ANDHRA PRADESH ELECTRICITY REGULATORY COMMISSION

4thFloor, Singareni Bhavan, Red Hills, Hyderabad 500004

DAY, THE FIRST DAY OF MARCH
TWO THOUSAND AND TWENTY ONE

:Present:

Justice C.V. Nagarjuna Reddy, Chairman

Sri P. Rajagopal Reddy, Member

Sri Thakur Rama Singh, Member

O.P.No.2 of 2020

In the matter of amendments to the APERC Forecasting, Scheduling and Deviation Settlement of Wind and Solar Generation Regulation, 2017 (Regulation No.4 of 2017)

The matter came up for hearing on 10.03.2020 and on 16.06.2020 in the presence of Sri P. Shiva Rao,learned counsel for the utilities, Sri S.V. Narayana representing (i) Aarohi Solar Pvt. Ltd, & (ii) ACME Solar Holdings Ltd, Ms. Mazag Andrabi, learned counsel for (i) Indian Wind Power Association, (ii) Sterling Agro Industries Ltd., and (iii) Renew Power Private Limited, Sri Anurag Dhyani representing RE Connect Energy Solutions Ltd., Sri K. Mahesh Kumar, Senior Manager representing Mytrah Energy (India) Pvt.Ltd., Sri S. Satish Kumar representing Vena Energy Power Resources Pvt. Ltd., Sri Amit Gupta representing Statkraft, Ms. Salonia representing Council on Energy, Environment and Water (CEEW), Cdr. Manan Sinha (Retd.) representing Manikaran Analytics Ltd.,Sri D. Srinivasa Rao representing Vector Green Energy, Sri P.Vikram, learned counsel representing M/s Axis Wind Farms (MPR DAM) Pvt. Ltd., Sri Aniket Prasoon, learned counsel and Ms. Akanksha Tanvi counsel representing M/s Vena Energy Solar India Power Resources Private Ltd., M/s Vayu Urja Bharat Pvt. Ltd., M/s Waneep Solar Pvt. Ltd., and Sri M.Venugopala Rao, one of the objectors. After carefully considering the arguments of the learned counsel and some of the objectors and the material available on record, the Commission passed the following:

ORDER

The Chief General Manager / HRD and Planning, the Transmission Corporation of Andhra Pradesh Ltd. (APTRANSCO),vide letter No.CGM/HRD&Plg./SE/Plg/EE/ RAC&Reforms/APERC/D.No.121/2019, dated 10-12-2019 submitted that the Chief Engineer, Andhra Pradesh State Load Dispatch Centre (APSLDC) has informed that during implementation of the Andhra Pradesh Electricity Regulatory Commission's (APERC) Forecasting, Scheduling and Deviation Settlement of Solar and Wind Generation Regulation, 2017 (for short, "the Regulation") which is effective from 01.07.2018 for levying and collection of deviation charges from the Qualified Coordinating Agencies (QCAs), certain observations were noticed in adopting Clauses 2.1 (a), 2.1 (j), 4.1, 6.3 and 2.1 (aa) of the Regulation in day to day operation of the grid with the mix of Variable Renewable Energy (VRE) and conventional generation and that therefore they feel that amendments are required to the above clauses. A detailed report was submitted consolidating the difficulties faced by APSLDC in day-to-day operation of the grid and requested the Commission for suitable amendments to the said Regulation. The amendments are stated to be for ensuring the integrated grid operations and for achieving maximum economy and efficiency in the operation of power system in Andhra Pradesh.

2. The amendments proposed and the justification given therefor are as under:

a) (i) Amendment 1:

That clause 2.1 (a) of the Regulation reads,

"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:

Absolute Error (%) = 100 X (Actual Injection - Scheduled Generation)/AVC

The proposed amendment reads as follows:

Substitute the term 'Absolute error' with 'Forecast error' and to substitute the term 'Available Capacity' with 'Scheduled Generation' for calculating Forecast error as per the following formula.

Forecast Error (%) = 100 X (Schedule Generation - Actual Injection) / Scheduled Generation.

(ii) Justification: That the formula for error should invariably contain one of the two parameters of the numerator, in the denominator. That the absolute error defined in

the Regulation contains an unrelated parameter in the denominator. That the Grid requirements are planned duly taking into account the forecast / schedules from RE generation on day-ahead basis which will be taken into account together with other sources and any deviation of such forecast in VRE generation is a burden to the utility. That by dividing the deviation with Available capacity as stated in the present regulations, the error becomes infinitesimal and the Regulation becomes redundant or toothless and that, since the VRE generation never reaches its maximum capacity i.e., Available capacity, the denominator should be replaced with scheduled generation.

b) (i) Amendment 2:

That clause 2 (j) of the Regulation reads, "deviation in a time block for a seller means its total actual injection minus its total scheduled generation."

That the amendment is proposed as under:

The definition of the phrase 'Allowable forecast error' in percentage should be considered for inclusion.

'Allowable forecast error' = 100 x (diversity factor 0.7 in control area in the beginning of financial year) x (quantum of deviation limit permitted under CERC's DSM Regulation amended from time to time) / (quantum of VRE installed capacity)

(ii) Justification: That the Hon'ble Central Electricity Regulatory Commission (CERC) allows a deviation limit of only ± 250 MW for RE Rich States. That for VRE capacity of 7500 MW in the State of AP, forecast error of 15% will result in 1125 MW deviation which is contrary to that allowed by the CERC. That the deviation in positive direction results in backing down of conventional generation and violation notices are served by Southern Regional Load Dispatch Centre (SRLDC) on SLDC to adhere to the Indian Electricity Grid Code (IEGC) Regulations while taking corrective steps for maintaining load-generation balance. That deviation in negative direction results in deficit conditions which require resources to bridge the gap between load and generation. That the deviation of maximum allowable quantum of 1125 MW variation in downward direction will result in over drawal from the grid beyond the permissible limits and in that event, it would lead to load shedding in real time operation of the grid since spinning reserves are not available from conventional sources. That, to overcome this, it is proposed to introduce Allowable forecast error to maintain & handle the AP grid system in real time operation and that as an example, for the installed VRE capacity of 7300MW in the State of AP, considering the diversity factor

as 0.7 and 250 MW deviation limit permitted under CERC's Regulations, the Allowable forecast error will be 4.89% or say 5%.

c) (i) Amendment 3:

That clause 4.1 of the Regulation reads that “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."

APSLDC has proposed the following amendment to the said clause:

To remove the option of rescheduling of forecast on one and half hourly basis during the day of operation and strictly adhere to scheduling on day ahead basis.

(ii) Justification: That DISCOMs have to plan the resources which include all conventional and RE Generators for meeting the demand on a day-ahead basis and accordingly DISCOMs optimise the purchase and sell power through Power Exchanges. That the deviation in forecast results in deficit or surplus power condition. That under deficit conditions there will be deviation in drawl and DISCOMs have to pay a high price for the power that is required to bridge the gap by availing high-cost Un Requisitioned Surplus (URS) power or purchasing power at high cost from the exchanges during the course of the day. That apart, SLDC would suffer with violation notices by SRLDC, forcing DISCOMs to resort to load shedding in case the above desired action is not realised. That such load shedding turns contrary to the policy mandate given by the Govt. to maintain 24x7 power supply to all categories of consumers. That the forecasting and scheduling tool of VRE generators must be effective to mitigate the power shortage as well as back down of generation. That as per the Forecasting & Scheduling Regulations, the generation from day ahead schedule of VRE power generation gives the quantum of variable energy for assessing the conventional energy requirements on day ahead basis and the day-ahead schedule of VRE generators is crucial for any grid management which is deciding the quantum of power allocation from other sources. If day ahead forecast & scheduling is accurate in respect of VRE generators, there will not be any power shortage and it would mitigate the backdown instructions. That,the SLDC is required to have an accurate day-ahead schedule from each wind & solar generator to avoid any variation of capacity allocation from other sources or to avoid compulsory load shedding. That, QCAs are submitting forecasts and schedules on day ahead and intra-day revision.

That DISCOMs are planning their availability to meet the grid demand on day-ahead basis and tie up power accordingly and the DISCOMs are not able to cope up with the deficit/surplus arising due to variation in VRE Generation in real time operation because, (a) the Power market mechanism is not mature, (b) Warm and cold start-up will take longer time to reach full load, and (c) DISCOMs have to tie up power subject to availability from all sources and hence, they invariably resort to load shedding with a view to adhere to the IEGC Regulations.

d) (i) Amendment-4:

That as per clause 6.3 of the Regulation, the deviation charges for over or under injection for sale / supply of power within the State are as tabulated hereunder:

S. No.	Absolute Error in the 15 min. Time block	Deviation charges payable to State Pool Account
1	<=15%	None
2	>15% but <=25%	At Rs.0.50 per unit for the shortfall or excess energy for absolute error beyond 15% and upto 25%
3	>25% but <=35%	At Rs.0.50 per unit for the shortfall or excess energy for absolute error beyond 15% and upto 25% + Rs. 1 per unit for balance energy beyond 25% and upto 35%
4	>35%	At Rs.0.50 per unit for the shortfall or excess energy for absolute error beyond 15% and upto 25% + Rs. 1 per unit for balance energy beyond 25% and upto 35% + Rs.1.50 per unit for balance energy beyond 35%.

That the amendment is proposed for the levy and collection of DSM charges as shown in the table given below:

S. No.	*Forecast Error in the 15 min. time block*	*Deviation charges payable to State Pool Account*
1.	*<Allowable Forecast Error*	*None*
2.	*Above Allowable Forecast error*	*At Rs.2.00 per unit for the shortfall or excess injection*

(ii) Justification: That with regard to VRE Generation, during the real time operation of the Grid, huge variation occurs between the forecast schedules and actual generation. That, due to errors in the forecast of VRE Generation, DISCOMs are resorting to purchasing high cost power from power exchanges. That, on many occasions, DISCOMs have purchased at the rate of 660 paise per unit and thus they are incurring Rs.2 per unit more than the average VRE power purchase cost. That even in that eventuality, sufficient power is not available at the relevant point of time. Hence, DISCOMs have to go for load relief which has deleterious effects on the State Gross Domestic Product (GDP). That considering an energy elasticity in the GDP of 0.8, this translates to losses in crores of rupees to the State GDP. That, another aspect of difficulty in this regard is that if the actual VRE generation is more than the forecast, conventional generation has to be backed down which has associated costs to be borne by the DISCOMs. The following are the associated costs involved in over injection which comes to Rs.2 per unit.

Adequacy costs - Rs.1.60 per unit; Balancing costs - Rs. 0.40 per unit

The adequacy costs of Rs.1.60 paise per unit are derived by considering the difference between VRE costs and weighted average pooled variable cost. The balancing costs of Rs.0.40 per unit are arrived by considering the deterioration of station heat rate, increased oil consumption and excluding wear & tear of the equipment when thermal stations are required to be frequently backed down.

e) (i) Amendment-5:

Clause 2.1 (aa) of the Regulation reads, "Virtual Pool means the virtual grouping of various pooling stations wherein the generators in such pooling stations have an

option for accounting their deviations in an aggregated / combined manner through a QCA for the purpose of availing the benefit of larger geographical area and diversity."

The amendment is proposed as under:

The definition phrase of virtual pooling may be considered to be deleted from the definition at clause 2.1 (aa) and also be deleted at clause 6.9 of the Regulation.

(ii) Justification: That as per clause 2.1(aa) of the Regulation, all the schedules and actuals of generators are aggregated while calculating the deviations. That this provision is not available in any of the regulations framed by the respective Regulatory Commissions and that the indiscipline caused by a few generators to the grid is shared and spread over among all the generators in the virtual pool.

3. The Commission has decided to consider the above proposals through public consultation process and accordingly a public notice was placed in the website of the Commission, inviting views / objections / suggestions of interested persons / stakeholders on the proposed amendments to the Regulations and also notifying that public hearing will be held on 10.03.2020 in the court hall of the Commission's office, Hyderabad.

4. M/s Axis Wind Farms (MPR Dam) Private Limited, M/s Aarohi Solar Private limited, M/s Acme Jaisalmer Ltd., M/s Viswatma Solar Energy Pvt. Ltd., M/s Niranjana Solar Energy Ltd., M/s Dayanidhi Solar Power Pvt. Ltd., M/s Vena Energy Power Resources Pvt. Ltd, M/s Mytrah Energy (India) Private Ltd., Solar Power Developers Association, M/s Vayu Urja Bharat Private Limited, M/s Waneep Solar Private Limited, Wind Independent power Association (WIPPA), National Solar Energy federation of India, M/s Azure power India private limited and India Wind Power Association (IWPA) have submitted their respective objections wherein they have, inter-alia, stated that several wind and solar project developers across the country have challenged the legal and constitutional validity of Forecasting, Scheduling and Deviation Settlement Mechanism (DSM) Regulations passed by the State Electricity Regulatory Commissions in the respective jurisdictional High Courts and interim orders were also passed to the effect that no coercive action may be taken against the renewable energy developers. That similarly, aggrieved by the Regulations framed by the APERC, several renewable energy developers have filed writ petitions before the Hon'ble High Court of Andhra Pradesh and the Hon'ble Supreme Court of India, challenging the legal and constitutional validity of the Regulations. That the Hon'ble High Court has (a) passed interim orders not to take any coercive steps on bank guarantees; (b) admitted the writ petitions and posted them for final hearing; and (c) directed to continue the interim orders until then. That the Hon'ble Supreme Court in CA No.4404 of 2019, has remitted back the issue to the Hon'ble High Court of Andhra

Pradesh for adjudicating on merits and the same is sub-judice before the Hon'ble High Court of Andhra Pradesh. Accordingly, they have requested that the public hearing on 10th March, 2020 for proposed steps to amend the Regulations may be kept in abeyance till the matter is disposed off by the Hon'ble High Court of Andhra Pradesh. However, as the Hon'ble High Court permitted the Commission to examine objections / suggestions and take appropriate decision, which, however shall not be given effect to pending further orders in the Writ Petition, the Commission has decided to proceed with the hearing and accordingly heard the learned Standing Counsel for the APTransco some objectors and the counsel for some of the objectors. The case was further heard on 16.06.2020.

5. A number of objectors have submitted their views / objections / suggestions and APSLDC have furnished their replies. Many of the objectors raised objections to the effect that the justifications given by AP Transco for the proposed amendments are not backed by data which APSLDC must have acquired during the implementation of the Regulation.

