Sr. Manager (E/M)	NEEPCO	-
28.	Sh. Sundar Moni Mohan, Dy.Mgr (E/M)	NEEPCO	09436898604
29.	Sh. B.K.Chakraborty, DGM (E)	NEEPCO	09436309730

30.	Sh. R. Sutradhar, DGM (MO)	NERLDC	09436302714
31.	Sh. N.R. Paul, AGM	NERLDC	-
32.	Sh. Ankit Jain, Sr. Engineer (SO-I)	NERLDC	09436335381
33.	Miss Momai Dey, Engineer	NERLDC	09436302716
34.	Sh. P. Kanungo, DGM (AM)	PGCIL	09436302823
	No Representative	NHPC	-
35.	Sh. Soubhik choudhury, AM (operation)	OTPC	07085060476
36.	Sh. Smruti Ranjan Das, Mgr (Electrical)	OTPC	09612400784
37.	Sh. J. Bhattacharyya, AGM	NTPC	09435720036
	No Representative	NETC	-
38.	Sh. P.K. Mishra, MS	NERPC	-
39.	Sh. B. Lyngkhoi, Director/S.E (C&O)	NERPC	09436163419
40.	Sh. S. Mukherjee, AEE	NERPC	08794277306
41.	Sh. A. Agrawal, AEE	NERPC	07424064484
42.	Sh. S. Ranjan, AE	NERPC	08794276168

Amendments of IEGC 2010

(1st. to 4th. Amendments

and

draft 5th. Amendment)

WHAT IS GRID CODE

- The Indian Electricity Grid Code (IEGC) is a Regulation made by the Central Commission in exercise of powers under clause (h) of sub-section (1) of Section 79 read with clause (g) of sub-section (2) of Section 178 of the Act.
- IEGC lays down the rules, guidelines and standards to be followed by various persons and participants in the system to **plan, develop, maintain and operate** the power system, in the most **secure, reliable, economic and efficient** manner, while facilitating **healthy competition** in the **generation** and **supply** of electricity.

Historical Background

IEGC, 2000

IEGC, 2006

IEGC, 2010

- The new Regulation on IEGC i.e. Central Electricity Regulatory Commission (Indian Electricity Grid Code) Regulations, 2010 were notified by CERC on 28.04.2010
- Became effective from 03.05.2010.

Time period	Permissible Frequency Band	Ceiling UI Rate (paise/kWh)	Floor UI Rate (paise/kWh)	Slope(paise/kWh for each 0.02 Hz)
1 st July 2002 – 31 st March 2004	49.0 Hz – 50.5 Hz	420	0	5.6
1 st April 2004 – 30 th Sept 2004	49.0 Hz – 50.5 Hz	600	0	8
1 st October 2004 – 29 th April 2007	49.0 Hz – 50.5 Hz	570	0	9
30 th April 2007- 6 th Jan 2008	49.0 Hz – 50.5 Hz	745	0	6 (50.5-49.8) 9 (49.8-49.5) 16 (49.5-49.0)
7 th Jan 2008 – 30 th March 2009	49.0 Hz – 50.5 Hz	1000	0	8 (50.5-49.8) 18 (49.8-49.0)
1 st April 2009 – 3 rd May 2010	49.2 Hz – 50.3 Hz	735	0	12 (50.3-49.8) 17 (49.8-49.2)
3 rd May 2010 to 16 th Sep 2012	49.5 Hz – 50.2 Hz	873	0	15.5(50.2-49.7) 47 (49.7-49.5)
17 th Sep 2012 to 16 th . Feb'14	49.7 Hz – 50.2 Hz	900	0	16.5(50.2-50.0) 28.5(50.0-49.8) 28.12(49.8-49.5)

Time period	Permissible Frequency Band	Ceiling UI Rate (paise/kWh)	Floor UI Rate (paise/kWh)	Slope(paise/kWh for each 0.02 Hz)
17th Sep 2012 to 16th.Feb'14	49.7 Hz – 50.2 Hz	900	0	16.5(50.2-50.0) 28.5(50.0-49.8) 28.12(49.8-49.5)

Time period	Permissible Frequency Band	Ceiling UI Rate (paise/kWh)	Floor UI Rate (paise/kWh)	Slope(paise/kWh for each 0.01 Hz)
17th Feb 2014 onwards	49.9 Hz – 50.05 Hz	824.04	0	35.60 (50.05-50.0) 20.84 (50.0-49.7)

Amendments of IEGC 2010 (1st. Amend; Mar'12)

Frequency band tightening from 49.5-50.2 Hz. to 49.7-50.2 Hz

CERC observation in SOR:

Regarding the possibility of increased load shedding and UI liability, **it is observed that with advance planning and using the power market platform, including power exchanges effectively, the distribution companies can manage load-generation balance effectively, rather than through over-drawal by the UI mechanism.** Moreover, with the tightening of frequency band and stricter UI regulations, **there would be improved operation of existing generating units and rotating machines connected to the load would give a higher output and operate more efficiently.** Therefore, we are of the view that the frequency band should be reduced from 49.5-50.2 Hz. to 49.7-50.2 Hz.

High Court order

Amendments of IEGC 2010 (1st. Amend; Mar'12)

Regulation 2.3.2 (d) : RLDC function changed from "Metering and data collection" to "**Meter data Processing**".

Regulation 5.2 (r): This amendment was done to **revise time line of "one week"** for **submitting information/ data including disturbance recorder/sequential event recorder** output to concerned RLDC for the purpose of analysis of any grid disturbance/event to "**24 hours**", to make it in line with the Grid Standards.

Regulation 5.7.4: The amendment in this regulation was done to **advance the outage plan report process** by one month in order to get the information in time for Point of Connection charges calculation.

