THE EDGE CONSULTANCY

The Edge Economic Update

Rare Earth Elements
U.S.-China Tensions

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Rare Earth Elements and the U.S.-China Tensions

Introduction

Rare earth elements (REEs) – a group of 17 metallic elements including the 15 lanthanides plus yttrium and scandium – have become a focal point of geopolitical and economic friction between the United States and China. These obscure-sounding elements are critical ingredients in modern technologies from smartphones and electric vehicles to fighter jets and wind turbines. Control over rare earth supply chains has thus turned into a strategic asset.

In recent years, China's dominance in rare earth mining and processing and its moves to restrict exports have stoked U.S. national security concerns, leading to policy responses aimed at reducing dependence on Chinese REEs.

This special report provides an in-depth overview of rare earth elements and their uses, the global supply chain with China's outsized role, recent developments in the U.S.–China rare earth conflict (including export curbs and counter-measures), up-to-date data on production and reserves, and an analysis of implications for global markets and power dynamics. It concludes with future scenarios and policy recommendations for navigating the rare earths rivalry.

Rare Earth Elements and the U.S.-China Tensions

Rare Earth Elements and Their Strategic Importance

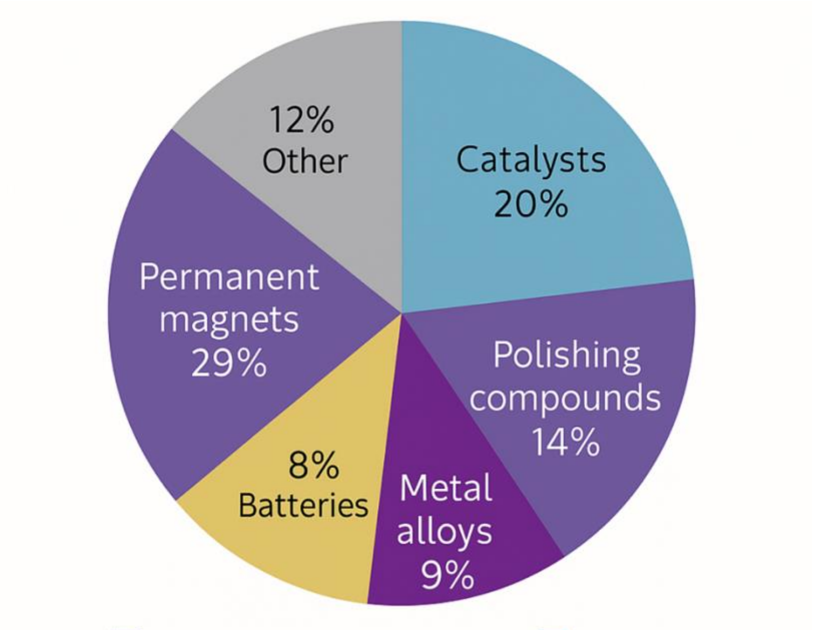
Rare earth elements are often called the "vitamins" of modern industry – used in small quantities but indispensable to countless high-tech and green applications. Despite their name, most rare earths are relatively abundant in Earth's crust; the challenge is finding economically viable concentrations and separating the elements from one another. REEs possess unique magnetic, luminescent, and electrochemical properties. This makes them critical in:

Defense systems: Powerful neodymium-iron-boron (NdFeB) magnets containing neodymium (Nd), praseodymium (Pr), dysprosium (Dy), and terbium (Tb) enable the motors and actuators in fighter jet control systems, precision-guided missiles, and unmanned drones. Samarium-cobalt magnets (using samarium and cobalt) are used in high-temperature applications like jet engine turbines and in some missile systems. The U.S. military relies on rare earths for night-vision goggles (lanthanum), laser targeting (neodymium), satellite communications, and other cutting-edge hardware. Substitutes for these roles tend to be less effective, hence REEs are considered irreplaceable for maintaining military superiority.

Electronics and communications: Rare earths are integral to consumer electronics and telecom equipment. Neodymium and praseodymium are key to making the strongest permanent magnets, found in the tiny speakers and vibration motors of smartphones, in laptop hard drives, and in high-fidelity audio systems. Europium (Eu), terbium (Tb), and yttrium (Y) are phosphors used in the LEDs and display panels of TVs, computer monitors, and smartphone screens, enabling vibrant reds and greens. Yttrium, erbium (Er), and dysprosium also appear in fiber-optic signal amplifiers and laser systems for telecommunications. In short, everything from our broadband internet infrastructure to the miniaturized components in personal gadgets benefits from rare earth materials.

Green energy and transportation: Decarbonization technologies are major rare earth consumers. Electric vehicles (EVs) use rare earth magnets in their motors – each EV can contain a few kilograms of NdFeB magnets in its drivetrain. Wind turbines rely on large rare earth magnets in their generators (a single large turbine can require two tons of NdFeB magnets). REEs like neodymium, praseodymium, dysprosium, and terbium are thus pivotal for the performance of EVs and wind power. Additionally, lanthanum (La) and cerium (Ce) were widely used in nickel-metal hydride (NiMH) batteries for earlier hybrid cars (each Toyota Prius battery contained ~10–15 kg of La). While lithium-ion chemistries have become standard for EV batteries, rare earths are still used in battery alloys and electrodes for some advanced battery designs. Rare earth-based catalysts also help refine cleaner gasoline and diesel, and cerium oxide is used in catalytic converters to reduce vehicle emissions.

Industrial applications: A host of industrial products rely on REEs. Cerium and lanthanum are important catalysts in petroleum refining and chemical production. Cerium oxide is also a premier polishing compound, used to polish optical glass, semiconductor wafers, and camera lenses to a high sheen. Europium and terbium provide the red and green phosphors in energy-efficient fluorescent lighting. Gadolinium (Gd) is used in MRI contrast agents in medicine, and scandium (Sc) is alloyed with aluminum to produce strong, lightweight metal for aerospace components and even sports equipment (most high-end aluminum baseball bats are Sc-enhanced). In metallurgy, adding small amounts of certain rare earths can improve alloy strength and heat resistance.



