
Deviation Settlement Mechanism

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The safety and reliability of the Electricity Grid is one of the most important components of the entire Electricity Supply System. Grid operators utilize mechanisms and ancillary services such as Deviation Settlement Mechanism to help ensure safety and reliability of the Grid. These are backed up by certain Regulations and Policies in India and work through the imposition of penalties and incentives. ¹

One of the most important steps in this regard, are the Deviation Settlement Mechanism Regulations- which have evolved from earlier forms of Availability Based Tariff.

Need for ABT

Prior to the introduction of Availability Based Tariff, the regional grids were characterized by large deviations in frequency from the rated frequency of 50 cycles per second (Hz) leading to low and high frequency situations. The low frequency situations resulted- *due to a higher consumer load than the total generation available in the grid* and high frequency resulted from- *insufficient backing down of generation when the total consumer load fell during off-peak hours*. This continued functioning at non-standard frequency led to long-term damages to both generation and end use equipment resulting in hidden costs that ultimately had to be borne by the end consumers.

What is ABT?

Availability Based Tariff (ABT) order became a part of the system on January 4, 2000 and was implemented in all the regional grids of India for improving grid discipline by frequency dependent pricing.

The term Availability Based Tariff, “stands for a rational tariff structure for power supply from generating stations, on an availability basis”.² It is a performance based tariff structure for the supply of electricity by generators owned and controlled by the Central Government that provides for a new system of scheduling and dispatch, which mandates the generators and beneficiaries to commit to day ahead schedules through a system of reward and penalty³. The defaulters are liable to pay a penalty which entails payment of prescribed charges, non-payment of which will call for appropriate action under section 45 of the Electricity Act 2003. The most significant aspect of ABT is the splitting of the existing rigid energy charges into three

¹ India Has New Rules to Maintain Power Grid Security. We Explain the Deviation Settlement Mechanism, CEEW

² ABC of ABT, Bhushan, Bhanu

³ Availability Based Tariff and its impact On different Industry Players-A Review, Holmukhe, R. M. ; Pawar, Yogini ; Desai, R. S. ; Hasarmani, T. S, (2010)

components viz. **capacity charges/ fixed charges, variable charges** and a third charge viz. **the unscheduled interchange (UI) charges**.⁴

- **Capacity charges/ Fixed charges:** The fixed charge (FC) in case of ABT is payable every month by each beneficiary to the generator for making generation capacity available for use. However, it is not the same for each beneficiary and varies with the share of a beneficiary in a generators capacity. It also varies with the level of availability achieved by a generator.
- **Variable charges:** It is the energy charge per kwh of energy supplied as per a pre-committed schedule of supply drawn upon a daily basis by Load Despatch Centres (LDCs). Under the earlier regime, fixed and variable charges were bundled together and payable in proportion to the actual energy drawn by the consumer.

Energy charges are calculated as:

- Energy Charge = MWh for the day as per drawl schedule for the beneficiary finalized in advance x Energy Charge rate for the plant.
- **Unscheduled Interchange:** Under the earlier regime, no penalty was applicable for deviation from generating/drawal schedule by an entity. An attempt had been made to do away with this drawback under the ABT regime through introduction of UI charge. Here, for any withdrawal of power other than the schedule, the beneficiary has to pay an unscheduled interchange (UI) charge for deviation from the day ahead schedule which is linked to the frequency. *The relationship between the UI rate and grid frequency, for the inter-state system*, is specified by Central Electricity Regulatory Commission. UI charges are calculated using the following relationship:

- i) a generator generates more than the schedule, thereby increasing the frequency;
- ii) a generator generates less than the schedule, thereby decreasing the frequency;
- iii) a beneficiary overdraws power, thereby decreasing the frequency;
- iv) a beneficiary underdraw's power, thereby increasing the frequency.⁵

It is thus clear from the above that UI charges are a commercial mechanism to maintain grid discipline. The UI charges penalize whosoever caused grid indiscipline, whether generator or distributor, is subject to payment of UI charges that are not following the schedule. The UI charges are not payable if the consumer maintains their drawl of electricity consistent with the schedule given by them.

Need for Deviation Settlement Mechanism

⁴ ABT Order, 4th January, 2000, Central Electricity Regulatory Commission

⁵ ABT Order, 4th January, 2000, Central Electricity Regulatory Commission

On July 30, 2012 the parts of North India came to a standstill, crippled with power failure that affected the states of Delhi, Punjab, Haryana, Himachal Pradesh, Uttar Pradesh, Rajasthan and Jammu and Kashmir. This power failure was attributed to overdrawing of power by some states. However, that has not been confirmed yet. While authorities were working round-the-clock to restore the Northern Grid, and were successful in partially restoring power in many parts after 15 hours, the northern grid collapsed again on the next day, July 31. This time, a cascading effect saw the collapse of the Eastern and North Eastern power grids as well. This affected the states of West Bengal, Odisha, Jharkhand, Bihar, Sikkim, Assam, Mizoram, Manipur, Nagaland, Meghalaya and Arunachal Pradesh. In what's being termed as the biggest ever power failure in Indian history, three inter-state transmission networks collapsed together, plunging most of north India into darkness and disrupting the daily lives of over 600 million people.⁶

After this incident the Ministry of Power (MoP), felt it was important to bring in a new mechanism to prevent these situation from happening again in the future and thus the Deviation Settlement Mechanism was introduced.

