

Rare Earth Elements (REE)

Article by Timothy O’Leary

The “rare earth elements” (REEs) consist of yttrium, scandium, and those elements in the Lanthanide Group (Fig. 1). Contrary to their name, REEs are actually quite abundant throughout the Earth’s crust; the difficulty lies in finding a deposit of REEs that is economical to both mine and process. Because of their unique properties and chemistry, the task of separating the REEs from one another is challenging (Burnell¹).

REEs are crucial to the Green Energy Initiative (U.S. Department of Energy²).

Currently, 97% of all rare earth production is carried out in China. China is also restricting exports of REEs due to a growing domestic demand for these-energy critical elements. These realities combined have led to a global REE supply shortage that has resulted in dramatically increasing prices. In response to these events, mining companies are beginning to invest into REE deposits and are attempting to open REE mines and processing plants. Below are listed some of the more prominent companies and projects. No underwater deposits have been included due to lack of short term feasibility due to non-existence of international underwater mining laws and lack of technology.

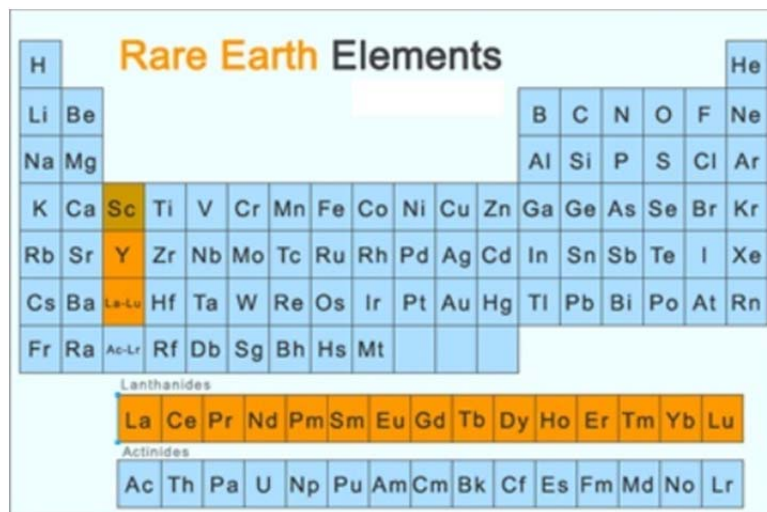


Fig. 1: Periodic Table with Rare Earth Elements Highlighted

Company ³	Location of Site	Amount of REE (Tons of Rare Earth Oxide, REO)	Projected time of REO export production
Rare Element Resources	Bear Lodge, Wyoming	605,500 (Estimated)	2018
Lynas Corp.	Mt. Weld, Australia	131,000	2011
MolyCorp	Mt. Pass, California	1,960,000 (Estimated)	Producing
Great Western Minerals Group	Hoidas Lake, Saskatchewan	41,300 (Indicated)	2015/2016
Great Western Minerals Group	Steenkampskraal Mine, South Africa	32,400 (Historical Assesment)	2013
Avalon Rare Metals Inc.	Nechalacho, Northwest Territories	988,000 (Indicated)	None given
Ucore Rare Metals	Bokan Mountain, Alaska	1,795,000 (Historical Assessment)	None Given
Quest Rare Minerals	Strange Lake, Quebec	465,000 (Indicated)	None Given
Arafura Resources	Nolans, Australia	848,000 (Indicated)	2013
Quantum Rare Earth Development	Elk Creek Nebraska	547,000 (Inferred)	None Given

Table 1: Select REE companies outside of China and their holdings

Selected rare earth projects outside China



(1) Lynas Corp, (2) Molycorp Minerals, (3) (4) Great Western Minerals, (5) Alkane Resources, (6) Vietnamese govt/Toyota Tsusho/Sojitz, (7) Arafura Resources, (8) Avalon Rare Metals, (9) Kazatomprom/Sumitomo, (10) Stans Energy, (11) Greenland Minerals and Energy, (12) Rare Element Resources, (13) Pete Mountain Resources, (14) Quest Rare Minerals, (15) Ucore Uranium, (16) US Rare Earths, (17) Matamec Explorations, (18) Etruscan Resources, (19) Montero Mining, (20) Tasman Metals, (21) Neo Material Technologies/Mitsubishi

Fig. 2: Select REE Projects outside of China.