Estimated breakdown of rare earth element demand by sector (U.S. end-use data). Permanent magnets (29%) are the single largest use of REEs – essential for motors, generators, and many electronics – followed by catalysts (20%), polishing compounds (14%), metal alloys (9%), batteries (8%), glass additives (8%), and other uses (12%). The dominance of magnets underscores why REEs are so critical for high-tech manufacturing and clean energy.

All told, rare earths are embedded in the supply chain of diverse sectors: defense, electronics, clean energy, automotive, chemicals, and more. In the United States, the largest end-use category for REEs is the manufacture of permanent magnets (about 29% of total REE demand), followed by catalysts (~20%), polishing powders (~14%), metal alloys (~9%), batteries (~8%), and glass additives (~8%). The pie chart below illustrates the breakdown of rare earth usage by sector. Magnets are especially vital, as they enable the miniaturization and efficiency of many modern technologies. Importantly, for many critical applications there are no easy substitutes – or substitutes sacrifice performance and efficiency. This makes a secure supply of rare earth elements a strategic imperative for advanced economies.

The strategic importance of rare earths first drew widespread attention in 2010, when China – the dominant producer – was reported to have halted REE exports to Japan for two months amid a diplomatic dispute. Prices of some rare earth oxides spiked several-fold, sending shockwaves through industries dependent on these materials. That episode, though later debated as to its exact scope, served as a wake-up call to the U.S. and other nations about the geopolitical leverage wielded by whoever controls the rare earth supply. In the decade since, rare earth elements have only grown more critical as the world enters an era of electrification, digitalization, and great-power competition.

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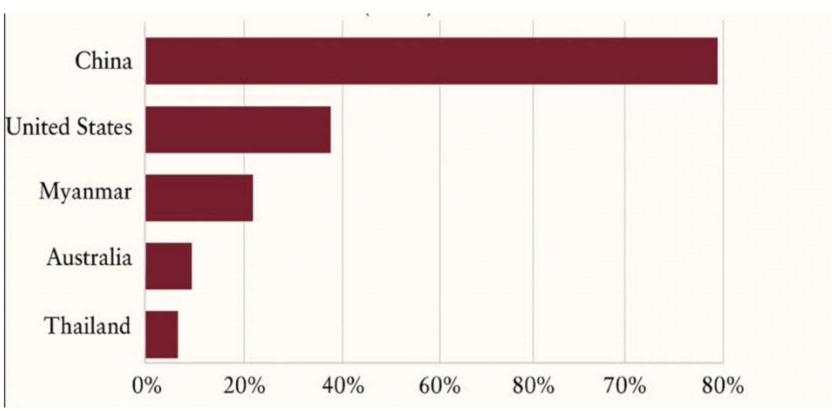
Global Supply Chains and China's Dominance

Who produces the world's rare earths? The answer, in a word, is China. While rare earth deposits exist in many countries, China has spent decades building an end-to-end supply chain and now commands a near-monopoly in this field. China is by far the largest miner of rare earth ores and the overwhelmingly dominant processor/refiner of rare earth oxides and metals. In 2024, global mine production of REEs was estimated at about 390,000 metric tons of rare-earth oxide equivalent – a nearly fourfold increase from a decade earlier as demand surged for EVs and electronics. Of that 390,000 tons, China alone accounted for roughly 270,000 tons (around 69% of world output) . The United States was a distant second with about 45,000 tons mined, and Myanmar third with about 31,000 tons. Other countries – including Australia, Thailand, and India – produce only marginal amounts by comparison.



Share of global rare earth mine production by country (2024). China produced roughly 70% of the world's rare earth ores in 2024. The United States (around 11.5%) and Myanmar (~8%) were the next largest producers, while countries like Australia and Thailand contributed smaller shares. China's dominant slice illustrates its outsized role at the mining stage.

China's grip is even tighter at the processing and refining stage. Once rare earth ore is mined, it must be separated into individual oxides or metals, an intensive process involving multiple rounds of solvent extractions and sometimes generating toxic waste. China has invested heavily in refining capacity and today operates an estimated 90% of the world's rare earth separation and processing facilities. In essence, even when rare earths are mined elsewhere, they often end up being shipped to China for refinement. For example, the sole U.S. rare earth mine at Mountain Pass in California ships its concentrated ore to China for processing into separated oxides (though new domestic processing facilities are under development). Australia's Mount Weld mine (run by Lynas Rare Earths) sends its concentrate to a Lynas-operated separation plant in Malaysia, but even that non-Chinese operation is the exception that proves the rule – virtually no other country has significant commercial REE refining capacity at scale. As a result, China produces over 90% of the global output of refined rare earth oxides and magnet alloys. An even greater proportion of downstream rare earth products (like high-performance magnets) are made in China – around 93% of the world's rare earth magnet production is in Chinese hands.

China achieved this dominance through conscious industrial strategy. In the 1980s and 1990s, while the U.S. and others saw rare earth mining as dirty and low-margin, China prioritized the sector. Chinese leader Deng Xiaoping famously quipped in 1992, "The Middle East has oil, China has rare earths." Generous government support, lax environmental regulations, and cheap labor allowed China to undercut other suppliers on cost. Over time, China moved up the value chain – progressing from extraction to separation, refining, metallurgy, and finally to manufacturing of advanced components like magnets. By the 2000s, China's low-priced exports had driven most competitors out of business, and Chinese firms (often state-owned or state-aligned) consolidated control over rich deposits such as Bayan Obo in Inner Mongolia – the world's largest rare earth mine.

