Ref: MAL/DEL/____/2025 **Dated- 17.10.2025**

To,
The Secretary,
Central Electricity Regulatory Commission
6th, 7th & 8th Floor, Tower B,
World Trade Centre, Nauroji Nagar,
New Delhi-110029

SUB:- **COMMENTS FROM MANIKARAN ANALYTICS LIMITED AGAINST PETITION NO.9/SM/2025 (SUO MOTU) & CERC DRAFT PROPOSAL DATED 10.09.2025**

Respected Sir,

We, Manikaran Analytics Limited, are engaged in providing the services of Forecasting, Scheduling and Deviation Settlement Mechanism in various states and are acting as a QCA for major renewable energy generators including both wind and solar, all across the country. Accordingly, we have few comments against the Petition No.9/SM/2025 (Su-Motu) & CERC Draft Proposal dated 10.09.2025 regarding determination of value of "X" for computation of the deviation (in %) for Wind and Solar (WS) Sellers from 01.04.2026 onwards under the provisions of the Central Electricity Regulatory Commission (Deviation Settlement Mechanism and Related Matters) Regulations, 2024.

This is in reference to the above cited subject and we as a concerned party and a stake holder have few comments on the Petition. Accordingly, please find the comments on the Petition No.9/SM/2025 (Su-Motu) & CERC Draft Proposal dated 10.09.2025.

We shall be grateful if this Hon'ble Commission considers our succinctly drafted comments in this regards and the same are attached herewith for your perusal.

Thanking you,
For and behalf of Manikaran Analytics Limited,

Regards

MANIKARAN ANALYTICS LIMITED

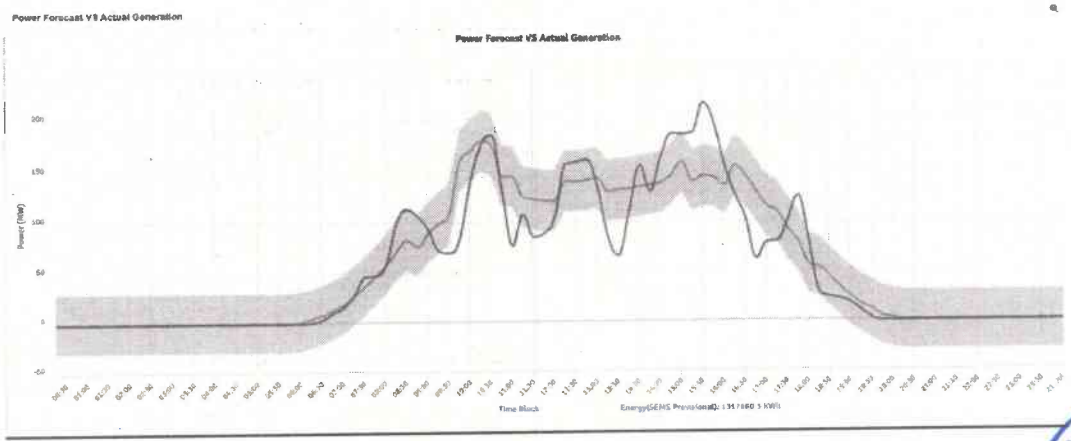
Dtd:17/10/2025

Comments from Manikaran Analytics Limited against Petition No. 9/ SM/2025 (Suo-Motu) & CERC Draft proposal dated 10.09.2025 regarding determination of value of "X" for computation of the deviation (in %) for Wind and Solar (WS) Sellers from 01.04.2026 onwards under the provisions of the Central Electricity Regulatory Commission (Deviation Settlement Mechanism and Related Matters) Regulations, 2024- Regarding.

1. As per Clause (4) of Regulation 8 of the DSM Regulations, 2024 the Revenue neutral band for Solar/Hybrid is reducing for 10% to 5% and Wind from 15% to 10%(Para 2):

Comment: The 50% Solar exemption band reduction from 10% to 5% from April 2026 is too stringent especially when the solar generation varies widely due to passing cloud predominant around monsoon season spread across 4 to 6 months of the year, the solar power forecasts being a mathematical output based on probability of generation considering various factors never output the zig-zag pattern during such times, at best it can forecast a curve between the intermittent generation and narrowing the band will only increase the DSM liability of the generator but will not translate to better forecasts or more grid discipline. Similarly, the Wind speed varies widely especially during the transition months spread across 4 to 5 months, the average wind speed is derived from weather and forecasted into 15 min interval, reduction of band by 5% is too steep in a given year,