Source: Department of Energy

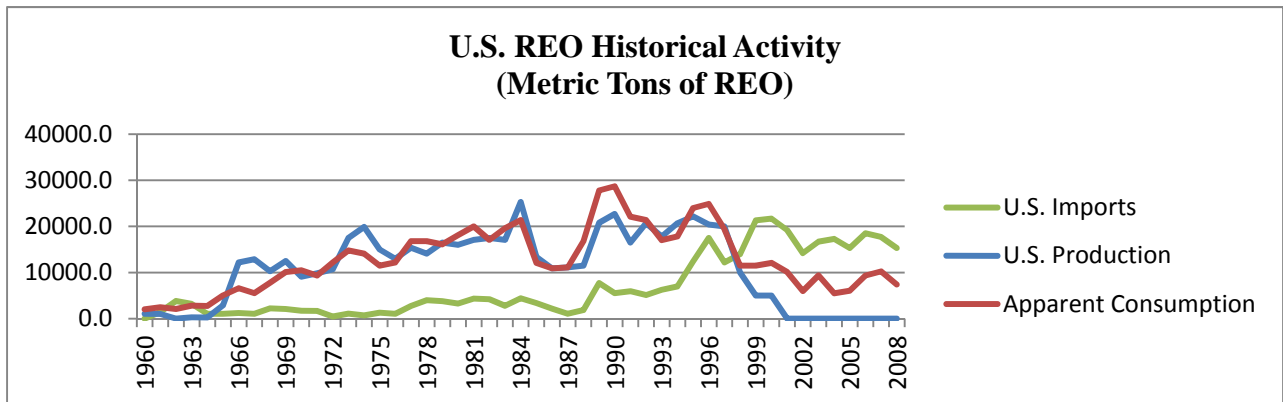


Fig. 3: U.S. REO Historical Activity

Source: United States Geological Survey⁴

Companies are not the only entities responding to the REE supply problem. Governments around the world are also responding in many ways. With many different options available, multiple entities of the United States government have begun to work together to help counteract this supply conundrum. The U.S. Department of Energy has spent \$109.5 million in REE replacement, recycling and research. The USGS just completed a study of all known REE deposits in the United States and the U.S. Department of Defense is currently watching the situation (U.S. Department of Energy). On the next page is a table describing current legislation in the United States Congress.

Action	S.383	S.1113	H.R.2011	H.R.1314	H.R.618	H.R.952	H.R.1388	H.R.2184
Sec. of Energy to promote R&D	X				X	X		
Sec. of Interior to analyze amount of REE	X	X	X	X				
Sec. of Energy to promote education of work force	X					X		
Amends National Materials & Minerals Policy, Research & Development Act of 1980					X	X	X	
Amends Energy Policy Act of 2005					X	X	X	
Repeals National Critical Materials Act of 1984		X			X	X		
Repeals NMMP of 1980		X						
Sec. of Interior to define Critical Minerals		X						
President to promote domestic supply		X				X		
Appropriations	As needed	\$106 million	\$2 million	None	None	\$70 million	None	None
Multi-Agency Permit Process Analyses		X					X	
Sec. to Interior to Promote REE replacements		X			X			
Sec. of Interior to report on permit process			X					
President to create an early shortage warning system						X		
Expedite Permitting Process							X	
Sec. of Interior to create REE task force							X	X
Create REE Magnet Inventory							X	
Contract guarantees							X	
Sec. of Interior to submit REE supply plan								X

Table 2: REE Legislation Description⁵

Source: Thomas.gov

Sources:

1. Burnell, Jim. "Rare Earths - What's All the Fuss." *The Professional Geologist* 48.3 (2011): 54-57. Web. http://64.207.34.58/StaticContent/3/TPGs/2011_TPGMayJun.pdf
2. United States of America. Department of Energy. Office of Policy and International Affairs. *Critical Materials Strategy*. By Diana Bauer, David Diamond, Jennifer Li, David Sandalow, Paul Telleen, and Brent Wanner. 2011. Web. <http://www.energy.gov/news/documents/criticalmaterialsstrategy.pdf>
3. All company information was derived from websites, such as www.lynascorp.com, and personal communication through E-mail.
4. United States of America. Department of Interior. U.S. Geological Survey. *The Principal Rare Earth Elements Deposits of the United States—A Summary of Domestic Deposits and a Global Perspective*. By Keith R. Long, Bradley S. Van Gosen, Nora K. Foley, and Daniel Cordier. 2010. Web. <http://pubs.usgs.gov/sir/2010/5220/pdf/SIR2010-5220.pdf#page=35>
5. <http://thomas.loc.gov/home/thomas.php> was used to access CRS summaries of each of the listed legislation.