INTUITION
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Rare Earths: what's the attraction?

Rare earth elements (REEs), a group of 17 metallic elements, are not actually rare. For example, Neodymium – the second most abundant REE, making up about 38 parts per million – is more common than gold, silver, or platinum. However, REEs are not found in their pure metallic form, like gold in the Witwatersrand, but rather in trace amounts within other mineral ores. Extracting them is difficult, dirty, and expensive. Yet these elements are crucial for technological advancement, placing them at the centre of global news flow. Last month, China announced stringent new export controls on REEs in retaliation to US restrictions on advanced semiconductors. The US softened its stance within weeks, exemplifying the reciprocal economic coercion between the world's great powers. Why is China able to use REEs as powerful trade leverage? This article will delve into the strategic importance of REEs, focusing on the most widely used REE, Neodymium.

Nick Rogers

Interestingly, it was the Chinese who invented the first magnetic compass in 200BC, used mainly for Feng Shui. It was only in the early 11th century, however, that Chinese sailboats navigated to Arab shores. The magnet evolved further in 1831 when British physicist Michael Faraday discovered that when he moved a magnet near a copper wire, a voltage was generated across it. Faraday's inventions formed the foundations of electric motor technology. In 1982, the Neodymium-iron-boron magnet was invented by General Motors (US) and Sumitomo (Japan), which was a crucial breakthrough for the IT revolution. These tiny, powerful magnets were vital in the miniaturization of hard disk drives, which made the personal computer feasible, shaping the technological landscape of the 21st century. Neodymium-iron-boron magnet uses include the following:

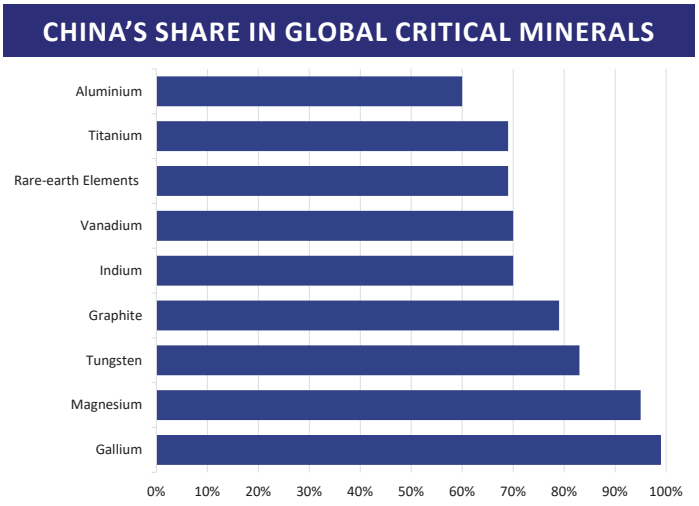
1. Smartphones – essential in the acoustic systems/ speakers, microphones, camera autofocus, and are used to drive the vibration motors.
2. Datacenters – increase system efficiency by about 20%, reducing energy consumption.
3. Wind turbines – improve efficiency and power output in the generators, strengthening the inner components and enabling the turbines to operate in both extreme cold and heat.
4. Electric Vehicles – critical for motors, steering, brakes, and sensors.
5. Medical – used in magnetic resonance imaging (MRI) machines, providing the strong magnetic fields required for imaging.
6. Drone – a single drone can contain several hundred magnets.
7. Artificial intelligence (AI) – enabling the hardware that powers AI systems.

SPEED READ

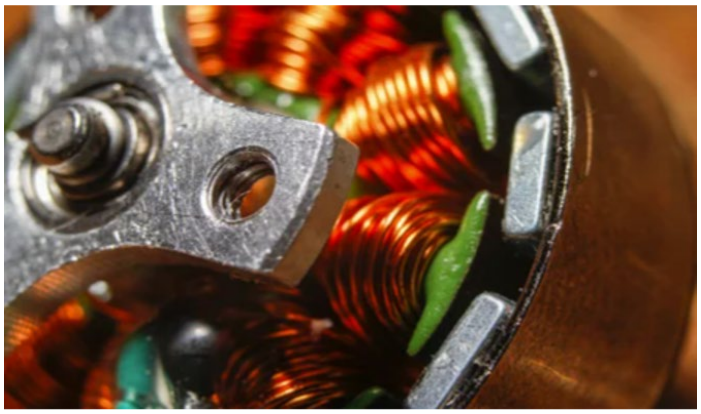
- **Rare Earth Elements (REE) are critical enablers of technological advancement. Without REE magnets and materials, cellphones, electric cars, wind turbines, and most modern defense systems, including space exploration, would not be possible.**
- **China controls around 70% of global REE ore extraction and roughly 90% of the refining and manufacturing of these elements, which allows it to leverage REEs in trade/tariff negotiations with the US.**
- **China has also secured most of the patents and built a "technological moat" around the entire REE value chain.**
- **The US only started to strategically invest in domestic rare-earth supply chains in 2024. Replacing just 15% of China's REE production could take five to seven years, placing the US and its allies at risk of supply disruptions as Beijing leverages its strategic advantage in the face of US tariffs.**

Today, however, China controls around 90% of magnet production – the most difficult segment to replicate according to Morgan Stanley – handing Beijing powerful leverage given the strategic uses across both new and old technology.

