adani
Renewables

Date: 17.10.2025

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

Sub: Submission of comments and suggestions draft proposal to determine the 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.

Ref: Draft Notification ref. No. L-1/260/2021/CERC Dated: 10.09.2025

Dear Sir,

On behalf of 'Adani Green Energy Ltd (AGEL), we hereby submit our comments & suggestion on the draft proposal to determine the 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 Deviation Settlement Mechanism and Related Matters) Regulations, 2024. Same is enclosed herewith as **Annexure-A,** for your kind consideration while finalizing the aforesaid regulation.

Thanking you,

Yours faithfully,
For & Behalf of Adani Green Energy Limited

Ravi Sinha
Deputy General Manager- Regulatory Affairs

Encl. As above.

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AGEL's Comments on CERC Draft Order 9/SM/2025 (Suo-Motu) dated 10.09.2025

Determination of value of "X" for computation of the deviation (in %) for Wind and Solar Generators

India's present capacity of Wind and Solar generation sources is ~171 GW and accounts for 35% of the total installed capacity of 490 GW. Government of India has already committed to achieving 500 GW of non-fossil fuel-based electricity generation capacity by 2030. In alignment with this goal various policies, rules, regulations and orders are required to be introduced with an objective to promote renewable energy (RE) generation.

However, the draft CERC proposal dated 10th September 2025 for determination of "X" factor along with the previously notified DSM framework, further treating RE plant at par with general seller and linking DSM with frequency, imposes significant challenges for RE generators. These provisions could result in substantial financial burden for RE developers, potentially undermining project viability at current tariffs and deterring future investments in the RE sector.

In the draft proposal, CERC has noted that since forecasting and scheduling framework for WS sellers has been in place since 2017, it expected that based on the experience gained over the last 8 year there would be an improvement in forecasting techniques which could be deployed in the larger interest of grid security.

However, CERC has not specified or provided any valid data in the proposal to show that such forecasting improvement has actually taken place over the last 8 years.

By equating, WS seller with General seller CERC has ignored the fact that the generation output is largely within control of General seller which is not in the case of WS seller. Conventional sources can control their generation depending on the market and grid condition by controlling the fuel input. Whereas the generation output from WS seller is dependent on nature and no operation cost is associated with the WS generation. Therefore, WS seller resorting to varying generation depending on market condition has not arisen. It is mainly for this reason, Wind / Solar / Hybrid projects are given "Must Run" power plant status by Ministry of Power. The proposed regulation is in a way taking away the "Must Run" status for WS seller and thus is not consistent with MoP Rules. There are enough evidences making it clear that the forecasting techniques have not improved at a level required and much needs to be done in that aspect.

Under this circumstance, the proposal to decrease the band from 10% to 5% for Solar / Hybrid plants and 15% to 10% for Wind plants, without ascertaining that whether the expected improvement in forecasting techniques have really being in place, is not in the interest of end consumer as it will deprive them of cheaper and clean power at cost as low as Rs.2.15 / kWh discovered in recent bids as against more than Rs.4.00 / kWh fixed cost alone of coal based generation sources. Even in situations of technical constrain (Grid Frequency > 50.05 Hz), it is necessary to first regulate costlier conventional source before asking no cost RE sources to curtail output.

There are ample provisions in various Rules and Regulations specified under the Electricity Act to regulate even the RE resources whenever a situation arises for grid security. Instead of finding the technical solutions, curtailing no cost RE generation is not a wise and economical principle. It basically goes against the mandate under the Electricity Act of promoting RE sources. We therefore strongly object to the proposed amendment and humbly request the Hon'ble Commission to review the proposal and defer its implementation till proven forecasting techniques are in place.