Amendments of IEGC 2010 (1st. Amend; Mar'12)

STOA revision (tripping of unit>100 MW)

“Notwithstanding anything contained in Regulation 6.5.18, **in case of forced outage of a unit of a generating station (having generating capacity of 100 MW or more)** selling power under Short Term bilateral transaction, the generator or trader or any other agency selling power from this generating station shall **immediately intimate the outage of the unit along with the requisition for revision of schedule and estimated time of restoration of the unit, to SLDC/RLDC**, as the case may be. **The schedule of all the long-term and medium-term beneficiaries and the buyers under short-term bilateral transaction, getting power, directly under long-term Power Purchase Agreements or through sale by trader or any other agency or by generator itself under short-term open access, from the generating station of which the unit has gone under forced outage, shall be reduced on pro-rata basis.** The schedule of beneficiaries, sellers and buyers of power from this generating station shall be revised accordingly. **The revised schedules shall become effective from the 4th time block, counting the time block in which the forced outage is declared to be the first one.** The RLDC shall inform the revised schedule to the seller and the buyer. The original schedule shall become effective from the estimated time of restoration of the unit. However the transmission charges as per original schedule shall continue to be paid for two days. Provided that the schedule of the buyer and seller shall be revised after forced outage of unit, **only if, the source of power (particular generating station) for a particular transaction has clearly been indicated during short-term open access application and the unit of that generating station goes under forced outage.”**

Amendments of IEGC 2010 (1st. Amend; Mar'12)

The pro-rata reduction in the schedule is proposed to avoid any gaming by the generator in case of multiple contracts from the same unit. The decision of reduction in schedule for the contracts should not be left to the generator as the schedule for the buyer with less rate of contract may be curtailed only.

Amendments of IEGC 2010 (2nd. Amend Jan'14)

Tightening of frequency band:

"49.7-50.2 Hz" shall be substituted with the words and figures "**49.90-50.05 Hz**".

The regional entities shall regulate their generation and/or consumers' load so as to maintain their actual drawal from the regional grid close to the schedule. Maximum inadvertent deviation allowed during a time block shall not exceed the limits specified in the Deviation Settlement Mechanism Regulations.

Every regional entity shall ensure **reversal of sign of deviation from schedule at least once after every twelve time blocks.**"

Amendments of IEGC 2010 (2nd. Amend Jan'14)

The concerned SEB/distribution licensee/User, SLDC shall ensure that their **automatic demand management scheme** mentioned in clause 5.4.2 acts to ensure that there is no over-drawal.

RLDC may direct the SLDCs/ISGS/ other regional entities to increase/decrease their drawal/generation in case of contingencies e.g. overloading of lines/transformers, abnormal voltages, threat to system security. Such directions shall immediately be acted upon.

The schedule finalized by the concerned load despatch centre for **hydro generating station**, shall normally be such that the **scheduled energy for a day equals the total energy (ex-bus) expected to be available on that day, as declared by the generating station**, based on foreseen/planned water availability/release. It is also expected that the total net energy actually supplied by the generating station on that day would equal the declared total energy, in order that the water release requirement is met.

Amendments of IEGC 2010 (2nd. Amend Jan'14)

In case of any **grid disturbance, scheduled generation of all the ISGSs supplying power under long term / medium term/short term shall be deemed to have been revised to be equal to their actual generation** and the **scheduled drawals of the beneficiaries/buyers shall be deemed to have been revised accordingly** for all the time blocks affected by the grid disturbance. Certification of grid disturbance and its duration shall be done by the RLDC.

For Bilateral short term and collective transactions, the methodology of settlement of accounts for the period of Grid Disturbance shall be formulated by **National Power Committee(NPC)**

Amendments of IEGC 2010 (2nd. Amend Jan'14)

Revision of declared capability by the ISGS(s) having two part tariff with capacity charge and energy charge and requisition by beneficiary(ies) for the remaining period of the day shall also be permitted with advance notice. **Revised schedules/declared capability in such cases shall become effective from the 4th time block, counting the time block in which the request for revision has been received in the RLDC to be the first one."**

Amendments of IEGC 2010 (3rd. Amend Aug'15)

Most of the wind and solar energy generators are presently connected to intra-State network and in future are likely to be connected to the inter-state transmission system (ISTS) as well. Keeping in view the variable nature of generation from such sources and the effect such variability has on the inter-state grid, and **in view of the large-scale integration of such sources into the grid envisaged in view of the Government of India's thrust on renewable sources of energy, scheduling of wind and solar generators which are regional entities, has been incorporated in this code.**

“A daily report covering the performance of the regional grid shall be prepared by each RLDC based on the inputs received from SLDCs / Users and shall be put on its website. **This report shall also cover the wind and solar power generation and injection into the grid.”**

Amendments of IEGC 2010 (3rd. Amend Aug'15)

Ultra Mega Power Projects including projects based on wind and solar resources and having capacity of 500 MW and above.

Forecasting shall be done **by wind and solar generators** which are regional entities as well as the concerned RLDC. The concerned RLDC may engage forecasting agency(ies) and prepare a schedule for such generating stations. The **forecast by the concerned RLDC shall be with the objective of ensuring secure grid operation. The forecast by the wind and solar generator shall be generator centric.**

Amendments of IEGC 2010 (3rd. Amend Aug'15)

