CENTRAL ELECTRICITY REGULATORY COMMISSION
(NEW DELHI)

Suo-Motu Petition No. 2/SM/2025

Coram:
Shri Jishnu Barua, Chairperson
Shri Ramesh Babu V., Member
Shri Harish Dudani, Member
Shri R.S. Dhillon, Member

Date of Order : 29.03.2025

In the matter of :

Measures to mitigate the risks on the power system under Clauses (2) and (3) of the Regulation 30 of the Central Electricity Regulatory Commission (Indian Electricity Grid Code) Regulations, 2023.

And in the matter of :

1. National Load Despatch Centre,
   Grid Controller of India Ltd. (CIN U40105DL2009GOI188682)
   B-9 (1st Floor), Qutab Institutional Area, Katwaria Sarai,
   New Delhi -110016

2. Northern Regional Load Despatch Centre,
   Grid Controller of India Ltd.
   18-A, Shaheed Jeet Singh Sansanwal Marg,
   Katwaria Sarai, New Delhi -110016

3. Western Regional Load Despatch Centre, Mumbai
   Grid Controller of India Ltd.
   F-3, M.I.D.C. Area, Marol Andheri (East),
   Mumbai -400093

4. Southern Regional Load Despatch Centre
   29, Race Course Cross Road,
   Bangalore -560009

5. Eastern Regional Load Despatch Centre, Kolkata
   Grid Controller of India Ltd.
   14, Golf Club Road, Tollygunge, Kolkata -700 03

6. North Eastern Load Despatch Centre, Shillong
   Grid Controller of India Ltd.
   Lower, Nongrah, Lapalang, Shillong,

Meghalaya 793006

Order

Background:

1. Grid-India, vide its letter dated 17.09.2024, submitted a Report to the Commission on high-frequency operation on 4th, 11th, and 25th August 2024. Grid-India, in its report, submitted that persistent high-frequency operation was observed on the 4th, 11th, and 25th of August 2024 in India's power system, with frequency remaining above 50.05 Hz for around 26%, 33%, and 38% of the time during the day, respectively. The key highlights with regard to high frequency of the grid on 4th, 11th and 25th August 2024 are as under:

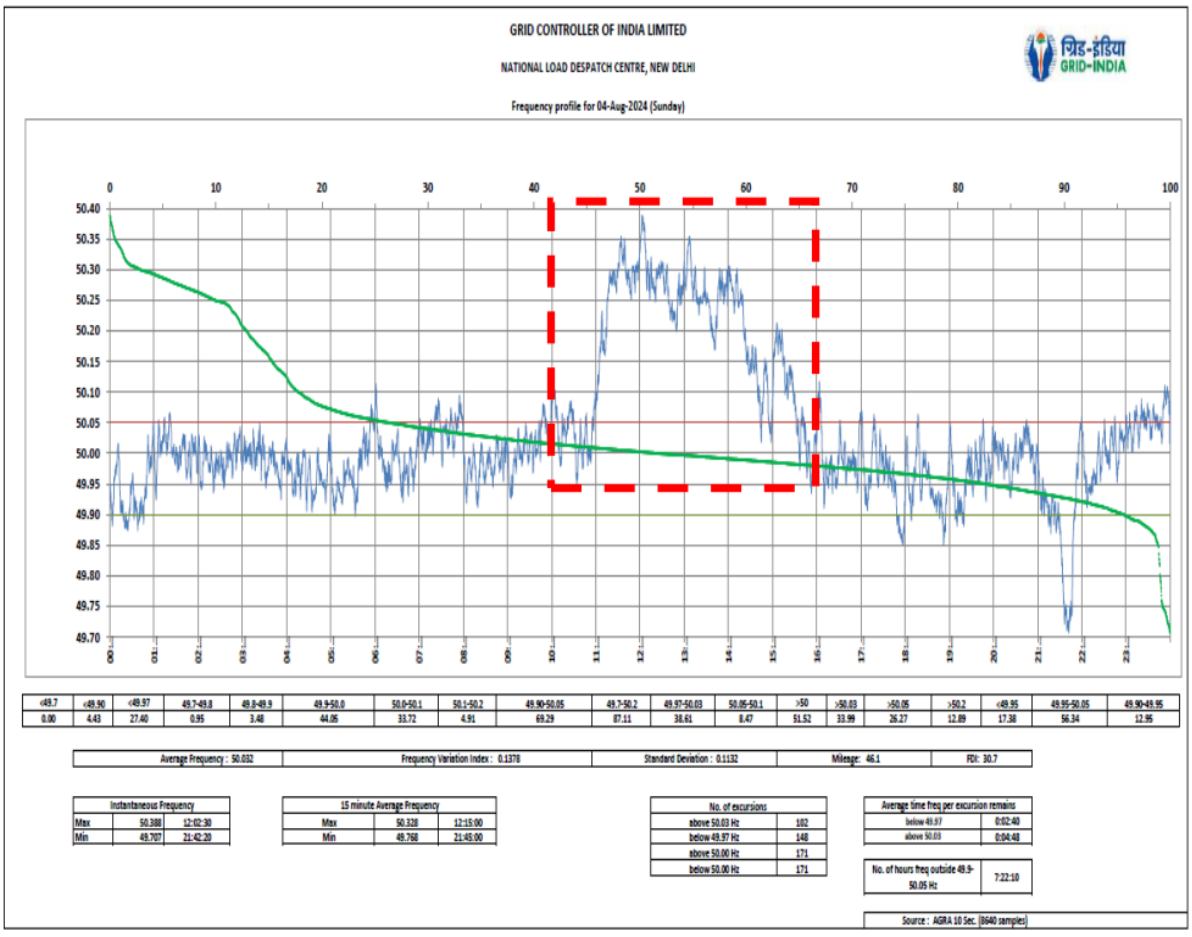
Metric	04 Aug 2024	11 Aug 2024	25 Aug 2024
% of time frequency remained above 50.05 Hz	26.27	33.32	37.97
Duration of continuous high frequency (>50.05 Hz) in minutes	226	120	258
Maximum instantaneous frequency (Hz) and its time of occurrence (hh:mm)	50.39 (12:02)	50.33 (13:44)	50.38 (13:07)

2. As per Grid-India's Report, the contributing factors for high-frequency operation in the Indian power system on 04, 11, and 25 August 2024 are listed below:
   a) Suppressed demand due to widespread rains and weekend
   b) Over-injection by VRE sources
   c) Limited flexibility from hydropower stations and pumped storage plants due to high inflows and high reservoir levels
   d) Inadequate flexibility of intra-state thermal generating stations and under-drawl
   e) Lack of DOWN reserves at the interstate level

f) Inadequate liquidity in DAM/RTM, resulting in the states committing more units.

