India

Money, Military & Markets-XIX

Battle for rare earth minerals

- With a 70% global share in the supply of rare earth minerals, China has the capacity to arm twist the rest of the world, and it is doing the same.
- Rare earth is most important for defence equipment & EVs where high strength permanent magnets are needed. Expect a production delay in these industries.
- India has started its self-reliance mission (it has 6.9% of the global reserves), with industry incentive plans. Mining companies can be the beneficiaries.

Rare earth elements are the 'vitamins of technology'

Rare earth elements are required in small quantities, but they are indispensable to a wide range of high-tech applications—from iPhones and wind farms to fighter jets and missiles. In electric vehicles (EVs), advanced missiles, and next-generation fighter aircraft, the most critical requirement is high-strength, shock-resistant magnets that can retain their magnetic properties at elevated temperatures—often up to 300°C. Among available materials, only neodymium-based magnets meet these demanding criteria. While ferrite magnets are sufficient for auxiliary functions in internal combustion engine (ICE) vehicles, EVs cannot operate effectively without neodymium magnets. Beyond magnets, rare earth elements are vital for stealth coatings on fighter aircraft, radar systems, nuclear reactors, drones, wind turbines, smartphones, and almost every major category of advanced electronics. It is no exaggeration to say that control over rare earth element supply chains equates to control over the global high-tech industrial and defence equipment output. In this context, China's dominance in rare earth mining and processing poses a strategic risk to the industrial and national security interests of many countries.

China controls rare earths & uses them to pressurize other nations

China is leveraging its dominance in rare earth elements (REEs) and related magnet production for strategic advantage. As of early Apr 2025, China imposed export licensing on seven rare-earth elements and finished magnets—like NdFeB—and launched a tracking system requiring detailed data on customers and trade volumes. Customs agents are now scrupulously inspecting shipments labelled with any 'magnet' keyword—even if they're not controlled—delaying exports by one-to-two months. Western manufacturers, especially automobile makers and electronics industries, are scrambling to secure supply. Companies outside China, like Neo Performance Materials, are commanding a premium of US$10–30/kg—up to 30% above Chinese prices. China's magnet exports plunged by roughly 75% after Apr 2025, causing hiccups in production—including some of Ford's car assembly lines—though some have slowly resumed with slow permit approvals (e.g., 5/180 US magnet licence requests granted). India relies on China for over 80% of its rare-earth magnet imports. Under current export policies, shipments to Indian companies have stalled: ~30 Indian companies—including Mahle, Bosch India, TVS Motor Company—are awaiting licence approvals, but none received as of Jun 2025.

India holds 6.9% of global reserves and is ramping up production…

India has initiated various schemes to ramp up production. Some of the schemes are: 1) National Critical Minerals Mission (NCMM)- Launched: Jan 2025, Budget: Rs163bn (~US$2 bn). 2) Rs50bn Rare Earth Mineral Development Scheme (proposed) - to incentivize private and public sector investment in the mining and processing of rare earth elements or REEs. 3) Production-linked incentive (PLI) scheme for magnet manufacturing. 4) Exploration Licence Auctions - First auctions started in 2025 for 13 blocks, including rare earth-rich areas. Opened for private players and foreign investors under updated mining laws. 5) Minerals Recycling Incentive Scheme. 6) Indian Rare Earths' expansion - India's only state-run REE mine has recently set up a rare earth permanent magnet plant in Visakhapatnam.

…but near-term supply chain delay will impact production

India's long-term plans are good; however, it doesn't address the near-term challenges. In the near term, we expect defence equipment companies as well as industry to feel the supply chain bottleneck pinch and delay in product rollouts.

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Battle for rare earth minerals

Rare earths are the 'vitamins of technology' — needed in small amounts but vital for everything from iPhones to fighter jets to wind farms. As global demand soars, they've become one of the most strategically contested resources on earth. China is strategically controlling rare earth exports to maintain its global dominance, safeguard national security, and strengthen its high-tech industries. By restricting exports, it gains geopolitical leverage, compels foreign companies to shift manufacturing operations to China, and conserves its own environment and critical resources. This approach also serves as a countermeasure to Western initiatives aimed at diversifying supply chains and reducing the dependency on China. China's dominance in the rare earth market poses a significant risk to India's industrial and defence sectors, particularly in areas such as electronics, renewable energy, and advanced military systems. The threat of supply disruption is pushing India to accelerate domestic rare earth production, forge international partnerships, and enhance self-reliance through initiatives like 'Make in India' and 'Atmanirbhar Bharat.' India possesses substantial rare earth reserves, often found alongside other mineral ores such as iron ore. For example, states like Goa have potential deposits, but outdated or restrictive mining laws prevent the extraction of rare earth elements when the primary lease is for iron ore. Addressing such legal and regulatory bottlenecks is crucial if India aims to build a secure and sustainable rare earth supply chain.