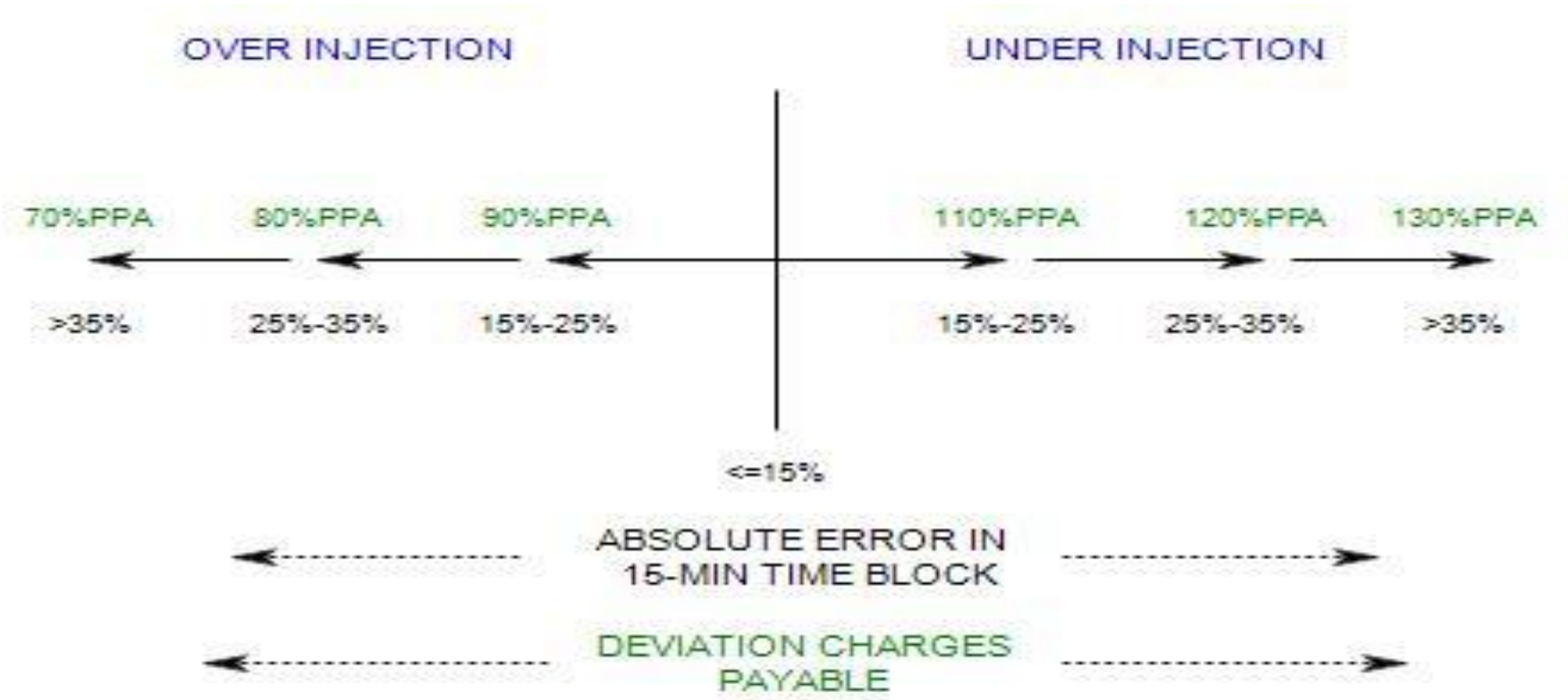
The schedule by wind and solar generators which are regional entities (excluding collective transactions) may be revised by giving advance notice to the concerned RLDC, as the case may be. Such revisions shall be effective from 4th time block, the first being the time-block in which notice was given. **There may be one revision for each time slot of one and half hours starting from 00:00 hours of a particular day subject to maximum of 16 revisions during the day.**

The **wind and solar generators which are regional entities shall forecast** renewable energy generation at the following time intervals:

Day ahead forecast: **Wind and solar energy generation forecast with an interval of 15 minutes for the next 24 hours for the aggregate generation capacity of 50 MW and above.**

The charges payable for **deviation from schedule by the wind and solar generators which are regional entities, shall be delinked from frequency.**

PROVISIONS IN DSM REGULATIONS, 2014 FOR SOLAR GENERATION



Where PPA rate is Power Purchase Agreement rate

Amendments of IEGC 2010 (4th. Amend April'16)

Procedure and mechanism for declaration of **Commercial Operation**

It may be seen that some of the Central generating stations supplying 100% power to one State which are not covered by the definition of ISGS may not get covered in the scope. Since the tariff of Central generating stations are regulated by CERC, **it is felt that central generating stations which are not ISGS may also be included in the scope.** The State generating stations would be out of scope as far as declaration of COD is concerned. **However, it is up to the State Electricity Regulatory Commission to extend these provisions in respect to State generating stations in their purview.**

“This code also provides for the procedure and mechanism for declaration of commercial operation of the Central Generating Stations, inter-State Generating Stations and the inter-State Transmission System and technical minimum schedule for operation of **Central Generating Stations and inter-State Generating Stations.**”

Amendments of IEGC 2010 (4th. Amend April'16)

The capacity intended originally which is reflected in the Maximum Continuous Rating of the unit or Installed Capacity or the Name Plate Rating only needs to be established and demonstrated before declaring the COD of any unit. This is desirable from the point of view of the beneficiaries / procurers and the grid operation.

However, to take care of the concerns of the generator that its unit is not rejected for demonstrating capacity less than MCR capacity or the Installed Capacity or the name plate rating, the COD declaration may be allowed at capacity less than MCR capacity or the Installed Capacity or the name plate rating subject to de-rating of the unit by the generator. **This would however be with a rider that such demonstration of capacity should not be less than 95% of the MCR capacity or the Installed Capacity or the name plate rating.**

Amendments of IEGC 2010 (4th. Amend April'16)

Trial Run or Trial Operation: Trial Run or Trial Operation in relation to a thermal Central Generating Station or inter-State Generating Station or a unit thereof shall mean successful running of the generating station or unit thereof on designated fuel at Maximum Continuous Rating or Installed Capacity or Name Plate Rating for a **continuous period of 72 hours** and in case of a hydro Central Generating Station or inter-state Generating Station or a unit thereof for a **continuous period of 12 hours**

Amendments of IEGC 2010 (4th. Amend April'16)

However, considering the large size of integrated grid, large capacity addition envisaged of large size units, integration of renewable sources of energy into the grid, low system demand during off peak hours, **ensuring load corresponding to the MCR or Installed Capacity or name plate rating may be difficult and it may not be desirable practically and commercially to prolong the COD of unit unduly.** Commission therefore, deem it fit to provide for **short interruptions and partial loading for a cumulative period of 4 hours with corresponding increase in duration of trial operation.** Any cumulative period of partial loading and interruption of more than 4 hours will require repeat of trial operation for a further period of 72 Hours.

Apart from above, the **average capacity demonstrated should not be less than MCR or Installed Capacity or the nameplate rating during the period of testing.**

Amendments of IEGC 2010 (4th. Amend April'16)

The Commission is of the view that 7 days prior notice for every trial operation including retesting is reasonable.

