

Staff Paper  
on  
**Grid Security Charge**



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## **Disclaimer**

The issues presented in this discussion paper do not represent the views of the Central Electricity Regulatory Commission, its Chairperson, or its individual Members and are not binding on the Commission. The views are essentially those of the staff of CERC and are circulated with the aim of initiating discussions and soliciting inputs from the stakeholders on the issue of reliability of the grid operation and the mechanism for allocation of cost towards ensuring such reliability.

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## 1. Introduction and Context

- 1.1 The country has been witnessing a huge surge in demand over the period. The peak demand recorded a high of 241 GW on 01<sup>st</sup> September 2023. The growth of around 23% in peak demand met in August 2023 is unprecedented. The country has resolved to ensure uninterrupted power supply to consumers and for this, a number of initiatives have been taken by the Government and Regulators.
- 1.2 In this context, references have been received from the NLDC highlighting the shortage of adequate reserves to meet the contingency. The NLDC has also suggested some measures to ensure advanced procurement of reserves and to optimally utilize the existing gas-based generation to meet the requirements of grid security and reliability.
- 1.3 It is against this backdrop that this paper discusses various measures for ensuring the adequacy of reserves and, in turn, the reliability of grid operation.

## 2. Present Regulatory Provisions

- 2.1 The Commission has notified the CERC (Indian Electricity Grid Code) Regulations, 2023 (IEGC 2023) on 11th July, 2023. Regulation 30 of Chapter 6: 'Operating Code' outlines provisions for maintaining reserves in order to ensure grid stability. This regulation requires the NLDC to estimate and allocate reserve capacity for both regional and state control areas, taking into account factors such as planning reserve margin and resource adequacy. Each state has to ensure the availability of the required reserves and inform the concerned RLDC and the NLDC. Additionally, the Regulation empowers the NLDC to procure reserves on behalf of states if they are unable to meet their reserve capacity allocation. The relevant provisions are quoted below:

***“(11) Secondary Control:***

.....

- (n) All India secondary reserve capacity requirement for the regional control area and the State control area shall be estimated by NLDC based on reference contingency and other factors such as forecast errors.*

(o) *NLDC shall allocate such All India secondary reserves capacity, to be maintained at regional control area and at State control area, based on the estimated reserves as per sub-clauses (k) and (l) of this clause and publish the information on its website by 25th January every year.*

(p) *NLDC through RLDCs shall re-assess the quantum of requirement of secondary reserves required at the state control area three days before the day of scheduling and communicate the same to the respective SLDC.*

(q) *Each State control area shall ensure the availability of the quantum of secondary reserve at the State control area with due regard to the secondary reserves estimated and allocated for that State as published by NLDC in terms of sub-clauses (o) and (p) of this clause, and inform the same to the concerned RLDC and NLDC two days before the day of scheduling. The modalities for information exchange and timelines in this respect shall be as per the detailed procedure to be issued by NLDC.*

.....

(t) *If a State falls short of maintaining secondary reserve capacity as allocated to it in terms of sub-clauses (o) or (p) of this clause, whichever is lower, the NLDC through RLDC shall procure such Secondary reserve capacity on behalf of the State under advance intimation to the concerned State and allocate the cost of procurement of such capacity to that State based on the methodology as per the detailed procedure to be issued by the NLDC after approval of the Commission.*

.....

**(12) Tertiary Control:**

(a) *Tertiary reserve requirement for the regional control area and the State control area, shall be estimated by NLDC with due regard inter alia to the requirement of planning reserve margin and resource adequacy as referred to in Chapter 2 of these regulations, so as to take care of contingencies and to cater to the need for replacing secondary reserves estimated as per clause (11) of this Regulation by 25th January every year, which will be implemented for the next financial year from 1st April onwards by the respective control areas.*

(b) *NLDC shall allocate such tertiary reserve capacity, to be maintained at regional control areas and state control areas, based on the estimated reserves as per these regulations*

*and publish the information on its website by 25th January every year.*

*(c) NLDC through RLDCs shall re-assess the quantum of requirements for tertiary reserves required at the state control area three days before the day of scheduling and communicate the same to the respective SLDC.*

*(d) Each State control area shall ensure the availability of the quantum of tertiary reserve at the State control area with due regard to the tertiary reserves estimated and allocated for that State as published by NLDC in terms of sub-clauses (b) and (c) of this clause, and inform the same to the concerned RLDC and NLDC two days before the day of scheduling. The modalities for information exchange and timelines in this respect shall be as per the detailed procedure to be issued by NLDC.*

*(e) Each State control area shall ensure availability of the quantum of tertiary reserve at the State control area on day ahead basis with due regard to the tertiary reserves estimated and allocated for that State by NLDC in terms of sub-clause (b) and (c) of this clause, and inform the same to the concerned RLDC and the NLDC.*

.....