Today, China is the only country that has a fully integrated rare earth supply chain from mine to magnet. This end-to-end dominance gives Beijing significant leverage. It also creates a critical vulnerability for manufacturing nations: any disruption in Chinese rare earth exports can choke off supply of materials essential to high-tech manufacturing. The U.S. learned this the hard way after China's 2010 export halt to Japan, and again during the U.S.–China trade war in 2018–2019 when Chinese officials openly floated cutting off REEs as a countermeasure. Even in normal times, China's market power allows it to influence rare earth prices – for instance, flooding the market to depress prices and make non-Chinese projects uneconomical, or restricting output to drive prices up. The sharp collapse of rare earth prices around 2015 (after a brief spike post-2010) led to the bankruptcy of the U.S.'s then-primary producer Molycorp, illustrating how China's production decisions can make or break foreign ventures.

Another consequence of China-centric supply is that other countries' rare earth resources remain underdeveloped despite sizable reserves. The U.S. Geological Survey estimates that global rare earth reserves (economically mineable deposits) are on the order of 110–130 million metric tons of contained REO, distributed in many regions. For example, Vietnam, Brazil, Russia, India, Australia, the U.S., and others together hold tens of millions of tons in reserves. Yet China's head start in production means those reserves have seen limited exploitation so far. Notably, China itself holds about 37% of the world's known rare earth reserves (44 million tons), but it produces far more than that proportion of supply – indicating its intensive mining of domestic resources. Countries like Brazil and Vietnam have substantial untapped deposits (Brazil ~21 million tons, Vietnam's estimate recently revised to ~3.5 million tons). Australia has about 5–6 million tons of reserves and is ramping up new mines. The United States' reserves are relatively small by comparison (~1.9 million tons) , concentrated at the Mountain Pass deposit and a few undeveloped sites. In short, the raw materials exist globally, but developing a mine and, more critically, the processing capacity, is a long, capital-intensive endeavor – one that China has already mastered and others are only beginning to invest in.

It's also important to note the environmental dimension of the rare earth supply chain. Rare earth extraction and processing can generate toxic and radioactive waste (many REE ores contain thorium or uranium that end up in tailings). China's dominance was partly enabled by tolerating pollution that stricter regulations in the U.S., Japan, and Europe would not allow. There are infamous toxic lakebeds near REE refineries in Inner Mongolia, and Southern China's ionic clay mines (which produce heavy rare earths like Dy and Tb) caused severe soil and water contamination. In recent years, China actually shuttered some of its most polluting mines and imposed production quotas to manage environmental fallout. However, an unintended result was that many independent Chinese processors turned to importing feedstock from elsewhere – notably from unregulated mining in Myanmar just across the border. Illegal rare earth mines in northern Myanmar's Kachin state have proliferated to feed Chinese demand for heavy rare earths, with devastating effects on local ecosystems. As of mid-2022, investigators identified 2,700+ leaching ponds gouged into Myanmar's hillsides for rare earth extraction, in an area collectively the size of Singapore, causing severe groundwater pollution and landslides. This opaque supply chain from Myanmar now supplies a significant portion of China's heavy rare earth inputs. The environmental and human toll of rare earth mining thus often remains hidden from end consumers but is very much part of the global supply chain equation.

In summary, China today exerts choke-point control over rare earth elements – mining the majority of REEs and processing an even larger share, while other nations remain dependent at various stages. As the next section details, this dominance has become a flashpoint in U.S.–China relations, with both sides maneuvering to secure these vital materials.

U.S.–China Tensions over Rare Earths

Rare earth elements have moved from a niche topic to center stage in the broader U.S.–China strategic rivalry. For China, its dominance in REEs is a source of economic strength and a potential geopolitical lever. For the United States, reliance on Chinese rare earths is now seen as a critical vulnerability – especially for defense and high-tech sectors – that must be urgently addressed. This dynamic has led to rising tensions, export restrictions, and a flurry of policy actions on both sides.

China's "Rare Earth Weapon" – Export Controls and Leverage

Beijing has not been shy about wielding its rare earth supremacy. The 2010 embargo on Japan during the Senkaku Islands spat was the opening salvo, sending a message that China could use resource access as a diplomatic weapon. In the late 2010s, as trade disputes with the U.S. escalated, Chinese state media and officials again floated the idea of cutting off rare earth supplies. An editorial in 2019 warned that products made from China's rare earths should not be used to thwart China's development – a veiled threat amid U.S. sanctions on Chinese tech firms.

In the past two years, China has taken concrete steps to tighten its grip, especially in response to U.S. moves. In December 2023, China's Ministry of Commerce announced a ban on exports of certain rare earth processing technologies. This measure prevents Chinese companies from sharing the know-how or equipment for REE separation – effectively trying to stop other countries from building their own refining capabilities. Then in April 2025, Beijing made a dramatic move: it introduced export restrictions on seven rare earth elements and related magnet products. This was explicitly framed as retaliation for U.S. trade measures (the U.S. had imposed new tariffs on Chinese goods, and China responded in kind using critical minerals). The restrictions caused immediate shortages around the world and sent industrial consumers scrambling. Among the targeted materials were several heavy REEs vital for magnet alloys. Chinese customs and regulators began requiring special export licenses for these items, slowing or denying shipments.

After rounds of negotiations, U.S. and Chinese officials reached a 90-day trade truce in mid-2025, which included China agreeing to ease rare earth flows temporarily. However, the truce was short-lived. U.S. negotiators accused Beijing of backtracking by delaying export licenses, and by the fall of 2025 China was *again ratcheting up controls*. In October 2025 – just weeks ahead of a planned presidential summit – China dramatically expanded its rare earth export controls to cover 5 additional elements (holmium, erbium, thulium, europium, ytterbium), bringing the total to 12 of the 17 REEs under some form of restriction. Beijing also added dozens of rare earth alloys and magnet manufacturing technologies to its export control list. Notably, the new rules extended extraterritorial reach: foreign companies that use Chinese-origin rare earth materials or Chinese-made equipment in their production process must now obtain Chinese government approval to export their end products. In other words, even if a magnet is made in Japan or Vietnam, if it contains trace amounts (>0.1%) of Chinese-sourced REEs or was made with Chinese technology, China wants a say in whether it can be shipped abroad. This mirrors the U.S. use of the Foreign Direct Product Rule in semiconductors, and it underscores how China is leveraging its supply chain dominance to exert *downstream control* over who ultimately gets rare earth products.

