



RARE EARTH ELEMENTS - GS III MAINS

Q. “The critical minerals and emerging technology are the major need of the hour to achieve ideals of Aatma Nirbhar Bharat”. Elaborate the statement in the light of present geo-political challenges in the rare earth minerals supply chain. (15 marks, 250 words)

News: *China tightens grip on rare earths industry, bans key technology exports for national security*

What's in the news?

- China, known for its dominance in rare earth production, has recently imposed restrictions on the export of technologies related to rare earth extraction and processing. This move has significant implications for global industries reliant on these essential materials.

Rare Earth Elements:

- Rare Earth Elements or Rare Earth Metals are a set of 17 elements in the periodic table — the 15 lanthanides, plus scandium and yttrium, which tend to occur in the same ore deposits as the lanthanides, and have similar chemical properties.
- Although called "rare", they are actually found relatively abundantly in the Earth's crust.
- However, they are hazardous to extract, and there are relatively few places in the world that mine or produce them.

Reserves of Rare Earth Minerals:

- China has the largest reserve (37 percent), followed by Brazil and Vietnam (18 percent each), Russia (15 percent), and the remaining countries (12 percent).
- India has the world's fifth-largest reserves of rare earth elements.

Significance:

- **Manufacturing of Batteries:** Minerals like Cobalt, Nickel, and Lithium are required for batteries used in electric vehicles.
- **Used in most of the consumer products:** REEs are an essential although often tiny component of more than 200 consumer products which includes mobile phones,



computer hard drives, electric and hybrid vehicles, semiconductors, flat screen TVs and monitors, and high-end electronics.

- **Electric Vehicles:** India has an ambitious plan to convert a large percentage of its transport to electric and this would require these minerals.
 - 80percent of the country's two- and three-wheeler fleet, 40percent of buses, and 30 to 70percent of cars will be EVs by 2030.
- **Clean energy:** They are critical for developing clean energy which is the need of the hour today.
- **Industrial use:** Traditional uses like Cerium for glass polishing and lanthanum for car catalysts or optical lenses.
- **Manufacturing of magnets:** neodymium, praseodymium and dysprosium, are crucial to the manufacture of magnets which are used in industries and also in wind turbines and Drones.

Issues associated with extraction of Rare Earth Metals:

- **Difficult to mine:** Although they are more abundant than their name implies, they are difficult and costly to mine and process cleanly.
- **Environmental Impact:** The chief concern is that the rare earth elements are bound up in mineral deposits with the low-level radioactive element thorium, exposure to which has been linked to an increased risk of developing lung, pancreatic, and other cancers.
- **Chinese Dominance:** Amid the transition to green energy, in which rare earth minerals are sure to play a role, China's market dominance is enough to sound an alarm in western capitals.
- **Monopoly of few:** Most of the reserves being present in few nations causes problems for most of the world because of the concentration of reserves in the hands of few countries.
- **Supply Chain:** Forming forward and backward supply chains will create problems when the reserves are mostly limited to one country.

Rare Earth Metals in India:

- **In India, monazite is the principal source of rare earths and thorium.**
- Rare earth elements contribute a total value of nearly \$200 billion to the Indian economy.
- **India has the world's fifth-largest reserves of rare earth elements**, nearly twice as much as Australia, but it imports most of its rare earth needs in finished form from its geopolitical rival, China.
- **Indian Rare Earths Ltd (IREL)**, a Government of India Undertaking, and **KMML, a Kerala State Government Undertaking**, are actively engaged in mining and processing of beach sand minerals from placer deposits.



Challenges for India:

- **Scaling Up:** The key challenge for India today is to scale up upstream and downstream processes in the rare earths value chain.
- **Monopoly of Government:** India has granted government corporations such as IREL a monopoly over the primary mineral that contains REEs: monazite beach sand, found in many coastal states.
- **Capital-Intensive:** The mining and extraction processes are capital-intensive and consumes large amounts of energy.
- **Competition from World:** India must open its rare earth sector up to competition and innovation and attract the large amounts of capital needed to set up facilities to compete with and supply to the world.
- **Toxic By-products:** The mining releases toxic by-products, an issue that has caused some controversy in India before.

WAY FORWARD:

- **Building up domestic capability:** There is a need to build domestic capability and broad-base supply sources for such an important and strategic raw material.
- **Making it part of Make in India campaign:** There is a need to make rare earth minerals a part of the 'Make In India' campaign.
- **New Department for Rare Earths (DRE):** The best move forward might be to create a new Department for Rare Earths (DRE) under the Ministry of Petroleum & Natural Gas, drawing on its exploration, exploitation, refining, and regulation capabilities.
- **Autonomous Regulator:** It should also create an autonomous regulator, the Rare Earths Regulatory Authority of India (RRAI), to resolve disputes between companies in this space and check compliance.
- **Better Coordination:** The DRE could coordinate with other agencies to partner directly with groupings such as the Quad, building up a strategic reserve as a buffer against global supply crises.

The critical minerals and emerging technology are the major need of the hour for achievement of green future goals.