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The New Power of Rare earth

Emerging as a new
form of global power



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The New Power of rare earth

Rare earth elements (REEs) are emerging as a new form of global power, shaping geopolitics, technology, and the clean energy transition. These 17 elements, vital for electronics, electric vehicles, wind turbines, and military systems, have unique magnetic, luminescent, and electrochemical properties that enable compact, efficient technologies.

Control over their supply chains is now a strategic asset akin to controlling oil in the past, driving competition especially between China, the US, and other resource-rich countries.

China remains the dominant supplier, controlling over 60% of global REE production and 85% of refining capacity, using this leverage as a geopolitical tool, including export restrictions that impact global supply chains and international trade tensions.

In response, countries like India are launching initiatives like the National Critical Mineral Stockpile to secure rare earth supplies for their green technology and defense sectors. The United States is focusing on rebuilding domestic production and securing supply chains to reduce dependency on China. This evolving landscape shows that those who control rare earth minerals will have significant technological, economic, and geopolitical influence in the coming decades.

Rare earth elements (REEs)

Rare earth elements (REEs) are a set of 17 chemical elements in the periodic table that are critical components in a vast array of modern technologies, including consumer electronics, renewable energy systems, defense applications, and more.

Despite their name, most REEs are not "rare" in the earth's crust; some are actually more abundant than gold or silver. Their classification as "rare" stems

from the fact that they are rarely found concentrated in economically viable deposits and their extraction and separation process is difficult and complex.

What are the Rare Earth Elements?

The group is comprised of two elements that are chemically similar to the lanthanides and are typically found in the same ore deposits, plus the 15 elements of the lanthanide series:

- Scandium (Sc)
- Yttrium (Y)
- The Lanthanides (atomic numbers 57 to 71): Lanthanum (La), Cerium (Ce), Praseodymium (Pr), Neodymium (Nd), Promethium (Pm), Samarium (Sm), Europium (Eu), Gadolinium (Gd), Terbium (Tb), Dysprosium (Dy), Holmium (Ho), Erbium (Er), Thulium (Tm), Ytterbium (Yb), and Lutetium (Lu).

The lanthanides are often further categorized into Light Rare Earth Elements (LREEs) and Heavy Rare Earth Elements (HREEs) based on their atomic weight, with LREEs generally being more abundant.⁷

Key Applications and Importance

REEs are essential because they possess unique magnetic, phosphorescent, and catalytic properties that are currently unmatched by other materials, making them virtually indispensable for high-tech and green technologies.⁸

Sector/Application	Key REEs and Function
High-Strength Permanent Magnets	Neodymium (Nd), Praseodymium (Pr), Dysprosium (Dy), Terbium (Tb) are vital for creating powerful magnets used in electric vehicle (EV) motors, wind turbine generators, hard disk drives, and headphones.

Sector/Application	Key REEs and Function
Electronics & Displays	Europium (Eu) and Terbium (Tb) are used as phosphors to produce red and green colors in flat-screen TVs and monitors. Yttrium (Y) is also used in phosphors.
Clean Energy	Aside from magnets in EVs and wind turbines, Lanthanum (La) and Cerium (Ce) are used to enhance the performance and lifespan of rechargeable batteries, particularly in hybrid vehicles.
Catalysts	Cerium (Ce) and Lanthanum (La) are widely used as catalysts, most notably in automotive catalytic converters to reduce exhaust emissions.
Optics and Glass	Lanthanum (La) improves the refractive index of glass, making it essential for high-quality camera lenses and optical fibers. Cerium (Ce) is used for polishing glass and as a glass additive.
Defense & Aerospace	REEs are crucial for various military systems, including jet engines, guidance systems, missile components, and specialized alloys.
Medical Imaging	Gadolinium (Gd) is used as a contrast agent in Magnetic Resonance Imaging (MRI) to enhance diagnostic clarity.

Geopolitical Significance

The global supply chain for rare earth elements is a matter of significant geopolitical concern. China currently dominates the global market, controlling a

vast majority of the world's mining, processing, and refining capacity.⁹ This concentration of supply presents a strategic vulnerability for other countries, especially those heavily reliant on these materials for key industries and defense. Securing diverse and stable supplies of REEs is a major focus of international trade and resource policy.

Importance of Rare Earths

Essential for advanced technology, including smartphones, electric vehicles (EVs), wind turbines, guided missiles, radar systems, and AI hardware.

Small supply disruptions or export controls can have outsized impacts on global industries and national security.

Geopolitical Dynamics

- China's near-monopoly on rare earths is a strategic chokepoint used for economic and diplomatic leverage.
- Global responses include diversifying supply through new mining projects, stockpiling, and technological innovation to reduce reliance.
- Countries with rare earth reserves and refined processing industries are gaining strategic importance.