Beijing's official stance is that these measures are about protecting national security and resource value. Chinese authorities note that the U.S. and Europe also have export control regimes, and argue that China's new rare earth licensing rules are "consistent with international practice" . A Chinese Ministry of Commerce spokesperson in October 2025 rebuked U.S. complaints, saying Washington had "grossly distorted" China's policies and *"deliberately stoked unnecessary panic"*. She insisted that licenses would be approved *"provided the export applications are compliant and intended for civilian use"*, implying the controls are aimed mainly at military end-uses. In practice, however, the distinction between civilian and military demand is not always clear-cut. Analysts worry that China could leverage bureaucracy – by slow-rolling or denying licenses – to hit foreign defense contractors indirectly. For example, an export curb ostensibly on civilian magnet products could still disrupt supplies for a U.S. missile guidance system, since many magnet producers serve both commercial and defense customers.

Crucially, Chinese leaders seem keenly aware of the leverage their rare earth dominance affords. As an analyst from Eurasia Group noted, *"China's ability to throttle rare earth exports is an exceptionally powerful tool"*, one that could sow insecurity among advanced economies reliant on these inputs. Another analyst described it as China's "key card" in trade negotiations with the U.S.. Indeed, during 2025, the pattern of escalation suggests China strategically timed its restrictions around trade talks and tariff deadlines. By squeezing rare earth shipments in the spring of 2025, Beijing put pressure on U.S. negotiators, then offered relief in a June deal – only to tighten the screws again by autumn when talks faltered. This cat-and-mouse game underscores that rare earths have become a form of geopolitical currency. From China's perspective, curbing rare earth exports serves multiple purposes: it punishes adversaries (or at least reminds them of their dependency), encourages foreign companies to relocate high-tech manufacturing to China (to ensure access to inputs), and elevates global prices to the benefit of Chinese producers. Of course, this approach is not without risk for Beijing – overplaying the rare earth card could backfire by accelerating supply diversification elsewhere. But so far, China has calculated that its dominance is unassailable in the short term, giving it free rein to tighten export conditions in the pursuit of broader strategic goals.

U.S. National Security Concerns and Policy Responses

The United States, for its part, has grown increasingly alarmed at the prospect of being cut off from rare earth supplies. A stark indicator of dependency: as of the late 2010s, 80% or more of U.S. rare earth imports (in oxide, metal, or magnet form) were coming directly from China. Even where the U.S. has domestic mines, the lack of processing means it effectively *imports* the refined products from China after raw ore is sent there. This reliance is viewed as a serious strategic vulnerability. Pentagon officials often note that if China were to embargo rare earths, it could cripple U.S. defense production within months – a scenario of supply-chain shock with grave national security implications.

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Policymakers in Washington have accordingly moved on multiple fronts to reduce Chinese rare earth dependence. Key U.S. actions and developments include:

Defense procurement requirements: The U.S. Congress has acted to bar Chinese rare earth materials from American defense supply chains. A provision in the FY2023 National Defense Authorization Act (expanded in FY2024) prohibits the Department of Defense from buying any weapon systems that include Chinese-origin rare earth magnets or metals after 2026. Effective January 1, 2027, Defense contractors must certify that no samarium-cobalt or neodymium-iron-boron magnets (and certain other materials like tungsten) in their products are sourced from China (or Russia, Iran, North Korea) . This looming ban forces a complete overhaul of sourcing for defense contractors, from giants like Lockheed Martin down to small component suppliers. It essentially sets a hard deadline for the U.S. to stand up alternate mine-to-magnet supply chains. Failure to do so could result in production line stoppages for critical defense programs if waivers aren't granted. (Notably, the law allows waivers if no viable alternative exists, but the intent is clearly to minimize such exemptions.)

Government investment in domestic capacity: To meet these goals, the U.S. government has been directly investing in rebuilding its rare earth industrial base. Since 2020, the Pentagon has poured hundreds of millions of dollars under the Defense Production Act (DPA) into rare earth projects. This includes funding for new separation and refining facilities: for example, the U.S. Department of Defense awarded contracts to Lynas (Australia's Lynas Corp.) to establish a heavy rare earth separation plant in Texas, and to MP Materials (which owns Mountain Pass mine) to develop light rare earth separation in California. In a landmark deal in mid-2025, the Pentagon (through the newly renamed Department of War) even took an equity stake of $400 million in MP Materials, becoming its largest shareholder. This investment came with a guaranteed purchase agreement – a 10-year offtake contract for all of MP's future magnet production – and even a price floor commitment for NdPr oxide, to ensure MP remains profitable despite China's price volatility. The Department of Defense has also expanded its strategic stockpile of rare earth materials: plans were made to acquire hundreds of tons of NdPr oxide, NdFeB magnet blocks, and samarium-cobalt alloy for the National Defense Stockpile. By stockpiling and backing domestic producers financially, the U.S. aims to buffer its defense sector against potential Chinese cut-offs.

Alliances and friend-shoring: U.S. strategy also emphasizes working with allied countries to develop alternative sources. In 2022, the U.S., Australia, and Japan launched a trilateral partnership to invest in critical mineral projects, with rare earths a priority. Australia (a close U.S. ally) is home to Lynas, the largest non-Chinese rare earth miner, and new Australian projects (like Arafura Resources' Nolans project) could supply significant volumes in coming years. The U.S. and Australia have signed agreements to coordinate on rare earth processing and to share technology and data to expedite new capacity. Similarly, the U.S. has engaged with Canada (which has several early-stage REE projects) and European partners to create a more diversified supply network. In March 2023, the U.S. and EU launched a Minerals Security Partnership that includes rare earths and aims to mobilize investment in sustainable mining globally. Even Vietnam – which holds promising heavy rare earth deposits – has been courted by the U.S. and Japan for potential development, though corruption scandals there have slowed progress. Japan, having felt the brunt of the 2010 embargo, has been proactive for years: it funded Lynas's rise, invested in Indian and Australian rare earth projects, and built up some recycling capabilities. The U.S. is now tapping into those allied efforts. For example, in 2024 the U.S. signed a critical minerals agreement with Japan to facilitate sharing of critical mineral supply (though focused on battery minerals, it set a cooperative tone). Overall, "friend-shoring" supply chains – i.e. sourcing from allies rather than adversaries – is a key U.S. objective in rare earths.