Defense spending will be a key theme over the next decade,



China controls over 90% of the global production of key components in electronics like gallium (in advanced semiconductors) and magnesium, as well as roughly 80% of graphite (used for battery technology), and around 70% of the world's rare earths.



China has an advtange in rare earths not because of their abundance in China but rather their government's tolerance for the pollution involved in their beneficiation.

driven by growing geopolitical tensions between the US and China. Trump's instructions to NATO members will underpin demand as modern warfare evolves from ground combat to aerial warfare. An alarming statistic that has emerged from the Russia-Ukraine War is that drones have been responsible for around 70% of deaths. Essentially, all high-performance drones rely on REEs, from the miniaturization of motors to batteries. REEs are essential for guidance systems, radar, and sonar, and are also used in applications such as night vision optics, laser rangefinders, and satellite communications. Think of the B-2 bombers that destroyed the Iranian nuclear capability – impossible without REEs. In fact, 78% of US weapons programs contain components that depend on rare earth magnets. It is not difficult to understand why REEs offer powerful leverage for China in the face of US hostility.

The table below shows the extensive use of REEs as crucial enablers for green energy, medical technology, modern warfare, and space exploration, to name a few.

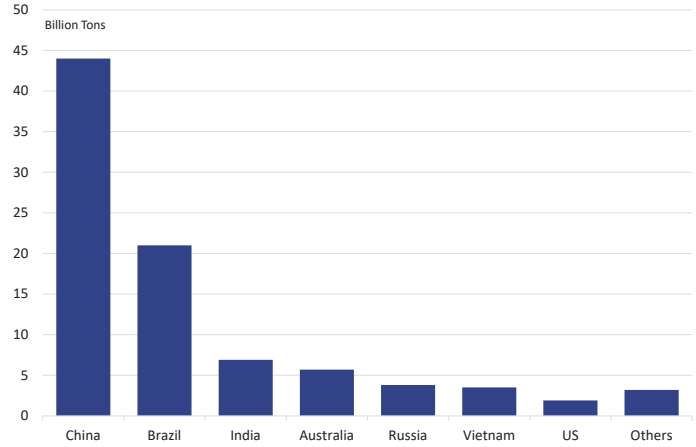
Decarbonization is another multi-decade global theme. Ironically, however, rare-earth mining – essential for solar panels, wind turbines, and electric vehicles – produces high levels of CO^2 emissions, even though these technologies power the green revolution. Most REEs are mined by digging vast, open, dusty pits. Interestingly, only five to ten percent of ore mined yields usable material. Of the ore that is mined, magnetic applications account for about 85% of the value. The real challenge is refining and separating elements like Neodymium, which require advanced chemical processing using harsh chemicals like ammonia and sulfuric acid. Contamination risk is very high.

Both Europe and the US once had major REE industries. Decades ago, however, they were forced to outsource much of the pollution-heavy production to China, where adherence

Equipment	Rare-Earths Used per Unit	Application Examples
Full Hybrid Motor Car	4.5 kgs	Battery, motor, and components
3MW Wind Turbine	600 kgs	Generator
TV, Computer Screens, Precision Lens	Varies	Produce efficient and stable luminescence
MRI Scanning Machine	700 kgs	Used for magnets and added to a contrast agent making body tissues more visible
F-35 Fighter Jet	400 kgs	Guided missiles, lasers for determining targets
US Arleigh Burke-Class Destroyer	2600 kgs	Advanced radar and missile-guidance systems, propulsion
US Virginia-Class Submarine	4 000 kgs	Tomahawk missiles, quieter electric propulsion
Satellites	Undisclosed	Gyroscopes, stability, radar, optoelectronics
NASA's Deep Space 1	Undisclosed	Enabling rocket engines and deep-space probes to operate in extreme temperatures.

to environmental and labor regulations is deemed lower. This outsourcing has left both the US and the EU reliant on Beijing. With its vast population and manufacturing sector, it comes as no surprise that China tops the rankings as the highest polluter (34% of total CO^2 emissions). The US is next at 12%, followed by India at 7.6%, and the EU with 6.4%. When it comes to REE mining and production costs, the US and the EU simply cannot compete with China either. Most of China's competitive advantage comes from its ownership of the entire value chain (e.g., mine to magnet), resulting in superior pricing power, scale, and geopolitical leverage, all backed by the Chinese Government.