Date of commercial operation in case of a unit of thermal Central Generating Stations or inter-State Generating Station shall mean the **date declared by the generating company after demonstrating the unit capacity corresponding to its Maximum Continuous Rating (MCR) or the Installed Capacity (IC) or Name Plate Rating** on designated fuel through a successful trial run and after getting clearance from the respective RLDC or SLDC, as the case may be.

Amendments of IEGC 2010 (4th. Amend April'16)

The **generating company shall certify** at the level of CEO/MD that:

- (a) The generating station or unit thereof meets the requirement and relevant provisions of the **technical standards of Central Electricity Authority (Technical Standards for Construction of Electrical Plants and Electric Lines) Regulations, 2010 and Indian Electricity Grid Code**, as applicable:
- (b) **The main plant equipment and auxiliary systems including Drainage Dewatering system, Primary and Secondary cooling system, LP and HP air compressor, Firefighting system, etc. have been commissioned** and are capable for full load operation of units on sustained basis.
- (c) Permanent electric supply system including emergency supplies and all necessary Instrumentations Control and Protection Systems and auto loops for full load operation of the unit are put into service.

Amendments of IEGC 2010 (4th. Amend April'16)

The concerned RLDC or SLDC, as the case may be, shall convey clearance to the generating company for declaration of COD within 7 days of receiving the generation data based on the trial run.

The scheduling should start from 0.00 Hr after declaration of COD.

Each repeat of trial run shall commence after a notice of not less than seven days by the generating company to the beneficiaries and concerned RLDC or SLDC, as the case may be;

Amendments of IEGC 2010 (4th. Amend April'16)

In case a hydro generating station with pondage or storage is not able to demonstrate the peaking capability corresponding to the installed capacity for the reasons of insufficient reservoir or pond level, the date of commercial operation of the last unit of the generating station shall be considered as the date of commercial operation of the generating station as a whole, and it will be mandatory for such hydro generating station to demonstrate peaking capability equivalent to installed capacity of the generating station or unit thereof as the case may be, as and when such reservoir/pond level is achieved

If a run-of-river hydro generating station or a unit thereof is declared under commercial operation during lean inflows period when the water inflow is insufficient for such demonstration of peaking capability, it shall be mandatory for such hydro generating station or unit thereof to demonstrate peaking capability equivalent to installed capacity as and when sufficient water inflow is available

Amendments of IEGC 2010 (4th. Amend April'16)

Declaration of **Commercial Operation of Transmission Systems**

Trial run and Trial operation in relation to a transmission system or an element thereof shall mean **successful charging of the transmission system or an element thereof for 24 hours at continuous flow of power, and communication signal from the sending end to the receiving end and with requisite metering system, telemetry and protection system** in service enclosing certificate to that effect from concerned Regional Load Despatch Centre.

Date of commercial operation in relation to a communication system or an element thereof shall mean the date declared by the transmission licensee from 0000 hour of which a communication system or element thereof shall be put into service after completion of site acceptance test including transfer of voice and data to respective control centre as certified by the respective Regional Load Dispatch Centre.”

Amendments of IEGC 2010 (4th. Amend April'16)

Date of commercial operation in relation to an inter-State Transmission System or an element thereof shall mean the date declared by the transmission licensee **from 0000 hour of which an element of the transmission system is in regular service after successful trial operation** for transmitting electricity and communication signal from the sending end to the receiving end:

In case a transmission system or an element thereof is **prevented from regular service** on or before the Scheduled COD **for reasons not attributable to the transmission licensee or its supplier or its contractors** but is on account of the delay in commissioning of the concerned generating station or in commissioning of the upstream or downstream transmission system of other transmission licensee, the **transmission licensee shall approach the Commission through an appropriate application for approval of the date of commercial operation of such transmission system or an element thereof.**

Amendments of IEGC 2010 (4th. Amend April'16)

Technical Minimum Schedule for operation of Generating Stations

The technical minimum schedule for operation in respect of ISGS shall be **55% of MCR loading of unit/units of generating stations.**

CERC in SOR:

Relying on the CEA recommendations we are not inclined to change the limit of technical minimum schedule corresponding to 55% of the Installed capacity of unit. However, considering the concerns of generators in operating their unit at such low schedule corresponding to 55% of Installed capacity due to various technical constraints the generator will have the option to take its unit in reserve shut down at schedules below 55%. **However, Commission is of the view that the generator should be adequately compensated for the loss of operational parameters due to operation of units at such technical minimum load below the normative operational level of 85%.**

Amendments of IEGC 2010 (draft 5th. amend)

Definition of Spinning Reserve

"Spinning reserves means the Capacity which can be activated on direction of the system operator and which is provided by devices including generating stations/units, which are synchronized to the grid and able to effect the change in active power."

CERC constituted "**Committee on Spinning Reserve**" under the Chairmanship of Shri A.S.Bakshi, Member, CERC for adoption of the Spinning Reserve Services in Indian Power system. Committee submitted its report on 17.09.2015 and has recommended that Spinning Reserve Services shall be in place by 01.04.2017.

Roles of RLDCs / NLDC / RPC / SLDCs in Ancillary Services.

Amendments of IEGC 2010 (draft 5th. amend)

FGMO / RGMO provisions

Amend the Regulation 5.2 (f) and its sub-clauses for **excluding the generators below 25 MW from the list of hydro stations** which are required to provide the primary response through governor action

and for **including the Open Cycle Gas Turbine/Combined Cycle generating stations having gas turbines of capacity more than 50 MW each in the list of stations** which are required to provide the primary response through governor action.

RLDC/SLDC shall not schedule the units beyond ex bus generation corresponding to 100% of the installed capacity. Further, it has been opined by the Committee that Valve Wide Open (VWO) operation of units shall not be allowed so that there is margin available in valve opening for providing primary response upto 5% of the generation level.