China controls the global rare earth supply chain

Rare earths are indispensable for modern economies, driving innovation, manufacturing, clean energy, and national defence. Any disruption in their supply can affect economic growth, technological progress, and strategic security.

Figure 1: Rare earth metals are used across a wide range of industries and form the backbone of modern industrial economies

Sector	Use of Rare Earths
Energy	Wind turbines, EV motors, and batteries.
Electronics	Smartphones, flat screens, and audio systems.
Defence	Drones, stealth tech, missiles, and lasers.
Healthcare	MRI scanners, cancer treatment, and imaging devices.
Telecom	Fibre optics, satellites, and communication networks.

SOURCE: INCRED RESEARCH, COMPANY REPORTS

Rare earth elements (REEs) are a group of 17 chemically similar elements divided into two main types - light and heavy rare earth minerals

1. Light rare earth elements (LREEs) - These are more common and usually found together in minerals like bastnäsite and monazite.

Figure 2: Light rare earth minerals are the most common

Element	Symbol	Key Uses
Lanthanum	La	Camera lenses, batteries.
Cerium	Ce	Catalytic converters, glass polishing.
Praseodymium	Pr	Magnets, aircraft engines.
Neodymium	Nd	High-strength magnets (used in EVs, wind turbines).
Promethium *(radioactive, rare)*	Pm	Nuclear batteries.
Samarium	Sm	Magnets, nuclear reactors.

SOURCE: INCRED RESEARCH, COMPANY REPORTS

2. Heavy rare earth elements (HREEs) - These are less abundant and more difficult to extract, often found in xenotime and ion-adsorption clays.

Figure 3: These elements are less common but not totally scarce

Element	Symbol	Key Uses
Europium	Eu	Fluorescent lighting, TV screens.
Gadolinium	Gd	MRI contrast agents, nuclear control rods.
Terbium	Tb	Green phosphors, fuel cells.
Dysprosium	Dy	Heat-resistant magnets, electric vehicles.
Holmium	Ho	Lasers, nuclear reactors.
Erbium	Er	Fibre optics, lasers.
Thulium	Tm	Portable X-ray devices.
Ytterbium	Yb	Stress gauges, electronics.
Lutetium	Lu	PET scans, cancer treatment.

SOURCE: INCRED RESEARCH, COMPANY REPORTS

3. Scandium and Yttrium - Though not traditional rare earth minerals, these two elements are included in the rare earth group due to their similar properties and co-occurrence.

