CENTRAL ELECTRICITY REGULATORY COMMISSION

Central Electricity Regulatory Commission (Deviation Settlement Mechanism and Related Matters) Regulations, 2021

EXPLANATORY MEMORNDOM

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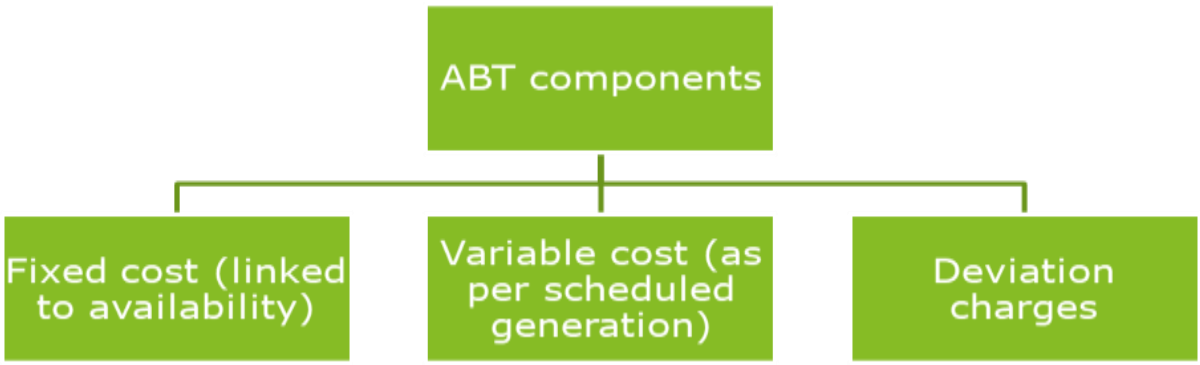
1. Introduction:

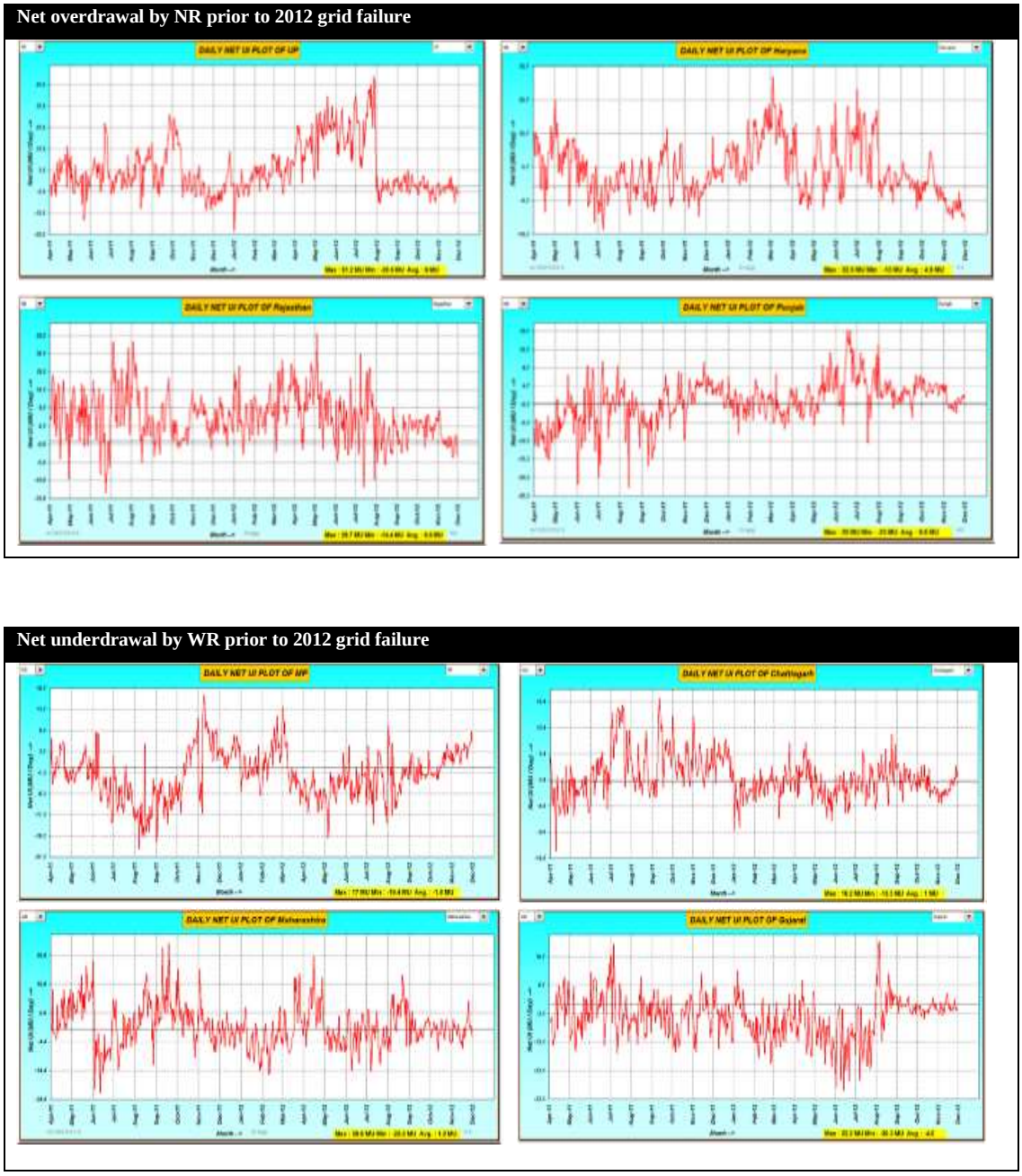
1.1 Effort to bring discipline in the grid operations started with the introduction of Availability Based Tariff (ABT) by the Commission in 2002-03, prior to which the regional grids faced large frequency fluctuations.ABT(Figure 1) introduced the concept of generation and drawal schedule to be given by the generators and the beneficiaries on a day-ahead basis. Any deviation from the scheduled generation and drawal on the day of operation was settled through Unscheduled Interchange (UI) mechanism under which the prices for settlement of deviation were linked with grid frequency.

