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## **Indian Rare Earth Industry: Need and Opportunity for Revival and Growth**

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Rare earth elements (REE) and other energy critical materials are extensively used in clean energy applications like wind turbines, electric vehicle batteries/electric motors, solar energy collectors, thin film technologies and in many strategic applications. In view of the near monopoly of supply from China, there is a need for an appropriate strategy for their indigenous production. This is critical to ensure long term national raw materials security.

The supply chain for rare earth sector generally consists of exploration, mining, extraction and manufacturing of finished products like permanent magnets used in clean energy industry. Magnets made from rare earths are many times more powerful than those made from conventional materials. Hence necessary initiatives need to be taken for value-added refining, metal/alloy production and manufacturing components for end-use.

In India, monazite mineral has been the principal source of rare earths. It occurs in association with other heavy minerals, such as ilmenite, rutile, zircon, etc., in the beach sands and inland placer deposits. It also contains thorium and uranium and hence comes under Department of Atomic Energy. Although India possesses large deposits of monazite, the more valuable heavier rare earth elements (HREE) are not present in this mineral. The feasibility of exploring some other non-radioactive minerals, like xenotime which is richer in HREE (essential to the manufacture of high performance permanent magnets), is to be accelerated in context of public-private partnership. There is a need for strengthening of exploration expertise with modern concepts and tools including remote sensing capabilities. This will help Geological Survey of India to generate more detailed and accurate data on unexplored areas. This will enable locating suitable target areas for further search of economically exploitable deposits of the preferred REE. Further, in case of REE the key issue is the separation of the individual elements. State of the art rare earth metals extraction techniques and facilities have to be pooled and the gap in the areas needs to be identified. Recycling of end-of-life rare earth containing products are another source of critical rare earths and these technologies need to be developed on commercial scale.

Self-sufficiency in rare earths is vital and critical to our national clean energy related missions like National Solar Mission and National Electric Mobility Mission besides several high tech applications. The issues surrounding the REEs need serious and sustained attention and we need a national level programme to develop a robust REE sector roadmap.