Introduction of the Deviation Settlement Mechanism

A new Deviation Settlement Mechanism (DSM) was introduced by CERC on 6th January 2014 to replace the UI (Unscheduled Interchange) Regulation 2009. The main objective of this was to maintain grid discipline and grid security as envisaged under the Grid Code through the commercial mechanism for Deviation Settlement through drawal and injection of electricity by the users of the grid.

It was observed that some of the states were using Unscheduled Interchange (UI) as a trading platform and this was identified as being one of the main reason for the grid failure. Certain States were overdrawing heavily whereas others were under drawing from their schedule resulting in frequency variation in the specified range. This action of these States led to the grid instability and thus resulted in the failure of grid.

Under this Regulation, CERC had implemented a *volume limit for buyer and seller depending on their approved schedule, range of frequency was tightened, charges for the unscheduled interchange or deviation was increased*. This was done to ensure better demand predictability by states and to avoid UI as a trading platform.⁷

Deviation Settlement mechanism and Related Matters Regulation 2014:

Some of the Highlights of the regulation are mentioned below:

⁶ *Northern Grid power failure: What went wrong?*(02 Aug 2012), Khedekar, Naina:firstpost.com

⁷ *(Unscheduled Interchange charges and related matters) (Amendment) Regulations*, (2010) Central Electricity Regulatory Commission

- i. The band frequency was fixed in the range of 49.70 to 50.10.
- ii. The charges for overdrawal (OD) / Overinjection (OI) and Underdrawal (UD) / Underinjection (UI) were restored.
- iii. Normal limit of deviation was introduced for OD/OI and UD/UI, i.e.; 12% of schedule or 150 MW, whichever is lower.
- iv. 48 MW of deviation was allowed when schedule is less than or equal to 400 MW.
- v. The Renewable Energy Rich states were given leverage by allowing them certain extra MW of deviation on normal limit of deviation (50 MW for states which have reinstalled capacity wind/solar is between 1000 to 3000 MW and 100 MW for states which have installed capacity more than 3000 MW)
- vi. 178 paise/KWh charges for deviation was fixed on 50 Hz average frequency of the time block.
- vii. Charges for deviation for each 0.01 Hz step was equivalent to 35.60 Paise/KWh in the frequency range of 50.05-50.00 Hz and 20.84 Paise/KWh in the frequency range below 50 Hz to below 49.70 Hz.
- viii. The charges for deviation was 0 paise at 50.05 Hz and 824.04 Paise/KWh at 49.70 Hz of frequency
- ix. No Overdrawl of electricity by any buyer was permissible when grid frequency fell below 49.70 Hz and no Underdrawal of electricity was permitted to any buyer when grid frequency was 50.10 Hz and above and vice-versa for the seller.
- x. Additional deviation charges were introduced for the buyer and seller who go beyond their normal limit of deviation.
- xi. Sign changed parameter was introduced in the event of sustained deviation from schedule in one direction (positive or negative) by any regional entity and such regional entity (buyer and seller) would have to make sign of their deviation from schedule changed, at least once after every 12th time blocks.
- xii. 50 Hz frequency was linked with to the Area Clearing Price (ACP) from exchange in the fourth amendment of DSM in month of November 2018 instead of the earlier price based on the average energy charge of coal/lignite based generating stations for efficient and proper accounting purpose.
- xiii. Frequency band was narrowed between 49.85 to 50.05 which was earlier 49.70 Hz to 50.10 Hz.
- xiv. The change of deviation at grid frequency below 49.85 Hz would be at 800 Paise/KWh.
- xv. The maximum ceiling limit applicable for average daily ACP discarded in DAM segment of power exchange at 50.00 Hz would be 800 Paise/KWh.
- xvi. Signed Charge Parameter was squeezed to 'after every 6th time block' and provided that the violation of the requirement under this clause shall attract additional charges at 20% on daily base DSM payable/receivables as the case may be.
- xvii. In the fifth Amendment there was more emphasis on the sign charge (sustain deviation) and imposing penalty criteria from 01/04/2020.

Deviation Settlement Mechanism Regulation 2022:

These mentioned evaluations in DSM were started in 2014 and evolved till the introduction of new DSM Regulations in 2022.