Figure 1: Availability Based Tariff (ABT)



1.2 Even after the introduction of UI mechanism the distribution utilities overlooked the need for planning their generation adequacy and relied on over-drawal from the grid for meeting their consumer demand. Similarly, many generators did not always adhere to their schedules and resorted to under-injection or over-injection. Over the years, the UI mechanism has been gradually used as a de-factotrading platform by many generators and distribution utilities leading to large frequency excursions, as is evident from the operational frequency of the grid (see Figure -2) prior to 2012 grid failure.

Figure 2: Frequency fluctuations (Prior to 2012)



1.3 The economic impact of the 2012 grid failure attracted the attention and steps were taken towards maintaining grid discipline. Acting on the recommendations of the Enquiry Committee constituted to investigate the two grid failure events in 2012, CERC introduced the new Deviation Settlement Mechanism (DSM) in 2014 by specifying the Central Electricity Regulatory Commission (Deviation Settlement Mechanism and related matters) Regulations, 2014 (in short, 'the 2014 DSM Regulations').

1.4 Maintaining grid discipline and grid security were the main objectives of DSM. DSM brought in strict volume limits for over drawl/under drawal and over injection/ under injection of electricity.

Additional deviation charges were made applicable in the event of breach of the volume limits. Steps such as tightening of operational frequency band and increased deviation charges were undertaken even before DSM came into being and continued after DSM was introduced in 2014, which improved the frequency profile of the grid as can be seen in the figure (Figure 3) below.

Figure 3: Frequency band and DSM

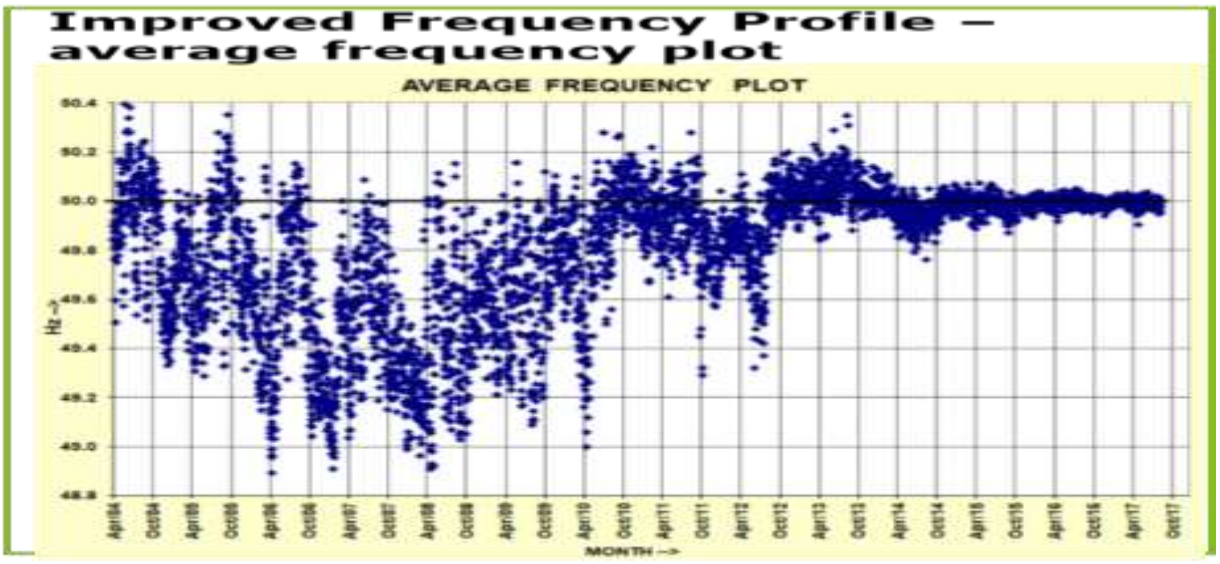
Period	Operational frequency band (Hz)	Ceiling rate (p /kWh)	Slope (p / kWh)
1 July 02 – 31 March 04	49.0-50.5	420	5.6
1 April 04 – 3 Sep 04	49.0-50.5	600	8
1 Oct 04 – 29 April 07	49.0-50.5	570	9
30 April 07 – 6 Jan 08	49.0-50.5	745	6-16
7 Jan 08 – 31 March 09	49.0-50.5	1000	8-18
1 April 09 – 2 May 10	49.2-50.3	735	12-17
3 May 10 – 16 Sep 12	49.5-50.2	873	15-47
17 Sep 12 – 16 Feb 14	49.7-50.2	900	16.5-28
17 Feb 14 onwards*	49.7-50.05	824	20.8-35.6