Indian Context

- India holds significant rare earth reserves in coastal and inland deposits and is taking steps to create a two-month strategic stockpile.
- Government incentives aim to boost domestic rare earth magnet production critical for green energy and defense.
- Challenges remain in extraction and refining technologies.

In sum, rare earth elements have become "the new power" in global affairs, pivotal to the green energy transition, technological innovation, and geopolitical rivalry, with supply chain security now a crucial priority for nations.

Rare earth elements-Beijing trade weapon

- China is increasingly weaponizing its dominance over rare earth elements as a strategic trade and geopolitical lever, especially against the United States.
- Rare earth elements, vital for cutting-edge technologies including electric vehicles, semiconductors, and advanced military hardware like fighter jets, missiles, and radar systems, are largely controlled by China—accounting for over 60% of mining and roughly 90% of global processing and refining capacity.
- Beijing has tightened export controls on these materials, citing national security concerns and dual-use capabilities for civilian and military applications. These restrictions require foreign companies to obtain government authorization for exporting rare earth-containing products, aiming to constrain U.S. defense supply chains and technology sectors ahead of key trade negotiations and summits between President Donald Trump and President Xi Jinping in late October 2025.
- The measures reflect China's strategic calculation to use rare earths as an economic coercion tool to maintain geopolitical leverage in the ongoing trade conflict, risking global supply chain disruptions. While China's actions have drawn sharp criticism from U.S. officials calling it economic coercion, China defends the controls as aligned with international norms and necessary to protect national security.
- The tight grip on rare earth exports enhances China's bargaining power but also risks accelerating efforts by the U.S. and its allies to develop alternative rare earth sources and supply chains outside China.

Key Points on Beijing's Rare Earth Trade Weapon:

- China controls the majority of rare earth mining, processing, and refining worldwide.
- Recent export restrictions target key rare earths essential for U.S. military and high-tech industries.

- New rules require foreign firms to seek Chinese government approval to export rare earths or related products containing even small amounts of Chinese rare earth materials.
- These measures come amid heightened trade tensions, just before a planned Trump-Xi summit in late October 2025.
- China justifies these controls as necessary for national security due to dual-use military and civilian applications.
- The U.S. and other nations see this as leveraging a de facto monopoly to disrupt global supply chains and pressure rivals.
- The moves may accelerate global diversification efforts but remain a potent tool for Beijing's strategic leverage.
- This evolving situation frames rare earth elements as a frontline in 21st-century geopolitical and economic competition, with China wielding its dominance as a significant trade weapon.

China so dominant in rare earth mining and processing

China's dominance in rare earth mining and processing is the result of a combination of resource endowment, technological expertise, economic strategy, and government policy.

Key Reasons for China's Dominance:

- **Resource Richness:** China holds over 30% of the world's rare earth reserves, especially in large deposits like the Bayan Obo mine in Inner Mongolia, giving it a strong natural resource base.
- **Government-led Industrial Ecosystem:** Since the late 20th century, China deliberately built a vertically integrated supply chain encompassing mining, refining, and manufacturing rare earth products including magnets, controlling each stage from extraction to finished goods.
- **Technological Expertise:** China invested heavily in refining and processing technologies. It perfected crucial methods like solvent extraction for rare earth separation, leading in patents (over 25,000 rare earth patents by

2018), far exceeding other countries, allowing efficient and cost-effective production.

- **Lower Environmental and Labor Costs:** China's mining and refining operations have historically operated under less stringent environmental regulations and lower labor costs, which reduced production costs relative to other countries, though environmental standards are rising.
- **Strategic Export Controls:** China uses export quotas and restrictions as geopolitical tools, tightening control to maintain dominance in global supply chains and incentivizing foreign companies to relocate manufacturing to China.
- **Comprehensive Supply Chain Control:** China controls around 60-70% of global rare earth mining and over 85-90% of processing and refining capacity, giving it near-monopoly power, including dominance in heavy rare earths and rare earth magnets critical for advanced technologies.
- **Long-term Development Focus:** China's strategy is embedded in broader economic plans like "Made in China 2025" and reflects a conscious effort to leverage rare earths as a source of technological, industrial, and geopolitical advantage.

This combination of abundant reserves, state-backed industrial policies, technological innovation, cost advantages, and strategic control has cemented China's position as the global rare earth powerhouse, able to influence global trade, technology supply chains, and geopolitical power dynamics.

Which rare earth elements does China control most strongly

China controls most strongly the following rare earth elements:

- **Light Rare Earth Elements:** China dominates production of neodymium and praseodymium, which are critical for permanent magnets used in electric vehicles and wind turbines. These two account for the largest share of China's rare earth output.

