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Institute for Energy Economics and Financial Analysis

Climate and Sustainability Initiative

Mobilising capital for India's critical minerals sector

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Briefing Note

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Mobilising capital for India's critical minerals sector

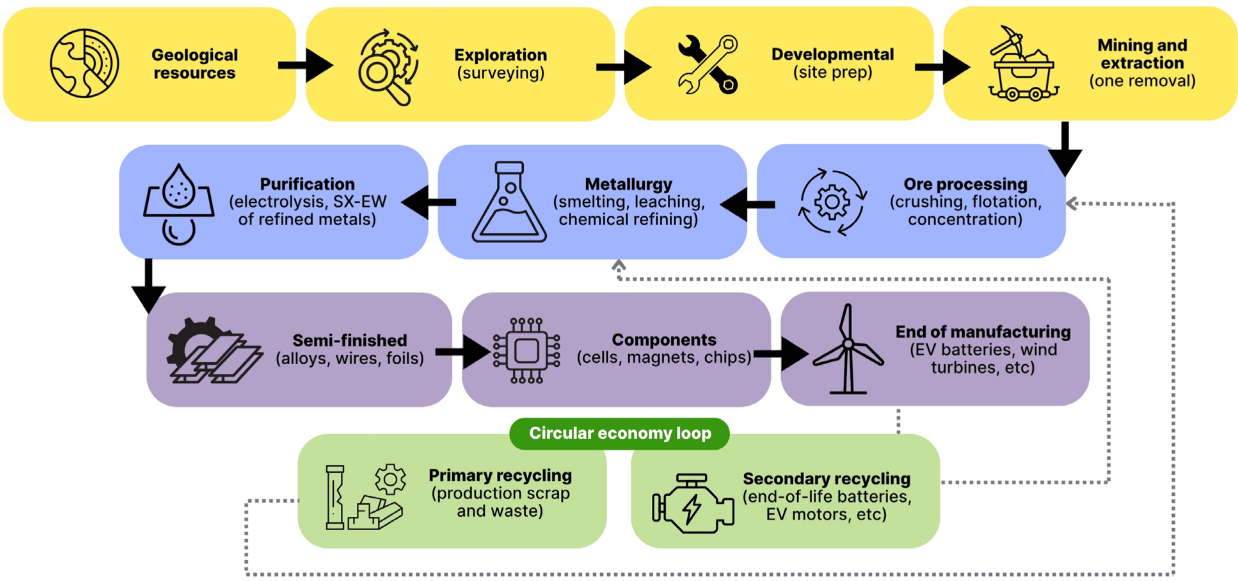
- *Volatile demand and supply, sharp swings in the prices of critical mineral inputs, long gestation periods, and high upfront capital requirements limit the flow of capital into the critical minerals sector.*
- *While the National Critical Mineral Mission (NCMM) aims to create regulatory and institutional enablers to develop the critical minerals supply chain, focused capital expenditure is needed to accelerate large-scale mining, refining, and processing. The NCMM creates intent and incentives, but outcomes will depend on institutional execution.*
- *For India to achieve its climate goals, the government must move beyond policy frameworks. It should focus on de-risking projects, ensuring that the critical minerals industry is commercially viable.*

Context

The global energy transition, while encouraging, is moving at a much slower pace than needed. One of the major hurdles is the difficulty in securing critical minerals as their production, refining, and processing are concentrated in few countries, mainly China.

China dominates the critical minerals landscape; it accounts for ~51.7% of the world's known rare earth reserves, followed by Brazil (~25.7%). For high-demand minerals such as lithium, nickel, and cobalt, China accounts for only 10–30% of global raw extraction, but dominates 60–70% of refining and processing capacity, and approximately 90% of rare earth refining. Between 2020 and 2024, most growth in the refined output of key energy minerals was driven by a few suppliers. For copper, lithium, nickel, cobalt, graphite, and rare earth elements, the combined market share of the top three producers (Indonesia, the Democratic Republic of the Congo and China) rose from about 82% in 2020 to 86% in 2024. In addition to the concentration of the critical minerals supply chain, resource nationalism is also shaping the sector's dynamics. For instance, Indonesia has imposed export bans on raw nickel (2020) and bauxite (2023), while Zimbabwe has suspended exports of all raw materials and lithium concentrates. These export bans and tariffs give countries geopolitical leverage over market conditions and trade.

