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EDITORIAL ANALYSIS

Not a Reserves Problem: India's Critical Minerals Midstream Gap

THE HINDU

4 August 2026

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Not a Reserves Problem: India's Critical Minerals Midstream Gap

 The Hindu

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GS3

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INTERVIEW ANGLE

"Refining is capital-intensive, environmentally burdensome and, at global prices set by an incumbent with two decades of scale advantage, frequently unprofitable. If private capital will not build refining capacity at market prices, what instrument would you use, and what would tell you it had gone wrong?"

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THE LIFT LINE

India has the cobalt. India has the graphite. What India does not have is the factory that stands between the rock and the battery, and that factory is the whole of the problem.

WHY THIS EDITORIAL MATTERS FOR YOUR EXAM

Critical minerals answers usually recite the National Critical Mineral Mission, name lithium and cobalt, and note Chinese dominance. This editorial supplies the segment analysis that turns those facts into a diagnosis: the concentration is in **refining**, not mining, and that single reframing changes which policies count as responsive. It also pairs directly with the C-DAC and GSI exploration partnership in today's news, which is an upstream measure and can be assessed against exactly this argument.

GS Paper 3: Infrastructure, energy and mineral resources; Indian economy and issues relating to mobilisation of resources; science and technology developments and their applications.

GS Paper 2: **Bilateral**, regional and global groupings and agreements involving India; effect of policies and politics of developed and developing countries on India's interests.

CONCEPT	MEANING	WHY IT IS TESTABLE
Critical mineral	A mineral whose supply is at risk of disruption and whose absence would materially affect economic or strategic sectors	The definitional basis of the entire policy category
Upstream, midstream, downstream	Exploration and mining; processing and refining; manufacturing and end use	The segment distinction on which the editorial's whole argument turns
Reserve-to-refining gap	Holding deposits while lacking the capacity to convert them into usable material	The editorial's organising phrase
Beneficiation	Concentrating a mineral by removing waste material after extraction	The step between mining and refining that India also lacks at scale
Secondary supply	Material recovered through recycling rather than newly mined	The only source over which no foreign supplier holds leverage

BACKGROUND AND CONTEXT

The author is **Vinayak Vipul** of EY-Parthenon India, writing in The Hindu on 4 August 2026.

Critical minerals span electric vehicles, renewable generation, semiconductors, defence systems and the hardware on which artificial intelligence runs. The category includes lithium, cobalt, nickel, graphite, copper and the rare earth elements. The strategic argument is that these have assumed for the energy transition the position oil held for the twentieth century, with one structural difference that the editorial makes central: oil's chokepoints were geological and geographical, while the critical-mineral **chokepoint** is **industrial**.

CONCENTRATION MEASURE	FIGURE
Average share of the top three refining nations across copper, lithium, nickel, cobalt, graphite and rare earths (IEA, <i>Global Critical Minerals Outlook 2025</i>)	86 per cent in 2024, up from about 82 per cent in 2020
Strategic minerals refined by China	19 of 20
China's average refining share across those minerals	Around 70 per cent
China's share for rare earths and graphite	Over 90 per cent
China's share for cobalt	Roughly three-quarters ; published estimates cluster between 70 and 79 per cent

The direction of travel is the point most commentary misses. Concentration rose over four years during which diversification was an explicit policy objective for several major economies.

THE CORE ARGUMENT / ISSUE

Why refining rather than mining is the chokepoint

Mining is geographically dispersed. Cobalt comes principally from the Democratic Republic of the Congo, lithium from Australia, Chile and Argentina, nickel from Indonesia. If control over supply required control over deposits, no single country could exercise it.

Refining is different. It is capital-intensive, technically demanding, environmentally burdensome and subject to strong economies of scale, which means it concentrates naturally and, once concentrated, resists entry. Rare earth separation in particular involves long solvent-extraction cascades that are difficult to operate at competitive yield without accumulated process knowledge.

The consequence is that a country need not own a mine to control what the mine produces. It needs only to be the place the ore must pass through. That is the structure of the chokepoint, and it explains why export controls on processed material are a usable instrument in a way controls on ore would not be.

The demand arithmetic

PROJECTION	FIGURE
Global copper supply shortfall by 2035	About 30 per cent
Lithium	A deficit of about 40 per cent by 2035 , on the same IEA projections
India's cumulative critical-mineral demand by 2070, net-zero pathway	169 million tonnes (NITI Aayog, <i>Critical Mineral Assessment: Demand and Supply</i> , July 2026)
Excess over the current-policy pathway	About 51 per cent
Timing of that demand	More than two-thirds materialises after 2050

The net-zero pathway requires materially more critical minerals than the current-policy pathway, which is a point worth stating explicitly in an answer: the [decarbonisation](#) commitment is itself a demand commitment, and a climate strategy without a minerals strategy is incomplete.