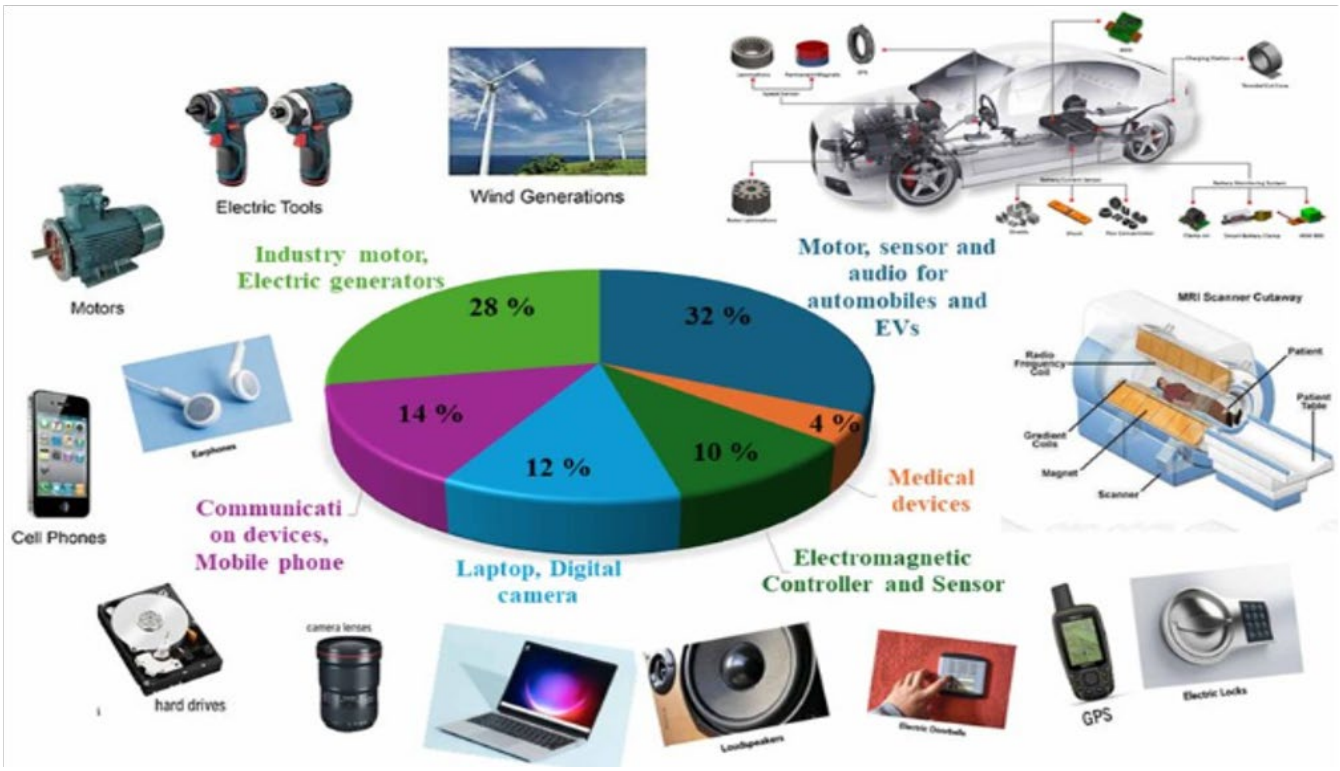
RARE-EARTH ELEMENT RESERVES



China owns 44% of global rare-earth element reserves. The US is going to have to increasingly rely on strategic partnerships to slowly diversify its supply chains away from Beijing.

Can the West catch up anytime soon? Urgency to restrict China's dominance has been well illustrated by the US government's recent multi-million-dollar deal with MP Materials, to produce magnets locally. Additionally, a $8.5 billion bilateral deal between the US and Australia was made recently, for the securing of supply in the mining of rare earths, which further alludes to the sense of urgency being felt from the West. In the absence of a major scientific breakthrough, however, the stark reality is that it could take five to seven years to replace just 15% of China's REE production.

In conclusion, REE materials remain core to almost all the new technologies responsible for driving the global economy forward. President Trump hopes to confirm a deal to secure rare earth supplies from China by the Thanksgiving holiday at the end of November. However, trust between Washington and Beijing is wafer-thin, and the devil will be in the details. While global REE supply chains will gradually become more diversified over the next five years, China will continue to play a dominant role in global REE supply chains. As a result, geopolitical tensions will continue to ebb and flow between the US and China as they compete for technological supremacy, using inherent skills and leverage to control the pace of each other's technological advancement. It is vital that diplomacy reigns supreme given what is at stake.



Modern technology requires rare earths.

Another year has come and gone, a year that has thrown up its fair share of surprises. Please join us for our year end seminar which will see us dusting off the crystal ball and looking into 2026 for clues as to what the new year might hold."

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Topic: Outlook for 2026

Natal Midlands

Date:	Thurs, 4th of December, 2025
Venue:	Christ Church Howick, 23 Mare Street, Howick
Morning Time:	10am for 10.30am
Evening Time:	5.30pm for 6pm

Johannesburg

Date:	Thurs, 27th of November, 2025
Venue:	Rosebank Union Church, Cnr Winne Mandela Drive and St Andrews Road, Hurlingham
Time:	7am for 7.30am

Cape Town

Date:	Tues, 25th of November, 2025
Venue:	SSISA Conference Centre, Boundary Road, Newlands, Morne du Plessis Boardroom, 4th floor
Time:	7.30am
Venue:	ABRU Motor Studio, Lourensford Wine Estate, Somerset West
Time:	5.30pm for 6pm