Figure 1: Critical minerals supply chain



In the midst of these developments, countries have been striving to accelerate the energy transition but are also rethinking their plans, in some cases pausing renewable energy capacity additions, particularly as access to critical minerals across the value chain is being used as political leverage. Energy security has been one of the key drivers of the transition but relying on a few countries for critical minerals could temporarily halt progress or even reverse it. In this scenario, some countries like the US, India, and the EU are making an attempt to diversify their supply chains and ramp up domestic manufacturing capabilities.

Like most other countries looking to advance the energy transition, India needs a massive volume of critical minerals to augment its domestic clean technology manufacturing. India imports 100% of lithium, cobalt, and nickel for manufacturing and intermediate green products. India has adopted a two-pronged approach to boost its energy transition by 2030 and beyond: strengthening domestic capacity and securing access to global critical mineral supply chains.

Table 1: India's critical minerals: Key sectors and minerals required

Sector	Target		Demand for minerals
Electric vehicles (EVs)	30% penetration by 2030		Lithium, nickel and cobalt
Wind	42GW (installed)	140GW (2030)	Neodymium and dysprosium
Solar	129GW (installed)	230GW (2030)	Silicon, indium, gallium, tellurium

Source: Press Information Bureau (PIB)

Meeting the rising demand will require significant investment across the critical minerals supply chain over the next two decades. Much of this investment is front-loaded and involves risks that may not naturally attract private investors. The key question is whether **private capital is being deployed adequately in this sector**, which is crucial to India's green energy ambitions and energy security.

This briefing note highlights financing challenges across the supply chain, i.e. from upstream exploration to capital-intensive midstream processing. Furthermore, it evaluates the current institutional and policy enablers, identifying areas where current schemes fall short in financing projects.

Early signs of a financing gap in India

The critical minerals supply chain spans mining, processing and refining, downstream manufacturing and recycling. Each segment requires long-term strategic investment (see Table 1) and coordinated policy planning. The International Energy Agency (IEA) estimates that approximately USD915 billion of fresh capital investment is required globally for mining and refining over 2026–2035 under the Announced Pledges Scenario (APS). This estimate exceeds the capital requirements for existing and announced projects, indicating potential supply gaps by 2040. In addition, more capital is required for technologies that mitigate the environmental and social impacts of mining and refining.

India is facing similar challenges, though quantifying the financing gap is difficult due to limited publicly available data on project-level investment. The National Critical Mineral Mission (NCMM) focuses on creating regulatory and institutional enablers to develop the critical minerals supply chain. While these serve as necessary foundations, the Mission does not provide direct budgetary support for capital expenditure in large-scale mining, refining or processing. Investment in critical minerals is expected from Public Sector Undertakings (PSUs) and private players, including for the acquisition of assets abroad. Missing elements include risk-sharing capital for upstream exploration, dedicated capex support for midstream processing, and explicit linkages to manufacturing incentives—similar to strategies employed by other countries to boost their critical minerals supply chain.

Understanding financing problems in the critical minerals supply chain

The critical minerals supply chain can be divided into three segments: exploration or mining, refining and processing, and recycling. Each segment has unique financing needs and challenges as outlined below.

Upstream: Mining or exploration

- **High upfront cost and delayed returns:** Mining projects for critical minerals are capital-intensive and typically take 10–15 years to move from exploration to commercial production. Key investment metrics such as payback period, net present value, and internal rate of return become meaningful only once production starts and revenues are realised. As a result, investors face prolonged periods of uncertainty and high upfront risk, creating entry barriers.

- **Policy execution uncertainty:** The 2023 MMDR Amendment Act introduced a new exploration licence, but rollout has been slow, with most licences going to PSUs. Several mining blocks awarded through auction bids have also failed to begin operations due to time-consuming environmental clearances, land acquisition hurdles, logistical constraints, and a lack of coordination between the respective ministries.

