How Storage Integrations Can Provide A Strategic Benefit in Large Scale Solar Projects and Create Synergy?

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At the COP 26 UN Climate Change Conference in Glasgow, the Government of India revised its non-fossil energy targets for 2030 from 450 GW to 500 GW. To accomplish this, developing India's solar potential is essential. Given the intermittent nature of renewable energy (RE) sources, we require energy storage systems (ESS) to maintain the power grid's security and dependability. Recent advancements in ESS technologies have resulted in a substantial decrease in capital cost, expanding market growth. Therefore, it is the right time to deploy suitable ESS technologies in upcoming large-scale solar projects to achieve our energy and economic goals.

Large-scale solar plants supported with ESS can cater to various degrees of intermittency on an hourly and minutely basis, enabling reliable solar integration. ESS technologies with longer discharge durations can be integrated with solar plants to ensure round-the-clock support to the grid by supplying energy during non-sunshine hours. Additionally, RE curtailment will be reduced because the storage would be charged using the excess energy generated during daylight hours.

Energy arbitrage can also be achieved with the integration of ESS. A co-located storage plant can generate additional revenue for the developer by charging during low-cost periods when excess RE is available and dispatching during high-cost periods.

Quick response ESS co-located with solar plants allows to meet peak demand and follow the load more efficiently than conventional thermal plants. Moreover, by utilizing efficient energy management techniques, these plants can avoid power generation from expensive gas power plants while meeting peak demand, lowering the overall cost of power system operations.

Co-located ESS can easily adjust frequency deviations caused by the intermittent nature of solar plants. They can help solar generators reduce the deviation settlement penalty caused by the under-injection of power into the grid, enabling better frequency regulation.

Seasonal mismatches associated with solar radiation can also be reduced by ESS integrated with large-scale solar plants. Excess solar energy generated during the summer can be stored and used during the monsoon and winter seasons, thereby supporting seasonal storage.

Various types of ESS can be integrated with large-scale solar projects. They are classified into three types based on their discharge duration (see Figure 1).

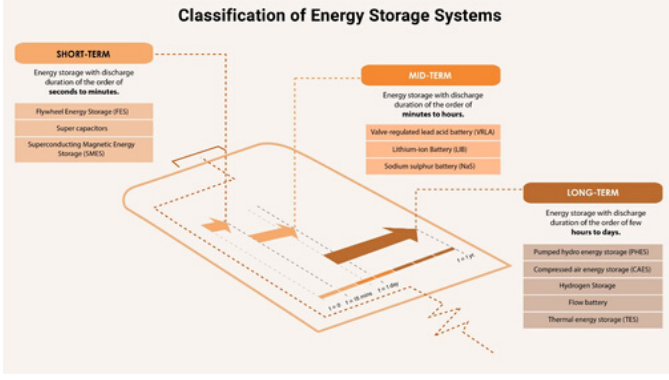

Figure 1: Infographic on the classification of energy storage systems (image recreated from the Center for Study of Science, Technology and Policy's working paper titled Energy Storage Options for Indian Power Grid)

In 2021, a Solar Energy Corporation of India (SECI) tender was won by Tata Power Solar to construct a solar photovoltaic plant with a capacity of 100 MW along with a 40 MW / 120 MWh Battery ESS. Greenko and ReNew Power won the SECI auction in 2020 for 1.2 GW of hybrid solar and wind along with ESS for peak power and round-the-clock supply. The issuance of these grid-scale solar and ESS tenders shows that India is on the right track in integrating large-scale solar plants with ESS.

The synergy between large-scale solar plants and ESS helps plant operators provide quality services that are faster and more competitive than conventional power plants. Therefore, to boost more investment in the sector, proper compensation schemes and market mechanisms should be implemented in the future.

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