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## KARNATAKA POWER TRANSMISSION CORPORATION LIMITED

Corporate Identity Number (CIN):U40109KA1999SGC025521

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Date : 07-06-2024

✓ **The Secretary,  
Central Electricity Regulatory Commission (CERC),  
3<sup>rd</sup> and 4<sup>th</sup> Floor, Chanderlok Building,  
36, Janpath,  
New Delhi - 110001**

Sir,

**Sub:** Draft Central Electricity Regulatory Commission (Deviation Settlement Mechanism and Related Matters) Regulations, 2024- Regarding

**Ref:** CERC Public Notice No: L-1/260/2021/CERC Dated: 30.04.2024

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Central Electricity Regulatory Commission (CERC) vide Public Notice Dated :30.04.2024 cited under reference has sought comments /suggestions /objections on the Draft Central Electricity Regulatory Commission (Deviation Settlement Mechanism and Related Matters) Regulations, 2024.

In this regard, I am directed to enclose herewith the comments/suggestions of KPTCL/SLDC on the Draft Central Electricity Regulatory Commission (Deviation Settlement Mechanism and Related Matters) Regulations, 2024 (**Annexure-A**) with a request to kindly place the same before the Hon'ble Commission for incorporating the suggestions made by KPTCL/SLDC.

" Approved by  
the Managing Director, KPTCL."

Yours faithfully,

  
**Financial Advisor  
Regulatory Affairs**

**SLDC/ KPTCL Submissions on the Draft Central Electricity Regulatory Commission (Deviation Settlement Mechanism and Related Matters) Regulations, 2024.**

**Preamble:**

- 1) The Hon'ble Commission has been issuing Regulations, Amendments and Orders on Deviation Settlement Mechanisms (DSM) to create resilient, stable, safe and reliable power system in the Country. The desired mission is yet to be accomplished in toto. In the last 10 years span, the Commission has amended the DSM Regulation more than 10 times by its Suo-Moto Orders, Amendments and Regulations. Some of the actions are being challenged by the beneficiaries and the cases are still pending in various Courts. These have financial implications on the beneficiaries.

The list of court cases on DSM Regulation pending in various forums is enclosed as **Annexure-1**.

- 2) The National grid being one of the largest inter-connected grid, the regulations in place should be robust to achieve the prime objectives to provide quality, reliable power supply to end consumers without any deviations by any beneficiaries. The uncertainty in the prevailing DSM regulations time and again has eluded the confidence in the beneficiaries.
- 3) Even after numerous revisions the DSM regulations is yet to meet the necessary goal since it has not considered the necessary actions at the required points.
- 4) In order to bring in discipline across all conventional and non-conventional resources, the Commission have to re-consider the notion of WS seller being not matured enough in providing accurate forecast for despatching RE sources by the SLDC. It is brought to the Hon'ble Commission's attention that WS sellers are still treated as immature products in terms of forecasting, despite the fact that they have already exceeded 50% of total installed capacity in many states and more than 35% of national installed capacity. The responsibility is to be enforced on WS sellers to achieve the objectives of the Commission and bring in discipline for establishing a resilient grid.

Even with advanced technology available in the global market, WS sellers are unwilling to invest in technologies to increase prediction in accuracy due to privileges endorsed by the Commission to WS sellers, at the behest of the end consumers. It is humbly requested that the commission has to allow them to comprehend their position for development in the larger interest of the nation.

- 5) It is herewith submitted, that all the previous DSM regulations released by the commission has minimal impact on the WS entities who actually create indiscipline in an inter-connected network by providing inaccurate forecasting & schedule, while on the other side, penalizing conventional sources and beneficiaries through DSM charges who are willing to be disciplined.

The Commission has to address the underlying issues of the DSM, the Commission is aware that WS sellers lack discipline in providing accuracy in their schedule under the provisions made in the DSM regulation by CERC. The provision of **Available Capacity (AVC) is to be removed to obtain desire objective.**

In the above context, we would like to put forth an analogy of unit measurement of distance, the measurement of unit remains constant, but relaxation can be based on many factors such as men, women, children, and physically challenged etc,. Every user in the nation will always be measured using the same standard.

**Rationale:** Running 100, 200, or 300 meters is all about the game, but the measuring unit by meters remains the same; 100 feet does not equal 100 meters, and the distance can be adjusted based on the ability of the runners (men, women, children, and physically challenged). In this case, changing the measuring unit meter for the same sports makes it impossible to assess their capabilities and areas for improvement.

The same analogy is being interpreted for the WS vendor, their inconsistency is being measured incorrectly against the fair rule of measurement using the word AVC. The commission has the authority to grant WS sellers a relaxation with deviations of up to 25% using a fair measuring unit viz., source, location, and seasonal variations. It will indicate exactly where the WS seller stands in terms of forecasting accuracy. Further, they may be incentivized to improve forecasts, and the path forward can be initiated by the state and federal governments. Otherwise, the system operator will never stop complaining about the genuine problem of RE with commission and inhibiting the country's expanding RE generation due to the lack of accurate unit measurement, even if the product is beneficial to the country.

Due to this kind of measurement, WS is not comprehending to target required accuracy level which is leading to unstable grid operation even with so many DSM regulations issued by the commission.

- 6) More importantly, it is to inform the Hon'ble commission that, as long as the central commission continues to use the AVC technique for WS sellers, the SERC will not adopt a fair measuring unit, even if they wish so.

The difficulties faced due to unscientific DSM regulations/ orders were raised in highest forum viz., southern regional council meetings and same was communicated to MoP, GoI through letters and Karnataka State was also part of DSM-2022 issues related committee constituted by MoP, GoI. The difficulties faced and prayer for RE rich state is mentioned in the report. The same is enclosed as **Annexure-2**.

The Hon'ble Commission is humbly requested to adopt a fair measurement rules to WS sellers as it does to the rest of the country's products.

- 7) As demonstrated by the implementation of DSM regulation 2022, the States are also playing a crucial role in maintaining the system frequency within the operating range. After learning that the States had not been contributing to frequency correction, which had resulted in low frequency in the Indian grid, the commission made the course corrective action by issuing a Suo-Moto Order: 01/SM/2023. Order date: February 6, 2023. The frequency improvement is shown as follows:

Duration	Total instances for 8 days	No of Instances FREQ > 50.05 Hz	No of Instances FREQ < 49.90 Hz	No of Instances Frequency touched below 49.7Hz	No of instances crossed above 50.2Hz
<b>Before Implementing New DSM-2022 (27-11-2022 to 04-12-2022)</b>	69128	10802	7006	60	53
		15.6%	10.1%	0.1%	0.1%
<b>After Implementing New DSM-2022 (05-12-2022 to 12-12-2022)</b>	69128	23003	8676	654	2493
		33.3%	12.6%	0.9%	3.6%
<b>After Sou motu: 01/SM/2023 order for New DSM-2022 (08-02-2023 to 15-02-2023)</b>	69128	18470	6685	388	1347
		26.7%	9.7%	0.6%	1.9%

**Note:**

- a. PMU 10 sec data is considered for above calculation
- b. 10 sec equal to One instance

From the above table, its clearly indicates that States actively participated in improve the frequency profile due to commission suo-moto intervention by way of incentivisation.



- 8) The extract of KERC feedback for *REPORT OF THE CERC EXPERT COMMITTEE ON ANALYZING THE CAUSES OF INADEQUATE PRIMARY AND SECONDARY RESPONSE WITHRESPECT TO IMPLEMENTATION OF DSM REGULATIONS* January 2024;

#### **"4.5 Feedback on DSM for RE-Rich States**

KERC noted that 51% of Karnataka's installed capacity is RE, with more additions expected in the following years. ISTS schedules during high RE generation and low state demand vary significantly. The schedule goes below the normal Inter-State schedule due to surplus trading of power outside the State through exchange.

Given the above challenges and deviations, KERC recommended the following solutions till the emergence of techno-commercial viable options:

1. Replacing volume limits based on solar + wind installed capacity for RE-rich and Super RE-rich states.
2. Replacing Available Capacity (AvC) with scheduled generation for calculating deviation.
3. Excluding STOA transactions while calculating deviations.

KERC recommended the following volume limits shown in Table 1 below:

<b>Sl. No</b>	<b>Combined Solar + wind IC (MWs)</b>	<b>Volume limit (MWs)</b>
1	Up to 5,000	200
2	> 5,000 up to 10,000	300
3	> 10,000	500

Table 1: KERC's Suggestion for Volume Limits of RE-Rich States

The Committee noted KERC's feedback and felt that replacement of AvC by scheduled generation might yield unrealistic deviation errors ranging from zero to infinity even with a small difference between schedule and actual generation. Given the uncertainty of solar and wind resources this might cause undue hardship and commercial impact for such generators. However, endeavor should be made to improve forecasting and make wind and solar dispatchable in future, especially by using energy storage systems. CERC should draw a road map for this and gradually move towards error definition for wind and solar to be at par with other generators."

The Committee concluded that replacement of AvC will lead to commercial burdens to RE generators, it is to bring to kind notice of Hon'ble central commission that TNERC brought out the regulation that "Tamil Nadu Electricity Regulatory Commission (Forecasting, Scheduling and Deviation Settlement and Related Matters for Wind and Solar Generation) Regulations, 2024". In which, they have addressed the infinite error during zero Scheduling and deviation formula as follows:

**(a) "Absolute Error"** means the difference between the actual generation injected and the scheduled generation of Wind or Solar Energy Generators in relation to their scheduled generation in each time block, and may be computed in percentage terms by applying the following formula:

$$\text{Absolute Error (\%)} = 100 \times [\text{Actual Generation} - \text{Scheduled Generation}] / \text{Scheduled Generation}$$

**Where, scheduled generation ≠ 0**

TNERC addressed the issues of undue hardship and commercial impact for RE generators for replacing AvC by Scheduled Generation by keeping the rider that "The total deviation charges remitted on account of deviations by wind / solar generator(s) into State Deviation Pool Account (wind and solar) in a financial year shall be capped at the Ceiling Rate of 3 paise per unit multiplied by the total annual generation at the respective Pooling sub-station(s)/total generated units in statewide aggregation. Any excess amount of deviation charges remitted beyond the capped amount as per deviation account statement over the financial year shall be adjusted in the subsequent billing without interest."

**In light of the above brief description on DSM regulation journey, the following prayer is humbly submitted to Hon'ble commission for consideration to establish a stable, reliable and resilient grid in the Country.**

- A. The definition of RE States is classified as:
  - (i) **RE-rich State**-1000 to 5000MW - deviation limit allowed: 200MW.
  - (ii) **RE Super-rich State**-5000 to 10000MW - deviation limit allowed: 250 MW subjected to frequency condition
  - (iii) **RE Ultra rich state**-10000MW and above- deviation limit allowed: 500MW subject to frequency conditions. (Additional definition)

- 2.5
- B. The deviation limit of **+/-500MW may be fixed** (Special consideration for RE ultra-Rich States with more than 10000 MW)
- C. The RE generation may be included in merit order dispatch after exhausting backdown of the conventional resources i.e., Must Run status of RE generators to be relaxed to honor the DSM regulation **or regulation to implement a minimum of 10% storage of their installed capacity to mitigate the uncertainties in RE generation.**
- D. Similar to General Seller when the system frequency is below the 49.90 Hz, irrespective of volume limit the buyer shall be paid from the Deviation and Ancillary Service Pool Account @ 150% of Normal rate for deviation by way over injection in such time block in the interest of system frequency improvement.
- E. Draft DSM Regulations 2024 clause 6 (2) needs to be modified as:
- Deviation-WS seller (in %) =  $100 \times \frac{[(\text{Actual Injection in MWh}) - (\text{Scheduled generation in MWh})]}{[(\text{Scheduled generation in MWh})]}$  to maintain healthiness/resilience of the power sector operation.

**The Clause wise submission are as follows:**

**1. As Proposed by CERC**

**3. Definitions and Interpretation**

(1) In these regulations, unless the context otherwise requires,-

(v) '**Renewable Rich State**' or '**RE-rich State**' means a State whose combined installed capacity of solar and wind generating stations under the control area of the State is 1000 MW or more but less than 5000 MW;

(w) '**Renewable Super Rich State**' or '**RE Super-rich State**' means a State whose combined installed capacity of solar and wind generating stations under the control area of the State is 5000 MW or more;

**Response by SLDC/ KPTCL**

Our submission is to have three categories for Renewable Energy State. Hence, additional definition of **Renewable Energy Ultra Rich State** definition may be added as mentioned below;

**RE Ultra Rich State:** means a State whose combined installed capacity of solar and wind generating stations under the control area of the State is 10000 MW or more;

## 2. As Proposed by CERC:

### 6. **Computation of Deviation:**

(2) Deviation in a time block for WS sellers shall be computed as follows:

Deviation-WS seller (DWS) (in MWh) = [(Actual Injection in MWh) – (Scheduled generation in MWh)]. Deviation-WS seller (DWS) (in %) =  $100 \times \frac{[(Actual\ Injection\ in\ MWh) - (Scheduled\ generation\ in\ MWh)]}{[(Available\ Capacity)]}$ .