Source: CERC

** Slope changed post 4th amendment*

Progressive tightening of permissible

Progressive increase in deviation charge



1.5 The frequency linked DSM worked on the following principles:

- By giving incentives for enhancing output capability of power plants, it enabled more consumer load to be met during peak load hours.
- Generators were paid to back down during off-peak hours if frequency rose above the specified

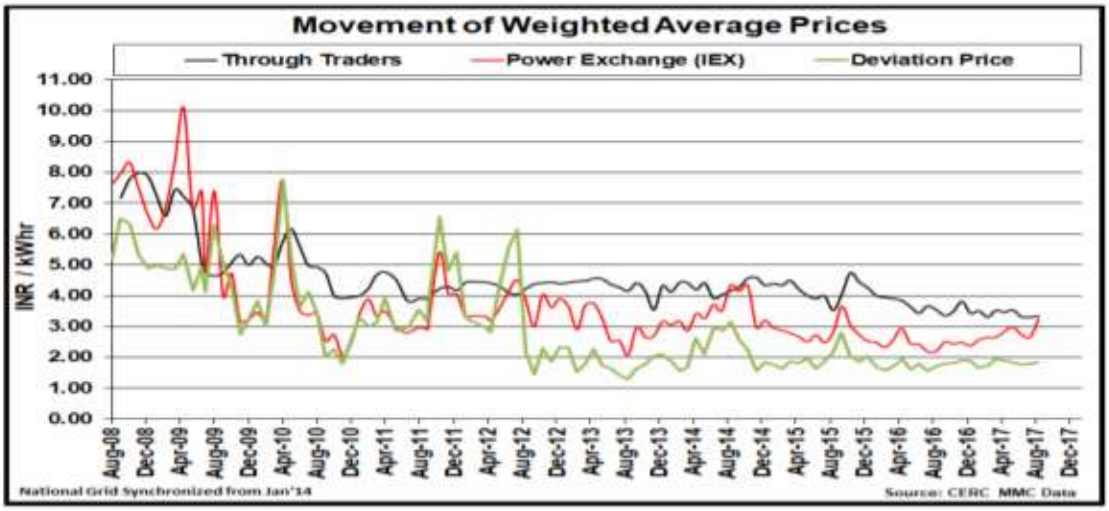
levels.

- In case of over-drawal, discoms had to pay at a higher rate during peak load hours, which discouraged them from over-drawing further. This payment went to the beneficiaries who had received less energy than was scheduled and acted as an incentive for assisting the grid in maintaining the load-generation balance, as well as compensation for energy paid for but not received.
- The high rate during low-frequency conditions induced all States to reduce their over-drawal from the grid, by maximizing their own generation.
- In low frequency condition, if a State drew less power than scheduled, it was paid back for the energy not drawn. On the other hand, during high-frequency conditions, a State could draw extra power at a low rate, and thus helped them to back down its own costlier generating stations.

1.6 DSM was further strengthened with amendments to the 2014 DSM Regulations. Through 1st Amendment, under-drawal/ over injection and over drawal/ under injection limit were added in case of frequency being at "50.10 Hz and above" and "below 49.70 Hz" respectively. The 2nd Amendment introduced the framework of scheduling and deviation for wind and solar generators, which are regional entities. With due regard to the variability of renewable energy (solar and wind) sources, relaxation in volume limits for under drawal/ over injection for renewable rich States was extended through the 3rd Amendments. Post 3rd Amendment the stability of the grid improved, however there were still some limitations that required urgent attention:

1) **Capturing value of lost load**: Ideally, the DSM price should capture the Value of Lost Load (VoLL) so that utilities procure adequately in advance so as to meet their universal service obligations.
2) **Constant prices**: The DSM prices till 2014 did not capture the difference between the peak and the off-peak value of electricity.
3) **Absence of transmission component**: DSM prices did not take into account the transmission congestion in different locations and the penalties remained static across geographies.
4) **Price convergence with organized markets**: Deviation price is generally lower as compared to Power exchange (DAM), bilateral and ancillary services prices(Please see Figure 4) and hence does not act as a deterrent against leaning on the grid for generating and drawing entities.

Figure 4:**Price movement (Traders; PX; and DSM**



1.7 Price convergence with organized markets and enforcing adequate energy planning by utilities have been the focus for next set of reforms in DSM. In this regard, the Commission notified the 4th Amendment to the 2014 DSM Regulations with effect from 1st January, 2019 and 5th Amendment with effect from 3rd June, 2019. The key change has been in terms of movement from the administered DSM price determination to indexing DSM rates to market prices (Area Clearing Price or ACP of the Day Ahead Market segment of the Power Exchange). This was introduced with the following key objectives:

- Linkage to ACP would factor in the geographical aspect of prices and effect of transmission congestion.
- Linkage to ACP would capture the peak and off-peak price variations.
- Linkage to ACP would incentivise participants to procure power from organized markets.
- Entities would not deviate substantially from their schedules because of higher charges leading to increased grid discipline in terms of forecasting and scheduling.