6. Considering the objections of the stakeholders, the Commission, vide letter dated 30.07.2020, has directed APSLDC to submit the following information:

   a. All the relevant and necessary data (soft copies of 15 min. block wise data) available since the date the Regulation came into effect, to conclusively demonstrate the necessity of the proposed Amendment-1 i.e., Change of Formula of Absolute Error which sought to be amended on the reason that by dividing the deviation with available capacity, the error becomes infinitesimal and the Regulation becomes redundant and that any deviation of day-ahead forecast in VRE generation is a burden to the utility.

   b. All the relevant and necessary data (soft copies of 15 min. block wise data) available since the date the Regulation came into effect, in support of the submissions made for the proposed Amendment-2 that the deviation of maximum allowable quantum of 1125 MW variation in downward direction will result in overdrawal from the grid beyond the permissible limits and in that event, it would lead to load shedding in real time operation of grid.

   c. All the relevant and necessary data available since the date the Regulation came into effect, in support of the claim that DISCOMs are not able to cope up with the deficit / surplus arising due to variation in VRE Generation in real time operation based on which claim the provision for intra-day revision of schedules is sought to be withdrawn, vide the proposed Amendment-3.

   d. All the relevant, necessary data since the date the Regulation came into effect in support of the claim that during the real time operation of Grid, huge variation

occurs between the forecast schedules and actual generation and that due to error in forecast of RE Generation, DISCOMs are resorting to purchase high-cost power from power exchanges and accordingly the deviation charges are sought to be revised to Rs.2 per unit, vide the proposed Amendment-4.

e. All the relevant, necessary data since the date the Regulation came into effect in support of the claim that indiscipline to the grid caused by few generators is shared and spread over among all generators in the virtual pool and accordingly the virtual pool provision is sought to be deleted, vide Amendment-5.

7. In response, the APSLDC vide letter dated 28.08.2020, submitted the following:

a) Soft copies for comparison of forecast error with existing formula and with the proposed formula, day wise for all the days for the months from July, 2018 to May, 2020 (as Annexure - A1 to the said letter)

- Consisting of Excel Sheets (separately for Wind and Solar) of 15 min. block-wise data for the following parameters viz., (i) Forecast (ii) Actual (iii) AvC (iv) % Error as per existing formula (v) % Error as per proposed formula (vi) Comparison of Forecast Errors (existing formula Vs. proposed formula)

b) Details of load shedding when VRE deviation is more than 1125 MW (as Annexure - B1 to the said letter).

- Details of Load shedding availed when deviation between Forecast & Actual of VRE generation is greater than 1125 MW on 13 instances, on 29.04.2019 (one instance), 6.05.2019 (three instances), 2.06.2019 (two instances), 9.06.2019 (two instances), 19.07.2019 (one instance), 13.08.2019 (one instance) and 14.08.2019 (three instances).

c) Copies of documents with details of previous incidents happened in the grid due to sudden and gradual variation of VRE generation, action taken by APSLDC (as Annexure - C1 to the said letter)

- Solar Generation Forecast and actual on 7.04.2020 and 8.04.2020.
- Solar and Wind generation uncertainty observations made on 24.04.2020.
- Occurrences / events and actions taken by APSLDC during the period of abnormal wind and solar variations on 30.04.2020, 1.05.2020 and majority in solar variation on 6.05.2020.
- Variations in Solar generation in real time operation of grid events and actions taken on 11.05.2020.

- Events occurred & actions being taken by APSLDC due to sudden variation in wind & solar generation on 27.06.2020.
- Events occurred & actions being taken by APSLDC due to huge variation in wind & solar generation on 31.07.2020.
- Solar variation in real time operation of grid on 05.08.2020, 06.08.2020, 07.08.2020.
- Solar and wind variations and action taken in real time operation of grid on 23.08.2020.

d) Copies of documents with details of some incidences of gradual and sudden deviation of VRE generation w.r.t. Forecast (Annexure - C2 to the said letter)

Solar Forecast day ahead by generators Vs. actuals on 13.08.2019, 16.08.2019, 17.08.2019, 18.08.2019, 19.08.2019, 24.08.2019, 27.08.2019, 28.08.2019, 29.08.2019, 05.09.2019, 10.09.2019, 08.11.2019, 14.11.2019, 15.11.2019 and 18.11.2019.

Wind Forecast day ahead by generators Vs. actuals on 13.08.2019, 17.08.2019, 19.08.2019, 28.08.2019, 29.08.2019, 22.09.2019, 25.09.2019, 27.09.2019, 28.09.2019, 29.09.2019, 22.10.2019, 27.10.2019, 02.11.2019, 03.11.2019, 04.11.2019, 05.11.2019, 07.11.2019, 08.11.2019, 09.11.2019, 11.11.2019, 15.11.2019, 17.11.2019 and 19.11.2019.

e) Copies of notices received from National Load Dispatch Centre (NLDC) / SRLDC to restrict drawal and to control grid parameters during the period from August, 2019 to March, 2020 - 155 Nos. (Annexure - C3 to the said letter)

f) Details of high-cost contingency purchases made by DISCOMs through exchange (IEX) - 85 Pages. (Annexure - D1 to the said letter)

g) Soft copies of the forecast error pooling station-wise and QCA-wise. (Annexure_E1 to the said letter)

(i) Forecast error_Stationwise_Reconnect_Solar_February 2019

(ii) Forecast error_Stationwise_Reconnect_Wind_February 2019

(iii) Forecast error_Stationwise_Statkraft_Solar_February 2019

(iv) Forecast error_Stationwise_Statkraft_Wind_February 2019

(v) Forecast error_Stationwise_TATA_August 2019

8. The data as above submitted by the APSLDC was uploaded on the website of the Commission on 08.09.2020 inviting responses of the stakeholders giving time upto 22.09.2020. A number of stakeholders sought further time stating that the vast data submitted by APSLDC needs to be analysed before submission of their responses and due to a sudden spike in Covid-19 cases, most experts are either unavailable or taking longer than usual time to provide requisite details / data. The Commission, in consideration of the requests granted appropriate time to all the stakeholders and considered all the objections so received.

9. The objections received on the amendments proposed by the AP Transco / APSLDC, the replies of AP Transco / APSLDC thereon and the responses of the stakeholders on the data submitted by APSLDC as above are summarised hereunder. (Some of the objectors have sent their further responses on the replies of the AP Transco / APSLDC and some of the objectors gave replies to the objections of Sri M.Venugopala Rao. As these responses and replies are generally reiterations of their original objections, they have not been specifically adverted to).

10. Objections on Amendment-1 (supra)**:**

    a) M/s Hindupur Solar Park Pvt. Ltd. have stated that Model Forecasting & Scheduling Regulations of Forum of Regulators (FOR), DSM Regulations of CERC and other State Electricity Regulatory Commissions (SERCs) have considered the error formula based on denominator as Available Capacity (AvC) after due consideration on the technology and related factors. That CERC has defined the error percentage normalized to Available Capacity, not on the schedule capacity to ensure optimum and genuine forecasting, the error quantity corresponds to the physical MW impact on the grid and the forecasting models are also aligned to minimize the actual MW deviations. That the Regulations that are proposed to be amended have been developed pursuant to detailed stakeholder consultation process only a short while ago wherein inputs from all parties were taken, and extensively deliberated. That there is no material change in the VRE forecasting and scheduling methodology and technology after promulgation of the said Regulations, demanding such huge variance proposed now in the Regulation. That the proposed change in the formula for Absolute Error would be against the interest of justice and would create serious prejudice against Renewables. Renewable energy generation is subject to uncontrollable variations in weather patterns (viz. cloud cover, wind flow etc.), and therefore its forecasting and scheduling accuracies cannot be treated at par with the conventional energy generators. That, in case of Solar plant, a deviation of 50 watts per meter square in Global Horizontal Irradiance (GHI) results in a 10% variation in terms of

power and average deviation noted for solar sites is of 100 watts per meter square as GHI. Further, for solar plants, 100 watt per meter second is an average error on day ahead basis which ultimately leads to an absolute error of 20%. Therefore, considering the present change in formula and other proposed amendment, stringent penalties for VRE Generator would become inevitable without any fault or role by VRE Generator and the entire purpose of the Regulation would be defeated.

b) Sri M.Venugopala Rao has stated that the amendment proposed to substitute "Forecast error" for the existing "Absolute error," and "Scheduled generation" for "Available capacity" is justified. That when grid requirements are planned taking into account forecast and schedule made by the must-run solar and wind power units along with other sources on day ahead basis, for the deviations caused by solar and wind units, they should be held responsible based on the impact of such deviations and for that "Forecast error" and "Scheduled generation" should be the basis.

c) M/s Ecoren Energy Ltd. M/s Weizmann Ltd., M/s Jindal Aluminium Ltd., M/s IWPA, M/s NALCO and M/s Reconnect Energy have stated that Renewable Regulatory Fund (RRF) Regulations, 2013 computed error in a similar way as being proposed by APTRANSCO and that as per the CERC DSM Regulation, 2014, the Commission has used Available Capacity (AvC) as the denominator for calculating Absolute Error and also, as per the Forum of Regulators on Model Regulation, the Central Commission, in the Statement of Reasons (SOR) accompanying the Framework on Forecasting, Scheduling and Imbalance Handling for Variable Renewable Energy Sources (Wind and Solar), has noted that the definition of error, calculated w.r.t. schedule does not adequately address instances such as low / no generation cases and low wind season where close to zero schedules would result in high numerical errors but with no real impact on the grid. Additionally, incentives to generators for better forecasting must be aligned with the objective of grid management, which is to minimize actual MW deviations from schedule. That as the commercial impact is designed to minimize MW deviations only if the denominator is constant (and not a variable such as 'schedule'). This will ensure that the error quantity corresponds to the physical MW impact on the grid, and the error definition holds valid in all seasons and accordingly requested not to deviate from the current Regulation i.e., calculation of error in absolute terms and not as per the proposed 'forecast error', keeping it consistent with the CERC DSM Regulation, 2014 and that if error is based on Scheduled Generation, it would be highly unfair to the Generators but at the same time it will have minimal or no impact on the overall grid.

d) Indian Wind Power Association (NRC) stated that, when there is no possibility of gaming when AvC is at denominator and also in order to ensure uniformity at National / Regional level, it is suggested to continue with the Error formula which is based on AvC at denominator.

e) M/s Ayana Renewable Power Ltd. have stated that change in formula for error would be against the interest of justice and would create serious prejudice against VRE as Renewable energy is predictable to some extent, that however, its forecasting and scheduling accuracies cannot be treated at par with conventional energy generators. That during low wind period and cloudy weather when scheduled energy for wind speed below 3.5 m/sec is low and when fluctuating wind hits turbine the error from 0 MW to 1 MW becomes 100% error and also this incremental MW addition grid of size 7000 MW doesn't impact stability and this was the reason why CERC took nameplate capacity as denominator instead of forecasted energy.

f) M/s Manikaran Analytics have requested to consider either:

Forecast Error (%) = 100 X (Schedule Generation - Actual Injection) / Available Capacity. (Exemption 15% of AVC);

OR

Forecast Error (%) = 100 X (Schedule Generation - Actual Injection) /Available Capacity. (Exemption 12% of AVC for Wind Plants & 7% of AVC for Solar Plants);

OR

Forecast Error (%) = 100 X (Schedule Generation - Actual Injection) / (Available Capacity or Scheduled Generation, whichever is higher).

g) M/s PTC Energy Ltd. have stated that the proposed forecast error shows the forecast error in relation to the forecast. However, such a metric can be misleading when applied on RE, as the numerator in the proposed forecast error i.e. (Schedule Generation - Actual Injection) represents the MW difference of generation; however, when divided by Schedule generation it represents the MW difference of generation in relation to the Schedule generation which is variable. Thus, even if the mean absolute error (Schedule Generation - actual Injection) is low; the resultant forecast error will be on the higher side contributing to high deviation charges with low impact on the grid. That a prime example of this is low wind season, where such forecast error will result in unnecessarily high numerical values but will have low impact on the grid.

h) Ashwin Gambhir, Ann Josey, Srihari Dukkipati and Sreekumar Nhalur of Prayas Energy Group have stated that using AvC based error definition enables better adherence to the guiding principles and that the F&S framework has to be enforceable and to be used to encourage scheduling discipline etc., as suggested by the FOR technical committee for ensuring smooth implementation of the mechanism and that the AvC based error definition should be continued for calculating the absolute error.

i) Council on Energy, Environment and Water (CEEW) have stated that the new term and the formula are redundant. That, the revised term 'Forecast Error' will not be applicable for intra-state transactions as charges for intra-state sale of electricity will be determined based on Allowable Forecast Error as per the proposed amendment. That, it is to be clarified whether the inter-state transactions will be governed by the new formula for 'Forecast Error' which will increase the charges to be paid to solar and wind generators from the State Pool Account for excess injection and that there should be a separate band for measurement of deviation in different seasons different tolerance band for windy and non-windy season in case of wind; and monsoon and rest of year in case of solar.

j) M/s Atria Power have stated that neighbouring States like Karnataka and Tamil Nadu are following 'Absolute Error' rather than forecast error which will reduce the allowable window of deviation as allowed by CERC. The allowable window of deviation by CERC was considered taking into account forecasting tools which are not much accurate with their results. Any reduction in allowable window of deviation is suggesting that APTransco is passing on its duties for Grid management to the Renewable Generators.

k) M/s Create Technologies have stated that if forecast error is calculated considering schedule data in denominator, it may show very high error but in actual it does not have much impact on the grid and explained with the following example:

E.g. AvC = 100 MW, Actual = 30 MW, Schedule = 60 MW

Case-1) Considering Schedule as denominator

Forecast error%= (30-60)*100/60= -50% error

Case-2) Considering AvC as denominator

% Error= (30-60)*100/100= -30% error

It can be seen that in actuality it impacts the grid upto (-30%) but if the schedule is used its impact is (-50%) which is wrong, Hence AvC should be used in the denominator.

l) Society for Water, Power and Natural resources conservation and Monitoring (SWAPNAM) stated that the proposal of APTRANSCO for amending the formula for calculation of error may be approved and consideration of Available capacity in the denominator is not justified for any reason. That the capacity of the solar project is the cumulative capacity of the individual solar panels. But some of the generators have gone for installation of additional panels arguing that the contracted capacity on the AC side is only the limitation for dispatch of energy to the grid. That, considering the optimization of equipment costs on the DC side and AC side of the projects, the developers are resorting to the addition of more panels and connected to the inverters and control / limit the plant output through the inverter to comply with the grid Regulations.

m) M/s Sembcorp Green Infra Ltd. have stated that the proposed amendment for substitution of "Absolute Error" with "Forecast Error" is not in line with the standard accuracy formula being practiced across the Centre and States for Solar and Wind Power Projects. That moving away from the current formula doesn't hold justice to the RE generator, which has already made huge investments in AP, considering the current formula. Since, the above absolute error formula is standardized across the Centre and all the State F&S regulations, the current absolute formula is to be continued for all future DSM calculations.

n) M/s Ushodaya Enterprises Ltd., M/s Adurjee & Bros. Private Limited, M/s Chanda Investment and Trading Company Private Ltd., M/s Cyrus Poonawalla Family Trust, M/s Cyza Chem Private Limited, M/s Naukhal Investment Private Limited, M/s Poonawalla Aviation Private Limited, M/s Poonawalla Estates Stud & Agri Farm Private Limited, M/s Poonawalla Shares and Securities Private Limited and M/s Villoo's Greenfield Farms have stated that 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 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. That, to highlight that the average error in calculating wind speed for wind power plant is around 0.7 meter per second. Further, the objective is to maintain grid discipline by minimizing the actual MW deviations from schedule by employing better forecast methods but not to penalize the renewable generators. Presently, QCAs are using the latest forecasting techniques wherein all the

parameters are iterated to give a forecast. If the DISCOMs are of the opinion that forecast techniques need improvement, they are authorized to examine the software tool being used by QCA / generators and may suggest for any development. That the existing formula for Absolute error does not contain any unrelated parameter and AvC is the basis on which generation is being forecasted and power is being scheduled. Forecast error represented by using AvC supports in encapsulating the mean absolute error or deviation from actual, in a relatively rational manner throughout the seasons.