Amendments of IEGC 2010 (draft 5th. amend)

Tariff Policy dated 28.1.2016

*"Power stations are required to be available and ready to dispatch at all times. Notwithstanding any provision contained in the Power Purchase Agreement (PPA), in order to ensure better utilization of un-requisitioned generating capacity of generating stations, based on regulated tariff under Section 62 of the Electricity Act 2003, **the procurer shall communicate, at least twenty four hours before 00.00 hours of the day when the power and quantum thereof is not requisitioned by it enabling the generating stations to sell the same in the market** in consonance with laid down policy of Central Government in this regard. The developer and the procurers signing the PPA would share the gains realized from sale, if any, of such un-requisitioned power in market in the ratio of 50:50, if not already provided in the PPA. Such gain will be calculated as the difference between selling price of such power and fuel charge. It should, however, be ensured that such merchant sale does not result in adverse impact on the original beneficiary(ies) including in the form of higher average energy charge vis-à-vis the energy charge payable without the merchant sale. For the projects under section 63 of the Act, the methodology for such sale may be decided by the Appropriate Commission on mutually agreed terms between procurer and generator or unless already specified in the PPA."*

Amendments of IEGC 2010 (draft 5th. amend)

Two day ahead scheduling summary

The scheduling is proposed to **start at 1 PM on D-2 day** if D is the day on which implemented schedules are applicable.

The original beneficiary whose power has still been left un-requisitioned may provide a formal communication to ISGS by 12 midnight on day before the day of implemented schedules. Such communication shall clearly specify the quantum of power and duration for which ISGS may sell the power in the market.

In case such power for which original beneficiary has allowed the generator to sell in the market has been sold in the market, beneficiary shall not be allowed to recall the power by rescheduling. In case power left unsold on the market, original beneficiaries may schedule the power from 4th time block as per procedure in vogue.

Amendments of IEGC 2010 (draft 5th. amend)

*By **1 PM** every day, the ISGS shall advise the concerned RLDC, the station-wise ex-power plant MW and MWh capabilities foreseen for the day after the next day, i.e., from 0000 hrs to 2400 hrs of the day after the next day*

*The foreseen capabilities of the ISGS and the corresponding MW and MWh entitlements of each State, shall **be compiled by the RLDC every day for the day after the next day, and advised to all beneficiaries by 3 PM.***

*SLDC shall advise the RLDC by **5 PM** their tentative drawal schedule for each of the ISGS in which they have Shares, long-term and medium-term bilateral interchanges, approved short -term bilateral interchanges.*

Amendments of IEGC 2010 (draft 5th. amend)

*By **7 PM** each day, the RLDC shall convey: The ex-power plant “despatch schedule” to each of the ISGS, in MW for different time block, for the day after the next day.*

*Original Beneficiaries of an ISGS will have first right to give requisition for the URS power of the ISGS. Such original beneficiaries shall advice RLDCs, through their SLDC, regarding quantum of power and time duration of such drawal out of declared URS of the ISGS, **by 8 P.M.** In case full URS of an ISGS is requisitioned by more than one original beneficiary, RLDC shall allocate URS proportionately based on the share of these original beneficiaries in the ISGS.*

*RLDCs to post the ISGS wise data of balance URS on its website by **9 P.M.***

Amendments of IEGC 2010 (draft 5th. amend)

*The original beneficiary shall communicate by **12PM** about the quantum and duration of such URS power to ISGS to enable ISGS sell same in the market . If the original beneficiary fails to communicate to ISGS, then the ISGS shall be entitled to sell the URS power of the beneficiary in the market .*

The URS which has been sold and scheduled by ISGS in the market (power exchange or through STOA) cannot be called back by the original beneficiary.

After sale in market as under 8(d) above, if any power still remains under URS, the same may be requisitioned by the beneficiaries of the station.

By 6 P.M, each day, RLDC shall convey ex-power power plant dispatch to each ISGS for the next day after incorporating sale in market.

Amendments of IEGC 2010 (draft 5th. amend)

In case of sale of un-requisitioned surplus power in market , the generator and the original beneficiary would share the realized gains in the ratio of 50:50.

Subject to provisions to CERC Tariff Regulations, the liability of fixed charge in such case shall remain with original beneficiary.

In case the un-requisitioned surplus power surrendered by the original beneficiary is requisitioned by the other beneficiaries of the ISGS, it shall be treated as reallocation and the fixed charge and variable charge for such energy exchanged shall be borne by the other beneficiary(ies).

Central Electricity Regulatory Commission
New Delhi

Staff Paper

on

Introduction of Electricity Storage System in India

Staff Paper on Electricity storage in India

The electricity demand fluctuates throughout the day.

The **peaking generating stations** with high variable cost, are intended to **bridge the gap between peak and base load**. These generating stations are capable to start and stop quickly and operate when high ramping rate is required.

The precise balancing of electricity demand and generation is achieved by adjusting output of generating stations such as **hydroelectric and gas based generating stations**. These generating stations are also called as load following generating stations

Staff Paper on Electricity storage in India

The **increasing share of renewable generations in the grid** has impacted.

the traditional approach of balancing. **Wind, Solar Power are intermittent in nature, that is, their output.**

depends on external conditions, such as sunshine or wind.

The **value and timing of their output are not controllable**

Staff Paper on Electricity storage in India

The balancing through the conventional load following generating stations such as hydroelectric plant and gas based thermal plant would not be adequate.

The decentralized market structure provides individual market entities to be more responsive in complying with grid discipline rules of balancing their generation and demand.

These challenges warrant a specific **energy storage solution (ESS)** to cater to peak demand and to address the variability of intermittent generation.

Staff Paper on Electricity storage in India

The ESS has a wide range of applications which can be deployed from consumer level, connected to distribution system, to bulk storage system connected to the grid.

Pump-storage hydroelectric plants represent about 6.80 GW capacity (under operation and construction).

