



Achieving American Leadership in the Rare Earth Magnets Supply Chain

Summary

Rare earth permanent magnets are a critical technology for the clean energy transition and electrified transport revolution. The global supply chain for rare earth metals and magnets is almost completely dominated by China, which controlled 58% of rare earth mining and 92% of magnet manufacturing in 2020. The United States produces only 15% of the global supply of raw materials for these magnets, and while the nation has several nascent downstream processing and manufacturing efforts, current domestic production is limited. Investments and incentives to boost the domestic supply chain, especially in the separation and refining phases, point the way to securing stable supplies of these critical clean energy components.

What Are Rare Earth Magnets Used For?

Rare earth magnets are the strongest magnets commercially available and provide a host of benefits to wide-ranging applications in consumer and industrial electronics, especially in advanced motor and drive systems. Within the energy sector industrial base, and clean energy in particular, rare

earth magnets are key components of wind turbine generators (especially for offshore turbines) and traction motors in battery and hybrid electric vehicles.

Key Findings and Opportunities

Demand abounds as clean energy technology continues to grow: As the United States strives to achieve net-zero carbon emissions by 2050, demand for rare earth magnets is expected to grow rapidly, both domestically and globally. However, this anticipated demand poses an undeniable challenge to U.S. decarbonization goals, as rare earth magnets and their components are characterized by substantial market volatility and geopolitical sensitivity.

Pivoting from an international reliance: At present, the majority of the global supply chain for these materials is highly opaque and largely concentrated outside of the United States (see box). Furthermore, substitution is difficult throughout the supply chain due to the unique characteristics and energy performance advantages of rare earth magnets.

Building a sustainable domestic supply chain through innovation: The U.S. government has been

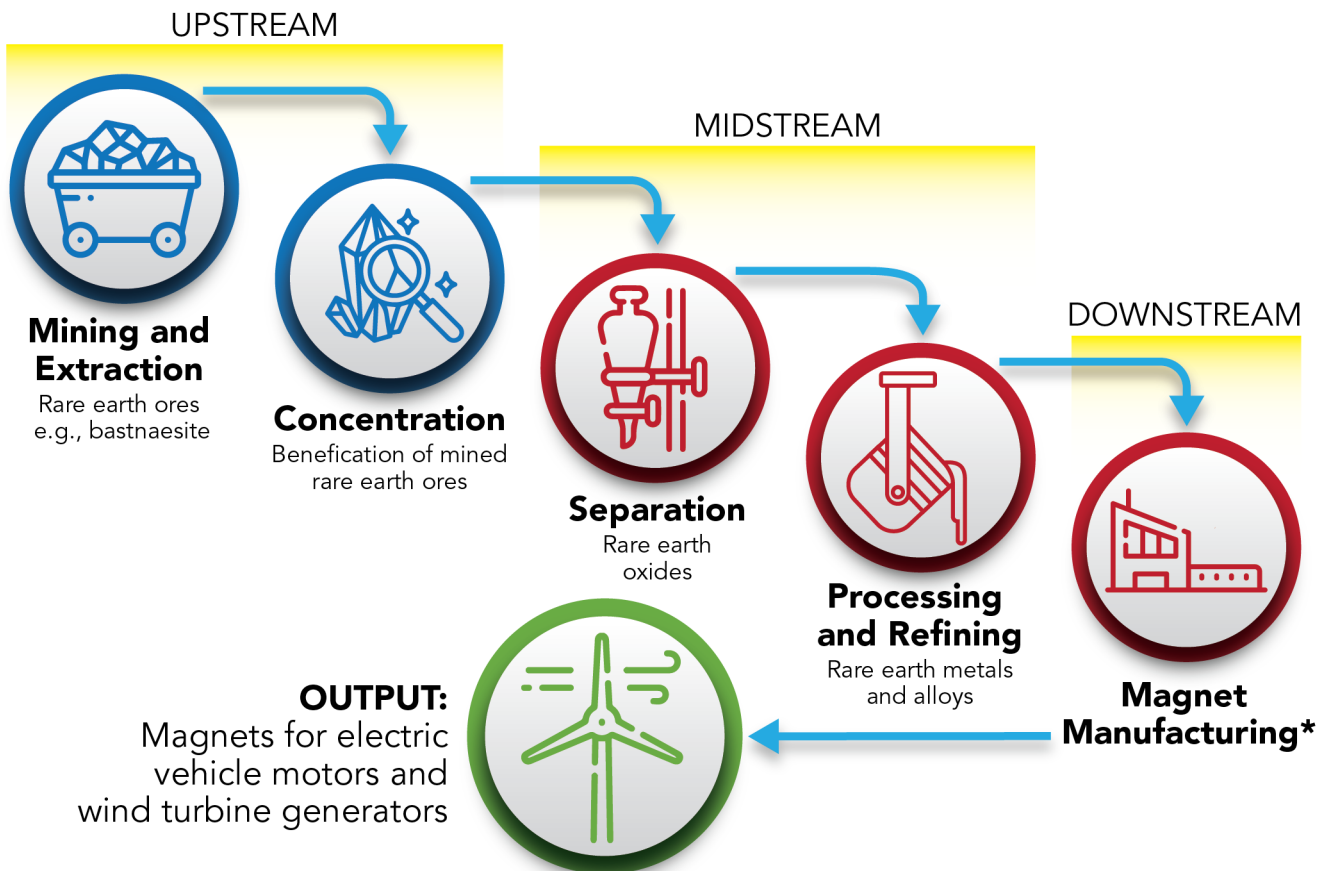
actively engaged in promoting U.S. production and building a more resilient supply chain. Our nation has significant rare earth reserves, active mining operations, and nascent domestic processing and refining. There is an opportunity for the U.S. to build a stable, resilient supply chain for rare earth magnets to secure the materials needed for clean energy technologies.

Several factors determine U.S. resilience and competitiveness in the rare earth magnet supply chain, including geographical concentration, geopolitical sensitivity of trade partners, net import reliance, price volatility, substitutability throughout the supply chain, and other factors. The chart shows the concentration of the mining, separation, refining, and magnet manufacturing steps in countries outside the United States, particularly China.

Policy Next Steps

The United States currently has limited domestic production capacity for rare earth elements and magnets, especially in the processing, refining, and manufacturing stages, despite having a wealth of these critical materials as natural resources beneath American soil. To build a secure supply chain for rare earth magnets, the United States should:

- **Strengthen the Market:** Engage government and private sector to lead efforts to utilize the Defense Production Act to develop the domestic rare earth magnet market across multiple supply chain stages.
- **Catalyze Innovation:** Establish a rare earth element manufacturing facility to demonstrate the commercial feasibility of a full-scale integrated rare earth element facility for extraction,



Red indicates no U.S. commercial capacity

* indicates sintered NdFeB (neodymium iron boron) magnets

separation, and refining, which can foster a domestic innovation ecosystem, and enable competitive advantage for domestic magnet manufacturers as authorized by the Bipartisan Infrastructure Law.

- **Incentivize Capacity Expansion:** Enact legislation to provide tax incentives to support domestic manufacturing of rare earth magnets with emphasis on the rare earth element separation, processing, refining, and magnet manufacturing steps. ■

Download the full document and the corresponding other documents that are part of the DOE response to the supply chain executive order at:
www.energy.gov/policy/supplychains

