

9 March 2020

The Secretary,
 Andhra Pradesh Electricity Regulatory Commission
 11-4-660, 4th Floor, Singareni Bavan, Red Hills Road
 Hyderabad – 500 004

Sub: Suggestions/comments on proposed amendments of Regulation 4 of 2017 i.e. APERC
 (Forecasting, Scheduling and Deviation Settlement of Solar and Wind Generation)
 Regulation 2017

Dear Sir,

We are writing to you in reference to the proposed amendments to APERC (Forecasting, Scheduling and Deviation Settlement of Solar and Wind Generation) Regulation, 2017 issued by Andhra Pradesh Transmission Corporation in December 2019 (Regulation 4 of 2017).

ReNew Power Private Limited ("ReNew Power") is the largest renewable energy generating company in India. We have a portfolio of more than 8 GW of operational and under construction wind and solar projects in India. ReNew Power also has wind power projects of 717.4 MW capacity and a solar power project of 60 MW capacity in the state of Andhra Pradesh.

We at ReNew Power believe that the amendments proposed by the Andhra Pradesh State Load Despatch Centre to Regulation 4 of 2017 will have a significant impact both on large-scale integration of renewable energy resources into the grid and the longer-term viability of the renewable energy generators in the state. To ensure continued progress of renewable energy projects across the State, we would like to raise some key concerns/suggestions and request for clarification by APERC on the proposed amendments.

Our comments/suggestions on the proposed amendments to Regulation 4 of 2017 are enclosed in **Appendix I** for your reference. We look forward to your kind consideration in this matter.



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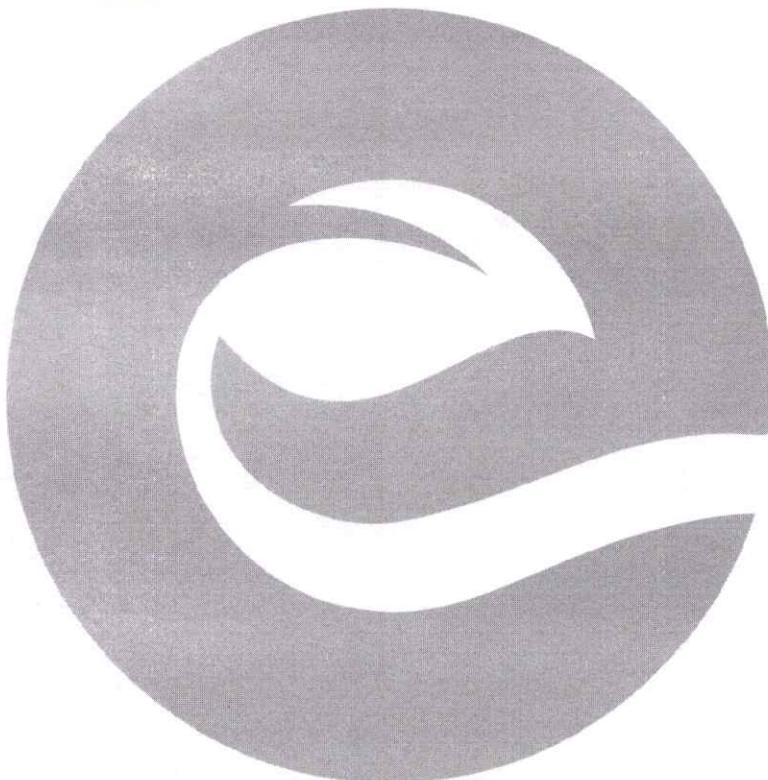
Yours sincerely,

Authorized Signatory

Pavan Bhagavatula



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**Appendix I: Comments/ Suggestions on Proposed Amendment to APERC Regulation
No. 4 of 2017**

