What are rare earth elements and why should we care about them?

There are 17 rare earth elements including cerium, neodymium and scandium to list a few. Despite the name, REEs are not necessarily rare as they are found in abundant quantities in the earth’s crust. However, they are not often found in large concentrations that would allow for economic extraction and production. There are also no clear product substitutes for REEs as alternative technologies are heavier, larger and less efficient.

Because of their unique qualities, REEs are vital to the technology industry because they allow for reduced weight, lower energy usage, improved speed and performance, and better thermal characteristics. Market research suggest 16 of the 17 rare earth elements are used in smartphones. While each smartphone uses a very small quantity of rare earth elements, they are essential in the design and utility. Several of the rare earth elements are difficult to substitute within a smartphone.

In addition to technology, REEs are heavily utilized in numerous products, namely in automotive and industrial manufacturing-related end markets (Exhibit 1). The automotive industry depends on REEs to facilitate the development of more fuel efficient vehicles and emissions control. Specifically, they are used in the creation of electric vehicle batteries and motors. In order to meet the increasingly strict global emissions standards, the automotive industry continues to increase the production of electric vehicles, placing a greater demand for REEs and leading to the growing concern for the availability of supply.

Industrial manufacturing utilizes REEs in a vast array of applications such as magnets, lenses, automation, advanced aircraft and weapon systems, military field equipment, and jet engines. These applications require the qualities REEs have to offer: magnetism, corrosion resistance, heat resistance, conductivity, pigmentation, malleability, strength, and weight reduction.

Exhibit 1: Common applications of REEs

<table>
<thead>
<tr>
<th>Wireless electric tools</th>
<th>Fiber optics</th>
<th>Energy efficient light bulb</th>
<th>LCD/PDP displays</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wind power generator</td>
<td>Electric/hybrid vehicle</td>
<td>Digital camera lens</td>
<td>Earphone</td>
</tr>
<tr>
<td>Magnet</td>
<td>Chargeable battery</td>
<td>National defense</td>
<td>Smartphone</td>
</tr>
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Source: Aegon AM US.
China’s Manipulation of the REEs Market

A number of factors have led to China’s dominance in REEs. In the 1980s, China increased supply of REEs, which pushed prices lower, hurting the economics of higher-cost, Western producers. This ultimately led to the closure of the US’ only rare earth mine, California’s Mountain Pass. Since becoming the main supplier of the world’s REEs, China has maintained tight control over the market, classifying them as a strategic resource. Non-Chinese enterprises cannot mine domestic deposits, or smelt/separate REEs except in joint ventures with Chinese national firms.

In 2010, China cut rare earth export quotas after a conflict with Japan which led to a tenfold increase in REE pricing. The export quota system was ultimately scrapped two years later as China’s justification was rebuked by the World Trade Organization.

While operations have resumed in California’s Mountain Pass rare earth mine, environmental regulations make it more costly to mine and process REEs as it is a fairly toxic and a resource-intensive exercise. China also recently increased tariffs on REE imports from 10% to 25%, so the Mountain Pass mine has once again been negatively impacted as it ships its ores to China for processing.

Moving toward a solution with supply chain adjustments

In an effort to reduce China’s dominant share in REE supply, there are a number of ex-China mining and processing plant projects underway. MP Materials is building a plant to process the rare-earth ore that its Mountain Pass mine currently ships to China for processing. In a best case scenario, this could provide self-sufficiency for nearly half of the US REE needs by late 2020. Other US-based projects include Texas Resources’ Round Top mine and processing project and the Lynas-Blue Line Honda processing project, both of which are slated to begin production in 2022 and beyond.

Outside of the US, Rainbow Rare Earths is expected to commence production on a REE mine in Burundi in 2019. In addition, there are a handful of mining/processing projects in locations including Greenland, Australia and Tanzania that are currently in the permitting/financing stages. Over the long term, these projects will reduce reliance on China for REEs, but the solution will likely come at a higher cost given the stricter environmental standards.

Other possible supply chain adjustments like substitution, recycling, and drawing down inventory are ways to respond to a Chinese ban on REEs. Substitution and recycling are only options over the long term. Inventory drawdowns are the most feasible option in the near term but would likely sustain supply chains for just a few months, as the largest inventory appears to be held within China itself. Essential sectors like the military would likely have priority of supply, which could lead to significant price rises for high-tech goods and other REE dependent products.

With few near term alternatives available, and China well aware of the world’s reliance on their supply of REEs, there is a greater potential for China to exert further control on rare earth elements. Because of this, we are actively monitoring the situation as the US/China tariff war plays out.
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