2. Rationale for revisiting the present DSM:

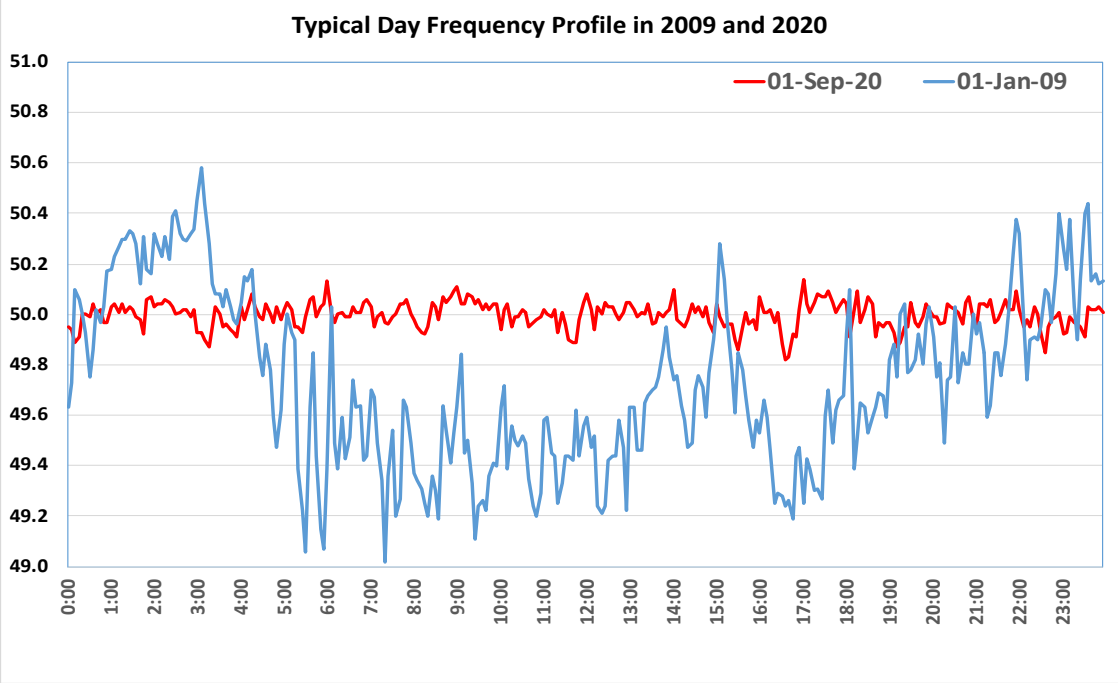
2.1 The 2014 DSM Regulations provide that the linkage of deviation charges to frequency may be reviewed by the Commission, keeping in view the changing power market conditions. Accordingly, the Commission has undertaken a review of this aspect in the light of various developments and the emerging market realities.

Need for revisiting linkage of frequency to DSM rate

2.2 In the last 15 years, the Indian power system operation has undergone considerable change in

many ways. CERC has acted at regular intervals by narrowing the operating frequency band from 49.0 – 50.5 Hz range prior to 2009, to 49.90 – 50.05 Hz at present. Frequency plots of 1st January, 2009 and 1st September, 2020, representative of the frequency patterns before and after the above changes inoperating band, are shown in the following figure (Figure 5).