Domestic mining and R&D: The U.S. is also promoting new domestic mining ventures and research. Aside from Mountain Pass, which reopened in 2017 under MP Materials and is increasing output, there are exploration projects in states like Texas, Wyoming, and Alaska to tap rare earth deposits (e.g. Round Top in Texas, Bear Lodge in Wyoming). The Department of Energy has funded R&D into extracting rare earths from unconventional sources such as coal mine waste and acid mine drainage. In one 2024 initiative, DOE earmarked $17.5 million for pilot projects to recover REEs from coal by-products – a potential two-birds-one-stone solution to reclaim waste and produce strategic minerals. Federal agencies are also investing in recycling technologies to retrieve rare earths from end-of-life electronics and magnets. While recycling is still nascent (current rare earth recycling rates are very low), it could eventually contribute to supply. On the legislative side, bills have been proposed to streamline mine permitting for critical minerals and to provide tax credits for establishing rare earth separation facilities in the U.S.

Trade measures and diplomacy: U.S. officials have not ruled out using trade tools to ensure access to rare earths. In the past, the U.S. (along with the EU and Japan) filed a WTO case against China's rare earth export restrictions in 2012, which led to China removing its export quotas by 2015. If China's new controls violate trade agreements, similar legal challenges or retaliatory tariffs could be on the table. Indeed, during 2025's tit-for-tat exchanges, President Donald Trump threatened to impose 100% tariffs on all Chinese goods if Beijing didn't reverse the rare earth curbs. This high-stakes brinkmanship shows how the rare earth issue has moved into the foreground of trade negotiations. U.S. officials have described China's actions as a "supply-chain power grab" and are using diplomatic forums (G7, Quad, etc.) to rally allies around the urgency of securing critical minerals supply.

The combined effect of these U.S. responses is a drive toward an independent or allied rare earth supply chain, "from mine to magnet," by the later 2020s. There have been some notable milestones. By late 2024, Mountain Pass had restarted its on-site processing facility, meaning the U.S. can once again produce modest amounts of separated light rare earth oxides domestically (for the first time since 2002). A magnet manufacturing facility in North Carolina (run by Noveon Magnetics) began pilot production, and MP Materials is building a large magnet factory in Texas scheduled to produce 1,000 tons of magnets annually in initial phases. Lynas's Texas plant for heavy REEs is expected to come online around 2026. U.S. defense contractors, under pressure from the 2027 ban, are auditing their supply chains and in some cases preemptively stockpiling parts.

However, significant challenges remain. For one, scaling up a full supply chain will take time. Even optimistic Pentagon projections say that by 2027, U.S. allied production might meet only a portion of domestic demand. For perspective, one analysis noted that MP's planned output of 10,000 tonnes of magnets by 2030 is only about half of projected U.S. demand at that time. Additionally, creating parallel supply chains is costly – non-Chinese REE products currently have higher production costs, and ventures depend on sustained government support to compete with China's economies of scale. There are also weak links such as heavy rare earth separation (needed for Dy, Tb), which is technically challenging; the U.S. will rely on Lynas and perhaps new projects for that. Recognizing these gaps, U.S. defense officials have warned that *"we can no longer afford to rely on overseas single points of failure"* for critical materials. The Chinese discovery of a forbidden Chinese magnet alloy in the F-35 fighter jet in 2022 – which temporarily halted F-35 deliveries – was a "Sputnik moment" that galvanized Congress into action. The year 2025 has only deepened the urgency, as Chinese export license delays reportedly forced some U.S. drone makers to pause production for weeks. Such incidents drive home the point famously quoted by one defense analyst: *"No minerals, no missiles."*

In summary, the U.S. is throwing policy weight and funding behind disentangling itself from Chinese rare earths. This marks a significant shift from a decade ago when market forces were expected to sort out any supply issues. Now it is accepted in Washington that government intervention and allied coordination are needed to ensure supply chain security for these strategic elements.

By the Numbers: Recent Production, Trade and Investment Trends

The rare earth sector is rapidly evolving, with output rising outside China even as Chinese production also grows. Below are some recent data highlights that illustrate the state of play:

Global Production: As noted, world mine production reached ~390,000 metric tons in 2024, up from 300,000 in 2022 and around 100,000 a decade ago. China's share has consistently been 60–70% of output, though its volume has expanded (from ~210,000 tons in 2022 to 240,000 in 2023, and an estimated 270,000 in 2024). The United States produced 43,000–45,000 tons in 2022–2024, all at Mountain Pass. Myanmar's production spiked from ~12,000 tons in 2022 to ~38,000 in 2023 (likely due to increased Chinese-backed extraction in Kachin), before possibly dipping to ~31,000 in 2024 as Chinese authorities imposed import controls to curb illegal mining. Australia has held steady around 13,000–18,000 tons annually, and is poised to increase as Lynas and new mines ramp up. Other countries like Thailand, India, Russia, and Madagascar each produce on the order of only a few thousand tons or less. The data underscore how concentrated production is, though the non-Chinese share has grown modestly in recent years.

