TRILATERAL ENERGY SECURITY COMMITTEE

SECURING CRITICAL MINERAL SUPPLY CHAINS:
LESSONS FROM JAPAN AND OPPORTUNITIES FOR TRILATERAL COOPERATION

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Contributors

To inform this report, we conducted interviews with a diverse group of experts representing a range of sectors and all three countries central to this study, the United States, Japan, and South Korea. These contributors included:

- **Leading Think Tank representatives (2)**
- **Academic Experts (1)**
- **Industry Professionals (4)**
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Their insights and perspectives were instrumental in shaping the analysis and recommendations presented in this report. We gratefully acknowledge their time and expertise.

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Securing Critical Mineral Supply Chains:

Lessons from Japan and Opportunities for Trilateral Cooperation

China's dominance in the rare earth elements (REEs) market poses significant challenges for many industrialized countries in the world. The vertically integrated supply chain established by China, supported by sustained industrial policy, has created a trade network that constrains diversification of suppliers and subsequently creates vulnerabilities through reliance on one supplier (Park et al., 2023). Additionally, the pragmatic reality, particularly the high costs of sourcing alternatives and the slow process of increasing domestic production capabilities exacerbate the situation. This has allowed China to, at times, weaponize exports of REEs for political goals. The United States, South Korea, and Japan (hereafter, the Triad) are among the countries that are negatively impacted by this monopoly and this paper proposes that the three collaborate to produce practical solutions.

Based on Japan's lessons learned over the past decade in reducing its dependence on Chinese critical minerals (what was attempted, what proved effective, and what was less successful), this paper proposes practical solutions and policy recommendations that the U.S. government could adopt in the short term. Furthermore, trade policy should be strategically implemented with concerns about rare earth metals in mind to ensure that downstream products such as automobiles and defense systems are not negatively impacted. Domestic industrial policies should also be coordinated among the Triad to limit and reduce China's share in key industries and to jointly develop robust supply chains for critical minerals.

Japan's Lessons Learned: A Systematic Analysis

Japan's experience following China's 2010 export suspension provides crucial insights for developing effective critical minerals strategies. Japan’s recent history of REE trade with China offers examples of how overreliance can damage economic activity and provides insight into a cooperative path forward.

What Japan Attempted

In 2010, China suspended REE exports to Japan over a territorial dispute, driving Japan to reevaluate the vulnerability of its REE supply chain. At the time, Japan relied on China for approximately 90% of its REE imports (Tatsuki, 2023) and this event catalyzed a comprehensive national response, culminating in the launch of the Comprehensive Rare Earth Measures, a policy package that coordinated public and private sector efforts. Japan’s strategy included five major initiatives. First, it invested in overseas mining projects in countries such as Australia, Vietnam, India, and Kazakhstan, with financial backing from institutions like JOGMEC (Japan Organization for Metals and Energy Security). Second, Japan advanced recycling technologies to recover rare earths from electronic waste, including fluorescent lamps, industrial magnets, and hybrid vehicle motors efforts led by companies like Honda. Third, it supported research into alternative materials to reduce or eliminate the need for rare earths in key applications like permanent magnets. Fourth, Japan established strategic stockpiles to buffer against future supply disruptions and stabilize prices. Finally, it pursued supply chain diversification by developing trade relationships with non-Chinese suppliers and investing in processing capabilities outside China.

What Proved Effective

Among these initiatives, recycling technology development emerged as the most successful. By 2023, recycling contributed approximately 15–20% of Japan's rare earth supply (Tatsuki, 2023). Honda's magnet recycling program and broader urban mining efforts became commercially viable and scalable, offering a sustainable supplement to imported materials. Strategic stockpiling also proved effective, providing immediate resilience and enabling Japan to manage short-term disruptions while negotiating from a stronger position. Most importantly, the government's coordinated policy framework ensured alignment between public and private sector efforts, offering clear direction, sustained funding, and a unified national strategy (Commissioner's Secretariat, 2020). These combined efforts helped Japan reduce its dependency on Chinese REEs from 90% in 2010 to about 58% by 2023.

What Was Less Successful

However, despite these efforts their effectiveness has been limited by factors such as market dynamics and the complexity involved in establishing new supply chains (Terazawa, 2023). Overseas mine investments encountered significant delays, often 5 to 10 years due to political instability, environmental opposition, and cost overruns in host countries. Although Japan has made strides, it still sources over half of its REEs from China and remains heavily dependent on Chinese processing capabilities. (Baskaran & Schwartz, 2025). Several ongoing challenges have hindered Japan's progress. Economic and environmental constraints, along with rising global demand for REEs, continue to complicate Japan's diversification efforts. The high costs associated with alternative sourcing and the logistical complexities of establishing new supply chains further limit the effectiveness of these strategies (Terazawa, 2023). Furthermore, reducing this dependency even further appears increasingly difficult, given China's dominance of both REE mining and refining in terms of cost competitiveness and access to adequate technology and human resources. This dominance was created partly by China's more relaxed environmental regulations, which would not be allowed in the Triad countries.

