Rare earths: supply, demand, and politics

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Described as a "complex and intriguing topic", Vasili Nicoletopoulos examines the rare earths industry and the continuing influence of China generating concern for the short term outlook

Rare earth elements (REE) have been in international headlines for the last two years, mostly owing to a succession of Chinese export quota limitations. China is also consolidating the number of its REE producing companies in Inner Mongolia to one, Baotou Iron & Steel Group Co. and imposing tougher environmental and health and safety regulations, along with increasing taxation for REE producers.

This is a complex and intriguing topic, involving technical and commercial considerations, and environmental, financial, social, legal and political issues.

However, this scenario is expected to continue to cause severe international concerns at least for the next couple of years.

The end of 2010 witnessed the first mine blast since 2002 at Molycorp's Mountain Pass bastnaesite mine in California; the company plans to produce 20,000 tpa REO by 2012.

Resources & supply

REE are not rare at all, but are difficult to exploit owing to geographical and mineralogical distribution, often remote locations, specialised technology required in processing, and, increasingly, environmental concerns.

China's share of world reserves is probably lower than 40%, with large unexploited deposits found in the USA, Australia, Russia and other CIS countries.

Reserve estimates for proven industrial REE oxide (REO) vary widely. For China, they range from 27m. to 52m. tonnes. Estimates for Russia also differ, from "28m. tonnes ahead of China" to "about 19m. tonnes including CIS countries".

REE mines in China have an abundance of heavier REE, while many of the projects elsewhere are overweight in light REE.

Over 50% of the reserves in Bayan Obo, Baotou, in Inner Mongolia, China comprise cerium, while the majority in Mountain Pass, California consist of lanthanum and yttrium.

In 2009, production of REO comprised: China 120,000 tonnes, India 2,700 tonnes, Brazil 700 tonnes, and Malaysia 400 tonnes.

Thus, China produces more than 95% of the world total. Baotou itself reports production of 55,000 tpa of processed REE , about 44% of global production.

The USA and Europe have no REE production but operate processing facilities.

Demand - expected to rise

Among the most important REE market applications are magnets and high-efficiency lighting.

The magnets are employed in small electric motors to power everyday items such as vacuum cleaners, lawnmowers, and washing machines, as well as high-end technology applications like computer disc drives, wind turbine motors, and electric and hybrid car engines.

Other important REE applications include catalysts, cell phones, metal alloys, and batteries. Many REE end uses are considered sensitive, eg. defense, aerospace, medical equipment, and green technology.

World demand for REE is estimated at 135,000 tpa, with global production around 125,000 tpa. The difference is covered by above-ground stocks or inventories. Domestic demand for REE in China has increased by as much as 200% during the last 12 months. Incredibly, almost half of that increase has come since the start of 2011.

World demand could rise to 180,000 tpa by 2012 and exceed 200,000 by 2014, barring a sharp economic downturn.

Lynas Corp.'s REE processing plant under construction in Malaysia, which has encountered some local opposition to the

Prices

plant.

REE prices have risen dramatically in the last two years. For example, at the end of April 2011, the price of cerium oxide had increased almost 20-fold over the last year.

An immediate result has been the increase in the price of end products made from REE. For example, prices of REE magnets made in Japan were expected to rise by over 40% from 1 July 2011, and companies like Nanophase have complained about the soaring cost of cerium and little or no guarantees over availability.

Even though REE market prices are not terminally traded and should, thus, be difficult for speculative investors to get involved with, some analysts report several speculative funds targeting the industry. This was noticeable soon after the Chinese Lunar New Year in 2011, where hoarding of REE material exacerbated price increases.

Smuggling and illegal mining

Experts estimate that illegal production accounts for about 14% of the world supply of light REE and as much as 50% of heavy REE.

Smuggling from China, recently under attack by the authorities, has been reported at 50% of REE exports to Japan/South Korea/Taiwan, with 20% of Japan's REE imports from China apparently on the black market.

Environmental factors

Environmental, health, and safety (EHS) issues have always been a significant factor in the REE industry.

In addition to the then low Chinese prices, it was EHS factors that contributed to the closure of the USA's Mountain Pass REE operation in 2002.

EHS is also behind the new Chinese policies condemning emissions of "fluorine, dust, hydrofluoric acid, sulphur dioxide, sulphuric acid and radioactive waste residue".