Figure 5: Frequency Profile in 2009 and 2020



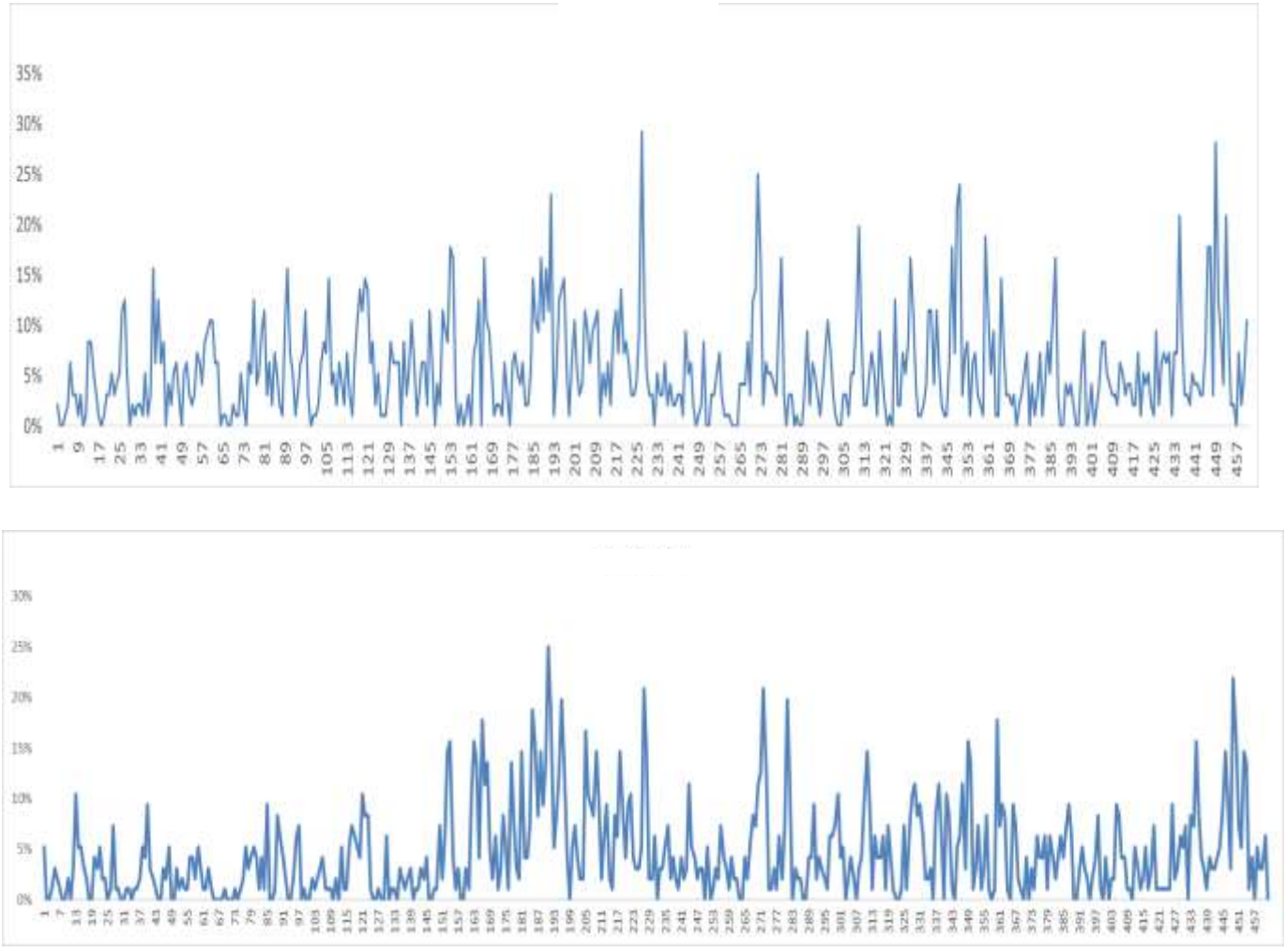
2.3 Clearly, there is a discernible improvement in power system operation (in terms of stable operation and frequency remaining within a close band) over the years. This has become possible because of various measurestaken by the Commission through changes in the grid code and UI mechanism/ DSM, thereby inducing the constituents to adhere to their schedule. In the absence of large frequency excursionsas at present, there hardly remains any scope for frequency linked pricearbitrage.Therefore, the system frequency is no longer a correct indicator of generation being short or surplus, and also link between the system marginal price and frequency hardly exists.

2.4 Apart from the above, another development in 2016 viz. introduction of ancillary services has made linkage of DSM price to frequency largely redundant. In fact, co-existence of ancillary services and frequency linked DSM could be counter-productive. While ancillary services are deployed centrally by the system operator to restore and maintain system frequency closer to 50 Hz, the frequency linked DSM price is a decentralised tool of controlling frequency. Existence of both centralised mode of frequency regulation through Ancillary Services and decentralised mode of controlling frequency through frequency

linked DSM could lead to avoidable conflict in system operation.

2.5 Another fallout of linkage of frequency to DSM rate is the perverse tendency of the Discoms to deviate from the schedule, especially during high frequency conditions. In view of the prevailing stability in grid operation and frequency and consequent DSM price being predictable, the drawee entities can choose to deviate during high frequency hours as DSM price tend to be very are low or even zero at those times. The following illustration (Figure 6) is a case in point. It depicts percentage of slots from January 2019- April 2020 where two States have overdrawn from the grid when the grid frequency was 50.05 and higher (x-axis represents the days from January 2019 to April 2020 and y-axis represents the percentage of slots)

Figure 6:Over-drawal during high frequency conditions



2.6 This strengthens the case for 'any deviation'irrespective of the nature of such deviation caused by the utilities liable for payment of DSM charges.

Need for revisiting the principle of indexing DSM rate

2.7 As stated earlier, the Commissionhas proposed a new framework for Ancillary Services including inter alia Secondary Reserves Ancillary Services and Tertiary Reserves Ancillary Services. To this end, draft Ancillary Services Regulations have already been floated and comments of stakeholders have been received. The intent of the new framework of ancillary services is to ensure that the frequency deviations are managed by the system operator through deployment of ancillary services of various types. This being the case, it would be reasonable to price deviation from the schedule according to what it costs to compensate the deviation through the dispatch of ancillary services.

2.8 Based on the review of the market developments as discussed above, the Commission has proposed a new framework of DSM. Salient features of the proposed DSM Regulations are discussed in subsequent paragraphs.

