Refining India's future in critical minerals

- *Amitabh Kant and Adil Rana Chhina***

The global scramble for critical minerals is no longer a future concern, it is a live strategic contest and India is in danger of arriving late. As countries race to lock in supply chains for clean energy and digital technologies, the real battle is not over who mines the ore or who assembles the final product, but who controls the midstream – the processing stage that turns raw minerals into usable, high-purity materials. This is where power in the global economy is being consolidated and without urgent action to build domestic processing capacity, India risks becoming permanently dependent on external actors.

Presently, the global midstream landscape is strikingly concentrated. China controls nearly 90% of processing capacity for key minerals such as lithium, cobalt, graphite and rare earths. Even when countries like Australia or Chile mine the ores, they often end up being refined in China before re-entering global markets as high-value materials. This structural asymmetry gives Beijing disproportionate leverage in green and digital value chains, with ripple effects across the global economy. Against this backdrop, India must now take deliberate and coordinated steps to establish its own midstream capabilities.

Firstly, India must secure reliable and diversified feedstock for its future processing industry. The Geological Survey of India aims to undertake 1200 exploration projects by 2031 which will be a crucial step for strategic self-sufficiency. However, developing a new mine typically takes an average of 15 years for most minerals. Therefore, in parallel to developing domestic mines, India must also secure a steady feedstock of raw ores in the short-to-medium term from resource-rich nations. This can be done through long-term offtake agreements, equity stakes or outright acquisition of mining rights which will be essential to insulate from supply disruptions and price volatility. While Khanij Bidesh India Ltd. (KABIL), a government joint-venture company, has been tasked with securing overseas mineral assets, it must move swiftly and decisively or risk being left behind in the global race to acquire critical minerals. India should also build strategic mineral stockpiles to buffer against geopolitical shocks or market fluctuations. This steady supply of raw ores will ultimately be the fuel that will power India’s midstream processing ambitions.

Secondly, India must move from policy intent to implementation through coordinated midstream infrastructure development. Establishing midstream facilities demands robust infrastructure, including reliable power, water and logistics connectivity. Without coordinated efforts between government, industry and research institutions, scaling up midstream processing can face delays and under-utilization. To overcome these challenges, India has begun laying the groundwork for a coordinated national approach to critical minerals. The notification of a list of 30 critical minerals in 2023 signalled clarity

in national priorities. This year, the National Critical Mineral Mission (NCMM) was launched to address the entire value chain from exploration and mining to recovery from end-of-life products. Embedded within the mission is the aspiration to build four critical mineral processing parks and achieving self-sufficiency in the processing of at least 5 critical minerals. India should now identify suitable sites, preferably near ports or mineral corridors, and rapidly operationalize these parks with single-window clearances, anchor investors and shared infrastructure for refining and testing.

Thirdly, India must leverage its strategic partnerships with Australia, Japan, the US, the UK and the EU to access advanced processing know-how and technology. For instance, the India–Australia Critical Minerals Investment Partnership already extends to collaboration on developing processing technologies for minerals like titanium and vanadium. The UK likewise presents a timely opportunity, with India designated as a priority partner under its new Critical Minerals Strategy, opening avenues for collaboration in refining and standards. Similarly, tie-ups with Japanese firms experienced in high-purity metallurgy, and German firms that bring advanced separation and refining processes, can help India achieve the quality standards needed for EV-grade and solar-grade materials. The objective should be to move from a buyer-seller dynamic to joint ownership of midstream assets that build domestic capability.

Fourthly, India must invest in human capital and R&D to build technological self-reliance. Advanced processing requires specialized expertise in materials chemistry, metallurgy and process control which is currently woefully lacking in the country. Dedicated training programs through the IITs, CSIR laboratories and the nine new Centres of Excellence established under the NCMM should be adequately supported to build this knowledge base. Collaborative research with global technology centres can help develop indigenous process flowsheets catering to a multitude of ore grades and environmental conditions. Bridging the gap between laboratory research and commercial deployment through pilot projects and R&D funds will be key to translating knowledge into scale.

And lastly, India must create market certainty to attract private investment into the midstream. To ensure assured offtake and strengthen investor confidence, the government should mandate that industries progressively source a portion of their processed critical minerals from Indian refiners. Complementing this, a price-floor mechanism could be introduced to guarantee minimum returns on investment and reduce market risk for early-stage processors. Such measures can be balanced with calibrated import duties to deter predatory low-cost imports, particularly from China, while maintaining competitiveness. India should also explore public–private partnerships to develop common refining infrastructure, testing and certification facilities as well as logistics linkages.

Ultimately, scaling critical mineral processing will determine whether India can truly anchor itself in the global clean technology value chains. The midstream processing sector is the missing link that connects mineral wealth to industrial competitiveness, energy security and green leadership. Building it will require not just capital and technology but strategic will and institutional coherence.

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