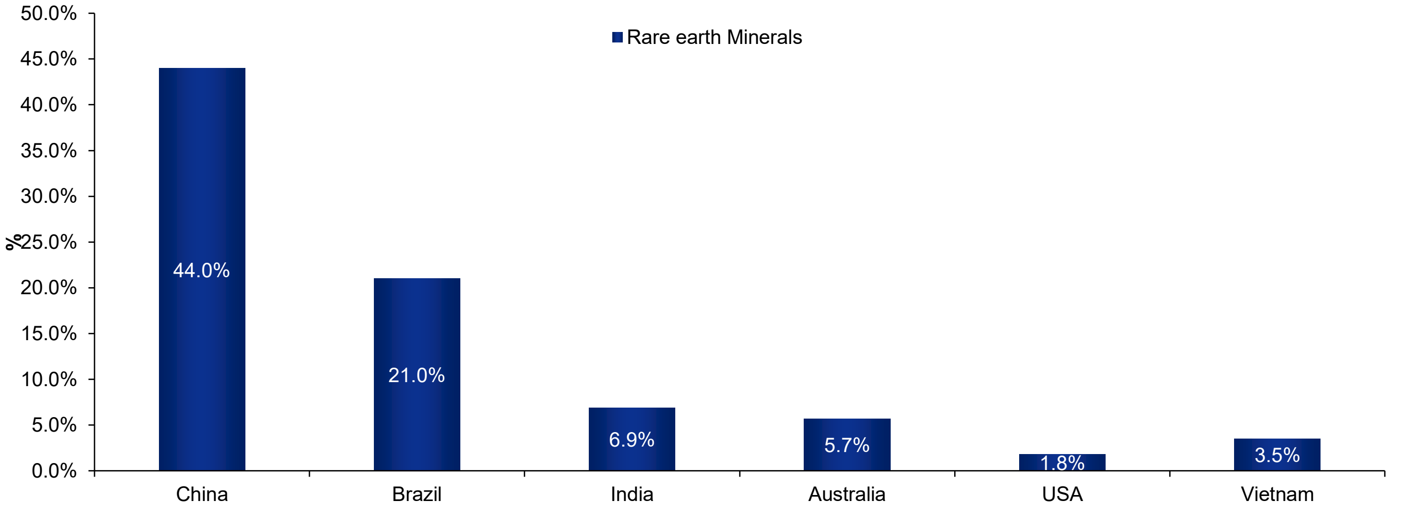
Figure 4: Scandium and yttrium doesn't belong to the traditional rare earth group but because of similar properties they are clubbed with the rare earth group

Element	Symbol	Key Uses
Scandium	Sc	Alloys for aerospace, fuel cells.
Yttrium	Y	Superconductors, LEDs, and ceramics.

SOURCE: COMPANY REPORTS, INCRED RESEARCH

China has the largest rare earth reserves followed by Brazil, while India is at the third place with 6.9% of the global reserves

Figure 5: China has the largest rare-earth reserves



SOURCES: INCRED RESEARCH, COMPANY REPORTS

While several countries hold significant rare earth reserves, China dominates global supply—accounting for approximately 70% of the total production

Figure 6: China is the largest producer of rare earth Minerals

Rank	Country	Production (2024, kt)	Notes
1	China	240	~70% of global output,
2	United States	45	Primarily from California's Mountain Pass mine.
3	Myanmar	38	Supplies ~70% of China's medium-to-heavy REE feedstock.
4	Australia	20	Home to Lynas Mount Weld; production ~13 kt.
5	Nigeria	13	Up ~80% in 2024; new partnerships with France.
6	Thailand	8.0	+261% growth; key supplier to China and EV plants.
7	India	2.9	Negligible global share (<1%); unchanged from prior years.
8	Russia	2.6	Stable output; plans to increase substantially by 2030F.
9	Madagascar	2.0	Infrastructure yet to be scaled.
10	Vietnam	0.3	Down from 1.2 kt in 2022; potential to scale exports by 2030F.

SOURCE: INCRED RESEARCH, COMPANY REPORTS

Even more importantly, China controls most of the global production of key rare earth elements used in magnet manufacturing

The most highly used rare earth minerals are those used in permanent magnets, electronics, and green technologies. Among the 17 rare earth elements, the following are the most in-demand:

Figure 7: China overwhelmingly dominates global production of rare-earth-based permanent magnets—especially neodymium–iron–boron (NdFeB)

Element	Major Uses
Neodymium	High-strength magnets for EV motors, wind turbines, headphones, hard drives.
Praseodymium	Used with neodymium in magnets; also in aerospace alloys, camera lenses.
Dysprosium	Added to magnets to improve heat resistance; critical for EVs, military tech.
Terbium	Also used in magnets and green phosphors for lighting and displays.
Lanthanum	Used in camera lenses, nickel-metal hydride batteries, and refining catalysts.

SOURCE: INCRED RESEARCH, COMPANY REPORTS

1. **China** - It provides about 90% of global rare-earth permanent magnet output, including sintered NdFeB magnets. Also accounts for ~90% of refined rare earth oxides needed for these magnets.
2. **Japan & Germany (Western Europe) -** Share the remaining ~10%. Japan leads advanced magnet technology (e.g., Progeria/Hitachi, TDK), especially precision and high-coercivity grades, while Germany/Europe focus on specialized applications like aerospace and wind turbines, often using recycled or green-sourced materials.
3. **USA, Estonia, Vietnam** - New producers contributing a small but growing portion. For instance, Neo Performance in Estonia is supplying non-China magnets, though still emerging.