The timing finding matters as much as the total. If two-thirds of the requirement arrives after 2050, India has a long build-out window, which is an argument for constructing processing capacity deliberately rather than in an emergency. It is also an argument against complacency, because refining capacity takes the better part of a decade to plan, clear and commission.

The resources that are not the problem

MINERAL	FIGURE CITED	WHAT IT ACTUALLY IS
Graphite	211.6 million tonnes	Total resources as on 1 April 2020. Only about 9 million tonnes , roughly 4 per cent, are reserves ; the remaining 96 per cent sit in the remaining-resources category
Nickel	189 million tonnes	Total ore resources , largely Odisha, associated with Sukinda chromite overburden at very low grade; Indian nickel reserves are effectively nil
Cobalt	44.9 million tonnes	Total ore resources , Odisha-dominated, from the same Sukinda material
Copper	163.9 million tonnes	This one is reserves, of copper ore , being under 10 per cent of India's roughly 1,660 million tonnes of total copper resources

The vocabulary here is exam-critical and the popular commentary gets it wrong. Under UNFC and National Mineral Inventory reporting, a **resource** is the total identified quantity and a **reserve** is the economically extractable subset. Three of the four figures above are resources, not reserves, and every one of them is **ore tonnage**, not contained metal. Writing that India holds 211.6 million tonnes of graphite reserves overstates the position by roughly twenty-three times.

This does not weaken the editorial's argument. It sharpens it: a resource base that has not been converted into reserves is precisely what shallow exploration produces, and it means India's upstream problem is real even though its deposits are large.

India nonetheless imports these minerals in processed form. The gap between the two facts is created by three deficits: exploration that has been **shallow**, in the literal sense that most Indian exploration has not gone deep enough to establish resources at depth; **processing capacity** that barely exists at commercial scale; and **recycling infrastructure** that is fragmented and largely informal.

What existing policy does and does not touch

INSTRUMENT	SEGMENT ADDRESSED
National Critical Mineral Mission (launched January 2025; outlay Rs 34,300 crore over seven years): 1,200 exploration projects; production of 15 critical minerals by 2030-31; 50 overseas assets , 26 by public-sector undertakings and 24 by private entities	Predominantly upstream and overseas, but with midstream components : 4 mineral processing parks, 3 centres of excellence, a strategic stockpile of at least 5 critical minerals, and a recycling incentive targeting 400 kilotonnes
KABIL lithium acreage in Argentina: five brine blocks totalling 15,703 hectares in Catamarca , agreement with CAMYEN SE signed January 2024	Upstream, overseas
Rare-earth corridors for Odisha, Kerala, Andhra Pradesh and Tamil Nadu, Union Budget 2026-27	Explicitly covers mining, processing, research and manufacturing
Rare Earth Permanent Magnet scheme , approved November 2025, Rs 7,280 crore , targeting 6,000 tonnes a year of integrated sintered magnet capacity	Midstream and downstream
India-United States Framework on Securing of Supply in the Mining and Processing of Critical Minerals and Rare Earths , signed 26 May 2026	Diplomatic, but covers processing and recycling as well as mining
Commercial-scale refining capacity actually operating	This is where the gap remains

Be careful how this argument is stated, because the strong version is wrong. It is **not** true that policy ignores the midstream: processing parks, a stockpile, a recycling incentive and a magnet-manufacturing scheme all exist on paper. The defensible claim is about **scale and sequencing**, that the midstream components are small relative to the exploration and acquisition targets that dominate the same instruments, and that none has yet produced commercial refining capacity. An answer asserting that India has no midstream policy would be corrected by a well-briefed examiner.

Why the counter-argument deserves genuine weight

The midstream is not neglected through oversight. It is avoided because the economics are hostile.

A **greenfield** refinery requires large capital with a long payback. It carries environmental burdens, tailings, effluent, and in the case of rare earths radioactive thorium and uranium residues, that make siting a multi-year political contest. The radioactive-residue problem is specific to **monazite** feedstock, which is precisely India's principal rare-earth source through the beach-sand placers worked by IREL, and much less acute for bastnasite or ion-adsorption clay deposits. India therefore faces the harder version of the refining problem,

not the easier one. And it must compete against an incumbent with two decades of scale advantage, learning-curve gains and, where relevant, the ability to price strategically against new entrants. A firm evaluating the investment on commercial terms will frequently decline it, and be right to.