11. Replies of APTRANSCO / APSLDC

a) On the objection that the proposed error definition is insufficient to handle varying seasons especially very low or zero schedules and is not aligned with direct grid impact (MW deviations) and instances of low / no generation cases cannot be covered if scheduled generation is considered in the denominator, APSLDC stated that in case of zero scheduled energy, the DSM charges could be levied at the rate of Rs.2/- per unit over / above the Allowable forecast error of respective actual energy being pumped into the grid in that particular 15 minute block.

b) On the question raised by the Council on Energy, Environment and Water (CEEW). that whether the inter-state transactions will be governed by the new formula for 'Forecast error', APSLDC replied that the proposed Amendments are not applicable to Inter-state transactions.

c) On the other objections that change in formula for error would be against the interest of justice and would create serious prejudice against VRE as Renewable Energy is predictable to some extent however, its forecasting and scheduling accuracies cannot be treated at par with the conventional energy generators, APSLDC stated that the formula for error should invariably contain one of the two parameters in the numerator as well as in the denominator and reiterated their justification given for the proposed amendment as extracted supra.

12. The following further objections have been received on the data (referred at Para 7 (a) supra) submitted by APSLDC which to the extent relevant is referred after excluding the submissions repeated from their main objections.

a) M/s Vena Energy Power Sources Private Limited, Indian Wind Power Association, M/s Azure Power India Private Ltd. IWPA, M/s Vayu Urja Bharat Private Limited, M/s Waneep Solar Pvt. Ltd., M/s Renew Power Private Ltd., M/s Sterling Agro Industries Ltd.,M/s Statkraft Markets Pvt. Ltd. and M/s REConnect Energy Solutions Pvt. Ltd.

have stated that on analysing the data provided by APSLDC, few calculation errors, mismatch of data sheets and formula errors are observed. Further, in the actual data provided by APSLDC (*for wind and solar*) for the year 2019, every two consecutive blocks are the same, which seems to be erroneous. That APSLDC is in effect trying to introduce a variable factor in the denominator, which will create uncertainties and will not adequately address instances such as low / no generation cases, thereby defeating the fundamental purpose / objective of the Regulation, i.e., maintaining grid stability and security while ensuring large scale integration of renewable energy. That, based on the data shared by the APSLDC, it can be clearly observed that the difference in the forecast error percentage and the absolute error percentage calculated for the early morning hours and the evening hours, and especially the early morning hours is exponential. If the proposed forecast error formula is adopted, it will create havoc for the solar power generators as it would not be economically feasible for them to continue the operations of their solar power plants, given such arbitrary and exponential penalty to be imposed upon them for deviating from the schedule. That from the review of the data submitted by the APSLDC, it can be safely inferred that the objective and intent behind proposing these amendments to the Regulations is not to maintain grid security but to penalize the RE generators and create a deterrent effect on them to continue their operations in the State of AP. That the only plausible explanation for deterring the RE generators could be to ensure that the AP DISCOMS do not remain obligated to purchase RE power at the PPA tariff and instead, can purchase cheaper power from the conventional energy sources, from the Indian Energy Exchange (IEX) or from the Real Time Market (RTM) and that APSLDC itself has not demonstrated the level of accuracy they expect from the generators with the available technology at the global level.

b) Azure Power India Private Ltd. IWPA, Vayu Urja Bharat Private Limited, M/s Sterling Agro Industries Ltd. and REConnect Energy Solutions Pvt. Ltd. have stated that for several time blocks, the error is in the range of 1-2% of Available Capacity (existing formula), but when calculated with respect to the schedule (proposed formula), it falls in the range of > 200%, and in several instances, it has crossed 1000%. That as per February, 2019 comparison data, the State overdrew from the National Grid in 1041 blocks out of which for almost 40% of the time blocks, RE was supporting the Grid in reducing the over drawl which shows there is no direct correlation. That, a similar analysis for June 2019 shows that RE supported the State Grid in 50% of the time blocks. That formulae applied for comparison are incorrect for the February and May, 2020 Comparison Data. The proposed forecast error formula is yielding exponentially

high forecast errors for the wind power generators as well. That, SLDC should first produce the results of exercises undertaken by it, if any, to forecast wind and solar power and subsequent planning for balancing such generation. Till such time the SLDC does not produce credible data that it has with all earnest fulfilled its responsibility as required under the extant Regulations, it cannot propose any amendment which is detrimental to the interest of wind and solar generators. That, as far as balancing of resources for grid operation is concerned, SLDC is mandated to undertake its own forecast and rely on the same. That relying on the forecast submitted by wind and solar generators is against the Regulations and that SLDC is clearly shying away from its responsibilities and attempting to create a false notion that all the grid disturbances are on account of VRE generators. That Renewable Energy Management Center (REMC) shall be capable of handling real time information from numerous projects within their geographical boundary which is critical to accurate forecasts. REMC, which shall be co located with SLDC, will provide the grid operators tools to integrate RE generation in its control area and its major function shall include: i) Forecasting of Wind & Solar generation, ii) Online geospatial monitoring of RE Generation at the transmission grid boundaries & at RE pooling stations, iii) Responsible for providing reliable RE data (generation, forecasting and scheduling data) to the SLDC, iv) Central Repository for RE generation data, v) Coordination agency on behalf of SLDC for interacting with RE Developers and the target date of establishment of the said REMC in AP was December 2018. That the Hon'ble Advocate General of Andhra Pradesh in his response in the Writ Petition No. 9844 of 2019 before the AP High Court had made a submission that AP SLDC shall be able to manage the renewable generation once REMC, is set up in the State of Andhra Pradesh. However, the SLDC by way of this amendment is trying to mask its own in-efficiencies. Any amendment must only be proposed only after REMC is operationalized with the necessary infrastructure and human capabilities in place and after drawing experience from operationalization of such REMC.

13. Objections on Amendment_2

a) APSEB Assistant Executive Engineers Association, Society for water power & Natural resources conservation awareness and monitoring (SWAPNAM), Manikaran Analytics Ltd, Prayas (Energy group) have stated that allowable forecast error is shown as 4.89% with 0.7 diversity factor but it will be 2.39% with the given inputs.

b) SWAPNAM have requested to examine the need for adopting the limits imposed by CERC Regulations and scientific reasons for consideration of the diversity factor. That the forecast error may be stipulated by the APERC at the level of 5% as requested by

TRANSCO or 6%, the maximum deviation observed by the APERC in the Tariff Order for FY2020-21 while discussing consideration of energy from the wind / solar projects and impact on grid stability.

c) M/s Hindupur Solar Park Pvt. Ltd. have stated that in case any amendment is required to be made, the SLDC should amend the Regulations to allow developers to use / access the closest Indian Meteorological Department (IMD) station data for forecasting and scheduling. That the authenticity and reliability of the data will be very high and the schedule will be provided as per IMD data which is likely to be much more accurate. However, if generation deviation is due to the forecast data mismatch from IMD itself then the developer should not be penalized for that quantum.

d) Sri M. Venugopal Rao has stated that allowing a deviation limit of +/- 250 MW only by CERC is irrational and reflects its unjustifiable pro-developer proclivity. That, such an irrational approach makes the deviation charges insignificant compared to the burdens the DISCOMs and their consumers of power have to bear and bails out the generators from paying deviation charges fully depending on the percentage of deviation and that the amendment proposed by APTransco should be brought about.

e) M/s Ecoren Energy Ltd. have stated that in case two VRE Generators deviate in the opposite direction, both the VRE Generators end up paying deviation charges despite there being no impact upon the State owing to deviation on the part of both the generators. The CERC, in view of the simulation studies as well as international research reports on the observed Mean Absolute Error (MAE), had put forth the framework for computing deviation charges based on error, with a tolerance band of 15% initially, which shall be tightened over time as the ecosystem gains experience.

f) M/s Weizmann Ltd., M/s Jindal Aluminium Ltd., M/s IWPA, M/s NALCO and M/s RE Connect Energy have stated that nowhere in the “detailed report” or any other place is such a “diversity factor” either defined, explained or any basis of the “0.7" multiplier is elaborated upon.

g) M/s Orient Green Power Ltd. have stated that the DSM at the State Periphery can be complied by regulating other sources of power in accordance with the generation from VRE sources. That the deviation in wind speed limit and wind power generation is not linear. That forecast error shall not be at 5% which is not at all possible due to variable, infirm and uncontrollable nature of VRE sources and hence, this amendment should not be carried out.

h) IWPA (NRC) have stated that there won't be any case that the entire 1125 MW will go towards underdrawal or over-drawal in a single shot, hence there would be some ratio

and that there are 16 intra-day revisions allowed in the schedule which provides better forecasting and scheduling.

i) M/s Ayana and M/s Manikaran Analytics Ltd. have stated that if renewable energy generators are treated at par with conventional energy generators that would seriously defeat the very target of the Government of India to meet its renewable energy target since VRE Generator has a very narrow scope for mismatch with respect to their revenue requirement. That VRE Generators are firmly dependent upon weather conditions for their plant operation and generation and accurate projection of their electricity generation and revenue cannot be ascertained and in such a scenario reducing permissible band for deviation would totally take away the commercial viability of VRE Generators.

j) M/s Manikaran Analytics have suggested that the formula may be adopted as 100 x (quantum of deviation limit permitted under CERCs DSM Regulation amended from time to time)/(diversity factor 0.7 in control area in the beginning of financial year) x (quantum of scheduled VRE for particular time block)

k) M/s PTC Energy Ltd. have stated that that the challenges of Variable Renewable Energy Sources (VRE) are well documented and forecasting of VRE is not the only culprit contributing to imbalance in the grid. That in addition to accurate forecasting of VRE, functional primary and secondary control reserves shall be utilized to ensure provision of ancillary and balancing services such as additional Pumped storage hydro plants, Spinning reserves etc. That the move should not be towards creating adverse provisions for environmentally benign VRE sector and that the existing framework on calculating DSM is suitable for balancing the grid without unduly disincentivizing the VRE generator.

l) Ashwin Gambhir, Ann Josey, Srihari Dukkipati and Sreekumar Nhalur of Prayas Energy group stated that the present allowable error of 15% as fixed by APERC was based on CERC studies for few pooling stations based on the error formula as presently adopted by APERC. Any change in the allowable error or the formula should be based on a rigorous study of existing data from implementation of Forecasting & Scheduling since 2017. That the study can also highlight if there is a need to have different allowable errors for new and old renewable energy generators. Similarly, predictability and forecasting accuracy of solar power is potentially higher than wind power and hence the 15% allowable error may become lax in the coming years, especially for solar. That whether solar and wind would need separate allowable error bands in the future is also a question before the Commission. That, under the existing

APERC framework, the DISCOMs bear the cost of deviation penalties by wind and solar up to 15% absolute error and that the deviation penalty caused due to wind and solar should be borne by these generators. Accordingly, in line with the Regulations of MERC, the clause 6.3 of the Regulation may be amended, by adding the following provision below the Table in Regulation 6.3 and that this provision should be applicable to the 'None' deviation charges applicable below the 15% error detailed in the Table.

"The methodology for deviation settlement for the State shall be as follows:

(i) The Deviation Charge payable or receivable for the State as a whole at the State periphery shall be determined by the SLDC.

(ii) The SLDC shall compute the impact of the deviation of the Solar and Wind Energy Generation and its contribution to the Deviation Charge at the State periphery.

(iii) The SLDC shall compute the Absolute Error, i.e., the difference between the scheduled and the actual energy injected, in respect of each Pooling Substation and each Generator feeding energy directly to another Sub-Station, and shall accordingly determine the amounts payable on account of the Deviation Charge in accordance with Regulations 7 and 8.

(iv) Any shortfall in the aggregate amount of Deviation Charge payable by Solar and Wind Energy Generators at the State periphery and the amount receivable from them by the Pool Account shall be paid by the respective QCAs in proportion to their deviation reflected at the State periphery."

m) M/s Atria Power have stated that installed Capacity in Renewable Generation in neighbouring States is 12179 MW in Tamil Nadu and 14870 MW in Karnataka. That as mentioned in the justification, at any point of time, there will not be a 15% forecast error with all the sources of Renewable Energy. All the contingency shortfall / surplus requirements can be met by the Real Time Market Regulation, DSM Regulation and Power Exchanges. That in case of Renewable Generation, system operators have to take advantage of the latest market practices by working closely with other neighbouring states and Power trading companies.

n) M/s Sembcorp Green Infra Limited has stated that the proposed accuracy bands by APSLDC have left no room for the RE generators to be within the accuracy limits, especially with the current forecasting technologies available for RE in India and globally, the desired accuracies as per proposed changes are unviable for an RE and

practically not possible to achieve and therefore suggested that current accuracy bands and DSM charges shall be continued.

o) M/s Ushodaya Enterprises Pvt. Ltd. have stated that formula used for deriving diversity factor seems to be incorrect as VRE capacity taken into consideration by APSLDC for determining diversity factor is 7500 MW consisting of both solar as well as wind. However, AVC of solar power plants is reduced to zero during the night time and similarly AVC of wind plants changes from season to season for e.g., high wind season and low wind season. APSLDC has fixed the AVC of VRE Generator to 7500 throughout the year. That, however, since VRE Generators are nature dependent, their AVC varies from time block to time block and fixation of installed capacity of the entire VRE Generator throughout the year will not give the desired result.

p) M/s Adurjee & Bros. Private Limited, M/s Chanda Investment and Trading Company Private Ltd., M/s Cyrus Poonawalla Family Trust, M/s Cyza Chem Private Limited, M/s Naukhal Investment Private Limited, M/s Poonawalla Aviation Private Limited, M/s Poonawalla Estates Stud & Agri Farm Private Limited, M/s Poonawalla Shares and Securities Private Limited and M/s Villoo's Greenfield Farms have stated that if the proposed definition of allowable error and calculation thereto are taken into consideration, 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. As per the proposed formula the allowable forecast error will always be 2.39% and is expected to decrease in future with every MW of VRE capacity addition and allowing such narrow bands is unjust and against special provision made for such VRE capacity in the Grid code, Model Regulations and CERC DSM Regulations. That VRE generators are heavily dependent upon weather conditions for their plant operation & generation and accurate projection of their electricity generation and revenue cannot be ascertained and that reducing the permissible band for deviation would totally take away the commercial viability of the projects set up by the RE generators.