3. Salient features of the proposed DSM Regulations:

All entities to adhere to schedule and deviation to be managed through deployment of ancillary services

3.1 Load generation balance is the prime objective of system operation. This requires the generators and the drawee entities to adhere to their schedule. Generally, schedule is finalised on day ahead basis. However, given the uncertainty in demand and possible unanticipated changes in generating station conditions, day ahead schedules may not be adequate for the drawee entities to meet their demand or for the generators to meet their supply obligation. To address these needs, organised market platforms like Real Time Market and other avenues of energy trade closer to real time have been enabled by the Commission. The sellers and the buyers can use these avenues to sell and buy energy to correct their day ahead position. Generally, such options for energy trade remain open up to gate closure (about one hour before the actual delivery in Indian context). After the gate closure, the system operator takes over and manages the system imbalances or deviations through deployment of ancillary services. The proposed regulations reiterate this philosophy and provide that all grid connected entities shall adhere to their schedules and deviation, if any, shall be managed by the system operator through ancillary services and charges for such deviation shall be governed by the proposed DSM Regulations.

Formula for computation of deviation

3.2 The formulae for computationof deviation remain the same as in the 2014 DSM Regulations. Deviation (in percentage) for general sellers (sellers other than wind and solar generators) shall be computedwith reference to their scheduled generation while that for the wind and solar generators the same shall be computed with reference to their available capacity to take care of the variability. Available capacity has been defined as thecumulative capacity rating of wind turbines or solar inverters that arecapable of generating power in a given time block. The relevant provisions of the proposed DAM Regulations are quoted below:

- Deviation in a time block for general sellers shall be computed as follows:
  (i) Deviation-general seller (in MWh) = [(Actual injection in MWh) – (Scheduledgeneration in MWh)].
  (ii) Deviation-general seller (in %) = 100 x [(Actual injection in MWh) – (Scheduled generation in MWh)] / [(Scheduled generation in MWh)].

- Deviation in a time block for WS sellers shall be computed as follows:
  (i) Deviation-WS seller (in MWh) = [(Actual Injection in MWh) – (Scheduled generation in MWh)].
  (ii) Deviation-WS seller (in %) = 100 x [(Actual Injection in MWh) – (Scheduled generation in MWh)] / [(Available Capacity)]

3.3 The deviation (in %) for the buyers shall be calculated with reference to scheduled drawal as in the existing DSM framework:

- Deviation in a time block for buyers including RE-rich States shall be computed as follows:
  (i) Deviation- buyer (in MWh) = [(Actual drawal in MWh) – (Scheduled drawal in MWh)].
  (ii) Deviation- buyer (in %) = 100 x [(Actual drawal in MWh) – (Scheduled drawal in MWh)] / [(Scheduled drawal in MWh)]

Normal rate of charges for deviation

3.4 As a natural corollary to the philosophy that deviation is to be managed by the system operator through deployment of ancillary services, the charges for deviation should be such that the costs of deploying ancillary services are recovered. Accordingly, the normal rate of charges for deviation for a time block has been proposed to be equal to the Weighted Average Ancillary Service Charge (in paise/kWh)

computed based on the total quantum of Ancillary Services deployed and the total charges payable to the Ancillary Service Providers for all the Regions for that time block.

3.5 However, as the Ancillary Services framework is still in the development phase, it has been proposed that for at least for a period of one year from the date of effect of the proposed regulations or such further period as notified by the Commission, the normal rate of charges for deviation for a time block shall be equal to the highest of:

(a) the weighted average Area Clearing Price (ACP) of the Day Ahead Market segments of all the Power Exchanges; or
(b) the weighted average ACP of the Real Time Market segments of all the Power Exchanges; or
(c) the Weighted Average Ancillary Service Charge of all the regions,

for that time block.

3.6 In case of non-availability of ACP for any time block on a given day, ACP for the corresponding time block of the last available day shall be considered for computation of the normal rate of charges for deviation for that time block.

Deviation Charges for Generators

3.7 *Generators (other than RoR, MSW and wind and solar generators)*

3.7.1 It is reiterated that the basic objective of the proposed DSM regulations is to ensure that all grid connected entities adhere to their schedule. Under the existing system the generators are paid for overinjection (which is also a deviation) on the assumption that by doing so they assist in restoring grid frequency within the permissible operating band. Going forward the responsibility of managing frequency is vested in the system operator, while the generators can continue to play the same role (of helping restore frequency within the operating band) but at the instruction of the system operator by participating in the Ancillary Services mechanism, rather than acting on their own driven by the price signals linked to frequency.

3.7.2 It is a fact that the generators (other than RoR, MSW and wind and solar generators) have much better control over their generation. They can decide time block schedule, taking into account fuel availability and technical parameters, and determine with precision their generation output. Thus, there is no case for such generators to deviate from their schedule. However, there could be some metering errors that need to be factored in while accounting for deviation of such generators. Also, inadvertent deviations from schedule may occur on account of operation of governor control (RGMO/ FGMO). Thus, for upto

2% over injection, the charges for deviation for such generators shall be zero. Over injection beyond the limit of 2% during a time block shall attract charges for deviation at the rate of 10% of the normal rate of charges for deviation applicable during that time block. This is akin to negative pricing already prevalent in markets of several developed economies, with the difference that the proposed deviation charge (for over injection beyond 2%) is nominal in Indian context.