That is why exhortation will not work, and why the policy instruments that matter are the ones that change the economics rather than the ones that state the objective: **offtake guarantees, risk-sharing, strategic stockpiles that stabilise demand**, and clearance timelines that reduce the cost of delay.

HOW TO THINK ABOUT THIS (ANALYTICAL FRAME)

When a dependency is described in terms of a resource, ask which segment of the value chain the dependency actually sits in, because the answer determines what policy can fix it. A dependency at the extraction stage is addressed by exploration and acquisition; a dependency at the processing stage is addressed by industrial policy; a dependency at the technology stage is addressed by research. Policy systems reliably respond to the segment that is cheapest to act on rather than the one where the constraint sits, because upstream action is visible, announceable and quick. Apply this segment test to semiconductors, pharmaceutical intermediates, solar manufacturing and defence electronics, all of which show the same pattern: India holds positions at the ends of the chain and is thin in the middle.

THE DIAGRAM IN WORDS

Picture a river running from a mountain to a city. At the mountain there are quarries, in many countries, owned by many people, and India has quarries too. At the city there are factories that make batteries, magnets and chips, and India is building those. Between them the river passes through a single narrow gorge, and in that gorge stands a mill that grinds rock into usable powder. Almost every mill in the gorge belongs to one owner. India can open more quarries at the top, and does; India can build more factories at the bottom, and does. But every tonne still has to pass through the gorge, and the owner of the mill decides what passes. Widening the river at either end does not widen the gorge.

WAY FORWARD

- ❶ **Make refining bankable rather than merely desirable**, through offtake guarantees, risk-sharing with private capital and viability-gap support **calibrated** to the payback period rather than to the capital cost.
- ❷ **Create strategic stockpiles**, which serve two purposes at once: insurance against supply disruption, and a stable demand signal that de-risks the first domestic processing plants.
- ❸ **Accelerate regulatory and environmental clearance for midstream facilities**, while being honest that the environmental burden of refining is real and must be managed rather than waived.

- ④ **Fund research on separation and refining technology**, since the incumbent's advantage is substantially process knowledge, and process knowledge is the part that can be researched rather than bought.
- ⑤ **Diversify sourcing through trusted partnerships**, including the India-United States framework and engagement with resource-holding countries, while recognising that sourcing diversification does not by itself relieve a processing dependency.
- ⑥ **Set measurable recycling targets and formalise the sector**, since secondary supply could meet 20 to 25 per cent of India's copper and graphite demand by mid-century, on NITI Aayog's 2026 assessment, and is the one supply source no external actor can restrict.

PYQ LINKAGE AND PRACTICE

UPSC has tested mineral resources, [energy security](#), rare earths, electric-vehicle supply chains and India's resource diplomacy across recent GS3 cycles. The segment analysis in this editorial is the step that distinguishes an answer describing the dependency from one explaining it.

Practice question: "India's critical mineral [vulnerability](#) is not a shortage of deposits but an absence of the industrial capacity that stands between deposit and product." Examine this claim, and assess whether India's present policy instruments address the constraint they are intended to relieve. (250 words, 15 marks)

Interview angle: Refining is capital-intensive, environmentally burdensome and, at global prices set by an incumbent with two decades of scale advantage, frequently unprofitable. If private capital will not build refining capacity at market prices, what instrument would you use, and what would tell you it had gone wrong?

Sources: The Hindu, Ministry of Mines, International Energy Agency

Source: Not a Reserves Problem: India's Critical Minerals Midstream Gap — [Ujiyari.com](https://ujiyari.com) | Free UPSC & State PCS Editorial Analysis

● KEY ARGUMENTS AT A GLANCE

India's critical-mineral vulnerability is a reserve-to-refining gap rather than a reserves problem: the country holds substantial deposits of several critical minerals and remains import-dependent because exploration is shallow, midstream processing capacity is minimal and recycling infrastructure is undeveloped, so upstream exploration targets and overseas acquisition diplomacy, however welcome, address the wrong segment of the value chain.