U.S. Policy Recommendations Based on Japan's Experience

Short-term

To reduce immediate dependence on Chinese rare earth element (REE) processing, the U.S. should prioritize the rapid development of domestic processing and refining infrastructure. Unlike mining, which is geographically constrained, processing facilities can be established in a variety of locations with the right technology and environmental safeguards. This represents the most actionable step toward breaking China's dominance. In parallel, the U.S. should adopt Japan's successful urban mining model by launching federally funded recycling programs aimed at recovering rare earths from electronic waste and end-of-life products even if the return on investment remains low. A national goal of achieving a 20% supply contribution from recycling within five years would mirror Japan's progress. Additionally, the U.S. should implement a strategic stockpiling program modeled on Japan's buffer stock system, ensuring 6-12 months of supply security to mitigate short-term disruptions. Importantly, the U.S. should avoid Japan's missteps in overseas mining investments, which were often delayed or derailed by political and environmental challenges. Instead, the U.S. should focus on forming processing partnerships with like-minded allies such as Australia and Canada to reduce geopolitical and operational risks.

Medium-term and beyond

U.S. should pursue joint technology development programs with allies such as Japan and South Korea, focusing on alternative materials, advanced recycling technologies and clean technologies with reduced(or non) use of those critical minerals in question. These trilateral initiatives would distribute costs and risks while accelerating innovation. Korea and Japan may invest in U.S. mineral projects to secure access to supplies that would help underpin electric vehicle (EV) battery components and requisite materials. The key chokepoint in securing critical mineral supply chains lies in processing capacity. A single country is unlikely to match China's scale and cost-efficiency in processing most critical minerals. Therefore, trilateral collaboration to jointly establish alternative refining capacity whether hosted in Japan, Korea, or tied to overseas mining projects would be a strategic priority. Simultaneously, the U.S. must expand its domestic processing capacity to handle both domestic and allied-sourced raw materials, with a target of meeting 50% of national REE processing needs by 2030. Workforce development is another critical priority; specialized training programs in rare earth processing and recycling are essential to address the current skills gap. To compete with China's cost advantages, the U.S. should also invest in cleaner, more efficient processing technologies that meet environmental standards acceptable to allied nations. These technologies could eventually be exported, positioning the U.S. as a leader in sustainable critical mineral processing.

Trade Policy and Supply Chains

The potential imposition of high tariffs on rare earths by the U.S. could lead to substantial cost increases across several key industries. In the automotive sector, each EV typically contains 1-2 kg of rare earth metals (John Zadeh, 2025). Following China's export restrictions, prices for essential REEs have surged significantly, with dysprosium oxide increasing from $152/kg to $485/kg and neodymium oxide rising from $87/kg to $225/kg. Analysts predict that tariffs could increase EV prices by $4,000 to $20,000 per vehicle, which would have far-reaching implications for both manufacturers and consumers (Breana Noble, 2025). Electric vehicle makers anticipate an 8% to 15% rise in overall costs due to tariffs, excluding any mitigation strategies (Akash Sriram, 2025). In the semiconductor industry, tariffs may lead to a 20%-32% increase in equipment costs, impacting profit margins and consumer prices. The defense industry is also expected to be impacted, as heavy rare earth elements are critical for military applications. For instance, RTX expects an $850 million cost impact from tariffs for 2025, while Boeing estimates an additional $500 million in costs (Alistair MacDonald, 2025).

Realistic alternative supply chains could be developed in regions like Australia, Canada, and parts of Africa. However, establishing these connections will require significant time and investment. Australia is emerging as a key player in diversifying critical mineral supply chains, with companies like Lynas Rare Earths producing heavy rare earths outside of China (Reuters, 2025). Canada, with its stable political environment and existing mining infrastructure, presents a viable alternative source for critical minerals, leveraging its longstanding partnership with the U.S. in the mining and defense sectors (Tang et al., 2025) . African countries, particularly the Democratic Republic of Congo, possess significant reserves of critical minerals, but face challenges such as limited infrastructure, acceptable transparent level of internal process and geopolitical risks (Nforngwa et al., n.d.) .

The United States has also launched a comprehensive strategy to ramp up domestic mineral production in response to growing concerns over supply chain vulnerabilities and dependence on foreign sources, particularly China. This effort is largely driven by national security, economic competitiveness, and the need to support the rapidly expanding EV and clean energy sectors. A cornerstone of this strategy is the Inflation Reduction Act (IRA), which provides a suite of tax credits and funding mechanisms aimed at strengthening the domestic EV battery supply chain. These include the Battery Materials Processing Grants Program, the Battery Manufacturing and Recycling Grants Program, and the Advanced Energy Manufacturing and Recycling Grant Program. The IRA also introduced the Section 45X tax credit, which incentivizes clean technology manufacturing and could save manufacturers up to $134.9 billion by 2031 (U.S. Congress, 2023). Additionally, the Section

30D clean vehicle credit offers up to $7,500 for EVs that meet domestic sourcing requirements for battery components and critical minerals, excluding materials from “foreign entities of concern” such as China (IRS, 2024).