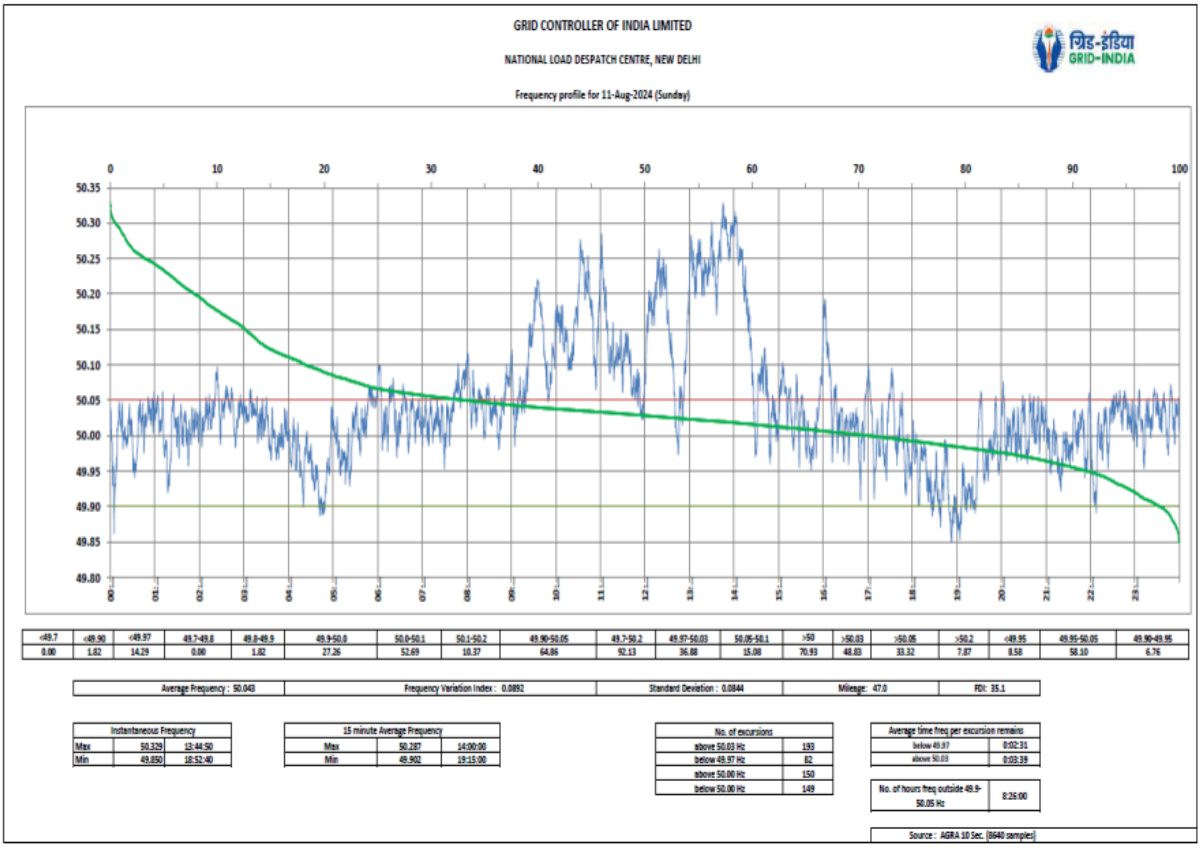
Frequency Profile:

3. **On 04th August 2024,** the frequency of the Indian grid exceeded the upper limit of the IEGC band (50.05 Hz) for a significant portion of the day. Starting at around 11:00 hrs., the frequency rose above 50.05 Hz and remained elevated until approximately 15:30 hrs. The maximum frequency recorded during the day was 50.39 Hz at 12:02:30 hrs. The frequency profile for 04th August 2024 is as under:

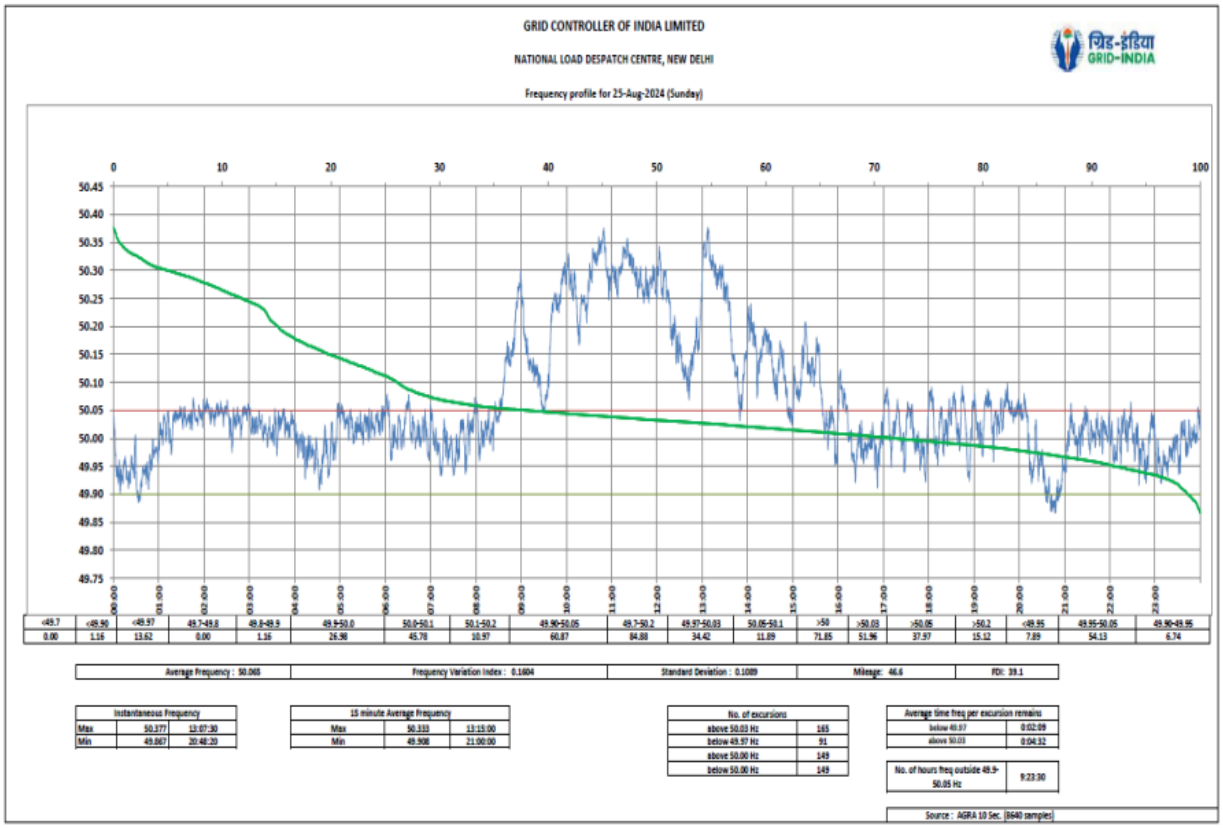


4. **On 11th August 2024,** the All-India power system experienced notable deviations in its frequency profile, with the system frequency consistently remaining above the Indian Electricity Grid Code (IEGC) permissible upper band of 50.05 Hz for a considerable portion of the day. The frequency remained high between 09:30 hrs and 15:00 hrs, barring a few minutes during this period.

