

India and the Permanent-Magnet Chain.

Rare earths, industrial capability and the distance between resource and strategic power.

A bounded evidence object.

This dossier reconstructs the permanent-magnet chain from public records. It distinguishes documented fact, Foundation inference and unresolved question; it does not convert resource figures, scheme announcements or tenders into operating-capacity claims.

INSTITUTIONAL AUTHOR

Nataraja Labs Research Foundation

PUBLICATION STATE

Released public dossier

PROGRAMME

India’s Material Sovereignty

EVIDENCE CUT-OFF

31 August 2026

GEOGRAPHY

India within a concentrated global value chain

CITATION

Nataraja Labs Research Foundation (2026), India and the Permanent-Magnet Chain, Dossier 001, version 1.0.

F/01

DOCUMENTED

Resource does not equal magnet capability.

India has a substantial rare-earth resource base, but official records describe domestic permanent-magnet production as developing and the oxide-to-magnet midstream as incomplete.

F/02

DOCUMENTED

Import exposure is concentrated.

For the official customs categories reported by DGCI&S, China supplied between 84.8% and 90.4% of import quantity in 2024–25, depending on category.

F/03

STRONG INFERENCE

The decisive bottleneck is downstream of separation.

Strategic constraint sits in metallisation, alloy, repeatable sintered-magnet manufacture and application qualification—not simply in ore or oxide.

F/04

DOCUMENTED

A domestic technical base exists, but it is narrow.

IREL records separated compounds, selected rare-earth metals and commissioned samarium–cobalt magnet production for strategic applications.

F/05

DOCUMENTED

Policy has crossed into implementation design.

The 6,000 MTPA integrated scheme was followed by a 2026 global tender. Intended capacity is not represented as operating output.

F/06

STRONG INFERENCE

No single intervention creates sovereignty.

Resilience requires domestic integration, diversified external supply, qualification, coordinated demand, recovery, substitution and continuity arrangements.

A country may possess the mineral and still lack the machine.

The strategic object is not rare earth in the abstract. It is a qualified chain of transformation: extraction, separation, metal, alloy, powder, sintered magnet, finishing, validation, integration and recovery.



01	Resource	Monazite, hard rock, other feed
02	Extraction	Concentrate and mixed compounds
03	Separation	Individual high-purity oxides
04	Metallisation	Rare-earth metal
05	Alloy & powder	Controlled NdFeB feed
06	Sintered magnet	Pressed and heat-treated block
07	Finishing	Machined, coated, magnetised part
08	Qualification	Application-approved component
09	Recovery	Recovered material and continuity

A chain is only as strategic as its least substitutable threshold. Public visibility is presently strongest at resource, oxide and policy levels—and thinnest around operating metal, alloy, grade-specific magnet and qualification capacity.

PLATE I / BEFORE THE OXIDE

A resource enters the chain only through process and institution.

India's rare-earth resource is substantial, predominantly light rare earths and frequently associated with regulated monazite. Grade, mineralogy, co-products, radioactivity, environmental control and process economics determine what can move downstream.

UPSTREAM RESOURCE AND EXTRACTION

13.15 million tonnes

MONAZITE RESOURCE

Department of Atomic Energy estimate across coastal, teri/red-sand and inland-alluvial deposits.

7.23 million tonnes

CONTAINED REO EQUIVALENT

Contained in the monazite resource; not equivalent to recoverable NdPr or finished-magnet output.

1.29 million tonnes

IN-SITU REO IN HARD ROCK

Documented in Gujarat and Rajasthan; grade and process route remain consequential.

Developing

DOMESTIC MAGNET PRODUCTION

The official record distinguishes resource availability from downstream industrial maturity.