Reserves and Resources: Global rare earth reserves are estimated at roughly 120 million metric tons of contained REO (this figure can shift with exploration and re-assessment; earlier USGS figures were ~130 million, revised down after Vietnam and Russia reduced their reported reserves). The largest reserves are in China (~44 million tons), Vietnam (previously thought 22 million, now ~3.5 million after reassessment), Brazil (~21 million) , Russia (~3.8 million after a downgrade from 10 million) , India (~6.9 million) , Australia (~5.7 million), and the United States (~1.9 million) . Additionally, significant rare earth resources (not yet counted as proved reserves) have been identified in places like Greenland (over 1.5 million tons in two major deposits) and Sweden (over 1 million tons in a newly discovered deposit). These numbers indicate that geological availability is not the most immediate constraint – rather, it's economic and geopolitical factors determining where new production comes online.

Trade and Processing: China's dominance in processing is reflected in trade flows. In 2024, China exported tens of thousands of tons of rare earth oxides and finished magnet products, but those exports have become volatile due to policy changes. For instance, Chinese exports of rare earth magnets totaled ~39,800 tons in the first 9 months of 2025, which was down 7.5% year-on-year– a drop attributable to new export license requirements causing bottlenecks. Notably, in September 2025, China's rare earth magnet exports fell over 28% to the United States (month-on-month), even as shipments to some other countries rose or held steady. Major destinations for Chinese rare earth magnets include Germany, Japan, South Korea, Vietnam, and the U.S.. This indicates that while the U.S. is a key end-user, a significant share of Chinese REE exports also feed industries in U.S. allies (Germany's auto industry, South Korea's electronics, etc.), meaning any Chinese restriction reverberates through global supply chains, not just America.

Pricing: Rare earth prices have historically been highly volatile. Neodymium-praseodymium (NdPr) oxide, a benchmark for magnet materials, saw prices soar in 2010–2011, crash by 2015, spike again in 2017, and fluctuate during the trade war. In early 2022, rare earth magnet prices jumped sharply amid post-COVID demand and speculation that China might impose export controls; they then softened in 2023 as supply caught up and Tesla's rare-earth-free motor announcement dampened sentiment. As of late 2025, prices for key REOs have been on a roller coaster: dysprosium and terbium (critical for high-temperature magnets) jumped when China tightened heavy RE export quotas, whereas lighter REEs like cerium remain relatively cheap due to oversupply. China's practice of periodically flooding the market or holding back supply makes forecasting prices difficult. This price volatility is one reason Western companies worry about relying on a single source – huge price swings can disrupt manufacturing economics, quite apart from the risk of physical shortage.

Investment and new projects: Global investment in rare earth mining and refining has surged since 2020. Outside China, over \$10 billion in new rare earth-related projects have been announced or are underway. In Australia, Lynas is expanding its Mt. Weld mine output by 50% and building a new refinery; Australian startup Hastings Technology Metals is developing the Yangibana mine to produce NdPr concentrates by 2026. The U.S. saw multiple companies go public or receive grants for rare earth projects, from MP Materials (which completed a SPAC IPO in

2020) to junior miners like Texas Mineral Resources and USA Rare Earth teaming up on the Round Top deposit. European efforts are also notable: the EU's 2023 Critical Raw Materials Act set a target of 10% of EU rare earth consumption to be mined domestically and 40% to be processed domestically by 2030. Projects in Norway, Estonia (an existing small separation plant), and Sweden's new discovery are in exploration stages. Japan's government-backed initiatives include funding recycling and a potential partnership with Vietnam to develop mines. Meanwhile, China is not standing still – it reorganized its domestic industry in 2021 by merging key producers into a state-owned behemoth (China Rare Earth Group) to better control output and prices. Chinese firms are also investing overseas: for example, state-owned Shenghe Resources holds stakes in a rare earth project in Greenland and is involved in Myanmar mining through intermediaries. Thus, investment is global, but many of these projects will take years to reach fruition and may still rely on Chinese technical input or markets.

Taken together, the data show a race against time: non-Chinese production is inching up and new sources are being pursued, but China remains the 800-pound gorilla in the room. In the near term, any supply shock – whether from a Chinese export ban or a disruption in Myanmar's output – could send the market into turmoil. Conversely, if all the planned non-Chinese projects come online by late this decade, we could see a more diversified supply and potentially even periods of oversupply. The next section explores what these developments mean for global markets and geopolitical power.

Implications for Global Markets and Geopolitics

The rare earth tug-of-war between China and the U.S. is already reshaping industries and alliances. Several key implications emerge:

1. Supply Chain Decoupling and "Bifurcation": The push from both sides – China localizing its control and the U.S./allies building alternate supply lines – points toward a structural bifurcation of the global rare earth supply chain. In a scenario increasingly discussed by analysts, we could end up with *two parallel rare earth ecosystems*: one centered in China, serving primarily Chinese and some Global South markets; and another centered in the U.S./EU/allied nations, with feedstock from non-Chinese mines and processing plants. This decoupling is driven by security concerns, but it likely brings inefficiencies (duplicate capacity) and higher costs (as non-Chinese production is more expensive). For multinational companies, bifurcation may force tough choices – for instance, an electronics manufacturer might need to certify a "China-free" magnet supply chain for products sold to the U.S. military, while still sourcing cheaper Chinese magnets for commercial goods in other markets. Over time, such divided technical standards could slow innovation and raise prices for end consumers.

2. Market Volatility and Industrial Impact: In the interim before new supply chains are fully established, markets remain vulnerable to price spikes and shortages. A sharp embargo or even a prolonged licensing slowdown from China could cause certain REE prices to skyrocket, similar to 2010. That would directly affect industries: high dysprosium prices, for example, raise the cost of neo magnets used in EV motors and wind turbines, potentially making those products more expensive and slowing the green energy transition. We have already seen automakers respond – Tesla's rare-earth-free motor plan is one example of industry hedging against future scarcity. Other automakers like Toyota and General Motors have been investing in research to thrift or eliminate rare earths in motors (using redesigned motors like induction or wound-field motors that need no RE magnets, albeit often with efficiency trade-offs). If rare earth supply becomes unreliable, more companies will follow suit, potentially leading to *technological shifts* – e.g. a resurgence of alternative motor technologies, or development of new magnet materials (like iron-nitride magnets or improved ferrite magnets) that bypass scarce heavy REEs. In the electronics realm, manufacturers might increase recycling of disk drive magnets or redesign components to use fewer REEs if prices climb. In the defense industry, contractors may need to redesign systems to accommodate non-REE components or at least multi-source every critical magnet and alloy.

