USINDIA BusinessCouncil

April 30, 2015

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New Delhi 110 001

Subject: Comments on "Proposed Framework on Forecasting, Scheduling & Imbalance Handling for Renewable Energy (RE) Generating Stations Based on Wind and Solar at Inter-State Level"

Dear Sir:

On behalf of the U.S.-India Business Council (USIBC) and its 325 member companies, thank you for your leadership of CERC.

The Council is grateful for the opportunity to provide comments on CERC's "Proposed Framework on Forecasting, Scheduling & Imbalance Handling for Renewable Energy (RE) Generating Stations Based on Wind and Solar at Inter-State Level", along with associated amendments to the Renewable Energy Certificate (REC), Indian Electricity Grid Code (IEGC), and Deviation Settlement Mechanism (DSM) regulations.

While the framework includes only inter-state transactions, it will have a significant impact due to the rapid increase in variable renewable energy generation across the country, the requirement that regional grids have conforming standards, and the expectation that SERCs will adopt similar regulations in the future.

I have attached our comments on the proposed framework for your reference. Thank you for your favorable consideration of these recommendations. We look forward to working with CERC to promote grid stability and the integration of variable renewable energy resources.

Sincerely,

Dr. Mukesh Aghi
President
U.S.-India Business Council

CC: Shri A. K. Singhal
Member, Central Electricity Regulatory Commission

Shri A. S. Bakshi
Member, Central Electricity Regulatory Commission

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Comments on "Proposed Framework on Forecasting, Scheduling & Imbalance Handling for Renewable Energy (RE) Generating Stations Based on Wind and Solar at Inter-State Level"

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Comments and Recommendations on the Proposed Methodology

According to the draft framework, generation must be at least 100% of schedule for no penalties to apply. We do not believe the draft framework has accounted for the significant potential impacts on project economics, the country's limited experience with forecasting and scheduling, and the lack of a robust renewable energy certificate (REC) market.

- **Impact on Project Economics:** Under these regulations, projects in states with tariffs lower than the assumed tariffs of Rs. 5/kWh and Rs. 7/kWh for wind and solar, respectively, will no longer be commercially viable, even if they are within the ±12% band. This mechanism will completely change the commercial structure of these projects and was not accounted for when regulators arrived at a feed-in tariff. Furthermore, there is considerable risk around receivables for RECs delivered or sold. All of these factors expose projects to potential defaults and significantly diminished investor returns.

- **Limited Forecasting Experience:** Currently, it is not possible to achieve the proposed band of ±12% consistently or at most times during the year. There is very limited experience in India with forecasting and scheduling for wind and solar PV. Those developers that are undertaking trial scheduling and forecasting exercises have seen errors up to 50%. More importantly, the fact that CERC itself does not recommend that developers rely solely on the Renewable Energy Management Center (REMC) forecasts for penalties suggest it is not confident of meeting the proposed error band. It is unclear why the regulator would then expect developers to achieve this level of precision at the project level.

- **Lack of Robust REC Market:** There is simply no depth in the REC market to cater to the proposed forecasting and scheduling mechanism. Bilateral trading of RECs is not allowed, and so it is not clear how the relevant parties would secure and transfer RECs. It is also not clear how this proposal will apply to projects under the captive or open access schemes as they are not related to utilities' RPOs.

Recommendations

- To reduce the considerable risk to project economics, we request the **regulations to be applicable only to projects with PPAs signed after the effective date of implementation** of this regulation or, **alternatively, be a pass-through for existing projects**.

- We recommend **adopting an incentive mechanism to improve developers' forecasting and scheduling capabilities** with **penalties imposed only for large errors** in consideration of the limited experience with forecasting and scheduling. Specifically, we recommend returning to the **error margin of ±30%** envisaged under the Renewable Regulatory Fund (RRF) without any penalties on the developer. These limits could be subsequently revised based on actual forecasting and scheduling experiences. At a minimum, the Rs. 3/kWh Deviation Settlement Mechanism (DSM) penalty and compulsory REC purchase should be waived for projects achieving 88-100% of scheduled generation.

- We also suggest an **additional incremental incentive over and above the power tariff for forecasting errors up to ±10%, no incentive/penalty for errors ±10-30%, and for greater**

than -30% an incremental penalty (*e.g.* an incrementally higher penalty with each 1% increase in error). This incentive mechanism will encourage developers to improve their forecasting techniques. These limits could be subsequently revised based on actual forecasting and scheduling experiences.

- To improve adherence to forecasted energy and dispatchability of wind and solar plants, CERC should **consider suggesting power factor, power curtailment, ramping, and frequency droop controls at the plant level**.