All major industrial nations remain heavily dependent on China for their magnet requirements, particularly those involving rare earth permanent magnets

United States

1. ~95% of rare earth magnet imports come either directly from China or from countries that source materials from China.
2. The US lacks large-scale domestic magnet-making capacity.
3. Critical sectors like F-35 jets, EVs, and missile systems rely on China-sourced magnets.

European Union

1. Over 90% of rare earth magnets used in the EU are China-made or dependent on Chinese supply chains.
2. The EU imports most REE oxides and does not have large-scale domestic magnet producers.
3. Germany, a major automobile exporter, is heavily dependent on NdFeB magnets for EV motors and wind turbines.

Japan

1. Once highly dependent, Japan has reduced direct reliance through:
   a) Stockpiling and diversification deals (e.g. with Lynas, Australia);
   b) Advanced recycling and magnet technology leadership.
2. Still, raw materials for many Japanese magnets are imported from Chinese refiners.

South Korea

1. High dependency on Chinese rare earths for electronics and battery industries.
2. Developing alternate supply lines but still imports a major portion of refined REEs and magnets from China.

India

1. Imports nearly all high-grade magnets and magnet materials from China.

2. Lacks industrial-scale rare earth magnet manufacturing.
3. Dependent in defence, electronics, wind, and automotive applications.

Figure 8: India and the US are nearly 100% dependent on China for their rare earth magnet supplies

MAJOR ECONOMIES' DEPENDENCY ON CHINESE RARE EARTH MAGNETS

United States	90–95%
European Union	90%
Japan	60–70% (reduced)
South Korea	80%
India	100%

SOURCE: INCRED RESEARCH, COMPANY REPORTS

China is strategically leveraging global dependence on its rare earth supply chains, especially magnets

China is leveraging its dominance in rare earth elements (REEs) and related magnet production for strategic advantage. This dominance, particularly in refining and manufacturing, gives China a significant influence over global supply chains for various industries, including defence, renewable energy, and consumer electronics. There was recent news flow of China arm-twisting its consumers for the supply of rare earth magnets.

1. As of early Apr 2025, China imposed export licencing on seven rare-earth elements and finished magnets—like NdFeB—and launched a tracking system requiring detailed data on customers and trade volumes.
2. Customs agents are now scrupulously inspecting shipments labelled with any 'magnet' keywords—even if they're not controlled—delaying exports by one-to-two months.
3. Western manufacturers, especially automakers and electronics industries, are scrambling to secure supply. Companies outside China, like Neo Performance Materials, are commanding a premiums of US$10–30/kg—up to 30% above Chinese prices.
4. China's magnet exports plunged by roughly 75% after Apr 2025, causing hiccups in production—including some Ford's car assembly lines—though some have slowly resumed with slow permit approvals (e.g., 5/180 US magnet licence requests granted).
5. India relies on China for over 80% of its rare-earth magnet imports. Under current export policies, shipments to Indian companies have stalled: ~30 Indian companies—including Mahle, Bosch India, TVS Motor Company—are awaiting licence approvals, but none received as of Jun 2025.

