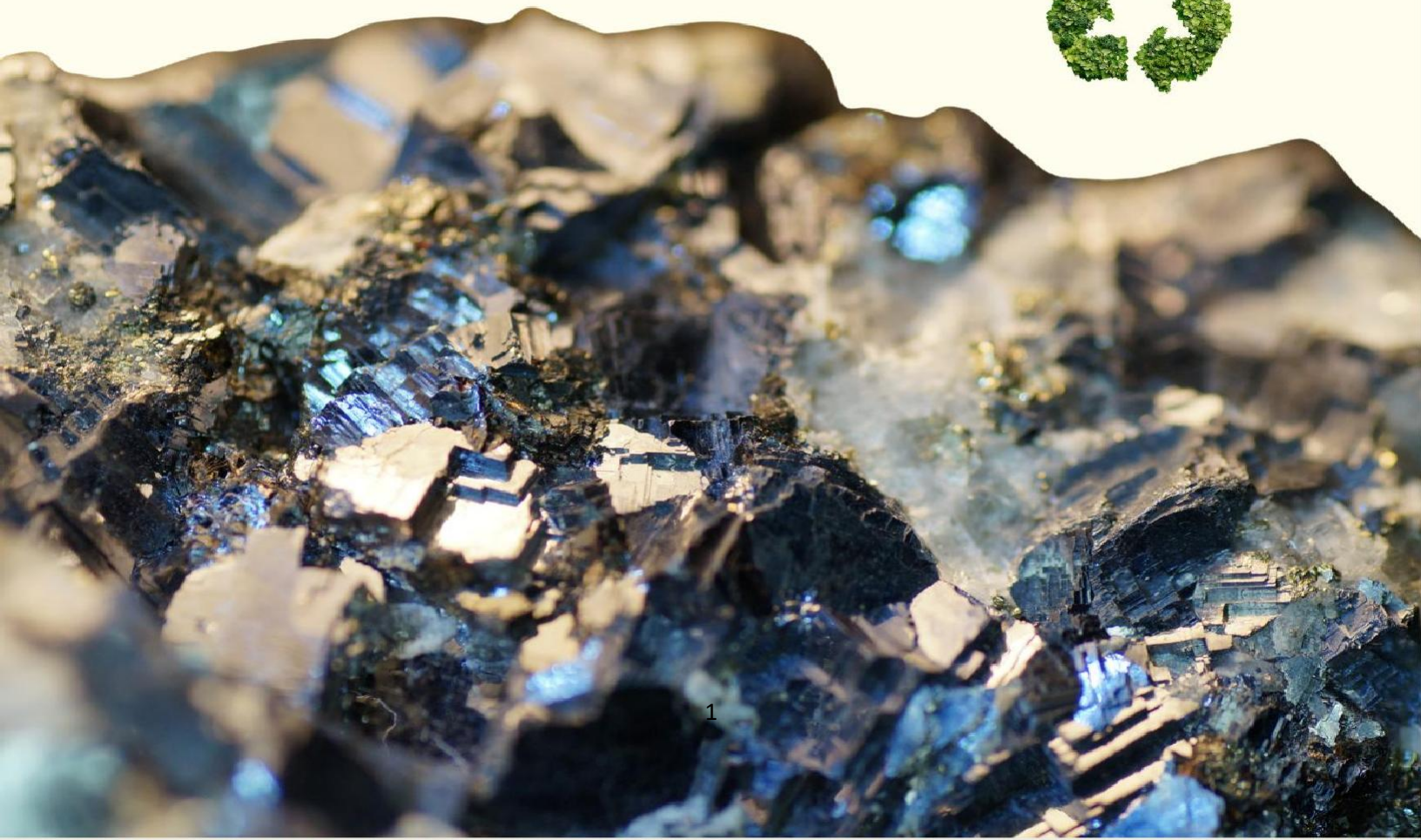
ASHOKA UNIVERSITY

CENTRE FOR A
People-centric Energy Transition

Critical Minerals and Circular Economy in the Indian Context: Policy Brief
ACPET Showcase Workshop Proceedings