3.7.3 In case of under injection by the generators, there could be a need for procurement of ancillary services by the system operator. Further, the regional entity generators are paid energy charge based on schedule, and as such in the event of under injection,the generators other than RoR, MSW and solar and wind generators,will have to pay deviation charge for any level of under-injection.However, recognising that deviation up to 2% of schedule could be inadvertent, it has been proposed that the generators would pay at the rate of the normal rate of deviation charges for under injection up to 2% and beyond 2%, atthe rate of 110% of the normal charges for deviation applicable during that time block.

3.8 *Deviation charge for RoR generating station*

3.8.1 The RoR generators are dependent on the upstream flow of water for their generation. The upstream flow may vary depending on weather conditions. Such generators face inherent constraints in the absence of pondage.Therefore, in the proposed DSM Regulation, it has been provided that the deviation charges for over injection by RoR generators shall be zero. Due to the same reasons, a special dispensation has been provided to the RoR generating stations for under injection. RoR generating stations shall pay charges for deviation at the rate of the normal rate of charges of deviation for under injection upto 12% of schedule and for under injection beyond the limit of 12%, at the rate of 110% of the normal charges for deviation applicable during that time block.

3.9 *Municipal solid waste based generators*

3.9.1 As per MNRE, the waste to energy potential in India is in the range of 5700 MW, out of which about 400 MW has been tapped so far. CEA has submitted a detailed report after examining the case of waste to energy from technical perspective and highlighted the variability in calorific value ofwaste and its impact on power generation. CEA has stated that WTE projects operate with a heterogeneous combination of solid waste which are inherently variable and the same cannot be predicted and is like the meteorological parameters of wind/solar generators. It is not possible to predict the composition of city waste being delivered to the WTE projects by the municipal corporation. Though WTE projects operate on the principle of Rankine Cycle technology, they cannot be treated at par with conventional thermal power projects as the

fundamental difference lies in the type of fuel (coal vs. municipal solid waste). Heterogeneity in case of waste is manifested in variation in type of waste, size/ shape of waste, bulk density, moisture content, chloride content, salt content, inert/ sand/ silica content, type of ash etc. Since multiple types of waste are used, heterogeneity increases exponentially and the ability to predict quality of fuel decreases proportionately, let alone the predictability of effects of interaction of different types of fuels during combustion and its impact on boiler and steam generation.

3.9.2 On the issue of operational and technical impact of variability of fuel in waste to energy project, CEA further highlighted that combustion dynamics of mixed waste is not predictable. As heterogeneity increases, ability to predict generation decreases. Waste to energy plants operate in a manner where the steam generation follows the fuel. i.e., turbine does not "demand" steam from boiler but generates only as much steam is being provided by the boiler. This is known as "fuel follow" or "boiler follow" mode. In contrast, conventional power plants operate in "turbine follow" mode where the boiler delivers the steam requirement for turbine to match the schedule. In case of waste to energy plant, which operates in boiler follow mode, the only option is to reduce power generation and keep matching grid power frequency – this results in deviation from schedule. Waste to energy plants are slow responding and cannot deliver the steam as quickly as conventional coal/gas based plants. Therefore, any deviation in generation is difficult to remedy in 15 minute time intervals. If the waste quality varies or is poor, the operating parameters are varied even at the cost of electricity generation to achieve environmental parameters and compliance since primary objective is to ensure processing of waste.In Europe, waste to energy plants are allowed to use auxiliary fuel to maintain requisite environmental controls. This mitigates the variability. The use of auxiliary fuel entails additional cost which needs to be recovered. In India, the use of fossil fuel is disallowed and it amplifies the variability.

3.9.3 Accordingly, CEA has recommended exemption for waste to energy projects from payment of deviation charges within a limit of +/-30%.

3.9.4 Ministry of Power has also recommended a special dispensation for waste to energy projects in so far as deviation charge is concerned. In fact, the waste to energy projects should be seen in context of processing and disposal of waste, and their contribution to social and environmental cause. To encourage such projects, the tariff policy also provides for must off-take of energy from WTE plants.

3.9.5 With due regard to the above considerations, the Commission has extended a completely different treatment to the Municipal Solid Waste (MSW) based projects under the proposed DSM Regulations. The charges for deviation for any over-injection by such generators, as also for under-injection up to 20% from schedule, shall be zero. However, if the under-injection is beyond 20%, the normal rate of charges of

deviation shall be applicable for such under-injection beyond 20%. The regional entity generators are paid based on schedule. This implies that in the event of under injection they will be able to retain the energy charge paid to them without producing actual energy. In order to ensure that this does not become a perverse incentive, the Commission has extended free band of deviation only up to 20% of schedule, as against CEA's recommendation for exemption up to 30%. The intent is to balance the interests of the MWS projects in terms of ensuring recovery of part of the fixed cost (by allowing retention of energy charge up to 20% deviation) while at the same time making sure that system operation is not put to risk due to wide deviation from schedule.