In the above context, Key concerns regarding the implementation of the Draft proposal for determination of "X" under DSM Framework for RE Generators are as follows:

1. **Operational Challenges for RE Generators**:

   The key elements of the draft proposal include:
   - Reduction of the tolerance band for deviations:
     - For solar and wind-solar hybrid generators: from ±10% to ±5%.
     - For wind generators: from ±15% to ±10%.
   - Phased reduction of the "X" factor used in deviation calculations:
     - From 100% (Available Capacity) in 2026 to 0% (Scheduled Generation) by 2031

   The draft proposes to treat RE generators deviations at par with conventional generators from April 2031 onwards i.e. linking of DSM charges with grid frequency and market rate. This approach is not consistent with the operational realities of RE plants. Unlike conventional (thermal) plants, RE generation is entirely dependent on weather conditions, which are inherently unpredictable due to immature forecasting technologies and dynamic weather patterns. Renewable energy sources like solar and wind are inherently variable and weather-dependent, making their generation infirm and intermittent. Unlike thermal power plants, RE generators cannot control output based on demand or grid requirements. Additionally, the variability and unpredictability of RE generation are much higher compared to coal or thermal power. The National Institute of Wind Energy (NIWE) and MNRE have acknowledged the site-specific and intermittent nature of wind energy. Over 900 wind monitoring stations have been installed, but even with extensive mapping, forecasting remains a challenge due to micro-climatic variations, sudden weather changes, limited predictive capability of existing models. The operational behavior and control mechanisms for RE plants are distinct from those of thermal technologies.

   Therefore, it is not appropriate or viable to apply such measures to RE plants deviations treating them at par with general sellers. Therefore, this Hon'ble Commission is requested to reconsider the said proposal in view of the unique characteristics of RE generation while finalizing the Regulations.

2. **Imposing "X" Factor and no revenue for over injection at grid frequency > 50.05 Kz:**

   The proposed trajectory for reducing the "X" factor appears to be based on the analysis of data retrieved from simulation studies conducted by Grid-India and operational experience of Renewable Energy Management Centers (REMCs). The data presented in

the draft proposal clearly shows that reducing deviation bands and introducing the "X" factor in the denominator of the deviation formula, will decrease the probability of RE generators to remain within the revenue-neutral deviation band. In other words, it would certainly result in higher DSM charges as most of the time it will remain outside the window of revenue neutral band and would further lead to impact negatively the cashflow/revenue of RE generators.

In practice, the reduction in deviation band combined with the new denominator ("X" factor) does not support normalization of deviations owing to the fact that current limitations in weather forecasting technologies. Current forecasting technologies despite ongoing advancements are not yet capable of consistently achieving the accuracy required under the DSM regulations. This is due to the inherent unpredictability of weather conditions and the limited availability of high-resolution meteorological data, particularly at RE sites. Even globally, forecasting tools have not matured to a level that ensures compliance with such stringent norms. Moreover, aligning operational practices alone is insufficient even with improved tools and effective adaptation will require time, investment, and detailed analysis. Without accounting for these limitations, the proposed framework risks penalizing RE developers for deviations that are technologically unavoidable.

Furthermore, in cases of over-injection when grid frequency exceeds 50.05 Hz, generation from RE are subject to total revenue loss. This is contrary to the basic commodity exchange principle as the injected power is consumed and paid for by consumers/DISCOMs, yet no revenue is allowed to be realized by the generators. This creates an additional financial burden on RE generators for the reasons beyond their control.

In summary, the proposed changes do not account for the unique operational challenges faced by RE generators.

3. **Implications of High DSM Penalties on Forecasting and Tariff Structures:**

Stringent DSM Regulation, treatment of RE generation at par with Thermal plant and high DSM penalty are unlikely to yield significant improvements in forecasting accuracy for renewable energy (RE) generators with current limitations. Developers are already leveraging the most advanced forecasting technologies available both domestically and globally, including AI-driven models and satellite-based systems. However, forecasting for solar and wind generation remains inherently limited by unpredictable weather patterns and infrastructural constraints such as sparse weather stations and inconsistent real-time data.