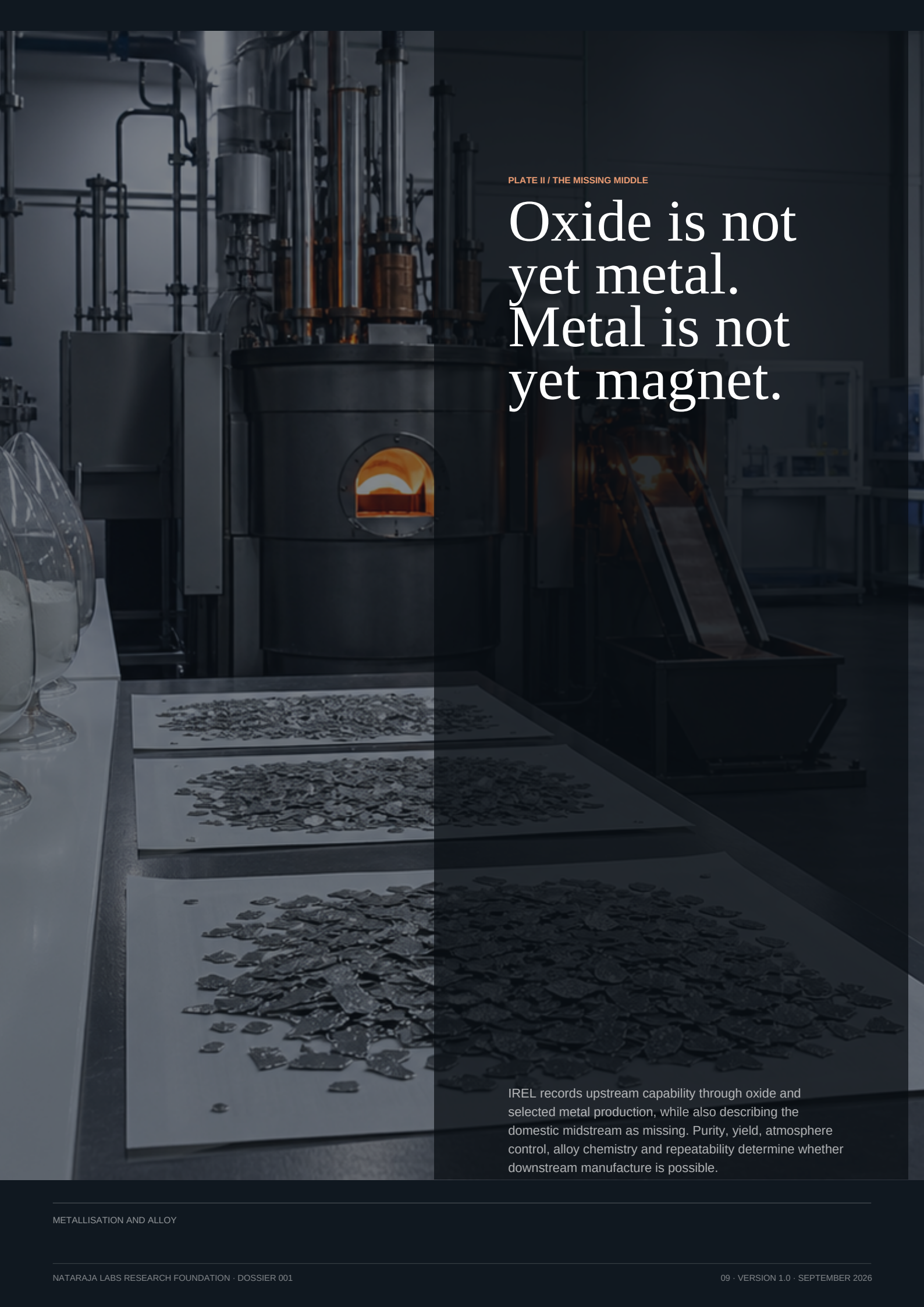


PLATE II / THE MISSING MIDDLE

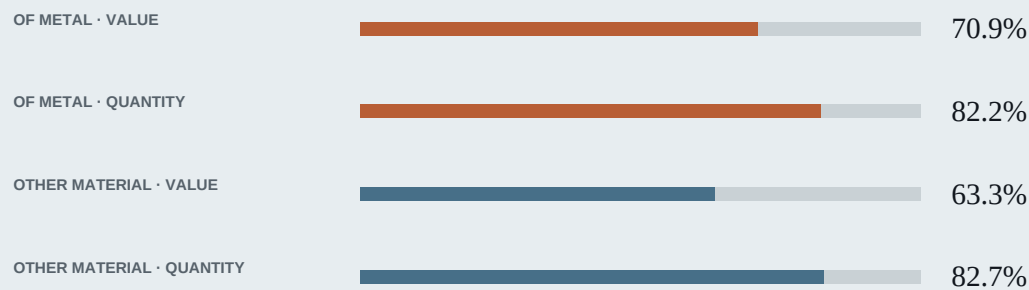
Oxide is not yet metal. Metal is not yet magnet.