<http://www.energystorageexchange.org/projects/>

Although, the ESS may initially have various challenges including cost/commercial reasons, but **in the long run, cost of the ESS is expected to decrease due to technological innovations.**

Staff Paper on Electricity storage in India

Ministry of New and Renewable Energy („**MNRE**”) has already come out with tender/s considering the **renewable generator with ESS for inviting tariff based bid for renewable projects.**

Staff Paper on Electricity storage in India

The generic technical parameters about various storage technologies based on the form in which the electricity is stored before converting into electricity, is given in following table:

Type of Storage	Net Energy Yield	Discharge Capacity	Range of Capacity
Pumped Storage	75-80%	6-10 hours	250-1000 MW
Electrochemical Battery Cell	60-75%	4-5 hours	100-200 MW

Staff Paper on Electricity storage in India

Grid Level Applications of Electricity Storage System:

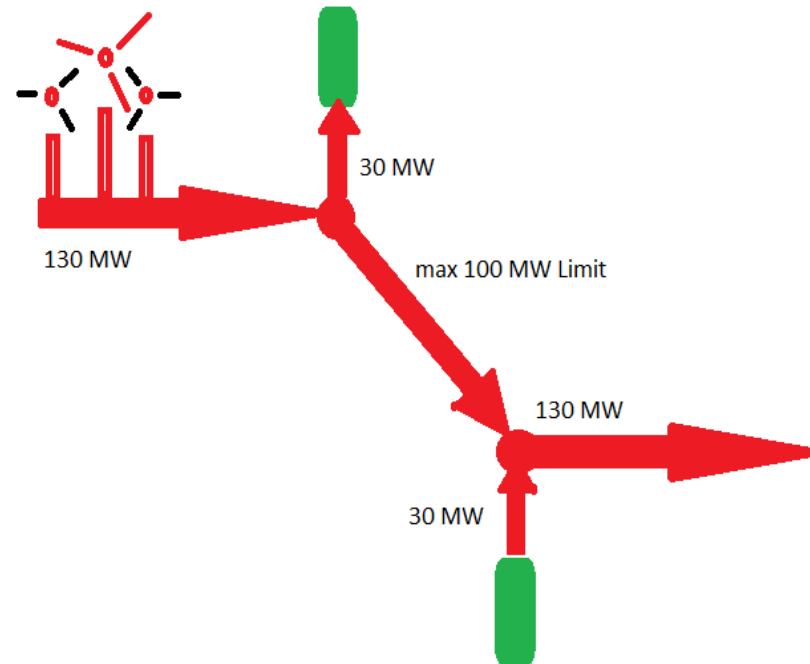
1. **Optimization of Generation:** One of the possible uses of a storage facility is to shift generation output from one period to another.
2. **Controlling Intermittent Generation from Renewable Sources:** Another possible use of a storage facility is to store generation output from renewable sources of intermittent nature for commitment of serving the electricity to the buyers over a longer period.

Staff Paper on Electricity storage in India

Grid Level Applications of Electricity Storage System:

3. **Reliable Operation of Power System Operation:** Further possible use of a storage facility is to store generation output for maintaining flow of power over tie-line.

4. **Minimize the deviation from schedule:**



Staff Paper on Electricity storage in India

Grid Level Applications of Electricity Storage System:

5. Storage of Excess Generation of Grid: The standard frequency of electrical system is 50.00 Hz which can be achieved at equilibrium level of load (including network losses and auxiliary consumptions) and generation in the grid. The average frequency of more than 50.20 Hz has been observed during number of blocks.

6. Ancillary Service: The storage service will be useful for providing the regulation service to the system operator at the rates of ancillary service decided by the Commission.

Staff Paper on Electricity storage in India

Potential Owners of Electricity Storage Facilities:

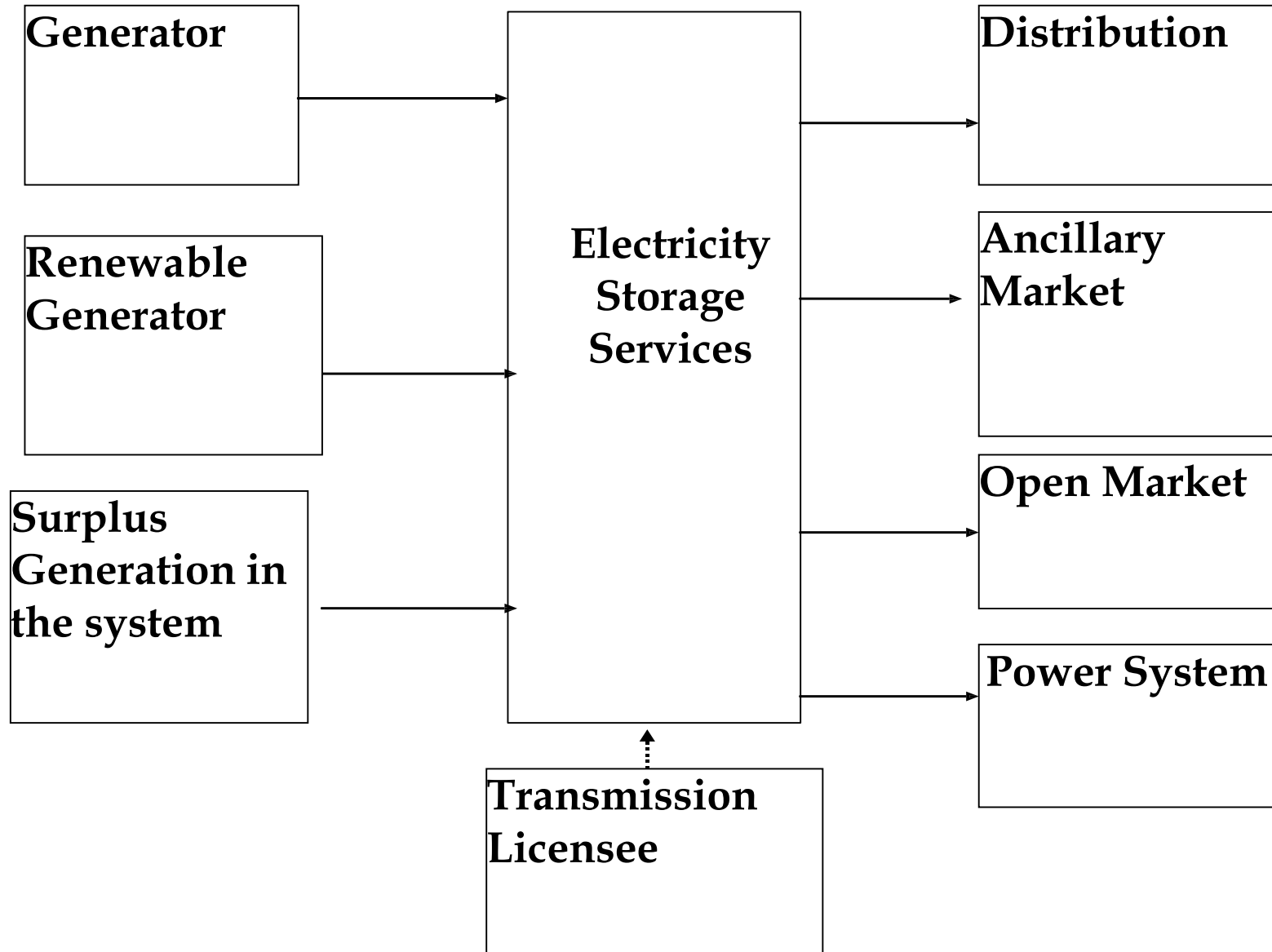
1. **Transmission licensees:** The transmission licensees may own the storage facility as a facilitator and provides storage services as supplemental to the transmission services based on the supplemental service rates.
2. **Generating Companies:** Generating companies may own the storage facility and provide bulk sale of power as part of generation obligation or provide storage services to the others.