Excessive penalties do not incentivize better performance beyond what is technologically feasible; instead, they introduce financial strain on developers, who may be compelled to factor these penalties into their tariff proposals. This cost escalation will ultimately be passed on to consumers, undermining the affordability of renewable energy. DSM regulations should therefore serve as instruments to promote grid discipline and reliability, not as mechanisms for revenue generation through punitive charges. A balanced regulatory approach that acknowledges operational realities while encouraging continuous improvement is essential for a sustainable growth of renewable energy capacity in the country.

4. **Major limitations/Challenges on Forecasting of RE plants:**

Renewable energy (RE) generation, particularly from solar and wind sources, is inherently dependent on local weather conditions and can vary significantly from site to site. Factors such as solar irradiance, wind speed and direction, temperature, humidity, and cloud cover directly influence the output of RE systems. For instance, a solar plant in a desert region will perform differently than one in a coastal or mountainous area due to differences in sunlight availability and atmospheric conditions. Similarly, wind turbines require consistent wind patterns, which can be disrupted by terrain features or seasonal shifts.

The Indian subcontinent's complex geography characterized by a mix of coastal, plain and mountainous regions and bounded by the Himalayas to the north and the ocean to the south creates highly varied physical processes that influence weather across the country. Tropical weather systems are particularly difficult to forecast, especially when it comes to predicting localized phenomena such as thunderstorms, cloud formation and dissipation, fog and sudden changes in wind speed. These rapid developments, common in tropical climates, differ significantly from the more predictable, advective weather patterns found in mid-latitude regions.

- **Impact of Climate Change:** Increasing atmospheric instability due to climate change and global warming has amplified convective activity, resulting in greater departures from established weather patterns and increased uncertainty in forecasts.

- **Limitations of Global Weather Models:** Global Numerical Weather Prediction (NWP) models such as the European Centre for Medium-Range Weather Forecasts (ECMWF) operated by the European Union and the Global Forecast System (GFS), developed by the National Centers for Environmental Prediction (NCEP), USA are among the most widely used forecasting systems worldwide. These models provide global coverage and predict key meteorological parameters including temperature, wind speed, solar irradiation, and precipitation. However, both ECMWF and GFS are primarily optimized for regions like Europe and North America, and their performance in Indian climatic conditions—especially during adverse or rapidly changing weather events—has been found to be suboptimal. Models developed by national weather agencies (IMD, NCMRWF, IITM Pune) are not customized for Renewable energy generation forecasting for every 15 minutes and are far from accuracies as per CERC guidelines.

- **Site/Plant-Level Forecasting Challenges:** ECMWF, GFS & NWP models do not directly report forecasts at specific points. Instead, they generate forecasts on a rectangular grid. Specifically, GFS and ECMWF produce forecasts and interpolate at a more localized level (such as a specific plant location), errors can occur due to spatial discrepancies. Additionally, the model forecasts are available at an hourly resolution. This means that any weather changes occurring within an hour are not captured by the model. For instance, if the sky is clear at 16:00Hrs and 17:00Hrs, but cloud movement occurs between those hours, the model cannot account for it. These discrepancies introduce errors into both weather and energy forecasts, known as temporal errors.

- **Instrumentation Limitations:** While installing weather measuring instruments like Skycam at the farm could enhance forecasts, they are limited to collecting data for 30 mins – 45 mins. Beyond that timeframe, their effectiveness diminishes further.

- **Cloud Movement Uncertainty:** There is no method of predicting the direction of movement of clouds, as at times wind causes the diversion/deviation of clouds from the predicted path at local level. CMV/sky-imager methods improve 0–2 hrs irradiance prediction and can yield modest gains at 2–4 hrs in simple cloud scenes, but correlations with ground winds are only moderate and performance degrades in complex or convective conditions.

- **Insufficient Weather Stations:** There are inadequate number of automatic weather stations and radars which are not aligned with RE intense zones.