*(h) If a State falls short of maintaining tertiary reserve capacity as allocated to it in terms of sub-clauses (b) or (c) of this clause, whichever is lower, the NLDC through RLDCs shall procure such tertiary reserve capacity on behalf of the said State under advance intimation to the concerned State and allocate the cost of procurement of such capacity to that State based on the methodology as per the detailed procedure to be issued by the NLDC after approval of the Commission.”*

2.2 Regulation 46 of the IEGC 2023 provides the enabling provision for Security Constrained Unit Commitment (SCUC), with the objective of securing the grid by strategically committing a generating station or its units in order to maximize reserves. The relevant provisions are quoted below:

**46. SECURITY CONSTRAINED UNIT COMMITMENT (SCUC)**

*(1) The objective of Security Constrained Unit Commitment (SCUC) is to commit a*

*generating station or unit thereof, for the maximisation of reserves in the interest of grid security, without altering the entitlements and schedule of the buyers of the said generating station in the day ahead time horizon.*

*(2) Reserves shall be procured and deployed in accordance with the Ancillary Services Regulations, and SCUC shall supplement such procurement of reserves under certain conditions, as specified in this Regulation.*

*(3) SCUC shall be undertaken if the NLDC, in coordination with RLDCs and based on an assessment of the power system condition, anticipates that there is likely to be a shortage of reserves despite efforts made to procure such reserves in accordance with the Ancillary Services Regulations.*

.....

*(4) (f) In order to maintain load generation balance consequent to scheduling of incremental generation as per sub-clause (d) of this clause, the NLDC in coordination with RLDCs, shall make commensurate reduction in generation from the on-bar generating station(s), subject to technical constraints, starting with the highest energy charge and SCED compensation charge in the stack of generating stations maintained for the purpose of SCED in accordance with these regulations.*

2.3 Regulation 16 of the CERC Ancillary Services Regulations 2022 provides for procurement of reserves on day ahead and real time basis as under:

***“16. Procurement of TRAS***

*(1) Procurement of TRAS through Day Ahead AS Market and Real Time AS Market shall be undertaken in accordance with the bidding timelines specified in the Grid Code:*

*Provided that until specific provisions in this regard are specified in the Grid Code, the bidding timelines for Day Ahead AS Market and Real Time AS Market shall be the same as those of the Day Ahead Market for energy and Real Time Market for energy respectively.*

*(2) TRAS Requirement: The Nodal Agency shall communicate to the power exchange(s),*

*the quantum of requirement of TRAS-Up and TRAS-Down on day-ahead basis before commencement of the Day Ahead Market and incremental requirement, if any, over and above the procurement in the Day Ahead Market, on real-time basis, before the commencement of the Real Time Market:*

*Provided that the quantum of requirement on day-ahead basis shall be communicated after considering the TRAS resources likely to be available on real-time basis.”*

### 3. Measures for ensuring adequacy of reserve

3.1 The NLDC has highlighted that during high demand periods, there are hardly any reserves left in the system. Further, some of the high-cost generation, especially gas-based generation, remains under shut down due to insignificant or no requisition of the beneficiaries from such stations. All this poses a serious threat to secure grid operations. There is, therefore, a need for advance procurement of reserves as well as measures to optimally utilize the existing gas-based generation in the interest of grid security.

#### 3.2 Advance procurement of reserves (long term measure):

- a) At present, the Ancillary Services Regulations provide for the procurement of reserves on a day ahead and real time basis. During high demand periods, most of the capacities get scheduled to the full, leaving no scope for any surplus capacity for reserves. Therefore, efforts at the procurement of reserves on a day ahead and real time basis are rendered infructuous, especially during such high demand periods.
- b) This necessitates the procurement of reserves in advance. But the question is, advance procurement in what time frame? The NLDC has filed a petition for advance procurement of 150 MW of battery storage on a long-term basis (25 years contract via SECI). It's a two-part tariff contract. There will be a fixed cost liability for the NLDC to be recovered from the DSM pool account.
- c) The other question is, how to prioritize the capacities procured in advance for dispatch under Ancillary Services? Should these capacities be dispatched on merit order or as must run outside of merit order?



