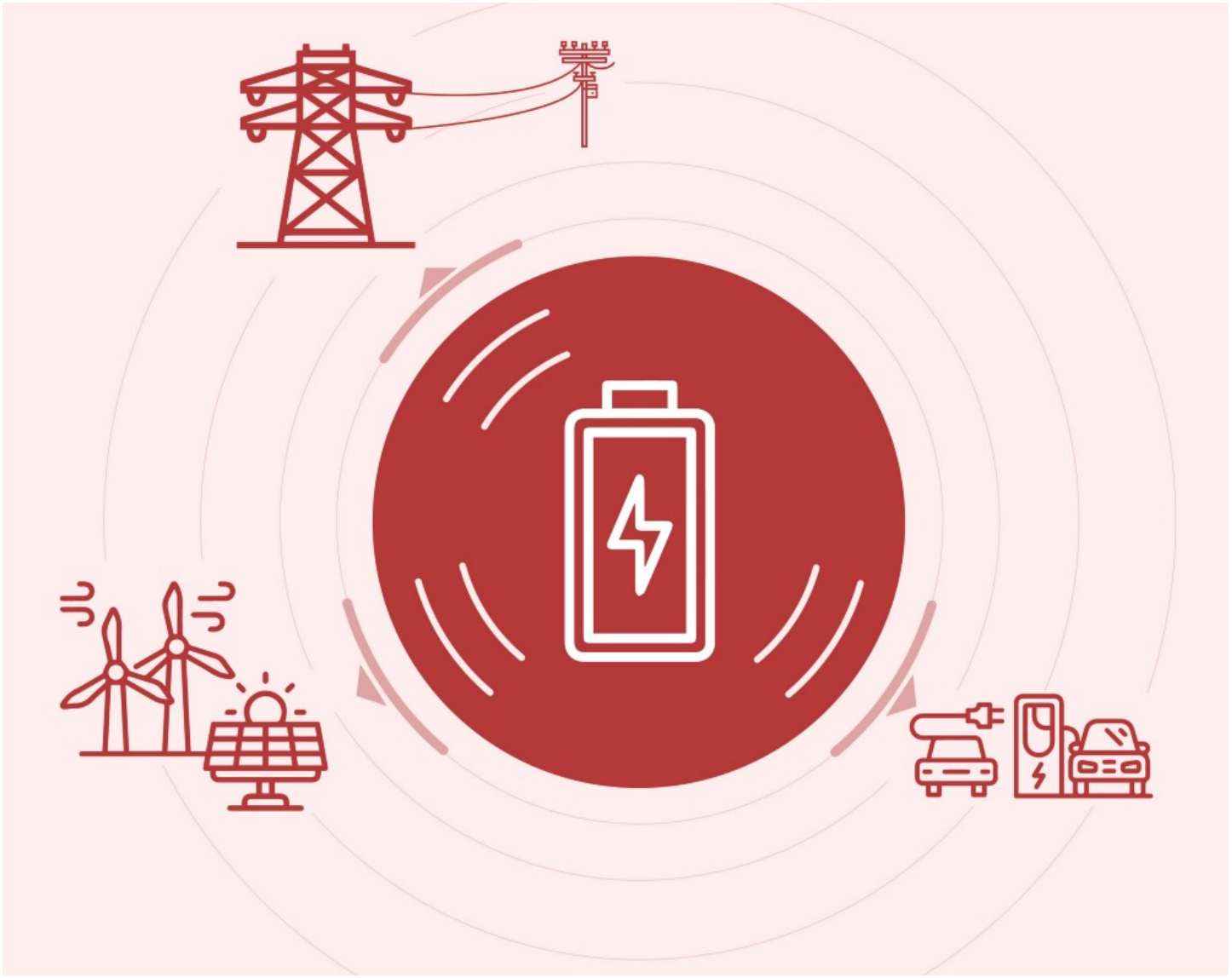
Energy Storage in India: A Wave of Opportunity

Center for Study of Science, Technology and Policy
Jul 23 · 5 min read

By Dr Vinay S Kandagal.

Thanks to favourable government policies and the reducing costs of technology, renewable energy is getting cheaper around the world. Today, it is cheaper to source energy from solar and wind plants than new thermal plants. This is great news for the renewable sector because market forces are now favourable for the large-scale adoption of solar and wind. However, one of the major drawbacks of increasing the share of renewables is that they threaten grid stability, owing to their fluctuating behaviour.

In general, a 20% share or more of intermittent renewables in the grid can destabilise it considerably. Furthermore, solar and wind energy are not available throughout the day. Therefore — and concomitant with the increasing popularity of electric vehicles (EVs) — energy storage is expected to play a vital role in transitioning towards a renewables-rich future.