The Regulation No. 4 of 2017 was issued by this Ld. Commission with the objective of facilitating large-scale grid integration of solar and wind generating stations through forecasting, scheduling and deviation settlement of wind and solar generators. Pursuant thereto, the Transmission Corporation of Andhra Pradesh Limited ("APTRANSCO") notified the procedure for implementation of Demand Side Management (DSM) for Wind and Solar generation ("**DSM Procedure**"). The DSM Procedure is approved by this Ld. Commission. In view thereof, the amendments proposed by the Andhra Pradesh State Load Despatch Centre ("APSLDC") in their 'Detailed Report' approved by APTRANSCO are uncalled for and will have an adverse impact both on large-scale grid integration and longer-term viability of the renewable energy ("**RE**") projects in the State.

We at ReNew Power Private Limited, would like to raise some key concerns/suggestions and request for clarification by APERC on the following points enclosed below:

It is inherently implied that RE resources are intermittent by nature. However, it is observed throughout the report that the APSLDC is misleading this Ld. Commission by intentionally using the phrase Variable Renewable Energy 'VRE' generation.

It is also misleading to say that "the uncertainties of VRE is affecting the reliability of conventional power as well". Conventional sources of power i.e. coal, natural gas, oil are already universally considered as highly reliable sources of power generation and RE has no impact on the reliability thereof.

APSLDC has, in its Detailed Report, specified large scale variation in RE as the key challenge before APSLDC in managing the grid. In this regard we would like to submit the following:

1. **To ensure that large-scale integration of renewable energy power is smooth, it is essential that Renewable Energy Management Centers ("REMC") are put in place**

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to provide real time forecasts/schedules to the SLDC, thereby increasing their preparedness.

It is our understanding that the REMC will be capable of handling real time information from numerous projects within their geographical boundary which is critical to accurate forecasts. The REMC, which shall be co located with APSLDC, will provide the grid operators tools to integrate RE generation in its control area and its major functions shall include:

- a) Forecasting of Wind & Solar generation;
- b) Online geospatial monitoring of RE Generation at the transmission grid boundaries & at RE pooling stations;
- c) Responsible for providing reliable RE data (generation, forecasting and scheduling data) to the SLDC;
- d) Central Repository for RE generation data; and
- e) Coordination agency on behalf of SLDC for interacting with RE Developers.

The target date for establishment of the said the REMC in the state of Andhra Pradesh was December 2018. The Ld. Advocate General of Andhra Pradesh in his response in the Writ Petition No. 9844 of 2019 before the Hon'ble AP High Court had made a submission that APSLDC shall be able to manage the RE generation once the REMC is setup in the state of Andhra Pradesh. However, APSLDC by way of this amendment is trying to mask its own in-efficiencies. It should, on the contrary, work towards establishment of the said REMCs and efficient and smooth grid operation, a right and function vested in it by the Electricity Act, 2003 ("Act"), and in line with the statement made by the Ld. Advocate General before the Hon'ble AP High Court rather than shifting the blame on RE generators. We therefore humbly submit that any amendment must only be proposed after the REMC are operationalized with the necessary infrastructure and human capabilities in place and after drawing experience from the operationalization of such REMC.

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We would also like to draw your attention to the observations made by the Ld. Central Electricity Regulatory Commission ("CERC") in the Statement of Reasons in the Framework for Real Time Market ("RTM") for Electricity:

"The Commission also feels that in respect of the RE generators tied up under long term PPAs with discoms, the variability in such RE generation can be adequately managed by the discoms as portfolio managers, by participating in the real time market."

From the foregoing it is amply clear that the state distribution companies ("AP Discoms") and APSLDC shall soon have the new RTM, duly recognized by the Ld. CERC as an avenue for settlement of variability in RE generation. The RTM is anticipated to be operationalized from 1st April 2020. As such, there is no urgent need for any amendment in Regulation No. 4 of 2017 before the results of implementation of RTM are analyzed.