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Authors

Dr.AnimeshGhosh,SeniorResearchFellow&Lead,CriticalMinerals&CircularEconomy,ACPET

Mr. Soumit Pandey, Junior Research Associate, ACPET

Ms. Upasna Ranjan, Co-Lead, Critical Minerals & Circular Economy, ACPET

About the Ashoka Centre for a People-centric Energy Transition (ACPET)

ACPET is a research-focused, transdisciplinary centre within Ashoka University, India, established to drive a sustainable, equitable, and "people-centric" shift towards net-zero emissions. It bridges the knowledge gap in energy transition by collaborating with industry and government to create scalable solutions, covering areas like renewable energy, policy, and technology. For further information about ACPET, please visit: acpet.ashoka.edu.in

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This study has been significantly informed by discussions and exchanges held through ACPET's flagship event, 'Translating Vision to Value: A People-Centric Energy Transition' (20 March 2026), which brought together diverse stakeholders: policymakers, industry representatives, researchers, and experts to reflect on building a secure, sustainable, and inclusive critical minerals ecosystem for India and the Global South. We sincerely thank all the participants whose insights on supply chain resilience, domestic processing, and circular economy strategies have helped shape the direction and substance of this work. These perspectives have been particularly important in situating the analysis within India's broader developmental priorities, including the Viksit Bharat 2047 vision and Net Zero Emissions (NZE) 2070 goals.

These engagements have added depth to the analysis and ensured that the findings remain closely aligned with emerging policy and investment priorities around sustainable and circular mineral value chains.

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CRITICAL MINERALS AND CIRCULAR ECONOMY IN THE INDIAN CONTEXT

Policy Brief | ACPET Showcase Workshop Proceedings
Synthesised from Participant Discussions | 2026





1. Background and Context

India is at a decisive moment. As the country accelerates its clean energy transition, critical minerals have moved from the periphery of industrial policy to the very centre of strategic debate. The National Critical Mineral Mission, launched on 29 January 2025 with an equity outlay of Rs. 16,300 crores, signals that the government recognises this shift. Six verticals anchor the mission: domestic production, overseas asset acquisition, trade and markets, recycling, technical upscaling, and human resource development. Yet, despite this institutional momentum, serious gaps remain in execution, coordination, and market development.

> *"It is not something that only the government has to do. We often call our mission a whole-of-government approach. We must work together in the field of critical minerals."*
>
> - ***Shri Anshoo Pandey, Director, Ministry of Mines, Govt. of India***



The energy transition is fundamentally material-intensive. Every solar panel, wind turbine, battery pack, electrolyser, and electric vehicle depends on a range of minerals whose supply chains are geographically concentrated and geopolitically sensitive. India, which is simultaneously pursuing energy security, climate commitments, manufacturing expansion, and economic growth, must treat mineral strategy as a decisive policy frontier.

> *"Critical minerals are omnipresent. I don't believe it is critical anymore; it has now become geopolitical minerals. The risk factors embedded in critical minerals include external shocks, natural disasters, export restrictions being put by States that possess these resources, resource nationalism, market manipulation, and political instability."*
>
> - ***Shri R. Saravanabhavan, Deputy Advisor (Industry & Foreign Investment), NITI Aayog***



2. The Problem: Where India Stands Today

2.1 Import Dependence and Demand Pressure

India imports 100 percent of its lithium, nickel, and cobalt requirements. Even for minerals where some domestic availability exists, such as manganese, import dependence remains close to 50 percent. The demand trajectory is steep: research presented at the workshop estimates that approximately 1,77,000 tonnes of lithium will be required by India alone by 2030, a figure that does not yet include solar energy storage systems and wind power, which will double in the time to come.

> *"NITI Aayog says we should have about 30 percent of vehicle conversion into EVs, and we need 10 gigawatts of energy, but no one has estimated how much lithium is required. We are totally dependent on China to have the cells from them, but if they cut, then from where do we get the lithium?"*
>
> - ***Shri Sandeep Hamilton, Founder & Chairman, Critical Minerals Association, India***



ACPET's own research, covering 39 clean energy technologies assessed on a technology readiness level basis, identifies copper, silicon, graphite, and nickel as the minerals of highest future demand. A criticality scoring exercise further identifies these minerals as ones where supply risks are most acute and where India needs to focus first.

