Powering sustainability with battery recycle and reuse

- By Amitabh Kant and Madhav Pai

India stands at the threshold of a transformative era, where energy independence and sustainability are not just aspirations but achievable goals. As we accelerate toward a low-carbon future, our nation is making strategic strides to build a self-reliant manufacturing base, enhance export competitiveness, and address the pressing challenge of climate change.

In this journey, critical minerals like lithium, copper, and cobalt are the backbone of emerging technologies such as electric vehicles, which are key to reducing carbon emissions. Ensuring a sustainable and secure supply chain for these essential resources is vital for India's energy security and economic growth. Our focus on recycling, innovation, and circular economy practices will not only reduce reliance on imports but also position India as a global leader in green technologies.

Exempting customs duty on 25 key minerals like lithium, copper, and cobalt will make these minerals more accessible in India, boosting local production and lowering costs. Critical raw materials make up 60% of the cost of manufacturing an EV battery and are mainly found in a few countries, which could lead to supply chain disruptions due to geopolitical issues. Therefore, we need a practical plan to create a

sustainable and secure supply chain for lithium-ion batteries, ensuring steady access to these materials while reducing our need for new mining.

The announcement of a Critical Mineral Mission for domestic production, recycling and overseas acquisition of critical mineral assets, is also a significant step towards promoting circularity and securing the supply chain. The Mission will play a pivotal role in developing the entire supply chain of critical minerals, from production to recycling, while supporting research, innovation, technical expertise, workforce development, trade and market access, and enabling viable financing solutions.

Recycling old batteries can greatly reduce the need for new mining by 2040—by 55% for copper, 25% for lithium, and 35% for cobalt and nickel. Adopting circular battery practices could also cut battery life cycle emissions by 7–17%. From 2022 to 2030, India could produce 120-180 GWh of used lithium-ion batteries from energy storage and transport. Recycling these batteries can help India create a domestic supply chain, support the country's 2070 net-zero goal, achieve energy independence, and ensure energy security.

India has already started taking measures towards effectively reducing battery waste and reusing, recycling and repurposing batteries for

second-life applications. In 2022, India introduced the Battery Waste Management Rules (BWMR) to integrate recycling into the LIB supply chain. These rules include extended producer responsibility (EPR) that holds manufacturers and producers accountable for collecting used batteries.

Going forward, we need transparent recycling outputs and rigorous EPR enforcement to ensure on-ground progress. During its G20 Presidency, India also initiated an industry-led initiative - the ‘Resource Efficiency and Circular Economy Industry Collaboration (RECEIC)’ to promote resource efficiency and circular economy practices. Additionally, the Ministry of Electronics and Information Technology has transferred a cost-effective lithium-ion battery recycling technology to nine recycling industries and startups as part of Mission LiFE's 'Promote Circularity Campaign'.

While we have started the collective pursuit to create a sustainable and circular battery ecosystem, there is a long way to go. The Budget has tremendously increased the allocations to the two Production-Linked Incentive (PLI) schemes for battery storage and automobile and auto components – making this an opportune time to promote the adoption of circularity-friendly design as demand soars. By 2030, India is expected to generate around 128 GWh of end-of-life lithium-ion battery waste, with over 59 GWh coming from electric vehicles.

Establishing a robust domestic refining capacity to convert the extracted black mass into battery-grade materials can create a viable recycling market in IndiaBy 2030, 54% of end-of-life batteries worldwide are expected to be recycled, meeting 7% of the material needed for lithium-ion battery production. In India, this recycled material could produce 60 GWh of new battery cells, boosting resource efficiency and sustainability

Today, we stand at a critical juncture that will shape the future of this rapidly evolving industry. Indian start-ups Attero, BatX, Lohum, EXIGO, and LICO Materials are already making significant strides in this field and now is the time to take proactive steps towards accelerating and scaling up the creation of a circular battery value chain. We must establish clear criteria for retiring batteries and set comprehensive guidelines for post-retirement usage of batteries. While concerted efforts towards standardization in manufacturing processes are critical, we must also undertake initiatives to integrate the informal sector into the mainstream. We must also look at boosting efficiency through source segregation while enforcing strict safety standards and forming cross-sectoral partnerships for battery reuse.

A pertinent and timely effort in this direction is the recent launch of the Battery360 Alliance – a multi-stakeholder platform to bring together industry, government, research organizations, and technical experts to create a sustainable and circular battery ecosystem in India.

Such cross-sectoral collaborative platforms can help promote reuse, recycling, and repurposing by providing an integrated space for co-creating solutions and enabling informed decision-making across ministries.

Battery manufacturing and recycling will not only support India's transition to a low-carbon economy but also drive economic growth by reducing dependence on imported raw materials, creating jobs, and fostering innovation. Establishing a robust battery industry will position India as a global leader in green technologies, attract investment, and contribute significantly to achieving energy security and sustainability.

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