- CERC should i**ntroduce a provision for on-site interconnection of energy storage technologies** with wind and solar projects, which will **provide balancing power at the site and thus smooth output.**

Market Elements Needed for Successful Forecasting and Scheduling

A successful forecasting and scheduling framework should be pursued in tandem with significant reforms to the country's power market.

Forecasting and scheduling have been successful around the world, including in the United States, Germany, Denmark, and Spain, because their power markets have four key elements: (1) reserve capacity for balancing against wind and solar PV forecasting errors; (2) robust, developed power markets/exchanges with the capacity to trade forward and futures contracts; (3) an ancillary services market; and (4) well-connected grid infrastructure.

Market Elements	India
• Reserve capacity	• Power deficit country; limited to no reserve capacity.[1] Very limited gas-fired capacity for balancing.
• Developed power market platform with capacity to trade forwards and futures contracts	• Does not exist currently.
• Ancillary services market	• No ancillary services market currently; CERC regulations still in draft form.
• Well-connected grid infrastructure	• Developing transmission corridors dedicated to renewable energy.

We assume this framework was drafted on the basis of the country's goal of 160 GW of installed wind and solar capacity by 2022. Achieving this goal would increase the renewable energy generation mix dramatically to 15-16% from the current 5-6%. However, implementing the proposed regulations for forecasting and scheduling for such a large increase in renewable energy capacity and generation without implementing the abovementioned elements would not be possible for the following reasons:

1. **Large balancing capacity requirements in very short time periods will be difficult to obtain.** Assuming the 160 GW target is achieved by 2022, it is possible that up to 128 GW of wind and solar would be injected into the grid on a sunny summer day in 2022.[2] Balancing a forecast error as small as 10% within a particular 15-minute time block would require 12.8 GW of balancing capacity[3]. It would be extremely difficult for grid operators to obtain this amount of balancing capacity in such a short window.

[1] Pumped hydro may not be a useful form of reserve capacity as all dams will likely be full during windy season.
[2] Assumes wind and solar are generating at peak capacity with a PLF of 80%. (160 GW * 80% = 128 GW).
[3] 128 GW * 10% forecasting error = 12.8 GW.

2. **Frequent ramp up/down of generation can lead to grid disturbances.** Grid operators must continuously match electricity supply and demand on an instantaneous basis. Because wind and solar resources are variable generation resources and are often must-take, grid operators must direct controllable resources to match the variable supply and demand. Dispatching controllable resources with longer ramp up times and output from must-take, non-dispatchable resources during periods of low demand increase the risk of over-generation and significant frequency fluctuations.[4] Without reserve capacity and a liquid power market with flexible settlement mechanisms, the proposed forecasting and scheduling rules will not achieve CERC's objectives.

3. **Effects at the state level, particularly in those with high penetration of renewables, will be even more pronounced.** While India's installed wind and solar capacity of approximately 27 GW can currently be balanced at the regional level with the hydro and gas-fired capacity available, balancing at the state level would be extremely challenging well before 2022, and we expect SERCs to adopt similar regulations in the future. The renewable energy generation mix in renewable energy-intensive states, including Rajasthan, Gujarat, Karnataka, and Tamil Nadu, already exceeds 20% during windy months.

Projected Wind and Solar Generation Mix, 2019

	Rajasthan			**Andhra Pradesh**		
	Capacity (MW)[5]	**PLF (%)**	**Generation (MWh)**	**Capacity (MW)[5]**	**PLF (%)**	**Generation (MWh)**
Wind	5,538	23%	11,158	4,795	25%	10,501
Solar	8,226	18%	12,971	5,127	17%	7,635
Total Energy Requirement[6]			89,792			90,214
Wind and Solar Mix (Annual)	**26.8%**			**20.1%**		

To integrate wind and solar and maintain grid stability, additional flexibility is needed throughout the power system to match supply and demand in real time, including flexible generation with short ramp up/down times, demand side management, energy storage, stronger transmission networks, and liquid power markets.

Energy storage in particular, including on-site integration with wind and solar projects, is needed to accommodate the expected 160 GW of wind and solar capacity by 2022. Energy storage can improve power quality and reliability by minimizing voltage sags and interruptions, regulating grid frequency by handling fluctuations in generation and load through injection and absorption, providing contingency reserves during a sudden outage, promoting load shifting and peak shaving, reducing transmission congestion by storing excess energy, and enabling black start conditions by initially energizing the grid from shutdown conditions. On-site integration of energy storage with solar/wind projects, potentially combined with load matching by the REMCs, would smooth output and increase grid stability.

[4] California ISO, "What the duck curve tells us about managing a green grid," October 2013. https://www.caiso.com/Documents/FlexibleResourcesHelpRenewables_FastFacts.pdf.
[5] Central Electricity Authority, 18th Electric Power Survey of India.