### Response by SLDC/ KPTCL

In order to have an improved accuracy in forecast by WS generators, for a stable grid operation, it is essential to reduce the deviation criteria gradually in phased manner by replacing available capacity by scheduled generation, The nation is aiming to achieve 500 GW of renewable energy installed capacity by 2030. It will be extremely difficult to streamline the accuracy in forecast at this level of 500GW of RE. Considering the situation explained in preamble, the specifics regarding forecast errors for wind and solar energy are outlined in **Annexure-3 and its Appendix-1.**

In this regard, SLDC/KPTCL suggests the following modification to the clause 6 (2) of the draft regulations as under:

Deviation-WS seller (in %) =  $100 \times \frac{[(Actual\ Injection\ in\ MWh) - (Scheduled\ generation\ in\ MWh)]}{[(Scheduled\ generation\ in\ MWh)]}$  to maintain healthiness of the power sector operation.

## 3. As Proposed by CERC:

### 7. **Normal Rate of Charges for Deviations:**

#### Response by SLDC/ KPTCL:

**Rationale:** In petition 04/SM/2023 (para 6), Hon'ble commission in public interest, directs all the Power Exchanges to re-design their bidding software for the period from 04.04.2023 until further orders, in such a way that the members can quote the price in the range of (a) Rs.0/kWh to Rs.10/kWh for all contracts, viz., DAM(including GDAM), RTM, Intra-day, Day Ahead Contingency and Term-Ahead (including GTAM); and (b) Rs.0/kWh to Rs.20/kWh in the HP-DAM segment.

This in our view would reduce the cost of power for the buyers, while providing an opportunity to the high cost generators and the willing buyers to participate in the HP-DAM market.

In Normal rate of charge, there is need to provide cap. Hence, the third following proviso shall be added in the clause 7 (1) of these draft regulations:

**"Provided that the normal rate is subject to a ceiling of 10 Rs per kWh".**

Further, NLDC/RLDCs shall be mandated to link rates of each time of DSM for economical grid operation and visible to the system operator. In absence of DSM rates, the system operators will be in a dilemma to take decision. This proviso was requested by RPCs to the Hon'ble commission in Suo Motu Petition No. 01/SM/2023 Date of Order: 06th February, 2023 Para 11 is as follows:

"11. .... It was suggested that indicative DSM rates may be made available ex-ante by the system operator to enable the States to take judicious actions to support frequency. ...."

In this regard, based on the above explanation SLDC/KPTCL suggests an additional clause to be added as Clause 7 (3) of the draft regulations as mentioned under:

**Clause 7(3)** :NLDC/RLDCs shall link Normal rate for a particular block in real time SCADA by considering clause (1) of this regulation.

**4. As Proposed by CERC:**

**8. Charges for Deviation**

*(4) Charges for Deviation, in respect of a WS Seller being a generating station based on wind or solar or hybrid of wind-solar resources, including such generating stations aggregated at a pooling station through QCA shall be without any linkage to grid frequency, as under:*

<b><i>Deviation by way of over injection (Receivable by the Seller)</i></b>	<b><i>Deviation by way of under injection (Payable by the Seller)</i></b>
<i>(i) for VLW<sub>S</sub> (1) @ contract rate;            (ii) for VLW<sub>S</sub> (2) @ 90% of contract rate            (iii) for VLW<sub>S</sub> (3) @ 50% of contract rate,            (iv) beyond VLW<sub>S</sub> (3) @ Zero;</i>	<i>v) for VLW<sub>S</sub> (1) @ contract rate;            (vi) for VLW<sub>S</sub> (2) @ 110% of contract rate;            (vii) for VL<sub>S3</sub> @ 150% of contract rate;            (viii) beyond VLW<sub>S</sub> (3) @ 200% of contract rate.</i>



**Note: Volume Limits for WS Seller :**

<b>WS Seller</b>	<b>Volume Limit</b>
<i>A generating station based on solar or a hybrid of wind –solar resources or aggregation at a pooling station</i>	$VL_{WS} (1) = \text{Deviation up to } 5\% D_{WS}$ $VL_{WS} (2) = \text{Deviation beyond } 5\% D_{WS} \text{ and up to } 10\% D_{WS}$ $VL_{WS} (3) = \text{Deviation beyond } 10\% D_{WS} \text{ and up to } 20\% D_{WS}$
<i>A generating station based on wind resource</i>	$VL_{WS} (1) = \text{Deviation up to } 10\% D_{WS}$ $VL_{WS} (2) = \text{Deviation beyond } 10\% D_{WS} \text{ and up to } 15\% D_{WS}$ $VL_{WS} (3) = \text{Deviation beyond } 15\% D_{WS} \text{ and up to } 25\% D_{WS}$

*Note: In case of aggregation of WS sellers at a pooling station through QCA,*

- (a) the contract rate for the purpose of deviation shall be equal to the weighted average of the contract rates of all individual WS seller(s) opting for aggregation at the pooling station;*
- (b) Available Capacity shall be equal to the cumulative capacity rating of wind turbines or solar inverters that are capable of generating power in a given time block;*

**Response by SLDC/ KPTCL**

As stated in the **Preamble**, in order to effectively apply the DSM for better accuracy in forecast and to build a resilient, stable grid, the Hon’ble commission is requested to modify as stated below for enabling fair play to all the generators and have an equitable measuring formula to achieve the larger objective of the country.

In this regard, based on the above explanation SLDC/KPTCL suggests the following modification to the clause 8 (4) as under:

8(4): Charges for Deviation, in respect of **a WS Seller being a generating station based on wind or solar or hybrid of wind-solar resources**, including such generating stations aggregated at a pooling station through QCA shall be without any linkage to grid frequency, as under:

<b>Deviation by way of over injection (Receivable by the Seller)</b>	<b>Deviation by way of under injection (Payable by the Seller)</b>
i. for VLW <sub>S</sub> (1) @ contract rate; ii. for VLW <sub>S</sub> (2) @ 90% of contract rate iii. for VLW <sub>S</sub> (3) @ 50% of contract rate, iv. beyond VLW <sub>S</sub> (3) @ Zero;	(v) for VLW <sub>S</sub> (1) @ contract rate; (vi) for VLW <sub>S</sub> (2) @ 110% of contract rate; (vii) for VL <sub>S3</sub> @ 150% of contract rate; (viii) beyond VLW <sub>S</sub> (3) @ 200% of contract rate.

Note: Volume Limits for WS Seller :

<b>WS Seller</b>	<b>Volume Limit</b>
A generating station based on solar or a hybrid of wind –solar resources or aggregation at a pooling station	VLW <sub>S</sub> (1) = Deviation up to 15% D <sub>WS</sub> <b>or 200 MW, whichever is less</b> VLW <sub>S</sub> (2) = Deviation beyond 15% D <sub>WS</sub> <b>or 200 MW, whichever is less</b> and up to 20% D <sub>WS</sub> <b>or 250 MW, whichever is less</b> VLW <sub>S</sub> (3) = Deviation beyond 20% D <sub>WS</sub> <b>or 250 MW, whichever is less</b> and up to 25% D <sub>WS</sub> <b>or 350 MW, whichever is less</b>
A generating station based on wind resource	VLW <sub>S</sub> (1) = Deviation up to 20% D <sub>WS</sub> <b>or 250 MW, whichever is less</b> VLW <sub>S</sub> (2) = Deviation beyond 20% D <sub>WS</sub> <b>or 250 MW, whichever is less</b> and up to 25% D <sub>WS</sub> <b>or 350 MW, whichever is less</b> VLW <sub>S</sub> (3) = Deviation beyond 25% D <sub>WS</sub> <b>or 350 MW, whichever is less</b> and up to 30% D <sub>WS</sub> <b>or 400 MW, whichever is less</b>

Note: In case of aggregation of WS sellers at a pooling station through QCA,

- c. the contract rate for the purpose of deviation shall be equal to the weighted average of the contract rates of all individual WS

- seller(s) opting for aggregation at the pooling station;
- d. Scheduled generation shall be equal to the cumulative capacity rating of wind turbines or solar inverters that are capable of generating power in a given time block by considering actual forecast of wind or solar;
- e. Depooling of deviation charges for WS seller(s) connected to the pooling station shall be as per the methodology mutually agreed upon between the QCA and such individual WS seller(s).

### **5.. As Proposed by CERC:**

### **8. Charges for Deviation**

(7) Charges for Deviation, in respect of a Buyer, shall be receivable or payable as under:

<b>Deviation by way of under drawal (Receivable by the Buyer)</b>	<b>Deviation by way of over drawal (Payable by the Buyer)</b>
<b>(I) For <math>VL_B</math></b>	<b>(1) and <math>f</math> within <math>f_{band}</math></b>
i) @ 85% of NR when $f = 50.00$ Hz;	iv) @ NR when $f = 50.00$ Hz;
ii) When $50.00 \text{ Hz} < f \leq 50.05 \text{ Hz}$ , for every increase in $f$ by 0.01 Hz, charges for deviation for such buyer shall be decreased by 7% of NR so that charges for deviation become 50% of NR when $f = 50.05\text{Hz}$ ;	v) When $50.00 < f \leq 50.05 \text{ Hz}$ , for every increase in $f$ by 0.01 Hz, charges for deviation for such buyer shall be reduced by 5% of NR so that charges for deviation become 75% of NR when $f = 50.05\text{Hz}$ ;
iii) When $49.90 \leq f < 50.00 \text{ Hz}$ , for every decrease in $f$ by 0.01 Hz, charges for deviation for such buyer shall be increased by 1 % of NR so that charges for deviation become 95% of NR when $f = 49.90\text{Hz}$ ;	vi) When $49.90 \leq f < 50.00 \text{ Hz}$ , for every decrease in $f$ by 0.01 Hz, charges for deviation for such buyer shall be increased by 5% of NR so that charges for deviation become 150% of NR when $f = 49.90\text{Hz}$ .
<b>(II) For <math>VL_B</math></b>	<b>(1) and <math>f</math> outside <math>f_{band}</math></b>
(i) @ zero when $[ 50.05 \text{ Hz} < f < 50.10\text{Hz}]$ : Provided that such buyer shall pay @ 10% of NR when $[ f \geq 50.10 \text{ Hz}]$ ;	(iii) @ 50% of NR when $[ 50.05 \text{ Hz} < f < 50.10 \text{ Hz}]$ : (iv) @ zero when $[f \geq 50.10 \text{ Hz}]$ ;

(ii) @ 95% of NR when [ $f < 49.90$ Hz];	(v) @ 150 % of NR when [ $f < 49.90$ Hz].
<b>(III) For VL<sub>B</sub> (2) and <math>f</math> within and outside <math>f_{band}</math></b>	
(i) @ 80% of NR when $f \leq 50.00$ Hz; (ii)@ 50% NR when [ $50.00$ Hz $< f \leq 50.05$ Hz]; @ zero when [ $50.05$ Hz $< f < 50.10$ Hz]: Provided that such buyer shall pay @ 10% of NR when [ $f \geq 50.10$ Hz];	(iii) @ 150% of NR when $f \leq 50.00$ Hz; (iv) @ NR when [ $50.00$ Hz $\leq f \leq 50.05$ Hz]; @ 75% NR when [ $50.05$ Hz $< f < 50.10$ Hz]; @ zero when [ $f \geq 50.10$ Hz].
<b>(IV) For VL<sub>B</sub> (3) and <math>f</math> within and outside <math>f_{band}</math></b>	
(i) @ zero when $f < 50.10$ Hz: Provided such buyer shall pay @ 10% of NR when [ $f \geq 50.10$ Hz];	(ii) @ 200% of NR when $f < 50.00$ Hz; (iii) @ 110% of NR when [ $f \geq 50.00$ Hz].

