From: smdeorah@lbl.gov
To: "Harpreet Singh Pruthi" <secy@cercind.gov.in>, "Shilpa Agarwal" <shilpa@cercind.gov.in>
Cc: "Sushanta K Chatterjee" <skchatterjee@cercind.gov.in>
Sent: Wednesday, August 10, 2022 10:32:01 PM
Subject: Comments on Draft IEGC

Dear CERC team,

Congratulations on the comprehensive draft IEGC!

PFA comments and suggestions on Chapter 2.

best regards,

Shruti M. Deorah
Affiliate Scientist, Lawrence Berkeley National Laboratory
Sr.Energy Policy Analyst, Goldman School of Public Policy, UC Berkeley
Email: smdeorah@lbl.gov
Desk: 510-486-4695

LBNL

Comments on Draft (Indian Electricity Grid Code) Regulations, 2022.

Central Electricity Regulatory Commission (CERC) published the draft Grid Code on 7th June 2022. We appreciate the vision of the Grid Code, especially keeping in view the evolving nature of Indian grid and power systems as it moves towards higher penetration of renewable energy. Resource adequacy (RA) and grid reliability would be of utmost importance as India's power sector works towards the objective of 50% clean power by 2030.

Chapter 2: Resource Planning Code
(1) states that the chapter covers 'integrated resource planning', as (2) elaborates that 'planning of generation and transmission resources shall be …. serving the load with ***optimum generation mix*** with a focus on integration of …".
(3) states that the distribution licensee shall 'identify the generation resource requirement' and 'prepare ***generation resource procurement*** plan'.

Lawrence Berkeley National Laboratory's (LBNL) national capacity expansion modelling under the Flexible Resources Initiative (FRI)[1] projects that the least-cost investment pathway for India's electricity sector over the next decade will consist mainly of new renewable generation and flexible resources, such as storage and load shifting (Nikit Abhyankar, 2021). In the LBNL Regulatory Report accompanying the modelling study, we examine key regulatory strategies for realizing the least-cost resource mix by 2030 (Dr. Frederich Kahrl, 2021).

The recommendations form a coherent framework of RA planning, resource planning and procurement, and markets and system operations. We state that well-designed system planning and RA frameworks, coordinated with state-level resource planning and procurement and supported by electricity markets, are critical to scaling renewables deployment with less curtailment and less financial and operational stress on conventional assets.

The proposed Resource Planning Code includes the critical components of Demand Forecasting and Generation Resource Adequacy Planning, along with Transmission Resource Planning.

However, to ensure that distribution licensees are able to assess the 'optimum generation mix' that would meet the Resource Adequacy requirement, it would be important to use engineering-economic models that are able to construct least-cost portfolios. Portfolio approach to planning & procurement of new resources accounts for interaction between resources with different characteristics and their combined economics vis-à-vis the projected load shape. For instance, optimal investments in battery storage will depend on the amount and cost of solar procurement; optimal investments in coal generation will depend on how much agricultural and industrial load is shifted to solar hours and how much peak hour demand batteries are able to meet.

[1] Flexible Resources Initiative (FRI) of the U.S.-India Clean Energy Finance Task Force has been supported by the U.S. Department of State and the Federal Energy Regulatory Commission (FERC) as co-leads, with India's Ministry of Power and the Central Electricity Regulatory Commission (CERC) as counter parties on the Indian side

Procurement of resources in silo only accounts for project level economics, whereas the objective of the distribution licensee is to minimize overall cost of serving its load, which has load on one side and its portfolio of generation resources (including energy markets) on the other. Current practice of separate procurement worked well when most procurement was focused on thermal, dispatchable resources. However, it is now difficult to determine most economic capacities of resources with varying characteristics to procure, particularly during periods of rapid changes in technology costs, hourly electricity system costs, and demand profiles. Portfolio optimization brings all of these aspects together to determine the mix of resources that can meet the load at minimum cost possible.

In the United States, a growing number of utilities are using all-source competitive solicitations, where all eligible resources compete in a single solicitation, rather than having separate solicitations for different kinds of resources, as this leads to a lower overall cost than procuring resources in silos of "traditional" and renewable resources. In Appendix D of the LBNL Regulatory Report, we provide a detailed case study for utilities in the states of Colorado and California.

For the Indian distribution licensees, a first step could be to determine the least-cost portfolio of resources as part of the 'generation resource procurement plan'. Competitive procurement could then procure these amounts of resources (including thermal, solar, wind, energy storage, demand response, etc.). All-source procurement could be piloted at a later stage once the value of portfolio approach is evident.

Our team has conducted optimal capacity expansion studies for four states, viz. Maharashtra, Rajasthan, Gujarat and Karnataka, under FRI. We'd be happy to share the results for these states with the Commission and the Forum of Regulators.

Our recommendation is to define the 'optimum generation mix' so that least-cost portfolio can be determined at the national and state level, and can be integrated into the 'generation resource procurement plan'. Additionally, FOR could consider laying down guidelines for all-source procurement.

Shruti M. Deorah
Affiliate Scientist
Lawrence Berkeley National Lab

Works Cited

Nikit Abhyankar, S. D. (2021). *Least-Cost Pathway for India's Power System Investments.* LBNL.

Dr. Frederich Kahrl, S. D. (2021). *Policy and Regulatory Recommendations to Support a Least-Cost Pathway for India's Power Sector .* LBNL.