2.2 The Processing and Refining Gap

The biggest lacuna in India's mineral strategy is not on the ground; it is in the processing and refining stage. Extracted ores must undergo sophisticated processing to become battery-grade materials, alloys, and advanced intermediates. India lacks this midstream capability at scale.

> *"Suppose you have the mineral. What is the next step? The next obvious step is to process. Unfortunately, I believe that is the biggest lacuna in our country. That is a challenge I must throw to all of you as think tanks and as industry. We must go ahead and do the processing of critical minerals in this country."*

- ***Shri Anshoo Pandey, Director, Ministry of Mines, Govt. of India***

India has upstream strengths through public institutions such as Indian Rare Earths Limited, which today remains the sole producer of rare earth oxides (REOs), with a current capacity of 400-500 tonnes. Yet for the Rare Earth Permanent Magnet scheme to produce 6,000 tonnes of sintered magnets, 2,000 tonnes of REO oxide are required. Where are the remaining 1,600 tonnes going to come from? This is a billion-dollar question that remains unanswered.

2.3 The Recycling Ecosystem: Enormous Potential, Deep Structural Flaws

Recycling can deliver critical mineral inputs within six months to a year, compared to 12-15 years to operationalise a mining lease. This makes circularity the most immediately actionable lever available to India. More than 6 million tonnes of e-waste enter the system annually. The amount of value locked in these resources today is estimated at Rs. 51,000 crores, a figure that will grow to Rs. 1,20,000 crores as the stream expands to EV batteries and telecom batteries.

"Today, if we were to focus similarly on circularity and recycling much more than we are at this point, I think it will change the destiny of how we look at critical minerals in the country very, very quickly. Recycling can come up with a product in six months to a year. Mining cannot."

- ***Dr. Abhinav Mathur, Head, Strategic Initiatives, Attero***



However, the ecosystem is broken at almost every level. More than 95 percent of e-waste collection happens through the informal sector. Of the 400 registered recyclers in the country, fewer than 10 are doing any real recycling. The rest are opening, dismantling, and issuing Extended Producer Responsibility (EPR) certificates without conducting scientific processing. This is a compliance mechanism masquerading as a national security initiative.

"The circular economy is not just a technical or economic challenge; it is deeply people-centred. Informal systems often embed complex social realities, including gender disparities and child labour, while also revealing sharp cost differences with formal systems. Any transition must therefore address not just efficiency, but equity."

- ***Shri Vaibhav Chowdhary, Director, Ashoka Centre for a People-centric Energy Transition (ACPET)***



"India is looking at e-waste recycling and the EPR system as a compliance mechanism, not as a national security initiator. Players who are 85 to 90 percent in the informal sector, we have to bring them into the legal framework so that a lot of things get streamlined."

- ***Dr. Abhinav Mathur, Head, Strategic Initiatives, Attero***

The human cost of informality is severe. Workers in informal dismantling are dying because of exposure to harmful chemicals, with lifespans of 29 years. Toxic residues from unscientific extraction of metals are being disposed in the ground and into rivers. India continues to put Rs. 30,000-40,000 crores into the Namami Gange Programme, but it will not succeed if we continue putting new toxic material there.

3. Key Debates from the Workshop Floor

3.1 On the Geopolitics of Minerals

Participants pushed back on the framing of critical minerals purely in geological or scarcity terms. The more important insight is strategic: mineral criticality is a function of where processing is concentrated, not just where the ore sits in the ground. In the critical metals sector, China already had 90 percent control by 2023 when India had only begun its journey. It is very difficult to outperform a country that has the advantage of decades of investment.