3. Leverage and Geopolitical Power: Control of rare earths confers leverage in the geopolitical arena. China's ability to use REEs as a bargaining chip gives it a form of asymmetrical power vis-à-vis the U.S. This could be significant in a crisis scenario – for example, in a future confrontation over Taiwan, China could embargo rare earth exports to the U.S. and its allies as a punitive measure. The impact on Western defense production could hamper wartime readiness (though the U.S. would likely have emergency stockpiles by then, the question is for how long they could last). More broadly, countries rich in critical minerals (rare earths and others like lithium, cobalt, etc.) are becoming key players to court. We may see a realignment of partnerships: nations in Africa or Asia with rare earth deposits could receive increased investment from the U.S. and allies as they seek to counter Chinese influence. For instance, resource-rich countries like Brazil or India (both have notable REE reserves) might use interest from multiple suitors to their advantage. However, Chinese firms are already well-entrenched in many developing countries' mining sectors, sometimes giving China a head start in those relationships.

4. Global Tech Leadership: Rare earth availability is tied to leadership in high-tech and green industries. If one country can guarantee ample supply of critical materials at stable prices, its companies have an edge in innovating and scaling up technologies like EVs, wind turbines, advanced weapons, etc. China's near-monopoly has arguably given Chinese companies a reliable input and the ability to become leading manufacturers of things like permanent magnets and electric motors. If the U.S. and allies manage to foster a competing supply chain, it could level the playing field and even tilt some advanced industries back toward Western countries (for example, a domestic magnet supply could spur more U.S. electric motor manufacturing). On the flip side, if diversification falters and China retains its stranglehold, Western industries might face chronic insecurity that hampers long-term investment – or they may be forced to relocate parts of their manufacturing to China to secure material supply, effectively ceding some technological ground.

5. Alliances and Security Blocs: The rare earth conflict also reinforces the formation of economic security blocs. Within NATO, for instance, there is growing emphasis on securing supply chains for critical materials jointly. The European Union's Critical Raw Materials Act is partly inspired by the rare earth risk, and it sets targets for internal capacity (though the EU will still need imports). The Quad (U.S., Japan, Australia, India) has a working group on critical and emerging technologies that includes minerals collaboration. These initiatives strengthen alliances but also deepen the divide with China. We could see something akin to an OPEC-like arrangement but in reverse – a *buyers' club* of rare earth importers coordinating stockpiles, sharing intelligence on supply, and jointly negotiating with suppliers. Already, the U.S. and Japan periodically share notes on rare earth market trends and coordinate approaches to China on this issue.

6. Developing Nations and Ethical Dimensions: Another implication is how the scramble for rare earths might affect developing countries that have these resources. There is risk of the "resource curse" or environmental harm if, say, African nations with potential rare earth mines (such as Burundi, which has a new REE mine, or Madagascar) ramp up production without strong governance. However, there's also opportunity: Western investment comes with pressure for higher environmental and labor standards, which could help set better norms in mining compared to the laissez-faire (or illicit) operations currently seen in Myanmar. If Western companies and governments truly prioritize "sustainable sourcing" of rare earths, it could lead to improved mining practices globally – though it might also increase costs. Ethical sourcing will likely become a topic: akin to conflict-free diamonds or sustainable palm oil, we may hear of "responsibly sourced rare earths" initiatives, which would have been unheard of when China was the only supplier.

In essence, rare earth elements have graduated from a wonky topic in materials science to a central issue in international economics and security. The global market impact is a mix of heightened innovation (as industries adapt) and heightened risk (as supply chains fragment). And in the big picture of geopolitics, rare earths exemplify how economic interdependence can become a vulnerability in times of rivalry. The current trajectory suggests rare earths will remain a hotspot in U.S.–China relations, with ripple effects worldwide.

Future Outlook

Looking ahead, there are several scenarios for how the rare earth contest could unfold - Possible Future Scenarios:

Scenario 1: Continued Escalation – "Resource Weaponization." In this scenario, U.S.–China relations remain tense or worsen. China might fully weaponize rare earth exports in a crisis, perhaps imposing a total ban to U.S. and allied countries. This would cause immediate disruptions in manufacturing, potentially forcing layoffs or factory stoppages in sectors from defense to automotive in those countries. Prices for certain REEs would skyrocket globally. The U.S. and allies would respond by activating emergency stockpiles, fast-tracking any available alternative supplies, and possibly retaliating with sanctions on Chinese tech exports or other goods. Such a scenario could also push China to keep more of its rare earth output for its own industries (a form of self-sanctioning to buffer domestic tech manufacturing from foreign pressures). The result would be a *hard decoupling*: Western industries might permanently shift away from any Chinese REE inputs, no matter the cost, and China would accelerate efforts to substitute or internally source anything it still imported (for instance, China still imports some rare-earth-containing products like certain catalysts or specialized magnets). Geopolitically, this would deepen mistrust and could be a prelude to broader economic conflict or even military confrontation.

Scenario 2: Partial Detente and Managed Trade. It's conceivable (though challenging) that the U.S. and China reach an accommodation on rare earths as part of a trade deal. For example, China could agree to exempt rare earth materials from any trade embargoes and to honor a steady supply commitment, in exchange for something like the lifting of certain U.S. tariffs or export bans on semiconductors. This would effectively neutralize rare earths as a weapon, treating them more like a public good or at least a commodity to be kept outside the conflict. The precedent here might be how the Soviet Union still sold oil and gas to the West even during the Cold War. However, given the strategic value, such a stable arrangement might be fragile – each side would remain wary. In this scenario, both sides might still pursue supply diversification, but with less urgency, and markets would be less volatile. A variant of this could be multilateral frameworks – perhaps through the WTO or a new critical minerals agreement – that impose rules on export controls for critical materials. This is idealistic but not impossible if enough nations see benefit in preventing resource wars.