Staff Paper on Electricity storage in India

Potential Owners of Electricity Storage Facilities:

3. **Distribution Licensees:** The distribution licensees that own distribution system may own a storage facilities to flatten the demand curve or to provide reliability support or sale of power as part of distribution obligation.
4. **Merchant power plant (including Captive Power Plant):** The merchant power plant may own storage facilities for sale of power in the open market when the market offers attractive prices.
5. **Bulk Consumers:** The bulk consumers may install storage facilities at their end-use locations

Staff Paper on Electricity storage in India



Staff Paper on Electricity storage in India

The business model for storage services will be more complex when there are multiple uses.

Model of natural gas storage facilities : The natural gas storage facilities are operated by pipeline owner (transporter) and offer open access storage services to customers who contract for that service.

Similarly, **The storage operator may operate and maintain the electricity storage facility at its customers" direction and never take title to the energy stored at the facility.** Thus, each storage customer would decide how to use its purchased storage capacity. If similar model is to be considered in the electricity, **a transmission licensee might be the owner of storage facilities and needs to sign an agreement with long term electricity customers or the grid operator.**

Staff Paper on Electricity storage in India

Joint ventures for ESS

Further, the investment for setting up of the storage facilities is higher, equivalent to the production of electricity and single owner engaged in the generation of electricity or load serving or transmission business, may not opt for the storage business.

One of the options could be to set up **storage facilities jointly by all State entities by creating special purpose vehicles or joint ventures**. There are certain advantages to creation of such multi owner company.

Staff Paper on Electricity storage in India

Dedicated use of the electricity storage services

In case the dedicated use of the electricity storage services by generating station or transmission licensee, separate charges for electricity storage services may not be required and it may be considered as a part of the generation or transmission business, as the case may be.

The cost of such ESS is to be considered in the tariff determination of generation or transmission licensee, as the case may be.

Staff Paper on Electricity storage in India

Dedicated use of the electricity storage services

Ministry of New and Renewable Energy („MNRE”) has already considered inviting renewable generators with ESS for developing projects through tariff based bid for renewable projects.

This type of the ESS will fall in this category and the recovery of storage service will be a part of electricity tariff of the generating station.

Staff Paper on Electricity storage in India

Dedicated use of the electricity storage services

The tariff of the ESS will comprise only a Fixed Charge component. If the use of ESS is dedicated to the generating station, the tariff of such ESS may be pooled with the annual fixed charges of the generating station.

The cash flow of the generating station will remain neutral, however, the benefit of the shifting of the generation will be available to the procurer as they can avoid the purchase of costlier power from the open market or burning costlier fuel during peak hours.

The ramping rate of the generating station will also undergo a change. Therefore, the procurer has an additional advantage to meet the ramping of the generation or to counter the variability of renewable generation.

Staff Paper on Electricity storage in India

Non-dedicated use of the ESS

If, use of the electricity storage services is not limited to the self use by the developer, **separate service charges are to be specified for the utilization of storage facilities.**

The developer of the electricity storage services have to enter into agreement with the multiple users specifying the storage capacity and storage period.

Staff Paper on Electricity storage in India

Non-dedicated use of the ESS

If the storage facilities are used by other generator (convention or renewable) or distribution licensee, the storage service charges are to be recovered from that generator or distribution licensee with mark up price

Deviation Control: The service charges of storage facilities for using tie line flow control or deviation control of the control area, the beneficiaries of the deviation control will be the regional entities.

Staff Paper on Electricity storage in India

Non-dedicated use of the ESS

Balancing Control or storage of excess generation: **The system operator may use storage facilities for storage of excess generation and dispatch when it is required.**

In this case, the storage services may be recovered from over injecting or under-drawing entity.

Staff Paper on Electricity storage in India

Challenges to the deployment of Energy Storage System:

The **cost also involves the factors such as technical risk mitigation**, controlling the uncertainties at the early stage of deployment, operational uncertainties etc.

Advanced research at international level is expected to reduce the cost of storage technologies

Staff Paper on Electricity storage in India

Some links to international sites / reports

<http://www.energystorageexchange.org/projects/>

<http://rameznaam.com/2015/04/14/energy-storage-about-to-get-big-and-cheap/>

Visiongain report on “Grid-Scale battery storage Technologies Market 2016-2026

Visiongain’s comprehensive new 234 page report reveals that CAPEX invested in grid-scale battery storage technologies will reach \$1,107m in 2016, with rapid growth anticipated over the next ten years.

Lithium Ion Battery Market

Sodium-Based Battery Storage Market

Flow Battery Storage Market Forecast

Advanced Lead Acid Battery Storage Market Forecast

Other Battery Storage Technologies Market Forecast

Staff Paper on Electricity storage in India

Stakeholders' views solicited in staff paper on:

i) Whether Electricity storage facility is required in the Indian Power System to address the various challenges discussed in the paper? Or can these issues be addressed through alternative solutions?

ii) How the requirements of storage facilities is to be assessed in the grid?