14. Replies of APTRANSCO / APSLDC:

a) On the objections that the allowable forecast error shown as 4.89 with 0.7 diversity factor but it will be 2.39% with the given inputs, APSLDC replied that typographical error had inadvertently crept-in in the "Allowable forecast error" formula as 0.7 diversity factor is to be considered in the denominator instead of in the numerator and with the above change allowable forecast error will be 4.89 % or say 5.0%.

b) On the objection that nowhere in the "detailed report" or any other place the "diversity factor" either defined, explained or any basis of the "0.7" multiplier elaborated upon, APSLDC replied that the diversity factor of 0.7 was taken from Central Electricity Authority's "Transmission Planning Criteria".

c) On the objection that the projects spread out over a large and geographically diverse area will result in low overall error as often errors of individual projects cancel each other, APSLDC replied that the Hon'ble CERC allows a deviation limit of only +/- 250 MW for RE rich states. That for VRE capacity of 7500 MW in the State of A.P / forecast error of 15% will result in 1125 MW deviation which is not allowed by CERC. The deviation of maximum allowable quantum of 1125 MW variation in downward direction will result in over drawal from the grid beyond the permissible limits and in that event it would lead to load shedding in real time operation of grid since spinning reserves are not available from conventional sources. That the deviation in positive direction results in backing down of conventional generators and violation notices are served by SRLDC on SLDC to adhere to IEGC regulations while taking corrective steps for maintaining load generation balance and deviation in negative direction results in deficit conditions which require resources to bridge the gap between load and generation. That, majority of wind and solar generating stations are located in the same place i.e., Anantapur and Kurnool districts and occurrences of deviation in opposite directions are rare.

15. The following further objections have been received on the data (referred to at Para 7 (b) supra) submitted by APSLDC which to the extent relevant is referred after excluding the submissions repeated from their main objections.

a) M/s Vena Energy Resources Ltd. IWPA, Vayu Urja Bharat Private Limited, M/s Sterling Agro Industries Ltd. have stated that APSLDC has conveniently provided data from the year 2018 onwards, that too not time block wise. That, APSLDC has clearly stated that no load shedding took place in the year 2018 on account of the variation in the renewable energy generation. That, in addition, for the year 2019, APSLDC enumerated only seven (7) days wherein allegedly load shedding took place on account of variation in renewable generation. That load shedding only on select 7 days over a span of 972 days (i.e., from 01.01.2018 to 30.08.2020) isn't sufficient to call for the amendments proposed by APSLDC and further fortifies the fact that APSLDC hasn't been facing any substantial issues and no grid instability has been caused as such. That data shared by APSLDC does not demonstrate that the load shedding on the given occasions is primarily due to the variation in the VRE power generation from their schedule and the prima facie study depicts an erratic pattern of load shedding

corresponding to the RE deviation. That it has been observed from the data shared that on the following dates the difference in load shedding is largely inconsistent as against VRE variation in a similar range:

a) 29.04.2019 – RE variation/Load shedding = 1125 MW/177 MW

b) 09.06.2019 – RE variation/Load shedding = 1200 MW/1670MW

c) 14.08.2019 – RE variation/Load shedding = 1160 MW/14 MW

That the above clearly depicts that the variation in RE generation as against the schedule is not the reason for load shedding and APSLDC by trying to inaccurately / forcibly correlate the same, is misleading this Commission. That, as per the details of load shedding shared by the APSLDC, the number of time blocks wherein the deviation in forecasting have been above 1125 MW is only 52 from July 2018 to May 2020. Also, these time blocks are spread over 7 non-continuous / non-consecutive days in 2019, the last one being on 14.08.2019. So, the probability of the occurrence of such an event can be computed to be only 0.077% of total time blocks (67296 - time blocks in 701 days) since 01.07.2018, which is a miniscule and does not by any stretch justify the proposed amendments by APSLDC. That, by submitting the insufficient and inadequate data, APSLDC has grossly failed in justifying the necessity of the proposed amendment on account of the significant variation of renewable energy (i.e., to the tune of 1125 MW) from the scheduled forecast.

b) Azure Power India Private Ltd. and M/s Statkraft Markets Private Limited have stated that that in the isolated incidents highlighted, the average load shedding is only 375 MW.

c) M/s Mytrah Energy India Pvt. Limited stated that to understand the cost of deviation from Variable Renewable Energy, the demand and supply forecast data needs to be studied. That since the APTRANSCO / APSLDC has provided data for the supply side only and has not provided data for the demand side, it is not justifiable to establish that the grid stability is just due to supply side forecast error. That entirely relying on supply data will not provide a balanced picture. Also, since demand and supply mismatch data is absent from the APSLDC document, implying that the impact is just because of supply side forecast error is an incomplete analysis.

d) M/s Statkraft Markets Private Limited have stated that with reference to the commercial deviation data downloaded from SRPC website for February-2019 (Weekly DSM data) and data submitted by APSLDC (Weekly DSM data) – While the State was over-drawing, the RE had over-injected and supported the grid for almost 40% (408 out of 1041) time-blocks of time block of such over-drawl events. That with

reference to the commercial deviation data downloaded from SRPC website for June-2019 (Weekly DSM data) and data submitted by APSLDC (Weekly DSM data) – While the State was overdrawing, the RE had over injected and supported the grid for almost 50% (603 out of 1199 timeblocks) of time block of such over-drawl events. That, therefore, provided data does not confirm that the impact on state grid stability is particularly due to VRE variation. That there are power purchase mechanisms such as an intra-day market already available in the market to lend support to grid management; however, there is less liquidity in the system due to low participation. Additionally, to improve grid management, CERC has notified the Framework for Real-Time Market for Electricity which came into effect from 1st April 2020 and that this will bring more liquidity into the market; allowing grid operators to purchase power effectively.

16. Objections on Amendment-3

a) M/s Hindupur Solar power park private Ltd. has stated that allowing intra-day revision helps the system planner to better manage the system in case of breakdown of overhead lines which are exposed to environmental events or sudden change in weather condition which will have an impact on generation affecting the grid. That not permitting any change in the day ahead schedule may impact the grid since actual is bound to change due to variability of nature at the same time no change in schedule will impact the grid operations. That shorter dispatch time helps in improving the system efficiency and reduce the requirement of reserve to meet any emergency, as the system operator has real time availability of information about the quantum of reserve and resources at hand at any given point of time and that the assumption taken into consideration does not cover all aspects of power procurement and power drawl scenarios of the DISCOMs.

b) Sri M.Venugopal Rao has stated that the amendment proposed seeking removal of the option to solar and wind units to reschedule on one and a half hourly basis during the day of operation and making them strictly adhere to scheduling on day ahead basis is justifiable for the reasons explained in the detailed report.

c) M/s Ecoren Energy Ltd. have stated that accurate prediction of weather conditions on day ahead basis is not technically possible. That with the available weather prediction technology and models, local weather changes cannot be predicted more than one hour in advance to the accuracy of +/- 15% especially the local cloud movements during the monsoon season in case of Solar projects. That removing provisions for revision in schedule and reducing the accuracy band to 5% would entirely make

projects unviable for developers to operate and that 16 revisions may be allowed as per FOR's framework considering the infirm nature of solar and wind power.

d) M/s Weizmann Ltd., M/s Jindal Aluminium Ltd., IWPA, M/s NALCO, M/s RE Connect Energy have stated that allowing only day Ahead schedule for VREs may significantly escalate the deficit / surplus scenario for the DISCOMs, due to much higher variations in the Day Ahead forecast and that with the Real Time Electricity Market, the utilities will have access to real time electricity trading market options so that the deficits/surplus can be better managed on a real time basis.

e) M/s Orient Green Power Ltd. have stated that it is impractical to schedule on day head basis because of the variable; infirm and uncontrollable nature of wind and that the existing practice shall be retained without any amendment.

f) Indian Wind Power Association (NRC) stated that the provisions of existing Regulation, related to number of revisions are in line with IEGC provisions and any change in the process of revision of schedules at State level will have impact on scheduling at regional level also which may create operational issues for RLDC as well as SLDC.

g) Ashwin Gambhir, Ann Josey, Srihari Dukkipati, Sreekumar Nhalur of Prayas (Energy Group) have stated that the 16 and 9 revisions of schedule for wind and solar generators closer to real time operation should be continued with, since the accuracy of forecast closer to real time is much better than a day-ahead forecast and that the CERC has already amended its Regulations to enable the implementation of Real Time Markets from 1st April, 2020 which would allow stakeholders to buy and sell power in a half hourly market, just one and half hours before delivery period and that this would enable generators / DISCOMs to reduce their deviation close to real time.

h) M/s Ayana Renewable Power Private Limited have stated that weather conditions vary from time to time in a particular given day and therefore real time data as provided by IMD or other service providers needs 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, entire purpose of the Regulation i.e., grid safety and stability would be defeated. That on account of equipment breakdown which are not scheduled in nature, it is impossible for predicting such breakdown and account the impact while submitting day ahead schedules and current plant design doesn't have any hot standby reserve to fulfill these transient impacts. That overhead transmission lines are exposed to environmental events which many times lead to breakdown of lines resulting outages which can't be accounted for in day-ahead

schedules hence intra-day schedule is required to make the scheduling exercise more realistic and useful for making right generation mix at State level.

i) M/s Manikaran Analytics Ltd. have stated that the proposed amendment must be struck down and Variable Renewable Energy Generators shall be allowed to submit revised schedules on intraday with at least 16 revisions by wind generators and 9 revisions by Solar Generators.

j) M/s PTC Energy Ltd. have stated that a forecasting framework has to be in place which captures the intermittent nature and allows the generators to improve the forecasting accuracy by utilizing revisions closer to the generation time and that the current provisions of intraday revision may be continued and for better forecasting accuracy levels the limit on intraday revisions should be removed.

k) APSEBAEA stated that the proposed amendment to remove the option of rescheduling of forecast on one and half hourly basis during the day of operation and strictly adhere to scheduling on day ahead basis may be approved as it gives convenience to maintain grid discipline and security and that it avoids violation notices by SRLDC and to avoid unscheduled load shedding.

l) M/s Atria Wind Power Private Ltd. have stated that on one hand the system operator is referring that the accurate forecasting for Renewable Sources is not possible because of which they are facing issues in Grid Management and on the other hand they want to take away the right of revision in schedule as per CERC and APERC Grid Code and that simultaneously, system operator is self-sufficient in maintaining Grid discipline not only by controlling Generation but also through Demand Management.

m) M/s Create Technologies LLP have requested to reconsider the clause, as in case of Solar and Wind energy the generation depends on the weather parameters such as GHI, wind speed, temperature etc. which is sometimes difficult to predict a day before. That sudden changes in weather have direct effect on the generation, in such cases intra-day schedules are required and that Real-time market has been introduced to maintain grid stability and for real-time power management.

n) M/s Sembcorp Green Infra Ltd. has stated that further to help the DISCOMs to absorb the changes in RE schedules, a real time market has been operationalised which offers the opportunity to buy / sell power with a time gap of half an hour to actual delivery. The revisions of RE schedule which are being allowed at the interval of six time blocks i.e., 1.5 Hr is much longer than RTM timeline of half an hour and DISCOMs should be able to manage the RE revisions effectively and to their benefit and that it

is imperative that frequent revisions should be allowed to RE to make effective revisions in schedule for real time grid balancing.

o) M/s Ushodaya Enterprises Pvt. Ltd. have stated that the solar and wind power generation is entirely dependent on weather parameters which are not accurately predictable, even one day ahead. That QCAs are largely dependent on currently available weather prediction technologies and models and many times localized, or limited geographical impact is not built into the prediction models. Solar or wind power plants are located in certain clusters and the vagaries of nature are sometimes difficult to predict. That forecasting accuracy improves as more updates are done aligned with shorter scheduling intervals. That removing provisions for intra-day revision in schedule and reducing the accuracy band to 5%, would entirely make projects unviable for developers and will hamper the quality of forecast and lead to greater instability in the grid. That Power plants based on conventional sources have the provision for multiple schedule revisions and the same provision should also be made applicable for RE based projects. That Renewable energy forecasting and scheduling and deviation settlement mechanism Regulations were put into place in order to ensure grid safety and stability. Weather data and parameters play an important role for VRE Generators as plant's generation is directly related to weather conditions. Weather conditions vary from time to time in a particular given day and therefore weather data as provided by IMD or other service providers at regular intervals 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, the entire purpose of the Regulation i.e., grid safety and stability would be defeated. Real Time Electricity Market in India is already operational with effect from 01 June 2020. That the utilities have access to real time electricity trading market options so that the deficits / surplus can be better managed on a real time basis. That it is impractical to schedule one day-ahead basis because of the variable, infirm and uncontrollable nature of wind and that the current provisions of intraday revision may be continued and for better forecasting accuracy levels, the limit on intraday revisions should be removed.

p) M/s Adurjee & Bros. Private Limited, M/s Chanda Investment and Trading Company Private Ltd., M/s Cyrus Poonawalla Family Trust, M/s Cyza Chem Private Limited, M/s Naukhal Investment Private Limited, M/s Poonawalla Aviation Private Limited, M/s Poonawalla Estates Stud & Agri Farm Private Limited, M/s Poonawalla Shares and Securities Private Limited, M/s Villoo's Greenfield Farms have stated that considering the prevalent technology, accurate predictions of weather conditions on day ahead

basis is not technically possible. That in case provision for revising schedules is taken away, then the entire purpose of the Regulations, i.e., grid safety and stability, would be defeated. That the energy demand is expected to grow significantly in the coming times while the conventional energy sources are limited. That 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 and the mechanism of forecasting and scheduling of RE was introduced to improve the integration of the RE power in the power grid. That therefore, there is a requirement of intraday revisions to achieve the goal of successful RE integration. That flexibility should be given for revising the schedule intra-day as many times as possible for attaining better accuracy. That removing the scheduled revision capacity will hamper the quality of forecast and lead to greater instability in the grid and that power plants based on conventional sources have the provision for multiple scheduled revisions, the same provision should also be made applicable for VRE based projects.

17. Replies of APTRANSCO / APSLDC

a) On the objection that overhead transmission lines are exposed to environmental events which many times leads to breakdown of lines and connected equipment resulting outages which can't be accounted on day ahead schedules, APSLDC replied that in any outgoing lines or connected equipment of power evacuated lines of particular generator breakdown occurs and evacuation of power to the grid is not possible, it is considered as force measure and schedule will be replaced with actual and that there will not be any deviation penalty in that case.

b) Replying to the other objections APSLDC stated that the proposed amendment is expected to bring in the VRE generators to forecast accurately which will be useful for planning the load generation balance in real time grid operation. That the amendment was proposed after going through the practical difficulties & field experiences with variable nature intermittent VRE generation in the last 2 to 3 years. That planning of resources by DISCOMs is done on a day ahead basis and the resources include all conventional and RE generators. That, DISCOMs optimize the purchase and sell power through power exchanges and any deviation from forecast during real time of VRE sources would affect load generation balance. That, DISCOMs have to tie up or sell power which is not always feasible and they need to take corrective action by taking load shedding or curtailment of generation. That URS power and UI power are laden with uncertainties. That SLDC system operator has no control on the Grid condition and RLDC may not permit the State to overdraw / under draw from the grid. That URS power is not always available and it depends on other State demand

pattern, unit outages etc., even if URS is available, DISCOMs have to pay a high price for the power that is required to bridge the gap. That apart SLDC would suffer with violation notices by SRLDC, forcing DISCOMS to resort to load shedding. In case the above desired action is not realized, DISCOMs are not able to cope up with the deficit/surplus arising due to sudden variation in VRE generation in real time operation, because of a) power market mechanism is not mature b) warm and cold start-up which will take longer time to reach full load, and c) DISCOMs have to tie up power subject to availability from all sources.