> *"In 1930, rubber was declared a critical mineral. Brazil had 99 percent supply because of the Amazon rainforest. A British explorer smuggled seeds out, took them to London, and ran plantations in South-East Asia. Japan started dictating terms, and the Great East Asia War happened. Think of the alternative. Think of our strengths. We have to fall upon our strengths, not upon our weaknesses."*
>
> - ***Shri R. Saravanabhavan, Deputy Advisor (Industry & Foreign Investment), NITI Aayog***

3.2 On Price Sensitivity and Strategic Procurement

India's market structure has emerged as a significant systemic problem. The country is deeply price-sensitive, and because of this tendency, it bypasses other important parameters, including geopolitics and supply chain resilience, treating price as the prime determinant. This has a direct consequence for the recycling sector. Domestically recycled materials cannot always compete in price with imports, so there is no demand for them even when the product is available.

> *"In case of recycling, a company raised the point that whatever is being recycled by them, because they are unable to offer it at a price in comparison to the imported price of that particular material, there is no demand. If we are not taking a regulatory call there, maybe after ten years we will face the same problem."*
>
> - ***Dr. Debajit Palit, Centre Head, Centre for Climate Change & Energy Transition, Chintan Research Foundation (CRF)***



3.3 On the Role of Policy versus Markets

A direct question arose at the workshop: should policy and regulation, command and control, solve the problem, or should it be market-driven? The answer was factoring in all these issues. The market was important, but initially, without an ecosystem, there must be policies and regulations to address the

problem. Policy must identify the problem and create a system by which the market can develop. Once the market develops, it can run on its own.

> *"Policy makers must take cognizance of the challenges we are facing, whether it is recycling or domestic exploration. We are in an emergency. We cannot wait for 15 years.*
>
> - ***Dr. Debajit Palit, Centre Head, Centre for Climate Change & Energy Transition, Chintan Research Foundation (CRF)***
>
> *"It is important to have a policy brief noting that the role the ministry could potentially play is to be the facilitator of markets that should evolve."*
>
> - ***Shri Vaibhav Chowdhary, Director, Ashoka Centre for a People-centric Energy Transition (ACPET)***

4. Recommendations from Workshop Participants

4.1 Fixing National Critical Mineral Mission Design

The Rs. 1,500 crore recycling incentive scheme was specifically critiqued on design grounds:

- **Restructure incentive caps.** Removal of Rs. 50 crore per player cap. Capping investment at this level will attract 20-30 fragmented players who will compete for the same e-waste material, driving up feedstock costs and destroying viability. This is to be compared with the US's approach, which identified 10-15 companies with real ability and gave them substantial backing to scale.
- **Focus on fewer, larger grants.** The Ministry of Heavy Industries made the right call by funding only five players in the Rare Earth Permanent Magnet scheme. The NCMM recycling scheme should adopt the same philosophy: identify players who have the technology, back them properly, ensure they scale, and achieve national-level impact.
- **Allocate funds for collection infrastructure.** Funds must be allocated not just for processing infrastructure but for setting up formal collection systems. Even a well-funded processor cannot operate without a guaranteed pipeline reaching the recycler.

4.2 Expanding and Enforcing the EPR Framework

The Extended Producer Responsibility mechanism is currently limited to four materials. This is insufficient given the full spectrum of critical minerals embedded in e-waste:

- **Expand EPR mandate.** Expand EPR to cover the full range of critical minerals recoverable from e-waste streams, not just gold, iron, copper, and aluminium.
- **Enforce a floor price for EPR compliance.** CPCB research showed a minimum of Rs. 22 per unit is required for genuine scientific recycling. The market is currently clearing at Rs. 6. Establishing and enforcing a floor price to eliminate fake recyclers who issue compliance certificates without processing, is required. Regulators in other sectors have the right to price; this should apply here as well.
- **Connect GST and EPR portals.** The GST portal should be linked with the EPR portal so that fraudulent certificate issuance by non-processors can be identified and stopped. This addresses material flow tracking and fake compliance simultaneously.

4.3 Formalising the Informal Recycling Sector

The informal sector is not a fringe player. It controls over 95 percent of e-waste collection and processes materials that are then exported rather than feeding downstream Indian industries. A simple, time-bound onboarding programme is required:

- **One-time registration for informal players.** A one-time registration pathway is to be created for informal players to enter the formal ecosystem on mission mode for one to two years. This should be a single-window process with minimal compliance burden at the point of entry.
- **Community equity participation.** Mechanisms are to be explored and developed that enable local communities to become equity investors or operational partners in mining and processing ventures rather than merely recipients of financial rehabilitation assistance. This addresses social license and community resistance simultaneously.