EHS is also a cause of opposition to new processing projects outside China, including the world's biggest planned REE processing plant by Lynas Corp. in Malaysia. Here locals have compared the project with radiation poisoning issues surrounding the last, Japanese-led, REE project in Malaysia, which closed in 1992.

Economics and finance

In 2010 Baotou Steel Rare Earth Group showed a revenue increase of 102.78% from RMB2.59bn. in 2009 to RMB5.26bn, while net income improved 1,246.13% from RMB55.77m. to RMB750.74m.

This followed a net profit decline of 66.6% in 2009 from 2008. Baotou's market value stood at RMB19.3bn.

Broadly speaking, financing in China seems easier than in the 'West', eg. Baotou City subsidises loan interest payments.

In the USA, Molycorp Inc. posted a net loss of $909,000 for Q1 2011, compared with a year earlier loss of $7.7m.

Many other Western companies with projects outside China, listed in Canada and Australia for example, are mostly at development stage and are still not in positive-result territory.

Interestingly, in May 2011, Baotou won approval to start an exchange to trade in REE, to "regularise market flows of RE", give greater leverage over foreign buyers, further regulate the market, and help China influence REE pricing on the global market".

The exchange would initially confine itself to modest spot trading in some of the REE and will not deal in futures.

Economising, substituting, recycling

Despite growth in demand from certain REE market applications, there are signs in the market that certain sectors are actually reducing their dependence on REE. Examples include:

- Albemarle Corp. has announced a REE content reduction in its catalysts by up to a factor of four
- WR Grace develops zero and low REE FCC products.
- Toyota plans to completely phase out REE metals from its electric and hybrid vehicles.
- Hitachi has developed a machine for the dismantling of neodymium magnets from hard disks and compressors.
- Mitsubishi is studying costs associated with extracting dysprosium and neodymium from washing machines and air conditioners.

However, it might take years for many similar campaigns to yield economically viable solutions.

For example, one criticism of recycling REE is the cost, with most applications using such small quantities of RE that it is unlikely to be economical to recycle.

New supply projects

New REE supply projects are being developed mostly outside China. Some of them may take years to materialise. Completely new discoveries will invariably take even longer.

Molycorp's Mountain Pass operation, which restarted mining in late 2010, could start to produce in 2012 but has yet to secure government guarantees.

Other major domestic projects include Lynas and Alkane Resources in Australia; Ucore in the USA; LKAB in Sweden; and Steenkampskraal in South Africa (*see IM March 2011: 10 steps to rare earths supply*).

At the same time, there is a flurry of investments and projects based on transnational co-operation in REE. For example, Chinese interests in Arafura and China Yunnan Copper, both in Australia; Molycorp in Silmet, Estonia; Lynas in Malaysia; Japan and the South Korea in Brazil, Kazakhstan, Uzbekistan, Vietnam; the USA in Afghanistan. Taiwan, for its part, has chosen to cooperate with China.

Prospects for efficient Chinese and rest of the world (ROW) producers are generally good, although some analysts worry about REE equities and the plethora of RE exploration companies.

Criticality, strategic considerations

A Chinese "withdrawal" from world supply of REE may starve ROW consuming industries of the relatively inexpensive raw materials they have been used to buying over the last 20 years.

According to many US and Japanese analysts and policy-makers, this will cause a strategic threat to the ROW by moving to dominate the magnet industry, and to gain total international market advantage, with the ROW losing market share in fields such as the environmental technology industry to China.

Eventually, the international threat could get bigger if China starts importing REE to meet rising internal demand.

The EU and the USA have recently established lists of "Critical Raw Materials", while Euromines, the European Association of Mining Industries, is setting up a special Task Force.

The US Department of Energy defines "critical" as a combination of a metal's importance to the clean energy economy and its risk of supply disruption. The DoE has found five REE metals most critical in the short and medium term (dysprosium, neodymium, terbium, europium and yttrium), with another two REE near-critical metals in the short term (cerium, lanthanum).

Chinese policies

In mid-2010, the Chinese cut their RE export quotas 40%, having issued 30,258 tonnes of quotas as of end-July 2010 (some 19,887 tonnes less than in 2009).

China also has announced that it will not be issuing any new mining licenses for REE from 2009 to 2015.

In September 2010, Japanese buyers claimed that China banned Japan REE exports in retaliation to a fishing vessel "capture", with China's Trade Ministry denying any embargo.