Federal agencies have also stepped up with targeted investments. The Department of Energy (DOE) is funding a $140 million initiative to recover rare earth elements from coal ash and mine waste, alongside a $3 billion investment in refining and recycling facilities. The Department of Defense (DoD) has awarded $35 million to MP Materials to establish a domestic supply chain for heavy rare earth elements in California. These efforts are part of a broader push initiated by Executive Order 14017, which called for a comprehensive review of critical mineral supply chains and emphasized the importance of expanding domestic mining, processing, and recycling capabilities.

At the state and private sector levels, several projects are underway to bolster U.S. mineral production. In Oklahoma, USA Rare Earth is constructing a neodymium magnet production facility in Stillwater, with feedstock sourced from its Round Top property in Texas. This facility is expected to begin operations by late 2025 or early 2026 (Oklahoma Manufacturing Alliance, 2025). Other examples include Stardust Power’s-grade lithium refinery in Muskogee, supported by state and federal incentives and Westwin Elements’ nickel and cobalt refinery in Lawton, which aims to reduce reliance on international sources while adhering to ethical and environmental standards. Other notable projects include MP Materials’ rare earth metal manufacturing facility in Texas and Tesla’s plan to source nickel from Talon Metals’ project in Minnesota (Young, 2024).

These initiatives are complemented by legislative efforts in Congress to further support domestic mineral production. Proposed bills aim to fund research, provide tax incentives, and encourage development through Department of Defense grants. Regulatory updates are also in progress, including revisions to mining laws, updates to the federal list of critical minerals, and enhancements to mineral stockpiling strategies. Collectively, these efforts represent a significant shift toward building a resilient, sustainable, and secure domestic supply chain for critical minerals essential to the future of clean energy and transportation.

The Triad possesses complementary capabilities in refining and recycling critical minerals, which can be leveraged for joint ventures. Collaborative efforts in these areas can enhance supply chain resilience. Potential areas for joint investment among the three countries include refining facilities, recycling infrastructure, and mine development, particularly in resource-rich regions. Given the U.S. administration’s current emphasis on domestic mining and processing, there is a unique opportunity for Korea and Japan to support and invest in these projects, either individually or jointly. Such collaboration would not only diversify supply chains but also strengthen economic and strategic ties across the Triad.

Each country should play specific roles in collaborations with non-Chinese critical mineral producers, with the U.S. focusing on technology development, Japan emphasizing innovation and market access, and South Korea concentrating on downstream processing equipment manufacturing and logistics.

In the short term, non-tariff barriers such as security reviews and environmental regulations may be more effective than tariffs in protecting domestic industries. These measures can safeguard national interests while promoting sustainable practices. To create a sustainable joint value chain, it is essential to establish clear roles and responsibilities, shared investments in key areas, and a focus on innovation and sustainability across the supply chain.

Given China's overwhelming dominance in critical minerals, significantly reducing dependence in the immediate term is not realistic. However, the Triad can pursue both short-term resilience measures and long-term strategic initiatives. For short-term responses, increasing commercial stocks and creating national stockpiling for emergency response represents the most viable approach. This would provide buffer capacity during supply disruptions while longer-term alternatives are developed. The most promising cooperation area lies in mining and refining operations in the U.S. and other resource-rich countries, rather than domestic recycling activities which tend to be more country-specific. However, alternative supply development faces the challenge of competing against China's existing excess refining capacity in certain minerals like lithium. Government support to mitigate CAPEX burdens would be essential for making these investments viable. For medium to long-term strategy, the three countries should focus on technology and human resource development aimed at minimizing and replacing critical mineral usage, while simultaneously supporting clean technologies that enable such alternatives.

Conclusion

While the Triad's collective experience offers valuable lessons in reducing dependence on Chinese rare earths, a realistic assessment acknowledges the significant challenges ahead. China's dominance in both mining and refining, supported by cost advantages, relaxed environmental standards, dominant skilled human resources, and the huge market of its own makes dramatic short-term reductions in dependence unlikely. However, by leveraging complementary capabilities and pursuing a dual-track approach to immediate resilience through stockpiling and long-term diversification through strategic investments and technology development these nations can enhance their security against supply chain disruptions. Success will require sustained government support, particularly in mitigating the CAPEX challenges of competing against China's excess capacity, while simultaneously investing in technologies that reduce overall critical mineral dependence.

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