2. **It is unreasonable for the APSLDC to state that they are unable to manage the integration of large-scale RE projects especially due to large variations in power generation from RE resources like wind and solar.**

Since the issuance of the GO RT 63 and filing of subsequent writ petitions in regard to the same by different IPPs before the Hon'ble AP High Court, there has been unprecedented curtailment of both wind and solar projects. Since prior to the filing of the said writ petitions there was no large-scale curtailment of RE power by APSLDC, we believe that the arbitrary curtailment was being undertaken to force the IPPs to renegotiate the PPAs. This clearly demonstrates that APSLDC has the technical ability to manage the grid. Hence, it is an irrational ask by the APSLDC to seek any amendments in Regulations No. 4 of 2017.

Additionally, for the state of Andhra Pradesh we draw a comparison of various parameters between 2018 and 2019:

Date	Curtailment %age	Demand (MU)	Wind Generation (MU)	Wind Speed (m/s)
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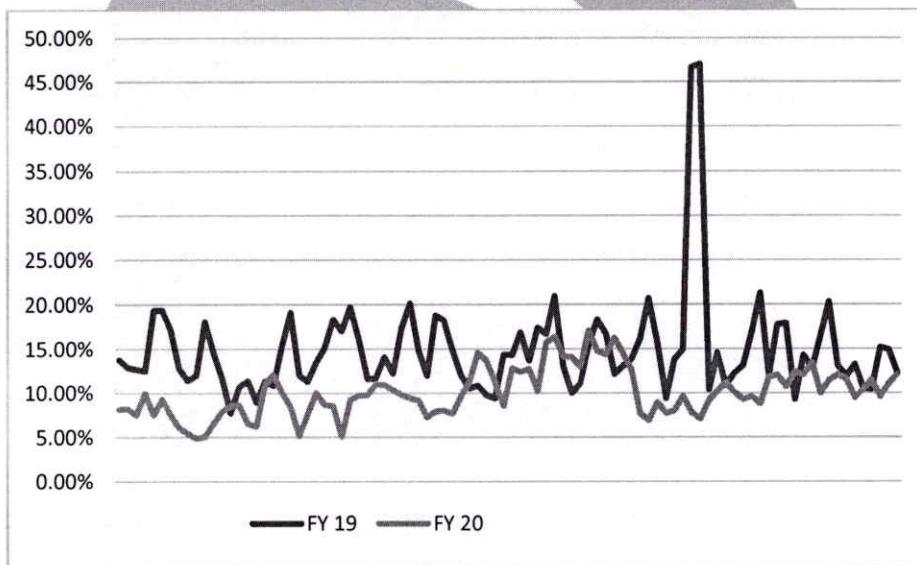
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17.12.2018	0	135.39	15.05 (11.11%)	5.24
17.12.2019	63.33%	158.17	9.62 (6.08%)	6.96
26.12.2018	0	164.97	11.71 (6.96%)	3.98
26.12.2018	40%	168.21	4.57 (2.7%)	4.99

It is therefore, clear from above that even though the demand had increased, the wind generation has reduced significantly (even though the wind speed is higher in December 2019). We place before this Ld. Commission a graph of comparison of wind and solar generation as a percentage overall demand in October 2018 to December 2018 versus October 2019 versus December 2019 for the state of Andhra Pradesh. It clearly demonstrates that nothing significant has changed in the RE generation while the curtailment has increased manifold.



We would also like to draw your attention towards the results of a pilot undertaken under USAID's Greening the Grid - Renewable Integration and Sustainable Energy (RISE) initiative, in partnership with Gujarat State Electricity Corporation Limited ("GSECL") and Bharat Heavy Electricals Limited ("BHEL"). Gujarat made its first successful move to achieve greater load flexibility at its coal-based plant to boost integration of

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renewables. With support from USAID, Gujarat's state power generation utility successfully operated its 500 MW unit of Ukai Thermal Power Station ("Ukai TPS") at only 40% (200 MW) of its capacity during a recently conducted low-load test run. This is the first time that the GSECL has been able to run its Unit to the lowest possible load points while still maintaining all the other operating parameters under stable conditions and without any supplementary oil firing support. These test run results will enable GSECL to further optimize its operating costs and customize its load under future flexible operating conditions. These low-load test runs demonstrate the ability of the utility to reduce its generation when asked by the system operator for integration of more RE and remain synchronized with the Grid.