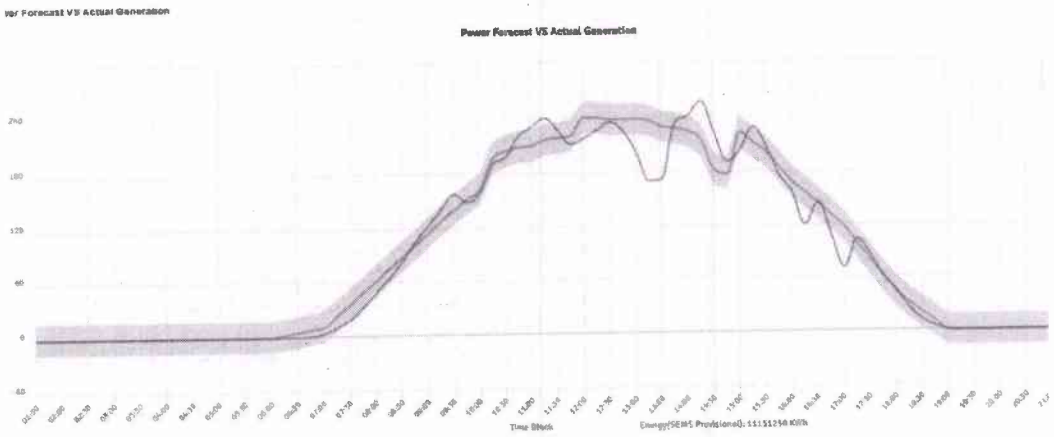
In the following illustration the green band denotes revenue neutral band of 10% around the blue schedule line, red is the generation, reducing it to 5% will mean push more energy to 100% revenue impact zone.



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In the following illustration the green band represents revenue neutral band of 7% around the blue schedule line, red is the generation, despite a very good forecast several part of generation went outside of revenue neutral band,



Suggestion: Considering the natural intermittency of solar generation, reduction of band to 5% will lead to loss of revenue, we suggest commission to only reduce it to 7.5%. we suggest reduction by 2.5% only. The 100% revenue loss band is requested to keep as it is.

WS Seller	Volume Limit (for the period from 01.04.2026 onwards)	Suggested bands for 01.04.2026 onwards	Revenue Impact
A generating station based on solar or a hybrid of wind–solar resources	Deviation up to 5%	Deviation up to 7.5%	No impact
	Deviation beyond 5% up to 10%	Deviation beyond 7.5% up to 15%	10% of revenue impact on deviated energy
	Deviation beyond 10%	Deviation beyond 15% (same as present regulation)	100% of revenue impact on deviated Energy
A generating station based on wind resource	Deviation up to 10%	Deviation up to 12.5%	No impact
	Deviation beyond 10% up to 15%	Deviation beyond 12.5% up to 20%	10% of revenue impact on deviated energy
	Deviation beyond 15%	Deviation beyond 20% (same as present regulation)	100% of revenue impact on deviated Energy



2. Revenue impact due to change of DSM bandwidths & Scheduling modalities (Para 6,9,10 & 11):

Comment: The CERC DSM regulation, has been changing widely over the years leading to following major changes:

a. **From Dec 2023:** For Solar the exemption band reduced by 5%, though it looks like only1/3rd reduction in band size but the % of time the deviation remained within the exemption band came from 88% to 97% to 74% to 93% (latter as per the study mentioned in the draft proposal)

b. **From 1st Oct 2023:**The implementation time for intra-day revised schedule was increased from 4th TB to 7th/8th TB which is the major blow as any revisions now cannot leverage the forecast continuity of present real-time conditions i.e. eliminating the nowcast. For intra-day weather variations picked up by forecasting software is limited by the time the schedule gets implemented almost 1.5hrs ahead, by that time the conditions would have changed or reversed. This alone has been contributor to sudden deviations.

c. **From 16th Sep 2024:** The under-injection beyond -10% for Solar and -15% for Wind attracted 200% payable.

All the above drastically increased the revenue loss impact for the generators that was in the range of 0.2% to 0.4 % for Solar and 0.4% to 0.65% for Wind before 2023 has increased to 1.5% to 2% annually for Solar and 1.8% for 2.5% for Wind. Generators had not accounted for such revenue losses at time of their bidding.

With further reduction of band to ±5% to Solar and ±10% Wind even keeping X=100% the impact of the study (by CERC) is reducing the band by half.

RE Generating Stations	Tolerance band	%Time Within Band	Tolerance Band	%Time Within Band
Solar	+/-10%	74% – 84%	+/-5%	45% – 58%
Wind	+/-15%	73% – 93%	+/-10%	32% – 73%
Hybrid	+/-10%	72% – 87%	+/-5%	38% – 47%

Merely reducing the bands, will not translate to better forecasting accuracy, we have to understand that there are inherent regional factors (further highlighted below) that comes as challenges in order to improve the forecasting accuracy.