4.4 Addressing the Processing and Midstream Gap

Raw material access without processing capability does not provide supply security. India must build midstream infrastructure deliberately:

- **Build on recent customs duty relief.** The Budget for 2025-26 exempted basic customs duty on cobalt, lithium-ion battery scrap, and 12 critical minerals. The Budget for 2026-27 further exempted customs duty on capital goods required for critical mineral processing. For a Rs. 2,000 crore plant, this translates to roughly Rs. 200 crores in savings. These measures must be matched with active industry mobilisation.
- **Establish dedicated rare earth processing parks.** Set up dedicated rare earth metal parks. India has good deposits in the monazite sands of the coast and needs to capitalise on the REE corridor announced in the recent Budget. Ratnagiri district alone can cater to a significant portion of the country's rare earth demand. Maharashtra must be included in the rare earth corridor.
- **PLI scheme for intermediate product manufacturers.** Intermediate product manufacturers, those making cathodes, anodes, electrolytes, and separators, are the missing link between recyclers and battery manufacturers. A Production-Linked Incentive (PLI)-type scheme for this segment with documented domestic content requirements should be developed immediately. Without buyers for intermediate products, the entire recycling value chain has no anchor.

4.5 Accelerating Domestic Exploration and Mining Timelines

The average cycle time to operationalise a mining lease in India is 12 to 14 years. Turkey, the most efficient mining jurisdiction by international comparison, achieves this in 11.2 years. Chile, the Democratic Republic of Congo, and even landlocked Burkina Faso bring mines into production in under 14 years. If India can do it in five or six years, it will top the table.

- **Scale the Exploration License regime.** The Exploration License (EL) regime, under which a share of the auction premium is paid to the explorer who establishes confirmed reserves, is a genuinely good concept. Seven blocks have been auctioned under EL, including three for critical minerals. The second tranche of 11 blocks must be processed faster.
- **Look for tailings and abandoned mines first.** Old copper mines, mine tailings, and abandoned mines are immediate sources. New mine operationalisation takes over a decade; tailings can be assessed and processed within a medium-term planning horizon. This should be carried out in mission mode.
- **Transfer technical validation to domain experts.** Investment projects reviewed by Centres of Excellence (COEs) are being verified by bureaucrats. Geological and mining domain experts should lead technical validation. Financial support to COEs, which has not been released even after a year in some cases, must be disbursed without further delay.
- **Build investor trust through regulatory stability.** Companies such as Mitsui, with existing presence in Indian mining, have flagged the core trust problem: if you put in money for 10 years and then the timeline shifts to 12 or the regulatory context changes mid-project, how do you build the trust to invest? Stable, predictable, judicially robust regulatory frameworks must be designed from the outset rather than patched after litigation.

4.6 Finance, Offtake, and De-risking Investment

Banks finance profits, not mines. Without a guaranteed offtake, no commercial lender will fund critical mineral processing. Green hydrogen has already demonstrated this problem: capacity has been built, but offtake is not in place. The same trap awaits critical minerals:

- **Government buffer procurement mechanism.** The government should explore a revenue stabilisation fund or a buffer procurement mechanism to buy certain amounts of critical minerals directly from domestic producers and then supply them to end-use applications such as EVs and defense. This provides the offtake anchor that unlocks commercial financing.
- **Insurance guarantee instruments.** Insurance guarantee mechanisms like the World Bank's Multilateral Investment Guarantee Agency scheme should be explored for early-stage critical mineral investments. Instruments such as partial risk guarantees and payment guarantees have precedent in sectors such as infrastructure and energy to reduce investment risks.
- **Activate multilateral financing channels.** India needs to strengthen relationships with multilateral financiers such as the Asian Development Bank and International Finance Corporation. A significant amount of global capital is still flowing to China and other parts of the world because India has not positioned its programmes attractively for these institutions.

