Make Those Li-ion Batteries Roar

By – Amitabh Kant

2023 was recorded as the hottest year in 173 years, and 2024 is expected to follow suit. At the current pace, global warming was expected to reach 1.5C between 2030 and 2052, but we have already breached that limit in 2023. At the current rate, global warming was predicted to reach 1.5°C between 2030 and 2052. However, we have already surpassed that threshold in 2023. Now, the possibility of exceeding 2°C, and even 3°C, is a real risk. Even with all nationally determined contributions (NDCs) considered, we still risk surpassing 2°C. If we fail to meet our collective NDCs, we could breach the 3°C mark.

Without taking action to address climate change, up to 35% of India's GDP could be at risk by 2050, making inaction a costly choice. The power and transportation sectors are among the largest contributors to total emissions in India and must be decarbonized. Decarbonizing these sectors by integrating renewable energy into the power sector and adopting electric vehicles in transportation is essential for a low-carbon technology transition.

According to the International Solar Energy Society, solar power is on track to generate more electricity than all the world's nuclear plants by 2026, surpass wind turbines by 2027, overtake dams by 2028, exceed gas-fired power plants by 2030, and outpace coal-fired plants by 2032. By 2042, solar energy is set to become humanity's largest source of primary energy—not just electricity. Solar will, therefore, be the dominant energy source, powering everything from the grid to storage and charging infrastructure for transportation. The transition to solar energy will heavily depend on lithium-ion batteries, which are essential for powering electric vehicles and storing renewable energy.

The need for a sustainable supply chain is essential for India's energy security. India's demand for lithium-ion batteries (LIB) is expected to exceed 300 GWh between 2022 and 2030. Currently, a majority of this demand is met through imports from countries like China, South Korea, and Vietnam. To meet future demand, it is crucial to establish domestic LIB cell manufacturing capabilities.

Lithium-ion technology is currently preferred over other battery technologies because it offers fast response times and high cycle efficiency (low energy loss between charging and discharging) while remaining cost-effective. The battery value chain includes mining, raw material processing, cell component production, battery cell/pack production, battery storage, electric vehicles, and recycling and reuse. The first three stages—mining, raw material processing, and cell component production—account for nearly 60% of value addition.

According to 2023 reports from the IEA and Bloomberg, Chinese companies dominate the global battery market with a ~60% share, followed by South Korea with 22% and Japan with 8%.

CATL and BYD alone account for 52% of global battery cell manufacturing. India's battery import bill reached USD 2.1 billion in 2023, with over 85% of imports coming from China. To ensure India's energy independence and achieve its decarbonization goals, scaling up and stabilizing battery cell manufacturing is critical. Leading players like Tata, Reliance, Maruti Suzuki, Amara Raja, Exide, TVS Lucas, OLA Electric, and JSW have already announced plans totaling 100 GWh by 2030, with investments of around 12-15 billion dollars by 2030. Additionally, the Government of India is implementing a PLI Scheme for 50 GWh of battery manufacturing in India.

Action Areas for India:

The government, private sector, and startups all have critical roles to play in advancing India's battery industry. Here's what needs to be done:

- **Speedy Implementation of PLI for GIGA Factories:** The government has launched the Advanced Chemistry Cell (ACC) PLI scheme with an outlay of Rs 18,100 crores to support 50 GWh of battery manufacturing. However, only 30 GWh has been awarded so far. There is a need for a robust monitoring and implementation framework to ensure speedy on-ground execution.

- **Niche Battery Chemistry PLI Program:** New applications for batteries are rapidly emerging in heavy transport, aviation, drone technology, and grid storage, requiring high energy density and power. With various potential improvements to existing technologies like Li-ion and alternatives such as solid-state, sodium-ion, flow, aluminum-air, and metal batteries in different stages of commercialization, it is crucial to push the niche ACC Program for futuristic battery technologies.

- **Establish Supply Chain Linkages under the Mineral Security Partnership (MSP):** Through the Minerals Security Partnership of 14 countries, India should focus on building a resilient supply chain for critical battery minerals like cobalt, nickel, lithium, and the 17 "Rare Earth" minerals essential for the Battery Value Chain.

- **Develop Mineral Processing Capabilities:** Minerals are refined into battery-grade chemicals and components used to make anode and cathode electrodes for battery cells. The Volta Foundation estimates that the mineral processing market will reach $62 billion by 2030. Currently, China controls 70% of global lithium refining capacity and 85% of anode and electrolyte production. India has a unique opportunity to position itself as a reliable supplier as the global market seeks to diversify the supply chain. India should rapidly build its mineral processing capabilities to carve out a niche in the global market.

- **Develop the Battery Value Chain and Ecosystem in India:** The battery ecosystem offers ample opportunities across upstream, midstream, and downstream segments, with extensive vertical integration and economies of scale being crucial. Companies like BYD and Tesla have demonstrated how vertical integration can lead to lower prices. Indian

companies should lead by forming joint ventures and acquiring suppliers to secure long-term access to input materials.

- **Develop Battery Swapping Networks:** Enabling battery-as-a-service (BaaS) through battery swapping could significantly reduce the cost of EVs, shorten charging times, and boost adoption.

- **Research and Development Support:** Universities and R&D institutes should focus on developing advanced prototypes, improving battery technology, enhancing range, and overall performance. Emphasis on R&D is critical, and the new Rs 1 lakh crore scheme should be utilized to advance battery storage.

- **Promote a Circular Economy through Reuse, Repurposing, and Recycling:** Repurposing EV batteries for energy storage systems (ESS) after their end-of-life will improve the economics of second-life applications, provide commercial markets at low costs, and reduce the need for new batteries in the power sector. Battery recycling units will ensure the recovery of critical minerals from end-of-life batteries and promote a circular economy by formalizing the processes of battery collection, aggregation, separation, transportation, and recycling.

India stands at a critical juncture in its pursuit of energy security and sustainability. As the demand for lithium-ion batteries continues to surge, driven by the rapid growth of renewable energy and electric vehicles, it is imperative that India builds a robust and resilient battery ecosystem. The collaborative efforts of the government, private sector, and startups will be key to driving this transformation, ensuring that India not only meets its decarbonization goals but also emerges as a significant player in the global battery value chain.

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