Dudley Kingsnorth, a REE consultant at Industrial Minerals Co. of Australia, has drawn up a list of Industry Constraints for REE, which includes production quotas, export taxes of 15-25%, VAT rebate on exports withdrawn, co-ordinated pricing, industry consolidation, enforced environmental legislation, and a lack of transparency.

To this list must be added the following: tax increases, that will increase production costs; large research and development assistance; and stockpiling to have China build up its strategic reserves of REE.

Policies like co-ordinated pricing could clearly be in favour of Chinese producers, but most of the rest will clearly work against them.

The Chinese justification for these policies is of a rather macro nature, and is based on the fact that China has been for many years exporting REE at very low prices, causing local environmental damage, and at the expense of their domestic consumption. Consultant Jack Lifton agrees that "we effectively said to them in the past that we wanted them to produce our REE in order to save money Ð to cut costs. That has been accomplished. Now, we are saying why did you do this to us?"

The Chinese also point out that many companies in the West depend, albeit indirectly, on Chinese illegal mining and smuggling.

Also, inflation and rising labour costs in China, coupled with power shortages, are phenomena that China clearly takes into account.

By only applying to the raw REE rather than the processed forms of the commodity, eg. REE magnets, quota cuts can also be seen as part of a strategy to boost development of the Chinese domestic manufacturing industry, owned or not by Chinese capital, by trading "resources for technology", ie. encouraging foreign companies to set up processing facilities inside the country.

Historical perspective

Many other emerging economies have been pursuing industrial development strategies by means of trade, taxation, and investment instruments aimed at reserving their resource base for their exclusive use, through government measures such as export taxes, quotas, subsidies etc.

REE far from constitute the first case of such policies by the Chinese. Over the last 35 years, China has undergone a transformation from exporting cheap raw materials to higher price but also higher value added products.

In the 1980s, for example, China reacted to the imposition of EU antidumping duties on magnesia and fluorspar by instituting an export license regime for these products, with the aim of capturing the "surplus" domestically, and has since being moving up the value chain to finished products.

In another case, in 1985, China decided to maintain its dominance in the tungsten market by pushing large quantities of the metal into the world market at low prices, with the result that tungsten miners in other countries went out of business.

Even today, China accounts for more than 85% of the world's tungsten output. The question remains whether Beijing would try to repeat this with REE.

ROW reactions and policies

On the positive side for ROW, if illegal mining and smuggling in China are taken into account, Chinese production and exports are considerably higher than officially reported.

Also, the US Pentagon is distancing itself from the "strategic danger" rhetoric. Non-Chinese companies for some time have been able to secure REE by operating in China, to benefit from cheaper REE prices in the country, eg. French REE processor Rhodia (recently acquired by Solvay SA) runs a processing plant near Baotou.

Furthermore, German wind turbine producers say they are not using magnets containing neodymium in their turbines, and that only 5% of wind turbines in Germany consume REE.

Any new REE projects which might come on stream internationally might cause overcapacity, especially if/when they coincide with an abrupt deceleration of the Chinese economy, and a negative effect on world commodity demand and prices. Another potential threat is if China were to turn around and bring prices back down.

Nevertheless, many countries have been officially opposing the 2010-2011 Chinese REE policies. They have been pressuring the Chinese to relax their export restrictions, and stimulating supply outside China by supporting the discovery and development of REE domestically or through international cooperation agreements.

The USA, aiming at energy independence, considers crucial the promotion of alternative sources of power generation. The government estimates that many REE applications are highly specific, and substitutes are either inferior or unavailable.

In early October 2010, the US House of Representatives passed the REE and Critical Materials Revitalisation Act "to reestablish the US as a leading producer of REE, to make it self-sufficientÉ. and to never be dependent on China for crucial components for national security".

Japan, the world's largest REE importer, stands to lose more from Chinese supply bottlenecks than perhaps any other nation.

Like South Korea, Japan is establishing joint ventures and supply agreements on REE with third countries, discussing the creation of strategic stockpiles outside China, and putting great emphasis on economising, substituting, and recycling.

The EU is undertaking a study to find economic REE deposits, examining raw materials stockpiling, and working on research and development in reducing the need for REE, and developing substitutes for them.

Regarding the World Trade Organisation, a decision is expected on a complaint lodged by the USA, the EU, Mexico and others on a "first wave" of minerals, with China arguing that environmental grounds justify their policies. Interestingly, neither "waves" include REE, but the EU is considering adding REE to its "second wave".

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