Historically the high capital cost of batteries has been a major barrier to their adoption. However, the costs have reduced steeply — as much as by 80% over the past 5 years. Image by CSTEP.

India is touted to emerge as one of the largest destinations globally for energy storage installations by 2040. This prediction is exclusive of the increasing adoption of EVs in India. A recent analysis by India Smart Grid Forum (ISGF) suggests that India's energy needs for all major applications will be around 2,400 GWh by 2032. In 2018, the demand for energy storage technology was around 23 GWh. It is projected that by 2023, more than double this amount would be required for the planned EV transition. The Government of India has ambitious targets for both EVs and renewables — by 2030, 30% of all vehicles sold to be electric and 40% of total energy generation to be from renewable sources. To achieve these targets, India will need more battery storage than any other country in the world.

Pumped hydro is the primary form of energy storage around the world. It involves releasing/absorbing energy by pumping water between reservoirs at different heights. However, this technology can be implemented only at locations with favourable geography. Batteries are the next most-preferred technology. They are modular and can thus be installed at various types of locations. In India, round-the-clock electricity is still out of reach for a considerable population, especially in rural areas. In remote villages, mini- or microgrids can be set up with a renewable energy source. Battery systems increase reliability in such cases by storing excess generated energy and supplying it when needed. They are an integral part of 'off-grid' mini-grids — grids isolated from the main electricity grid.

There are two main methods for integrating battery storage into the electric grid. One is implemented at the utility scale, wherein the battery system is connected to the

transmission or distribution network and ensures grid reliability. This happens on a considerably large scale (~MWh scale) and is termed front-of-the-meter application. The other method is implemented at the residential and commercial/industrial level, mainly to provide back-up during power failure or to store excess locally generated energy from solar rooftop photovoltaic (PV) systems. Such applications are termed behind-the-meter (BTM) storage. Globally, energy storage has been picking up mainly on the utility scale and is slowly making its way into the BTM storage sector. The main reason for this is that energy storage can create more value for utility scale through multiple applications. A recent report by Bloomberg predicts that utility-scale applications will dominate the total number of energy-storage-installations by 2040. Even in India, a number of storage tenders have been floated recently (mostly since 2018), bundling together large-scale solar and wind projects.

Historically the high capital cost of batteries has been a major barrier to their adoption. However, the costs have reduced steeply — as much as by 80% over the past 5 years — compared to the 2010 costs. According to recent data (2018–19), the global battery installation costs range from USD 300/kWh to USD 500/kWh (INR 22,500 to 37,500). Another type of cost which is widely used to report and compare energy costs (estimated over an asset's lifetime) is the levelised cost of electricity (LCOE), estimated over the lifetime operation of equipment. The LCOE for battery storage, estimated from recent global projects, is about INR 11.5/kWh or USD 150/MWh, a 76% decrease since 2012. This LCOE decrease has now made battery technology competitive to that of peaker plants (peaker plants are power plants that are fired up to provide backup

during high demand). However, most of these cost estimations have been made from projects implemented outside India. This may be attributed to the fact that storage projects are yet to pick up in India. In this context, the recent commissioning of 10 MWh lithium-ion battery storage at the Rohini substation of Tata Power Delhi Distribution Ltd. (TPDDL) is a promising start.

More such projects with energy storage can be expected in the future, especially using solar and solar-plus-wind hybrid systems. Project planners and policymakers would, therefore, need to estimate the costs of including storage technologies in power plants. In a recent analysis conducted for the Indian scenario, the total installation cost for a 1 MW/4 MWh-standalone storage was estimated to be INR 15,264 (USD 203/kWh). Furthermore, it was found that a co-located battery system storing 25% of the PV energy would result in a tariff adder of INR 1.44/kWh. Another study estimated a higher cost of around INR 8/kWh for a 25 MW solar-plus-40 MWh storage plant. More research and analysis is required for informed decision-making for setting up solar-plus-storage projects in India.

In view of the rapid growth of India's economy and infrastructure, it's imperative to plan the huge demand for battery storage in the near future. In particular, to meet the EV targets, local manufacturing will play a key role in lowering the costs, because battery cost constitutes about 40% of the total vehicle cost. Initiated in early 2019, the National Mission on Transformative Mobility and Battery Storage is aimed at implementing giga-scale battery manufacturing in a phased manner until 2024. A recent proposal by Niti Aayog to set up ten large factories for lithium-ion battery

production is a move in the right direction. Further, the recent announcement by India's Finance Minister on introducing an incentive mechanism to promote 'champion sectors' such as advanced cell battery storage indicates a brighter future for battery storage technology in the country.

About the author: Dr Vinay S Kandagal is Research Scientist at CSTEP working in the Materials & Strategic Studies sector. His areas of interest include application of batteries for electric vehicles and grid integration.

Energy Storage Solar Wind Cstep Policy Analysis