THREE ON THURSDAY

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FIRST TRUST ECONOMICS

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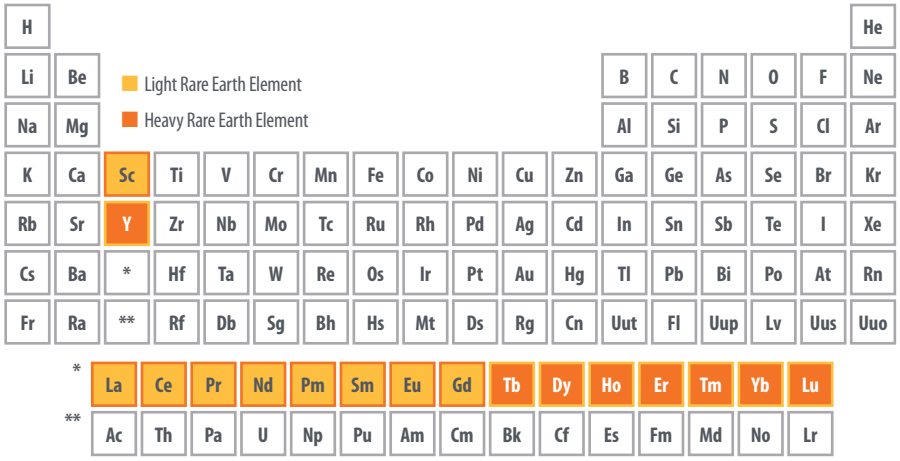
The 17 Elements Shaping the 21st Century—and Who Controls Them

Rare earth minerals are the unsung heroes of modern technology. From smartphones and wind turbines to electric vehicles and advanced defense systems, these 17 elements play a critical role in the 21st-century economy. Despite their name, rare earths aren't actually rare in the earth's crust—but they are rarely found in economically viable concentrations, and even more rarely processed outside of China. As the global energy and tech race accelerates, rare earths have become both a geopolitical flashpoint and a strategic imperative for the United States and its allies. In this week's Three on Thursday, we dig into the numbers behind global rare earth production, U.S. dependency, and what it would take to break free from China's dominance. View the table and two charts below to gain greater insight.

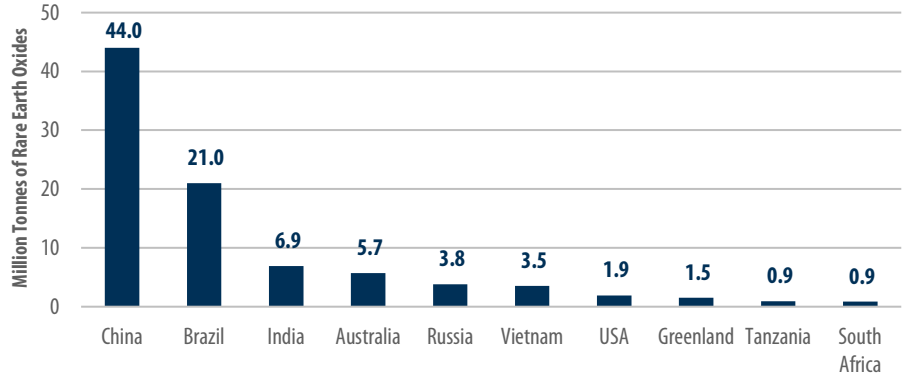
Rare Earth Elements



Source: Science Notes, First Trust Advisors.

Rare earth elements are a group of 17 metals that are essential to modern technology. They include 15 elements known as lanthanides, plus scandium and yttrium. The name "rare earths" is a bit of a misnomer. Rare earth minerals got their name in the 18th and 19th centuries when scientists first discovered them in uncommon mineral deposits and extracted them as oxides, which were then called "earths." The term "rare" referred to how infrequently these minerals appeared in concentrated, mineable form—not to their actual abundance in the Earth's crust. Despite the name, many rare earth elements are relatively common, but they're difficult and costly to separate and refine. They share similar traits: most are silvery, soft, and good at conducting electricity. They're also highly reactive—especially with air and moisture—and are key ingredients in everything from electric cars and wind turbines to smartphones and military systems. Even though some are classified differently on the periodic table, they behave so similarly that scientists group them all together as "rare earths."

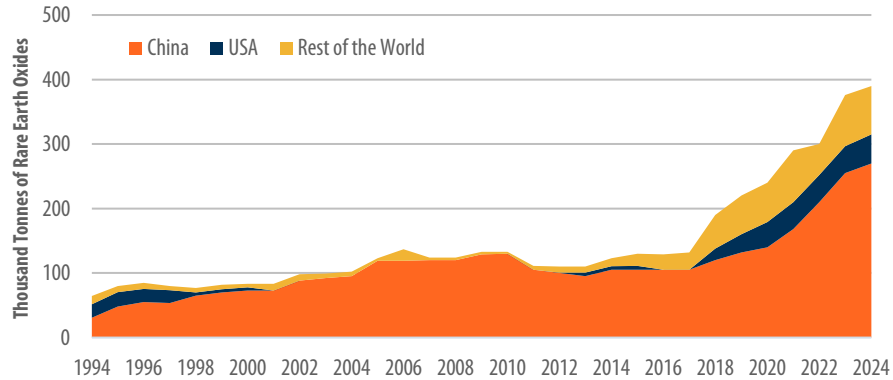
Top 10 Countries with Rare Earth Reserves



Sources: U.S. Geological Survey, First Trust Advisors. Data as of 2024.

The world's rare earth reserves are heavily concentrated in just a few countries. China holds the largest known reserves, with roughly 44 million metric tonnes, giving it both a resource and processing advantage. Brazil follows with an estimated 21 million tonnes, though production levels remain relatively low there. India possesses about 6.9 million metric tonnes, while the United States holds only around 1.9 million tonnes, primarily at the Mountain Pass mine in California. While these deposits are globally dispersed, the infrastructure to extract and refine rare earths is far less so—meaning the true bottleneck isn't just access to raw materials, but the ability to process them.

Mine Production of Rare Earths



Sources: U.S. Geological Survey (USGS), First Trust Advisors. Annual data 1994 – 2024.

China continues to dominate the global rare earth production landscape, accounting for approximately 69% of total estimated output in 2024. The United States, the second-largest producer, contributed 11.5%, with Burma following at 7.9%. This concentration of production in a few countries, particularly China's dominance, poses significant risks to global supply chains, especially considering China's control of nearly 90% of rare earth processing capabilities.