Statkraft

Ref: SKM/AP/2020/APERC/01

Dated: 3rd March 2020

To,
The Secretary,
APERC, 4th Floor, 11-4-660,
Singareni Bhavan, Red Hills,
Hyderabad – 500 004

Dear Sir,

Sub: *Comments and suggestions on the proposed amendment by APTRANSCO – Regulation 4 of 2017 for Andhra Pradesh State Electricity Regulatory Commission (Forecasting, Scheduling, Deviation Settlement and Related Matters for Solar and Wind Generation Sources) Regulations, 2017 (Regulation No. 4 of 2017)* ***- O.P.No.2 of 2020.***

We thank the Hon'ble Andhra Pradesh Electricity Regulatory Commission (APERC) for giving us an opportunity to offer our views and suggestions on the proposed amendment by APTRANSCO – Regulation 4 of 2017 for Andhra Pradesh State Electricity Regulatory Commission (Forecasting, Scheduling, Deviation Settlement and Related Matters for Solar and Wind Generation Sources) Regulations, 2017 (Regulation No. 4 of 2017).

About Statkraft
Statkraft is 100% Government of Norway owned organization and Europe's largest renewable energy generator and strongest analytic hubs within energy management and trading services. Statkraft Markets is category-1 trading licensee from CERC and registered QCA with APTANSCO handling the largest portfolio of Forecasting and Scheduling of Renewable Energy in the state of Andhra Pradesh.

The Comments and suggestions of Statkraft on the various parameters mentioned in the proposed amendment are given below for your kind consideration -

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4/7/6/3/2020

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S No	Current Regulation	Amendment Proposed	Comments / Suggestions
1.	**Clause 2.1 (a)** "Absolute Error" means the absolute value of the error in the actual injection Of Wind or solar generators with reference to the scheduled generation and the Available Capacity (AVC), as calculated using the following formula for each 15-minute time block.	Substitute the term 'absolute error' with 'forecast error' Substitute the term 'Available Capacity' With 'Scheduled Generation' for calculating Forecast error as following formula. Forecast Error (%) = 100 X (Schedule Generation — Actual Injection) / Scheduled Generation	1. The proposed forecast error shows the forecast error in relation to the forecast. However, such metric can be mis-leading 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 higher side contributing to high deviation charges with low impact on the grid. 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. 2. Forecast error represented with relation to Available capacity (AvC) supports in encapsulating the mean absolute error or deviation from actual in relatively rational manner throughout the seasons. Model Regulations on Forecasting, Scheduling and Deviation Settlement of Wind and Solar Generating Stations at the State level states that *"incentives to generators for better forecasting must be aligned with the objective of grid management, which is to minimize actual MW deviations from schedule. As commercial impact on generators is directly proportional to the error percentage, forecasting models will be designed to minimize MW deviations only if the denominator is a constant (and not a variable such as 'schedule')."* 3. Model Regulations on Forecasting, Scheduling and Deviation Settlement of Wind and Solar Generating Stations at the State level also states that scientific methods such as mean absolute error is a good metric to evaluate forecasting

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			accuracy. Furthermore, the error formula with AvC in the denominator showcases the difference in the CUF/PLF of generation and the CUF/PLF of forecasted generation. In other words, it is the mean absolute error between the average actual generation and the average forecasted generation w.r.t the maximum generation of a plant at a point of time. 4. As we are moving towards a power system with high renewable penetration, a normalized forecast error in relation to available capacity will accurately represent the uncertainty or error in the forecast affecting the power system. 5. **<u>Request/Submission</u>: It is proposed to continue using the extant Formula for calculation of Absolute Error as per existing APERC (Forecasting, Scheduling, Deviation Settlement and Related Matters for Solar and Wind Generation Sources) Regulations, 2017.**
2.	**Clause 2.1 (j)** "deviation in a time block for a seller means its total actual injection minus its total/ scheduled generation.	The definition of phrase 'Allowable forecast error in percentage should 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 CERCs	1. The justification provided by APTRANSCO for these points do not appear plausible. 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. 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. The scope of the framework on Forecasting, Scheduling and Imbalance Handling of Variable Renewable Energy Sources (Wind and Solar) states that "*Forecasting and scheduling of these generators is critical to anticipate balancing requirements and procure requisite reserves to maintain load-generation balance and grid reliability. At the same time, due to the intermittent nature of these sources, special provisions must be made so that the generators are not unduly penalized.*" Thus, we should not move towards creating adverse provisions for environmentally benign RE sector.