From the foregoing it is amply clear that if GSECL, a state owned utility similarly placed as AP Discoms and APTRANSCO, has the ability to operate plants at low operating PLF for large scale grid integration of RE then the instrumentalities of the state of Andhra Pradesh can and should, if they so choose, be able to operate the grid in a flexible manner for renewable integration.

We state that the Central Electricity Regulatory Commission (Indian Electricity Grid Code) (Fourth Amendment) Regulation, 2016 provides for a technical minimum of 55% and the same should expeditiously be adopted by this Ld. Commission before undertaking any amendments in Regulation No. 4 of 2017.

3. We would also like to draw your attention to the extant Regulation 4.3 of Regulation No. 4 of 2017, as notified by this Ld. Commission:

"Forecasting shall be done by every wind and solar generator connected to the Grid, either by itself or by a QCA on its behalf. The SLDC shall also undertake forecasting of wind and solar power that is injected into the grid with the objective of ensuring secure Grid operation by planning for the requisite balancing resources."

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The extract of the Regulation reproduced above clearly requires the APSLDC to undertake forecasting of wind and solar power with an objective to plan suitable balancing requirement. We would therefore, humbly request this Ld. Commission to direct APSLDC to disclose whether since the notification of Regulation No. 4 of 2017 it has undertaken this function. We state that APSLDC has failed in its statutory function and is now shifting the blame on RE generators. APSLDC should first produce the results of the exercise undertaken by it, if at all, to forecast wind and solar power and subsequent planning for balancing of such generation. Till such time the APSLDC does not produce credible data that it has fulfilled its responsibility, as required under the extant Regulation No. 4 of 2017, it cannot propose any amendment which is detrimental to the interest of wind and solar generators. We have been given to understand by the National Institute of Wind Energy ("NIWE") in a public meeting that the variation in forecast and actual generation undertaken by NIWE for the state of Andhra Pradesh on day-ahead basis is minimal. Therefore, as highlighted above, APSLDC should undertake its responsibility under the Regulation No. 4 of 2017 before any amendment is considered by this Ld. Commission.

4. **Amendment 1** - APSLDC has, in its Detailed Report, proposed substitution of the terms 'absolute error' with 'forecast error', 'Available Capacity' with 'Scheduled Generation' for calculating Forecast error as per following formula - Forecast Error (%) = $100 \times \frac{(\text{Schedule Generation} - \text{actual Injection})}{\text{Scheduled Generation}}$.

It is proposed to continue using the extant Formula for calculation of 'Absolute Error' as per existing Regulation No. 4 of 2017. It is submitted that in the year 2015 the Ld. CERC while introducing the Forecasting and Scheduling Regulations dealt with the issue of Error definition in detail. Accordingly, Forum of Regulators ("FoR") framed its Model Regulations for the States of India and subsequently all State Commissions have followed the same, including all RE rich states. The calculation of 'Absolute Error' takes care of low or zero schedule scenario in the off-peak season for wind as well as solar.