Note: Volume Limits for Buyer :

Buyer	Volume limit
Buyer <u>other than</u> (the buyer with a schedule less than 400 MW and the RE-rich State)	VL <sub>B</sub> (1) = Deviation up to [10% D <sub>BUY</sub> or 100 MW, whichever is less] VL <sub>B</sub> (2) = Deviation [ beyond 10% D <sub>BUY</sub> or 100 MW, <i>whichever is lower</i> ] and up to [15% D <sub>BUY</sub> or 200 MW, <i>whichever is lower</i> ] VL <sub>B</sub> (3) = Deviation beyond [15% D <sub>BUY</sub> or 200 MW, whichever is less]
Buyer (with a schedule up to 400 MW)	VLB (1) = Deviation [20% DBUY or 40 MW, whichever is less] VLB (2) = Deviation beyond [20% DBUY or 80 MW, whichever is less]
Buyer (being an RE Rich State)	VLB (1) = Deviation up to 200 MW VLB (2) = Deviation beyond 200 MW and up to 300 MW VLB (3) = Deviation beyond 300 MW
Buyer (being Super RE Rich State)	VLB (1) = Deviation up to 250 MW VLB (2) = Deviation beyond 250 MW and up to 350 MW VLB (3)= Deviation beyond 350 MW

### **Response by KPTCL**

Whenever buyer is **under drawal** State, by increasing the hot and warm reserves like hydro, gas and BESS to improve the system

frequency, buyer has to bear the system losses like transmission and distribution losses. In such case the buyer is further discouraging by paying only 85% of normal rate for way of under drawal, buyer will not show any interest to contribution to improve the system frequency, when the Normal rates lesser than actual cost buyer as anticipated.

The Hon'ble commission in suo motu Petition No. 01/SM/2023 Date of Order: 06th February, 2023 took decision based on RPCs request (para 11) and commission decision (para 27). The same is mentioned for kind consideration.

*"11. It was also suggested during the interaction with the RPCs that till the adequate reserves are made available with the system operator, appropriate incentive may **be required for passive support from States to support the grid with available resources in their hand.***  
....."

Accordingly, Hon'ble commission in para 27. Relaxation of Regulation 8 of the DSM Regulations, 2022: has introduced the provision that : (c) The buyer shall be paid back for deviation by way of under drawal  
**(i) @ 120% of normal rate of charge for deviation when [49.90 < f < 49.95]; and**  
**(ii) @ 150% of normal rate of charge for deviation when [f ≤ 49.90];**

In the light of above and past experiences in situations, States are having potential in their resources to improve the system frequency, rather than individual generators. Individual Generator's will always show interest & obligation to meet its scheduled generation and may not take risk, thinking that the average block frequency may settle lesser than the reference rate. However, in case of States, States are more obligated to maintain the system frequency within the operating range and States will take risk to improve the system, if the commission incentivised with reasonable rates. **Hence the Hon'ble commission should encourage the States to give passive support to the grid with available resources in their hand.**

Hence, whenever buyer is **under drawal**, the Hon'ble commission is requested to fix 100% of Normal Rate when the system frequency  $f=50\text{hz}$  and When  $49.90 \leq f < 50.00 \text{ Hz}$ , for every decrease in  $f$  by 0.01 Hz, charges for deviation for such buyer shall be increased by 1 % of NR so that charges for deviation become 115% of NR when  $f = 49.90\text{Hz}$ ; Further, @ 150% of normal rate of charge for deviation when  $[f \leq 49.90]$ ;



Particularly, As per clause 7, Charges for Deviation, in respect of a Buyer, buyer shall pay @ 10% of NR for under drawing when frequency is  $\geq 50.10\text{Hz}$ .

**Submission:** Karnataka being a RE rich State would like to strongly urge the commission to modify the above section as Charges for Deviation, in respect of a Buyer, shall be zero for underdrawing when frequency is  $\geq 50.10\text{Hz}$ .

**Rationale :** With the must run status of RE generators, it is extremely difficult for the states to control the under drawal during high RE periods. Even if we go for distress sale with the market mechanism, the power may not get cleared in some time blocks. In such situations State are forced to under drawal at zero cost. With added penalty when frequency is  $\geq 50.10\text{ Hz}$  , this will be a huge burden on the DISCOMs and will seem like a penalty for adopting the Govt. of India initiative of leaning towards to more RE energy than the conventional energy.

**Hence it is requested to make payable for under drawing as nil, when the frequency is  $\geq 50.10\text{Hz}$ .**

The Hon'ble commission Petition No. 18 /SM/2023 (para 10) connected to IEGC-2023 has taken out the flexibility by stating that *"Keeping in view the difficulties expressed by the Grid-India with respect to SCUC and generating stations, we are of the considered view that while the beneficiaries/buyers shall have full flexibility to decide on their requisition from a generating station up to 1430 hrs on 'D-1' day, (their right to revision of schedules in the said generating station for 'D' Day shall be subject to the condition that such revision of schedule for 'D' Day shall not be below their respective share of minimum turndown level in the respective generating station. This shall enable a realistic SCUC exercise and help ensure adequacy of reserves in the system, while at the same time enabling the beneficiaries/buyers to undertake advance planning and optimal portfolio management of their power purchases."*

To add to the above point, in the existing IEGC with suo moto order 18 /SM/2023 there is no provision for the state to provide zero schedule to generators in intraday revisions. This will further add burden on the States to absorb those generation along with the must run RE generation. Hence if there is penalty for underdrawing when frequency is  $\geq 50.10\text{Hz}$ , this will be a double penalty for the States considering we are already under drawing the high cost power at zero cost.

The commission further obligating that Buyer use to under drawal Further (i) @ zero when [  $50.05\text{ Hz} < f < 50.10\text{ Hz}$ ]: Provided that such buyer shall pay @ 10% of NR when [  $f \geq 50.10\text{ Hz}$ ];

**Or**

To honor the this, Commission must allow to curtailment of Must Run RE generation or else its highly impossible to honor for Renewable Energy Super and Ultra States as difficulties expressed in **details in preamble.**

Based on the above explanations, SLDC/ KPTCL suggest the following modification to the Regulation 8(7) of the draft regulations as under:

(7) Charges for Deviation, in respect of a Buyer, shall be receivable or payable as under:

<b>Deviation by way of under drawal Receivable by the Buyer)</b>	<b>Deviation by way of over drawal (Payable by the Buyer)</b>
(I) <b>For</b> <b>VL<sub>B</sub></b>	<b>(1) and <math>f</math> <math>f</math> band within</b>
<b>i) @ NR <math>f = 50.00</math> Hz;</b> <b>when</b>	iv) ..... ;
ii) When $50.00 \text{ Hz} < f \leq 50.05 \text{ Hz}$ , for every increase in $f$ by 0.01 Hz, charges for deviation for such buyer shall be decreased by <b>10% of NR</b> so that charges for deviation become 50% of NR when $f = 50.05 \text{ Hz}$ ;	v) .....
iii) When $49.90 \leq f < 50.00 \text{ Hz}$ , for every decrease in $f$ by 0.01 Hz, charges for deviation for such buyer shall be increased by 1 % of NR so that charges for deviation become <b>115% of NR</b> when $f = 49.90 \text{ Hz}$ ;	vi) When $49.90 \leq f < 50.00 \text{ Hz}$ , for every decrease in $f$ by 0.01 Hz, charges for deviation for such buyer shall be increased by <b>3% of NR</b> so that charges for deviation become <b>130% of NR</b> when $f = 49.90 \text{ Hz}$ .
(II) <b>For VL<sub>B</sub> (1) and <math>f</math> outside <math>f</math> band</b>	
(i) @ zero when [ $50.05 \text{ Hz} < f < 50.10 \text{ Hz}$ ]: Provided that such buyer shall pay @ 10% of NR when [ $f \geq 50.10 \text{ Hz}$ ]; <b>Provided that Buyer (being Super RE Rich State) and Buyer (being Ultra RE Rich State) shall not pay NR when [ <math>f \geq 50.10</math></b>	(iii) .....

Hz];	
(ii) @ <b>150%</b> of NR when [ $f < 49.90$ Hz];	(v) .....
(III) <b>For VL<sub>B</sub> (2) and <math>f</math> within and outside <math>f</math> band</b>	
(i) @ 80% of NR when $f \leq 50.00$ Hz; (ii) @ 50% NR when [ $50.00$ Hz $< f \leq 50.05$ Hz]; @ zero when [ $50.05$ Hz $< f < 50.10$ Hz]; Provided that such buyer shall pay @ 10% of NR when [ $f \geq 50.10$ Hz]; <b>Provided that Buyer (being Super RE Rich State) and Buyer (being Ultra RE Rich State) shall not pay NR when [<math>f \geq 50.10</math> Hz];</b>	(iii) @ <b>130% of NR when <math>f \leq 50.00</math> Hz;</b> (iv) @ NR when [ $50.00$ Hz $\leq f \leq 50.05$ Hz]; @ 75% NR when [ $50.05$ Hz $< f < 50.10$ Hz]; @ zero when [ $f \geq 50.10$ Hz].
(IV) <b>For VL<sub>B</sub> (3) and <math>f</math> within and outside <math>f</math> band</b>	
(i) @ zero when $f < 50.10$ Hz; Provided such buyer shall pay @ 10% of NR when [ $f \geq 50.10$ Hz]; <b>Provided that Buyer (being Super RE Rich State) and Buyer (being Ultra RE Rich State) shall not pay NR when [<math>f \geq 50.10</math> Hz];</b>	(iv) .....; (v) .....

Note: Volume Limits for Buyer:

Buyer	Volume limit
Buyer <u>other than</u> (the buyer with a schedule less than 400 MW and the RE-rich State)	VL <sub>B</sub> (1) = Deviation up to [10% D <sub>BUY</sub> or 100 MW, whichever is less] VL <sub>B</sub> (2) = Deviation [ beyond 10% D <sub>BUY</sub> or 100 MW, <i>whichever is lower</i> ] and up to [15% D <sub>BUY</sub> or 200 MW, <i>whichever is lower</i> ] VL <sub>B</sub> (3) = Deviation beyond [15% D <sub>BUY</sub> or 200 MW, whichever is less]
Buyer (with a schedule up to 400 MW)	VLB (1) = Deviation [20% DBUY or 40 MW, whichever is less] VLB (2) = Deviation beyond [20% DBUY or 80 MW, whichever is less]
Buyer (being an	VLB (1) = Deviation up to 200 MW

RE Rich State)	VLB (2) = Deviation beyond 200 MW and up to 300 MW VLB (3) = Deviation beyond 300 MW
Buyer (being Super RE Rich State)	VLB (1) = Deviation up to 250 MW VLB (2) = Deviation beyond 250 MW and up to 350 MW VLB (3)= Deviation beyond 350 MW
<b>Buyer (being Ultra RE Rich State)</b>	<b>VLB (1) = Deviation up to 350 MW</b> <b>VLB (2) = Deviation beyond 350 MW and up to 500 MW</b> <b>VLB (3)= Deviation beyond 500 MW</b>

**6. As Proposed by CERC:**

*(11) The charges for deviation in respect of cross-border transactions caused by way of over drawal or under drawal or over injection or under-injection shall be payable or receivable at the deviation charge rates and subject to volume limits as applicable to a seller (of the respective category) or to a buyer (other than a RE-rich State or a Super RE-rich State), as the case may be.*

**Response by SLDC/ KPTCL**

Additional definition of Renewable Ultra Rich State is requested to add in the definition part. In this regard, SLDC/KPTCL suggest modification to the clause 8 (11) of the draft regulations as under:

*(11)The charges for deviation in respect of cross-border transactions caused by way of over drawal or under drawal or over injection or under-injection shall be payable or receivable at the deviation charge rates and subject to volume limits as applicable to a seller (of the respective category) or to a buyer (other than a RE-rich State or a Super RE-rich State or Renewable Ultra Rich State ), as the case may be*

**7. As Proposed by CERC:**

*(12) Notwithstanding anything contained in Clauses (1) to (5) of this Regulation, in case of forced outage of a seller, the charges for deviation shall be @ the reference charge rate for a maximum duration of eight time blocks or until the revision of its schedule, whichever is earlier*

**Response by SLDC/ KPTCL:**

In "Force majeure" event, it is very difficult to adhere the net drawl schedule strictly. In such condition, the deviations from net drawl

5  
schedule is uncontrollable despite of taking various measures. In IEGC – 2023 and its subsequent amendments or in the CERC (Deviation Settlement Mechanism and related matters) Regulations, 2022, there is no provision of declaration of “Force majeure” event as a grid disturbance, which leads to heavy penalties to the concern State subsequently to the State ESCOMs.

During such event, there is need to replace the drawl schedule of the affected entities with actual drawl to avoid penalty under DSM for the affected period.

