BHUPESH VERMA
Senior Research Analyst, Center for Study of Science, Technology and Policy (CSTEP)

DR ANJALI SINGH
Research Scientist, Center for Study of Science, Technology and Policy (CSTEP)

Battery energy storage (BES) technology is set to play a crucial role in helping India achieve net-zero carbon emission goals. The country is committed to increasing the renewable energy (RE) share in power generation by 40% and reducing carbon emissions by 33-35%, by 2030. Currently, the share of RE in the primary energy-supply mix is approximately 20%. This is projected to reach 100% by 2050.

The falling costs of RE technologies and the Government's thrust on deploying green energy create an attractive environment for REinstallation in the country. However, the intermittent nature of RE makes it challenging to integrate it into the grid. BES, by storing the excess energy and feeding it to the grid, can improve the reliability of the grid while providing power system flexibility. This is applicable to off-grid power supply as well.

Of the various energy storage technologies, like pumped-hydro, compressed air, thermal fluid storage, etc., BES—which is compact, fast-ramping, and has a smaller gestation period— is the most preferred. Among the various BES technologies available, lithium-ion batteries (LiBs) are the most popular as they offer better performance characteristics (power and energy density, cycle life, safety, etc.).

LiB technology is currently gaining momentum for utility-scale applications, constituting almost a 90% share in the utility-scale energy projects across the globe. India too has installed a 10 MW LiB energy storage system in Delhi—its first such system—designed to improve the reliability and efficiency of the grid, support peak demand, and aid grid stabilisation, among others.

LiB prices have reduced by about 70% in the last five years, and are expected to decline further, given the global impetus towards electric vehicles and RE deployment.

Currently, the price of LiBs is approximately USD 137/kWh, which is expected to come down to USD 58/kWh by 2030.However, there are significant challenges in employing the LiB technology. Presently, Indian battery manufacturers import Li cells from countries such as China, Japan, and Korea, and assemble the modules.

Another concern is that LiBs are being considered primarily for electric vehicle (EV) applications; their use in the RE sector is neglected. Going ahead, it may become difficult to meet India's rising demand, as the exporters of Li cells will also have to achieve their EV- and RE-deployment goals.

To preempt future supply-chain risks, India needs to start manufacturing these cells domestically. Considering the scarcity of materials used currently in LiB variants (Ni, Co), alternate battery materials (Li iron phosphate, Li manganese oxide) should be prioritised. Further, emerging battery technologies like LiS, Li air, and solid-state batteries should be explored, as they are better than the conventional LiBs, and their raw materials can easily be sourced domestically.

Also, to boost domestic production, Indian battery manufacturers should utilise the production-linked incentive scheme that provides a substantial financial support of INR 18,000 crore for setting up LiB cell manufacturing.

Moreover, as a sizable number of retired batteries (from EVs) become available in the coming years for secondary use, they can be utilised in RE applications. BES deployment at utility-scale, along with such secondary use, will reduce energy costs and mitigate environmental impact. This should be complemented by a battery recycling ecosystem that enables using recycled materials for domestic-cell manufacturing.

> **“TO BOOST DOMESTIC PRODUCTION, INDIAN BATTERY MANUFACTURERS SHOULD UTILISE THE PRODUCTION-LINKED INCENTIVE SCHEME THAT PROVIDES A SUBSTANTIAL FINANCIAL SUPPORT OF INR 18,000 CRORE FOR SETTING UP LIB CELL MANUFACTURING."**