Report Summary

Report of NITI Aayog on Renewables Integration in India

- The NITI Aayog released a report on "Renewables Integration in India" in July 2021. Renewable integration refers to incorporating generation, transmission, and distribution of renewable energy in the mainstream power system. The report recommends ways to integrate the increasing share of renewable energy capacity. The report observed that the solar and wind energy will contribute significantly to achieving renewables targets of 2030 (450 gigawatt) in India. Key observations and recommendations include:
- **Challenges with renewable integration:** The report highlighted following as key challenges in achieving renewables integration across states in India: (i) limited inter-state transmission lines due to concentration of solar wind energy sites in certain regions of states or certain states, (ii) increasing peak demand from new demand sources (such as air conditioners and electric vehicles), and (iii) increasing fluctuations in frequency and voltage levels at regional levels.
- **Power system flexibility**: The report recommended that states should leverage all possible sources to build flexibility in the power system. This includes ability of the system to respond to any variation in power demand and supply by modifying production or consumption. Key options recommended in the report to ensure flexibility include: (i) battery storage, (ii) smart-meters, (iii) demand forecasting equipment, and (iv) inter-regional transfers and cross-border transmission lines. Further, the report provides for a regional level model and a state level model to evaluate impact of increasing renewable energy and role of flexibility solutions in India.
- The report identifies demand-side flexibility as the top priority for ensuring flexibility in the power system. Key sources to achieve demand-side flexibility include: (i) aligning agricultural demand with solar peak hours, (ii) time-of use tariff (tariff based on the time of consumption in a day), and (iii) encouraging rooftop solar and energy efficient cooling systems (such as air conditioners).
- **Challenges with rooftop solar:** The report observed that rooftop solar systems lack visibility of demand forecast. This impacts the demand forecast for distribution companies (discoms). The report recommended that visibility of rooftop solar should be improved for better demand forecast to discoms. Further, it recommended to develop a platform for registration of solar pump and rooftop solar systems is states. The data collected on this platform should be shared with discoms for better demand forecast.
- **Regulatory framework for storage systems:** The report noted high solar output during the day may be stored for later use (such as meeting evening demand). Thus, energy storage (such as batteries) may provide flexibility in renewables integration in future. India currently lacks policies for provision of energy storage, and certain regulations restrict earning revenue from energy storage. The report recommended that a regulatory and remuneration framework should be developed for energy storage.
- **Power curtailment:** Power curtailment refers to deliberate reduction in power output below the actual production capacity. This is done either to balance supply and demand of power, or to optimise transmission constraints. The report noted that while renewables have must-run status in India, renewable generators may be curtailed due to system security considerations. The expectations of future curtailments may significantly increase the solar power purchase cost in future. Further, it noted that there is no transparent public data on curtailment and its reasons along with lack of related policies, which are of critical concerns for investors. The report recommended that instilling more flexibility in the power system will help in minimising curtailment.
- **Wholesale market:** The report noted that Indian power market enables cost-effective integration of low-carbon sources. However, there are certain barriers in inter-state trade such as: (i) lack of transmission capacity, (ii) low liquidity in short-term wholesale market, and (iii) lack of flexibility in existing contractual structures (such as power purchase agreements).
- The Indian power market depends mainly on physical power purchase agreements (PPAs) (agreements based on physical delivery of electricity) for resource adequacy. The report recommended that financial PPAs (agreements based on fluctuation in wholesale price of electricity) should be used in wholesale market to ensure resource adequacy. A physical PPA refers to the agreement in which the concerned party is compensated with physical delivery of electricity or with applicable charges, whereas, in case of a financial PPA the party is compensated based on the difference between a mutually agreed reference price and the wholesale market price.

Aditya Kumar
aditya@prsindia.org

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