

# Briefing: Rare Earth Elements

## Overview

The Rare Earth Elements (REEs) are a group of 17 chemical elements with unique magnetic and optical properties. Despite their name, global reserves of REEs are estimated at 100 million tonnes (not rare). REE processing is a bottleneck to unlocking supply: their low concentrations and similar physical and chemical characteristics require precise refining methods to differentiate them from one another.

REEs are mainly used in renewable energy generation, defense applications, and for manufacturing electronic devices. They are also used as catalysts in petroleum refining and in automotive catalytic converters. The properties of certain REEs make them difficult to substitute without lowering performance, both in critical applications like defense and non-defense applications such as EV motors.

China's dominance in REE production, refining, and manufacturing gives it control of the U.S.'s \$190 million REE metal, alloy, and compound market.<sup>1</sup> Canada has 1% of global REE reserves and 9 mines in development but does not produce REEs at a meaningful scale.<sup>2</sup> Canada imported \$12 million in REE metals and compounds in 2022 (43% from China and 37% from the U.S.).<sup>3</sup>

### 1. REEs are critical for defense, energy, and electronics, with limited substitutability

- 44% of global REEs are used to produce high-strength permanent magnets for defense (e.g., missile guidance and control systems), energy generation and storage (e.g., wind turbines and EV motors), and consumer electronics (e.g., mobile phones and hard disk drives).<sup>4</sup>
- 16% of REEs are used globally as catalysts, primarily for petroleum refining and in automobile catalytic converters.<sup>5</sup>
- Other key applications are in the glass industry (e.g. as a polishing agent to produce high-precision lenses), to manufacture phosphorescent materials (e.g. for electronic device screens), and for telecommunications (wavelength amplification in fibre optics).<sup>6</sup>
- Key applications of REEs in the U.S. include catalysts (75%), ceramics and glass (10%), and metallurgical applications (6%).<sup>7</sup>
- Defense-specific applications of REEs have historically been a fraction of overall consumption in the U.S. (~5% in 2012), and the U.S. lacks domestic REE magnet manufacturing capabilities. Defense-grade REE magnets are currently produced by a company in Texas.<sup>8</sup>

### 2. China-led refining and manufacturing constrains REE supply despite U.S. mine production

- The United States is the second-largest producer of REE concentrates (12% of the global total), followed by Myanmar (11%) and Australia (5%). China produces 69% of mined REEs and holds 85% of refined REE supply.<sup>9</sup> Additionally, China's share of U.S. REE magnet supply grew to 92% in 2024.<sup>10</sup>
- China has previously leveraged its dominant position in REEs with a 2010 export ban on REEs to Japan,<sup>11</sup> a 2023 ban on exports of REE extraction and separation technologies, and 2024 regulations on the domestic REE industry that increase government oversight and traceability.<sup>12</sup>

## Key Challenges

- Challenges in diversifying from China: Other major suppliers of refined REE metal and compounds include Malaysia, Vietnam, Japan, and Estonia, which collectively supplied 38% of U.S. imports from 2019 – 2022.<sup>13</sup> However, Japan has itself been historically reliant on China for REEs (~50% in 2018), and Vietnam's REE production dropped 91% between 2022 and 2023.<sup>14</sup>
- Challenges in growing domestic supply: Increasing dependence on China has spurred \$439 million in U.S. federal funding since 2020 to build a domestic REE supply chain.<sup>15</sup> However, U.S. production of REE metals and compounds has reached only 3% of annual estimated consumption as of 2022.<sup>16</sup>
- Financial challenges: The relatively small market size for REE metals and compounds makes the development of REE projects unattractive for large mining companies. Broader lack of capital has constrained REE exploration in Canada.

## The Opportunity

- Canada is advancing 9 REE mining projects, 2 processing projects, and 1 recycling facility to build a local supply chain for REEs, which could eventually contribute to securing U.S. supply.<sup>17</sup>
- Canada has local expertise in REE processing and extraction. Toronto-headquartered Neo Performance Minerals (TSE:NEO) operates a REE refining and manufacturing facility in Estonia.<sup>18</sup>

- A REE processing facility at the Saskatchewan Research Council reportedly produced Canada's first commercial-scale REE metals in September 2024. Expected to be operational in 2025, the facility will be able to accept 3000t of monazite concentrate or 3000t of mixed rare earth carbonate and produce LaCe, 400t of NdPr, 5t of Dy, and 2t of Tb oxides for sale. The metals smelting facility can accept Nd and NdPr oxides and will produce 400t of Nd and NdPr metal.<sup>19</sup>

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