SPECIAL REPORT FOR CIGRE-INDIA SC C2, C4, C5 WEBINAR ON

Participation of Battery Energy Storage in Ancillary Services - Challenges and Opportunities dated 15-May-26

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The webinar focused on one of the most important emerging topics in power system operation — the role of Battery Energy Storage Systems, or BESS, in supporting reliable and secure grid operation in an increasingly renewable-rich power system.

The session began with opening remarks from the Chairpersons of the National Study Committees. Shri R.K. Porwal highlighted the importance of technical performance evaluation and modelling of inverter-based resources for smooth integration of renewable energy. Shri Manoj Kumar Agarwal emphasized the need for suitable market and regulatory mechanisms to enable flexible resources like BESS to participate effectively in ancillary services. Shri Vivek Pandey elaborated upon the growing importance of coordinated control, monitoring, and dispatch of ancillary services for ensuring reliability and security of the grid under high renewable penetration conditions.

The technical session by Shri Phanisankar Chilukuri and Shri Anmol Sharma from GRID-INDIA provided a very comprehensive overview of the evolution of ancillary services in India and the emerging role of BESS in this framework.

The speakers highlighted India's energy transition roadmap and the rapidly increasing renewable energy capacity in the country. With increasing penetration of solar and wind generation, the system is witnessing growing flexibility requirements and increasing "duck curve" challenges. In such a scenario, flexible and fast-responding resources like BESS are becoming extremely important for maintaining grid frequency and balancing system operation.

The deliberations in the webinar covered the evolution of the Ancillary Services framework in India, including implementation of Secondary Reserve Ancillary Services (SRAS) and Tertiary Reserve Ancillary Services (TRAS) under the CERC regulations and the Indian Electricity Grid Code, 2023. The successful implementation of Automatic Generation Control, or AGC, in secondary frequency regulation and tie-line flow control was also explained in detail.

One of the key highlights of today's webinar was the discussion on the AGC pilot project undertaken on the 20 MW / 40 MWh BESS installed at Kilokari, New Delhi which opens up a host of opportunity and value proposition for the upcoming BESS in Indian Grid. The

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closed-loop testing results demonstrated the excellent capability of BESS to provide fast and accurate charging and discharging support under AGC operation.

The speakers also discussed the commercial and operational aspects of BESS participation in ancillary services. Various compensation mechanisms and value-stacking opportunities were presented. It was highlighted that while BESS can provide fast ramping, accurate controllability, and superior flexibility services, the existing compensation mechanisms may need further enhancement to adequately recognize these premium capabilities.

Another very important part of the webinar was the simulation study carried out by GRID-INDIA for assessment of optimal BESS size. Based on extensive simulations using operational data, it was demonstrated that a BESS configuration of around 2500 MW / 5000 MWh with two-cycle capability could significantly improve frequency performance within the IEGC operating band. The importance of state-of-charge management and adequate cycle availability for reliable operation was also clearly brought out.

The presentation further discussed multiple operational strategies for BESS, including exclusive participation in AGC, pure energy arbitrage operation, and hybrid approaches involving simultaneous participation in energy markets and ancillary services. These discussions provided valuable insights into future operational models for storage resources in India.

The webinar also highlighted the need for supportive policy and regulatory frameworks, wider AGC coverage including renewable energy plants, and future integration of intra-state entities and RE generating stations under ancillary services mechanisms.

Overall, the webinar provided an excellent platform for technical exchange and discussion on the future role of BESS in ensuring grid reliability, flexibility, and secure operation in the evolving Indian power system. The deliberations clearly indicated that Battery Energy Storage Systems will play a critical role in enabling India's clean energy transition while supporting frequency control, reserve management, congestion management, voltage support, and other essential reliability services.

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