

5. India's Minerals Diplomacy – Economy

As India aims for Net Zero by 2070, its clean energy transition depends heavily on Critical Minerals (CMs) and Rare Earth Elements (REEs)

Critical Minerals and India's Minerals Diplomacy

1) Meaning and "Criticality" Logic

Critical minerals are minerals that are

- a. essential for economic development and national security, and
- b. exposed to high supply risk due to scarcity, import dependence, and geographic concentration of production/processing, creating supply-chain vulnerability.

Criticality is typically assessed using two lenses-

- a. Importance (strategic/economic indispensability)
- b. Risk (concentration, geopolitics, trade restrictions, lack of substitutes, weak recycling)

India's Official List of Critical Minerals – The Ministry of Mines' Committee on Identification of Critical Minerals identified 30 critical minerals for India. The list includes (as you noted)– Antimony, Beryllium, Bismuth, Cobalt, Copper, Gallium, Germanium, Graphite, Hafnium, Indium, Lithium, Molybdenum, Niobium, Nickel, PGE, Phosphorous, Potash, REE, Rhenium, Silicon, Strontium, Tantalum, Tellurium, Tin, Titanium, Tungsten, Vanadium, Zirconium, Selenium, Cadmium.

Critical Minerals Matter (India Context)

Energy Transition and Industrial Strategy – These minerals are foundational to

1. EVs and battery storage (Li, Co, Ni, graphite)
2. solar PV and grid (silicon, copper, silver-like ecosystem, though silver isn't in your list)
3. wind turbines and power electronics (REE magnets, copper)
4. hydrogen, advanced manufacturing (specialty alloys and catalysts)

Defence and Strategic Tech – Critical minerals underpin

1. jet engines and superalloys (e.g., rhenium)
2. radars, precision-guided systems, aerospace (REEs, specialty metals)
3. secure communications and electronics (germanium, gallium, tantalum)

Semiconductor and Digital Economy – Inputs like gallium, germanium, silicon, and specialty metals support-

1. high-end electronics,
2. telecom,
3. photonics and fibre optics,
4. defence-grade sensors.

Global Supply Chain Reality

Concentration Across the Value Chain

1. A key vulnerability is that mining and processing/refining are often concentrated in different countries.
2. "Criticality" rises when
 - a. upstream mining is concentrated (few producers),
 - b. midstream refining is dominated (often the more strategic choke-point),
 - c. export controls or geopolitical tensions disrupt flows.

Typical Global Producers – Many analyses highlight

1. DRC for cobalt,
2. Chile/Australia for lithium,
3. Indonesia for nickel,
4. China for rare earths and significant refining capacity (especially midstream).

Rare Earth Elements (REEs)

Definition – 17 elements– 15 lanthanides + Scandium + Yttrium.

“Rare” if Not Truly Rare – Not scarce in the crust, but rare as economically viable concentrated deposits. Separation/refining is complex, chemistry-intensive, and environmentally sensitive.

REEs are “Critical” – High strategic value + high concentration of processing capacity → supply disruption risk.

Core Applications

- a. Permanent magnets– EV motors, wind turbines, defence systems
- b. Phosphors– LEDs, screens
- c. Catalysts– refining and emission control

India’s REE Opportunity and Constraint – India has monazite-bearing resources (beach sands), but the binding constraint is often

1. limited scale of separation/refining,
2. regulatory/environmental handling (monazite has thorium association),
3. need to build end-to-end value chains.

Value Chain Approach

Geoscience and Exploration– mapping, drilling, resource estimation

Upstream– mining and extraction

Midstream (strategic choke-point)– processing, refining, separation, metallurgy

Downstream– manufacturing (cells, magnets, components, semiconductors), clean-tech products

Recycling/Recovery– urban mining, end-of-life recovery, circular economy

Status of India’s Mineral Ecosystem

High Import Dependence (Strategic Vulnerability) – India’s dependency is especially high for several battery and magnet-grade inputs; the policy discourse consistently flags import dependence as the central risk driver.

Exploration Push but Processing Deficit – India is improving exploration intensity; however, the primary bottleneck remains processing/refining and “battery-grade” conversion capacity.