IREL records upstream capability through oxide and selected metal production, while also describing the domestic midstream as missing. Purity, yield, atmosphere control, alloy chemistry and repeatability determine whether downstream manufacture is possible.

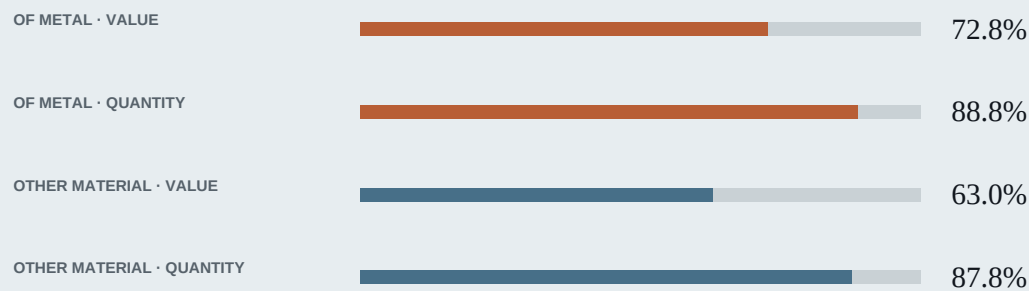
The import chain is concentrated.

DGCI&S categories are exposure indicators. They are broader than sintered NdFeB and do not isolate chemistry, grade, application or upstream origin.

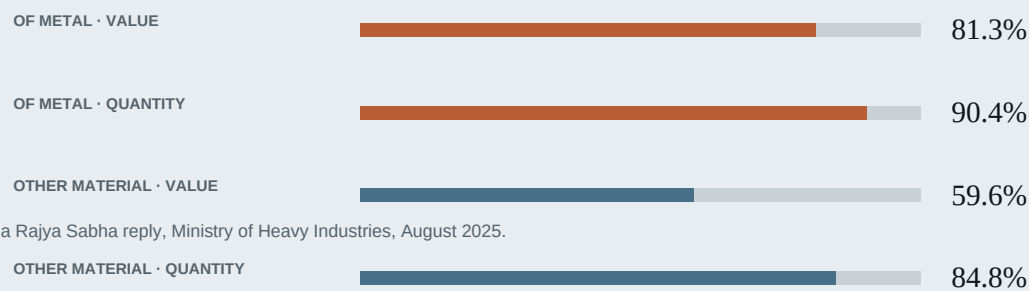
2022–23



2023–24



2024–25



Source: DGCI&S data reproduced in a Rajya Sabha reply, Ministry of Heavy Industries, August 2025.

60%

MINED MAGNET RARE EARTHS

91%

REFINED MAGNET RARE EARTHS

94%

The global chain becomes more concentrated as it approaches the finished magnet. Diversification therefore requires more than new mines: it requires separation, metallisation, alloy, magnet production, equipment, knowledge and demand.



PLATE III / PROCESS BECOMES PRODUCT

Capacity must survive the factory floor.

Jet milling, field alignment, pressing, sintering, heat treatment, machining, coating and magnetisation are process-sensitive. Strategic capability requires repeatable yield, grade range, traceability and commercial output—not only installed machinery.

C/01

Oxide-to-metal

Consistent NdPr metal at commercial purity, volume and cost.

C/02

Alloy and powder

Composition, casting, milling and atmosphere control at repeatable yield.

C/03

Sintered NdFeB

Commissioning, grade range, learning curve and stable output.

C/04

Qualification

Sector-specific validation, reliability and traceability infrastructure.

C/05

Anchor demand

Credible offtake through global price pressure and early yield learning.

C/06

Heavy rare earths

Access to Dy and Tb, or lower-intensity designs for high-temperature grades.

C/07

Recovery

Scrap access, disassembly, process economics and magnet-to-magnet scale.

C/08

Continuity

Stocks, alternate designs, qualified sources and allocation rules.



Policy sequence is not operating proof. The next evidence must concern financial closure, technology access, commissioning, yield, grade, qualification, demand and stable commercial production.



PLATE IV / THE QUALIFICATION GATE

A magnet
becomes
strategic when
a
consequential
system can
trust it.



Thermal performance, corrosion resistance, geometry, consistency, traceability and lifecycle behaviour differ by application. Qualification infrastructure and anchor users are therefore part of industrial capability.

