U.S. Rare Earth Strategy Taking Shape

Congress, Department of Defense Tackle Supply Vulnerability

The recent press about China's 97% share of global rare earths production in 2009 has gotten Congress's attention. Rare earths are used in a wide range of consumer products, medical devices, and green technology (including electric vehicles and wind turbine generators), as well as in communications satellites, jet fighters, Navy radar, tank navigation, missile guidance and other national defense systems. Needless to say the Pentagon is also taking a closer look at U.S. supply vulnerability. The Department of Energy has been working on its own strategy to increase United States access and domestic development, and is expected to release its draft plan this fall.

The U.S. was once self-reliant in rare earth elements (REE) production, but faltered in the 1980s due to the high costs of mining and extraction and China's lower costs for labor and environmental regulation. The Mountain Pass Mine in the Mojave Desert in California, which stopped operating in 1992, was the world's leading producer for several decades. There are also U.S. deposits in several other states, including Idaho, Wyoming, and Utah.

The Mountain Pass mine, owned by Molycorp Minerals, was re-opened earlier this year. Molycorp is the owner of the largest U.S. repository of rare earth ores. According to the *New York Times*, a government-controlled Chinese oil company tried to buy the mine in 2005, when Molycorp was owned by Unocal. Congress blocked the transaction, and Molycorp was subsequently acquired by Chevron, then by private equity group Resources Capital Funds in 2008. The company went public July of this year, raising close to $400 million. Interestingly, in 2002 a state-owned Chinese company also tried to buy Lynas Corporation, Australia's most promising REE producer.

The reopening of the Molycorp mine is a sign of the times. However rare earths don't always occur naturally in metallic form. The supply chain for REEs includes mining, separation, refining, and alloying, and the U.S. currently lacks the capability to refine and alloy new REE production. REEs, which are often found together, are actually more abundant than other metals and are found in relatively high concentrations in the Earth's crust, but aren't concentrated in the way other metals are and are not easily exploited economically. (The "rare" in the name refers to the rareness of the minerals in which REEs are concentrated, primarily bastnaesite and monazite. It's been suggested that a better name would be "the hard-to-extract-safely minerals.")

While China controls the market today, it only possesses a third of total global rare earth deposits. Bastnaesite deposits in the United States and China account for the largest concentrations of REEs, while monazite deposits in Australia, Brazil, China, India, Malaysia and South Africa account for the second largest concentrations of REEs. Sri Lanka, Thailand, and Vietnam also have REE ore deposits, according to the U.S. Geological Survey (USGS).

A Congressional research paper entitled "Rare Earth Elements: The Global Supply Chain" published September 30 cites the USGS as saying it expects that global reserves and undiscovered resources are large enough to meet demand in the long run. Recent USGS figures estimate that the U.S. has rare earth reserves of up to 13 million metric tons (compare to current world demand of approximately 134,000 metric tons annually).

That's enough reserves in the United States alone to supply global needs for almost a century at current demand levels. As the Congressional report states, "the current goal of U.S. mineral policy is to promote an adequate, stable, and reliable supply of materials for U.S. national security, economic well-being, and industrial production."

Ramping up REE production will take time and significant capital expense. Congress is considering legislation to support domestic production and increase stockpiles, including H.R. 6160 (Dahlkemper), H.R. 4866 (Coffman), and S. 3521 (Murkowski). The House approved H.R. 6160 on September 29, a bill that beefs up Department of Energy R&D and authorizes federal loan guarantees to mine and develop the minerals. The vote was 325-98.

In June, a European Commission report reiterated the importance of developing a complete supply chain outside of China. Lynas in Australia launched its rare-earths business in 2001, and plans to begin production in Malaysia in late 2011. According to a *New York Times* article in April, Nicholas Curtis, Lynas' executive chairman, said that Australia should be considered as reliable a supplier "as if it were the 51st state." And then there's Afghanistan, where the Soviets and now the Pentagon and USGS have identified nearly $1 trillion in untapped mineral deposits, including REEs, though infrastructure to mine the ores and get them to ports will be a long time in coming.

In the meantime, Molycorp plans to increase its capacity to mine and refine neodymium, which in alloy form is used to make the strongest permanent magnets known, including those used in wind turbine generators. Neodymium is also mined in Brazil, India, Sri Lanka, and Australia, and reserves are estimated at about 8 million tons. (World production of neodymium in 2004 was about 7,000 tons.) Another U.S. company, U.S. Rare Earths, has additional REE claims in concentrations worth mining, with its resources in Idaho considered to be the most accessible undeveloped REE resource in North America. Canada is also developing potentially significant REE deposits.

China's historical willingness to tolerate heavy environmental damage from rare earth mines have reportedly turned some areas into moonscapes. As reported in the *Global Post, t*he massive Inner Mongolia mine on the banks of the Yellow River is said to be an enormous toxic wound on the earth. To be extracted, the REE ore needs to be boiled in acid thousands of times, which also makes its waste stream dangerous. It is dirty work. Most rare metals come with elements that are radioactive or poisonous. Mining is an environmental conundrum, but as investor analyst Jack Lifton points out, "the road to the green economy starts in the black earth" – the mine.

China is now investing enormous time and energy into going green, and its historically low labor costs and tolerance for environmental damage are things of the past. If China continues to restrict exports of REEs, rising demand will stimulate new supply elsewhere. "To manage supply risk, we need multiple, distributed sources of clean energy materials in the years ahead. This means taking steps to facilitate extraction, refining and manufacturing here in the U.S., " David Sandalow, assistant secretary of energy for policy and international affairs, told a Senate panel last month.

The Department of Energy plan is expected to identify another recently developed source of REEs -- electronic and other wastes that have significant rare earth components. New advances in recycling technology have made extraction of rare earths from these materials more feasible, and recycling plants are currently operating in Japan, where there is an estimated 300,000 tons of rare earths stored in unused electronics.

The pricing and availability of REEs will have an effect on Continental, since REEs are used in the generators in its turbines. However the effect should not be large, because the generator is only a fraction of the cost of the turbine and the rare earth magnets are only a small fraction of the cost of the generator, limiting the impact of future price volatility on Continental as the U.S. seeks to reduce its reliance on foreign rare earth production.