- d) The phenomenon of capacity crunch during the high demand period is clearly a reflection of inadequate resource adequacy (RA). The RA framework ensures generation resource planning to take care of peak demand, plus a planning reserve margin. The IEGC as well as the guidelines issued by the Ministry of Power have laid the ground work for this. Once the RA framework is put in place by the states, adequate reserve margin will be available in the system at all times, including during high peak periods, obviating the need for the system operator to separately procure reserves in advance. However, it will take time before the RA framework is institutionalized in the country. In the interim, therefore, there is a need for advance procurement of reserves by the system operator.
- e) However, advance procurement over a long-term time horizon may not be optimal, as this will entail huge fixed cost liabilities without commensurate utilization. It is suggested that, to start with, advance procurement may be allowed over a three-month time horizon, with provision for payment of commitment charges to be discovered through competitive bidding.
- f) As regards dispatch, the capacities procured must be subjected to merit in order to optimize the short run marginal cost.
- g) A suitable amendment to the Ancillary Service Regulations would be required to enable advance procurement of reserves on the lines outlined above.

### 3.3 Optimal utilization of the gas-based generation (Interim measure):

The NLDC has highlighted that in order to ensure the adequacy of reserves, particularly during periods of sustained high demand, it is deploying additional gas-based generation. This includes RLNG and liquid firing, which incur variable charges ranging from Rs. 12 to 18 per unit, depending on combined or open cycle operation. These are being committed under the Ancillary Services Regulations in order to uphold grid security.

In order to optimally utilize the available gas-based generation, two methodologies are detailed below:

#### Option-I

- Optimally utilize the existing gas-based generation capacity through Security Constrained Unit Commitment (SCUC), subject to merit order, i.e. bringing such capacity on bar by

scheduling up to the technical minimum during a high demand period and keeping the balance capacity (the difference between the declared capacity and the technical minimum) as reserves for deployment under the Ancillary Service mechanism.

- Recovering the cost of such dispatch under SCUC and Ancillary Service through the DSM Pool Account and the shortfall (if any) in the DSM Pool Account will be charged as a Grid Security Charge as per the methodology discussed in subsequent sections.

#### Option-II

- Direct such gas-based generating stations to bid during high demand periods into the market (in DAM as well as HP DAM, and in TAM) in such a way as to ensure it is cleared at least up to the technical minimum. The shortfall in recovery of the cost of generation (the difference between the cost of generation and the market price) will be recovered as a Grid Security Charge from the DSM Pool Account.
- With the gas-based generating stations getting scheduled by virtue of participation in the market/Power Exchange, they will be available on bar for the System Operator to use the surplus capacity (declared capacity minus the technical minimum schedule as finalized in the market/Power Exchange) as Ancillary Service.
- Once used as an Ancillary Service, such costs may also be recovered from the DSM Pool Account.
- As in Option-I, the deficit in the DSM Pool Account (if any) will be charged as a Grid Security Charge as per the methodology discussed in subsequent sections.
- An illustration highlighting the optimal utilization of gas-based generation is enclosed as Annexure-I.

## 4. Mechanism for recovery of cost towards Reserves/Ancillary Services

- 4.1 As elucidated in the preceding sections, it is imperative to address the need for adequate reserves for maintaining and enhancing grid security and grid operation reliability. Consequently, two mechanisms were explored: long-term measures such as advance procurement of reserves and short-term measures such as optimal utilization of available gas-based generation. Both of these measures entail associated costs. Advance procurement involves various costs, such as fixed charges for the capacity procured and charges related to the dispatch of energy in real time. Furthermore, dispatching gas-based generation incurs specific charges, as detailed in Annexure-I.
- 4.2 It is proposed that the cost towards the reserves/Ancillary Services procurement by NLDC/RLDCs (including the reserves procured in advance) should first be met out of the surplus available in the DSM Pool account. However, the DSM account might not have ample surplus to cover the costs. The balance amount i.e. the cost of Ancillary Services / Reserves over and above what is met out of the DSM Pool Account surplus shall then be recovered as Grid Security Charge.
- 4.3 At present, the Regulations on Ancillary Services provide for recovery of deficit in the Deviation Pool Account through RLDC fees and charges. The Grid-India has observed that the RLDC fees and charges are paid by the generating stations, transmission licenses and distribution licensees. Requiring the generating stations to pay for the cost of ancillary service as Grid Security Charge might not be fair as they themselves might be providing the ancillary services. Levying Grid Security Charge on the transmission licensees also might not be desirable.
- 4.4 Pertinently, the drawee DICs are expected to maintain reserves. However, in the absence of drawee DICs maintaining adequate reserves, the NLDC/RLDCs have to procure reserves for safe and reliable grid operation. IEGC 2023 has provided the provisions for procurement of such tertiary reserve capacity by the NLDC/RLDCs on behalf of the State if it falls short of maintaining the required reserve, and allocates the cost of procurement of such capacity to that State.
- 4.5 Under the given scenario and the current regulatory provisions, the following mechanisms are

being proposed for the allocation of the grid security charge:

- Option-I: The net deficit in recovery from the DSM Pool Account shall be apportioned among the drawee DICs in proportion to the shortfall against their allocated share of reserves as estimated and published by NLDC. The net effect on each state as a percentage of the deficit amount is shown in Annexure-II.
- Option-II: The other option is that the net deficit amount be allocated across the drawee DICs as the Grid Security Charge in proportion to their GNA quantum. The net effect on each state as a percentage of the deficit amount is shown in Annexure-III.
- Option-III: Yet another option is to allocate the net deficit in the ratio of 50% on the shortfall of reserves and 50% on the GNA of DICs.

## 5. Summary of Recommendations for ensuring adequacy of reserve

5.1 Direct the NLDC to use gas-based generation under SCUC and Ancillary Services as per Option I under section 3.3 above; and to explore the feasibility of Option II and to provide feedback for the Commission to take further action in this regard.

5.2 Amendment to Regulations on Ancillary Services:

- (i) To provide for an enabling provision for advance procurement of ancillary services; and
- (ii) Payment of commitment charges for such advance procurement from the DSM Pool Account.

5.3 Allocation of the deficit in DSM Pool Account:

- The net deficit amount shall be apportioned among the drawee DICs in proportion to the shortfall against their allocated share of reserves as estimated and published by NLDC; or
- The net deficit amount shall be allocated across the drawee DICs in proportion to their GNA quantum; or

- The net deficit amount shall be allocated across the drawee DICs in the following manner: 50% in proportion to the shortfall against their allocated share of reserves and 50% in proportion to their GNA quantum.

## 6. Comments solicited

6.1 In view of the above discussions, the comments of the stakeholders are invited on the issues presented in the staff paper.

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## Illustration: Optimal utilization of gas-based generation under Option I and Option II

### 1. Assumptions

- The total available gas-based generation capacity: 6000 MW (including around 5000 MW from NTPC and the remaining from other generators).
- The tariff for utilizing this capacity: Rs. 15/kWh.
- NLDC to estimate the number of days/hours of utilization of the gas-based generation. An assumption based on inputs from NLDC is as under:
  - During the six-months of high demand period, spanning from April to September, the gas-based generation capacity will be operational for around 16 hours each day at 50% capacity utilization and for 8 hours daily at full 100% capacity utilization. It is estimated that the gas-based generation capacity will be utilized for at least 40 days during the span of 6 months of high demand period.
  - In the remaining six months period, the gas-based generation will operate in an open cycle mode for 8 hours each day for an estimated 40 days. The tariff for open cycle operation is assumed to be Rs. 24/kWh.

### 2. Scheduling and dispatch

#### Under Option I:

- The available capacity of gas-based generation to be operated under SCUC “subject to merit order” and Ancillary Services.
- Under the SCUC framework, the capacity will be scheduled on both D-1 day and the D Day. During this period, the generation capacities will be maintained at their technical minimum, corresponding to 50% generation capacity.
- Under Ancillary Services, the gas-based generation capacity will be dispatched as per requirement.

### Under Option II:

- The available capacity of gas-based generation to bid into the DAM in such a way as to ensure dispatch up to their technical minimum, corresponding to 50% generation capacity, so that the balance is available for use as Ancillary Services by the NLDC.
- Under Ancillary Services, the gas-based generation capacity will be dispatched as per requirement.

### 3. Expenses as a result of such dispatch

- a. During the High Demand Period, the daily expenses calculated at the rate of Rs 15/kWh amounts to approximately Rs. 150 Crores per day. Assuming recovery from the SCED-down (as the gas-based capacity will be committed under SCUC, SCED-down instruction will be given to the marginal cost generators under SCED, which are required to pay back to the DSM Pool at their variable charge/compensation charge) or sale in the Power Exchanges at Rs 6 per kWh (conservative estimate), the total revenue generated will be to tune of Rs 60 Crore/day. Over the course of 40 days during this period, the total expenses will amount to Rs. 3600 Crore.
- b. During the remaining six months, the total expenses calculated at the rate of Rs. 24/kWh amounts to approximately Rs. 2300 Crore for this period.
- c. Considering additional expenses of Rs. 3000 Crore (based on estimate provided by NLDC) to be incurred for the dispatch of other resources (other than gas-based capacity) under Ancillary Services, the combined annual expenses for the operation and dispatch under Ancillary Services will sum up to Rs. 9000 Cr.
- d. It is imperative that this amount has to be adjusted from the DSM Pool Account.