As a major forecasting and scheduling company, we are employing leading statistical and regression models, working on advance AI/ML simulations but what is limiting substantial improvement expected by the generators as there is almost no improvement observed either in Indian or International weather sources which are not able to improve and give time and regional granularity required.

3. <u>The challenges in the weather forecasting where major improvement required are highlighted in the following article/publications which unless overcome, tightening the regulation alone will not strengthen the grid: (Para 7,9,21)</u>

a. **India moves to sharpen weather forecasting amid renewable energy push By Sethuraman N R August 22, 2025, 2:36 PM GMT+5:30Updated August 22, 2025**

NEW DELHI, 22 Aug 2025 (Reuters) - India is working to significantly improve the accuracy of its weather forecasting systems to meet the growing demands of its renewable energy sector, a senior government official of Central Electricity Authority Chair Ghanshyam Prasad said at a Bloomberg NEF Summit on green energy – "With solar and wind energy generation highly dependent on local weather conditions, the country is finding traditional broad-scale forecasts — such as state-wide or regional predictions — no longer sufficient. Currently, India's forecast resolution - the precision of weather predictions over small time intervals or areas - does not match 15-minute operating cycles of the power grid."

https://www.reuters.com/sustainability/boards-policy-regulation/india-moves-sharpen-weather-forecasting-amid-renewable-energy-push-2025-08-22/

b. **International vs India scenario** *International Journal of Energy and Environmental Engineering*:

Most of the advanced countries have TSO's (Transmission System Operator) for the purpose of coordinating the operation of VRE (Variable Renewable Energy) generators with the operation of other generators, transmission, and distribution system.

In India, REMC was conceptualized due to the need of an entity that would be able to generate control area-level aggregate VRE generation forecast in order to assist LDCs in calculating net load forecasts and managing grid security, which is quite different from the site-specific forecasts mandated by forecasting and scheduling regulations for scheduling and accounting.



For site specific forecasts: "there is a need for **benchmarking the different forecasting methods in Indian conditions.** Interesting insights could be revealed through the benchmarking exercise, e.g. **a typical meteorological condition related to convective clouds prevalent in India is its quick formation and dissolution**. This is different from common weather situations in mid-latitudes where there is a mostly advective nature of cloud motion."

"Today, there is still a lack of scientific experience in performing solar power forecasting for different spatio-temporal scales in India. Robust infrastructure for VRE forecasting will assist the Indian Government in achieving its RE targets."

c. **Ranjan, R., & Karmakar, S. (2024). Compound hazard mapping for tropical cyclone-induced concurrent wind and rainfall extremes over India.** ***npj Natural Hazards*****, 4(1).** https://www.nature.com/articles/s44304-024-00013-y

India is the worst affected region in the world by tropical cyclones (TCs).

The proportion of intense **tropical cyclones** (TCs) (category 4–5) and **peak wind speeds** of the most intense **TCs are projected to increase at the global scale** with **increasing global warming** (high confidence), according to the IPCC AR6 report. While the AR6 report does not explicitly address changes in the frequency of cyclones for the Indian Ocean region, studies suggest an increase in heavy precipitation associated with TCs in this region.

Additionally, Murakami et al. and Murakami and Wang projected an increase in the frequency of very severe cyclonic storms over the Arabian Sea and the Bay of Bengal by the end of the 21st century under a high-emissions scenario.

d. **IPCC SIXTH ASSESSMENT REPORT (AR6) "CLIMATE CHANGE 2023"**

Human activities, principally through emissions of greenhouse gases, have unequivocally caused global warming, with global surface temperature reaching 1.1°C above 1850-1900 in 2011-2020. Global greenhouse gas emissions have continued to increase over 2010-2019, with unequal historical and ongoing contributions arising from unsustainable energy use, land use and land-use change, lifestyles and patterns of consumption and production across regions, between and within countries, and between individuals (high confidence). Human-caused climate change is already affecting many weather and climate extremes in every region across the globe. This has led to widespread adverse impacts on food and water security, human health and on economies and society and related losses and



damages to nature and people (high confidence). Vulnerable communities who have historically contributed the least to current climate change are disproportionately affected (high confidence).