The maximum instantaneous frequency recorded was 50.329 Hz at 13:44:50 hrs. Over the course of the day, the average frequency was measured at 50.043 Hz, which, although close to the nominal value of 50 Hz, highlights some deviation from the ideal frequency range. The frequency profile for 11th August 2024 is as under:



5. **On 25th August 2024**, the All-India power system experienced deviations in its frequency profile, with the system frequency staying above the Indian Electricity Grid Code (IEGC) permissible upper band of 50.05 Hz for an extended period. The frequency remained above the IEGC band from approximately 08:30 hrs to 16:00 hrs, except for a few short intervals. The maximum instantaneous frequency recorded during the day was 50.377 Hz at 13:07:50 hrs, and the average frequency for the entire day was 50.065 Hz, which, while close to the nominal 50 Hz, still reflected deviations from the ideal range. The frequency profile for 25th August 2024 is as under:



6. Grid-India, in its report, has suggested the following measures for enhancing flexibility in grid operations:

   a) Reduction in a minimum turn down level of intrastate thermal stations as per CEA regulations
   b) Reduction in a minimum turn down level to 40% of MCR
   c) Two shift operation of selected thermal units with high energy charge rate
   d) Incentivise flexible operation by notification of compensation for part load operation and start/stops
   e) Implementation of resource adequacy framework
   f) Increase the capacity of long duration storage
   g) Power market reforms - reduce fragmentation of the market, raise the market cap, negative pricing
   h) Frequency response from renewable energy sources
   i) Curtailment of renewable energy generation as a last resort during sustained high-frequency

Analysis and Decision

7. CERC (Indian Electricity Grid Code) regulations, 2023 provide as follows:

*"**30.** FREQUENCY CONTROL AND RESERVES*

(1) The National Reference Frequency shall be 50.000 Hz and the allowable band of frequency shall be 49.900-50.050 Hz. The frequency shall be measured with a resolution of +/-0.001 Hz by NLDC, RLDCs and SLDC and such frequency data measured every second shall be archived by RLDCs.

(2) The NLDC, RLDC and SLDC shall endeavour that the grid frequency remains close to 50.000 Hz and in case frequency goes outside the allowable band, ensure that the frequency is restored within the allowable band of 49.900-50.050 Hz at the earliest.

(3) All users shall adhere to their schedule of injection or drawl, as the case may be, and take such action as required under these regulations and as directed by NLDC or respective RLDCs or respective SLDCs so that the grid frequency is maintained and remains within the allowable band."

As per above, the National Reference Frequency is 50.000 Hz, and the allowable band of frequency is 49.900 Hz - 50.050 Hz. IEGC mandates that NLDC, RLDC, and SLDC shall endeavour that the grid frequency remains close to 50.000 Hz, and in case the frequency goes outside the allowable band, they shall ensure that the frequency is restored within the allowable band of 49.900 Hz - 50.050 Hz at the earliest. Accordingly, all users of the grid are required to maintain their drawl as per schedule to ensure frequency remains within the IEGC-specified band.

8. The overall issue of high frequency during the stated days can be broadly summarised due to (a) over-injection by thermal generators to maintain MTL injection (b) over-injection by solar sources (c) under-drawl by States (possibly due to high RE within the State or suppressed demand) (d) high hydro injection due to high inflows as pointed out by Grid India at Paragraph 2 of this Order. We have analysed the data for 25.08.2024 as a sample study in respect of ISGS thermal power plants, RE Generators, and drawl by the States as received from NLDC.

9. A summary of the detailed analysis on aspect of (a) over-injection by thermal generators to maintain MTL injection (b) over-injection by RE sources (c) under-drawl by States, is as under:

A. ISGS Thermal Generators having schedule below Minimum Turndown Level (MTL) on 25.08.2024 (12:00 hrs to 14:00 hrs):

The detail of the thermal generators having scheduled below Technical Minimum on 25.08.2024 (12:00 hrs to 14:00 hrs) is as under. The generators had a schedule below MTL. However, they were continuously over-injecting so as to maintain their generation near MTL.

Over-injection (in MW) by Generators whose Schedule is less than MTL												
Generating Station	**10:30 - 10:45**	**10:45 - 11:00**	**11:00-11:15**	**11:15-11:30**	**11:30-11:45**	**11:45-12:00**	**12:00-12:15**	**12:15-12:30**	**12:30-12:45**	**12:45-13:00**	**13:00-13:15**	**13:15 - 13:30**
DADRIT	61	61	65	59	65	62	63	64	71	72	67	61
Darlipali_NTPC							119		201	385	394	380
KHARGONE	85	83	84	86	154	154	155	153	156	150	147	144
KHSTPP_I		44	45			33	29	23	24	24	23	20
KHSTPP_II				0	16	52	50	53	77	54	52	47
MOUDA1	2		34	176	196	188	159	180	166	156	155	165
MOUDA2			61	221	217	206	172	174	176	176	175	175
NLCEXP	5	29	67	68	67	67	66	66	27	27	35	35
NLCIIST1	13	51	48	47	52	51	48	46			7	12
NLCIIST2	56	122	124	117	101	82	84	86	15	15	4	4
NTPL	5					149		2	10	14	156	
RSTPSU7	103	106	122	118	117	119	115	112	114	115	121	133
SIMHST1			24	166	239	244	247	239	234	236	234	237
SIMHST2	338	335	331	337	334	335	300	305	307	306	307	307
SOLAPUR	105	114	131	138	126	123	221	219	221	220	219	224
UNCHAHAR 1	48	48	48	46	46	50	47	51	49	49	47	47
VALLUR NTECL	113	116	119	118	122	116	103	103	105	108	106	106
VSTPS1							42	43				
	933	**1106**	**1303**	**1697**	**1853**	**2029**	**2021**	**1919**	**1953**	**2107**	**2248**	**2097**

*Only over-injection has been shown. Empty blocks have under-injection

10. A sample schedule during solar hours for generating stations in sub-critical and super-critical categories is as follows:

SIMHST2 (2X500 MW)						
Time Block	**DC (MW)**	**MTL (MW)**	**Schedule(MW)**	**Actual(MW)**	**Actual in % of DC**	**Deviation(MW)**
10:30-10:45	948	521	163	500	53	338
10:45-11:00	948	521	163	497	53	335
11:00-11:15	948	521	163	494	52	331
11:15-11:30	948	521	163	500	53	337
11:30-11:45	948	521	163	497	52	334
11:45-12:00	948	521	163	498	53	335

12:00-12:15	948	521	198	498	53	300
12:15-12:30	948	521	198	503	53	305
12:30-12:45	948	521	198	505	53	307
12:45-13:00	948	521	198	504	53	306
13:00-13:15	948	521	198	505	53	307
13:15-13:30	948	521	198	505	53	307

Solapur (2x660 MW)						
Time Block	**DC (MW)**	**MTL (MW)**	**Schedule(MW)**	**Actual(MW)**	**Actual in % of DC**	**Deviation(MW)**
10:30-10:45	1231	677	512	617	50	105
10:45-11:00	1231	677	500	613	50	114
11:00-11:15	1231	677	489	620	50	131
11:15-11:30	1231	677	478	616	50	138
11:30-11:45	1231	677	483	609	49	126
11:45-12:00	1231	677	483	606	49	123
12:00-12:15	1231	677	389	610	50	221
12:15-12:30	1231	677	388	608	49	219
12:30-12:45	1231	677	388	609	49	221
12:45-13:00	1231	677	388	608	49	220
13:00-13:15	1231	677	388	607	49	219
13:15-13:30	1231	677	388	613	50	224

Darlipalli (2X800 MW)						
Time Block	**DC (MW)**	**MTL (MW)**	**Schedule(MW)**	**Actual(MW)**	**Actual in % of DC**	**Deviation(MW)**
10:30-10:45	1500	825	834	808	54	-27
10:45-11:00	1500	825	833	797	53	-36
11:00-11:15	1500	825	834	813	54	-21
11:15-11:30	1500	825	834	824	55	-10
11:30-11:45	1500	825	834	824	55	-9
11:45-12:00	1500	825	834	830	55	-4
12:00-12:15	1500	825	694	813	54	119
12:15-12:30	1500	825	834	824	55	-10
12:30-12:45	1500	825	618	819	55	201
12:45-13:00	1500	825	428	813	54	385
13:00-13:15	1500	825	424	819	55	394
13:15-13:30	1500	825	422	802	53	380

It is also observed that the Schedule during evening peak hours for abovesaid generating stations, which got scheduled below MTL during the solar hours, was much above MTL. Such schedule above MTL can be met by such generating stations only when they remain on bar.