National Critical Mineral Mission (NCMM) (Official)

1. The Union Cabinet approved the National Critical Mineral Mission on 29 January 2025 with a total outlay of ₹34,300 crore over seven years to build a resilient critical mineral value chain.
2. Mission logic (how to write in answers)
 - a. reduce import dependence,
 - b. enable exploration → mining → processing → recycling,
 - c. strengthen institutions, technology and strategic reserves.

KABIL (Overseas Minerals Strategy) – Khanij Bidesh India Limited (KABIL) is a JV of NALCO, HCL, and MECL; it was incorporated on 08.08.2019 to secure supply of critical and strategic minerals through overseas assets and partnerships.

Minerals Security Partnership (MSP) (India's Global Integration)

1. MSP was officially announced in June 2022 in Toronto on the margins of the PDAC convention (as described by the U.S. State Department).
2. India became the 14th member of MSP in June 2023, as stated in an official Government of India PIB release (with the member list).
 - a. platform for ESG-aligned supply chains,
 - b. coordination on financing and projects across the value chain.

India Needs Minerals Diplomacy

Supply Security for 2030 Energy and Manufacturing Goals - India's scale-up of renewables, EVs, storage, and electronics requires long-term mineral supply assurance.

Manage "Geopolitical Leverage" and Export Controls - Concentrated processing creates vulnerability to

1. export restrictions,
2. sanctions,
3. shipping choke points,
4. cartel-like pricing.

Technology and Capital Access - Midstream and recycling technologies are

1. capital intensive,
2. IP and process-knowhow heavy,
3. often dominated by a few players—making collaboration and joint ventures strategic.

Price Stability and Industrial Competitiveness - Long-term offtake + equity stakes + diversified sourcing reduces volatility shocks for EV, solar, electronics, defence manufacturing.

Strategic Autonomy (Atmanirbhar Bharat) - Minerals diplomacy is now a pillar of strategic autonomy because it underpins

1. defence readiness,
2. critical infrastructure,
3. future growth sectors.

Regional Strategy (Value Chain Mapping)

Upstream (Mining/Extraction) - Africa, Australia, Latin America- resource-rich; scope for equity stakes and long-term contracts.

Midstream (Processing/Refining/Stockpiling) - Partnerships with tech-capital hubs (Japan; West Asia capital hubs; other advanced industrial ecosystems) to build refining and separation capacity.

Downstream (High-tech Manufacturing) - EU/US/Japan-type ecosystems for

1. advanced battery chemistries,
2. magnet manufacturing,
3. recycling technology,
4. standards and ESG-compliant supply chains.

Challenges in India's Minerals Diplomacy

The Refining Gap (Most Critical Constraint) - Discovering ore is insufficient without

1. hydrometallurgy,
2. separation technologies,
3. ultra-high purity conversion (battery-grade, magnet-grade).

Financing and Competitive Bidding – Indian firms often face

1. higher cost of capital,
2. aggressive state-backed competitors offering package deals (infrastructure + financing + offtake).

Resource Nationalism in Partner Countries

Producer countries increasingly want-

1. local processing,
2. value addition,
3. jobs and skills transfer,
4. constraints on raw export.

ESG and Social License – Critical mineral projects are scrutinised for

1. biodiversity impact,
2. tribal/indigenous rights,
3. water use and waste,
4. community consent and rehabilitation.

Domestic Exploration Intensity – Improving, but deep-seated deposits need

1. advanced geophysical datasets,
2. risk capital,
3. private participation with clear rules.

Way Forward

Develop “Integrated Value-Chain Partnerships” – Prioritise deals that include

1. equity + offtake,
2. technology transfer,
3. processing capacity creation,
4. skill development,
5. recycling collaboration.

Build Midstream at Scale in India – Create

1. dedicated refining clusters,
2. common effluent and environmental management infrastructure,
3. assured power/water/logistics,
4. stable policy to crowd-in private capital.

Recycling and Urban Mining as the Second Supply Pillar – Scale battery recycling, magnet recycling, e-waste recovery to reduce import dependence structurally.

Strategic Mineral Reserves – Stockpile selected minerals with high disruption risk and limited substitutes (especially for defence and grid needs).

Governance and Standards – Establish clear ESG frameworks and certification so Indian supply chains become globally acceptable and financeable.

Source- <https://www.thehindu.com/opinion/op-ed/an-exploration-of-indias-minerals-diplomacy/article70510652.ece>