India's first grid-scale BESS by Tata Power-DDL – HC Sharma

Most of the renewable energy generation is based on natural resources – be it solar, wind, hydro or any other source. The natural resources come as and when gifted and provided by nature, and are uncontrollable to a large extent. With more renewable energy generation coming into the Indian grid, there is a huge requirement for storage of energy, to store it at the time of generation and use the same whenever the demand arises.

With an ambitious target of reaching 500 gigawatts of renewable energy capacity before 2030, it is evident that India's power sector has undergone significant transformation over the past few decades and is emerging as one of the fastest-growing electricity markets globally. The growth trajectory is fuelled by the surging demand for electricity and the need for the transition to renewable energy sources.

Hence in pursuit of sustainable energy solutions, incorporating energy storage to store power during lean period and redistribute surplus electricity during demand is a crucial step to ensure an uninterrupted supply of power, especially during electricity fluctuations due to weather conditions. Though the demand can be estimated, it remains an uncontrollable factor to a large extent, except the programmes of demand response with customer collaborations, that too for a very small fraction of total demand.

Battery energy storage system (BESS) is a storage solution designed to store excess electricity generated from renewable sources by using batteries, with the primary goal of optimising energy utilisation, reducing dependency on the grid, reducing energy costs, and enhancing the reliability and stability of power systems, along with environmental gains.

In 2019, Tata Power-DDL achieved a significant milestone by empowering the energy sector with grid-scale battery energy storage system at Rohini, Delhi. The project was done in collaboration with AES & Mitsubishi Corporation to stabilise the grid, manage peak load demands better, add system flexibility and enhance the reliability of power supply in the region.

The state-of-the-art BESS offers an array of applications and features including demand side management, frequency regulation, transmission/ distribution system deferral to build new generation/ distribution capacity and reactive power management. Furthermore, BESS aids in energy arbitrage.

The solar plant is available during the day and the performance of the same is highly weather dependent. This brings a challenge in maintaining continuous availability of power which can be addressed only through power storage. Storage of power can be done in multiple ways, but in an urban scenario, BESS gives a unique solution. It can be implemented in minimum time, thereby helping in making wind or solar power more reliable, by filling in the gaps when there's not enough sun or wind. Moreover, BESS helps in avoiding the need for building new power plants or power lines, making the energy system more efficient and dependable. The system also defers or reduces the need for new generation or distribution capacity.

The 10 MW BESS located at Tata Power Delhi Distribution Limited's grid substation at Rohini, Delhi has successfully completed over five years of operation, paving the way for wider adoption of grid-scale battery storage across India.

Being a pioneer in adopting BESS technology, with the successful operation and maintenance, gives a unique advantage to Tata Power-DDL in getting familiarised with the technology and becoming self-reliant. Since the installation of Tata Power-DDL's BESS in Delhi in 2019, the focus has been on enhancing its operation and performance and it is at par with the world's best systems. Efforts have been made towards developing and adopting best practices in operation and maintenance, arbitrage, HVAC, safety, inverters, energy management system and battery aspect of the plant. Tata Power-DDL has developed capabilities for in-house repair of BESS equipment like PCS, UPS, HVAC and fire safety suppression system which brings with it the benefits of self-sufficiency and reduced cost.

For effective arbitrage, the company has developed a matrix model that helps in predicting the frequency and DSM rates. This gives better insights for forecasting charging and discharging schedule of the BESS, thereby maximising revenue and enabling better utilisation of the BESS. In the energy management system (EMS) space, Tata Power-DDL supported the deployment of enhanced EMS with remote capabilities and better user experience.

The company has plans to scale up its battery energy storage system in the next two years.

With the setting up of 10 MW BESS in Delhi, the system is instrumental in ensuring continuous power supply, reducing the likelihood of blackouts and grid failures, and is especially crucial for areas dependent on solar energy or prone to natural disasters as it serves as a buffer between solar generation and consumption.

The BESS is deployed with lithium-ion battery-NMC (nickel, manganese and cobalt oxide) chemistry for faster ramp rates, which enhances grid stability and peak load management, while ensuring reliability for over two million consumers.

These systems have set a benchmark in the power industry enabling advanced technology to capture and discharge electricity efficiently. As technology advances, the power and energy sector has witnessed significant growth. With such advancements, the demand for renewable energy grows and the importance of battery energy storage systems continues to increase.

India's power and energy sector is poised for continued growth, driven by a commitment to clean energy and the need to meet the rising demands of its population. Battery energy storage systems, such as Tata Power-DDL's exemplify a cleaner and more resilient power grid. The system is a versatile and essential component of modern energy infrastructure, enabling efficient energy management, cost savings and enhanced reliability, while supporting the transition towards a greener tomorrow.

Mr HC Sharma is Chief – Technical Services, Power Management, Power System Control, Quality & Sustainability, Business Development & Collaboration and Contracts at Tata Power-DDL.

NumberSpeak

4,000 MWh: Capacity of BESS approved by MNRE for viability gap funding (VGF)

40%: Maximum percentage of capital cost to be provided by central government as VGF

85%: Percentage of power from VGF-funded BESS to be offered to discoms first

Source: Ministry of Power