3.10 *Wind and Solar Generators*

3.10.1 The generation from the wind and solar generators is uncertain and variable. Over the period, efforts are being made by such generators to address variability by deploying robust forecasting tools and techniques. However, recognising the inherent uncertainty of these resources and in order to promote generation from these green sources, the existing framework of DSM as under the 2014 DSM Regulations carves out a special dispensation for wind and solar generators. In the proposed DSM Regulations also, special dispensation has been continued but with certain changes. For over injection, they will neither be paid nor will they have to pay any deviation charge. For under injection, they have been exempted from the payment of deviation charge up to 10% deviation unlike the current tolerance band of (+/-) 15%. This is based on the experience gained over the period in terms of improved forecasting and aggregation of scheduling at the pooling station thereby reducing error for individual generators. Under injection beyond the limit of 10% during a time block shall attract charges for deviation at the rate of 10% of the normal charges for deviation applicable during that time block.

3.10.2 It is also important to note that the regional entity wind and solar generators are paid as per their schedule. As such, in order to make such generators revenue neutral, the proposed regulation provides that the solar and wind generators shallpay back to the Deviation and Ancillary Service Pool Account for the total shortfall in energy against its schedule in any time block due to under injection at the contract rate at which it has been paid based on schedule. In the absence of a contract rate, such generators shall pay at the rate of the Area Clearing Price of the Day Ahead Market for the respective time block.

Deviation charges for Buyers

3.11 As in the case of generators, the Commission expects the buyers to also adhere to their schedule. Under the existing system of the 2014 DSM Regulations, the buyers are paid for under drawal (which is

also a deviation) on the belief that such an action (under drawal) helps restore grid frequency within the operating band. As stated earlier, the responsibility of managing frequency would henceforth primarily lie with the system operator in terms of the new draft Ancillary Services Regulations, and the buyers can continue to play the same role (of helping restore frequency) but at the instruction of the system operator by participating in the Ancillary Services mechanism, rather than acting on their own driven by the price signals linked to frequency. As such, the proposed regulations provide that the buyers will neither pay nor be paid for any under drawal.

3.12 Over drawal has to be discouraged under all circumstances, as this could pose serious threat to grid security. In case of over drawal by the buyers, the system operator will have to deploy the services of Ancillary Service providers. The deployment of AS will impose cost on the system and the causer needs to pay for this. As such, the buyers will have to pay for over drawal. However, recognising the fact that unlike the generators, the distribution companies have less control over the consumption of the consumers, the volume limit for deviation charges in the proposed DSM Regulations has been retained as it existed in the 2014 DSM Regulations.

3.13 Thus, when the over drawal is within the volume limit, as indicated below, buyers shall be liable to pay for deviation at the normal rate of charges for deviation:

1) 12% of schedule or 150 MW whichever is less in case of the buyer other than the buyer with schedule less than 400 MW and the RE rich State;
2) 12% of schedule in case of the buyer with schedule up to 400 MW; or
3) 12% of schedule or 250 MW whichever is less in case of the buyer being an RE Rich State.

Any deviation beyond the above indicated volume limit shall attract the charges for deviation at the rate of 110% of normal rate of charges for deviation.

Deviation charges for infirm power, start up power and inter-regional deviation and cross-border transactions

3.13 Infirm power is akin to over injection. Accordingly, the proposed regulations provide that the charges for deviation for injection of infirm power shall be zero. Start up power is akin to over-drawal and can be avoided by entering into contracts which can be scheduled. As such, the proposed DSM Regulations provide that the charges for deviation for drawal of start-up power before COD of a generating unitor for drawal of power to run the auxiliaries during shut-down of a generating stationshall be payable at the normal rate of charges for deviation.The charges for inter-regional deviation and for

deviation in respect of cross-bordertransactions, caused by way of over-drawal or under-injection, shall be payable at thenormal rate of charges for deviation.

Accounting of Deviation and Ancillary Service Pool Account

3.14 The proposed regulations provide that there shall be a Deviation and Ancillary Service Pool Account which shall be maintained and operated by the concerned RLDC. The Deviation and Ancillary Service Pool Account shall receive credit for:

a. payments on account of charges for deviation referred to in Regulation 8 of these regulations:
b. payments made by:
    i. SRAS Provider for the SRAS-Down despatched under the Ancillary Services Regulations; and
    ii. TRAS Provider for the TRAS-Down despatched under the Ancillary Services Regulations.

Further the Deviation and Ancillary Service Pool Account shall be charged for:

a. the full cost of despatched SRAS-Up including the variable charge or the energy charge or the compensation charge, as the case may be, for every time block on a regional basis as well as the incentive for SRAS, payable to the concerned SRAS Provider as referred in the Ancillary Services Regulations;
b. the full cost towards TRAS-Up including the charges for the quantum cleared and despatched and the commitment charge for the quantum cleared but not despatched as referred in the Ancillary Services Regulations.

4. Power to Relax and Power to Remove Difficulty:

4.1 The proposed DSM Regulations provide for powers to relax and to remove difficulty to take care of unforeseen eventualities and to remove difficulty if any in implementation of the regulations.

5. Repeal and Savings:

5.1 With the commencement of the proposed DSM Regulations, 2014 DSM Regulations shall stand repealed. However, anything done or any action taken or purported to have been done or taken including any procedure, minutes, reports, confirmation or declaration of any instrument executed under the repealed regulations have been saved.

5.2 On commencement of these regulations, the Regional Deviation Pool Account Fund constituted under the repealed regulations shall be renamed as the Deviation and Ancillary Service Pool Account constituted under these regulations.