- **Fragmented property rights:** The current framework lacks secure property rights, as exploration licences are time-bound and susceptible to cancellation. The transition from discovery to mining is uncertain, approvals are lengthy, and licences are largely non-transferable. These two factors, together, discourage high-risk exploration by limiting tenure security, offtake certainty, and risk-sharing mechanisms.

- **Absence of risk sharing and capital market infrastructure:** India lacks the institutional ecosystem that exists in global mining hubs. There is no secondary market, i.e. exploration is conducted by discovering entities, unlike in global hubs like TSX-V, where junior miners make discoveries and sell them to major miners through specialised exchanges. In the Indian ecosystem, entities must see projects through from exploration to production without any exit option.

Midstream: Refining and processing

- **Feedstock and excess capacity risk**: The midstream segment is associated with several risks, including a lack of long-term contracts for regular feedstock supply, and volatile prices and demand for output. These risks deter investors, particularly in setting up new plants that face competition from midstream plants in China. The excess capacity of midstream plants in China is keeping output and margins low, discouraging new investment in these plants without government support.

- **Capital-intensive technologies:** Mineral processing and refining are capital-intensive, with capex requirements for plants varying significantly across technologies. For nickel processing, the high-pressure acid leaching route used to produce battery-grade mixed hydroxide precipitate from low-grade laterite requires approximately USD108.8 million (~INR10.2 billion) in capex for a 12,000 tonnes per annum (tpa) plant and incurs about USD93.5 million (~INR8.7 billion) in annual opex. Financing, often structured through vertically integrated models, remains constrained, highlighting the need for targeted de-risking incentives to crowd in early-stage investment in critical mineral processing. Moreover, the capital-intensive nature of the sector, coupled with feed supply constraints, discourages investment in the midstream segment.

- **Limitations of government incentives:** Schemes like the Production Linked Incentive (PLI) for Advanced Chemistry Cell (ACC) battery storage incentivise downstream manufacturing. However, they largely overlook the upstream and processing segments. This strategic supply chain gap could undermine India's long-term global competitiveness.

