Field visit to 10 MWH Grid-connected battery energy storage pilot

With increasing penetration of renewable energy sources there is an increase in the intermittency and unpredictability of power generation requiring a grid connected Battery Energy Storage System (BESS). Various countries have started to deploy grid scale BESS devices within utility services areas to provide a host of functions ranging from standby capacity reserves, frequency control, forecasting and economic order dispatch, peal load management, deviation settlement mechanism and other areas pertaining to grid stability.

TPDDL has deployed a 10 MW/MWh grid scale battery energy storage systems (BESS) and has been providing grid support functions to the utility. On 3rd March 2020, the following representatives from European Union member states, policymakers, institutions and private sector companies visited one of the Asia biggest grid connected battery based energy storage technology pilot plant deployed by Tata Power Delhi Distribution Limited (TPDDL):

Delegation of the European Union to India	European Investment Bank (EIB)	Embassy of Germany	Indo-German Energy Forum (IGEF)
Embassy of France	Embassy of Sweden	Solar Energy Corporation of India (SECI)	Indian Renewable Energy Development Agency (IREDA)
The European Association for Storage of Energy (EASE)	Geco Global	Smart Innovation Norway	Larsen & Toubro

The distribution licensees that own distribution system may own and/operate BESS to flatten the demand curve or to provide reliability support or sale of power as part of distribution obligation or provide storage services to others. The Indian electricity regulators are working on the feasible business models for ancillary services including frequency control and primary reserves to optimally utilise the BESS services in future. The fast ramp-up/down capabilities of the battery system provide critical system flexibility and enhance system reliability of the grid for the Tata owned utility.

BESS Operational Information

- Currently the BESS device is only providing grid stabilization and peak load management services, as the policy and regulatory regime in India still does not include all the services of battery energy storage operators to be compensated.
- The system has conducted trial operations for other services including frequency regulation and will soon provide those services as and when policy and regulations allow them to provide such services.
- Battery storage projects help defer upgrades to Transmission & distribution (T&D) infrastructure required to address load growth and rising peak demand, congestion on the network, and reliability issues.
- The current operation of the system is governed by the power manager who manually calculates the price differential in energy and directs the battery system operator to charge or discharge the battery.
- With the commissioning of the BESS TPDDL has been able to save ~Rs 21 million due to penalties associated with the overdrawal of power during peak load conditions.
- The approximate cost of the battery was quoted around Rs. 700 million including the battery management system.
- Policy and regulatory interventions are required for such BESS systems to monetize their entire of suite of capabilities for grid services.

Delegation and site visit photos

Key Technical Points about the project:

- This energy storage system consists of lithium ion based Nickel Manganese Cobalt (NMC) cells supplied by LG Chem and a battery management system by Fluentgrid (JV of AES and Siemens).
- The BESS is interconnected with the utilities SCADA systems, isolation transformers, and switchgear protection systems. Currently the system is able to meet the partial services due to policy restrictions in India including on peak load management, deviation settlement, and emergency power supply (grid islanding).
- The 10 MWh batter consists of four individual cores of 2.5 MWh each which are interconnected at 11 kV. Each core has 37 racks with each rack having 14 battery modules, 1 Battery Management System, 1 node and 1 inverter.
- The rack voltage is 725 V, with an inverter (parker make) capacity of 88 kVA and an inverter output of 415 V at 126 A. Each of the pouch configuration battery cells has a capacity of 6.5 kWh
- The claimed efficiency of the system is yet to be calculated but is believed to be between 85-90%
- Cooling capacity of approximately 600 KW is utilised to keep the battery system at the optimal temperature. Therefore, a large amount of auxiliary power consumption is required to ensure optimal battery performance.