18. Further, the following objections have been received on the data [as at Para 7 (c) to (e) supra] submitted by APSLDC.

a) M/s Vena energy systems, IWPA, M/s Vayu Urja Bharat Private Limited, M/s Renew Power Private Limited, M/s Sterling Agro Industries Ltd.M/s RE Connect Energy Solutions Pvt. Ltd. and M/s Statkraft Markets Pvt. Ltd. have stated that as per the proviso to clause 1.2 of the Regulations, forecasting, scheduling and deviation settlement was in effect from 01.01.2018, therefore, in essence, data had to be submitted by APSLDC is from 01.01.2018 onwards. That, data records previous incidents of grid instability due to sudden and gradual variation of VRE generation and the consequent action taken by APSLDC in this regard and the data submitted consist of incidents/instances only from 25.04.2020 and not from 01.01.2018. That APSLDC is adopting a very selective approach in providing data in support of the amendments proposed by it and in any case, is highly insufficient to support the claims made by APSLDC. That the data submitted by APSLDC only covers the actions taken by APSLDC due to the variation in the VRE generation from the scheduled forecast after 25.04.2020, i.e., after the aforesaid amendments have been proposed. That they have failed to produce any data which shows that APSLDC has approached this Commission to highlight the deviation in VRE generation by the power developers prior to submission of proposed amendments by APSLDC. That APSLDC had started to collect data in support of the proposed amendments after this Commission has recorded in the Tariff Order for FY2020-21 that there are no problems reported in relation to grid stability due to the despatch from the RE sources and the data submitted cannot be relied upon as it is not substantiating the proposed amendments. That Annexure-C2 records certain instances of gradual and sudden deviation of RE generation w.r.t forecast. That APSLDC has selectively provided data in this regard from 10.08.2019 and not from 01.01.2018 and that too data pertaining to only certain dates in the month of August and November 2019 which means that there was no impact on the grid prior to 10.08.2019. That, since the effective date of the aforesaid

Regulations on 01.01.2018 till 09.08.2019 which is more than one and half years of the operation of the Regulation, no data has been provided by APSLDC. That the data shared by APSLDC only highlights the graphical depiction of the instances when there is deviation in VRE generation from the forecast and while highlighting these instances, failed to highlight the impact of these deviations on the grid. That based upon the data shared, it cannot be inferred that such instances of deviation have affected the stability of the grid as there is nothing on record to support the same. Also, on comparison of the data shared by APSLDC, there is only one common entry, i.e., on13.08.2019, where it states that it had to undertake load shedding and the data does not corroborate as to what actions APSLDC had to undertake due to such alleged variations. That the notices received by APSLDC from the NLDC / RLDC to restrict the drawl and to control grid parameters pertains to the period from 10.08.2019 and not from the time the Regulation came into effect i.e., 01.01.2018 which again makes it apparent that APSLDC does not have sufficient data and is providing piece meal selective data to unscrupulously justify the proposed amendment to remove intra-day revisions. That from review of the data, APSLDC has failed to draw any correlation between the variation in RE generation and grid instability and in any case, is insufficient to call for the proposed amendments. That all mentioned incidences have been measured with reference to the day-ahead forecast only and not the intra-day revised forecast which if considered will greatly lower the deviation incidences and that since, APSLDC itself has failed to abide by the Regulation, they do not have any locus standi to propose any amendments to the same.

b) M/s Azure Power India Private Ltd. have stated that it is not clear whether the comparison done by the APSLDC for Forecasting and Actual data is with day-ahead forecasting data or Intra-day data. That variability of generation from VREs can only be bridged if revisions are allowed close to real time so that the variations can be kept at a lower level. That allowing only day ahead schedule for VREs may significantly escalate the deficit / surplus scenario for the DISCOMs, due to much higher variations in the day ahead forecast.

c) M/s Statkraft Markets Pvt. Ltd. have also stated that the amendments sought by APSLDC/APTRANSCO if implemented, will drastically increase the DSM charges. That in their analysis on Feb'2019 data provided by APSLDC shows that effective DSM charges for the entire State considering proposed amendments and excluding demand for not allowing the intra-day revisions will result in increase in the burden of DSM charges to the tune of Rs.100 thousand/MW/Month and Rs.30 thousand / MW/Month for Wind and Solar respectively and that considering proposed amendment

for not allowing intra-day revision, DSM penalty amount may increase further by 20-30 %.

19. Objections on Amendment-4

a) M/s Hindupur Solar Park Pvt. Ltd. has stated that none of the Regulations by CERC and other State regulators have such provision i.e., 5% range capping, applicability of Rs.2 per unit penalty, removal of intra-day revision etc., and these proposed provisions are arbitrary and without basis.

b) SWAPNAM stated that for the over injection by VRE generator, imposing a penalty is not suggested. That if the grid cannot absorb due to difficulty in further backing down of thermal stations below their technical limits, the VRE projects monitored by the SLDC can be asked to be backed down. That the estimated balancing cost of 40 paise per unit may be imposed on VRE generator and be given to the thermal generator who backs down the generation and that for the shortfall by the VRE generator, the UI rates in the market or actual rate of purchase in the market by SLDC may be collected, instead of the proposed Rs.2 / unit.

c) M/s Hindupur Solar Pvt. Ltd. have stated that justification provided for the proposed amendment is flawed as it is already assumed that in case of deviation, DISCOMs are purchasing power at high cost, however, the same is not correct in every case. There can be instances that DISCOMs procuring power from exchange or other short-term sources at a rate cheaper than its PPA rate and thereby deviations on account of VRE Generator would end up benefiting DISCOMs. That Rs.2 per unit for energy deviated would be so onerous for VRE Generator, payable on account of deviations. Further, the amendment is against the CERC Regulations and initially, during planning of RE Integration with the grid, deviations on account of VRE Generators was 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 VRE Generators are not put at a losing end owing to nature of the infirm power and weather conditions and that as per the proposed amendment, the entire equilibrium would be disturbed with VRE Generators being at the losing.

d) Sri M. Venugopal Rao stated that the objectives of the subject Regulation to maintain grid discipline and grid safety are not realised, as utilities are facing difficulties with uncertainty in VRE generation, a realistic assessment has to be made to determine deviation charges, keeping in view the burdens being imposed on the DISCOMs and their consumers due to failures of commission and omission of solar and wind power units. He has requested to examine the veracity of calculations made and deviation

charges proposed by AP Transco, as per the amendment proposed and determine the same realistically and to re-examine the whole issue thoroughly and bring about necessary amendments to the Regulation to make it stringent in consonance with the real impact of deviations and determine penalties higher than the present ones in the existing Regulation, to be in tune with such a real impact.

e) M/s Ecoren Energy Ltd. stated that even the dedicated government departments using the best of the forecasting technologies cannot accurately predict the phenomenon of nature. That, it would be completely unfair to penalize wind/solar generators for any inaccurate forecasting, that too at the lowest tolerance band of +/- 5% and at Rs.2.0 per kWh. That, according to CERC DSM Regulations, 2014, the penalty is based on percentage of fixed rate with each error band and not an absolute penalty value as proposed by AP Transco and the proposed absolute penalty of Rs.2 per kWh is extremely harsh and unviable and that DSM charges may be aligned as per CERC DSM Regulation 2014 with deviation penalty charges in percentage basis of Tariff and with similar error bands.

f) M/s Weizmann Ltd., M/s.Jindal AluminumLtd., IWPA, M/s NALCO, M/s REConnect Energy Ltd. have stated that detailed calculations of how the adequacy cost of Rs.1.6/unit and balancing cost of Rs.0.4/unit have been arrived at are not available. That, other States have taken an opposite approach of reducing per unit DSM charges. In Gujarat, DSM charges are Rs.0.25/-, Rs.0.5 and Rs.0.75 per unit. This is done in conjunction with marginal reduction in accuracy thresholds. That the reduction in per unit DSM charge is in line with the recent PPA tariffs, which have been significantly lower than the Rs. 5/unit benchmark used by FoR when determining the current DSM charges and that reduction of per unit DSM charges should be considered.

g) M/s Orient Green Power Ltd. have stated that the proposal to levy deviation charges of Rs.2 per unit of deviation has no basis and is much higher. That all costs namely the adequacy costs and balancing costs that are mentioned as reasons for seeking the increase are factored in the ARR and passed on as tariff to the consumers. Further, the DISCOM is obligated to fulfil its own RPO for which it has to buy RE power and the APDISCOM is claiming RECs in respect of green power purchased in excess of the RPO and thus gets income from sale of REC.

h) Indian Wind Power Association (NRC) stated that the same bands of % Absolute Error may be stipulated as stipulated by CERC.

i) M/s Ayana Renewable Power Ltd. have stated that justification provided for the proposed amendment is very narrow to the extent as it already assumed that in case of deviation DISCOMs are purchasing power at high cost, however, the same is not correct in every case. There can be instances that DISCOMs procuring power from exchange at a rate cheaper than its average pooled variable cost and thereby deviations on account of VRE Generator benefitting DISCOMs. Rs.2 per unit for energy deviated would be so onerous for VRE Generator that running plant would become very difficult for them owing to penalties payable on account of deviations as average PPA rate of VRE Generator comes out to be Rs.3 kWh and such penalties may amount to more than 50% of the total revenue of the VRE Generator and thereby posing negative impact upon the plant sustainability.

j) M/s Manikaran Analytics have requested the Commission to consider introducing penalty for deviation in different bands that too with graded deviation charges as may be deemed fit, instead of charging Rs.2/unit. That the neighbouring RE rich State Tamil Nadu's final Regulation also incentivizes the generator by capping the penalty and paying back deviation charges if the deviation charges of the entire year are greater than Rs 0.50 per unit. That the objective of the prevailing Regulation is fulfilling the State's objective of facilitating large scale grid integration of solar and wind energy generating stations while maintaining grid stability and security and that the existing regulation may be continued.

k) M/s PTC Energy Ltd. stated that forecasting for wind and solar PV in India is gradually evolving with advancement of forecasting technology and participation of international players in the sector. That global studies emphasize that errors reduce over a period. Yet, achieving 100% accuracy is not possible given the nature of VRE.

l) Ashwin Gambhir, Ann Josey, Srihari Dukkipati, Sreekumar Nhalur of Prayas Energy Group stated that an analysis of the approved power procurement for 2020-21 shows that the variable cost alone, of thermal generation for a significant share (~80%) of the total thermal procurement is above Rs.3/kWh, which is higher than the recently adopted solar tariffs by APERC which suggests that backing down of expensive coal generation to accommodate new solar and wind power (Rs. 3/kWh) can actually save costs for the DISCOMs and would not have any additional burden of adequacy costs. That on the aspect of Rs 0.4/kWh of balancing costs due to higher heat rate and auxiliary consumption due to flexible operation of coal plants, it is needed not just to accommodate renewables, but also due to variation in load. That rather than accounting for such costs in the Regulations, the appropriate way is to have a compensation mechanism akin to CERC's Mechanism for compensation for

degradation of heat rate, auxiliary power consumption and secondary fuel consumption (due to part load operation and multiple start / stop of units) for flexible operation of thermal plants and that the Commission should consider amending the tariff Regulations to introduce such compensation mechanisms.

m) APSEBAEA stated that to accommodate VRE generation all the State owned thermal power plants are running at their technical minimum load. That in case of excess generation than scheduled further back down of thermal plants is not possible so, it is advised to go for the back down of VRE even if they have must run status, in view of grid stability. That the proposed balancing cost of 40 paisa per unit shall be given to the thermal generators which are backed down to accommodate VRE. From the FY2016-17 onwards, the APGENCO Thermal Power Plants were backed down in order to accommodate VRE. That shortfall of generation caused due to back down of units shall be compensated by the balancing cost and that in case of shortfall of the scheduled energy, the deviation charges levied by SLDC shall be as per the actual rate of power purchase in the market instead of Rs.2/- per unit.

n) M/s Atria Power have stated that all the Renewable Energy assets are under huge stress because of the poor recovery from their beneficiaries and ongoing pressure from the lenders. That the cost of DSM works out to be the operational cost for Renewable Generators for which every generator works on keeping it as low as possible. Also, the whole purpose of DSM charges is not to make benefits or compensation for loss but to maintain Grid discipline, which seems lacking in justification given by the System Operator.

o) M/s Kreate Technologies have stated that the DSM charge of Rs. 2.00 as penalty is a very high rate. The deviation band in all the States is based on the Absolute Error and the penalty is within the range of Rs. 0.25 to Rs.1.50 per unit for different ranges of deviation band.

p) M/s Ushodaya Enterprises Pvt. Ltd. have stated that the attribution of the entire variations to renewable energy alone is unjust and unfair, keeping in view the renewable generation dependence on weather conditions. That the proposed deviation band consisting of no incremental band and a flat band of allowable forecast error would remove commercial viability of wind and solar projects and that the current provisions of deviation charges for over or under injection for sale/supply of power within the State may be continued.

q) M/s Adurjee & Bros. Private Limited, M/s Chanda Investment and Trading Company Private Ltd., M/s Cyrus Poonawalla Family Trust, M/s Cyza Chem Private Limited, M/s

Naukhal Investment Private Limited, M/s Poonawalla Aviation Private Limited, M/s Poonawalla Estates Stud & Agri Farm Private Limited, M/s Poonawalla Shares and Securities Private Limited, M/s Villoo's Greenfield Farms have stated that the deviation band requested by most of the generators during draft Regulations without penalties is 30%, however, it has been considered only 15% in line with the central Regulations for which all the renewable generators are suffering by paying huge penalties. That, it is to be appreciated that schedules are being forecasted based on tools factoring many real time parameters on which there is no control of generators and still generators are bearing penalty for the fault of developing environment friendly sustainable renewable energy projects. That, it's important to have a rational penalty mechanism in place to incentivize the quality of forecast by RE Generators, therefore having incremental penalty bands promotes better forecast without any harsh commercial impact. That the allowable deviation without any penalties should be amended to 30% instead of 15% under the current Regulations as there is no fault of generators in deviation of schedules and to encourage renewable generation in view of the above social cost and that the average Power Purchase Agreement rate of VRE 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.

r) Sri M.Venugopala Rao stated that in view of divergent views taken by the DISCOMs and the generators relating to the methodology to be adopted for determination of the impact of deviations and the penalties therefor etc., the whole issue may be re-examined thoroughly by the Commission bringing about necessary amendments to the Regulation to make it stringent in consonance with the real impact of deviations and determine penalties higher than the present ones in the existing Regulation to be in tune with such a real impact.