Based on the above explanations, SLDC/ KPTCL suggests the following modification to the Regulation 8(12) of the draft regulations as under:

(12) Notwithstanding anything contained in Clauses (1) to (5) of this Regulation, in case of forced outage of a seller, the charges for deviation shall be @ the reference charge rate for a maximum duration of eight time blocks or until the revision of its schedule, whichever is earlier.

Provided that, “Force majeure” event such as GD-5, actual drawal shall be replaced with the drawl schedule of the affected entities.

#### **8. As Proposed by CERC:**

#### **9.Accounting of Charges for Deviation and Ancillary Service Pool Account**

*(7) In case of deficit in the Deviation and Ancillary Service Pool Account of a region, the surplus amount available in the Deviation and Ancillary Service Pool Accounts of other regions shall be used for settlement of payment under clause (6) of this Regulation:*

*Provided that in case the surplus amount in the Deviation and Ancillary Service Pool Accounts of all other regions is not sufficient to meet such deficit, the balance amount shall be recovered from the drawee DICs - (i) for the period from the date of effect of these regulations till 31.03.2025, in the ratio of [50% in proportion to their drawal at the regional periphery] and [50% in proportion to their GNA]; and (ii) from 01.04.2025, in the ratio of the shortfall of reserves allocated by NLDC to such DICs in accordance with the detailed procedure to be issued in this regard by the NLDC with the approval of the Commission.*

#### **Response by SLDC/ KPTCL:**

In case the surplus amount in the Deviation and Ancillary Service Pool Accounts is not sufficient to meet such deficit, the balance amount shall be recovered from the drawee DICs 50% in proportion to their GNA **is leading to punishing the disciplined buyer/sellers** where ancillary and Grid code regulations are notified. The additional shortfall amount shall be collected from the defaulting buyer/seller by the way of



overdrawal /under injection from the grid by forcing through ancillary services charges by the NLDC/RLDC.

Based on the above explanations, SLDC/ KPTCL suggests the following modification to the Regulation 9(7)) of the draft regulations as under:

Provided that in case the surplus amount in the Deviation and Ancillary Service Pool Accounts of all other regions is not sufficient to meet such deficit, the balance amount shall be recovered from the drawee defaulting buyer/sellers - (i) for the period from the date of effect of these regulations till 31.03.2025, in the ratio of [50% in proportion to their over drawal / under injection at the regional periphery] and [50% in proportion to their Ancillary service charges which is deployed for frequency stability]; and (ii) from 01.04.2025, in the ratio of the shortfall of reserves allocated by NLDC to such DICs in accordance with the detailed procedure to be issued in this regard by the NLDC with the approval of the Commission.

**9.Additional Submission:**

Similar to conventional generators, for wind/solar/hybrid generators shall also include in **Treatment to Gaming such as:** Any intentional mis-declaration or understatement of Scheduled Generation to the RLDC by the QCA for its own undue commercial gain or that of a Generator or for avoiding risk associated with forecast shall be considered as gaming and shall constitute a breach of DSM Regulations.

**For such mis-declaration charges shall be as follows:** Upon identification of gaming by RLDC if any, such as intentional mis-declaration of scheduled generation, the QCA / Generator shall be liable to pay a penalty of three times of deviation charges that would have been applicable had the Scheduled Generation been correctly declared.

The amount of penalty shall be payable by the QCA(s)/Generator(s) to the State Deviation Settlement Mechanism (DSM) Pool as per the procedure to be issued by the RLDC.

The RLDC may, after giving due notice, as stipulated in the Detailed Procedure, cancel the registration of the QCA upon repeated events of mis-declaration.

If the scheduled generation is zero and if there is actual generation in a particular 15 minutes block by the wind/solar generator(s), the deviation settlement charges will be collected from those generator(s) at 125% of the capped price for such energy injected.

\*\*\*\*\*

**DETAILS OF CASES PENDING IN VARIOUS FORUMS ON DEVIATION SETTLEMENT MECHANISM**

SL No.	Forum	Case No.	Petitioner	Respondents	Name of Advocate	Particulars
1	High Court of Karnataka	WP.NO. 9629/2023	M/s Dhruvdesh Metasteel Pvt Ltd & others	KPTCL & SLDC	M/s Just Law	To quash the impugned demand invoices by sldc and issue directions that the DSM charges ought to be leived taking into consideration the Order of CERC dated :06.02.2023 and retrospectively apply this order for month of Dec 2022 and Jan 2023.
2	High Court of Karnataka	WP. No.: 15347/2023	M/s. ILC Iron and Steel Pvt.ltd.	GoK , KPTCL& KSLDC	M/s. Just Law	Agreived by the provisional bills towar sopen access deviation charges dated : 08.06.2023 amounting to Rs. 1,03,63,207/- issued by the SLDC towards DSM charges for the months of
3	KERC	OP No. 05 of 2020	Indian Railways (South Western Railways)	KPTCL, SPRC and SRLDC	M/s. Just Law	Sign change charges demand raised based on CERC (DSM and related matters) (4th Amendment), 2018
4	CERC	180/MP/2019	India Railways	DVC, KPTCL and others	M/s. Just Law	Sign change charges demand raised based on CERC (DSM and related matters) (4th Amendment), 2018
5	CERC	132/MP/2022	SRLDC	APTRANSCO, SLDC, TANGEDCO, SRPC	M/s. Just Law	To maintain actual drawl from the grid as per drawl schedule and avoid overdrawing from the grid in compliance with Regulation 5.4.2 of the Grid Code and DSM Regulations so as to ensure safety & security of the grid and obviate any
6	High Court of Karnataka	WP 104470 of 2023 (Dharwad)	Siruguppi Sugars	KPTCL and SLDC	M/s. Precinct Legal	To quash the demand notices issued by the SLDC claiming DSM charges.
7	High Court of Karnataka	WP No. 17589/2023	TATA Power Trading Company Ltd	KPTCL, Greenko Mamatkhedde Wind Pvt Ltd, ICICI Bank Ltd, HDFC Bank Ltd	M/s. Just Law	To quash the demand notices issued by the SLDC claiming DSM charges and the Minutes of meeting dtd 13.07.2023



GOVERNMENT OF INDIA  
MINISTRY OF POWER

**Report of the  
Ministry of Power Committee  
to address issues related to  
Renewable (Solar/Wind) generators  
in the Deviation Settlement Mechanism  
Regulations, 2022**



**January, 2023**

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## EXECUTIVE SUMMARY

In the meeting chaired by Hon'ble Minister of Power & NRE on 01 December, 2022 on CERC DSM Regulations, 2022, it was directed that a Committee may look into various issues related to Renewable (Solar/Wind) generators and RE-rich states in the new DSM Regulations, 2022.

Accordingly, a Committee was constituted with Chairperson, CEA as the Chairman and Chief Engineer (Regulatory Affairs), CEA as Member-Convener. The members include representatives from MNRE, SECI, Grid India and Energy Department, Govt. of Karnataka.

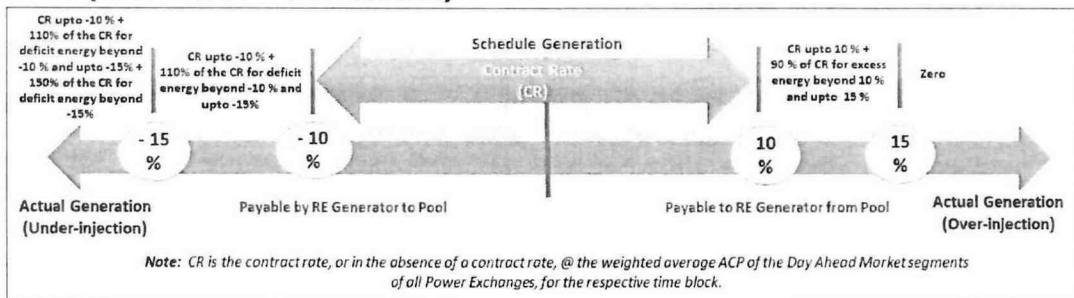
The Committee, after detailed deliberations with stakeholders (SLDCs of Gujarat & Karnataka, IMD, and associations of wind & solar power generators), has recommended as follows:

- The present technologies for forecasting of generation from Solar/Wind have to be developed further in a collaborative manner by all stakeholders. In addition to data from WMO (World Meteorological Organization), the forecasting service providers in India need to develop indigenous/domestic data sources for forecasting. Forecasting needs to be done in a site specific manner.
- All renewable power plants should provide data for forecast to Indian Meteorological Department (IMD) at shorter time intervals (say hourly or 15 min. time interval).
- At present, IMD provides wind speed forecast every six (6) hours. With the help of granular data, IMD should attempt shorter forecast periods say hourly, etc.
- A task force comprising of CEA, MOP, MNRE, IMD, Grid India, Wind power association and Solar power Association, needs to be constituted on priority basis, for coordination in forecasting, data communication, process, validation and implementation.
- As there is significant difference in forecasting accuracy for solar and wind forecasting technologies, there is a need for a differential treatment for deviations by Solar and Wind generators in DSM Regulations, keeping in view the requirements of both grid discipline ensuring grid security as well as for promoting generation from Solar and Wind sources.
- There may be relaxation in the provisions for Wind and Solar generators in the extant DSM Regulations, 2022 for three (3) years i.e. upto 31<sup>st</sup> March, 2026. With effect from 1<sup>st</sup> April, 2026, the tolerance band and charges for deviation may be reviewed. A roadmap may be provided by CERC for further tightening of the tolerance band for deviation to keep the grid secure as RE penetration increases.



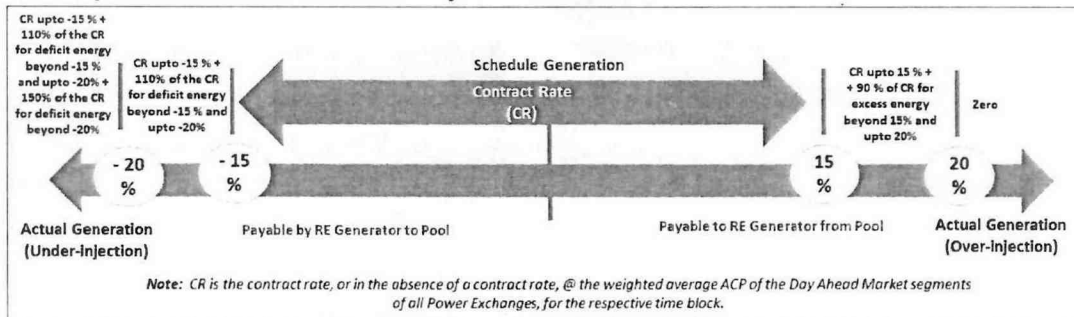
- Aggregation at pooling station level may be promoted for scheduling and deviation settlement of renewables. The forecasting accuracy would increase by aggregating the forecasting and scheduling at pooling station. With increase in accuracy of forecast and aggregation of pooling station, there would be reduction in the risk of deviation. This may minimize the financial impact on RE generator due to deviation from schedule. The DSM rates in case of pooling station shall be the weighted average of all transactions of the plants connected to the pooling station.
- The error calculation as a percentage of 'available capacity' basis shall be continued.
- The settlement of payment for the energy and deviations at inter-state and intra-state level should be harmonized to be based on 'schedules'. Presently, at inter-state level, the payment to generators by DISCOMs is based on schedules, with the deviation amounts settled through RLDCs Deviation and Ancillary Services Pool Account. Whereas, at intra-state level, generally it is based on actuals and the deviations accounted for in few states. The respective state utilities may raise this issue for redressal by the concerned SERC.
- For judicious apportionment of deviation among intra state entities within states it is essential that the SAMAST framework should be implemented in each state.
- Detailed recommendation of the Committee are given in Chapter-3 of this report.
- Suggested tolerance band and charges for wind and solar plants are depicted below:

**Solar (01.04.2023 – 31.03.2026)**



Recommended DSM Framework for Solar (01.04.2023 – 31.03.2026)

**Wind (01.04.2023 – 31.03.2026)**



Recommended DSM Framework for Wind (01.04.2023 – 31.03.2026)

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## CHAPTER 1 - INTRODUCTION

### 1.1 BACKGROUND

In the meeting chaired by Hon'ble Minister of Power & NRE on 1<sup>st</sup> December, 2022, on Deviation Settlement Mechanism (DSM) Regulations, 2022, it was directed that a Committee may be formed to look into various issues related to Renewable (Solar/Wind) generators in the DSM Regulations, 2022.

Accordingly, a Committee has been constituted with Chairperson, CEA as the Chairman and Chief Engineer (Regulatory Affairs), CEA as Member-Convener. The members include representatives from MNRE, SECI, Grid-India (formerly POSOCO) and Energy Department, Govt. of Karnataka.

