



Mentioning the Strategic Significance That Rare Earth Minerals Hold, Highlight the Limitations For India's Low Rare Earth Production. (250 Words / 15 M) (GS-1 Key Natural Resources)

Approach:

1. Introduction on rare earth elements.
2. Briefly mention their characteristics.
3. Mention the strategic significance of RREs.
4. Mention about limitations in India's production.
5. Conclusion

Rare earth elements (REEs) are a group of **17 chemically similar metallic elements** in the periodic table. The rare earths are actually not 'rare' in nature; they occur **abundantly** but are often **not concentrated** enough for viable extraction.

Characteristics: REEs are characterized by high density, high melting point, high conductivity, and high thermal conductance. REEs are classified into **Heavy REE** and **Light REE**. REEs do **not occur** in a **free state**. They are found in **mineral oxide ores**. Some of the principal sources of rare earth elements are bastnaesite, xenotime, loparite and monazite.

Strategic significance of REEs:

- They are used in various hi-tech applications & processes like EVs, Medicinal appliances, LEDs, healthcare, clean energies, aerospace, defence, etc.
- Their multifarious uses in new age technologies cause **rise in future demand**. For e.g., the current demand of neodymium in India is small, at around 900 tonnes per annum, because domestic manufacturing of EVs and wind turbines is still limited. However, as manufacturing of EVs and wind turbines picks up, the demand for neodymium is estimated to rise sharply by 6-7 times by 2025.
- India is almost **100% import dependent** for most rare earths. Further, **prices** of rare elements are **consistently rising** due to the rising demand.
- The global supply chain is **highly concentrated**, posing a strategic challenge. China had controlled 90% of the supply of rare earths. Now, after aggressive production by the US, Australia and Canada, China's share is down to 60%. Following dispute over the Senkaku Islands, China stopped exports of RREs to Japan. Given India's border dispute, China might resort to similar tactics in future.
- **India has greater reserves** than the US and Australia, only behind China, Vietnam, Russia, and Brazil. With Russia embroiled in conflict, **India** can potentially emerge as a **supplier** not just for domestic use but also for international consumption.

India's limited production of RREs:

- RE materials are not concentrated enough in geographical locations for **commercially**



viable exploitation.

- Presently, they are classified as ***atomic minerals***, whose ***mining is reserved exclusively for government companies***. Currently, there are only two companies – ***Indian Rare Earths Ltd (IREL)*** and ***Kerala Minerals and Metals Ltd*** that can mine them. Further, their production capacities and technological capabilities are limited.
- Extraction companies have ***poor incentives*** to refocus as a globally competitive rare earth extraction and processing firms. This has restricted India to be a ***low-cost exporter*** of rare earth oxides instead of higher value-added products.
- The present system results in ***separating the rare earths ecosystem from other R&D ecosystems*** like electronics or metallurgy. This severely impacts the overall umbrella of strategic research, undercutting the interdisciplinary nature of modern research work. The situation is similarly disintegrated with regards to exploration.
- ***Beach sand mining*** was permitted until a few years ago but was ***banned in 2016*** to conserve strategic minerals including rare earths and thorium.

The time is right to focus on boosting the indigenous supply of rare earth metals, contributing a total value of nearly ***US\$ 200 billion*** to the Indian economy. A ***sustained supply*** is also essential to ***reduce its dependence on Chinese imports*** and truly realize the vision of *Aatmanirbhar Bharat*.