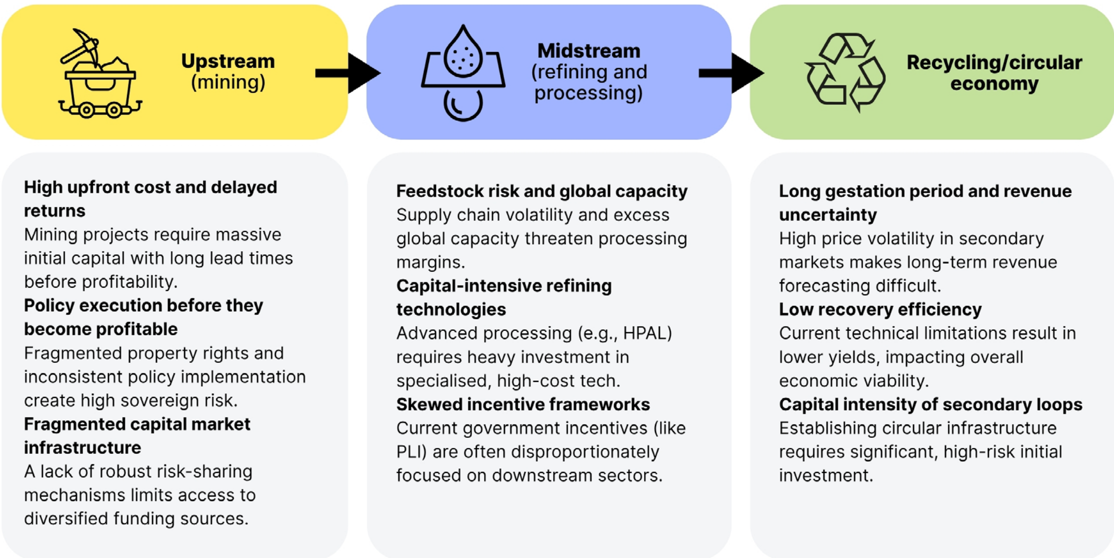
Recycling or circular economy

- **Capital-intensive and long gestation period:** A recycling plant with a capacity of 2,500tpa typically requires an investment of INR250–300 million (USD2.7–3.3 million) (state-level recycling operations), including machinery, installation, and utilities. Smaller plants cost around INR80–100 million (USD0.86–1.07 million) (for R&D), but at this scale, the cost per tonne increases sharply, reducing economic efficiency. Other capital expenditure requirements include land and ancillary infrastructure (e.g., supply chain development). Longer recovery periods for upfront capital investments, combined with limited visibility of returns, pose a key challenge.

- **Revenue uncertainty:** The time gap between purchasing the feedstock and selling the recovered materials exposes recyclers to unpredictable cash flows as the later price and demand is sensitive to commodity cycles. While price swings destabilise profitability, demand fluctuations lead to a high level of working capital. This limits capital for future plant expansion and technologies.

- **Technology risks:** Current technologies often face limitations in handling the complex and heterogeneous nature of products containing critical minerals. This results in inefficient separation processes, lower recovery rates, and higher material losses, reducing the economic viability and resource efficiency of recycling and processing operations.

Figure 2: Supply chain challenges



Given the challenges associated with investment in the critical minerals sector, policy interventions are warranted. The government has taken several measures in recent times to address these challenges, but it remains unclear whether they are effective or adequate to attract private investment into the sector.

Institutional and policy enablers in India

India announced the NCMM in January 2025, with an outlay of INR343 billion (USD~3.7 billion) over seven years (see Table 2). The NCMM has seven components: enhancing domestic production, foreign asset acquisition, recycling, trade and markets, R&D, skilling, and fiscal incentives. All these institutional enablers in various critical minerals supply chain segments are examined in detail below.

Mining

India's critical minerals policy is centrally driven, making coordination between the Ministry of Mines, state mining departments, and PSUs essential to translating national ambitions into on-ground outcomes. Under the NCMM, exploration and auctioning powers have become increasingly centralised, with the Geological Survey of India (GSI) intensifying exploration across multiple states. In the 2025–2026 field season, the GSI undertook nearly 230 projects, including 92 targeting rare earth elements, while the Mission is targeting 1,200 exploration projects and the auction of over 100 critical mineral blocks by 2030–2031. Additionally, the Ministry of Mines has already auctioned 34 critical mineral blocks.

To support investment, the MMDR Amendment Act 2025 introduces measures that reduce the capital intensity of critical mineral projects by eliminating additional inclusion payments typically required for new critical and strategic mineral finds. Combined with a 50% auction premium discount for early production, if production begins within five years for a mining lease (exclusive rights to explore and extract minerals) or seven years for a composite licence (a two-stage mining concession that grants both exploration and subsequent mining rights under a single approval), this will significantly improve profitability and reduce capex needs.

However, while the NCMM acknowledges the importance of state participation, coordination mechanisms are not well-defined. States differ widely in mineral endowments, technical capacity, institutional readiness, and experience with complex mineral projects. Stronger Centre-state coordination—through clearer institutional roles, shared project pipelines, and aligned incentives—is critical to reducing execution risk and accelerating project delivery.

Moreover, for mineral-rich states to capture domestic value, processing and refining infrastructure must be close to extraction sites. The Union Budget (2026–2027) includes a proposal for setting up dedicated rare earth corridors in mineral-rich states to ensure that they directly contribute to the manufacturing of rare earth permanent magnets and improve Centre-state coordination.

A related constraint is India's high exploration risk and the limited availability of investor-ready geological data. Although GSI has expanded reconnaissance and exploration activities, public geological agencies must move beyond mapping to actively de-risk exploration by generating pre-competitive data that reduces uncertainty before mineral blocks are auctioned. India needs a streamlined, consistent mechanism for the public release of detailed, publicly funded exploration data. The absence of such a mechanism restricts private players' ability to build on early-stage findings and increases reliance on speculative bidding. These weaknesses are reflected in limited investor participation in some mineral block auctions and delays in post-auction development, particularly where reserve data, technical feasibility, or processing pathways remain unclear.