11. This issue was also raised by NTPC vide its letter dated 30.9.2024 to CERC, whereby NTPC stated as follows:

"

(i) *Infeasible schedules to thermal units:*

IEGC-2023 has put an obligation to supply on Generators but there is no corresponding obligation on beneficiaries to give equal to or more than MTL schedules which is the foremost requirement for safe and reliable operations of these thermal units.

Such dispensation has prompted beneficiaries to give schedules based on their own consideration and keeping aside the technical requirement of the thermal units. This has resulted in a situation wherein stations are continuing to get infeasible schedules i.e., full schedule during peak-hours and negligible or less than MTL schedule during off-peak hours (Annexure A).

It is also observed that instead of giving requisite schedule up to MTL so that the unit to remain on bar to serve during peak hours, many Discoms are driven by purely commercial considerations by purchasing power from market whenever market rates are lower than ECR of the stations. However, when the market rates are high, Discoms again provide full schedules during peak hours and such scheduling pattern is not at all taking care of technical constraints of the machines and endangering the life of machines (Annexure B). Here, it is pertinent to mention that Discoms are giving technical minimum schedule to their own stations.

Due to such infeasible schedules, stations are constrained to over inject to ensure the technical minimum loading of the machines which results in Grid violations, congestion charges & DSM losses. Since the implementation of IEGC 2023 to 09.09.2024, NTPC has incurred loss of around Rs. 335 crores, due to over injections on above accounts (Annexure-C).

It is pertinent to mention that in case a unit decides to go under shut down due to such infeasible schedules, it is required to fulfil the obligation of supply and IEGC 23 provides provisions for meeting the same, However, due to various reasons these provisions are also not feasible.

It is humbly submitted that for safe and reliable operation of the machines which are national assets, it is imperative that units are scheduled at or above MTL and an obligation may also be put on Discoms to provide MTL schedule. Further in case of non-availability of schedules up to MTL, generators may be allowed to take the unit under shut down with no obligation of supply."

As per above, the issue of scheduling below MTL during off peak hours

and above MTL during peak hours, leading to over-injection during off peak hours so as to meet supply obligations during peak hours, has been highlighted.

12. We have analysed the total block-wise over-injection by all the ISGS thermal generating stations having schedule below MTL as under:

Block-wise over-injection (in MW) by thermal generators having schedule below MTL	
25.08.2024	**Over-injection Quantum in MW**
10:30-10:45	933
10:45-11:00	1106
11:00-11:15	1303
11:15-11:30	1697
11:30-11:45	1853
11:45-12:00	2029
12:00-12:15	2021
12:15-12:30	1919
12:30-12:45	1953
12:45-13:00	2107
13:00-13:15	2248
13:15-13:30	2097

As per above, the maximum over-injection in a time block went up to 2200 MW.

NLDC, vide its Report dated 17.09.2024, has also noted DAM prices during the period of high frequency on 25.8.24 as follows:

25th Aug 2024

DAM Results: The prices were low in power exchanges for DAM throughout the day, however prices were comparatively higher during evening hours. The prices in DAM are observed to go as low as Rs.0.50/kWh which rose to around Rs. 4/kWh in the late evening hours. The prices as discovered in DAM are given in Fig 87

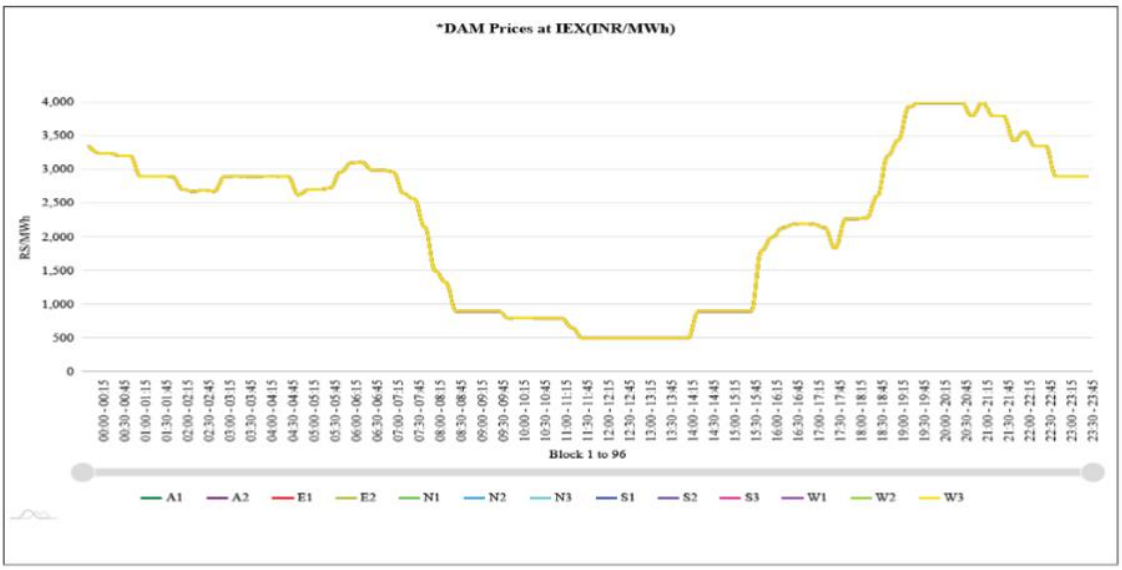


Figure 87: DAM Prices at IEX _25-Aug-24

As per above, DAM prices were close to 50 paise/unit whereas the variable cost of generating stations which got scheduled below MTL was between ~Rs 3/unit to ~ Rs 5/unit power, and hence, power from such generating station with high variable cost becomes unviable for sale in DAM / RTM. It is also observed from the table that DAM prices rose to ~Rs 4/unit in the evening peak hours.

13. Grid Code provides at Regulation 49(1)(f) as follows:

"

(f) Requisition of schedule by the buyers which are GNA grantees:

(i) Based on the entitlement declared in accordance with sub-clause (b) of clause (1) of this Regulation, SLDC on behalf of the intra-State entities which are drawee GNA grantees, shall furnish time block-wise requisition for drawal to the concerned RLDC in accordance with the contracts, by 8 AM of 'D-1' day.

(ii) Other drawee GNA grantees, which are regional entities shall furnish time block-wise requisition for drawal to the concerned RLDC in accordance with contracts, by 8 AM of 'D-1' day.