Accordingly, Ministry of Power vide Order no. 23/17/2022 -R&R dated 21<sup>st</sup> December, 2022 (Annexure – I) constituted a Committee under the Chairmanship of Chairman, CEA to look into various issues related to Renewable (Solar/Wind) generators in the New DSM Regulation, 2022. The Composition of the Committee as suggested by Min. of Power is as under: -

Chairperson, CEA	- Chairman
Representative from MNRE	- Member
Representative from SECI	- Member
Director (Market Operation), Grid India	- Member
ACS, Energy, Govt. of Karnataka	- Member
Chief Engineer (Regulatory Affairs), CEA	- Member Convener

The Terms of Reference (TOR) of the Committee are as under:

- i. To assess the present technologies for forecasting of generation from Solar/Wind and accordingly recommend the treatment required for Solar/Wind generators in DSM Regulations, keeping in view the requirements of both grid discipline as well as for promoting generation from Solar and Wind sources.
- ii. To assess whether a different treatment is required in DSM Regulations for Solar and Wind generators.
- iii. To recommend the possible trajectories for tightening the permissible deviations for such technologies over next the few years.
- iv. Whether a more gradual tightening is required for Wind based generating stations already set up/bid out before the new regulations become effective.
- v. To assess the potential effectiveness of proposed mechanism of aggregators, with a view to facilitate tightening of deviation range for Wind/Solar generators.

The Committee was asked to look into the issues raised by stakeholders and if required may consult stakeholders.

The order of the Constitution of the Committee is placed at **Annexure – 1**.

## 1.2 SPECIAL DISPENSATION FOR ISTS CONNECTED RENEWABLES

### 1.2.1 DEVIATION CHARGES DELINKED FROM FREQUENCY

In November 2015, when the DSM framework for renewables was introduced, the quantum of ISTS connected renewables was of the order of 40 MW. In order to encourage renewable integration, deviation charges for renewables were delinked from frequency with immunity from deviation charges within a tolerance band. Since 2015 till 05<sup>th</sup> December, 2022, the tolerance band of +/-15 % has been in vogue.

As of December, 2022, there is ISTS connected renewables capacity of about 22 GW. In the new DSM Regulations, 2022 effective from 05<sup>th</sup> December, 2022, the tolerance band has been reduced to +/-10 %.

The special dispensation of deviation charges delinked from frequency for RE generation, has been retained in the new DSM Regulations, 2022 also.

### 1.2.2 ERROR CALCULATION BASED ON AVAILABLE CAPACITY

Error definition based on schedules had the drawback that it was insufficient to handle varying seasons, especially very low or zero schedules. Further, it is not aligned with direct grid impact (MW deviations). Hence, in order to ensure optimum and genuine forecasting, Central Commission in 2015 had specified that error percentage would be normalized to available capacity, instead of schedule. The formula for computation of error is as follows:

$$\text{Error (\%)} = (\text{Actual Generation} - \text{Scheduled Generation}) / (\text{Available Capacity}) \times 100$$

Available Capacity (AvC) is the cumulative capacity rating of the wind turbines/solar inverters that are capable of generating power in a given time-block.

AvC would be equal to the Installed Capacity, unless one or more turbines/inverters are under maintenance or shutdown.

There are penal provisions for mis-declaration of Available Capacity. The RE developer is liable to action under appropriate provisions of the Act or the Regulations.

For example, taking the case of Wind Power Plant of installed capacity of 100 MW (2 MW x 50 turbines), it can have schedule of, say, 60 MW in a given time block. The actual generation may be 45 MW (under-injection scenario) or 75 MW (over-injection scenario). The error calculation based on schedule basis and available capacity basis is as follows:

	<b>Error Calculation on schedule basis</b>	<b>Error Calculation on available capacity basis</b>
<b>45 MW (under-injection)</b>	$100 \times [45-60]/60 = -25 \%$	$100 \times [45-60]/100 = -15 \%$
<b>75 MW (over-injection)</b>	$100 \times [75-60]/60 = +25 \%$	$100 \times [75-60]/100 = +15 \%$

Therefore, renewables have the advantage of reduced error percentage and corresponding reduced charges for deviation with the error calculation based on available capacity basis. This advantage has been retained in the new DSM Regulations, 2022 also.

### 1.2.3 FREEDOM TO REVISE SCHEDULES

Wind/solar developers at the inter-state level have been given freedom to revise their schedule 16 times in the intra-day operations and the error with respect to these revised forecasts are much lower. However, from the utility perspective, the day ahead forecast is important for committing or de-committing the thermal units. Therefore, any large errors with respect to day ahead forecast leads to operational challenges in minimizing the deviation from the schedule.

The forecasting by system operator is purely from system security point of view whereas the forecasting by developer would be to avoid deviations and corresponding financial implications.

The forecasting improves as it is a repeated game with larger set of historical data. Further, the tolerance band tightening with improvement in forecast was signalled long time ago in the Statement of Reasons issued by Central Commission in August, 2015.

### 1.3 PROVISIONS FOR RE-RICH STATES

In the earlier mechanism, there was flat 200 MW and 250 MW tolerance band in which normal deviation charges applied for renewable rich states having installed capacity of lesser than 3000 MW and greater than 3000 MW renewables respectively. There were additional deviation charges in a graded manner.

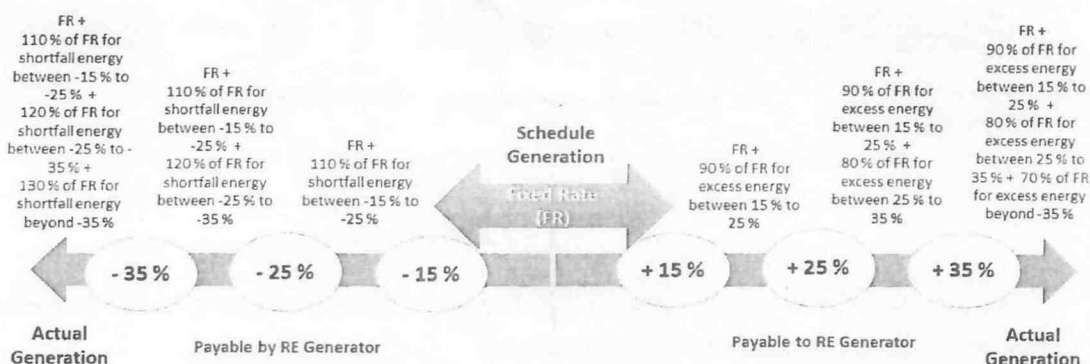
In the new DSM, 2022 mechanism, "RE-rich State" has been defined as the state which has greater than 1000 MW installed capacity of renewables. RE-rich states would not have to pay charges for deviation in case of under-drawal and would receive compensation in a graded manner. The normal rate for deviation would be applicable upto 10 % of overdrawal. For over-drawal between 10 – 15 %, the deviation charges would be at the rate of 120 % of normal rate. For over-drawal beyond 15 %, the deviation charges would be payable at the rate of 150 % of normal rate.



### 1.4 CHARGES FOR DEVIATIONS PRE DSM REGULATIONS, 2022

The salient features of DSM in the pre-DSM Regulations, 2022 were as follows:

- Charges for Deviation de-linked from frequency for RE
- Buyer has to pay as per schedule energy (one to one payment) to RE generator
- Additionally, deviation from schedule is to be settled through Regional DSM pool account
  - $Error (\%) = 100 \times [Actual\ Generation - Scheduled\ Generation] / (Available\ Capacity)$
  - Renewable generator would get entire charges recovered as per its tariff for any deviation within +/- 15 %
  - There would be graded reduction in tariff for deviation beyond 15 % only.
  - Actual generation being less than the scheduled generation
  - Deviation charges for shortfall in generation shall be payable by such wind or solar generator to the Regional DSM Pool
- Actual generation being more than the scheduled generation
  - Deviation Charges for excess generation shall be payable to the wind or solar generators which are regional entities from the Regional DSM Pool



*Note: Fixed Rate (FR) is the weighted average rate of all transactions of the plant connected to the pooling station.*

Figure 1: Charges for Deviation Pre DSM Regulations, 2022

### 1.5 CHARGES FOR DEVIATIONS POST DSM REGULATIONS, 2022

The salient features of DSM in the pre-DSM Regulations, 2022 were as follows:

- Charges for Deviation remain de-linked from frequency
- Buyer has to pay as per schedule energy (one to one payment) to RE generator
- Additionally, deviation from schedule is to be settled through Regional DSM pool account
  - $Error (\%) = 100 \times [Actual\ Generation - Scheduled\ Generation] / (Available\ Capacity)$

- **Over-injection**

- Charges for Deviation Payable = 0
  - Amount receivable for over-injected quantum at the rate of contract rate or in absence of that-at the rate of ACP of DAM in that Tolerance Band (TB) up to 5 %.
  - Amount receivable for over-injected quantum at the rate of 90% of contract rate or in absence of that, at the rate of 90% of ACP of DAM in that TB beyond 5 % and upto 10 %.

- **Under Injection**

- Upto 10 % : Charges for Deviation Payable = 0
- Above 10 % : Charges for Deviation Payable = 10% of Normal Deviation Charges
  - Amount payable for under-injected quantum at the contract rate or in absence of that, at the rate of ACP of DAM in that TB.

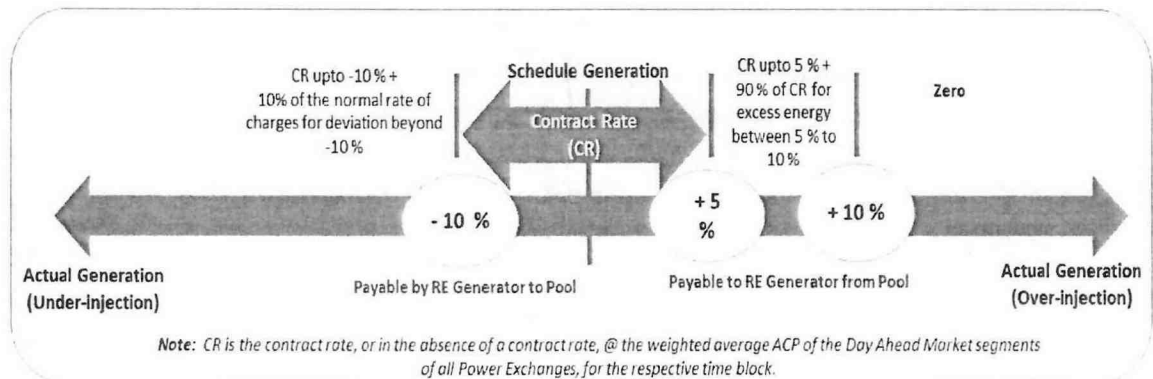


Figure 2: Charges for Deviation Post DSM Regulations, 2022

As per new DSM regulations, 2022, the normal rate of charges for deviation for a time block is to be taken as the highest of:

- the weighted average Area Clearing Price (ACP) of the Day Ahead Market segments of all the Power Exchanges;
- the weighted average ACP of the Real Time Market segment of all the Power Exchanges;
- the Weighted Average Ancillary Service Charge of all the regions for that time block.

Provided further that 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.

## CHAPTER 2: STAKEHOLDER DELIBERATIONS

### 2.1 MEETINGS

A preparatory meeting, as an outcome of the meeting the meeting held in the ministry on this subject, was held under chairmanship of Chairperson, CEA on 12<sup>th</sup> December, 2022. In this meeting the representatives form GRID India, Govt. Of Karnataka and MNRE were present. The minutes of the preparatory meeting of the Committee are attached at **Annexure-2**.

In the preparatory meeting, a need was felt to get views of a few industry associations/ representatives of wind and solar generators in this matter. Subsequently a meeting was held on 26<sup>th</sup> December, 2022. In this meeting beside members of the Committee, representative from Gujarat (SLDC), IMD, WIPPA & IWPA, NSEFI, SPDA, Rajasthan Solar Association, Athena and few representatives from other wind/solar industries were present. The minutes of the meeting of the meeting of the Committee are attached at **Annexure-3**.