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S No	Current Regulation	Amendment Proposed	Comments / Suggestions
1	Clause 2.1 (a) “Absolute Error” means the absolute value of the error in the actual injection of wind or solar generators with reference to the scheduled generation and the Available Capacity (AvC), as calculated using the following formula for each 15-minute time block.	Substitute the term ‘absolute error’ with ‘forecast error’. Substitute the term ‘Available Capacity’ with ‘Scheduled Generation’ for calculating Forecast Error as per the following formula: $\text{Forecast Error (\%)} = \frac{\text{Scheduled Generation} - \text{actual Injection}}{\text{Scheduled Generation}} \times 100$	<p>1. Change in formula for calculating error would be against the interest of justice as it would create serious prejudice against Renewable Energy (RE) generators as their forecasting and scheduling accuracies cannot be treated at par with conventional energy generators. For instance, in case of wind power plants, an error of 0.5 meter per second in calculating/ analyzing wind speed may result in 15% variation in terms of power generated and it is pertinent to note that 0.5 meter per second is the minimum error that can be recorded/ achieved by any method adopted in the world for the same. Further, it is also quintessential to highlight that the average error in calculating wind speed for wind power plant is of around 0.7 meter per second.</p> <p>2. In the case of solar power plants, an error of 50 watt per meter square in calculating Global Horizontal Irradiance (GHI) result in an error of 10% variation in terms of power and it is pertinent to note that for solar</p>

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	<p>sites, the average error in calculating GHI is 100 watt per meter square. Further, for day ahead basis, the average error in calculating wind speed is increased to more than 0.9 meter per second for wind generating plants which ultimately results in an absolute error near to 25% and for solar power plants, 100 watt per meter second is the average error in calculating GHI on day ahead basis which ultimately leads to an absolute error of 20%. Therefore, considering the present change in formula and other proposed amendments, avoiding penalties for the RE generators would become impossible without any fault or role by the RE generators and entire purpose of the Regulations would be defeated.</p> <p>3. Forecast error represented by way of using AvC supports in encapsulating the mean absolute error or deviation from actual, in relatively rational manner throughout the seasons. Model Regulations on Forecasting, Scheduling and Deviation Settlement of Wind and Solar Generating Stations at the State level, 2015 (Model Regulations) states that “<i>incentives to generators for better forecasting must be aligned with the objective of grid management, which is to minimize</i></p>
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		<p><i>actual MW deviations from schedule. As commercial impact on generators is directly proportional to the error percentage, forecasting models will be designed to minimize MW deviations only if the denominator is a constant (and not a variable such as 'schedule')."</i></p> <p>4. As we are moving towards a power system with high renewable penetration, a normalized forecast error by way of using AvC will accurately represent the uncertainty or error in the forecast affecting the power system. So, it is humbly requested to not change existing clause as the same is consistent with the Model Regulations by the Forum of Regulator (FOR) and the Central Electricity Regulatory Commission (CERC).</p>
2	Clause 2.1 (j) Deviation in a time block for a seller means its total actual injection minus its total/scheduled generation.	<p>The definition of phrase “allowable forecast error” in percentage should be considered for inclusion.</p> <p>Allowable forecast error = $100 \times$ (diversity factor 0.7 in control area in the beginning of financial year) \times (quantum of deviation limit permitted under CERCs DSM Regulation</p>

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<p>amended from time to time)/ quantum of VRE installed capacity)</p>	<p>furnishing penalty for such deviation which has not affected the Grid in any manner whatsoever.</p> <p>2. Treating RE generators at par with conventional energy generator was never the intent of FOR and the same is evident through methodology adopted by them in the Model Regulations. If taken into consideration the proposed definition of allowable error and calculation thereto, it would be impossible for the RE generators to avoid penalties on account of deviation from the schedule and would therefore, be deeply discouraging for them to operate generating plants owing to such onerous negative revenue impact.</p> <p>3. RE generators are heavily dependent upon weather conditions for their plant operation & generation and accurate projection of their electricity generation and revenue cannot be ascertained. In such a scenario, reducing permissible band for deviation would totally take away the commercial viability of the projects set up by the RE generators. In this context, it is suggested that this Hon'ble Commission does not make any amendments to the definition of "deviation" and "absolute error" and its calculations.</p>