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		DSM Regulation amended from time to time) / (quantum of VRE installed capacity)	2. Furthermore, to ensure utmost accuracy for RE grid integration, CERC and Model Regulations on Forecasting, Scheduling and Deviation Settlement of Wind and Solar Generating Stations at the State level suggested that *"the concerned SLDC should also undertake forecasting of wind and solar power that is expected to be injected into the State grid, by engaging forecasting agency(ies) if required. The forecast by the concerned SLDC shall be with the objective of ensuring secure grid operation by planning for the requisite balancing resources. The forecast by the QCA or wind and solar generator, as the case may be, shall be generator centric." Furthermore, the regulation clarifies that schedules submitted by QCA on behalf of generators "shall be used as reference for deviation settlement."* 3. 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 the grid management, CERC has notified Framework for Real-Time Market for Electricity which will come in effect from 1st April 2020. This will bring more liquidity into the market; allowing grid operators to purchase power effectively. Same was also suggested by SOR on Framework on Forecasting, Scheduling and Imbalance Handling for Variable Renewable Energy Sources (Wind and Solar) wherein it states that *"a real time market (or an hour ahead market) can enable these generators to make up for the day ahead forecast error, and ensure a total generation supply close to their original schedule"*. 4. **<u>Request/Submission</u>**: Keeping in mind the above points, **it is proposed the existing framework on calculating DSM is suitable for balancing the grid without unduly disincentivizing the VRE generator.**

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3.	**Clause 4.1** "The Methodology for day-ahead scheduling of wind and solar energy generating stations which are connected to the Grid and rescheduling them on one and half-hourly basis and the methodology of handling deviations of such wind and solar energy generating stations shall be as stated hereunder and accordingly forecasting tools shall be provided by the generator concerned."	It is proposed to remove the option of rescheduling of forecast on one and half hourly basis during day of operation and strictly adhere to scheduling on day ahead basis	1. The energy demand is expected to grow significantly while the conventional energy sources are limited. Renewable energy 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 of the country. Mechanism of forecasting and scheduling of renewable energy was introduced to better integrate the RE power in the power systems. 2. There is a requirement of intraday revisions to achieve the goal of successful RE integration. The forecast accuracy improves the closer it is to real time (more accurate for short term than long term). Currently we are restricted to 16 revisions for wind and 9 revisions for solar. However, we should be given flexibility of revising as many times as possible for better accuracy. Removing the schedule revision capacity will hamper the quality of forecast and lead to greater instability in the grid going against the objective of the regulation. Conventional sources have the provision for multiple schedule revisions. The same provision should also be applicable for renewable. Furthermore, GIZ's Report on Forecasting, Concept of Renewable Energy Management Centre's and Grid Balancing strengthens the importance of intraday revisions as it states that "*Wind and solar power forecasts for the near term tend to be more accurate than forecasts for longer terms*". 3. **Request/Submission**: We need to appreciate that VRE by its definition is subject to vagaries of the nature and cannot forecasted with 100% accuracy. Hence, we need to have a forecasting framework which captures the intermittent nature and allows the generators to improve the forecasting accuracy by utilizing revisions closer to the generation time. **It is proposed to continue the current provisions of intraday revision and for better forecasting accuracy levels the limit on intraday revisions should be removed.**