(iii) The SLDC on behalf of the intra-State entities which are drawee GNA grantees, as well as other drawee GNA grantees while furnishing time block-wise requisition under this Regulation shall subject to technical constraints, duly factor in merit order of the generating stations with which it has entered into contract(s):

Provided that the renewable energy generating stations shall not be subjected to merit order despatch, and subject to technical constraints shall be requisitioned first followed by requisition from other generating stations in merit order. "

As per above, drawee GNA grantees can requisition for drawl schedule duly factoring into merit order despatch where power from renewable energy generating stations are required to be scheduled first and not subjected to merit order despatch.

14. We observe that there was continuous high frequency for hours on the stated days of 4.08.204, 11.08.2024, and 25.08.2024. The situation needs to be addressed keeping in view more additions of RE generation in the future, particularly solar generating stations which would inject power during solar hours and varying demand patterns during such hours. It can also be established that many of such thermal plants, which get scheduled below MTL during solar hours, are required to be On-bar to meet the evening peak. At the same time, distribution licensees are mandated to schedule power from REGS first, which may be one of the reasons for giving a schedule below MTL during solar hours.

15. We have considered the issue of over-injection by thermal generating station to maintain injection upto MTL. Grid India has suggested to operationalise Two shift operation of selected thermal units as mentioned at Paragraph 6 of this Order. Grid India also informed that Two shift operations of Tuticorin and Mettur thermal units was carried out during coal shortage period (from March 2022 to May 2022) and high RE period (From June 2022 to October 2022) (total 308 times) as follows:

Unit wise no of Two shift operations in 2022

Sl.No	Generating Unit	No of Days Two shift operation done
1	Tuticorin - UNIT 1	14
2	Tuticorin - UNIT 2	47
3	Tuticorin - UNIT 3	31
4	Tuticorin - UNIT 4	67
5	Tuticorin - UNIT 5	48
6	Mettur TPS - UNIT 1	4
7	Mettur TPS - UNIT 2	33

8	Mettur TPS - UNIT 3	19
9	Mettur TPS - UNIT 4	43
10	Mettur TPS - UNIT 5	2

Tuticorin Unit#4 was operated with two shifts for more than two months during 2022

16. We have considered the suggestions of Grid-India and we are of the considered view that in order to address the challenges being faced with meeting the demand during evening hours with thermal power and, at the same time, low demand for such power during solar hours, action is required to operationalise two shift operation for some of the thermal plants keeping in view technical feasibility and operational efficiency.

17. The "Standard Technical Specification for Main Plant Package of Sub- critical Thermal Power Project - 2x(500MW or above) " issued by CEA in September 2008 provides as follows:

> *"1.4.3 The unit shall be designed to operate as a base load station. However, continuous operation under two shift and cyclic modes during certain periods of the year is also envisaged. The design should cover adequate provision for quick startup and loading of the unit to full load at a fast rate and apart from constant pressure operation would also have the facility for sliding pressure operation. The design of the equipments and control system would permit participation of the machine in automatic load frequency control."*

Similarly, "Standard Technical Features for BTG System for Supercritical 660/ 800 MW thermal units," issued by CEA in July 2013, provides as follows:

> *"2.1 The plant shall be designed to operate as a base load station and shall have a design life of minimum twenty five (25) years. However, continuous operation under two shift and cyclic modes during certain periods is also envisaged. The design of the plant equipment and control system would permit participation of the plant in automatic load frequency control."*

18. Although the standard specifications provide for two shifts , the thermal units have not been operated in two-shift mode. Hence, there is a need to first operate some of the coal based thermal units on two shifts on a pilot basis to gain experience and address technical issues encountered during the course of such pilot operation. Accordingly, we direct that as a pilot project, regional entity thermal generating stations whose tariff is determined by this Commission under Section 62 of the Act, to be operated in two-shift operations, shall be identified by NLDC in

consultation with the owner of such thermal units and CEA. While identifying the units for such pilot, the experience of Tuticorin and Mettur as stated in Paragraph 15 of this Order shall be taken into account.

19. We clarify that since the pilot of two shifts is being carried out to gain operational experience, it is not necessary to select units that have the highest variable cost since such units may not give the best solution under operational efficiency. We acknowledge the fact that 600 MW/800 MW, which are newer units, are more efficient as compared to older 500 MW units. Accordingly, to start with rail-fed 500 MW Units may preferably be selected under the pilot project. We are of the considered view that two-shift operation has to be incentivised keeping in view the need for integration of renewables, especially Solar and safe grid operation, and hence, under the pilot, units operating under two shifts shall be paid incentive @20 paise/kwh (the ceiling rate for commitment charge under CERC Central Electricity Regulatory Commission (Ancillary Services) Regulations, 2022). Such incentive of 20 paise /unit shall be given for the down reserve created (below the-Minimum turndown level) for the hours the unit is kept off-bar during the day. For instance if a 500 MW unit (ex-bus as 471.25 MW - after deducting normative auxiliary power consumption) is taken off-bar for 10 hours of the day under two shift operation, the down reserve works out as 259.2 MW (= 55% of 471.25, considering MTL of 55%) and such unit shall be paid incentive @ 20 paise x 259.2 x 1000 kW x 10 hr for one day.

20. The broad modalities of the day ahead scheduling for such units identified for two shifts shall be as per Annexure-I to this Order.

21. NLDC is directed to identify such pilot thermal units and issue a detailed procedure for operating such units under a two-shift cycle within two months of the issue of this Order. The Detailed Procedure shall contain the guidelines regarding operational aspects, including scheduling, dispatch, accounting, settlement, compensation on account of expenses due to two-shift operation (including start-up cost, heat rate, etc.), and any residual matter. The same shall be shared with stakeholders and shall be submitted to the Commission for approval.

22. NLDC in association with owner(s) of the thermal generating units selected for pilot operations are directed to apprise the Commission regarding the experience gained in the form of a feedback report covering all the aspects within a month of completion of the six months of pilot operation including financial impact of running a thermal station in Two shift operations, assessment of Two shift operation on plant viability and plant damage if any and impact on useful life of the plant. For this purpose, the owners of the thermal generating units selected for the pilot project shall maintain a record of extra expenditure incurred by it on account of it operating in two shifts, including operational parameters, wear and tear of units on this account.

B. Under-drawal by the States:

23. NLDC vide its report dated 17.09.2024 has emphasized the requirement of intra-state generating stations to operate up to minimum turndown level, especially keeping in view large under-drawl by States during the stated days of 4.08.24, 11.08.2024, and 25.08.2024. The state-wise summary of the down margin availability (based on a technical minimum of 55% of MCR) at the instant of highest recorded frequency of 50.38 Hz at 13:07 hrs as recorded in NLDC Report dated 17.09.24 is as under:

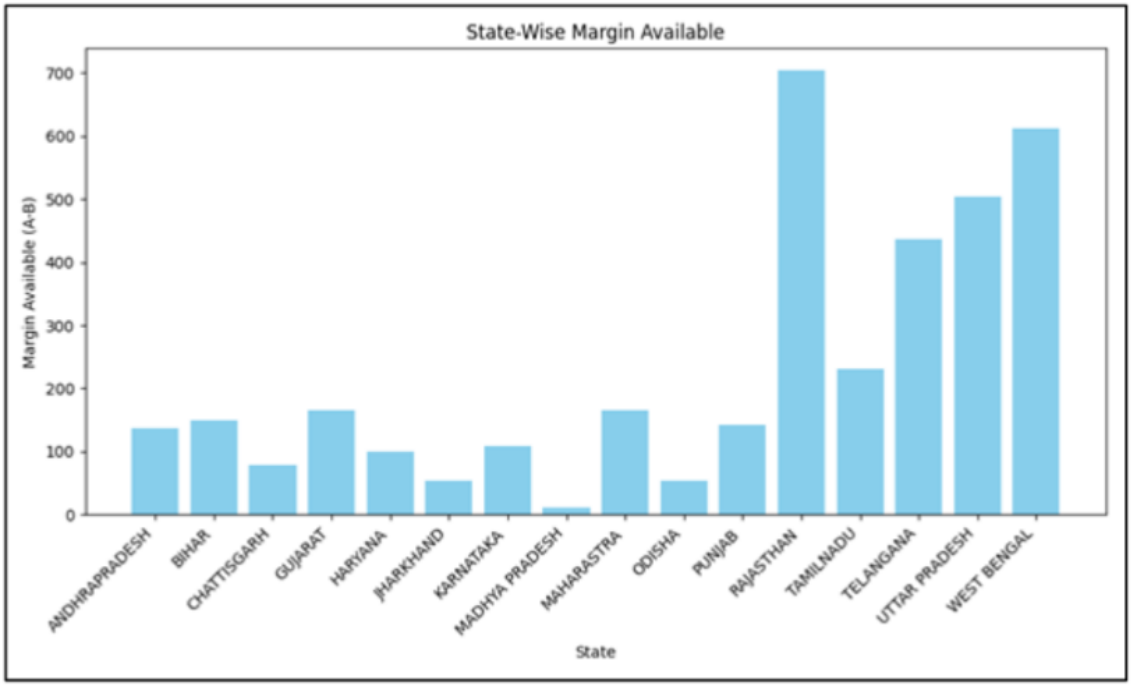


Figure 61: State wise down margin availability

The data of under-drawl by States, based on data obtained from NLDC, have been analysed as follows

(All figures in MW)

	12:30-12:45			12:45-13:00			13:00-13:15			13:15-13:30		
ER	**SD**	**AD**	**Deviation**	**SD**	**AD**	**Deviation**	**SD**	**AD**	**Deviation**	**SD**	**AD**	**Deviation**
BIHAR	**5137**	**5195**	**58**	**5144**	**5173**	**30**	**5285**	**5263**	**-22**	**5310**	**5317**	**7**
JHARKHAND	**1160**	**1230**	**70**	**1162**	**1219**	**57**	**1185**	**1215**	**30**	**1186**	**1197**	**11**
DVC	**-896**	**-727**	**169**	**-903**	**-757**	**146**	**-904**	**-758**	**146**	**-908**	**-732**	**176**
ODISHA	**2608**	**2600**	**-8**	**2610**	**2540**	**-70**	**2652**	**2565**	**-87**	**2653**	**2568**	**-85**
WB	**3105**	**3317**	**211**	**3154**	**3457**	**303**	**3252**	**3554**	**301**	**3320**	**3611**	**291**
SIKKIM	**41**	**40**	**-1**	**41**	**42**	**1**	**43**	**48**	**5**	**43**	**40**	**-3**
BANGLADESH_NVVN	**911**	**905**	**-6**	**911**	**906**	**-5**	**911**	**905**	**-7**	**911**	**906**	**-6**
Nepal	**-620**	**-598**	**22**	**-620**	**-603**	**17**	**-620**	**-586**	**34**	**-620**	**-616**	**4**
ECR	**2**	**6**	**5**	**1**	**6**	**5**	**1**	**6**	**5**	**1**	**7**	**6**
NEA_Bihar	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Bhutan	**-1733**	**-1768**	**-35**	**-1733**	**-1773**	**-40**	**-1733**	**-1771**	**-38**	**-1733**	**-1767**	**-34**
NR												
Uttar Pradesh	**9037**	**11815**	**2778**	**8919**	**11137**	**2218**	**8908**	**10053**	**1145**	**8909**	**9692**	**782**
Haryana	**7360**	**7553**	**193**	**7328**	**7610**	**282**	**7438**	**7571**	**133**	**7437**	**7578**	**141**

Himachal Pardesh	137	199	62	137	209	72	163	204	41	163	176	13
Delhi	4690	4738	48	4663	4763	100	4718	4676	-42	4736	4657	-79
Uttarakhand	646	599	-47	646	585	-61	613	618	5	613	632	20
Rajasthan	2607	2475	-132	2625	2663	38	2686	2543	-142	2693	2421	-272
Punjab	9801	9940	139	9801	10007	206	9866	10053	186	9871	10041	170
Chandigarh	239	262	23	241	267	26	263	272	9	263	277	14
Jammu and Kashmir	1195	1342	147	1195	1302	107	1213	1359	146	1213	1388	176
Nepal PTC	-61	-50	11	-61	-55	6	-61	-59	2	-61	-61	0
SR												
Andhra pradesh	1709	2328	619	1713	2469	756	1618	2145	527	1633	2233	600
Telangana	3867	3994	127	3881	3959	79	3663	3983	320	3567	3833	265
Karnataka	-1302	-1254	48	-1268	-1242	26	-1229	-1325	-96	-1250	-1421	-171
Kerala	2166	2222	56	2127	2235	108	2138	2249	111	2138	2251	113
Tamil nadu	4689	2011	-2677	4745	1898	-2847	4560	1931	-2629	4979	2140	-2838
Pondichery	412	384	-27	413	391	-22	414	398	-16	416	394	-22
Goa-SR	83	82	-1	83	82	-2	83	75	-8	83	78	-5
WR												
Chhattisgarh	2562	2645	83	2576	2548	-28	2233	2525	292	2177	2465	287
Gujarat	5110	5012	-98	5155	5066	-89	5186	4964	-222	5153	4955	-198
Madhya Pradesh	4746	3730	-1016	4767	3755	-1012	4839	4150	-689	4841	4275	-565
Maharashtra	6146	4796	-1350	5849	4774	-1074	5758	4699	-1060	5752	4651	-1101
Goa	445	426	-19	445	412	-33	443	405	-39	443	397	-47
DNH-DD	1175	1214	40	1160	1208	47	1155	1195	40	1155	1195	40
Balco Drawee	526	522	-4	526	521	-5	526	521	-5	526	520	-6
PG DRAWAL	6	5	-1	6	5	-1	6	5	-1	6	5	-1
ESIL	0	286	286	0	394	394	0	510	510	0	353	353
BARC	9	4	-4	9	4	-4	9	4	-4	9	4	-4
NER												
Arunachal Pradesh	105	108	2	105	112	6	105	111	5	105	104	-1
Assam	1492	1511	19	1502	1532	30	1513	1545	32	1523	1565	42
Manipur	103	103	-1	103	104	1	103	102	-1	103	103	0
Meghalaya	-20	-20	0	-24	29	53	-24	81	105	-27	53	80
Mizoram	19	5	-14	19	7	-12	21	8	-12	21	9	-12
Nagaland	100	105	4	100	103	2	101	99	-1	101	100	-1
Tripura	152	153	2	152	153	1	152	154	2	152	141	-10
Overdrawl			5223			5118			4133			3591
Underdrawl			-5442			-5306			-5121			-5464
Net			-219			-189			-988			-1873

As per above, overall under-drawl was more than 5000 MW with simultaneous over-drawl by some states leading to net under-drawl of ~1800 MW in the time block when maximum frequency was observed. As per Figure 61 of the NLDC Report dated 17.9.2024, quoted above, the maximum down reserves that could be despatched were in the States of Rajasthan, UP, Telangana, and West Bengal. Out of these, UP, West Bengal and Telangana were overdrawing during the stated blocks. This implies that resources with down reserve availability within the State need to be seen as a part of the overall generator mix for the Indian grid, which may be despatched as per the requirement.