- **Limitation of AI & Machine Learning:** AI global weather models (e.g., GraphCast, FourCastNet, Pangu) run fast and can match NWP on many routine cases, but they underperform for many record-breaking extremes and fine-scale hazards; physics-based models remain essential. However, these models are still in the early stages of deployment and have not yet demonstrated consistent reliability for operational use.

- **Regulatory Constraints:** The feasibility of the power forecasts, under the new regulations are crippled both by the bands on which the penalties are imposed and the nature of revisions, by which the minimum update interval is 2 hours. While over injection and under injection may be different mechanisms in the energy ecosystem, they cannot be modelled separately in a numerical weather prediction system. As an example, in the case of forecasting errors caused due to the formation, dissipation or movement of clouds, the same cloud system that might be causing an under injection over one location may be causing an over injection at another location. In India's tropical climate system, convective cloud systems are one of the major drivers of uncertainty of irradiance forecasts. The clouds can form or dissipate within 1.5 / 2 hours, and under the new regulations, the dissipation (which would cause over injection) would be penalized unfairly.

Given these persistent limitations, the continuous tightening of deviation bands and the imposition of the "X" factor, treating RE generators as general sellers without accounting for practical realities results in severe commercial impacts for RE generators as mentioned. We urge the Commission to consider these challenges and adopt a more balanced regulatory approach that reflects the operational realities of renewable energy forecasting in India.

5. Financial Impact of RE Developers and control measure:

Under the current deviation band, which is applicable up to 31.03.2026, RE developers face an average revenue loss of 1%-3% due to deviation penalties. However, with the proposed changes effective from 01.04.2026, this loss could potentially rise multiple times (Approx 6 to 8 time). In addition to DSM charges, several other charges such as RTDA/RTA charges, Congestion charges etc. are already being imposed on RE projects, which also contributes to financial burden, affecting the economic viability of RE projects which are deterrent to the investment to be made in renewable energy sector.

Clause 45(11)(b) of the CERC's IEGC, mandates the aggregation of pooling stations for the purpose of combined scheduling and deviation settlement for wind, solar, or renewable hybrid generating stations. This provision is a critical enabler for improving grid efficiency and reliability, particularly in the context of increasing renewable energy penetration. Aggregation allows multiple renewable energy generators connected to a common or nearby pooling station to be treated as a single entity for scheduling and DSM compliance. This approach helps in smoothing out generation variability, as deviations from individual generators can offset each other, thereby reducing the overall deviation and associated penalties. It also facilitates better forecasting accuracy at the aggregated level and simplifies grid monitoring and control for system operators.

The recent CERC GNA (Third Amendment) regulation have introduced the concept of "Cluster of ISTS Substations" which supports aggregation to combine multiple renewable sources at cluster level. The aggregation of multiple ISTS substations at regional level or multiple PSS level would be beneficial for RE generator to minimize the penalty as well enhance grid stability, security and ease of grid monitoring by grid operator. Currently aggregation for DSM has been allowed for entities connected to single ISTS substation and has stabilized. We urge the Commission to allow multiple ISTS substation aggregation and stabilize same before implementation of the proposal.

6. Use of BESS for Grid Management and Renewable Integration:

BESS offers a flexible and scalable tool to address these challenges by enabling energy time-shifting, frequency regulation, voltage support, and reactive power compensation. Pilot projects in India, such as those led by POWERGRID under the Greening the Grid (GTG) initiative, have demonstrated the effectiveness of BESS in supporting grid operations. These systems have been deployed for applications such as RE firming, load following, and dynamic frequency response, showcasing their potential to stabilize grid fluctuations and reduce curtailment of clean energy.