20. Replies of APTRANSCO / APSLDC

Replying to the objections, AP Transco stated that with regard to VRE generation, during the real time operation of grid, huge variations occur between the forecast schedules and actual generation. Due to error in forecast of RE generation, dependency on URS / UI gets increased, which has an uncertainty in both price and availability associated with it. That DISCOMs are resorting to purchase high-cost power from power exchange and on many occasions DISCOMs have purchased at the rate of more than Rs.6 per unit whereby DISCOMs are incurring Rs.2 per unit more than the average VRE Power purchase cost. That even in said eventuality, sufficient power is not available at that point of time and hence DISCOMs have to go

for load relief which has deleterious effect on State GDP, Considering an energy elasticity of GDP of 0.8, this translates to Crores of rupees in losses to the State GDP. That the deviation charges of Rs.2 per unit was computed by considering adequacy costs along with balancing costs and the same is proposed. That the Adequacy cost is computed as differential cost between Weighted Average RE Tariff and the weighted average Thermal Variable Cost. The balancing cost is due to increase in specific coal consumption and increased oil consumption while operating in ramped down condition and reduced coal plant life etc., due to frequent ramp up/ramp down or start/stop operations.

That the details of calculations are as under:

Tariff determined / Discovered =Rs.5/-

Weighted average Thermal variable Cost = Rs.3.5/-

Balancing cost = Rs.0.5/-

Additional cost incurred by DISCOMs on VRE Integration in the State is = Tariff Determined / Discovered - weighted average Thermal variable Cost + Balancing Cost i.e., Rs. (5 - 3.5+0.5) = Rs.2/-

The deviation settlement charges will not be levied below the allowable forecast error and even for the very high forecast error also, the penalty is same i.e. Rs.2 per unit.

a) M/s Statkraft Markets Pvt. Ltd. have stated that the proposed deviation band consisting of no incremental band and a flat band of allowable forecast error (proposed at 4.89%) would remove commercial viability of wind and solar projects. The revenue loss estimated for this is approximately 5-10% depending on season.

21. Further, the following objections have been received on the data [referred to at Para 7 (f) supra] submitted by APSLDC.

a) M/s Vena energy systems, IWPA, M/s Vayu Urja Bharat Private Limited, M/s Renew Power Private Limited, M/s Sterling Agro Industries Ltd. have stated that the data submitted highlights the power procured and sold by the DISCOMs through the IEX. That, there is no correlation between the data submitted and the instances of variation in RE generation highlighted except on 19.07.2019 where the deviation due to the RE variation is highlighted and in correspondence to it purchase through IEX is depicted. That, in the period of around 2 years 8 months since the commencement of the Regulations from 01.01.2018, APSLDC has submitted details of purchases made from IEX only for 12 days in 2018 and for 17 days in 2019 respectively. That the data

submitted by APSLDC is grossly insufficient as it only covers a few instances of purchases and with the data submitted, APSLDC failed to demonstrate that the procurement of power has been consistently necessitated at a higher price to offset reduction in generation from VRE sources. That the proposed deviation band consisting of no incremental band and a flat band of allowable forecast error (proposed at 4.89%) would remove commercial viability of wind and solar projects and the revenue loss estimated for this is approximately 5-10% depending on season.

b) M/s Mytrah Energy India Pvt Limited have stated that on comparison of IEX data wherein APSLDC has procured power in certain time blocks clearly shows that, energy procured is not in consonance with the deviation between forecast and actuals of RE energy in those time-blocks. That in few blocks where the RE projects are under generating, AP DISCOMs are selling the power in exchange which clearly shows that there is no correlation among deviation in RE quantum versus the quantum bought by AP DISCOMs in exchange during that period and that the data submitted by AP DISCOMs are not relevant in this regard.

22. Objections on Amendment-5

a) SWAPNAM stated that pooling of the generators spread across the State through the QCA indirectly causing creation of a parallel or virtual SLDC dealing with the renewable projects. That the capital cost of the network for transmission of each kWh will get reduced when generation & utilization of electricity is at the same node / place and that the location of generation, its transmission and utilization is playing a huge impact on overall cost of service to the consumer and therefore shall be compensated by the generators for deviations from their own schedules. That small capacities may be exempted from compliance of the Regulations. Alternatively, the SLDC which was also authorized to act as QCA may be entrusted with the task by collecting a nominal fee from small generators.

b) M/s Hindupur Solar Ltd. have stated that virtual pooling should not be removed from the Regulation as it is beneficial for the SLDC / DISCOM and VRE Generators. That the overall power injected in the grid by VRE generators balanced out through virtual pooling and day ahead scheduling is much more accurate than the schedule provided by the single pooling station.

c) Sri M. Venugopal Rao has stated that if cumulative generation and supply of all units under a QCA is in tune with cumulative forecast and scheduling, it won't cause problems related thereto to the DISCOMs. If there is deviation in cumulative

generation and supply, to that extent deviation charges can be levied and collected. That if the developers of solar and wind power units under a QCA prefer continuance of virtual pooling, the same may be continued.

d) M/s Ecoren Energy Ltd. have stated that having all the RE generators connected to the virtual pool is advantageous in many ways. That it reduces the number of QCA sending their schedule to SLDC thus removing multiple data analysis / entries. Further, aggregation of schedule and actual generation at the State level and/or with respect to each distribution licensee would ensure that the deviation from the schedule in generation of renewable power is averaged out. That, this will enable the SLDC to plan their day ahead schedule more accurately, thus enhancing grid stability and security through more accurate management while parallelly helping RE generators minimize their penalties and accordingly requested not to remove virtual pooling from the Regulation as this helps all the stakeholders.

e) M/s Weizmann Ltd., M/s Jindal AluminumLtd., M/s IWPA, M/s NALCO, M/s REConnect Energy have stated that the concept of aggregation had been proposed in the FoR Model Regulation, and it has been proposed at the Inter-State DSM in the draft IEGC,2020 code. That, Karnataka has successfully implemented aggregation along with Andhra Pradesh, and the aggregate level schedules and revisions have resulted in much lower overall deviation at the State level.

f) M/s Orient Green Power Ltd. have stated that aggregation is one of the best practices followed internationally for the reason that larger the area, better the accuracy. That, there would be compensating deviations between the substations that off-set deviation and the accuracy is better and that the objective of forecasting Regulation will not get fulfilled if virtual pooling is removed from the Regulation and that the existing Regulations should be retained without any amendment.

g) Indian Wind Power Association (NRC) have stated that the report of the Expert Group on Review of Indian Electricity Grid Code published in January 2020, provides that, NLDC shall notify a procedure for aggregation of pooling stations for the purpose of combined scheduling and deviation settlement for multiple pooling stations wind/solar/hybrid generating stations within six (6) months and in line with the above reasoning, the existing mechanism of aggregation of pooling substations may be continued.

h) M/s Ayana Renewable Power Ltd. have requested that the Commission may reconsider the decision of removing aggregation at State level.

i) M/s PTC Energy Ltd. have stated that variable renewable energy and demand are both variable components in the power system. That as demand forecasting is done at State level, it is appropriate to do power forecasting at the State level as well.

j) M/s Statkraft Markets Pvt. Ltd. stated that in a study of the State imbalance from Andhra Pradesh (AP) and Rajasthan (RJ) conducted by them, where Andhra Pradesh allows virtual pool while Rajasthan does not, it is found that the MW imbalance above permissible limit of ± 250 MW for RJ was greater than that of AP. That, this indicates that there is no correlation between effective management of grid with forecasting at individual site level and hence requested to continue with the provision of virtual pool in the existing Regulation. It is helpful for system operators to manage grid on virtual pool level in a stable and secure manner.

k) Ashwin Gambhir, Ann Josey, Srihari Dukkipati, Sreekumar Nhalur of Prayas have stated that the issue of virtual pool would be addressed if the framework wherein first penalties are levied as per the deviation at each pooling station and the virtual pool comes into play only if these penalties are not enough to cover the entire State DSM penalty on account of wind and solar power, similar to the MERC F&S regulations.

l) APSEBAEA have stated that by de-pooling of VRE generators, the deviation between the forecasted schedules and actuals of generators will get minimised as the individual VRE generator will schedule their generation accurately. In such a case there will be no need for QCA which acts as a virtual LDC for VRE generators.

m) M/s Sembcorp Green Infra Ltd. have stated that it has also been demonstrated globally that the impact of variations in RE generation is only relevant at the aggregated Grid level, and thus aggregated forecast is more relevant for true grid management. That the virtual pool allowed in Karnataka has not only reduced the high DSM impact on RE generators at the plant level, but also captured the true forecast errors at the State level by nullifying minor weather variations for different geographical areas. That, the DSM charges for the DISCOMs are also at the State periphery level, where the deviations due to total wind and solar generation in the State are grossed up and resultant DSM charges are calculated. Thus allowing virtual pool for wind and solar generation is in line with the DSM methodology and should be continued.

n) M/s Ushodaya Enterprises Pvt. Ltd. have stated that aggregation of power in the form of virtual pool is beneficial to the grid. That the errors are not uniformly distributed in time within a region, therefore forecasting errors for a region are smaller than for a single site. That aggregation lowers the uncertainty of power by reducing forecast error.There would be compensating deviations between the substations that offset

each other, and the accuracy is better. The objective of forecasting Regulation will not get fulfilled if virtual pooling is removed from the Regulation.

o) M/s Adurjee & Bros. Private Limited, M/s Chanda Investment and Trading Company Private Ltd., M/s Cyrus Poonawalla Family Trust, M/s Cyza Chem Private Limited, M/s Naukhal Investment Private Limited, M/s Poonawalla Aviation Private Limited, M/s Poonawalla Estates Stud & Agri Farm Private Limited, M/s Poonawalla Shares and Securities Private Limited, M/s Villoo's Greenfield Farms have stated that RE and demand are both variable components in the power system and since the demand forecasting is done at the State level, it is appropriate to do power forecasting at the State level as well. German Corporation for international Cooperation (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-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". That 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. That their research shows that the aggregate variation (in percentage terms) over multiple sites is typically lower than the variation in output on one site, that the forecasting accuracy is higher for aggregate forecast over multiple sites and that for scheduling purposes it is desirable to use the aggregate level forecasts of VRE generation.

23. Replies of APTRANSCO / APSLDC

Replying to the objections, AP Transco stated that the proposals of deletion of Virtual Pooling concept in the existing regulations may be considered and justification for this deletion is to bring grid discipline. That except Karnataka no other State is following the virtual pooling method.

24. Further, the following objections have been received on the data [referred to at Para 7 (g) supra] submitted by APSLDC.

a) M/s Vena energy systems, IWPA, M/s Vayu Urja Bharat Private Limited, M/s Renew Power Private Limited, M/s Sterling Agro Industries Ltd. IWPA, Vayu Urja Bharat Private Limited, Waneep Solar Private Limited, Renew Power Private Limited, M/s Sterling Agro Industries Ltd. and M/s Statkraft Markets Pvt. Ltd. have stated that APSLDC has only provided data for the month of February 2019 and August 2019 and not from 01.01.2018 and it cannot, by providing only the selective and insufficient data, call for the proposed amendments and these few instances cannot be the sole basis for proposed amendments.

b) M/s RE Connect Energy Solutions Pvt. Ltd., M/s Azure Power Ltd. have stated that there is error in the data provided, that for the month of February-19 for B.V. Palem substation, where total solar capacity is 0.5 MW, the total deviation over the said month is 44,38,450 units which is not possible considering the capacity. The maximum generation from a 0.5 MW capacity with a CUF of 25% in a month can be 90,000 units. That AP Transco /APSLDC has not provided any data to establish that few generators in the State are continuously / permanently are not adhering to the schedule.

25. Commission's Decision:

Having carefully considered the proposals of AP Transco / APSLDC, various objections put forth at different stages and the replies to the objections, the Commission deduces the following points for determination.

a) Whether the proposed amendment for replacing the words 'Available Capacity' with the words 'Scheduled Generation' in the denominator of the following original formula can be permitted?

Absolute Error (%) = 100 X (Actual Injection - Scheduled Generation) / Available Capacity (AvC)

b) Whether the proposed amendment for insertion of definition 'Allowable Forecast error' (in percentage) with suggested formula in the Regulation can be accepted?

c) Whether the proposed amendment for levy and collection of "Deviation Charges" as proposed can be approved?

d) Whether the proposed amendment for removing the option of rescheduling of forecast on one-and-half hourly basis during the day of operation and to strictly adhere to scheduling on day ahead basis, can be approved?

e) Whether the proposed amendment for deletion of the definition of the phrase “virtual pooling” can be accepted?

26. Re Point (a)

The justification offered by APSLDC for the proposed amendment is that the formula for error should invariably contain one of the two parameters of the numerator, in the denominator. That the absolute error defined in the Regulation contains an unrelated parameter in the denominator. That the Grid requirements are planned duly taking into account the forecast / schedules from RE generation on day-ahead basis which will be taken into account together with other sources and any deviation of such forecast in VRE generation is a burden to the utility. That by dividing the deviation with the available capacity as stated in the present Regulations, the error becomes infinitesimal and the Regulation becomes redundant or toothless and that, since the RE generation never reaches its maximum capacity i.e., available capacity, the denominator should be replaced with “scheduled generation”.

Sri M.Venugopala Rao, the learned objector and SWAPNAM have supported the proposed amendment for the reasons that when grid requirements are planned based on the forecast and schedule of the must-run solar and wind power units along with other sources on “day ahead” basis, for the deviations caused by the solar and wind units they should be held responsible based on the impact of such deviations. SWAPNAM further added that the generators have gone for installation of additional panels arguing that the contracted capacity on the AC side is only the limitation for dispatch of energy to the grid. But neither Sri.M.Venugopal Rao nor SWAPNAM have given reasoning / comments either on the disadvantage of the existing formula or the advantage by the proposed change in the formula for calculation of Absolute error.

However, as noted above, many objectors have opposed the amendment on the ground that the proposed formula has been already examined and rejected by the Central Electricity Regulatory Commission (CERC) and Forum of Regulators (FOR) and that such formula is nowhere existing in the Country.

Based on the data provided by the APSLDC, it is observed that the impact of the proposed change in the formula on the deviation percentage is high which will result in high penalties to the generators, disproportionate to the impact on the grid as contended by some stakeholders.

Moreover, the CERC, vide its Statement of Reasons on the Framework on Forecasting, Scheduling and Imbalance handling for Variable Renewable Energy Sources (Wind and Solar) at paras 6.2.1 and 6.2.2 (as also referred to by the Forum of Regulators at para 3.3 of the Explanatory Memorandum for the Model Regulations on

Forecasting, Scheduling and Deviation Settlement of Wind and Solar Generating Stations at the State level) has stated as follows:

"6.2.1 The Commission has reviewed the inputs of the stakeholders. The present error definition has been pointed out to be insufficient to handle varying seasons, especially very low or zero schedules, and not aligned with direct grid impact (MW deviations).