24. NLDC has suggested operationalising the intra-state generating stations to go upto Minimum turndown level. The issue was discussed during the Second Meeting of the Standing Technical Committee, which was held on September 20, 2024, under the Chairmanship of Shri Ramesh Babu Veeravalli, Member (Technical), CERC, wherein the following was concluded:

> *"2. Representatives of the GRID-India apprised the committee on the framework of minimum turn-down levels and compensation for inter-state and intra-state thermal generating stations . It was highlighted that for inter-State generating stations, a minimum turn-down level of 55% has been specified in IEGC to enable flexible operation in the wake of RE integration into the system. This has also been supported with a corresponding compensation mechanism for the deterioration of heat rates, auxiliary energy consumption and oil support. Representative of Grid-India apprised the Forum that many States are yet to implement the matching provisions of minimum turn down level for intra-state thermal generating stations. Some States have specified a minimum turn--down level up to 55% but have not provided any compensation mechanism for intra-state generators to recover their cost due to heat rate deterioration, auxiliary consumption, or oil support. It was highlighted during the meeting that on a number of instances where even pit head cheaper inter-state generating stations are being backed down by the system operator to accommodate renewable energy. In view of the ambitious RE integration targets by 2030, it was emphasised that the intra-State generating stations also need to be enabled to run at a minimum turn-down level of 55% on lines of inter-state thermal generating stations.*
>
> *3. After deliberations, it was decided that a sub-group of technical experts should be formed to assist state- thermal plant operators in lowering the minimum turn down level upto 55%. This group should consist of representatives from GRID India, NTPC and key states like Uttar Pradesh, Haryana, Maharashtra, Madhya Pradesh, and Karnataka. Further, it was decided that the state thermal generating stations from five states namely, Andhra Pradesh, Telangana, Tamil Nadu, West Bengal and Odisha, may be selected in the initial phase for technical experts to visit and implement the required testing and procedure to implement minimum turn down level for state thermal generating stations."*

The Commission notes that the sub-group shall assist the state level thermal plants to lower their MTL up to 55%. The commission shall review the status of implementation under the aegis of the Standing Technical Committee of FOR.

C. Over-injection by the RE Generators:

25. One of the reasons for the high frequency during the stated days was Over-injection by the RE Generating Stations over and above their schedule. Data for REGS over-injection for 25.08.2024 is as under:

Time block	Over-injection (MW)
10:30-10:45	1737
10:45-11:00	2033
11:00-11:15	1928
11:15-11:30	2094
11:30-11:45	1799
11:45-12:00	2054
12:00-12:15	1849
12:15-12:30	1918
12:30-12:45	1805
12:45-13:00	1723
13:00-13:15	1727
13:15-13:30	1702

26. It is observed that out of the three issues leading to high frequency which are being considered under the instant Order viz (i) over-injection by thermal units to maintain MTL, (ii) under-drawl by States, (iii) over-injection by REGS, it is observed that there was a substantive quantum of over-injection by such REGS leading to high frequency.

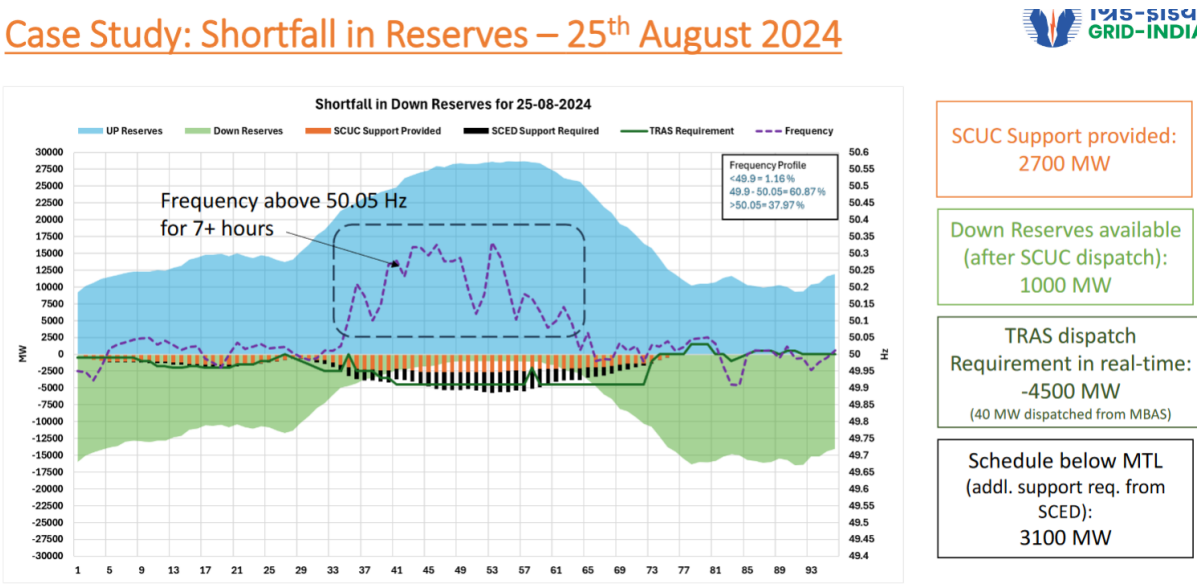
27. We observe that the Deviation settlement mechanism for RE allows over-injection by RE within the allowable band with no penalty, even when the frequency is high. We appreciate that in order to manage the grid in conditions of high frequency, the solution lies in reducing the renewable generation. We note that Regulation 8(8) of

the CERC(Deviation Settlement Mechanism and Related Matters) Regulations,2024 effective from 23.12.2024 have been amended as follows:

> *"(8) The charges for injection of infirm power shall be zero:*
>
> *Provided that if infirm power is scheduled after a successful trial run as specified in the Grid Code, the charges for deviation over the scheduled infirm power shall be as applicable for a general seller or WS seller, as the case may be:*
>
> *Provided further that when the system frequency, f > 50.05Hz, the charges for deviation of scheduled infirm power by way of over injection by a general seller or WS seller, as the case may be, shall be zero."*

As per above charges for over-injection (in case of scheduled infirm power) have been reduced to zero for both general seller and WS seller in case of frequency is more than 50.05 Hz.

28. Further NLDC, in its report dated 17.09.2024, stated that all down reserves in thermal generating stations were exhausted as per Figure below. In fact, we have already observed that many thermal units did not have a schedule up to MTL and were over injecting to remain on bar to meet schedules for the evening.