SUPPORTING

- Refining is where the chokepoint sits and it is tightening rather than easing: the average market share of the top three refining nations across copper, lithium, nickel, cobalt, graphite and rare earths rose to 86 per cent in 2024 from about 82 per cent in 2020, on the International Energy Agency's Global Critical Minerals Outlook 2025, and China refines 19 of 20 strategic minerals at an average share near 70 per cent, rising above 90 per cent for rare earths and graphite and around 75 per cent for cobalt, which converts a commercial dependency into a geopolitical instrument.
- Demand is moving against India: a projected copper supply shortfall of about 30 per cent and a lithium deficit of about 40 per cent by 2035 meet an Indian cumulative critical-mineral requirement estimated at 169 million tonnes by 2070 under a net-zero pathway, some 51 per cent above the current-policy trajectory.
- The irony is that India is not resource-poor. The National Mineral Inventory records cobalt at about 44.9 million tonnes, copper at 163.9 million tonnes, graphite at 211.6 million tonnes and nickel at 189 million tonnes, but these are figures for **ore**, not contained metal, and for graphite, nickel and cobalt they are **resources** rather than reserves: Indian graphite reserves are around 9 million tonnes against 211.6 million tonnes of resources. The resource-to-reserve gap is itself evidence of the shallow exploration the argument identifies, and the gap between what lies underground and what reaches an Indian factory is created by the absence of intermediate industrial capacity rather than by geology.



COUNTER

The midstream is not neglected by oversight; it is avoided because it is genuinely unattractive. Refining is capital-intensive with long payback periods, environmentally burdensome in ways that make siting politically difficult, and competes against an incumbent with two decades of accumulated scale advantage that can price new entrants out of viability. Upstream exploration and overseas acquisition are pursued first because they are cheaper,

faster and politically easier, and a strategy that simply exhorts private capital into refining without addressing the economics will produce announcements rather than plants.

**WAY FORWARD**

Build domestic processing capacity with instruments matched to the economics, including risk-sharing with private capital, offtake guarantees and a strategic stockpile that stabilises demand; accelerate regulatory and environmental approvals for midstream facilities; raise research and development spending on separation and refining technology; diversify sourcing through trusted partnerships; and integrate recycling with measurable targets, since secondary supply could meet 20 to 25 per cent of India's copper and graphite demand by mid-century, on NITI Aayog's 2026 assessment.


MAINS ANSWER FRAMEWORK
QUESTION

Examine the proposition that India's critical mineral vulnerability arises from a deficit in processing capacity rather than in reserves, and assess whether current policy instruments address that constraint. (250 words)

INTRODUCTION

Critical minerals have become for the decarbonisation and digitalisation era what oil security was for the twentieth century, spanning electric vehicles, renewable generation, semiconductors, defence systems and the hardware substrate of artificial intelligence. India's vulnerability in this domain is widely described as a shortage of reserves.

It is more accurately a reserve-to-refining gap, and the distinction determines which policies can work.

BODY

Three findings frame the problem. First, concentration is increasing rather than diminishing: the top three refining nations held an average 86 per cent share across copper, lithium, nickel, cobalt, graphite and rare earths in 2024, against about 82 per cent in 2020, on IEA figures, and China alone refines 19 of 20 strategic minerals at an average share near 70 per cent, exceeding 90 per cent for rare earths and graphite.

Because refining rather than mining is the concentrated segment, control over supply does not require control over deposits, which is what converts a market position into a strategic instrument. Second, demand is tightening: a projected copper shortfall near 30 per cent and a lithium deficit near 40 per cent by 2035 coincide with an Indian cumulative requirement estimated at 169 million tonnes by 2070 on a net-zero pathway, about 51 per cent above the current-policy trajectory.

Third, and decisively, India is not resource-poor: National Mineral Inventory resources of cobalt, copper, graphite and nickel are substantial, though the distinction matters, since for graphite, nickel and cobalt these are resources rather than economically extractable reserves, and all are measured as ore rather than contained metal. Import dependence persists because exploration is shallow, processing capacity is minimal and recycling is undeveloped.

Policy has responded, through the National Critical Mineral Mission with its targets of 1,200 exploration projects, production of 15 critical minerals by 2030-31 and acquisition of 50 overseas assets, through KABIL's lithium acreage in Argentina, through rare-earth corridors proposed for Odisha, Kerala, Andhra Pradesh and Tamil Nadu, and through the India-United States critical minerals framework. The weight of these instruments sits upstream and in resource diplomacy.

Midstream provisions exist, in the processing parks and the strategic stockpile under the Mission, in the explicit processing mandate of the rare-earth corridors, and in the Rare Earth Permanent Magnet scheme, but they are small beside the exploration and acquisition targets alongside which they sit, and none has yet delivered commercial refining capacity.

CONCLUSION

The corrective is to treat the midstream as the object of policy rather than its assumed consequence: risk-sharing instruments and offtake guarantees that make refining bankable, a strategic stockpile that stabilises demand while capacity is built, faster environmental and regulatory clearance for processing facilities, sustained research on separation technology, and recycling targets that are measured, since secondary supply could meet 20 to 25 per cent of India's copper and graphite requirement by mid-century and is the one source over which no foreign supplier holds leverage.

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