Globally, countries like the United Kingdom and Australia have implemented regulatory incentives to accelerate the deployment of energy storage. The UK's Long Duration Electricity Storage (LDES) Investment Scheme, backed by Ofgem, provides a cap-and-floor revenue model to de-risk investments and unlock billions in funding for storage infrastructure. Similarly, Australia's Powering Australia Plan and Renewable Energy Transformation Agreements (RETAs) offer targeted funding and long-term contracts to support large-scale solar and storage projects.

Despite policy efforts such as VGF and transmission charge waivers to promote BESS, the deployment of operational storage projects specifically designed for grid support and participation in ancillary services markets remains limited in India. Most BESS installations are either in pilot stages or focused on commercial arbitrage, rather than providing primary, secondary, or tertiary grid services such as frequency regulation, ramping support, or deviation mitigation. The use of BESS for DSM compliance is particularly

underutilized, even though it offers a technically viable solution to manage the variability of RE generation. BESS can absorb excess generation during peak RE output and discharge during shortfalls, thereby reducing deviations and enhancing grid reliability.

In light of above stated challenges, we request the Hon'ble Commission to acknowledge these limitations and to ensure that the DSM framework remains fair and reflective of ground realities for RE generators. We urge the Hon'ble Commission to reconsider the proposed provisions and adopt a more balanced approach that supports the growth of renewable energy while maintaining grid discipline.

We hereby submit following comments and suggestions on the proposed draft regulations for consideration of the Hon'ble Commission:

- **The trajectory for reduction of "X" for Existing Projects (WS Sellers):**

  The draft proposal suggests a phased reduction of the "X" factor from 100% to 0% for existing WS Sellers between 01.04.2026 and 01.04.2031. This approach requires reconsideration, taking into account the practical challenges faced by RE plants, particularly in forecasting accuracy and the dynamic nature of weather conditions as highlighted above.

  Additionally, the draft proposal references a simulation study of 16 regional RE generators over 41 weeks, which indicates a significant decline in forecasting accuracy and increased impact on revenue loss of RE generators as the "X" factor is reduced from 100% to 0%. Specifically, the impact on revene loss increased from 4.6% to 8.5% for solar plant (nearly double), 4% to 18.3% for wind plant (over fourfold), and 4.6% to 11.1% for hybrid (nearly three times) demonstrating a substantial increase. We have also conducted a simulation across pan-India level for RE plants under aggregation and the findings show that with a 5% reduction band and the transition from X=100% to X=0%, increases the DSM impact on RE generators by 6 to 8 times compared to existing DSM regulation.

  Reduction of the deviation band to 5% w.e.f. 01.04.2026 along with the "X" factor will disproportionately penalize RE generators. The proposed order itself acknowledges that forecasting accuracy deteriorates with a reduced deviation band. As previously stated, current technological limitations hinder the achievement of the desired forecasting accuracy. Thus, reducing the band and introducing the "X" factor will penalize RE generators rather than support grid stability through improved forecasting. The changes in deviation band analyzed by us for month of April-25 (Summer) and July-25 (Monsoon) shows significant impact.

- **No penalty Band:**

Apr-25		
RE Generator	As per CERC DSM Regulation 2024 up to 31.03.2026 (± 10% for Solar/Hybrid & ± 15% for wind)	As per CERC DSM Regulation 2024 w.e.f 01.04.2026 ((± 05% for Solar/Hybrid & ± 10% for wind)
Hybrid	77.99%	42.64%
Solar	93.53%	76.84%
Wind	72.68%	60.46%

July-25		
RE Generator	As per CERC DSM Regulation 2024 up to 31.03.2026 (± 10% for Solar/hybrid & ± 15% for wind)	As per CERC DSM Regulation 2024 w.e.f 01.04.2026 ((± 05% for Solar/Hybrid & ± 10% for wind)
Hybrid	71.77%	43.15%
Solar	68.73%	50.43%
Wind	71.84%	57.17%

