

RARE EARTH ELEMENTS AND POLICY OPTIONS FOR PAKISTAN: SEPARATING FACT FROM FALLACY

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Abstract

Rare earth elements are seventeen elements that sit at the end of the periodic table and occur naturally in earth. They are found with other earth minerals and exist in traces. Recently, media has been replete with discussion of rare earth elements and their significance in new world order, as these elements are linked with production of advanced weaponry, aerospace and green technologies etc. (of prime significance in new world order). There are discussions on how Pakistan can use export of rare earth elements in winning allies and also some random estimates of their worth and quantum in Pakistan. However, there is yet no authentic mapping done in Pakistan as to the quantum etc of the rare earth elements. At the same time their extraction and separation is technology intensive process and requires huge investment, whereas the processes are pollution prone and may not be beneficial to local communities. This article provides policy options for Pakistan in matter of rare earth elements and provides a better option of using urban mines to extract rare earth elements, which will generate employment and better for local communities. Pakistan may keep doing mapping of these elements but prime focus should be on established mineral resources like copper, gold, bauxite, silicon etc.

Introduction

Nowadays rare earth elements (REEs) are widely being discussed. Newspaper reports try to link new world order with the possibility of getting more and more dominance over rare earth mineral. Even in Pakistani media, pundits have highlighted the strategic importance of REEs for Pakistan in winning allies and earning foreign exchange. There has appeared numerous claims of REEs wealth in the country terming it up to trillion-dollar mineral wealth. However, there remains a gap between simple unverified assertion and actual facts depending on geological surveys. The purpose of this article is to see current available data and explore policy options for Pakistan in matter of REEs.

What Are Rare Earth Elements?

REEs are a group of seventeen metallic elements. These elements occur naturally in the earth's

crust. They include Scandium and yttrium, which are in the main body of the periodic table in Group 3, while the fifteen lanthanides (lanthanum through lutetium) are conventionally displayed as a detached row beneath the table for space reasons, although they physically belong between barium (element 56) and hafnium (element 72). The seventeen elements are further divided into light rare earth elements (LREEs), which are comparatively abundant, and heavy rare earth elements (HREEs), which are scarcer and concentrated in far fewer deposits worldwide.

REEs are considered strategic minerals because they are used in production of high-technology and low-carbon products. They are used in production of permanent magnets, electric vehicle motors, wind turbines, smartphone and television screens, camera lenses, catalysts, hard-disc drives, batteries, defense systems, and laser

technology. Despite the name, REEs are not geologically scarce; what is scarce is the capacity to extract, separate, and refine them economically and in an environmental friendly way. They rarely occur in isolation and are typically found as minor constituents alongside other minerals, which makes processing technically difficult and financially very costly.

Global Production and China's Dominance

China is the main supplier of rare earth elements. China is estimated to account for roughly 69–70% of global mine production and close to 90–91% of global refining and separation capacity, even though its share of proven global reserves is considerably smaller, at an estimated 29–38% depending on the source and methodology used (Mining Technology, 2025; ScienceDirect, 2025; Statista, 2026).

This asymmetry between reserves and output is the crux of China's structural leverage, wherein, Chinese supply dominance does not depend on the available mineral resources but on the decades of sustained investment in industrial separation and refining capacity (Andaman Partners, 2026; CKGSB Knowledge, 2025).

Since April 2025, China has tightened export licensing on a number of heavy rare earths, including dysprosium, terbium, and yttrium, contributing to price increases and supply anxiety among manufacturers in the aerospace, automotive, and renewable energy sectors (Center for Strategic and International Studies, 2026; GQG Partners, 2025).

Western governments, including the United States, the European Union, and Australia, are investing in alternative mining, separation, and magnet-manufacturing capacity, but most analysts estimate it will take three to four years, at minimum, for these efforts to meaningfully close the gap with China's existing infrastructure (Andaman Partners, 2026; China Briefing, 2025).

Pakistan's Rare Earth Potential: Promise and Uncertainty

The Geological Survey of Pakistan and China Geological Survey conducted initial mapping of Pakistan under initiative called 'National-Scale Geochemical Survey of South and Central Asia (NGSSCA)'. This mapping had confirmed the

presence of light rare earth elements in different parts of the country (ScienceDirect, 2024).

They are in Northern regions of the country and are distributed in Balochistan, Gilgit-Baltistan, and the Hazara region in Khyber Pakhtunkhwa. They are also present in the Himalayan fold-and-thrust belt, the Karakoram terrane, and the Kohistan island arc in the north of the country. Cerium, lanthanum, and neodymium have been identified in the Skardu-Chilas region of Gilgit-Baltistan and in the Neelum valley of Azad Kashmir, with additional occurrences reported in Khyber Pakhtunkhwa districts such as Tarbela, Swat, and Buner. Fly ash from the Thar coalfield has also been investigated as a potential unconventional source.