Future warming will be driven by future emissions and will affect all major climate system components, with every region experiencing multiple and co-occurring changes. Many climate-related risks are assessed to be higher than in previous assessments, and projected long-term impacts are up to multiple times higher than currently observed. Multiple climatic and non-climatic risks will interact, resulting in compounding and cascading risks across sectors and regions. Sea level rise, as well as other irreversible changes, will continue for thousands of years, at rates depending on future emissions. (high confidence)

Climate change is altering the meteorology that drives solar, wind and hydro generation in India (changes in mean winds, cloudiness/solar radiation, monsoon timing and extremes). That makes historical relationships less reliable, increases forecast uncertainty (especially at seasonal-to-sub seasonal and intraseasonal timescales), and raises both operational and revenue risk for renewables.

e. Climate Change Impact Assessment **for Future Wind and Solar Energy Installations** in India: Frontiers in Energy Research 2022

Solar and wind assets are climate-dependent and changes in climate will result in variations in their generation and intermittency. Developers of solar and wind parks in India have observed changes in climate conditions and variability in solar irradiation and wind profiles at the seasonal and year-to-year timescales. Future climate change perturbations, including monsoon shifts, could lead to lower-than-predicted wind and solar energy production and affect the economics of solar and wind assets.

Climate change makes the Indian monsoon season more chaotic and impacts its predictability, which could be dramatic for resource planning and **energy production scheduling**. Seasonal monsoons play a crucial role in determining the local climate in India and are also impacted by climate change.

India today 23 Sept 2025 - Lack of Data to predict accurately through the Numerical Weather Model

The weather prediction models massively depend on the data gathered by highly specialized kinds of equipment. Different tools like Doppler radars, satellite data, Radiosondes, surface observation centers, computing tools, and advanced weather processing systems are needed to predict and forecast weather



developments. Although India has added capacity in a few of these areas, it is lagging by a distance from the advanced countries in Europe and America.

Speaking to India Today, IMD Director General Mrutyunjay Mohapatra claimed that there are only 34 radars present in the country as of now. The number has increased by just 6 in the last 5 years. At the same time, the United States of America (USA) does a weather prediction with almost 200 doppler radars. According to the official website of the National Oceanic and Atmospheric Administration (NOAA), the USA has 159 doppler radars across its area.

Himawari (Japan) and INSAT (India) comparison:

Satellite cadence: INSAT-3DR provides critical geostationary imagery/products but many operational products are released at ~15–30 minute cadence or longer for some products, whereas modern rapid-scan imagers (e.g., Himawari AHI) can provide 2.5–10 minute rapid scan capability that improves cloud-motion nowcast skill for rapidly developing convection.

Comment: The conclusion of the above are as follows:

a. The current weather forecast doesn't align with the 15 min operational cycles of the grid which and F&S provider is expected to do.
b. In India convective cloud formation is typical meteorological condition which leads to quick formation and dissolution and not possible to forecast schedule within the implementation window.
c. Climate change is altering the meteorology that makes historical relationships less reliable, increases forecast uncertainty (especially at seasonal-to-sub seasonal and intraseasonal timescales), and raises both operational and revenue risk for renewables. It's also making Indian monsoon season more chaotic and impacts its predictability, for e.g. this year witnessed extended monsoon season which lead to high number of cloudy days that impacted solar resource and overall revenue realization of Solar generators.
d. Lack of highly specialized kinds of equipment like Doppler radars, satellite data, Radiosondes, surface observation centers, computing tools, and advanced weather processing systems which impacts the quality of Numerical Weather Model.
e. The satellite data scans are currently too much delayed to predict the site impact several hours ahead that too within 15 min accuracy.



4. CERC's intention to **strengthen grid discipline** through tighter DSM bands can significantly enhance system security as India integrates large shares of renewable energy generation. However, the **physical and observational realities** of the Indian subcontinent, which include diversified physical **topography**, very **vulnerable monsoon/climate systems**, strong seasonal convection, aerosol/fog regimes, and **cyclone-driven ramps**, create frequent sub-hourly errors that are not yet uniformly controlled across the country.

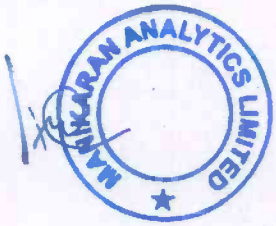
Challenges of **Global warming** and their subsequent impacts, like **La Niña - Cooling of sea surface temperatures** in the central and eastern Pacific Ocean; Strengthening of the trade winds & **El Niño - Warming of sea surface temperatures** in the central and eastern Pacific Ocean; and Weakening of the trade winds, not only affecting the winds but also the cloud patterns.

Furthermore, the infrastructural facilities are also a challenging part, where the physical and climatic conditions demand massive support, but in comparison to Western countries, we are way behind in terms of weather observatories, radars, and satellites.

