6. Rare Earth Corridors- Geography

In the Union Budget 2026–27, the Union Government proposed the establishment of dedicated Rare Earth Corridors in the coastal States of Odisha, Kerala, Andhra Pradesh and Tamil Nadu

Rare Earths in India

Primary Source and Geological Context

In India, Beach Sand Minerals (BSM) constitute the principal source of rare earth elements (REEs). BSM deposits are formed due to long-term wave and current action, leading to concentration of heavy minerals along coastal belts. India's long coastline provides a natural comparative advantage in REE availability, unlike hard-rock rare earth mining dominant in some other countries.

Role of Monazite

BSM deposits contain monazite, a phosphate mineral rich in- Light rare earth elements such as neodymium and praseodymium. Uranium and Thorium, which are radioactive

Due to the presence of radioactive elements-

1. Monazite is classified as a strategic mineral
2. Its mining and processing are strictly regulated under the Atomic Energy Act, 1962

This regulation has historically limited private sector participation, slowing downstream value addition.

Strategic Importance of Rare Earths

Rare earths are designated as critical minerals because-

1. They are indispensable for advanced manufacturing and clean energy technologies
2. There are limited global suppliers with high entry barriers
3. They have significant national security and defence relevance

Control over rare earth supply chains is increasingly viewed as a geopolitical lever.

About Rare Earth Permanent Magnets

Core Characteristics

Rare earth permanent magnets are the strongest commercially available permanent magnets. They are manufactured using rare-earth element alloys combined with metals like iron, boron, or cobalt. Key properties include-

1. Extremely high magnetic strength
2. High energy density
3. Compact size and weight efficiency

They outperform traditional magnets such as ferrite and alnico, enabling miniaturisation of devices.

Limitations

1. Brittle in nature, making machining difficult
2. Highly prone to corrosion
3. Typically coated with nickel or other protective layers
4. Cost-intensive due to complex processing and supply chain concentration

Types of Rare Earth Permanent Magnets

Neodymium–Iron–Boron (Nd–Fe–B)

Strongest permanent magnet currently in commercial use

Composition- Neodymium, Iron, Boron

Widely used in-

1. Electric vehicle motors
2. Wind turbine generators
3. Consumer electronics

Limitations-

1. Sensitive to high temperatures
2. Prone to corrosion without coating

Samarium–Cobalt (Sm–Co)

Slightly weaker than Nd–Fe–B but more thermally stable

Composition- Samarium and Cobalt

Advantages-

1. Operates at temperatures up to ~350°C
2. Excellent corrosion resistance

Limitations- Significantly more expensive

Critical applications-

1. Aerospace systems
2. Defence and missile technologies
3. High-reliability environments

State-wise Distribution of Rare Earth Resources

Odisha

Chhatrapur (OSCOM) region hosts the highest level of active rare earth processing in India. Acts as a nucleus for downstream mineral separation

Andhra Pradesh

Major coastal deposits in-

1. Srikakulam
2. Visakhapatnam
3. Nellore

Large untapped potential for integrated rare earth corridors

Tamil Nadu

Rich beach sand mineral zones in-

1. Manavalakurichi
2. Southern coastal districts

Historically significant site for monazite extraction

Kerala

High-grade reserves located at-

1. Chavara
2. Areas near Vizhinjam Port

Strong potential for port-led mineral value chains

Key Features of the Rare Earth Magnet Manufacturing Initiative

Integrated Corridor Model

Co-location of-

1. Mining
2. Mineral separation

3. Processing
4. Research and Development
5. Manufacturing

Benefits-

1. Reduces logistics and transaction costs
2. Accelerates technology transfer
3. Enables end-to-end value chain development within India

Magnet Manufacturing Linkage

Corridors aligned with the ₹7,280 crore Sintered Rare Earth Permanent Magnet (REPM) Scheme.

Target- 6,000 metric tonnes per annum (MTPA) of domestic magnet manufacturing capacity

Policy Linkages

Builds upon-

1. National Critical Minerals Mission
2. Magnet Manufacturing Scheme

Reflects a shift from resource extraction to value-added industrialisation

State-led Industrialisation

Implementation anchored by state governments

Encourages-

1. Competitive federalism
2. Industrial clustering
3. Local employment generation

Moves beyond a purely centralised policy approach

Capacity and Beneficiary Structure

Total manufacturing capacity support- 6,000 MTPA. Five beneficiaries selected through competitive bidding. Each beneficiary eligible for up to 1,200 MTPA capacity

Financial Incentives

Sales-linked incentives- ₹6,450 crore over five years

Capital subsidy- ₹750 crore for setting up integrated facilities

structure designed to de-risk private investment in a high-capex sector

Strategic Importance of Rare Earth Permanent Magnets (REPMs)

Key Applications

1. Electric vehicles
2. Renewable energy (wind turbines)
3. Electronics and semiconductors
4. Aerospace platforms
5. Defence systems (radars, guidance systems)

Global Supply Concentration

China controls-

1. Over 90% of global rare earth processing
2. A dominant share of REPM manufacturing

This concentration gives China significant geoeconomic leverage

Supply Chain Vulnerabilities

Heavy import dependence exposes India to-

1. Export restrictions
2. Price shocks
3. Strategic coercion

Risks India's-

1. Energy transition goals
2. Defence preparedness
3. Manufacturing competitiveness

India's Demand–Supply Scenario

Rising Demand

Rapid growth in-

1. Electric mobility
2. Renewable energy capacity

REPM demand is a direct function of green transition policies

Import Dependence- India imported over 53,000 metric tonnes of rare earth magnets in FY 2024–25.

Most imports sourced from China-dominated supply chains

Future Projections

Domestic consumption of REPMs expected to double by 2030

Without domestic manufacturing-

1. Import dependence will deepen
2. Strategic vulnerability will increase

Conclusion

Rare earths and REPMs lie at the intersection of industrial policy, energy transition, and national security.

India possesses-

1. Significant natural resource potential
2. A growing domestic market

The challenge lies in-

1. Overcoming regulatory bottlenecks
2. Building processing and manufacturing capabilities

The integrated corridor and REPM schemes mark a strategic shift from raw material control to full-spectrum value-chain sovereignty, crucial for India's long-term economic and strategic resilience.

Source- https-//indianexpress.com/article/explained/explained-economics/budget-rare-earth-corridors-odisha-kerala-tamil-nadu-andhra-10506902/