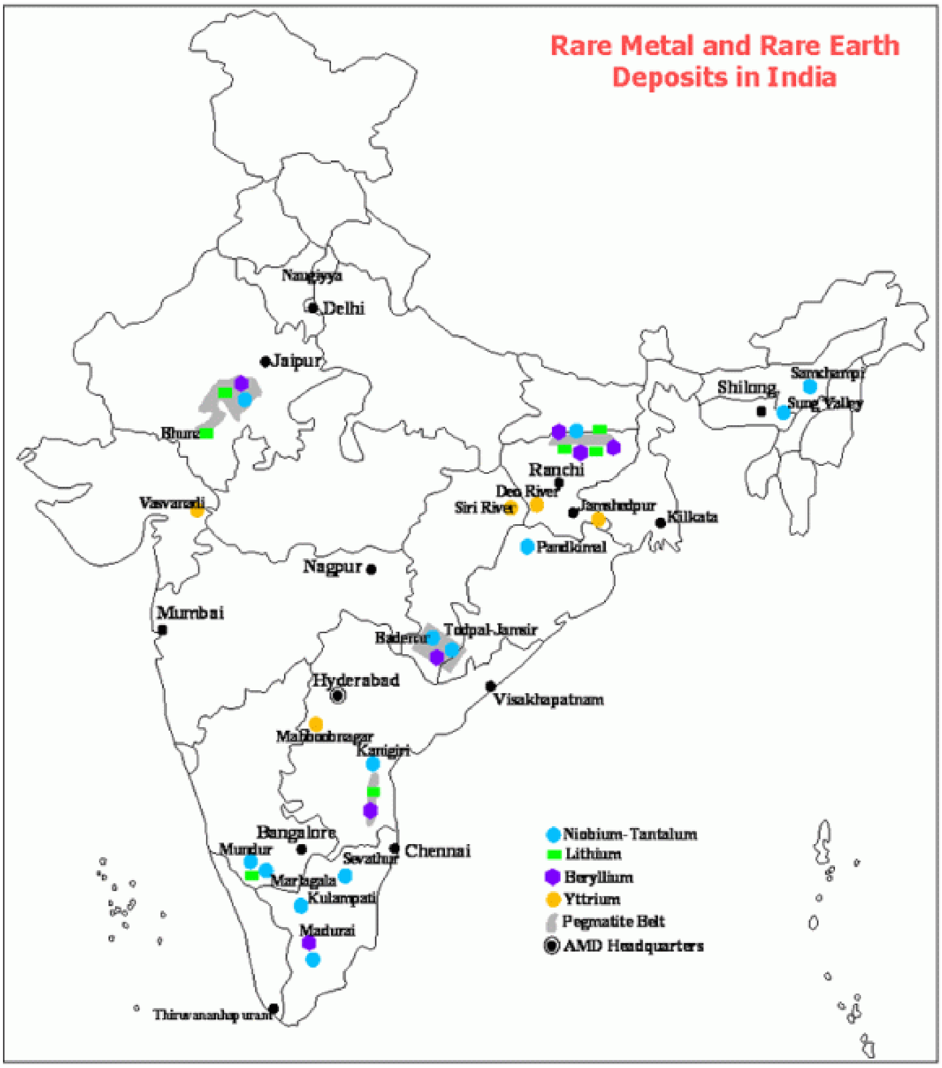
6. Rating agency ICRA warns that India's EV and two-wheeler production lines may exhaust inventories by mid-Jul 2025F, risking delayed launches and disrupted assembly.

India is intensifying its efforts to become self-reliant in rare earth mining

India is taking a multi-pronged, well-funded, and coordinated approach—with exploration, regulation, state capacity, private participation, recycling, diplomacy—and while the progress is rapid, building a full domestic rare-earth supply chain remains a multi-year journey. Long-term self-reliance is now a national mission.

India has 6.9% of the global rare earth mineral reserves ➤

Figure 9: India has multiple niobium and tantalum reserves and hence, there is a huge opportunity for mining companies



SOURCE: INCRED RESEARCH, COMPANY REPORTS

Indian government has started multiple schemes for the mining of rare earth elements ➤

1. **National Critical Minerals Mission (NCMM)**- Launched: Jan 2025, Budget: Rs163bn (~US$2bn). It will provide end-to-end support for critical minerals (exploration to manufacturing) including rare earths, lithium, cobalt, etc. The support will include mining, refining, recycling, stockpiling, and R&D.
2. **Rs50bn Rare Earth Mineral Development Scheme** *(proposed)* - To incentivize private and public sector investment in the mining and processing

of REEs. The focus is on capacity building, mining infrastructure, and downstream processing.

3. **Production-linked incentive (PLI) scheme for magnet manufacturing** - Rare earths like neodymium and praseodymium are vital for permanent magnets. The scheme encourages domestic manufacturing of rare earth magnets for EVs, wind turbines, and defence use.
4. **Exploration licence auctions** - First auctions started in 2025 for 13 blocks, including rare earth-rich areas. Opened for private players and foreign investors under updated mining laws.
5. **Minerals Recycling Incentive Scheme** - Proposed a Rs15bn fund for recycling rare earths from e-waste, magnets, and batteries. Encourages urban mining and circular economy principles.
6. **Geological Survey of India (GSI) mapping projects** - Hundreds of reconnaissance surveys to map REE-rich areas in Andhra Pradesh, Odisha, Gujarat, Tamil Nadu, North-East India (Arunachal, Assam, and Meghalaya).
7. **IREL's expansion** - India's only state-run REE miner is scaling up rare earth oxide production. Recently, it has set up a rare earth permanent magnet plant in Visakhapatnam.