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3.	Clause 4.1 The Methodology for day-ahead scheduling of wind and solar energy generating stations which are connected to the Grid and rescheduling them on one and half-hourly basis and the methodology of handling deviations of such wind and solar energy generating stations shall be as stated hereunder and accordingly forecasting tools shall be provided by the generator concerned.	It is proposed to remove the option of rescheduling of forecast on one and half hourly basis during day of operation and strictly adhere to scheduling on day ahead basis	1. Model Regulations permit 16 intra-day revisions of scheduling per day and such revisions are permitted owing to the nature of infirm power. Considering the prevalent technology, accurate predictions of weather conditions on day ahead basis is not technically possible and the same has also been explained hereinabove and is not being repeated for the sake of brevity. State Electricity Regulatory Commissions while formulating regulations on RE Forecasting and Scheduling need to be guided by the CERC's framework and the Model Regulations and the said proposed amendment would be in direct conflict with the same. 2. Further, weather data and parameters play an important role for RE generators as plant's generation is directly related to weather conditions. Weather conditions varies from time to time on a particular given day and therefore real-time data as provided by India Meteorological Department or other service providers need to be taken into consideration and is to be incorporated by revising schedules in order to ensure grid safety and stability. In case provision for revising schedules is taken away, then the entire purpose of the
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	<p>Regulations, i.e., grid safety and stability, would be defeated.</p> <p>3. Furthermore, the energy demand is expected to grow significantly in the coming times while the conventional energy sources are limited. RE sources are being built and efficiently utilized for supplementing the energy requirement of the country in a sustainable way, thereby reducing the greenhouse gas emissions in the country. Mechanism of forecasting and scheduling of RE was introduced to improve the integration of the RE power in the power grid. Therefore, there is a requirement of intraday revisions to achieve the goal of successful RE integration. The forecast accuracy improves when it is closer to the real time, i.e., forecasting is more accurate for short term than long term. Currently, in the State of Andhra Pradesh, there is a restriction of 16 intra-day revisions for wind power projects and 9 such revisions for solar power projects. It is humbly submitted that flexibility should be given for revising the schedule intra-day as many times as possible for attaining better accuracy. Removing the scheduled revision capacity will hamper the quality of forecast and lead to greater</p>
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			instability in the grid. Power plants based on conventional sources have the provision for multiple scheduled revisions. The same provision should also be made applicable for RE based projects.									
4	<p>Clause 6.3</p> <p>The deviation charges for over or under injection for sale/supply of power within the State are tabulated here under:</p>	<p>The levy and collection of DSM charges should be amended as shown in the table given below:</p> <table border="1"> <thead> <tr> <th>Forecast Error in the 15 min. time block</th> <th>Deviation charges payable to State Pool Account</th> <th>Deviation charges payable to State Pool Account</th> </tr> </thead> <tbody> <tr> <td>< Allowable Forecast Error</td> <td>None</td> <td>None</td> </tr> <tr> <td>> Allowable Forecast Error</td> <td>At Rs. 2 per unit for the shortfall or excess injection</td> <td>At Rs. 2 per unit for the shortfall or excess injection</td> </tr> </tbody> </table>	Forecast Error in the 15 min. time block	Deviation charges payable to State Pool Account	Deviation charges payable to State Pool Account	< Allowable Forecast Error	None	None	> Allowable Forecast Error	At Rs. 2 per unit for the shortfall or excess injection	At Rs. 2 per unit for the shortfall or excess injection	<p>1. Justification provided for the proposed amendment is very narrow since it has already been assumed that in case of deviation DISCOMs are purchasing power at high cost. However, the same is not true in every case. There are various instances when the DISCOMs are procuring power from exchange at a rate cheaper than its average pooled variable cost and thereby, in effect, the deviations on account of RE generators actually benefit the DISCOMs. Further, Rs. 2 per unit for energy deviated would be onerous on the RE generators as the functioning of the plant would become very difficult for them owing to penalties payable on account of deviations. This is because the average Power Purchase Agreement rate of RE generators comes out to be Rs. 3 kWh and such penalties may amount to more than 50% of the total revenue of the RE generator and thereby posing negative impact upon its plant's sustainability.</p>
Forecast Error in the 15 min. time block	Deviation charges payable to State Pool Account	Deviation charges payable to State Pool Account										
< Allowable Forecast Error	None	None										
> Allowable Forecast Error	At Rs. 2 per unit for the shortfall or excess injection	At Rs. 2 per unit for the shortfall or excess injection										