- **Maximum Penalty Band:**

Apr-25		
RE Generator	As per CERC DSM Regulation 2024 up to 31.03.2026 (>15% for Solar/Hybrid & >20% for wind)	As per CERC DSM Regulation 2024 w.e.f 01.04.2026 (>10% for Solar/Hybrid & >15% for wind)
Hybrid	6.44%	21.93%
Solar	2.94%	5.75%
Wind	16.48%	23.56%

July-25		
RE Generator	As per CERC DSM Regulation 2024 up to 31.03.2026 (>15% for Solar/Hybrid & >20% for wind)	As per CERC DSM Regulation 2024 w.e.f 01.04.2026 (>10% for Solar/Hybrid & >15% for wind)
Hybrid	15.93%	28.20%
Solar	19.15%	31.26%
Wind	16.69%	25.27%

Moreover, the Hon'ble Commission has noted that waivers granted to RE generators since 2017 were based on the assumption that forecasting technology has matured. However, this assumption does not reflect ground realities.

To address the forecasting issues, RE developers have initiated multiple efforts to enhance forecasting accuracy, including:

- Advanced techniques using high-resolution global and Indian weather models
- Collaborations with national and international agencies
- Hiring weather scientists for data analysis and daily monitoring
- Integration of AI-based weather models

Despite these world-class efforts, the proposed forecasting accuracy remains unachievable at present. A balanced approach is needed—one that supports RE generators while ensuring grid reliability. Measures such as aggregation at state/regional/multiple

PSS levels, reducing revision windows, and allowing revisions for STOA-operated plants will support grid operators and enhance grid security, which remains a shared priority.

Therefore, regarding the reduction of the deviation band by 5% and introduction of the "X" factor in deviation error calculation, we respectfully request the Hon'ble Commission to defer implementation until at least FY 2031 for "X" factor and amend the CERC DSM Regulation 2024 for further relaxation for not imposing 5% band reduction effective from 01st April 2026.

- **Treating RE plant as conventional/General seller:**

  In the draft proposal, the Hon'ble Commission has proposed to treat existing RE plants at par with General Sellers for DSM calculation from 01.04.2031 and new plants with tendering or bid submission date on or after 01.04.2026 to be treated at par with General Seller. However, as highlighted above, both types of plants operate on fundamentally different technologies. Conventional plants are dispatchable and predictable, with controllable and schedulable output, allowing them to adhere strictly to their schedules. Deviations from schedule are therefore penalized uniformly. In contrast, RE plants are intermittent and weather-dependent, making accurate forecasting inherently more challenging. Hence, this proposal contradicts the principles of fairness and equity. It is a well-established legal principle under Article 14 of the Constitution of India that 'un-equals cannot be treated equally'. In this case, general sellers and WS/RE sellers are inherently unequal and hence deserve different treatment. We respectfully urge the Hon'ble Commission not to proceed with this implementation.

  The Hon'ble Commission has directed its staff to amend DSM Regulation 2024 to treat all new Wind and Solar (WS) projects as general sellers, applicable to projects with tendering or bid submission dates on or after 01.04.2026. This change, coupled with the significant commercial impact, will adversely affect future RE investments in India and may delay the country's target of achieving 500GW of renewable capacity by 2030.

- **No Receivable for WS Seller for over-injection when the system frequency is at or above 50.05 Hz:**

  RE generation is entirely dependent on weather conditions, and sudden ramps may occur during real-time operations due to fluctuations, leading to over-injection beyond the scheduled generation. As per IEGC grid code 2023, schedule revisions become effective only from the 7th to 8th time block. With the implementation of this proposal, RE generators will again face revenue loss as no compensation is provided for the units generated and injected into the grid, even though the power is consumed and paid for by the consumers/Discoms. However, no revenue is allowed to be realized by the generators.

  We acknowledge that during high-frequency conditions, generators are expected to avoid over-injection to support grid reliability. However, over-injection in RE generation occurs due to factors beyond the control of generators. Therefore, we respectfully request the Hon'ble Commission not to impose such regulation on RE generators.