### 4. DSM Pool Account

- During FY 2022-23, based on actual figures obtained from the NLDC, the total surplus in the DSM Pool Account was approximately Rs. 5,000 Crore.

- This may not be sufficient to meet the costs (estimated to be the tune of Rs. 9000 Crore based on the above assumptions) towards reserves/Ancillary Services including those procured in advance for reliability of grid operation.
- All this is based on assumptions. The actual figures would vary depending on the price of gas and actual operation and deployment of gas-based generation.
- Some mechanism need be devised to meet this shortfall.



**Annexure-II**

State/ Union Territory	Reserves to be maintained as estimated and published by NLDC * [A]	Reserves (to be) declared by the States/UTs [B]	<u>Assumed</u> Shortfall in reserves maintained/declared by States/UTs [C=A-B]	Apportion of the Grid Security Charge in the ratio of shortfall in reserves maintained (in %) [D= C/ΣC*100]
UT of Chandigarh	28	17	11	0.14
Delhi	269	159	110	1.87
Haryana	600	354	246	4.96
Himachal Pradesh	174	103	71	1.12
UT of Jammu and Kashmir and UT of Ladakh	335	198	137	1.7
Punjab	559	330	229	3.52
Rajasthan	731	431	300	5.29
Uttar Pradesh	790	466	324	5.58
Uttarakhand	169	Not declared	169	1.72
Chhattisgarh	488	288	200	3.67
UT Daman and Diu UT Dadra and Nagar Haveli	81	48	33	0.43
Gujarat	1296	765	531	8.44
Goa	57	34	23	0.32
Madhya Pradesh	860	506	354	6.06
Maharashtra	1119	660	459	7.21
Andhra Pradesh	942	546	396	6.68
Karnataka	850	501	349	4.89
Kerala	205	121	84	1.34
UT of Puducherry	49	Not declared	49	0.42
Tamil Nadu	978	577	401	6.36

Telangana	894	527	367	6.44
Bihar	493	280	213	3.08
Damodar Valley Corporation	671	396	275	4.87
Jharkhand	292	172	120	1.98
Odisha	675	398	277	5.22
Sikkim	35	21	14	0.18
West Bengal	620	366	254	4.33
Arunanchal Pradesh	32	19	13	0.16
Assam	146	86	60	0.88
Manipur	25	15	10	0.13
Meghalaya	59	35	24	0.4
Mizoram	20	12	8	0.12
Nagaland	19	11	8	0.11
Tripura	70	41	29	0.4
<b>TOTAL</b>	<b>14630</b>	<b>8480</b>	<b>6150</b>	<b>100</b>

*\*Source: Summary of reserves requirement (Secondary and Tertiary) published by NLDC for Q2 of FY 2023-24*

**Annexure-III**

State	Apportion of Grid Security Charge as per GNA	
	GNA* [A]	Grid Security charges (in %) [B= A/ΣA*100]
Chandigarh	342	0.31
Delhi	4810	4.42
Haryana	6913	6.35
Himachal Pradesh	1130	1.04
UT of J&K and Ladakh	1977	1.82
Punjab	5497	5.05
Rajasthan	5755	5.29
Uttar Pradesh	10165	9.34
Uttarakhand	1402	1.29
Railways-NR-ISTS-UP	130	0.12
PG-HVDC-NR	8	0.01
Chattisgarh	2149	1.97
Dadra Nagar Haveli &	1126	1.03
Goa	548	0.50
Gujarat	6434	5.91
Madhya Pradesh	7361	6.76
Maharashtra	8496	7.80
Essar-Steel	563	0.52
PG-HVDC-WR	5	0.00
BARC	5	0.00
Andhra Pradesh	4516	4.15
Karnataka	4376	4.02
Kerala	2679	2.46
Puducherry	398	0.37
Tamil Nadu	9177	8.43
Telangana	6140	5.64
PG-HVDC-SR	6	0.01
Bihar	5043	4.63
DVC	956	0.88
Bangladesh	782	0.72
Jharkhand	1110	1.02
Odisha	2157	1.98

Sikkim	111	0.10
West Bengal	3946	3.62
PG-HVDC-ER	2	0.00
Arunachal Pradesh	134	0.12
Assam	1529	1.40
Manipur	204	0.19
Meghalaya	238	0.22
Mizoram	95	0.09
Nagaland	134	0.12
Tripura	311	0.29
PG-HVDC-NER	1	0.00
<b>Total</b>	<b>108861</b>	<b>100.000</b>

\*Source: NLDC