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Dr. Balaraman K
Chief General Manager
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30th April, 2015

Ms. Shubha Sarma
Secretary
Central Electricity Regulatory Commission (CERC)
3rd & 4th Floor, Chandralok Building,
36, Janpath, New Delhi 110 001

Sub: Comments on the "Proposed Framework on Forecasting, Scheduling & Imbalance Handling for Renewable Energy (RE) Generating Stations based on wind and solar at Inter-State Level"

Ref: Public Notice No. 1/14/2015-Reg. Aff. (FSDS)/CERC dated 31st March, 2015

Dear Madam,

M/s Power Research & Developments Consultants Pvt. Ltd (PRDC) is the largest power system consulting and system development company. M/s PRDC has advised many utilities, renewable energy developers, investors and also the associations like IWTMA, IWPA on renewable integration.

In response to the draft framework published by CERC on March 31st, 2015, we have made few observations and are enclosed for your kind reference. We draw these inputs from our recent study (Scheduling & Forecasting of Renewable Energy sources for large scale integration) conducted with support from Shakti Sustainable Energy Foundation.

Please let us know if we could provide any additional information.

Thanking you.

Sincerely,

Dr. Balaraman K

Encl: Comments to the Proposed Framework

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Comments on the
"Proposed Framework on Forecasting, Scheduling & Imbalance Handling for Renewable Energy (RE) Generating Stations based on wind and solar at Inter-State Level"

1. Introduction:

The proposed framework consists of many salient features which consider the variability and uncertainty of renewable energy sources while setting up forecasting, scheduling and deviation settlement mechanisms. We present our views below:

1.1 Salient Features:

1. The proposed framework recognizes the fact that the accuracy of the wind/solar forecasts will be high when forecasting is performed over a large geographical area taking advantage of resource diversity. It also points out the inclusion of metrological data/models for reduction of error in forecasting tools.
2. It is mentioned that the forecast by the concerned RLDC would be more with the objective of secure grid operation, the forecast by the wind/solar energy generator would be wind-farm/solar facility centric for accounting and would form the basis of scheduling. Appropriate use of forecast for scheduling is also expected to reduce commercial impact for the wind and solar energy generators.
3. It proposes a maximum of 16 revisions for each fixed one and half hour time slot, starting from 00:00 hours, during the day (as against 8 revisions allowed currently).
4. Wind/Solar forecasting, scheduling and deviations are decoupled with the UI mechanism, providing incentives for a reasonable level of forecasting.

1.2 Concerns with the proposed framework

1. Even though the proposed framework recognizes that the accuracy of forecasting depends on the area considered, the same is not reflected in the methodology. The methodology refers to de-centralized forecasting.
2. It is mentioned that the errors in wind/solar power forecast can be minimized by including the metrological data to the forecasting tools. It is clear that in addition to real time weather data, the forecasted weather data is also necessary to improve the accuracy of the forecast. However, it does not clarify who will provide the weather forecast data to generation forecasting facility at the solar/wind farm, and how will this be done.
3. In the proposed framework, it is mentioned that 'Appropriate use of forecast for scheduling is also expected to reduce commercial impact for the wind and solar energy generators'. However, it is illustrative of how the proposed framework reduces the commercial impacts.

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4. The framework mentions that 'Wind/solar energy generator may choose to utilize its own forecast or the forecast given by REMC/concerned RLDC'. However, it is also not certain, whether a choice being available between forecasts is a mandatory condition under the proposed regulations.
5. It is also not clear that how the RLDC or REMC will perform forecasting with expected accuracy, and at what level (would RLDC produce a system-level ensemble forecast or wind-farm level forecasts?). Typically, an REMC/RLDC would be able to provide good accuracy forecasts at cluster level or state level.
6. With reference to revision schedules, the framework is not clear about the time block from which such revisions shall be effective. For example, if schedule is revised at 00.00 hrs, whether revised schedule is applicable from block 1 itself or from 4th block onwards or as applicable in deviation settlement mechanism i.e., 6th block onwards (under normal operation).
7. With reference to meter locations at boundary for metering, accounting and settlement, it is not clear whether Smart Energy Meters are to be installed at pooling station or at the wind turbine-level. Farms may have turbines scattered across investors and it is not necessary that the investor would have all his wind turbines connected to dedicated internal wind farm feeder.
8. The deviation of $\pm$ 12% deviation is permitted (figures below pertain to wind).
    a. Deviation within 88% to 100% - Rs.3 / kWh to DSM pool + wind generator must buy RECs worth units short and transfer these RECs to the power purchaser
    b. Deviation below 88% - Rs. 4/kWh to the DSM pool + wind generator must buy RECs worth units short and transfer these RECs to the power purchaser
    c. Deviation within 100% to 112% - wind generator would be paid Rs.4/kWh for excess generation + RECs issued to generator for excess generation
    d. Deviation beyond 112% - No payment for excess generation, but RECs will still be issued.
9. This formulation may incentivize the schedule to be always close to the positive limit (i.e. +12%), with no advantage for the generator to keep narrowing the band over time.
10. With the proposed framework, multiple forecasts may exist (at RLDC/REMC level and at various individual farms). Hence, there is no optimization on the forecasting services.
11. As the deviation is with respect to schedule, $\pm$12% may be difficult to achieve at the individual farm level, and there would be revenue impact on the RE generators.

2 Suggested alternate framework

The goal is to maximize RE generation and at the same time maintain system security and reliability. Further, the attempt must be to reduce the overall cost of balancing the system, thus lowering the ultimate cost to consumers. This could be achieved through adopting cost-effective approaches to address and the uncertainty and variability of RE, and then tackle the residual

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variability through ancillary services. To meet these objectives, it is proposed to institute cluster/state level forecasting.

It may be advantageous to perform cluster-level forecasting and scheduling for wind farms which enter into PPAs with distribution companies – either in the host state or outside the host state. From the cluster or area level forecast, the individual plant forecast can be derived based on the turbine level data) and the same can be used for commercial purposes.

In effect, SLDCs could treat all RE generators as one aggregate generator for each cluster. Instead of the forecasting and scheduling rules applying to each RE generator individually (and in this process, incurring more costs), they could apply to aggregate RE capacity.

Concerned system operator could procure system-level forecasts from appropriate parties ("forecasting agencies or aggregators") under an appropriate mechanism – e.g. multiple vendors can be contracted and the most accurate forecast gets an additional incentive thereby creating a competitive environment for continued improvement in RE forecasts. The associated costs could be collected from all RE generators in form of an 'annual fee'.

This approach will result in the lowest ultimate cost to consumers because this takes full advantage of tapping the geographical diversity that minimizes both uncertainty and variability while improving forecasting accuracy of RE generation, thereby minimizing the incremental ancillary services required for RE.

Further it is noted that in this approach, the concerned RLDC or NLDC bears no risk – whatever, incremental costs it faces due to RE – e.g. procuring centralized forecasts from forecasting agencies and integrating them in system operations, deviations from forecasts and the resulting ancillary service costs – can all be recovered as an 'annual fee' from all RE generators on a per MW or per MWh basis.

It is also seen that reduction could be achieved through centralized forecasting at 15-minutes advance notice (i.e. in synch with current dispatch instructions). Again, the residual deviations – at the aggregate level could be managed by the concerned system operator by procuring the required ancillary services on behalf of all the RE generators and recovering the costs from all of them.

Detailed analysis and recommendations around this framework are available here (http://shaktifoundation.in/wp-content/uploads/2014/02/Framework-for-scheduling-and-forecasting-in-India_final_published.pdf).

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