### 2.2 STATE UTILITIES

#### 2.2.1 GUJARAT

Representative from Gujarat presented the DSM charges in Gujarat under state DSM regulation for wind and solar plants in Gujarat. The presentation is enclosed (Annexure-IV of Annexure – 3). The highlights from their presentations are as follows:

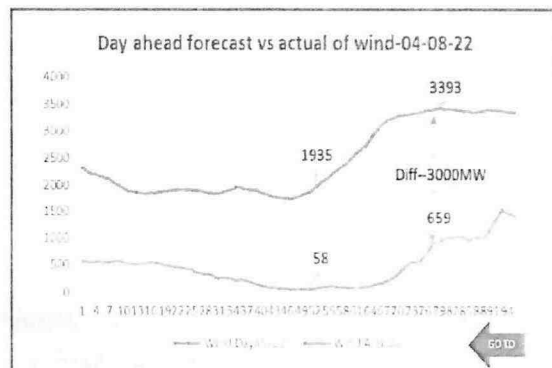
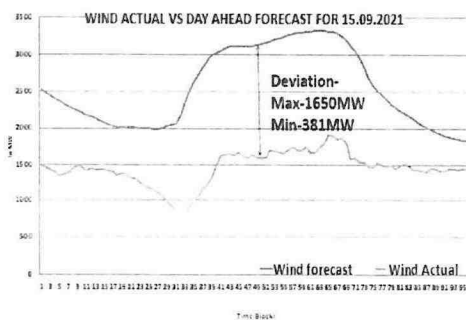
- Wind and solar installed capacity in Gujarat are 19 % and 17 %, respectively.
- In Gujarat demand variation is very high, varies from 2000 MW to 7000 MW on a day.
- Significant variations in wind and solar generation in comparison to day ahead forecasted data.
- Day ahead forecast would improve for optimum system operation.
- For wind generation, deviation charges on absolute error range of 12% to 28%. Whereas, for solar generation deviation charges on absolute error range of 7% to 23%.
- Representative from Gujarat informed that in state DSM regulation of Gujarat, deviation calculation is based on installed capacity, irrespective of plant operational status, which should be changed in the state DSM regulation.

#### 2.2.2 KARNATAKA

Representative from Karnataka highlighted the impact of large frequency variations on state deviation due to new DSM regulation. It was explained that the large variations in frequency from 49.41 Hz to 50.50 Hz after the implementation of new DSM regulations is not good for grid operation. Presentation from Karnataka (SLDC) is

enclosed (Annexure-III of Annexure-2) and (Annexure-VI of Annexure-3). The highlights from their presentations are as follows:

- Karnataka has excess generation capacity as compare to their demand. The RE capacity in Karnataka exceeds peak demand which was 14830 MW in 2021-22.
- Karnataka faces difficulties in maintaining the drawal as per schedule due to high variability and high RE.
- Karnataka, being RE rich State, the deviation limit of + / -15% of schedule or +/- 300MW needs to be increased to +/-15% (excluding STOA transactions) or +/- 500MW.
- In CERC DSM regulations 2022 clause 6 (2) needs to be modified as: Deviation-WS seller (in %) =  $100 \times ((\text{Actual Injection in MWh}) - (\text{Scheduled generation in MWh})) / ((\text{Available Capacity}) [(\text{Scheduled generation in MWh})])$  to maintain healthiness of the power sector operation.
- Karnataka has roughly 50-50 % share of conventional (15592 MW) and RE (15855 MW) capacity. For the year 2021-22, the contribution of RE in total energy for Karnataka has been more than 41%, it peaked to 76% in July, 2021 and was between 52% to 67% in rest of the months. The RE contribution, here, include contribution from Hydro projects also.
- Karnataka presented that their state experienced high deviation (more than 1000 MW) during May-September, 2021 and deviation exceeded 250 MW for more than 36% time blocks in each month.
- Karnataka presented the variation in wind generation forecast v/s the actual generation in their state, as given below:



## 2.3 RENEWABLE DEVELOPERS

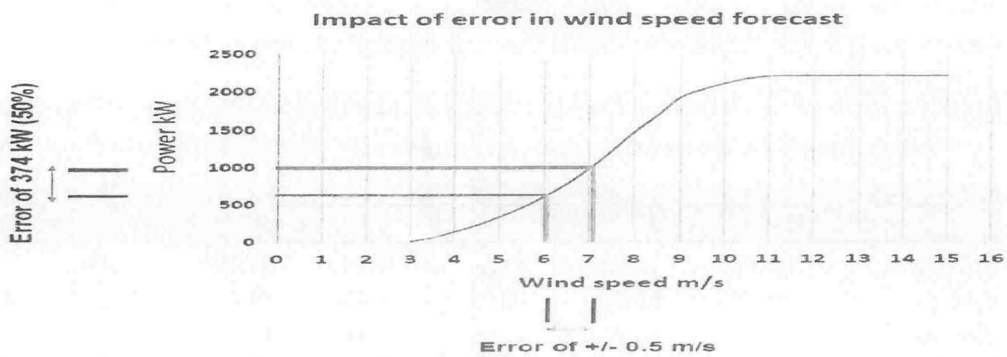
### 2.3.1 WIND POWER ASSOCIATION

A combined presentation from WIPPA and IWPA was made before the committee. The presentation is enclosed (Annexure-III of Annexure-3). The mechanism of wind

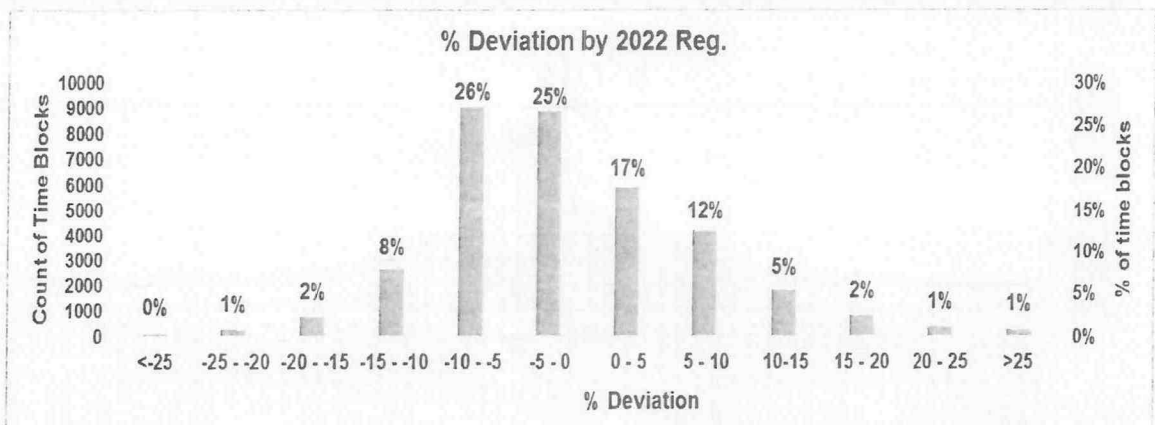
power forecast and scheduling was presented. The highlights from their presentation are as follows:

- i) IMD provides wind speed forecast every six (6) hours, but wind speed varies from forecasted value in real time.
- ii) Wind forecast is done by two methods:
  - a. NWP (Numerical Weather Production) used globally.
  - b. NWP with real time data from wind farms with 15 min. time interval.
- iii) They explained with graph that average wind speed at most sites ranges between 6 to 7 m/s. Due to cubic nature of the slope, for this range the impact of wind speed forecast error in output of wind power plant is very high. Whereas, at speed of 9 m/s & above the impact of wind speed forecast error will be very less.
  - For example, if error of +/- 0.5 m/s in wind speed the power production error in wind power plant reaches to 50 %.

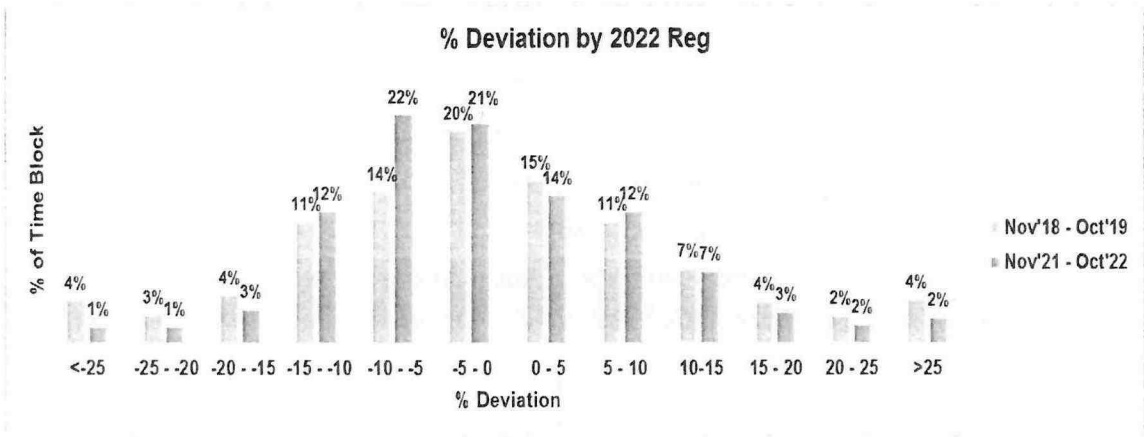
**Impact of error in wind speed forecast**



- iv) Around 84 % of deviations were falling under tolerance band of +/- 15% as per old DSM regulation. Whereas, in new DSM regulation about 70-80% of deviations fall under tolerance band of +/- 10%. However, about 85-90% of deviations fall under tolerance band of +/- 15% and more than 90% get covered under +/- 20%.







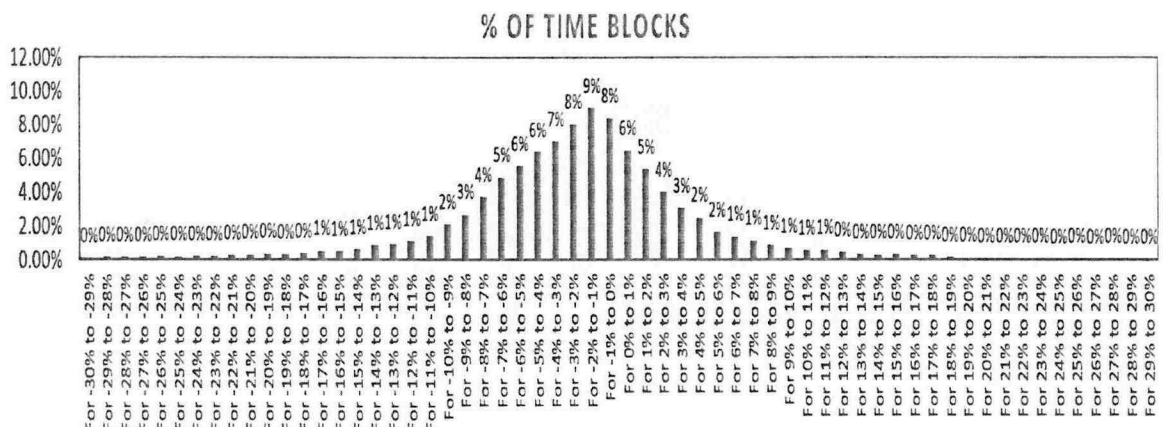
v) They requested to take up with IMD for improving the forecasting. They also requested to provide wind generators some relief as it was not possible to forecast very accurately for wind power generation due to errors in wind speed forecast.

2.3.2 SOLAR POWER ASSOCIATION

Representatives from NSEFI presented an analysis of impacts of new DSM regulation, 2022 on solar power plants. The presentation is enclosed (Annexure-V of Annexure-3). The highlights from their presentation are as follows:

i) The 85% of deviations of solar parks get covered in deviation band of +/- 10% and more than 90% deviations get covered under deviation band of +/- 15%

Band	Under Injection				Over Injection			
	NR	WR	SR-KAR	SR-AP	NR	WR	SR-KAR	SR-AP
Upto 1%	12.3%	13.9%	10.7%	9.3%	20.2%	9.3%	7.6%	8.0%
Upto 5%	56.7%	53.0%	43.7%	38.8%	67.2%	43.5%	38.6%	38.4%
Upto 10%	84.2%	74.7%	59.8%	65.3%	85.5%	78.1%	70.0%	57.9%
Upto 12%	87.8%	80.8%	75.1%	72.8%	89.3%	86.8%	79.8%	68.5%
Upto 15%	91.5%	86.9%	83.7%	82.1%	92.7%	92.5%	88.1%	77.8%
Upto 20%	94.7%	91.9%	91.0%	89.2%	96.2%	95.7%	94.4%	86.3%
Upto 25%	96.6%	95.4%	95.3%	93.6%	97.6%	97.1%	97.5%	94.5%
Upto 30%	97.7%	97.0%	97.7%	96.4%	98.7%	98.2%	98.9%	97.8%
Upto 100%	100%	100%	100.0%	100.0%	100%	100%	100%	100%



- ii) Revenue loss will increase from 1.62 % as per earlier regulation to 11.33 % as per new DSM regulation, 2022. This was mainly due to no payment for over injection and under injection.
- iii) The solar developers are unable to forecast fog conditions, which decreases plant power output.

