OPINION: Charging up Lithium-ion battery landscape in India

The Lithium-Ion Battery (LIB) industry is poised to play a vital role in the highly electrified transport sector of the near future.

ETEnergyWorld July 29, 2020, 11:31 IST

New Delhi: COVID-19 has rattled global industrial production by disrupting supply chains of raw materials and intermediates. Even in India, the outbreak has had an unprecedented impact on the manufacturing sector. This is forcing us to rethink our supply chain models—especially for the industries heavily dependent on imports. One such

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industry is lithium-ion battery (LIB), which is poised to play a vital role in the highly-electrified transport sector of the near future.

Today, electric vehicles (EVs), which contribute to air quality and reduce fossil-fuel consumption, are powered by LIBs. The lithium-ion batteries are also front-runners for supporting the large-scale deployment of renewable energy (RE) generation plants. As much as 2,300 GWh of battery demand—~38 % of Karnataka's monthly power consumption—will be required for India's EV and power sector by 2030.

India is yet to achieve commercial LIB cell-manufacturing capacity (a battery pack is an assembly of a cluster of cells) and has to completely depend on imports. To counter this outflow of capital and secure the production against all potential supply-chain disruptions, the Government of India has made ambitious plans to indigenise cell manufacturing. The likely economic opportunity from battery manufacturing to meet Indian EV targets is approximately INR 6 to 9 lakh crores by 2030 (NITI Aayog-RMI, 2018). This includes the imports of components to make battery packs and also limited cell production.

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Further, the high volume of industrial waste at the 'end-of-life' of these batteries has generated interest among Indian manufacturers. Research is on to develop a robust localised recycling ecosystem for the retired LIB, which can reduce the required volume of fresh battery manufacture and secure the supply of precious raw materials (many of which are classified as 'critical' in terms of value and resource).

Interestingly, the 'used' LIBs retired from EVs retain about 60%–70% of their original charge-storing capacity. It means that the retired batteries can be reused in solar, wind and other applications. This can delay the need to recycle or dispose of LIBs phasing out from the EV sector. As per the Faster Adoption and Manufacturing of Electric Vehicles policy (FAME II), at least 30% of India's entire transport fleet is expected to be electrified by 2030. Given this scenario, the end-of-life options should be seriously considered.

A crucial driving factor for recycling is the lack of easy availability of critical materials such as cobalt, nickel and lithium. These key elements required in LIB cell manufacturing are imported. For example, cobalt majorly comes from Congo and Australia; nickel is imported primarily from Australia, Indonesia, and Philippines; Chile controls ~80 % of lithium production, and around 70% of battery-grade graphite is produced by China. Providing LIB recycling facilities at the local level can enable relatively easy access to these scarce and costly materials for supporting the cell manufacturing supply chain.

Globally, only 5% of used LIBs are recycled, due to economic, technical, and other factors. For example, the recycling of LIB in European Union and United States is less than 5% of the used stock, whereas it is even lower (2%–3%) in Australia. In 2019, China recycled around 67 thousand tonnes of LIBs, which is 69% of all the LIB stock available for recycling worldwide. In India, Tata Chemicals is the only company to have started recycling LIB.

Most of the used LIB stock ends up in landfills or the informal sector, harming the environment and workers' health significantly, besides inadvertently encouraging child labour. Burying spent LIBs in waste disposal sites is hazardous.

Global research currently is focused on developing environment-friendly recycling techniques. Some of them are (i) pyrometallurgy, which involves melting the metals to extract valuable materials for reuse, (ii) hydrometallurgy, which involves recovering the scarce materials from batteries by immersing it in a solution, and (iii) directly reusing good (working) components of retired batteries in new ones. It is crucial to note that the current costs associated with these processes are often higher than the value of the materials if purchased fresh from open markets.

Recover, Recycle & Reuse

The LIB industry needs a clear roadmap to enable a large-scale techno-economically viable recycling ecosystem aligned with Indian requirements. The Government should formulate policies that these precious materials from the batteries reaching end-of-life in EV and RE (renewable energy) sectors, along with those from consumer electronics. This can include technology partnership and bilateral trade agreements with countries like Finland, Belgium, Germany, USA, and Canada, which are front-runners in the LIB recycling business.

Batteries currently installed in EVs and other applications use a variety of battery chemistries. To implement an efficient 'recycling, secondary use and scrapping protocol', all batteries should be clearly labelled with the specific battery chemistry. Battery manufacturers can collect used batteries, adhering to and complementing existing e-waste management regulations. Development of standards for used batteries for secondary applications will go a long way in absorbing these LIBs before they reach actual 'end-of-life'. Finally, the LIB recycling industry will also provide huge employment and skill enhancement opportunities at relatively lower investment levels (with cell manufacturing being capital-intensive), besides securing manufacturing output in critical situations.

[This piece was authored by Anjali Singh, Research Scientist, and Dr Mridula D Bharadwaj, Former Sector Head – Materials and Strategic Studies at CSTEP]

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