Some unverified estimates place Pakistan's total REE resource potential at roughly 100,000 to 500,000 tonnes, an order of magnitude smaller than established reserve holders such as India (over 7 million tonnes), Brazil (21 million tonnes), Vietnam (22 million tonnes), or China's Bayan Obo deposit alone (over 40 million tonnes) (SFA Oxford, 2025; Discovery Alert, 2025a, 2025b). These figures may be taken with caution as no certified mapping is at the back of Pakistani data as with other countries. However, they only point out to an existence of the potential, and more than 95% of Pakistan's mineral terrain remains geologically under-explored (Discovery Alert, 2025a; The Friday Times, 2025).

Structural and Governance Challenges

Even if Pakistan's REE deposits prove larger than currently estimated level, there are many constraints in making it a functional industry.

Institutional fragmentation. Multiple bodies like the Geological Survey of Pakistan (GSP), the Pakistan Mineral Development Corporation (PMDC), the Pakistan Council of Scientific and Industrial Research (PCSIR), Provincial Mines and Minerals Departments, and academic institutions all make efforts in silos. They conduct overlapping or uncoordinated efforts towards surveys. In Pakistan there is no single reserve-certification body.

"Weak governance, fragmented federal-provincial coordination, and poor geological

data are consistently identified as key bottlenecks to the development of the mineral-sector of Pakistan” (Institute of Policy Studies and International Relations, 2026).

Absence of midstream capacity. Pakistan has no established facility and technology base in matter of REEs mining, extraction and refining. If Pakistan considers supply of raw material. It has to be understood that REEs are present with other minerals in small amounts and separation is necessary even if it is to be exported raw. It requires a heavy investment and advanced technology and further, the investment may not give immediate returns. If raw REEs mixed with other minerals are considered to be supplied. The supply cost will be heavy with meagre foreign exchange earnings, as in huge extracted volume there would be very small amount of REEs. The question will remain ‘was the extraction worth it?’

Security risks. Parts of Balochistan and other resource-bearing regions face persistent insurgent activity and sabotage risk. Previously, too mining and infrastructure projects, including some Chinese-linked investments were disrupted.

Water scarcity. Refining and separation process of REEs requires huge amount of water. For example according one estimate 20,000 to 2000,000 litres of water and approx. 100 kWh/kg of electricity (equivalent to 2 weeks consumption by an average household), will produce 1 kg of Neodymium. Cost of extraction of this amount will be USD 10-12 It will also require 1 to 5 kg of HCL worth US-5/KG. The extraction will create some radioactive waste and acidic effluent (Lecture of Dr Daanish Mustafa , Professor in Critical Geography at Kings College, London at Conference on REEs dated 18.08.2026). REE separation and refining are water-intensive processes and Pakistan is water scare country and some regions where REEs are located are arid places. Such extraction and refining will create social-conflict risks and would be environmentally unfriendly.

Regulatory fragmentation. Hydrocarbons fall under the Federal Ministry of Petroleum and Natural Resources, while solid minerals,

including REEs, are managed by provincial Mines and Minerals Departments. This bifurcation, reinforced by the provincial autonomy provisions of the Eighteenth Constitutional Amendment, has produced overlapping mandates and inconsistent policy across provinces.

Long investment horizons and environmental costs. REE extraction and processing are highly capital-intensive, pollution-prone, and can pose health risks to local communities. Returns on investment may come in span of 10-20 years. It is long time period to allow for a consistent policy space, as historically Pakistan face policy discontinuity.

New World Order. As new world order is still setting in, with China and USA in the race, Pakistan need to be cautious. It may be noted that REEs are used in air defence system. It would be pertinent not to take side in supply chain of advanced defence systems of different countries. It would be more appropriate to wait and see.

Policy Recommendations

1. Prioritize confirmed high-potential minerals. Pakistan's most immediate and realistic opportunities lie in minerals with better-established reserve bases and existing projects in pipelines like copper, gold, molybdenum, bauxite (aluminum), chromite, silicon, and antimony, rather than REEs, where potential remains largely unproven, capital intensive and low earning in terms of exporting raw and damaging to local communities.
2. Conduct a rigorous cost-benefit review before committing to REE extraction. Any decision to pursue REE mining should weigh the scale of required investment, water scarcity, environmental and social costs, the distribution of benefits between local communities and national revenue, and the risk of exporting low-value raw ore abroad for a marginal foreign-exchange return, rather than capturing higher-value downstream processing domestically.
3. Invest in recycling and urban mining as a lower-cost alternative. Recovering REEs from end-of-life products already in circulation such as mobile phones, industrial scrap, e-waste, acid sludge, red mud, and electric drivetrains is far

better option. It is emerging globally as a technically viable and comparatively low-cost complement to primary mining, and could benefit local populations without the capital intensity, water demand, or long payback horizons associated with new extraction (Rare Earth Exchanges, 2026; Rare Earth Mining, 2026; Forbes, 2026).