In view of the above, it is imperative to apply such a regulation, which seems to be a catastrophic decision for grid balancing. The regulations should be aligned with the weather observatories and Global & Indian weather conditions. Till the time the weather forecast improvements are not observed, reducing the band and changing the denominator from AvC towards schedule will be double whammy only increasing the pain of the RE generators and will not translate into better grid security or discipline.

While the Commission has acknowledged advancements in technology and the availability of real-time weather data, it is important to note that, in practice, the accuracy of weather forecast inputs used for scheduling of wind and solar generation has **not shown significant improvement over the years**. The existing forecasting models continue to exhibit **high spatial and temporal variability**, particularly in predicting cloud movement and wind speed at project locations. Reliable site-level weather data is still limited. This results in persistent forecasting errors despite access to broader meteorological datasets. Therefore, the assumption that improved prediction capability will automatically reduce deviation margins may not fully align with the ground realities faced by RE developers and forecast service providers.

Suggestion: We **pray to the Commission to allow the value of *X%* to remain at 100% for at least the next 5 years**, or until demonstrable improvement is achieved in weather forecast inputs, spatial and temporal resolution, and site-level data quality. Then gradually decrease the value by 10% every two years to see the impact but limit to 50%, remaining 50% will be schedule, the reason is RE is never controllable source of Generation and hence it will not be prudent to make it par with general seller. Reducing X will only over



burden the REGs to the point of making the project unviable but it will not translate to better grid-discipline or more accuracy.

Furthermore, even if X value is reduced further, it should be done for projects that were bid after finalization of draft say after 2026 where BESS is integral part of the project and accounted for in the tariff bided.

5. Challenges of Aggregation with Decreasing Value of X (Para 17-18)

Our study suggests that as the value of *X* decreases as proposed with decrease in the permissible deviation or tolerance band from 01.04.2026, several practical and systemic challenges emerge that may undermine the effectiveness of aggregation:

a. Reduced benefit of portfolio diversity:
   Aggregation allows offsetting of deviations among multiple RE projects. A lower X value narrows the tolerance margin, diminishing the smoothing effect of diversity in wind and solar generation patterns.
b. Increased frequency of deviations and penalties:
   With tighter deviation limits, even minor forecasting or scheduling mismatches across projects lead to higher penalties for deviation, eroding commercial viability thus impacting revenue realization for the RE projects.
c. Risk of disincentivizing aggregation participation:
   As commercial risks increase with tighter limits, fewer generators may opt for aggregation, defeating its purpose of collective forecasting improvement and grid stability.



Reduction in benefit of aggregation with reduction of "X" (Example on 1 year data of Southern Wind ISTS projects)

6. The trajectory of "X" (Para 22)

Comment: The proposed sharp reduction of "X" from 100% in 2026 to 0% in 2031 is very aggressive, especially for wind projects, which face higher forecasting uncertainty. The simulation results (Table in Para

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15–16) clearly show that wind projects could lose up to 48% of revenue under X=0, which would make many projects unviable even after aggregation.

Suggestion: As the exemption bands are reducing from 01.04.2026, we suggest observing the performance of forecasting accuracy over 5 years period where the value of X is maintained at 100% and then gradually reduce to X by 10% every two years so that it gives enough time to increase the weather forecasting and wind/solar power forecasting. This ensures financial sustainability while still pushing for improved forecasting.

7. New vs. Existing Projects (Para 24, 25(a),(b))

Comment: While the Commission's intent to align the operational discipline of wind and solar generators with that of conventional generators is well appreciated, several practical challenges remain:

a. **Forecasting accuracy limitations:**
   Weather-based generation forecasting continues to face high uncertainty due to inadequate spatial and temporal resolution of meteorological inputs and the absence of reliable, site-level data.
b. **Lack of advanced forecasting infrastructure:**
   The supporting ecosystem—high-resolution weather models, localized sensors, and real-time data-sharing platforms—has not matured sufficiently to ensure consistent scheduling accuracy.
c. **Data and telemetry constraints:**
   Many wind and solar projects lack real-time SCADA connectivity and robust data integration with SLDCs, hampering precise scheduling and revision capabilities.
d. **Operational flexibility differences:**
   Unlike thermal plants, RE generators have no control over fuel input (sun/wind), making it inherently difficult to demonstrate the same level of dispatch compliance.
e. **Regulatory and penalty asymmetry:**
   Applying deviation or compliance frameworks designed for controllable generators to variable RE may lead to unintended commercial penalties, discouraging participation.

Justification: Existing PPAs were signed on assumptions of DSM regimes with wider tolerance. A sudden tightening will lead to regulatory uncertainty and financial distress, potentially discouraging further RE investment. Transitional protection is key for investor confidence.

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