What can be the specific criteria to be considered for development of storage facilities and associated transmission system?

iii) What are the perceived policy changes required to deploy the bulk storage facilities in the Indian Power System?

Staff Paper on Electricity storage in India

- iv) Whether Electricity storage technology is expected to achieve commercial viability as believed in the international market?

- v) What could be the appropriate model for fixation of tariff for multiple uses of storage facilities? Can the tariff of the ESS be determined under cost plus or competitive bidding basis as a part of augmentation of generation or transmission assets? What can be the operational or performance parameters for recovery of the cost?

- vi) What type of financial and nonfinancial data, if any, and what level of detail need to be reported to CERC for the storage technologies for fixation of cost based tariff ?

Staff Paper on Electricity storage in India

- vii) How scheduling, energy accounting and open access issues will be dealt when the generation output and energy storage output are measured at two different grid points ?

- viii) What would be the role of system operators and Central Transmission Utility in operations and planning of the Electricity Storage System ?

- ix) Any other issues for development and market acceptance of storage technologies.

Spinning Reserve in Indian **Power System**

Committee Report on Spinning Reserve : September 17, 2015
CERC order dated 13.10.2015 Petition No. 11/SM/2015

Maintenance of Load - Generation balance is one important aspect of reliability.

Number of uncertainties associated with Power System.

Increasing penetration of Renewables (both Wind and Solar) in the country

Creation of adequate system reserve margin and spinning reserve of 5% at national level has not yet materialized.

Amidst all these uncertainties, it is very important to have different '**Real Power Reserves**' in the Power System.

Committee Report on Spinning Reserve : September 17, 2015

CERC order dated 13.10.2015 Petition No. 11/SM/2015

Types of reserves

Primary control: Through turbine speed governors; response. Primary control is for providing immediate support to correct imbalance which lasts for short period of up to 30 seconds - 15 minutes, within which secondary control should come into play so as to push generation of units providing primary control reserves back to their scheduled values.

Secondary control: Through Automatic Generation Control – AGC; Centralized area wise automatic control which delivers reserve power in order to bring back the frequency and the area interchange programs to their target values.

Area Control Error ($ACE = \Delta P_{tie} + k \Delta f$).

Units have to be wired under AGC (Automatic Generation Control) and both sides communication between control room and generators has to be provided. AGC (Automatic Generation Control) software is needed to implement and handle the calculations

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Area Control Error ($ACE = \Delta P_{tie} + k \Delta f$).

Area Control Error (ACE) is the difference between scheduled and actual electrical generation within a **control area** on the power grid, taking frequency bias into account.

K is FRC of the area in MW/Hz.

If NER is overdrawing from ER by 100 MW at 49.5 Hz,

$ACE = 100 + 0.5 \times 80 = 140$ MW. (If FRC = 80 MW/Hz)

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Tertiary control: manual change in the dispatching and unit commitment in order to restore the secondary control reserve ;

Tertiary control therefore, refers to rescheduling of Report of the Committee on Spinning generation to take care of deviations in a planned manner during real time operation and leads to restoration of primary control and secondary control reserve margins.

The general response time of reserves

Reserve	Start	Full availability	End
Primary Response	Immediate	<30 sec	>15 min
Secondary Control	>30 Sec	<15 min	As long as required or till replaced by Tertiary Reserves
Tertiary Control	Usually > 15 min to Hours		

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What does Spinning Reserve mean?

"The spinning reserve means "the capacity which can be activated on decision of the system operator and which is provided by devices which are synchronized to the network and able to effect the change in active power."

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Regulatory provisions in India:

National Electricity Policy, 2005 envisages 5 % Spinning Reserves at national level.

Relevant extract from IEGC, from the section 5.2(i) is quoted as below:

“The recommended rate for changing the governor setting, i.e., supplementary control for increasing or decreasing the output (generation level) for all generating units, irrespective of their type and size, would be one (1.0) per cent per minute or as per manufacturer’s limits. However, if frequency falls below 49.7Hz, all partly loaded generating units shall pick up additional load at a faster rate, according to their capability.”

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In terms of National Electricity policy, spinning reserves at **5% of the Installed Generation Capacity of around 272 GW works out as 13600 MW**. This would include primary control reserves, secondary control reserves and tertiary control spinning reserves.

The spinning Reserve may be maintained, to start with at the regional level.

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Primary reserves of 4000 MW would be maintained on an All India basis considering 4000 MW generation outage as a credible contingency. The same **would be provided by generating units in line with the IEGC provisions.**

Each region should maintain **Secondary reserve** corresponding to the largest unit size in the region.

1000 MW in Southern region;

800 MW in Western regions;

800 MW in Northern region;

660 MW in Eastern region and

363MW in North-eastern region. **(total approx. 3600 MW on an All India basis).** To start with it is **felt that the spinning reserves may be carried on the ISGS regulated by CERC.**

Tertiary reserves should be maintained in a de-centralized fashion by each state control area for at least **50% of the largest generating unit available in the state control area.**

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Region	FRC in MW/Hz	Maximum Value of ACE (in MW) for a typical day 6th May 2015
NR	1260	1281
WR	1700	704
SR	2250	746
ER	373	903
NER	86	392
Simultaneous sum (same time)	5669	2053

At least 2000 MW secondary control reserves are required.

$$\underline{ACE = \Delta P_{tie} + k \Delta f}$$

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The respective RLDC shall be the Nodal agency at the regional level and NLDC at the country level.

The reserve requirement may be estimated by the nodal agency on day ahead basis along with day ahead scheduling of all available generating stations.

Implementation of AGC is necessary along with reliable telemetry and communication. **The AGC may be planned to be operationalised in the power system from 1.4.2017.**

It is essential that load forecasting is done at each discom level, at each SLDC/State level and each RLDC/Regional level and finally at NLDC/country level.

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The nodal agency may have the option of carrying such reserves on one or more plants on technical and commercial considerations and **may withhold a part of declared capacity on such plants from scheduling**. It could be in terms of % of declared capacity or in MW term as deemed fit.

To start with a regulated framework in line with the Ancillary Services Regulations may be evolved for identification and utilising of spinning reserves and implemented with effect from 1.4.2016. This framework may continue till 31.3.2017