The introduction of exploration licences aims to address this gap by encouraging private sector-led exploration. However, uptake has been slow, partly due to uncertainty around regulatory transitions from exploration to mining, data ownership, and commercial rights. International experience shows the importance of robust geological data systems: countries such as Australia have invested heavily in publicly accessible geological databases designed to crowd in private investment by lowering early-stage risk. Following the Australia model, the GSI can adopt an investor-facing role by providing high-quality digital geological datasets to help investors better understand the mineral potential of mines. Otherwise, exploration will remain a high-risk area rather than a data-driven investment opportunity.

Additionally, implementing Environmental, Social and Governance (ESG) practices can reduce risks in the critical minerals supply chain, as mining projects are associated with significant ESG risks. These include geopolitical tensions, armed conflicts, corruption, emissions, and other factors that can erode support for mining projects and, in turn, limit the supply of critical minerals. Without reliable supply chains for these minerals, most of which come from high-risk areas, it will be difficult to sustain the clean energy transition in India. Moreover, ESG practices can enable critical mineral companies to attract sustainable finance, particularly when these minerals are used exclusively for the energy transition.

Processing and refining

While upstream exploration is being accelerated, a coherent strategy for building domestic processing and refining capacity is lacking. There is limited clarity on how midstream facilities will be financed, where they will be located, or how they will be integrated with mining activity.

On the processing side, India's R&D ecosystem remains fragmented, with weak linkages between academic research, public sector units, and private industry. While IITs and CSIR labs produce strong research, there are few clear pathways to translate lab results into commercially viable processing technologies. Emerging collaborations such as the Australia-India Critical Minerals Research Hub, established between IIT Hyderabad and Monash University, and industry-linked initiatives involving firms like LOHUM working with Australian universities, demonstrate the potential of cross-border, industry-led R&D. Additionally, the exemption of customs duties on capital goods for critical mineral processing in the Union Budget 2026–2027 may reduce the cost of importing advanced technology. However, these efforts are exceptions rather than the norm. Scaling domestic processing capacity will require linking R&D funding to commercialisation through industry cost-sharing and grants. For example, the US government committed USD1.4 billion (~INR131 billion) in November 2025 through a combined debt-and-equity package specifically designed to accelerate the scale-up of domestic rare-earth magnet recycling, recovery, and manufacturing. This ensures that pilot-scale facilities transition to commercial scale. A similar project-level financing mechanism for critical mineral processing plants is worth exploring.

Manufacturing and recycling

India's clean energy ambitions increasingly depend on the ability to scale domestic manufacturing across key sectors such as batteries, electric vehicles (EVs), solar modules, and electronics. While policy incentives, including PLI schemes, have been introduced to support these industries, manufacturing growth has been slow as upstream supply chains remain underdeveloped.

Notably, experience under the ACC PLI highlights the limits of this approach when upstream constraints are unresolved. Although 40GWh of battery manufacturing capacity has been awarded under the ACC PLI, installed capacity remains negligible, with no incentives claimed so far. Manufacturers are reported to be facing structural challenges, including limited access to technology, a lack of skilled workforce, dependence on imported equipment, and, most importantly, the absence of a reliable domestic supply of mineral-derived inputs. This reflects a broader supply chain misalignment: while policy incentives aim to stimulate downstream manufacturing, continued reliance on imported raw materials constrains companies' ability to operationalise production. As a result, India risks creating demand for EVs and batteries without first developing the upstream infrastructure needed to sustain domestic manufacturing.

While the NCMM seeks to address these upstream vulnerabilities through exploration, overseas asset acquisition, and recycling, explicit linkages between the NCMM and PLI remain weak.