- i. The normal rate of charges for deviation for a time block shall be equal to the Weighted Average Ancillary Service Charge (in paise/kWh) computed based on the total quantum of Ancillary Services deployed and the net charges payable to the Ancillary Service Providers for all the Regions for that time block
- ii. The Central Commission, recognizing the necessity for grid stability, highlighted several concerns regarding the current state of Ancillary Services Regulations, noting a lack of desired participation and the reliance on costly RLNG-based generation to mitigate capacity shortfalls. Emphasizing the importance of Resource Adequacy, it called for states to balance load and generation, maintain reserves for contingencies, and invest in long-term resource planning.
- iii. Frequency excursions and inadequate response from generators underscored the need for a high-level investigation and the implementation of Tertiary Reserves Ancillary Service (TRAS).
- iv. Urgent measures were recommended, including prudent reserve procurement, encouraging participation from state entities and innovative technologies, and intervention to maintain grid frequency.
- v. Despite efforts to ease implementation difficulties through DSM Regulations, stricter penalties on buyers introduced challenges, leading to load shedding. Overall, the Commission aimed to ensure smooth and secure grid operation amidst evolving energy demands and integration of renewable sources.
- vi. It was also noticed that that while some improvement in the frequency profile excursions above 50.05 Hz was observed, the overall frequency profile still remained a matter of concern. Further, the required support from the buyers and the sellers in the form of Reserves and Ancillary Services, as was envisioned, under the Ancillary Services Regulations dated 31.01.2022, has not been forthcoming.

However, the introduction of new DSM on December 5, 2022 imposed stricter penalties on the buyers for overdrawal and this led to inefficiencies and load shedding as a preventive measure.

With respect to frequency, it was noticed that that while some improvement in the frequency profile excursions above 50.05 Hz was observed, the overall frequency profile still remained a matter of concern. Further, the required support from the buyers and the sellers in the form of Reserves and Ancillary Services, as was envisioned, under the Ancillary Services Regulations dated 31.01.2022, had not been forthcoming.

Therefore certain relaxations in the DSM mechanism were made vide order dated 08/02/2023, which included:⁸

- i. Ancillary service charge was removed from determining the DSM charge and highest from DAM and RTM Market was used. ACP was introduced to determine the block-wise deviation charge.
- ii. Lower frequency range was changed to 49.90 from earlier 49.85 Hz.
- iii. Five new frequency bands were introduced with different deviation charge with each band of course with different limit of OD/OI and UD/UI.
- iv. Sign change Deviation Charge parameter was removed.

HIGHLIGHTS OF DEVIATION SETTLEMENT MECHANISM 2023

Deviation Settlement Mechanism (DSM) for Over-Drawal					
DSM Amended Order by CERC-w.e.f 00Hrs of 08.02.2023					
Frequency Zone	f≤49.90	49.90<f<49.95	49.95≤f≤50.03	50.03<f<50.05	f≥50.05
OD (Payable)	200 % of Normal rate of charge for Deviation irrespective of Quantum of OD	150 % of Normal rate of charge for Deviation irrespective of Quantum of OD	Normal rate of charges for Deviation upto [10% Deviation-buyer (in %) or 100MW Deviation-buyer (in MWh) in a time block, whichever is lower]	75% of Normal rate of charge for Deviation irrespective of Quantum of OD	Zero irrespective of Quantum of OD
			120% of Normal rate of charges for Deviation beyond [10% Deviation-buyer (in %) or 100MW Deviation-buyer (in MWh) in a time block, whichever is lower] and upto [15% Deviation-buyer (in %) or 200MW Deviation-buyer (in MWh) in a time block, whichever is lower]		
			150% of Normal rate of charges for Deviation beyond [15% Deviation-buyer (in %) or 200 MW Deviation-buyer (in MWh) in a time block, whichever is lower]		
Normal rate of charge for deviation: Maximum of weighted average price of DAM all segment and RTM					
Deviation Settlement Mechanism (DSM) for Under-Drawal					
DSM Amended Order by CERC-w.e.f 00Hrs of 08.02.2023					
Frequency Zone	f≤49.90	49.90<f<49.95	49.95≤f≤50.03	50.03<f<50.05	f≥50.05
UD (Receivable)	150% of Normal rate of charge for Deviation irrespective of Quantum of UD	120 % of Normal rate of charge for Deviation irrespective of Quantum of UD	90% of Normal rate of charges for Deviation upto [10% Deviation-buyer (in %) or 100MW Deviation-buyer (in MWh) in a time block, whichever is lower]	50% of Normal rate of charge for Deviation irrespective of Quantum of UD	Zero irrespective of Quantum of UD
			50% of Normal rate of charges for Deviation beyond [10%Deviation-buyer (in %) or 100MW Deviation-buyer (in MWh) in a time block, whichever is lower] and upto [15% Deviation-buyer (in %) or 200MW Deviation-buyer (in MWh) in a time block, whichever is lower]		
			0% of Normal rate of charges for Deviation beyond [15% Deviation-buyer (in %) or 200 MW Deviation-buyer (in MWh) in a time block, whichever is lower]		
Normal rate of charge for deviation: Maximum of weighted average price of DAM all segment and RTM					

The evolution of DSM started in 2014 and is still evolving, especially with the growing complexity of the power market. These regulations and rules are highly important to maintain

⁸ Order in Petition no. 01/SM/2023, (6.02.2023) Central Electricity Regulatory Commission

safety and reliability of a large Grid such as India's, specifically with regards to the vision of 'One nation One Grid'.

However, it should be ensured that the basic nature of these rules and regulations do not change very frequently and that the mechanism is not misused by utilities to leverage power costs.