4.7 Data, Research, and Human Capital

Data played a crucial role in India's wind story. The government provided wind resource data that helped the sector grow exponentially in the 1990s and 2000s. The critical minerals sector is in the same situation today and needs the same enabling intervention:

- **Build a living, continuously updated demand database.** There is still no scientific assessment of the demand for critical minerals at the level of granularity that industry needs. The study recently released by ACPET and partner institutions is the first serious contribution in this regard. This work needs to be scaled, updated continuously, and made actionable for both government and private investors.
- **Adopt JORC reporting standards.** The world is adopting Joint Ore Reserves Committee (JORC) standards, a professional code of practice that puts in place minimum standards for public reporting of minerals exploration results, mineral resources and ore reserves. India's United Nations Framework Classification for Resources (UNFC) documents are not bankable. Adoption of JORC standards for mineral resource reporting is a prerequisite for accessing global capital markets and bringing in experienced international operators.
- **Build a critical mineral scientist community.** One reason that China went ahead of the US is the number of critical mineral scientists in China, which stands close to 7,500, as compared to only 30 in the US. India needs to build this community through its COE network on a hub-and-spoke model, where industry tells the research institutes what it needs, and research is translated into industry-relevant outcomes.

5. A Broader Framing: Mineral Security as Strategic Security

The greatest debate of our time is not about poles or non-poles. It is about electrons versus molecules. Whether India continues with molecules or shifts in a faster way to electrons will define the nature of its mineral requirements for the next three decades. If we believe that it is the electron pathway, then within the electrons, the role of critical minerals is even more central. If electricity is produced, it needs to be stored. For storing, one needs critical minerals. This means critical mineral supply chain security has become as important to national security as the oil supply chain once was.

> *"In the supply chain, what we have done is diversified sources but not systems thinking. We may have said I am not buying from Qatar, but ultimately, I am buying from areas which have choke points. In critical minerals, we also have to see that we do not have such choke points. Security and economics are now inseparable."*
>
> - ***Dr. Debajit Palit, Centre Head, Centre for Climate Change & Energy Transition, Chintan Research Foundation (CRF)***

Mineral strategy, if it is to be coherent, cannot remain confined to the Ministry of Mines. The National Critical Mineral Mission needs alignment across the Ministry of Finance, Ministry of Heavy Industries,

Ministry of Environment, Ministry of Electronics and Information Technology, Ministry of New and Renewable Energy, the Department of Atomic Energy, and the Prime Minister's Office. All the relevant ministries, whether responsible for gold, aluminium, or any other input mineral, need to sit together and make a comprehensive plan. This has become a strategic security matter. Any strategy must start from the top.

> *"Mineral security must be built in a way that is responsible, inclusive, and people-centric. We have perhaps missed the first bus, but it is not too late."*
>
> - ***Shri Animesh Ghosh, Senior Research Fellow, Ashoka Centre for a People-centric Energy Transition (ACPET)***



6. Summary of Priority Actions

Horizon	Action	Lead
Immediate	Restructure NCMM recycling caps; fund fewer, larger players	Ministry of Mines / PMO
Immediate	Enforce EPR floor price; connect GST and EPR portals	Ministry of Environment, CPCB
Immediate	Release COE funding; assign domain expert-led technical review	Ministry of Mines
Short-term	Formalise informal recyclers via one-time registration mission	MoEFCC / Ministry of MSME
Short-term	Develop PLI scheme for cathode, anode, and electrolyte manufacturers	Ministry of Heavy Industries
Short-term	Government buffer procurement mechanism for domestic critical minerals	Ministry of Mines / Ministry of Finance
Medium-term	Adopt JORC mineral reporting standards for bankable resource certification	GSI / Ministry of Mines
Medium-term	Mandatory rare earth mineral parks; include Maharashtra in RE corridor	Ministry of Mines
Long-term	Build India's critical mineral scientist community via COE network	Ministry of Education / DST
Long-term	Operationalise Kabil as a PPP model rather than a pure government entity	Ministry of Mines / KABIL



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Campus Location
Plot No. 2, Rajiv Gandhi Education City, National Capital Region P.O. Rai, Sonepat Haryana-131029

Delhi Office
Ashoka University Office, 222, Second floor, Okhla Industrial Estate, Phase III, New Delhi-110020