#### 2.4 SYSTEM OPERATOR: GRID-INDIA (FORMERLY POSOCO)

Representative from Grid-India presented on various aspects related to DSM framework for renewables, Aggregation, DSM Charges, Forecasting & Scheduling of RE at intra-state level and analysis of Karnataka renewable data. The presentation is enclosed (Annexure-II of Annexure-2). The highlights from their presentation are as follows:

- i) The special dispensation to ISTS connected renewables since 2015 was highlighted.
- ii) There is advantage of reduced error percentage and corresponding reduced charges for deviation with the error calculation based on available capacity basis.
- iii) Deterioration in the frequency profile has been observed post implementation of new DSM regulations, 2022. The frequency profile post implementation is attached at **Annexure – 4.**
- iv) The region-wise effective tariff realization by the ISTS Connected Solar & Wind Generating Stations over last three years was analyzed. Sample comparison of DSM charges based on old versus new DSM mechanism for a solar as well as wind plant of capacity 250 MW each in Southern Region was done.
  - a. In case of solar generation, DSM Liability as per Old Mechanism on annual basis (2021-22) has been in range of 1 – 2 Paisa/kWh which is ~ 0.5 % of PPA Rate on annual basis. However, as per new DSM, 2022 this liability may increase upto range of 10 – 12 Paisa/kWh which is ~ 4 % of PPA Rate on annual basis.
  - b. In case of wind generation, DSM Liability as per Old Mechanism on annual basis (2021-22) has been in range of 1 – 5 Paisa/kWh which is ~ 0.5 % of PPA Rate on annual basis. However, as per new DSM, 2022 this liability may increase upto range of 10 – 20 Paisa/kWh which is ~ 4.5 % of PPA Rate on annual basis.
- v) DSM for RE plants has been implemented in 23 states (Some states have embedded the provisions in their Grid Code / DSM Regulations).
  - a. State level aggregation viz. virtual pool through Qualified Coordinating Agency is allowed in Karnataka, Andhra Pradesh, Bihar, Jharkhand, Assam, Tripura, Mizoram and Manipur. All other states implemented Pooling station wise aggregation.

- b. Majority of states have implemented  $\pm 15\%$  band. Tamilnadu, Haryana, Assam, Tripura, Mizoram & Manipur have implemented  $\pm 10\%$  band. Gujarat has allowed  $\pm 7\%$  for Solar and  $\pm 12\%$  for wind.
- c. RE generation is paid based on actuals in all states except in case of Bihar and Chhattisgarh, the payment is based on schedules.

The state-wise status is placed at **Annexure – 5**.

- vi) In the draft Grid Code 2022, the aggregation has been allowed for combined scheduling and deviation settlement of renewables. The relevant extract is reproduced below:

“46.11.b) .....aggregation of pooling stations for the purpose of combined scheduling and deviation settlement for wind or solar or renewable hybrid generating stations .....”

The sample exercise was carried out for Wind and Solar plants is placed at **Annexure – 6**. It is inferred from plots that accuracy has increased by aggregating the scheduling and forecasting at pooling station. With increase in accuracy of forecast and aggregation of pooling station may further reduce the risk of deviation. This may minimize the financial impact on RE generator due to deviation from schedule.

- vii) There is a fundamental difference in the settlement of deviations at inter-state and intra-state level. At inter-state level, the payment to generators by DISCOMs is based on schedules (with the deviation amounts settled through RLDCs Deviation and Ancillary Services Pool Account) whereas at intra-state level, it is based on actuals (with the generators paying graded charges for forecast errors into the SLDCs DSM Pool Account).

- viii) It was suggested that

- a. Different deviation bands for wind and solar
  - i. Graded payment and penalties over different bands
  - ii. Retain zero payment beyond pre-specified limit
- b. Aggregation at pooling station level
- c. Roadmap for further tightening of tolerance bands with improved forecasting over time.

## 2.5 INTERACTION WITH OTHER STAKEHOLDERS

The committee also received representation from SJVN and FICCI. Based on interaction with these agencies it was found that there is a need to link the DSM framework with grid frequency. Also it was observed the % error allowed for hydro generators has been reduced to 2% from earlier value of 12%. As hydro plants helps in balancing and in meeting responses, the limit of tolerance band of 2% deviation from schedule should be reviewed.

## CHAPTER 3: RECOMMENDATIONS AND WAY FORWARD

### 3.1 GENERAL COMMENTS AND OBSERVATIONS

- i) In the interest of grid stability, the DSM framework for entities other than renewables may be linked with frequency. So that power injection or drawal is varied in a manner to maintain frequency within the band.
- ii) The hydro generation plant generally provide quick start stop capability and they do so around twice a day based on the instructions of the Load despatch centres. Hydro plants facilitate grid by providing primary response (FGMO). However, this change in despatch is not getting recognized and instead they are being penalized through DSM. The % error allowed for them has been reduced to 2% from earlier value of 12%. As hydro plants helps in balancing and in meeting responses, the limit of tolerance band of 2% deviation from schedule is recommended to be increased to 10% for one year. Further, this may be reviewed based on data submitted by hydro plants after one year.

### 3.2 DIFFERENTIAL TREATMENT FOR WIND AND SOLAR GENERATORS IN CASE OF DEVIATIONS

- i) As there is significant difference in forecasting accuracy for solar and wind forecasting technologies in India, therefore, there is a need for a differential treatment for deviations with symmetrical provisions in case of over-injection & under-injection by Solar and Wind generators in DSM Regulations.
- ii) Considering the requirements of both grid discipline for ensuring grid security as well as for promoting generation from Solar and Wind sources, it is recommended that in case of solar generation, the tolerance band for immunity from deviation charges should be  $\pm 10\%$  band whereas in case of wind generation, the tolerance band for immunity from deviation charges should be  $\pm 15\%$  band.
- iii) In case of solar generation, there should be graded deviation charges in the band  $\pm 10\%$  to  $\pm 15\%$ . In case of over-injection beyond  $15\%$ , there should be zero charges payable to solar generator from the pool. In case of under-injection beyond  $15\%$ , there should be upto  $150\%$  of contract rate payable as deviation charges.
- iv) In case of wind generation, there should be graded deviation charges in the band i.e.  $\pm 15\%$  to  $\pm 20\%$ . In case of over-injection beyond  $20\%$ , there should be zero charges payable to wind generator from the pool. In case of under-injection beyond  $20\%$ , there should be upto  $150\%$  of contract rate payable as deviation charges.
- v) Further, instead of normal rate, the deviation charges have to be linked to contract rate or in the absence of a contract rate, @ the weighted average ACP of the Day Ahead Market segments of all Power Exchanges, for the respective time block.

The above recommendations are depicted below:

**Solar (01.04.2023 – 31.03.2026)**

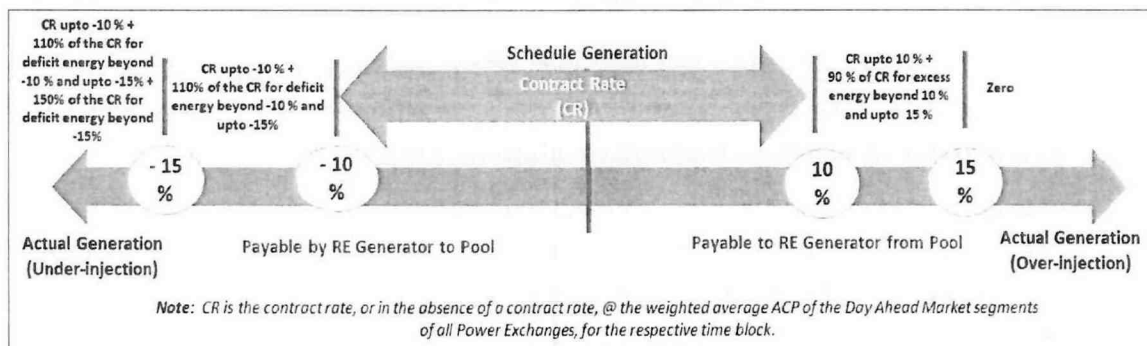


Figure 3: Recommended DSM Framework for Solar (01.04.2023 – 31.03.2026)

**Wind (01.04.2023 – 31.03.2026)**

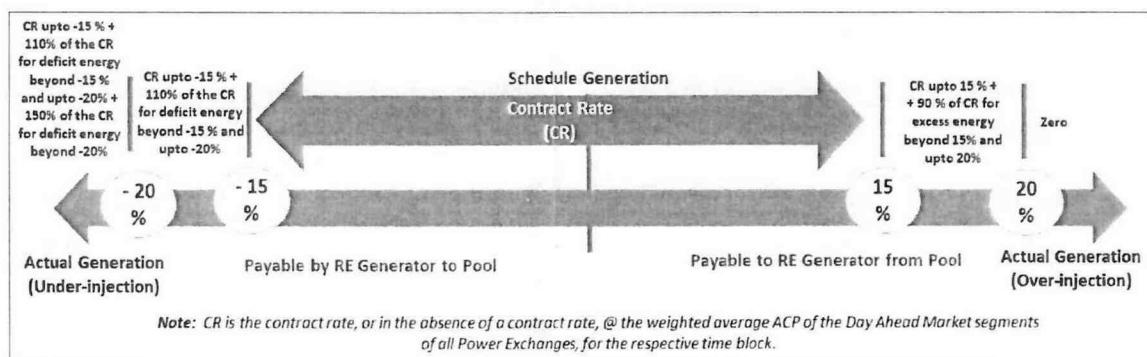


Figure 4: Recommended DSM Framework for Wind (01.04.2023 – 31.03.2026)

**3.3 RELAXATION IN DSM PROVISIONS UPTO 31<sup>ST</sup> MARCH 2026**

- i) These recommendations may be implemented for three (3) years i.e. upto 31<sup>st</sup> March, 2026. W.e.f 1<sup>st</sup> April, 2026, the tolerance band and charges for deviation may be reviewed.
- ii) A roadmap may be provided by CERC for further tightening of the tolerance band for deviation to keep the grid secure as RE penetration increases.

**3.4 AGGREGATION AT POOLING STATION LEVEL**

- i) Aggregation at pooling station level may be promoted for combined scheduling and deviation settlement of renewables. The forecasting accuracy would increase by aggregating the forecasting and scheduling at pooling station. With increase in accuracy of forecast and aggregation of pooling station, there would be reduction in the risk of deviation. This may minimize the financial impact on RE generator due to deviation from schedule.



- ii) The DSM rates in case of pooling station should be the weighted average rate applicable to individual generator(s) connected to the pooling station.

### 3.5 ERROR CALCULATION ON 'SCHEDULE' BASIS

- i) The error calculation based on 'available capacity' basis should be continued.

### 3.6 SUGGESTIONS FOR RE – RICH STATES

- i) The settlement of payment for the energy and deviations at inter-state and intra-state level should be harmonized to be based on 'schedules'. Presently, at inter-state level, the payment to generators by DISCOMs is based on schedules, with the deviation amounts settled through RLDCs Deviation and Ancillary Services Pool Account. Whereas, at intra-state level, generally it is based on actuals and the deviations accounted for in few states. The respective state utilities may raise this issue for redressal by the concerned SERC.
- ii) For judicious apportionment of deviation among intra state entities within states it is essential that the SAMAST framework should be implemented in each state.

### 3.7 IMPORVEMNT IN FORECASTING

- i) Development of RE Forecasting: The present technologies for forecasting of generation from Solar/Wind have to be developed further in a collaborative manner by all stakeholders. In addition to data from WMO (World Meteorological Organization), the forecasting service providers in India (eg. IMD, etc.) needs to develop indigenous/domestic data sources for forecasting. Forecasting needs to be done in a site specific manner.
- ii) Granular data communication and RE plants: All renewable power plants should provide forecast data to Indian Meteorological Department (IMD) at shorter time intervals (say hourly or 15 min. time interval).
- iii) Weather forecast at shorter intervals: At present, IMD provides wind speed forecast every six (6) hours. With the help of granular data, IMD should provide shorter forecast for periods say hourly, etc.
- iv) Task-force for forecasting coordination: A task force comprising of CEA, MOP, MNRE, IMD, Grid India, Wind power association and Solar power Association 'needs to be constituted on priority basis' for coordination in forecasting, data communication, process, validation and implementation.

**Annexure-3**

1. Karnataka is one of the largest producers of green energy mainly from Solar and Wind sources. The state has 8629MW of Solar and 5387MW of Wind power besides 2777MW of other RE Sources. The total installed capacity of RE is 16739MW out of 33030MW of overall capacity generation marking RE Power at 51% of capacity.

