Energy storage systems in india

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Globally, power systems are undergoing a pivotal phase of development. The exponential surge in renewable energy installations within the past decade has exposed the grid infrastructure to increased risks arising from the variable nature of renewable energy, especially from solar and wind.

Since solar and wind power supply fluctuates, energy storage systems (ESS) play a crucial role in smoothening out this intermittency and enabling a continuous supply of energy when needed. Thus, for sustainable renewable energy addition, concurrent growth of ESS capacity is imperative.

The Central Electricity Authority"s (CEA) latest optimal generation mix report indicates that India will need at least 41.7 gigawatt (GW)/208.3 gigawatt-hour (GWh) of BESS and 18.9GW of PHS in the fiscal year (FY) 2029-30.

The tendering agencies, led by the Solar Energy Corporation of India (SECI), have developed several tender designs over the years to find the ideal model for India. It includes solar + BESS, peak power supply, round-the-clock (RTC), standalone ESS, and firm and dispatchable renewable energy (FDRE). These tenders, first issued in 2023, are demand profile-driven to ensure firmness and dispatchability of renewable energy and create a win-win scenario for power developers and offtakers.

Despite the surge in ESS uptake in recent years, challenges remain. These include high initial capital expenditure (CAPEX), a longer gestation period of ESS projects (especially for PHS projects), suboptimal transmission and distribution (T& D) infrastructure, and a dearth of domestic manufacturing in ESS, highlighting potential supply chain risks.

In terms of ESS technology, in the near term, large grid-scale ESS will favour PHS, mainly due to its levellised cost of energy (LCOE). However, with the likely decline in battery prices, BESS may overtake PHS as the most financially viable option to implement grid-scale ESS. In the long term, with green hydrogen-based ESS possibly attaining parity with PHS and BESS, green hydrogen may also become the dominant grid-scale ESS technology.

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