A/01

Electric mobility

Traction motors combine power density, efficiency, thermal stress and severe cost pressure.

A/02

Wind generation

Permanent-magnet generators can reduce drivetrain complexity in selected turbine architectures.

A/03

Industrial motion

Motors, robotics and precision motion place magnets inside broad productive capability.

A/04

Electronics & data

Miniaturised drives, actuators and cooling systems create diffuse but strategic demand.

A/05

Strategic systems

Aerospace, defence and atomic-energy uses can place reliability and controlled supply above price.

S/01

Build integrated capability

Join oxide, metal, alloy, magnet, finishing and qualification.

S/02

Diversify external supply

Avoid suppliers that conceal the same upstream dependency.

S/03

Aggregate and qualify demand

Coordinate users, laboratories and procurement pathways.

S/04

Recover material

Begin with manufacturing scrap; build end-of-life systems in advance.

S/05

Engineer substitution

Reduce intensity where whole-system performance permits.

S/06

Design continuity

Combine stocks, alternates, contracts and allocation rules.

Stocks buy time; they do not repair a missing capability. New mines do not diversify a chain if separation, equipment, alloy and qualification remain concentrated elsewhere.

PLATE V / RECOVERING OPTIONALITY

Recovery must be designed before the material returns.

Manufacturing scrap is the near-term resource. End-of-life recovery depends on collection, product access, disassembly, demagnetisation, contamination control, process economics and traceability.

Q/01

What operating NdPr oxide, metal and alloy capacity is available to third-party Indian manufacturers at commercial terms?

Q/02

Which magnet grades and geometries are already producible in India, at what yield and with which application approvals?

Q/03

How much demand can credible Indian offtakers commit across automotive, wind, industrial, electronics and strategic uses?

Q/04

Which proposed plants have secured technology, equipment, talent, finance, raw material and qualification partners?

Q/05

What proportion of future demand requires Dy- or Tb-bearing high-temperature grades, and where can exposure be reduced?

Q/06

Which scrap and end-of-life streams can be captured earliest for magnet-to-magnet recovery?

These questions define the next evidence programme. They should be answered through plant-level records, field research, customs microdata, technical testing, buyer qualification pathways and verified company disclosures.

A chain reconstruction—not an industry census.

EVIDENCE	Official Indian records from DAE, IREL, the Ministry of Mines and the Ministry of Heavy Industries are prioritised. IEA, US DOE and USGS provide global and process context.
EXCLUSIONS	No confidential production data, plant visits, interviews, customs microdata, commercial pricing, audited capacities or independent material testing are represented.
CAPACITY	A scheme, tender or announced plant is treated as intended capacity until operating evidence establishes commissioning, yield, grade and stable production.
TRADE	Published customs categories are reproduced as exposure indicators and are not treated as chemistry-specific sintered NdFeB data.
INTERPRETATION	Where documented facts are joined into a strategic conclusion, the edition labels the result as a strong inference rather than an official finding.

R/01	Department of Atomic Energy · PIB	Rare Earth Reserves in the Country	2026
R/02	IREL (India) Limited	Annual Report 2024–25	2025
R/03	IREL (India) Limited	Compendium on Rare Earths and Heavy Minerals	2021
R/04	Ministry of Heavy Industries · PIB	Disruption in Supply of Rare Earth Magnets	2025
R/05	Ministry of Heavy Industries · PIB	Scheme to Promote Manufacturing of Sintered REPM	2025
R/06	Ministry of Heavy Industries · PIB	Global Tender for Integrated Sintered REPM Facilities	2026

Full source URLs and source notes are maintained in the web edition at natarajalabs.org/publications/india-and-the-permanent-magnet-chain.

R/07	Ministry of Mines	Critical Minerals for India	2023
R/08	Ministry of Mines	National Critical Mineral Mission	2025
R/09	Indian Bureau of Mines	Indian Minerals Yearbook 2023 — Rare Earths	2026 release
R/10	International Energy Agency	Rare Earth Elements: Pathways to Secure and Diversified Supply Chains	2026
R/11	United States Department of Energy	Rare Earth Permanent Magnets: Supply Chain Deep Dive Assessment	2022
R/12	U.S. Geological Survey	Mineral Commodity Summaries 2026 — Rare Earths	2026

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The chain should be seen before it is secured.

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CORRECTIONS AND SUBSTANTIVE EVIDENCE

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