- **Heavy Rare Earth Elements:** China has near-monopoly control over heavy rare earths including dysprosium, terbium, gadolinium, holmium, erbium, thulium, europium, and ytterbium. These are scarcer and vital for advanced tech like nuclear reactors, high-performance magnets, specialty glasses, semiconductors, and green phosphors.
- China enforces export controls on 12 out of the 17 rare earth metals, which notably includes samarium, dysprosium, gadolinium, terbium, lutetium, scandium, yttrium, holmium, erbium, thulium, europium, and ytterbium.
- The Bayan Obo mining district in Inner Mongolia is rich in light rare earths, while heavy rare earths are concentrated in southern provinces like Jiangxi, Guangdong, and Fujian.
- China accounts for about 70% of the world's mined rare earths and over 90% of permanent magnets made from these elements, which underlines its grip on critical supply chains for both light and heavy rare earths.

Thus, China's strongest control lies in both dominant light rare earths essential for magnets (neodymium, praseodymium) and a near-monopoly on the more scarce heavy rare earths essential for high-tech, strategic applications.

Rare Earth Trade Weapon-China's fresh curb

Recent developments reveal that China has imposed stricter export controls on rare-earth metals, expanding its strategic leverage amid ongoing US-China trade tensions. These measures, announced in October 2025, are a significant escalation in China's use of critical minerals as geopolitical tools, particularly ahead of upcoming high-level talks between China and the United States.

The controls affect 12 of the 17 recognized rare-earth elements, including additional metals like holmium, erbium, thulium, europium, and ytterbium, along with restrictions on the export of specialized processing equipment.

Key Details of China's Rare Earth Curbs

- China has increased export restrictions on five more rare-earth metals, supplementing earlier restrictions on seven metals. This move tightens China's grip on global supply chains essential for manufacturing advanced technology, defense systems, and renewable energy components.
- The controls include licensing requirements for foreign firms to export products containing Chinese-origin rare earths or manufactured using Chinese processing technologies, especially critical for defense and high-tech industries.
- The rationale provided by China centers on national security concerns. The Chinese government argues that these materials have dual-use capabilities for both civilian and military applications, and the restrictions are meant to prevent transfer to military or sensitive uses outside China.

Global Implications

- China dominates approximately 60-70% of global rare-earth mining and around 90% of processing, giving it substantial control over the supply chain for these critical inputs used in electronics, electric vehicles, wind turbines, and defense systems.
- These restrictions are expected to cause ripple effects across industries worldwide, especially in sectors dependent on rare-earths like automotive, electronics, and defense industries, which have already raised alarms over potential supply disruptions.

Geopolitical Context

- The timing of these restrictions, just weeks before a planned high-level meeting between Trump and Xi Jinping, underscores their strategic use to influence negotiations and assert China's economic clout.
- The US and its allies are actively seeking to diversify supply sources and reduce dependency on Chinese rare earths, recognizing the move as part of a broader struggle for technological and economic supremacy.

Rare Earth Trade Weapon-Impact on India

China's use of rare earths as a trade weapon has significant impacts on India due to its heavy dependency on Chinese imports for these critical minerals. China's export restrictions and licensing controls on rare earth metals and related technologies have created delays, increased procurement complexities, and disrupted Indian manufacturing sectors, notably electric vehicles (EVs) and defense production. India's industries face longer wait times and supply shortages, which threaten production targets and the country's clean energy transition goals.

Key Impacts on India

- **Import Dependency and Supply Disruptions:** India relies on China for about 90% of its rare earth imports, including critical elements like neodymium crucial for EV motors and defense systems. China's export curbs cause delays (40-45 day procurement processes) and reduced availability of rare earth metals and compounds, impacting automotive and electronics manufacturing.
- **Strategic and National Security Concerns:** Rare earths are vital for defense technology, including missile guidance systems, radar, and fighter jets. China's control over processing and export gives it leverage over India's defense production and broader national security.
- **Geopolitical Leverage:** China demands assurances from India not to re-export rare earth magnets to the US or for military purposes before resuming supplies, illustrating the geopolitical use of these minerals as a bargaining tool. This increases India's diplomatic pressure and vulnerabilities.
- **Economic and Industrial Impact:** The disruptions increase input costs and hamper India's ambitions in sectors like EV manufacturing, semiconductors, and renewable energy, which are vital for its "Make in India" and green energy goals.

India's Response and Opportunities

- India possesses the third-largest rare earth reserves globally and is focusing on ramping up domestic extraction, refining capacity, and building complete value chains, including magnet production, to reduce dependency on China.
- The government plans stockpiles of rare earths to buffer supply shocks and is engaged in strategic partnerships, including with the US, to diversify sources and enhance technological capabilities.
- Developing rare earth industries is seen as an economic opportunity that could enhance India's technological leadership and geopolitical standing in a technology-driven global economy.

In summary, China's rare earth trade restrictions significantly impact India's industrial production, defense security, and economic ambitions by exploiting India's dependency. However, these challenges also drive India to accelerate its strategic autonomy and invest in domestic rare earth resource development and international collaborations.