Source	Installed Cap of RE in MW
Wind	5387
Solar	8629
Small Hydro(ROR)	907
Bio-mass	139
Co-generation	1731
<b>RE Total</b>	<b>16793</b>

Other than RE sources, State is having thermal (5020MW), hydro (3798MW out of which 772MW-ROR), IPP (1200MW), DVC (450MW) and CGS share (4740MW-in CGS, share of **779MW from Nuclear plant (Must run)**), totaling of 16237 MW. Karnataka is having all variants of generation and load.

2. The State is facing grid discipline issues due to RE forecasting uncertainties in the absence of strict deviation bandwidth and special status of Must Run. Integration of such huge quantum of RE into the grid is a challenge for the State to balance LGB. The wind generation varies from 500MW to 2000 MW w.r.t forecasted schedule and sometimes solar power generation varies to an extent of 1000MW in a time block w.r.t forecasted schedule.
3. It is pertinent to note that the forecast error w.r.t Schedule, out of total 2976-time blocks in a month (July-23), the error for day-ahead forecast of wind is more than 250MW in 2778-time blocks (93% of

92

the time block is Wind deviation is more than 250MW) and the error for after intra-day forecast of wind is more than 250MW in 2052-time blocks (69% of the time block is Wind deviation is more than 250MW).

4. However, as per Regulatory provision, the deviation Forecasting Error (WIND) beyond 15% w.r.t Available Capacity (AVC), out of total 2976-time blocks in a month (July-23), the error for day-ahead forecast of wind is more than 15% in 1933 time blocks [ No of blocks with Deviation beyond 15% is 64.95% (no penalty for day ahead forecast error)] and the error for after intra-day forecast of wind is more than 15% in 107-time blocks only [ No of blocks with Deviation beyond 15% is 3.60% only].
5. The Karnataka being RE rich State, with 51% of the demand met by RE sources, the variations in the forecast for RE to meet the demand is the challenge faced by the system operators. In this regard, it is pertinent to note that **the forecast error w.r.t to Schedule**, out of total 35136-time blocks in a year, the deviation is more than 250MW for day-ahead forecast of wind is 52% of time blocks (18281). (2023-24 data is considered).
6. Similarly, during the year 2023-24, the day ahead solar forecast deviation is more than 250MW against the actual generation in 10917-time blocks (out of 17223, time blocks-solar period). This indicates that the large-scale deviations in forecasting by the RE Generators in the State, the safety and security of the grid can be severely endangered. The allowable State deviation (limit +/-250MW) has exceeded many time blocks due to improper forecasting by wind and solar generators. Furthermore, such abnormal deviation had to be absorbed by the State, sometimes the excess power is been traded at the lowest price of 5 paisa /unit to maintain grid discipline.
7. The RE forecasters are not making sincere effort in their forecast and to reduce the forecast error as minimum as possible w.r.t RE

generation (Wind and Solar), since the deviation formula in prevailing CERC and SERC DSM regulations : Deviation-WS seller (in %) =  $100 \times [(Actual\ Injection\ in\ MWh) - (Scheduled\ generation\ in\ MWh)] / [(Available\ Capacity)]$  is favorable to the forecasters. It is a herculean task for the system operators to maintain the LGB and deviation.

8. To contain the variability, thermal generators are kept on bar at technical minimum to operate flexibly. Further, the absorption of “must run” energy from RE along with available TPS on bar will result in availability of energy over and above the State demand. In such circumstances, to avoid deviation and to maintain grid discipline, the State is forced to trade the surplus power at market clearing price as low as 5 paisa per unit in certain time blocks.
9. Also, frequent start/stop, Ramp up/Ramp down of thermal stations are leading to lower efficiency, high specific coal consumption and deterioration of machine performance.
10. In order to absorb the Must Run RE generation/maintain deviation within the 250MW, State reduces the inter-state schedule to minimum possible, in some cases schedule will be on negative side, by way of surrendering ISGS generation or trading the power in power markets.
11. The grid maintainability by the grid operator is further burdened, due to the fact that RE forecasters are not pushing sincere effort to reduce the forecast error as minimum as possible in RE generation (Wind and Solar), since deviation formula in CERC DSM existing and new regulations : *Deviation-WS seller (in %) =  $100 \times [(Actual\ Injection\ in\ MWh) - (Scheduled\ generation\ in\ MWh)] / [(Available\ Capacity)]$*  has minimal impact on disciplining the forecasters.
12. The specifics regarding forecast errors for wind and solar energy are outlined in **Appendix-1**.

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## Appendix-1

1. It is pertinent to note herein that the deviation above 250MW with respect to wind projects in the state of Karnataka is 18281 blocks out of 35136 blocks w.r.t forecasted schedule. However, as per Regulatory provision, the deviation Forecasting Error (WIND) beyond 15% w.r.t Available capacity (AVC), out of total 35136-time blocks in a year (2023-24) the error for day-ahead forecast of wind is more than 15% in 4028 time blocks [ No of blocks with Deviation beyond 15% is 11.46 % (no penalty for day ahead forecast error)]. The table produced hereunder indicates the same:

WIND	DAYAHEAD	NO OF BLOCKS WITH DEVIATION w.r.t SCHEDULE					NO OF BLOCKS WITH DEVIATION BEYOND 15% w.r.t AvC		
		MONTH	NO OF BLOCKS	DEVIATION 250-500MW	DEVIATION 500-750MW	DEVIATIO N>750MW	TOTAL DEVIATION >250MW	% OF DEVIATION	NO OF BLOCKS
Apr-23		2880	867	227	31	1125	39.06	33	1.15
May-23		2976	1165	246	102	1513	50.84	100	3.36
Jun-23		2880	735	522	478	1735	60.24	481	16.70
Jul-23		2976	300	525	1953	2778	93.35	1933	64.95
Aug-23		2976	946	624	326	1896	63.71	309	10.38
Sep-23		2880	894	379	151	1424	49.44	170	5.90
Oct-23		2976	791	227	85	1103	37.06	77	2.59
Nov-23		2880	947	125	30	1102	38.26	30	1.04
Dec-23		2976	1036	324	1	1361	45.73	0	0.00
Jan-24		2976	958	226	14	1198	40.26	12	0.40
Feb-24		2784	797	171	12	980	35.20	10	0.36
Mar-24		2976	592	564	910	2066	69.42	873	29.33
<b>TOTAL</b>		<b>35136</b>	<b>10028</b>	<b>4160</b>	<b>4093</b>	<b>18281</b>	<b>52.03</b>	<b>4028</b>	<b>11.46</b>

2. The wind deviation with respect to its intra-day forecasted schedule, the deviation above 250MW is observed in 17068 blocks out of 35136 blocks w.r.t schedule and same shown in table below; However, as per Regulatory provision, the deviation Forecasting Error (WIND) beyond 15% w.r.t Available capacity (AVC), out of total 35-time blocks in a month (2023-24), the error for after intra-day forecast of wind is more than 15% in 1080-time blocks only [ No of blocks with Deviation beyond 15% is 3.07% only]. The table produced hereunder indicates the same:



3. The solar deviation with respect to its day ahead forecasted schedule, the deviation above 250MW is noticed in 10917 blocks out of 17223-time blocks-solar period w.r.t forecasted schedule. However, as per Regulatory provision, the deviation Forecasting Error (SOLAR) beyond 15% w.r.t Available capacity (AVC), out of total 17223-time blocks-solar period in a month (2023-24), the error for day ahead forecast of solar is more than 15% in 2261-time blocks only [ No of blocks with Deviation beyond 15% is 13.13% only] and same is shown in below table:

WIND	INTRA DAY	NO OF BLOCKS WITH DEVIATION w.r.t SCHEDULE						TOTAL	NO OF BLOCKS WITH DEVIATION BEYOND 15% w.r.t AVC
		NO OF DEVIATION 250-500MW	DEVIATION 500-750MW	DEVIATION >750MW	TOTAL DEVIATION >250MW	% OF DEVIATION	NO OF BLOCKS		
Apr-23	2880	1473	111	1	1585	55.03	2	0.07	
May-23	2976	1390	57	1	1448	48.66	1	0.03	
Jun-23	2880	944	243	26	1213	42.12	26	0.90	
Jul-23	2976	1341	592	119	2052	68.95	107	3.60	
Aug-23	2976	1104	190	24	1318	44.29	18	0.60	
Sep-23	2880	410	498	890	1798	62.43	925	32.12	
Oct-23	2976	1303	8	0	1311	44.05	0	0.00	
Nov-23	2880	1114	17	0	1131	39.27	0	0.00	
Dec-23	2976	1104	18	1	1123	37.74	0	0.00	
Jan-24	2976	1518	27	0	1545	51.92	0	0.00	
Feb-24	2784	1070	66	0	1136	40.80	0	0.00	
Mar-24	2976	1374	32	2	1408	47.31	1	0.03	
<b>TOTAL</b>	<b>35136</b>	<b>14145</b>	<b>1859</b>	<b>1064</b>	<b>17068</b>	<b>48.58</b>	<b>1080</b>	<b>3.07</b>	

4. The Solar deviation with respect to its intra-day forecasted schedule, the deviation above 250MW is observed in 11372 blocks out of 17233 blocks-solar period w.r.t forecasted schedule; However, as per Regulatory provision, the deviation Forecasting Error (SOLAR) beyond 15% w.r.t Available capacity (AVC), out of total 17233-time blocks-solar period in a month (2023-24), the error for after intra-day forecast of solar is more than 15% in 1147-time blocks only [ No of blocks with Deviation beyond 15% is 6.66% only] and same is shown in below table:

SOLAR	DAYAHEAD	NO OF BLOCKS WITH DEVIATION w.r.t SCHEDULE					AVC	
		NO OF BLOCKS	% OF DEVIATION	NO OF BLOCKS	% OF DEVIATION	NO OF BLOCKS	% OF DEVIATION	
MONTH	NO OF BLOCKS	DEVIATION 250-500MW	DEVIATION 500-750MW	DEVIATION N>750MW	TOTAL DEVIATION >250MW	% OF DEVIATION	NO OF BLOCKS	% OF DEVIATION
Apr-23	1410	358	366	231	955	67.73	176	12.48
May-23	1460	458	373	129	960	65.75	85	5.82
Jun-23	1410	327	275	343	945	67.02	265	18.79
Jul-23	1460	317	244	235	796	54.52	163	11.16
Aug-23	1460	400	246	104	750	51.37	43	2.95
Sep-23	1410	297	251	333	881	62.48	270	19.15
Oct-23	1460	582	231	236	1049	71.85	172	11.78
Nov-23	1410	249	263	568	1080	76.60	430	30.50
Dec-23	1460	336	304	455	1095	75.00	341	23.36
Jan-24	1460	312	320	419	1051	71.99	275	18.84
Feb-24	1363	413	267	60	740	54.29	32	2.35
Mar-24	1460	460	141	14	615	42.12	9	0.62
TOTAL	17223	4509	3281	3127	10917	63.39	2261	13.13

**Note:** The provisions in the prevailing DSM regulations enables the RE generators without any commercial impact on their large scale error in forecasted schedule which in turn is impacting on the real time grid operation.

SOLAR	INTRA DAY	NO OF BLOCKS WITH DEVIATION w.r.t SCHEDULE						NO OF BLOCKS WITH DEVIATION BEYOND 15% w.r.t AVC	
		MONTH	NO OF BLOCKS	DEVIATION 250-500MW	DEVIATION 500-750MW	DEVIATION >750MW	TOTAL DEVIATION >250MW	% OF DEVIATION	NO OF BLOCKS
Apr-23	1410	253	541	278	1072	76.03	180	12.77	
May-23	1460	391	531	166	1088	74.52	82	5.62	
Jun-23	1410	338	478	197	1013	71.84	135	9.57	
Jul-23	1460	379	391	89	859	58.84	34	2.33	
Aug-23	1460	430	303	58	791	54.18	21	1.44	
Sep-23	1410	535	217	44	796	56.45	30	2.13	
Oct-23	1460	485	348	192	1025	70.21	117	8.01	
Nov-23	1410	255	374	323	952	67.52	195	13.83	
Dec-23	1460	326	372	341	1039	71.16	178	12.19	
Jan-24	1460	308	384	378	1070	73.29	169	11.58	
Feb-24	1363	522	137	16	675	49.52	2	0.15	
Mar-24	1460	611	336	45	992	67.95	4	0.27	
TOTAL	17223	4833	4412	2127	11372	66.03	1147	6.66	