Scenario 3: Successful Diversification – "Redundant Supply Chains." Here, the U.S. and its allies succeed by the late 2020s in building a robust rare earth supply chain largely independent of China. New mines in Australia, the U.S., Canada, etc., are operational; processing plants in the U.S. and Europe meet most of allied demand; recycling contributes a small but growing share; and magnet production capacity is established in North America, Japan, and Europe. China remains a major producer but its share of global output might fall from ~70% to closer to 50% or even lower. In this world, China loses much of its leverage, as consumers have alternative sources to turn to. We could even see excess capacity that leads to competition and potentially lower prices long-term (benefiting manufacturers). China, noticing its waning dominance, might try to undercut competitors with price dumps, but government-supported operations in the West could endure temporary losses. Ultimately, this scenario makes rare earths more of a normal commodity market, less prone to politicization. The downside is the duplication of facilities and environmental impacts of mining in more places, but the upside is resilience.

Scenario 4: Technological Breakthrough – "Demand Destruction." Another possibility is that innovation significantly reduces reliance on rare earths altogether. For instance, if scientists develop a new class of powerful room-temperature superconductors or alternative magnet materials, the demand for NdFeB magnets could drop. Or if EV motors move wholesale to rare-earth-free designs without performance loss (say, new motor architectures or wireless power transfer tech), the auto industry's consumption of REEs could plunge. Similarly, advances in nanotechnology might yield new types of catalysts or phosphors not reliant on these specific elements. While no such breakthrough is guaranteed, heavy R&D is underway in magnetics and materials science. If a disruptive technology emerges, China's "trump card" could be dramatically weakened as the world shifts to alternatives. However, given current physics and engineering knowledge, incremental improvements are more likely than total elimination of REEs in the next decade. So this scenario would probably play out beyond the 2030 horizon if at all.

Conclusion

Rare earth elements will likely remain a *strategic hot potato* in the near future – a linchpin resource connecting the global ambitions of the U.S. and China. Ensuring reliable access to these "hidden" yet crucial materials is now recognized as a matter of national security and economic stability.

The U.S.–China rare earth tussle is driving a reconfiguration of supply chains that could fundamentally alter the landscape of tech manufacturing and trade. While China currently enjoys the upper hand, the concerted efforts of the U.S. and its allies can gradually mitigate that dominance.

Policymakers must navigate this challenge with a mix of resolve (to build resilience) and caution (to avoid unnecessary escalation), all while fostering innovation that might eventually reduce our dependence on any single group of elements or single country.

The rare earths saga underscores a broader lesson: in a technology-driven world, mastery over critical materials translates to geopolitical power. How that power is managed – cooperatively or coercively – will shape not just markets, but the balance of global influence in the years to come.

Rare Earth Elements and the U.S.-China Tensions

Sources & Links: The information and data in this report are drawn from a range of up-to-date sources, including U.S. Geological Survey reports, industry analysis, and recent news from Reuters, CSIS, and other expert outlets. Key references include USGS Mineral Commodity Summaries (2023–2024) for production and reserve figures, analysis by the Center for Strategic and International Studies for details on China's export control measures and U.S. defense supply chain vulnerabilities, Reuters news reports for the latest developments on Chinese export restrictions and U.S. policy moves, and industry publications like Investing News Network and Rare Earth Exchanges for context on reserves, market shares, and legislative actions. These and other cited sources provide a fact base for understanding the evolving rare earth landscape amid U.S.–China tensions.

REE - Rare Earth Elements - Metals, Minerals, Mining, Uses
https://geology.com/articles/rare-earth-elements/

China's New Rare Earth and Magnet Restrictions Threaten U.S. Defense Supply Chains
https://www.csis.org/analysis/chinas-new-rare-earth-and-magnet-restrictions-threaten-us-defense-supply-chains

Rare Earths Reserves: Top 8 Countries | INN
https://investingnews.com/daily/resource-investing/critical-metals-investing/rare-earth-investing/rare-earth-reserves-country/

Rare Earth Elements copy
https://www.energy.gov/sites/prod/files/2020/02/f71/Rare%20Earth%20Elements%20Infographic.pdf

Revisiting the China–Japan Rare Earths dispute of 2010 | CEPR
https://cepr.org/voxeu/columns/revisiting-china-japan-rare-earths-dispute-2010

Top 10 countries by rare earth elements production DevelopmentAid
https://www.developmentaid.org/news-stream/post/193928/top-countries-by-rare-earth-elements-production

China expands rare earths restrictions, targets defense and chips users | Reuters
https://www.reuters.com/world/china/china-tightens-rare-earth-export-controls-2025-10-09/

Mineral Commodity Summaries 2024
https://pubs.usgs.gov/periodicals/mcs2024/mcs2024-rare-earths.pdf

China blames US for global panic over rare earths controls | Reuters
https://www.reuters.com/world/china/rare-earths-tensions-rise-us-china-trade-barbs-2025-10-16/

Fall in China's exports of rare earth magnets stokes supply chain fears | Reuters
https://www.reuters.com/world/asia-pacific/china-september-rare-earth-magnet-exports-fall-6-seven-month-high-2025-10-20/

The Pentagon's Rare Earth Ultimatum: Ban on Chinese Materials by 2027
https://rareearthexchanges.com/news/the-pentagons-rare-earth-ultimatum-ban-on-chinese-materials-by-2027/

Tesla hits the brakes but rare earths juggernaut rolls on | Reuters
https://www.reuters.com/markets/commodities/tesla-hits-brakes-rare-earths-juggernaut-rolls-2023-03-08/

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