While the automobile industry may experience limited disruption from magnet shortage, the defence sector is expected to be more severely affected

The immediate shortage of niobium-based magnets calls for a structured response balancing critical needs and supply constraints. Priority should be given to essential sectors such as defence, aerospace, and the automotive industry, while restricting usage in non-critical applications. Emergency imports must be arranged from non-Chinese sources, especially Brazil, which dominates global niobium production. Simultaneously, domestic exploration and production efforts within India should be accelerated.

In less-demanding applications, substitutes such as ferrite or samarium-cobalt (SmCo) magnets may be considered, despite their performance limitations. Additionally, magnet recycling from e-waste—particularly from hard drives, wind turbines, and old electric vehicles—can help alleviate short-term supply issues. While ferrite magnets may serve many components in internal combustion engine vehicles, they are not suitable for electric vehicles, missiles, or aircraft due to their lower magnetic strength, thermal instability, and bulkier design requirements. Ensuring long-term magnet security will also require policy incentives, joint ventures, and robust domestic manufacturing ecosystems.

The fractured global political and strategic landscape is driving increased demand for rare earth minerals in defence industries, while China is leveraging its control over these elements to exert geopolitical pressure on other nations ›

China, as the dominant global producer of rare earth elements, is increasingly using its control over these critical materials as a strategic bargaining tool in its international dealings. In a geopolitical landscape where conflict is becoming the new normal, China's ability to restrict the supply of rare earths gives it substantial leverage over nations, particularly the US and other countries with advanced defence industries. This leverage is especially potent in today's multipolar world, where several regional powers—such as India, Russia, and Israel—have moved away from the traditional rhetoric of moral high ground and are, instead, pushing the boundaries of military engagement. The US, for its part, has historically relied on military power as a first response, further increasing its dependency on the uninterrupted supply of advanced materials like rare earths. The rise of localized defence manufacturing ecosystems across these powers has only deepened the global reliance on critical inputs. Rare earth elements are not only essential for renewable energy technologies but also form the backbone of modern military systems—from precision-guided missiles to advanced radar systems. By controlling access to these vital materials, China is positioning itself to influence or constrain the strategic capabilities of other global and regional powers, thereby reinforcing its geopolitical clout in an increasingly fragmented world order.

By controlling the supply of rare earth elements, China can influence—and potentially cripple—multiple global defence industries ›

Rare earth elements (REEs) are a group of 17 metals essential for manufacturing advanced technologies. They are crucial in defence applications such as jet engines, missile guidance systems, radar and sonar systems, satellites, and electromagnetic weapons.

China currently dominates the global rare earth supply chain, controlling more than 70% of global production and even more in processing. So, if China restricts exports or increases prices, it can create a severe shortage worldwide.

China can leverage its supply dominance to exert pressure on other countries diplomatically or economically, like delaying shipments to punish a country. It can use REE exports as a bargaining chip in trade or political negotiations.

In extreme cases, if China halts exports altogether, countries heavily dependent on rare earth imports could face halted defence equipment production, grounded aircraft, or delayed weapons systems. Since developing alternatives takes time, such a disruption can cause significant operational and strategic setbacks.

Countries like the US, Japan, South Korea, and European nations rely on rare earth imports for their defence systems. Most do not have sufficient domestic mining or refining capacity. Thus, the entire defence manufacturing chain — from semiconductors to stealth technology — could be disrupted.

Even EV manufacturing and supply chains could be severely disrupted if China imposes restrictions on rare earth element exports ➤

Electric vehicle (EV) manufacturing is highly dependent on rare earth elements (REEs)—especially for electric motors and batteries that power these vehicles. If China were to restrict the export or supply of rare earths, it would severely disrupt the global EV supply chain.