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4.	**Clause 6.3** The deviation charges for over or under injection for sale/supply of power within the State are tabulated here under: S No. | Forecast Error in the 15 min time block | Deviation charges payable to State Pool Account (Rs / unit) 1 | < 15% | None 2 | 15% - 25% | 0.5 3 | 25% - 35% | 1.0 4 | >35% | 1.5	The levy and collection of DSM charges should be amended 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 | > Allowable Forecast Error | At Rs. 2 per unit for the shortfall or excess injection	1. Forecasting for wind and solar PV in India is gradually evolving with advancement of forecasting technology and participation of international players in the sector. Global studies emphasize that errors reduce over a period. Yet, achieving 100% accuracy is not possible given the nature of VRE. Thus, according to Model FOR, "to incentivize investment in better forecasting methodologies and reliable data, deviation charges would be levied outside a tolerance band. Within this tolerance band, there will be no revenue impact on the generator. However, outside this band, a graded deviation charge can be applied. This will provide incentive to forecast as accurately as possible, utilizing the schedule revisions, and communicate accordingly with SLDC". 2. 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. 3. In fact, 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. 4. **<u>Request/Submission</u>: The objective of APERC forecasting and scheduling regulation is** *to facilitate large scale grid integration of solar and wind energy generating stations while maintaining grid stability and security* and not generation of revenue. The prevailing regulation is fulfilling the states objective. **Thus, it is proposed to continue with the existing regulation.**

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5.	**Clause 2.1 (aa)** Virtual pool means the virtual/ grouping of various pooling stations wherein the generators in such pooling stations have an option for accounting their deviational in an aggregated/combined manner through a QCA for the purpose of availing the benefit of larger geographical / area and diversity.	The definition phrase of virtual pooling may be considered to be deleted from definition 2.1 (aa) and also be deleted at clause 6.9 of Regulation 4 of 2017.	1. Variable Renewable Energy and demand are both variable components in power system. As demand forecasting is done at state level; it is appropriate to do power forecasting at the state level as well. 2. Aggregation of power in the form of virtual pool is beneficial to the grid. A large interconnected power system is beneficial because it enables aggregation of imbalances from a large geographical area. The errors are not uniformly distributed in time within a region, therefore forecasting errors for a region are smaller than for a single site. Aggregation lowers the uncertainty of power by reducing forecast error. GIZ's Report on Forecasting, Concept of Renewable Energy Management Centre's 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".* 3. Report of the Expert Group: Review of Indian Electricity Grid Code, proposes to "notify a procedure for aggregation of pooling stations for the wind/solar/hybrid generating stations". 4. In addition, Lawrence Berkeley National Laboratory (LBNL), USA in SOR 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 generators are expected to be penalized depending on the extent of their individual deviation even though they may not impose any additional costs on the overall system. Their research shows that the aggregate variation (in percentage*

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			terms) over multiple sites is typically lower than the variation in output on one site; moreover, the forecasting accuracy is higher for aggregate forecast over multiple sites. Therefore, for scheduling purposes it is desirable to use the aggregate (total balancing area) level forecasts of RE generation." 5. Statkraft conducted a study of the state imbalance from AP and RJ. AP allows virtual pool while RJ does not. In this study, we found that the MW imbalance above permissible limit of +/-250 MW for RJ was greater than that of AP. This represents that there is no correlation between effective management of grid with forecasting at individual site level. 6. Furthermore, Statkraft operates large Virtual Power Plants spread over wide geographical areas in European countries of Germany and UK. Wherein, these large geographical areas are aggregated together to form balancing circles. 7. **Request/Submission**: It is proposed 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.

We once again thank the Andhra Pradesh Electricity Regulatory Commission (APERC) and APTRANSCO for the opportunity given to us to participate in the consultative process and request you to kindly consider our comments.

Thanking you,

Yours sincerely,

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For & On behalf of Statkraft