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	<p>2. Further, aforesaid amendment is against the CERC (Deviation Settlement Mechanism and related matters) (Second Amendment) Regulations, 2015 as CERC permits deviation band of 15% without deviation charges. Initially, during planning of RE integration with the grid, deviations on account of RE generators were taken into consideration and it was proposed to propound a balanced mechanism taking into consideration grid safety and stability and at the same time ensuring that RE generators are not put at a losing end owing to nature of infirm power and weather conditions. In this context, the exemption band of 15% was decided. As per the proposed amendments, the entire equilibrium would be disturbed with the RE generators facing the huge financial losses.</p> <p>3. Further, forecasting of wind and solar power generation in India is gradually evolving with advancement of forecasting technology and participation of international players in the sector. Government of India in its various policies and the Government of Andhra Pradesh in their Wind Power Policy, 2018 and Solar Power Policy, 2018 respectively have envisaged to encourage, develop and</p>
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	<p>promote solar and wind power generation. Further, the investment in RE sector has prominently contributed in the GDP of the State in various manners like generating employment opportunities, environment associated cost benefits, etc. There is the growing demand for power which must be catered in an environmentally and economically sustainable manner, which can only be met through RE. So, it is important to have a rational penalty mechanism in place to incentivize the quality of forecast by RE generators, and thereby encouraging the power developers to generate power through RE sources.</p> <p>4. FOR, CERC and other states had proposed to provide incremental bands for deviation charges. The sudden imposition of stringent penalty band will discourage the RE generators. Further, it is quintessential to highlight that the Tamil Nadu's final regulations, i.e., a neighboring RE rich State, on forecasting and scheduling (Tamil Nadu Electricity Regulatory Commission (Forecasting, Scheduling and Deviation Settlement and Related Matters for Wind and Solar Generation) Regulations, 2019) also incentivizes the generator by capping the penalty and paying back</p>
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		deviation charges if the deviation charges of the entire Financial Year are greater than Rs 0.05 per unit.
5	<p>Clause 2.1 (aa)</p> <p>Virtual pool means the virtual/grouping of various pooling stations wherein the generators in such pooling stations have an option for accounting their deviational in an aggregated/combined manner through a QCA for the purpose of availing the benefit of larger geographical area and diversity.</p>	<p>The definition phrase of virtual pooling may be considered to be deleted from definition 2.1 (aa) and also be deleted at clause 6.9 of Regulation 4 of 2017.</p> <p>1. RE and demand are both variable components in the power system and since the demand forecasting is done at the State level, it seems appropriate to do power forecasting at the State level as well. Therefore, it is humbly submitted that the aggregation of power in the form of virtual pool would be beneficial for the Grid. A large interconnected power system is beneficial because it enables aggregation of imbalances from a large geographical area and thereby ensures the grid safety. The errors are not uniformly distributed in time within a region, therefore forecasting errors for a region are smaller than for a single site. Aggregation lowers the uncertainty of power generation by reducing forecast error. GIZ's Report on Forecasting, Concept of Renewable Energy Management Centres and Grid Balancing stated that "typical accuracies for German wind power forecasts show 10-15% root mean square error of installed wind capacity for a single wind project, drop to 5-7% for day-ahead forecasts for a (regional) control area, and reduce to 4-6% for day-</p>