Neodymium (Nd), praseodymium (Pr), dysprosium (Dy), and terbium (Tb) are used in permanent magnets for EV motors (especially in high-performance types like NdFeB magnets). These magnets are essential for lightweight, efficient, high-torque motors. Some lithium-ion battery chemistries also depend on rare elements like lanthanum. China controls over 70% of rare earth mining and around 85-90% of processing capacity. It has also invested deeply in the rare-earth-based EV supply chain, including magnet and motor production.

Consequences of supply disruption: EV manufacturing slowdown or halt due to material shortages. Price spikes in magnets and motors, making EVs more expensive. Global automakers (like Tesla, BYD, Toyota, Volkswagen or VW) may face delays in production and miss climate or sales targets. Supply chain instability could delay the global shift to clean energy vehicles.

How to address the shortage of neodymium-based magnets on an immediate basis? ➤

Addressing the **shortage of niobium-based magnets** on an *immediate basis* requires both tactical and strategic steps.

1. **Prioritize allocation to critical sectors**- Automotive, defence, and aerospace sectors should get priority.
2. **Divert non-essential industrial usage** (e.g., hobby electronics, consumer gadgets) to conserve supply.
3. **Import from alternate suppliers** (Non-China) - Brazil is the largest niobium producer (over 85% global share, mostly from CBMM). Secure emergency import contracts directly with CBMM or NioCorp (US). Other minor producers: Canada (Niobec), Australia (emerging projects).
4. **Use NdFeB substitutes (if technically viable) -** Switch to ferrite or samarium-cobalt (SmCo) magnets in non-critical areas. SmCo: High temperature stability but costly. Ferrites: Cheaper, less efficient — but available and workable in fans, motors, etc.
5. **Retool low-power applications to accept performance trade-offs and use magnet recycling -** Set up temporary collection centres to retrieve magnets from e-waste. Focus: Hard drives, speakers, wind turbines, old EVs. Partner with companies like Hitachi Metals, RECLAIM, or Indian Rare Earths (IREL) for processing.
6. **Medium-term steps (6–24 months)** — to prevent recurrence
    - Set up joint ventures with CBMM (Brazil) for stable supply.
    - Accelerate India's own niobium exploration projects (Aravalli range, Karnataka, and Chhattisgarh).
    - Incentivize domestic magnet-making via the Rs50bn PLI scheme.

Can automobiles operate with ferrite magnets? Yes, in many areas they can be used in ICE vehicles but replacing in EVs is very difficult

Ferrite magnets remain viable for low-performance or auxiliary systems. It's important to note that most Indian automobile manufacturers still primarily produce internal combustion engine (ICE) vehicles, which do not require high energy density magnets based on rare elements like neodymium, niobium, or tantalum.

Figure 10: Ferrite-based magnets are already used in multiple parts of IC engine-based vehicles

Component	Ferrite Use Feasibility
Power windows	Commonly used
Windshield wipers	Used
Blower motors (HVAC fans)	Used
Fuel pumps	Possible
Seat adjusters	Used
Instrument cluster motors	Possible
Starter motors (for ICE cars)	Possible with trade-offs

SOURCE: INCRED RESEARCH, COMPANY REPORTS

However, ferrite magnets *cannot* replace rare earths (e.g., NdFeB/Niobium magnets) in 1) EV traction motors (main drive motors), 2) hybrid motor-generators (MHEV, HEV, PHEV), 3) high-torque e-axles, and 4) regenerative braking systems.

The usage is not possible because ferrite magnets have:

1. Lower magnetic energy density (typically 1/3rd to 1/5th of NdFeB).
2. Poor high-temperature stability (above 150°C, they degrade faster).
3. Bulky design requirements (larger, heavier motors needed for the same output).

In EVs or performance hybrids, this leads to lower efficiency, bigger motors (heavier vehicles), higher power consumption, and less range.

Whether missiles and fighter planes need neodymium-based magnets? Yes, and it's not easy to replace them with ferrite-based magnets

Missiles and fighter aircraft require niobium-based or rare earth-based magnets, but not always directly for propulsion—rather, for critical subsystems where high magnetic strength, thermal stability, and miniaturization are essential.

Figure 11: Missiles: Where are neodymium-based or rare earth magnets used?

Subsystem	Magnet Use
Actuators (for fins/control surfaces)	Precise, fast-response motors often use NdFeB or SmCo magnets (may contain niobium).
Seeker guidance units	Miniature motors and gimbals need high magnetic density magnets.
Gyroscopes / IMUs	For inertial navigation – require stable magnetic fields.
Servo motors / reaction wheels	Compact, high-efficiency – rare earths preferred.
Radar systems (active seekers)	Cooling fans, gimbals, or electronic steering units.