6.2.2 The Commission has noted that with the current definition, instances such as low / no generation cases cannot be covered. With due regard to these constraints and with a view to ensuring optimum and genuine forecasting, the Commission has decided to define the error percentage normalized to available capacity, instead of schedule. This will ensure that the error quantity corresponds to the physical MW impact on the grid, the forecasting models are aligned to minimize the actual MW deviations, and the error definition holds valid in all seasons. Revised definition shall be:

Error (%) = (Actual Generation – Scheduled Generation) / (Available Capacity) x 100

Where, 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."

It is to be noted that CERC's DSM Regulations and the Forecasting and Scheduling Regulations of the Regulatory Commissions of other States define the Absolute Error as existing in the present Regulation under consideration. As can be seen from the above, the impact / disadvantage of the proposed change of the formula, as in the proposed amendment has already been examined by the CERC and observed that instances such as low / no generation cases cannot be covered by the formula based on 'Schedule' and accordingly it has decided to define the error percentage normalized to Available Capacity, instead of to 'Schedule'. When such a finding has already been given and is being followed by the CERC and other Renewable energy rich States, there is no point in proposing the amendment by the APSLDC and opt for the CERC discarded formula. As noted above, the FOR on a thorough examination, endorsed and accepted the CERC formula. Therefore, the Commission sees no reason to revise the existing formula as regards the denominator "Available Capacity".

It is not out of place to refer to section 61 of the Electricity Act, 2003, in this context. This provision envisages, inter-alia, that the Commission, while making its tariff Regulations, shall be guided by the principles and methodologies specified by the Central

Commission for determination of the tariff applicable to generating companies and transmission licensees. The Commission shall also keep in mind the promotion of co-generation and generation of electricity from renewable sources of energy. While this Commission is not bound by the CERC's decisions / methodologies, it nevertheless follows such decisions / methodologies, wherever, it has no reason to arrive at a different view. As regards the formula in question, as discussed above, the Commission has no reason to lay down a different formula from what has been laid down by the CERC and provided by this Commission, in the existing Regulation.

For the reasons stated above, the Commission finds no merit in the proposal for amendment in the formula for calculation of Absolute Error and accordingly rejects the proposed amendment for change in the said formula.

27. Re Points (b) & (c)

Since points (b) and (c) are interconnected, they are discussed together.

The justification given by the APSLDC for inclusion of the definition of the phrase "Allowable Forecast Error" in the Regulation is that, the present permitted error of 15% causes deviation of the wind and solar generation upto 1125 MW (with the installed capacity of 7500 MW) without any levy of penalties, whereas the inter-state drawal limit, being a renewable rich State, is only +/- 250 MW. That the prescribed error limit is not sufficient to handle the imbalance caused by the deviation of the entire installed Wind and Solar capacity in the State and that the deviation in positive direction results in backing down of conventional generation and violation notices being served by the Southern Region Load Dispatch Center (SRLDC) on SLDC to adhere to the India Electricity Grid Code (IEGC) Regulations, while taking corrective steps for maintaining load generation balance. That deviation in negative direction results in deficit conditions which require resources to bridge the gap between load and generation. That the deviation of maximum allowable quantum of 1125 MW in downward direction will result in over drawal from the grid beyond the permissible limits and in that event, it would lead to load shedding in real time operation of the grid since spinning reserves are not available from conventional sources.

The objections raised, inter-alia, are that there is an error in the formula; that the basis for adoption of diversity factor in the formula is not mentioned; that the assumption that deviation of 1125 MW taken into consideration by AP Transco may not be correct in every case as, if two VRE Generators deviate in the opposite direction, both the VRE Generators end up paying deviation charges, despite there being no impact upon the State owing to deviation on the part of both the generators; that forecast error shall not be at 5% which is not at all possible to maintain due to variable, infirm and uncontrollable nature of VRE sources; that reducing permissible band for deviation would totally take away the commercial viability of VRE Generators; that forecasting of VRE is not the only culprit contributing to the grid imbalance and in addition to accurate forecasting of VRE, functional primary and secondary control reserves shall be utilized to ensure provision of ancillary and balancing services such as additional pumped storage hydro plants, spinning reserves etc.; that any change in the allowable error or the formula should be based on a rigorous study of the existing data from implementation of Forecasting & Scheduling since 2017; that all the contingency shortfall / surplus requirements can be met by the Real Time Market Regulation, Scheduling and Deviation Settlement Regulation; that the accuracy bands proposed by APSLDC have left no room for the RE generators to be within the accuracy limits especially with current forecasting technologies available for RE in India and globally; that the desired accuracies as per the proposed changes are unviable for an RE generator and practically not possible to achieve; that as the VRE Generators are nature dependent, their AVC varies from time block to time block and fixation of installed capacity of entire VRE Generator throughout the year will not give the desired result, and that allowing such narrow band (5%) is unjust and against the special provision made for such VRE capacity in the Grid code and that, Model Regulations, and CERC DSM Regulations as 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.

On the objection that according to the formula given in the proposed amendment, the Allowable Forecast Error comes to 2.39% but not 5%, APSLDC clarified and admitted that it is a typographical error and the diversity factor has to be included in the denominator and not in the numerator of the formula.

Be that as it may, the data furnished by the APSLDC has taken 1125 MW as the benchmark for deviations. The following table indicates the same.

S. No.	Year / Date	Time in Hours	Time block no.	Total VRE deviation between forecast and Actual in MW

1	29.04.2019	15 to 16	61 to 64	1125
2	6.05.2019	21 to 22	85 to 88	1850
3		22 to 23	89 to 92	1900
4		23 to 24	93 to 96	1700
5	2.06.2019	0 to 1	1 to 4	2000
6		1 to 2	5 to 8	2000
7	9.06.2019	0 to 1	1 to 4	1200
8		1 to 2	5 to 8	1200
9	19.07.2019	18 to 19	73 to 76	1200
10	13.08.2019	15 to 16	61 to 64	1200
11	14.08.2019	6 to 7	25 to 28	1200
12		7 to 8	29 to 32	1350
13		8 to 9	33 to 36	1160

From the above table, it is clear that in all, only 13 deviations involving equal to or more than 1125 MW during the period from 29.04.2019 to 14.08.2019 have been noticed to have occurred in 52 time blocks out of the total number of 10464 time blocks for the said period. In order to convince this Commission to reduce the permissible deviation to around 5%, APSLDC should have furnished data, if any, showing deviations between the proposed reduced percentage and 15%. No such effort has been made by APSLDC in this regard. Equally, the developers have not filed any data during real time operations to buttress their stand that the proposed reduction causes severe losses to them and is hence unworkable. As a result, the pleas of both the sides are not supported by relevant data with regard to their respective stands. In the absence of such data, the Commission does have the benefit of knowing the real time deviations. However, based on the available material including the opinion of experts such as CERC, FOR, this Commission is proceeding to take appropriate decision.

As regards the diversity factor of 0.7 mentioned in the proposed formula, it is stated to be taken from the CEA's Manual on Transmission planning Criteria and an extract of the said manual is submitted by APTransco along with their letter dated 11.05.2020 while furnishing replies to the objections. A careful reading of the said extract (Table -II of Annexure-III of the Manual) reveals that, the referred factor which is a Capacity factor (but not diversity factor which, as per the general definition in the electrical system, is known to be the ratio of "the sum of the individual maximum demands of the various sub

circuits of a system" to "the maximum demand of the whole system" and is always greater than or equal to '1') considering diversity in wind / solar generation, is the ratio of maximum generation available at an aggregation point to the algebraic sum of capacity of each wind machine / solar panel connected to that grid point. The relevancy of the capacity factor has been discussed in the CEA manual, as under:

"Para 16.1 The capacity factor for the purpose of maximum injection to plan the evacuation system, both for immediate connectivity with the ISTS / Intra-STS and for onward transmission requirement, may be taken as given in Table-II at Annexure – III."

As can be seen from the above, the proposed "diversity factor" of 0.7 is actually the "Capacity factor" to be considered while planning for the new transmission systems (0.7 corresponds to 400 kV aggregation level, whereas it is 0.6 for the State as a whole) but not intended for estimating the level of generation that the Solar and Wind generators generate on a real-time basis.

The objectors strongly pleaded that, deviation beyond the CERC's prescribed limit of ± 250 MW for RE Rich States cannot be attributed to the VRE generation alone at all times (as applied in the proposed formula apparently to arrive at a stringent limit of deviation) as it can also be due to other factors like variations in load, loss of other sources etc., as well.

As noted above, the APSLDC, is not able to conclusively demonstrate with reference to the relevant data, the necessity of introduction of the definition "Allowable Forecast Error" in the Regulations.

As regards the proposal to reduce the deviation limits, in justification of the said proposal, APSLDC stated that during the real time operation of the Grid, huge variations occur between the forecast schedules and actual generation with regard to VRE. That on many occasions, DISCOMs have purchased at the rate of 660 paise per unit and thus DISCOMs are incurring Rs.2 per unit more than the average VRE power purchase cost. That, if the actual VRE generation is more than the forecast, conventional generation has to be backed down which has associated costs i.e., Adequacy costs at Rs.1.60 per unit and Balancing costs Rs.0.40 per unit involved in over injection, which comes to Rs.2 per unit. That the adequacy cost of Rs.1.60 paise per unit is derived by considering the difference between VRE cost and weighted average pooled variable cost. That the balancing cost of Rs.0.40 per unit is arrived at considering the deterioration of station heat rate, increased oil consumption and excluding wear & tear of the equipment when thermal stations are required to be frequently backed down.

The objections on the proposal of APSLDC essentially are that, none of the Regulations by CERC and other State regulators have such a provision i.e., 5% range capping and applicability of Rs.2 per unit penalty; that penalty of Rs.2 per unit for energy deviated would be highly onerous for VRE Generators, that CERC DSM Regulation allows 15% deviation; that a realistic assessment has to be made to determine deviation charges keeping in view the burdens being imposed on the DISCOMs and their consumers; that it would be completely unfair to penalize wind / solar generators for any inaccurate forecasting and that too at the lowest tolerance band of ± 5% and at Rs.2.0 per kWh; that in Gujarat, DSM charges are Rs.0.25/-, Rs.0.50/- and Rs.0.75/- per unit; that all costs, namely; the adequacy costs and balancing costs are factored in the ARR and passed on as tariff to the consumers; that running plants would become very difficult owing to penalties payable on account of deviations as average PPA rate of VRE Generator comes out to be Rs.3 per kWh and the penalties may amount to more than 50% of the total revenue of the VRE Generator; that the neighbouring RE rich State Tamil Nadu's final Regulation incentivizes the generator by capping the penalty and paying back deviation charges if the deviation charges of the entire year are greater than Rs.0.50 per unit; that achieving 100% accuracy is not possible, given the nature of VRE; that the purpose of DSM charges is not to make benefits or compensation for loss but to maintain Grid discipline; that deviation band consisting of no incremental band and a flat band of allowable forecast error would remove commercial viability of wind and solar projects and that FOR, CERC and other State Commissions had proposed to provide incremental bands for deviation charges and the sudden imposition of stringent penalty band will discourage the VRE generators.

There are also some suggestions from some of the objectors that the estimated balancing cost of 40 paise per unit may be imposed on VRE generator and be given to the thermal generator who backs down the generation and that for the shortfall by the VRE generator the UI rates in the market or actual rate of purchase in the market by SLDC may be collected instead of the proposed charges of Rs.2/unit; that rather than accounting for balancing cost, a compensation mechanism should be considered akin to CERC's Mechanism for compensation for degradation of heat rate, auxiliary power consumption and secondary fuel consumption due to part load operation and multiple start / stop of units for flexible operation of thermal plants.

As regards to the objection that all costs, namely; the adequacy costs and balancing costs are factored in the ARR and passed on as tariff to the consumers, suffice it to say that the cost of deviations over and above the allowable bands, as a principle are to be borne by those who are causing the deviation subject to validation of the said costs.

Further to the foregoing, it is to be noted here that, the Commission is not inclined to accept the proposal of APTransco / APSLDC for inclusion of definition of the Allowable Forecast Error in the Regulation and thereby seeking revision of deviation charges based on the 'Allowable Forecast Error'. Consequently the proposal to uniformly levy the deviation charges (unlike the existing charges based on gradation) at Rs.2/- per unit beyond the "Allowable Forecast Error" is also liable to be rejected.

However, the Commission, in furtherance of the objective of the Regulation and with an intent to bring-in more discipline as regards the forecast and scheduling of the Solar and Wind generation and keeping in view the problems being faced by the APTransco / APSLDC in maintaining the Grid, has decided to revisit the existing deviation charges structure. In this regard, the Commission has examined the relevant Regulations of the Commissions of the RE rich States. A comparison of the relevant Regulations is shown in the following table:

Deviation charges structure of RE rich States:

State-->	Andhra Pradesh Karnataka Maharashtra Rajasthan (Wind and Solar)		Tamilnadu (Wind and Solar)		Gujarat			
					Solar		WInd	
Deviation Limits and Charges	Deviation Limits	Charges	Deviation Limits	Charges	Deviation Limits	Charges	Deviation Limits	Charges
	≤15%	None	≤10%	None	≤ 7%	None	≤ 12%	None
	> 15% but ≤ 25%	Rs.0.50	> 10% but ≤ 20%	Rs.0.25	> 7% but ≤ 15%	Rs.0.25	>12% but ≤20%	Rs.0.25
	> 25% but ≤ 35%	Rs.0.50+ Rs.1.0	> 20% but ≤ 30%	Rs.0.25+ Rs.0.50	> 15% but ≤ 23%	Rs.0.25+ Rs.0.50	> 20% but ≤ 28%	Rs.0.25+ Rs.0.50
	> 35%	Rs.0.50+ Rs.1.0+ Rs.1.50	> 30%	Rs.0.25+ Rs.0.5+ Rs.1.00	> 23%	Rs.0.25+ Rs.0.50+ Rs.0.75	> 28%	Rs.0.25+ Rs.0.50+ Rs.0.75

CERC, at paras 7.3.3 and 7.3.4 of the Statement of Reasons on the framework of Forecasting, Scheduling and Imbalance Handling for Variable Renewable Energy Sources observed that based on the requests by various stakeholders for studies on the Framework, some simulations / analytical inputs from agencies engaged in wind forecasting for various sites across India based on actual data of one year with the error normalized to capacity has been simulated. And in respect of solar forecast, as per para 7.3.8 of the statement of reasons on the framework, forecast data of one year, analyzed for 3 forecasters and 6 months data for the 4th forecaster, saw a typical performance of 7-11% Mean Absolute Error for day-ahead forecasts and accordingly the Central Commission made the following observations:

7.3.10 *All the above inputs give the Commission confidence that with the error normalized to Available Capacity, and 16 revisions of schedule allowed, the generators shall be able to forecast well within a tolerance band of 15% for a high % of energy output.*

7.3.11 With the altered error definition, this band is now determined with respect to Available Capacity (AvC). This itself makes the band much bigger, and keeps it mostly constant through the year (except during cases of maintenance or turbine outage). Within +/-15% band, there shall be no adverse commercial impact. While beyond 15%, a gradient band is proposed.