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	<p><i>ahead wind forecasts for complete Germany. More importantly, with aggregation, the impact of forecast errors on individual plants is not as severe because the aggregate forecast of all plants drives the generation scheduling”.</i></p> <p>2. Report of the Expert Groups: Review of Indian Electricity Grid Code, proposes to notify a procedure for aggregation of pooling stations for the wind/solar/hybrid generating stations. In addition, Lawrence Berkeley National Laboratory, USA in Statement of Reason for Forecasting, Scheduling and Imbalance Handling for Variable Renewable Energy Sources (Wind and Solar) has submitted that in the case where there is no aggregation of schedules, if two RE generators deviate in the opposite direction with no net deviation from the aggregate schedule, both the generators are expected to be penalized depending on the extent of their individual deviation even though they may not impose any additional costs on the overall system. Their research shows that the aggregate variation (in percentage terms) over multiple sites is typically lower than the variation in output on one site. Moreover, the forecasting accuracy is higher for</p>
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		aggregate forecast over multiple sites. Therefore, for scheduling purposes it is desirable to use the aggregate (total balancing area) level forecasts of RE generation.
6.	Additional Comments	<p>a. Day ahead forecast cannot be accurate. Day ahead forecasting will make the complete project(s) unviable.</p> <p>b. The option could be to allow IPPS to install energy storage and pass on the additional capex cost in tariff.</p> <p>c. Without 100% storage technology, proposed stringent regulations by APSSLDC cannot be met.</p> <p>d. Plants were built on the technical standards existing during plant erection. Technological challenge is there to implement these changes with existing infrastructure to adhere day ahead implemented schedule.</p> <p>e. Proposed changes are not compliant with the best available scientific technology to forecast the renewable generation.</p>

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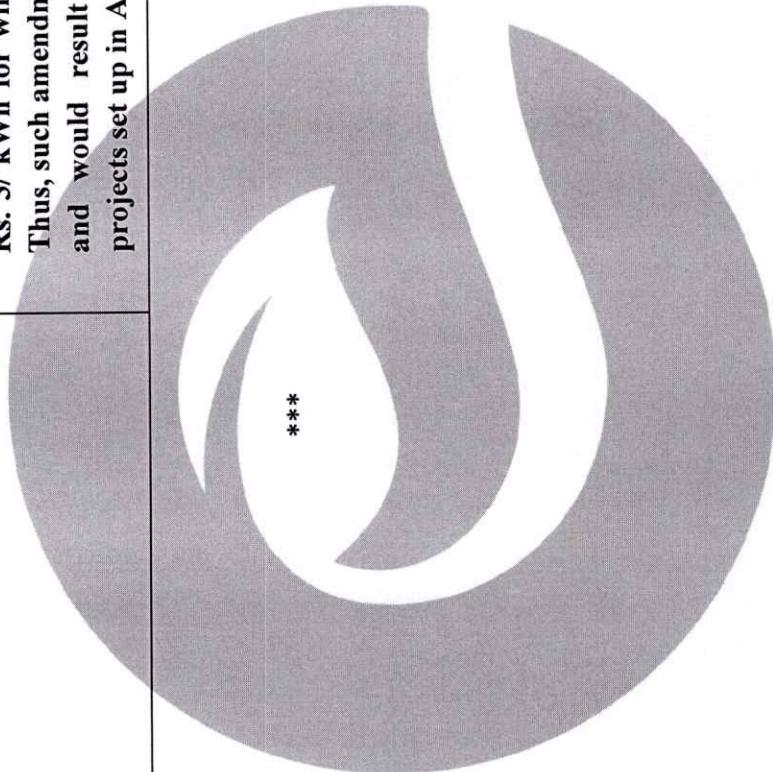
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		On over all basis, based on proposed amendment the DSM charges will approximately tantamount to Rs. 3/ kWh for wind and Rs. 0.58/kWh for solar. Thus, such amendments are financially prohibitive and would result in decimation of renewable projects set up in Andhra Pradesh.



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