# Building power utilities of the future

## Battery energy storage systems are poised to emerge as a key tool for facilitating clean and resilient power supplies

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The energy sector in India is set to undergo a significant change in the coming years with the enhanced focus on integration of renewable energy into the grid. India has already laid pathways to integrate 175 gigawatts (Gw) of renewable energy into India's electricity grid by 2022. While green energy is a welcome step towards combatting the effect of greenhouse gases, it comes with its own challenges, as solar and wind power are infirm in nature and need to be supplemented in real-time through alternative options to manage the demand-supply situation without affecting the resilience and stability of the grid.

Utilities in India are struggling to balance their demand and supply on a real-time basis with a tightening of frequency bands under the new CERC regulation on deviation settlement mechanisms. Key aspects of CERC's fourth amendment of deviation settlement mechanism regulations are narrowing operating frequency band, linkage of deviation charges with market rate and, importantly, additional surcharge in the event of sustained deviation from schedule in one direction (positive or negative), resulting in additional penalty.

In such a scenario, the key challenge is to ensure a perfect balance between demand and schedule generation (power purchased). This would mean readiness on the part of utilities to manage uncertainties in both demand and supply on a real-time basis. Moreover, the solutions need to act fast so as to avoid both commercial and stability issues.

Taking cognizance of the above, battery energy storage systems (BESS) are gradually being recognised as a crucial tool for enabling the effective integration of renewable energy and unlocking the benefits of local generation and a clean, resilient energy supply. BESSs are increasing around the world as system costs are rapidly decreasing and as energy markets are being reformed to allow for the use of more distributed resources. BESSs hold the potential to transform the Indian power utility space in the years ahead.

BESSs would provide for fast-acting ancillary service for managing the grid drawal in contingent situations like sudden loss of generation (renewables) or high influx of the same. The commercials for the same could be based on pricing this service on two fronts — capacity charges (based on all beneficiaries and availability) and a variable charge (could be market- or frequency-based). With the growing focus on integration of electric vehicles, these are assuming further importance.

In order to do so, it is necessary to open up competitive markets for ancillary services to multiple technologies rather than only sourcing from large generators, thereby allowing storage operators to obtain additional sources of revenue for different services provided, enabling financial feasibility. Battery storage can be treated as an independent source to introduce in real-time.

Going forward, it is necessary to consider battery storage as a unique asset on the grid and allow multiple players on the grid system to install, own, and operate the system. Storage should be categorised as a fast-responding alternative with incentive mechanisms for fast response during black-outs and contingencies.

It is also necessary to encourage longer-term contracts for services from energy storage, thereby reducing risk for finance institutions. It is also necessary to introduce flexible tariff rates, allowing customers to use decentralised battery storage to reduce their electricity costs.

Another case for BESS is deferring of capital expenditure, which has a direct bearing on the consumer tariff. Utilities design their network to meet peak demand, and accordingly, capital expenditure is planned in order to build T&D infrastructure and sub-stations. Energy storage is becoming a cost-effective alternative that enables deferring of capital expenditure necessary to meet growing demand.

**Energy storage enables the deferring of capital expenditure on transmission and distribution infrastructure and sub-stations that the growing demand for power necessitates**

Further, addition of distributed solar generation would mean addition of more network elements like transmission lines and substations. This along with peak load condition would mean utilising the network to its maximum for a few hours a day. This could be addressed by localised BESS at load centres and renewable concentrated sub-stations. As BESS prices continue to decline, storage will increasingly be an attractive alternative to replacing conventional infrastructure or deferring investments.

**Developed countries such as the United States have already brought in structured regulations to promote energy storage systems**

Another critical support that BESS can offer to the environment is to function as an effective replacement to polluting DG sets which are owned and operated by many industrial consumers across the country to meet demand in the absence of reliable grid power. This would help in addressing pollution levels, which have become a health hazard for all. Consumers can also leverage storage to optimise their billing by using peak and off-peak tariffs.

Developed countries such as the United States have already brought in structured regulations to promote energy storage. A Federal Energy Regulatory Commission (FERC) order opens wholesale electric markets to energy storage resources in regional electricity markets. This rule covers all storage technologies interconnected to the transmission system, distribution system, or behind-the-meter.

The majority of storage capacity in US is currently located within the fast-responding frequency regulation markets. Geographically, the wholesale markets covering 13 eastern states (PJM Interconnection) and California (CAISO) are the two largest energy storage markets in the US, making up 81 per cent of the aggregate deployment in storage. This is largely due to the increasing renewable integration in PJM's and CAISO's energy mix. Since the real-time energy output from renewable resources cannot be predicted accurately, and the availability of these resources is time-varying, the demand for fast-responding frequency regulation increases accordingly in these two markets.

The characteristics of energy markets are different in each country. The applications that storage systems will support will also depend on a number of factors, such as mix of DER, existing energy storage, power sector regulations and tariff structures for customers. However, the day is not far off when a storage obligation will be imposed on utilities and consumers similar to the current RPO mechanism to ensure that a certain portion of the demand is met through storage, making BESS a critical component of the utility of the future in India.

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