29. In this situation where there are no thermal reserves to back down, REGS needs to be backed down so that the grid is operated in a safe and secure manner. Grid Code provides at Regulation 30(10(j) as under:

> *"(j)All generating stations, including the WS seller mentioned in Table-4 (under sub-clause (g) of this clause) shall have the capability of reducing output at least by 5% or 10%, as applicable, of their operating level and up to 5% or 10% of their MCR, as applicable, limited to the minimum turndown level when the frequency rises above the reference frequency and thus providing primary response, whenever condition arise. Any generating station not complying with the above requirements shall be kept in operation (synchronized with the regional grid) only after obtaining permission from the concerned RLDC.*
>
> *…*
>
> *(m)The PRAS shall start immediately when the frequency deviates beyond the dead band as specified in sub-clause (k) of this clause and shall be capable of providing its full PRAS capacity obligation within 45 seconds and sustaining at least for the next five (5) minutes. "*

As per above, PRAS for REGS is mandated for the specified WS Sellers. However, there is no record of whether REGS did provide the PRAS, especially keeping in view the high quantum of over-injection by REGS. We direct NLDC to furnish the PRAS response given by REGS (which is mandated to provide PRAS Under the Grid Code and CEA Standards) during the events of high frequency on 4.08.2024, 11.08.024, and 25.08.2024 within a period of one month of issue of this Order.

30. NLDC has carried out the pilot study at Adani Devikot (180 MW), where the performance baseline established from the tests for the Devikot Solar plant is between 80%-100%. Keeping in view the controllability of REGS with PPC mandated under the Grid Code, there is a need to incentivise REGS to come forward for AGC services. NLDC shall, in consultation with REGS, identify additional REGS, including based on wind sources, for a pilot study for operationalising AGC in REGS. NLDC is directed to submit implementation modalities and suitable commercial mechanisms to facilitate such AGC services from REGS within a period of three months of issue of this Order, after consultation with stakeholders.

31. As per the scheduling principles, RE is to be despatched first. However, since the availability of RE sources is not enough to meet the demand in the evening without the thermal sources, hence thermal is required to be on bar to provide power during evening hours. In such a scenario, thermal units that cannot be taken under two shifts , with schedules below MTL, resort to over-injection in to the grid, which is not a desirable & feasible solution. Therefore a framework need to be worked out to install ESS systems at such thermal units to store the excess energy rather than over-injecting in grid leading to wastage of energy, high frequency, which is both technically and commercially unviable. We direct the Commission's staff to work out modalities for the implementation of ESS at thermal generating stations keeping in view the above.

32. The directions under this Order are summarised as follows:

a) As a pilot, regional entity thermal generating stations whose tariff is determined by this Commission under Section 62 of the Act, to be operated in two-shift operation, shall be identified by NLDC in consultation with the owner(s) of such thermal units and CEA. While identifying the units for such pilot, the experience of Tuticorin and Mettur as stated in Paragraph 15 of this Order shall be taken into account. To start with, rail-fed 500 MW Units may preferably be selected under the pilot. NLDC is directed to identify such pilot thermal units and issue a detailed procedure for operating such units under a two-shift cycle, within two months of the issue of this Order. The Detailed Procedure shall contain the guidelines regarding operational aspects, including scheduling, dispatch, accounting, settlement, compensation on account of expenses due to two-shift operation (including start-up cost, heat rate, etc.), and any residual matter. The same shall be shared with stakeholders and submitted to the Commission for approval.

b) Under the pilot, units operating under two shifts shall be paid incentive @20 paise/kwh for the down reserve created (below the Minimum Turndown Level) for the hours it is kept off-bar during the day. For

instance if a 500 MW unit (ex-bus as 471.25 MW – after deducting normative auxiliary power consumption) is taken off-bar for 10 hours of the day under two shift operation, the down reserve works out as 259.2 MW (= 55% of 471.25 MW, considering MTL of 55%), and such unit shall be paid incentive @ 20 paise x 259.2 x 1000 kW x 10 hrs for one day.

c) NLDC and the owner(s) of the thermal generating units selected for this pilot project are directed to apprise the Commission regarding the experience gained in the form of a feedback report covering all the aspects within a month of completion of the six months of pilot operation including financial impact of running a thermal station in Two shift operations, assessment of Two shift operation on plant viability and plant damage if any and impact on useful life of the plant. For this purpose, the owner of the thermal generating units selected for the pilot project shall maintain a record of extra expenditure incurred by it due to operating two shifts, including operational parameters, wear and tear of units on this account.

d) NLDC to furnish the PRAS response given by REGS (which is mandated to provide PRAS Under the Grid Code and CEA Standards) during the events of high frequency on 4.08.2024, 11.08.024, and 25.08.2024 within a period of one month of issue of this Order.

e) NLDC is directed to submit implementation modalities and suitable commercial mechanisms to facilitate such AGC services from REGS within a period of three months of the issue of this Order, after consultation with stakeholders.

f) The Commission's staff to work out modalities for the implementation of ESS at thermal generating stations.

33. Regulation 60 of the Grid Code provides as follows:

"60. ISSUE OF SUO MOTO ORDERS AND DIRECTIONS
The Commission may from time to time issue suo motu orders and practice directions with regard to implementation of these regulations and matters incidental or ancillary thereto, as the case may be."

34. Accordingly, the directions under this Order are issued under Regulation 60 of the Grid Code, specifically under Clauses (2) and (3) of Regulation 30 of the Grid Code.

35. Accordingly, Suo Motu Petition 2/SM/2025 is disposed of in terms of the above.

Sd/	Sd/	Sd/	Sd/
(R.S. Dhillon)	**(Harish Dudani)**	**(Ramesh Babu V.)**	**(Jishnu Barua)**
Member	**Member**	**Member**	**Chairperson**

Annexure-I

Modalities of day ahead scheduling from units identified under two shifting

1. Generating station shall declare DC on day ahead basis as per the timelines under the Grid Code.
2. Beneficiaries/ buyers shall be eligible to requisition share from such generating station as per the provisions of the Grid Code under GNA / T-GNA under Regulation 49(1)(a)- (j) of the Grid Code.
3. For the time blocks in which generating station is required to be off-bar due to two shifting, the schedules from such generating station as finalised upto Regulation 49(1)(k) of the Grid Code i.e. till issuance of final drawl schedules of T-GNA grantee and release of balance corridors by RLDC for market on 'D-1' day, shall be allowed to be revised by beneficiaries/buyers downwards only. No upward revision shall be permitted for such time blocks in which generating units are off- bar due to two shifting.
4. The schedule for the generating station(s) as finalized on day ahead basis for the time blocks during which the generating station is decided to be off-bar due to two shifting shall be adjusted through SCUC in the real-time prior to running SCED under Regulation 49(2)(a)(iv) as per following
    a. SCUC-Down will be provided for the stations in the time blocks in which generating station is required to be off-bar due to two shifting
    b. To maintain load-generation balance, commensurate SCUC-Up will be provided over and above the schedule of the generating stations on-bar in the merit order of ECR.
    c. This SCUC-Up is in addition to the incremental generation scheduled to bring the generation up to minimum turndown level in the general 'SCUC-Yes' units selected in D-1, but not identified for two-shifting.
5. The accounting and settlement for the two shifting operation shall be as per the modified Detailed Procedure for SCUC to be issued by NLDC considering the following
    a. Deviation and Ancillary Service Pool Account shall be utilized for SCUC
    b. Startup costs, if applicable, shall be paid from the Deviation and Ancillary Service Pool Account for generating stations undertaking two-shifting as per the Detailed Procedure.