Further, the establishment of dedicated rare earth corridors across mineral-rich coastal states such as Odisha, Kerala, Andhra Pradesh and Tamil Nadu (Union Budget 2026–2027), followed by the announcement of the Rare Earths Permanent Magnets Scheme (November 2025, INR72.80 billion [USD~800 million] outlay), signals a targeted push to localise midstream processing and magnet manufacturing. However, without stronger integration with downstream PLI-linked manufacturing ecosystems, these initiatives may not fully resolve structural supply dependencies. As a result, scaling manufacturing might reinforce dependence on imported refined materials.

While recycling and urban mining are recognised as policy priorities, scaling them into a reliable source of critical mineral supply will require stronger institutional coordination and policy mechanisms beyond financial incentives. By integrating EV deployment, battery manufacturing, and e-waste management systems with standardised regulations, feedstock aggregation mechanisms, and coordinated implementation across states, recycling can evolve into a scaled and dependable pillar of India's critical mineral supply.

International partnerships

Apart from domestic potential and exploration efforts, India is building bilateral partnerships with Australia, Argentina, Peru, Chile, Zimbabwe, Mozambique, Malawi, and Côte d'Ivoire to secure access to critical minerals. At the same time, India is part of multilateral frameworks, including the Minerals Security Partnership (MSP), the Quad Critical Minerals Initiative, the Indo-Pacific Economic Framework, and the Initiative on Critical and Emerging Technologies to strengthen and diversify its critical mineral supply chains. Complementing these initiatives, Khanij Bidesh India Limited—a joint venture of Indian public sector enterprises—is pursuing overseas exploration and strategic asset acquisitions, particularly in lithium and cobalt, through partnerships with countries such as Argentina, Chile and Australia.

The way forward

Critical minerals are capital-intensive, high-risk, and long-gestation assets. Without strategic government intervention, uneven progress and underinvestment could emerge as major risks. Global experience shows that state coordination, risk-sharing, and long-term policy clarity are essential. The NCMM creates intent and incentives, but ultimately, execution is determined by institutions. Without strong enablers, India risks fragmented investments, stalled projects, and continued import dependence in the midstream and downstream stages. Despite recent policy momentum, India's institutional framework for critical minerals needs further strengthening.

Annexure

Table 2: Investment estimates for mining of critical minerals

Source	Scenario	Time period	Years	Total investment required (USD bn)	Avg. annual requirement (USD bn/ year)
BNEF	Energy transition minerals	2025– 2050	25	2,100	84
IEA	Announced Pledges Scenario (APS)	2025– 2040	15	590	39.3
IEA	Net Zero Emissions (NZE) Scenario	2025– 2040	15	800	53.3
IEA	Copper only (APS)	2025– 2040	15	330	22
IEA	Copper only (NZE)	2025– 2040	15	490	32.7

Source: IEA, Bloomberg, IEEFA

Table 3: Proposed expenditure and investment under India's National Critical Mineral Mission

<table>
<tr><th>Mission objectives</th><th>Finance heads</th><th>Source of allocation</th><th>Total allocation (INR billion) (FY2024–2025 to FY2030– 2031)</th></tr>
<tr><td rowspan="6">Securing domestic and foreign sourcing</td><td rowspan="2">Domestic critical mineral exploration</td><td>National Mineral Exploration Trust (NMET)</td><td>30</td></tr>
<tr><td>Geological Survey of India</td><td>40</td></tr>
<tr><td>Risk coverage for foreign sourcing</td><td>NMET</td><td>40</td></tr>
<tr><td>Support for exploration activities outside India</td><td>NMET</td><td>16</td></tr>
<tr><td rowspan="2">Recycling</td><td>Incentive scheme for mineral recycling</td><td>Budget</td></tr>
<tr><td>Pilot projects -mineral recovery</td><td>NMET</td></tr>
</table>

Strengthening value chains	R&D and human resource development	*ANRF & other R & D schemes	5
	International R&D support	*ANRF & other R & D schemes	5
	Skill development centres	Budget	1
	Critical mineral processing parks	Budget	5
	Stockpiling of critical minerals	Budget	5
Total			163
Expected investments by PSUs, etc.			180

*Source: National Critical Mineral Mission, Ministry of Mines, Government of India. Note: *Anusandhan National Research Foundation*

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