As evident from the simulations above, negligible % of energy generated shall lie outside the 25% band, and hence the commercial impact of deviation charges shall be minimal. In fact, the no-impact band of 15% is quite liberal and the Commission is allowing it consciously so as to get the processes and discipline of forecasting and scheduling in place. The Commission reiterates that as stakeholders get experience, and forecasting models mature, the tolerance band may be tightened over time. (Emphasis added)

Further, the FOR, in the Explanatory Memorandum for the Model Regulations, 2015 on Forecasting, Scheduling and deviation settlement of Wind and Solar generators at the State level, has stated, inter-alia,that,

"The Central Commission, in view of simulation studies such as above, as well as international research reports on observed MAE, has put forth a framework for computing deviation charges based on error, with a tolerance band of 15% initially, which shall be tightened over time as the ecosystem gains experience….The State Commission proposes the following, with a structure in line with CERC's framework; however, a tighter tolerance band for new projects, as it is felt that with the framework of aggregator (QCA)

at pooling station, 10% accuracy (defined w.r.t. available capacity) is quite achievable."
(Emphasis added)

Accordingly, FOR suggested a tolerance band of 15% for the generators Commissioned before the date of issuance of Regulations and a band of 10% for the new generators. The CERC also, as noted above observed that the tolerance band may be tightened over time as stakeholders get experience and forecasting models mature.

This Commission while issuing the Regulation in 2017 (which came into effect from 01.01.2018) has adopted a liberal tolerance band of 15% for all the generators while also allowing virtual pooling which is being implemented (the forecasting and scheduling) since three years. The FOR observed in the year 2015 itself, while framing the Model Regulations, that 10% accuracy is quite achievable with the framework of aggregator (QCA) at pooling station. In order to maintain stability of the grid and ensure proper accountability in forecasting by the VRE generators, the Commission feels that the tolerance band needs to be tightened from the present level to a reasonable extent. In the Commission's view, this will not only achieve grid discipline but also enable the APSLDC and the licensees to plan their activities in a more efficient and economical manner. Accordingly, under clause 6.3 of the Regulation the table given below shall replace the existing table.

S. No.	Absolute Error in the 15 min. Time block	Deviation charges payable to State Pool Account
1	<=10%	None
2	>10% but <=20%	At Rs.0.50 per unit for the shortfall or excess energy for absolute error beyond 10% and upto 20%
3	>20% but <=30%	At Rs.0.50 per unit for the shortfall or excess energy for absolute error beyond 10% and upto 20% + Rs. 1 per unit for balance energy beyond 20% and upto 30%
4	>30%	At Rs.0.50 per unit for the shortfall or excess energy for absolute error beyond 10% and upto 20% + Rs. 1 per unit for balance energy beyond 20% and upto 30% + Rs.1.50 per unit for balance energy beyond 30%.

28. Re Point (d)

APSLDC contended that the DISCOMs have to plan the resources which include all conventional and RE Generators for meeting the demand on a day-ahead basis and accordingly the DISCOMs optimise the purchase and sell power through Power Exchanges. That as per Forecasting & Scheduling Regulations, the generation from day ahead schedule of VRE power generation gives the quantum of variable energy for assessing the conventional energy requirements on day ahead basis and the day ahead schedule of VRE generators is crucial for any grid management which is deciding the quantum of power allocation from other sources. That if day ahead forecast & scheduling is accurate in respect of VRE generators, there will not be any power shortage and it would mitigate the backdown instructions. That, SLDC is required to have an accurate day ahead schedule from each wind & solar generator to avoid any variation of capacity allocation from other sources or to avoid compulsory load shedding. That QCAs are submitting forecasts and schedules on the day-ahead basis and revising them intra-day. That DISCOMs are planning their availability to meet the grid demand on day-ahead basis and tie up power accordingly and the DISCOMs are not able to cope up with the deficit/surplus arising due to variation in VRE Generation in real time operation because (1) the power market mechanism is not mature, (2) warm and cold start-up of thermal stations will take longer time to reach full load, and (3) DISCOMs have to tie up power subject to availability from all sources and hence, APDISCOMs invariably resort to load shedding with a view to adhere to the IEGC Regulations.

The objectors have contended, inter-alia, that not permitting any change in the day ahead schedule may impact the grid and shorter dispatch time helps in improving the system efficiency and reduce the requirement of reserve to meet any emergency as the system operator has real time availability of information about the quantum of reserve and resources at hand at any given point of time; that VRE by its definition is subject to vagaries of nature and cannot be forecasted with 100% accuracy; that sudden changes in weather have direct effect on the generation and in such cases intra-day schedules are required; revisions of RE schedule at the interval of six time blocks is much longer than Real Time Market timeline of half an hour and SLDC should be able to manage the RE revisions effectively; that removing provisions for intra-day revision in schedule and reducing the accuracy band to 5% would entirely make projects unviable for developers and will hamper the quality of forecast and lead to greater instability in the grid; that power plants based on conventional sources have the provision for multiple schedule revisions and the same provision should also be made applicable for RE based projects and that

the forecast accuracy improves when it is closer to the real time i.e., forecasting is more accurate for short term than long term.

In its detailed report enclosed to the letter dated 10.12.2019 seeking the amendments, AP Transco stated that all the issues stated therein (as justifications for the respective amendments) have surfaced during implementation of the provisions of the Regulation and that the said issues are being encountered by the grid operator in real time operation of the grid. Having regard to this report, the Commission required the APSLDC to produce all the relevant and necessary data available since the date the Regulation came into effect, in support of their claim that they are not able to cope up with the deficit / surplus arising due to variation in VRE Generation in real time operation.

However, APSLDC, instead of submitting the data for the relevant period during which it has allegedly faced problems, submitted some data related to the period subsequent to their letter dated 10.12.2019 including some data related to just a few months before the date of the letter.Even with the said data, APSLDC could not conclusively demonstrate that the provision of intra-day revision of schedule by wind and solar generators disabled it from coping up with the deficit / surplus arising due to variation in VRE generation in real time operation warranting amendment of the existing Regulation.

In this regard, the Commission notes the following:

a) The CERC vide Statement of Reasons for the Framework on Forecasting, Scheduling and Imbalance handling for Variable Renewable Energy Sources (Wind and Solar) observed as follows:

> *5.3.1 The Commission has taken note of the comments. On the issue of frequency of revisions, the Commission recognizes that accuracy of forecasting improves as one gets closer to time of dispatch. This is borne out by plenty of research that is available on how forecasting accuracy improves as more updates are done aligned with shorter scheduling intervals.*
>
> *Most stakeholders have supported the proposal of doubling the number of revisions allowed, to 16 per day. Some have suggested even further increase to enable hourly revisions. The Commission is of the view that while increasing frequency of revision would enhance forecasting accuracy, it might be difficult for beneficiaries to manage contracts due to very frequent revisions. As such, the Commission has decided to retain the number of proposed revisions to 16.*

b) Further, parat 23 (iii) of the Indian Electricity Grid Code reads as under:

The schedule by wind and solar generators which are regional entities (excluding collective transactions) may be revised by giving advance notice to the concerned RLDC, as the case may be. Such revisions shall be effective from the 4th time block, the first being the time-block in which notice was given. There may be one revision for each time slot of one and half hours starting from 00:00 hours of a particular day subject to a maximum of 16 revisions during the day.

c) The Explanatory Memorandum on FOR Model Regulations on forecasting, Scheduling and Deviation Settlement of Wind and Solar Generating Stations at the State level states that,

3.4 Once the day ahead schedule is submitted, flexibility must be accorded to the generators to revise it as the accuracy of forecasting improves closer to real time. Keeping this in mind, 16 revisions per day have been allowed, to provide maximum opportunity to minimize deviations from schedule, and hence limit the commercial burden on the generator.

5. … The deviation from schedule is inevitable for RE generators as 100% accuracy is not possible to achieve, even with frequent revisions. To manage these uncertain deviations in real time, the grid operator must have access to reserves.

Further, it is to be noted that the objective of the Regulation is to facilitate large-scale grid integration of solar and wind generating stations while maintaining grid stability and security as envisaged under the State Grid Code through forecasting, scheduling and deviation settlement of these generators. Undoubtedly, load generation balance is the key activity for any grid operator for maintaining the grid stability for which the grid operator must have the most updated visualization of the generation, more particularly of the variable generation sources like Wind and Solar which are subject to vagaries of nature, and the load that is expected on the system as close to the real time operation as possible. Thus, the provision for revision of schedules for the generators more particularly for the Wind and Solar sources has to be seen as helping in achieving the stable operation of the grid. This conclusion is fortified by the observations made in the CERC and FOR Regulations, as extracted above, that the forecast of Wind and Solar generation will be more accurate closer to the time of dispatch minimizing the deviations from the schedule.

When such is the position as discussed above, the proposal to withdraw the provision of intra-day revision of schedule for Wind and Solar generators and mandating only day-ahead forecast is against the well considered reasoning of the expert bodies like CERC

and FOR. The Commission, therefore rejects the proposal of AP Transco / APSLDC in this regard.

29. Re Point (e)

APSLDC submitted that as per Clause 2.1(aa) of the Regulation, all the schedules and actuals of generators are aggregated while calculating the DSM. That such provision is not available in any of the Regulations framed by the respective Regulatory Commissions of other States and that the indiscipline to the grid, caused by few generators is shared and spread over to all generators in the virtual pool.

Some objectors have supported the amendment on the reasons that pooling of the generators spread across the State through the QCA is indirectly causing creation of a parallel or virtual SLDC dealing with the renewable projects, that by de-pooling of VRE generators, the deviations between the forecasted schedules and actuals of generators will get minimised and the individual VRE generator will schedule its generation accurately.

The other objections, inter-alia, are that the overall power injected into the grid by VRE generators is balanced out through virtual pooling and day ahead scheduling is much more accurate than the schedule provided by the single pooling station; that aggregation of schedule and actual generation at the State level and / or with respect to each distribution licensee would ensure that the deviation from the schedule in generation of renewable power is averaged out; that the result of aggregate level schedules and revisions have resulted in much lower overall deviation at the State level; that aggregation is one of the best practices followed internationally for the reason that larger the area, better is the accuracy; that as demand forecasting is done at State level, it is appropriate to do power forecasting at the State level as well; that as the DSM charges for the DISCOMs are also calculated at the State periphery level, the virtual pool should be continued and that a large interconnected power system is beneficial because, it enables aggregation of imbalances from a large geographical area.

AP Transco, in its reply to the objections submitted that the proposal for deletion of the provision of 'Virtual Pool' is aimed at bringing grid discipline.

The objectors who have submitted their responses on the data furnished by the APSLDC in support of their proposals, stated that the data provided covers only a period of two months and thus it is selective and insufficient to call for the amendments and that APSLDC assumes that all the sites will have equal or similar deviation in the same direction, whereas in practical scenario it is not the case and that APTransco / APSLDC

has not provided any data to establish that some generators in the State are continuously / permanently indisciplined and impacting the grid stability.

In the data submitted by the APSLDC, the percentage absolute errors of each generator under a pooling station are simply added and arrived at as the pooling station-wise forecast error as though the deviations are always either positive or negative, which is not correct. In the realtime, the net deviations (resultant of the positive and negative deviations) only will reflect at the pooling station level. As contended by some of the objectors, based on the data furnished, APTransco / APSLDC could not justify their contention that the indiscipline to grid caused by a few generators is shared and spread over to among all generators in the virtual pool.

However, the Commission notes that the provision of Virtual pool suggested in the FOR Model Regulations is not adopted by the other RE rich State Commissions except by the KERC, where the pooling concept is allowed under the definition of “Aggregator”.

As earlier referred, FOR Model Regulations, inter-alia, stated that a tighter tolerance band, with the framework of aggregator (QCA) at pooling station, 10% accuracy is quite achievable.

There is no gainsaying of the fact that the forecasting accuracy increase if only the individual generator is made liable for the deviation in the forecast by all together dispensing with forecasting at the pooling station by QCA. However to start with, when the Regulations were framed, this Commission has allowed the concept of virtual pooling as an option as forecasting has not properly evolved at that time. Post Regulation, QCAs have been established and a proper forecasting system has come in to existence. This apart, the VRE Generators have got well acquainted with the weather conditions in the state and gained rich experience in forecasting in the State. Thus, the conditions as they stood when the Regulations were made in 2017 have undergone a qualitative change on the aspect of forecasting. However the Commission feels that a sudden change in the deviation settlement from virtual pool concept to an individual generator stage is not desirable. Further, the point of entry of the pooled VRE generation into the grid and possible first point in the grid that encounters the effect of deviations, is the pooling station or the substation as the case may be. Therefore, as a via media, this Commission, for the present, intends to allow aggregation at pooling station level instead of restricting to individual level, as also being followed in all other RE rich states such as Tamilnadu, Gujarat, Rajasthan and Maharashtra. As per this, deviations of all generators connected to a pooling station / substation will be settled accordingly. As a consequence the

definition of the phrase of virtual pooling at clause 2.1 (aa) and clause 6.9 of the Regulation stands deleted. All the points are accordingly answered as above.

30. The Hon'ble High Court at Amaravati in its Order dated 6.03.2020 in W.P.No.13860 of 2019 filed by certain wind power developers gave the following direction,

"In such view of the matter, subject to filing of the reply to the applications in I.A.No.1 and 3 of 2020, this Court is of the opinion that it would be appropriate to issue the following directions for the present, in the interest of justice:

(a) The application in I.A.No.2 of 2020 seeking amendment is hereby allowed. Amendment be incorporated within a period of three working days. Until further orders in I.A. Nos. 1 and 3 of 2020, the petitioners are at liberty to submit their objections / suggestions to the proposed amendments in addition to those, if any submitted, for examination of the A.P. Electricity Regulatory Commission;

(b) on receipt of such objections/suggestions, the 2nd respondent / Commission would examine the same and take appropriate decision; and

(c) the decision, If any, so taken for amending Regulation No.4 of 2017, shall not be given effect to pending further orders in the Writ Petition."

31. In the light of the above order, this Commission refrains from giving effect to the amendments allowed in this order pending further orders in W.P.No.13860 of 2019. The parties shall inform the result of the Writ Petition to this Commission on its disposal. The Commission will then pass appropriate orders for implementation or otherwise of this Order depending upon the result of the Writ Petition.

The O.P. shall accordingly stand disposed of.

Sd/-	Sd/-	Sd/-
Thakur Rama Singh	**Justice C.V. Nagarjuna Reddy**	**P. Rajagopal Reddy**
Member	**Chairman**	**Member**