4. Consolidate institutional mandates. There should be a single, adequately resourced authority to coordinate with GSP, PMDC, PCSIR and Provincial departments and provide certified mapping. Instead of creating another body PMDC can be tasked to do this.

5. Communicate resource potential responsibly. Public and official statements should distinguish clearly between speculation and certified mapping report. As may give wrong signals to potential investors.

Conclusion

Pakistan's rare earth story sits closer to genuine. However, it presently appears lesser than a trillion dollar claims as highlighted in many public discourses. Pakistan needs to prioritize its policy towards those mineral in which it has a commercial advantage rather than on those minerals in which initial studies are lacking and whose extraction becomes costlier in terms of environmental and security risks. In the present scenario building a domestic recycling and urban-mining sector seems to be a better option.

References

- Andaman Partners. (2026, May). *Rare earths remain a China-controlled supply chain*. <https://andamanpartners.com/wp-content/uploads/2026/05/Rare-Earths-Remain-a-China-Controlled-Supply-Chain-ANDAMAN-PARTNERS-2026.pdf>
- Center for Strategic and International Studies. (2026, May 5). *Rare earth export restrictions one year later*. <https://www.csis.org/analysis/rare-earth-export-restrictions-one-year-later>
- China Briefing. (2025, August 29). *China's rare earth elements: What businesses need to know*. <https://www.china-briefing.com/news/chinas-rare-earth->

[elements-dominance-in-global-supply-chains/](#)

- CKGSB Knowledge. (2025, May 19). *Understanding China's global rare earth power leverage*. <https://english.ckgsb.edu.cn/knowledge/article/china-dominance-of-rare-earth-and-impact-on-global-market/>
- Discovery Alert. (2025a, October 28). *Pakistan rare earth supply chain: Strategic overview*. <https://discoveryalert.com.au/pakistan-rare-earth-supply-chain-2025/>
- Discovery Alert. (2025b, November 11). *Pakistan's \$6 trillion mineral wealth claims under scrutiny*. <https://discoveryalert.com.au/pakistan-mineral-wealth-2025-economic-transformation/>
- Forbes. (2026, April 26). *Magnets are a critical national demand. Developing rare earths is key*. <https://www.forbes.com/sites/noelfletcher/2026/04/26/magnets-are-a-critical-national-demand-developing-rare-earth-is-key/>
- GQG Partners. (2025, November 11). *Critical dependence on rare-earth minerals*. <https://gqg.com/insights/critical-dependence-on-rare-earth-minerals/>
- Institute of Policy Studies and International Relations. (2026, January 6). *Mineral resources and economic development in Pakistan: A sectoral analysis*. <https://ipripak.org/mineral-resources-and-economic-development-in-pakistan-a-sectoral-analysis/>
- Mining Technology. (2025, January 18). *China currently controls over 69% of global rare earth production*. <https://www.mining-technology.com/analyst-comment/china-global-rare-earth-production/>
- Rare Earth Exchanges. (2026, April 9). *Urban mining, big promise—but still stuck in the lab*. <https://rareearthexchanges.com/news/urban-mining-big-promise-but-still-stuck-in-the-lab/>

Rare Earth Mining. (2026, June 19). *Rare earth magnet recycling: Key 2026 outlook*.
<https://rare-earth-mining.com/rare-earth-magnet-recycling/>

ScienceDirect. (2024, January 6). *Concentration and distribution patterns of rare earth elements (REEs) in stream sediments of Pakistan*.
<https://www.sciencedirect.com/science/article/abs/pii/S0375674224000025>

ScienceDirect. (2025, October 27). *Tracing China's unseen rare earth exports that sustain global consumption*.
<https://www.sciencedirect.com/science/article/pii/S2949790625002496>

SFA Oxford. (2025, October 15). *Pakistan-U.S. rare earth partnership: Strategic breakthrough in supply chain security*.
<https://www.sfa-oxford.com/market-news-and-insights/sfa-pakistan-s-rare-earths-partnership-advances-us-supply-chain-security-and-independence/>

Statista. (2026, April 13). *Rare earths: Production share by country, 2025*.
<https://www.statista.com/statistics/270277/mining-of-rare-earths-by-country/>

The Friday Times. (2025, December 24). *Pakistan's mineral paradox: Vast rare earth and gold wealth amid governance gaps*.
<https://thefridaytimes.com/24-Dec-2025/pakistan-s-mineral-paradox-vast-rare-earth-gold-wealth-amid-governance-gaps>