SOURCE: INCRED RESEARCH, COMPANY REPORTS

Figure 12: Fighter aircraft: Where neodymium/rare earth magnets matter

Subsystem	Role of Magnets
Fly-by-wire actuation systems	Electromechanical actuators use high-energy magnets.
Radar (AESA)	Beam steering and cooling fans may use rare-earth-based components.
Electric generators / motors	Compact alternators and motor-generators often need NdFeB/SmCo magnets.
Weapons bay actuators / landing gear	Miniaturized servo systems.
Avionics cooling systems	High-efficiency electric fans with permanent magnets.

SOURCE: COMPANY REPORTS, INCRED RESEARCH

Please note that ferrite-based magnets are generally unsuitable for use in missiles and aircraft due to several limitations, such as:

- **Lower magnetic strength**, which restricts performance in high-demand applications.
- **Heavier weight**, making them less viable for aerospace and defence systems where weight is critical.
- **Low temperature tolerance**, as they typically cannot function effectively above 150°C.

- **Poor resistance to demagnetization under shock and vibration**, which is a major drawback in high-stress environments.

While magnets are a critical application, rare earth elements have several other important uses in the defence industry as well ➤

Fighter jets and missiles rely on several rare earth elements (REEs) due to their unique magnetic, optical, and thermal properties, which are critical for performance, survivability, and stealth. Here is a breakdown of the key rare earth elements commonly used:

1. Neodymium (Nd)

- **Used in:** High-performance **permanent magnets** (NdFeB).
- **Applications:** Radar systems, actuators, servo motors, missile guidance, and jet engine components.
- **Why important:** High magnetic strength; essential for miniaturized and efficient systems.

2. Samarium (Sm)

- **Used in: Samarium-cobalt (SmCo)** magnets.
- **Applications:** Missiles and aircraft systems where **high temperature** and **corrosion resistance** are needed.
- **Why important:** Works well in extreme environments (up to 300°C+).

3. Dysprosium (Dy)

- **Used in:** Added to NdFeB magnets to increase **temperature resistance.**
- **Applications:** Radar systems, stealth coatings, magnet stability in hot environments like jet engines.
- **Why important:** Maintains magnet strength under high heat.

4. Terbium (Tb)

- **Used in:** Magnet alloys and **stealth coatings.**
- **Applications:** Enhancing magnet performance, used in **stealth radar absorbent materials**
- **Why important:** Crucial in stealth and thermal imaging tech.

5. Yttrium (Y)

- **Used in: Laser targeting**, ceramics, and missile guidance.
- **Applications:** Infrared sensors, electronic countermeasures.
- **Why important:** Stable at high temperatures and used in optics.

6. Gadolinium (Gd)

- **Used in:** Specialized radar and **thermal sensors.**
- **Applications:** Infrared imaging and guidance.
- **Why important:** Good neutron absorption and magnetic properties.

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Stock Ratings	Definition:
Add	The stock's total return is expected to exceed 10% over the next 12 months.
Hold	The stock's total return is expected to be between 0% and positive 10% over the next 12 months.
Reduce	The stock's total return is expected to fall below 0% or more over the next 12 months.

The total expected return of a stock is defined as the sum of the: (i) percentage difference between the target price and the current price and (ii) the forward net dividend yields of the stock. Stock price targets have an investment horizon of 12 months.

Sector Ratings	Definition:
Overweight	An Overweight rating means stocks in the sector have, on a market cap-weighted basis, a positive absolute recommendation.
Neutral	A Neutral rating means stocks in the sector have, on a market cap-weighted basis, a neutral absolute recommendation.
Underweight	An Underweight rating means stocks in the sector have, on a market cap-weighted basis, a negative absolute recommendation.

Country Ratings	Definition:
Overweight	An Overweight rating means investors should be positioned with an above-market weight in this country relative to benchmark.
Neutral	A Neutral rating means investors should be positioned with a neutral weight in this country relative to benchmark.
Underweight	An Underweight rating means investors should be positioned with a below-market weight in this country relative to benchmark.