

Unearthing China's Rare Earths Strategy

Roderick Kefferpütz

Relations between China and the West have been difficult at best in recent months. Frustrations on both sides have increased palpably. Besides long-standing disagreements over Beijing's policy on the renminbi, the stalled climate change negotiations and human rights, new challenges have also (re)emerged. These include, amongst others, rising concerns over China's role in the South China Sea and the conflict over the Japanese-controlled Senkaku or Diaoyu Islands in the East China Sea. Recently, however, one issue in particular has made the headlines: rare earths.

Rare earths are a previously little-known group of 17 elements consisting of scandium, yttrium and the lanthanide series¹ and have become a major point of contention. Vital for the production of low-carbon products such as hybrid cars and wind turbines; consumer goods such as cell phones and computers and sensitive military hardware like cruise missiles and smart bombs, rare earths are indispensable for high-tech industries and emerging technologies. With China responsible for the production of almost 97% of these rare earth elements (REE), recent reductions in exports, coupled with increasing export taxes, are causing jitters not only in the markets but also politically. Export quotas were slashed by 72% in the summer for the rest of 2010 (year-on-year), while further reductions for 2011 are currently being

discussed. Although these cuts have only now made the headlines, they have long been part of a well-calculated long-term strategy that is now paying dividends.

China's long march towards rare earths dominance

Interest in rare earths became apparent in the early years of the People's Republic, particularly in relation to research and development (R&D). The General Research Institute for Nonferrous Metals was established in Beijing in 1952, followed by the Baotou Research Institute of Rare Earths, the world's largest rare earth research institute, in 1963. At this point, most of the world's rare earths were sourced from South Africa, eventually superseded by the United States with its mine at Mountain Pass in California. US domination of the rare earths market lasted until the late 1980s, when, following significant increases in production in the late 1970s, China flooded the market and caused a price depression that both inhibited new mining projects outside China and forced the closure of existing mines.

Having tanked its competitors, Beijing simultaneously set about controlling the entire production flow by attracting industries working with rare earths through advantageous conditions.² By the early 2000s, America's most advanced rare earths magnetic facility had already moved, together with its patents, to China, and other industries also jumped on the bandwagon in

¹ The lanthanide elements ranging from atomic number 57 to 71 are lanthanum, cerium, praseodymium, neodymium, promethium, samarium, europium, gadolinium, terbium, dysprosium, holmium, erbium, thulium, ytterbium and lutetium.

² Offering them access, reduced prices, and hardly any environmental restrictions.

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pursuit of cheap rare earths.³ The result? Not only is China dominant in the mining and refining of rare earths (up to 97% of worldwide production emanates from China), it also leads in the forming of rare earth metals into alloys and even the manufacture of magnet parts and components (up to 80% globally). Former President Jiang Zemin aptly summed up this strategy on a visit to Baotou in 1999 by stating: “Improve the development and applications of rare earths and change the resource advantage into economic superiority”.

After having acquired control over all of the elements relevant to the rare earths industry, Beijing is now steadily reducing exports. This is for a number of reasons.

First and foremost, China is no longer content to merely supply Western value chains; it now aims to increase its own manufacture of high-tech products such as consumer goods and wind turbines. With domestic demand rising, the Chinese government has begun crowding out exports via quotas and tariffs. By 2010, for example, China had imposed export taxes on 23 rare earths categories⁴ ranging from 25% on selected rare earths, primarily heavy ones, to up to 15% on light rare earths.⁵ This, together with other factors such as market sentiment, has naturally led to higher prices. From 2006 to August 2010, europium rose from \$110/lb to nearly \$270/lb while cerium, used in window polishing and autocatalysts for example, increased from \$0.74/lb to \$11.34/lb. In this context, particularly if prices remain high over the mid- to long term, Western companies could be enticed to move production to China as they blindly follow the siren song of cheaper and more accessible rare earths. However, given the murky intellectual property rights environment, which provides China with the added bonus of access to new technologies and innovations, and given uncertainties with regards to demand, supply, prices and China in general, the majority of market players have so far been disinclined to re-locate production to China.⁶

Second, Beijing aims to increase its control and consolidate its domestic rare earths industry to

transform it into something akin to a ‘rare earths OPEC of one’. According to a draft plan by the Chinese central government, a wave of mergers and acquisitions will take place that will see around 120 mining companies merge into fewer than ten and 73 processing firms into about 20, supposedly by 2015. In addition, Beijing plans to establish a stockpiling system and rare earths producing provinces such as Shandong and Inner Mongolia have been asked to unify the supervision of extraction and set up a monitoring system for the entire production, transportation and sale of rare earths.⁷ Coupled with this, Baotou Steel Rare Earth, which alone supplies 46% of the global market, and Jiangxi Copper have expressed interest in creating a unified pricing mechanism for light rare earths. According to equity analysts, that news alone was a prime reason behind a significant rise in prices. In short, the industry is being consolidated and production significantly controlled, as the government is considering eliminating producers whose annual production capacity is less than 8,000 tons of mixed rare earth minerals. This has also led to a crackdown on illegal mining and exports, which have provided importers with an important source of rare earths.

Last but not least, China aims to reduce the extremely high environmental burden associated with rare earths production. Mining and refining is difficult due to radioactive slurry tailings coming from thorium and uranium commonly found in rare earth ores as well as the toxic acids used in refining processes. Regulations are therefore currently being drafted that aim to upgrade production techniques. According to Yang Wanxi, a government adviser, the permissible amount of ammonia nitrogen per litre of production waste water will be lowered to 15 (from 25) milligrams. These new standards might close down numerous miners, further affecting supplies.⁸ Beijing has often used these environmental concerns to argue for the restriction of rare earth supply. While it is an important and justifiable factor that explains reduced output, China is at times stretching this argument to mean that there will be significantly reduced exports to the West. This need not be the case. Naturally, reduced output could lead to less material being available for export but in an ideal, free, competitive market it can also mean less material available for the domestic market if international competitors offer better prices so more production is allocated to exports in order to maximise profits. The fact of the

³ “Critical and Strategic Failure of Rare Earth Resources”, J. Kennedy, March 2010, (<http://www.smenet.org/rareEarthsProject/TMS-NMAB-paperV-3.pdf>)

⁴ These include many rare earth oxides, unmixed and mixed rare earth chlorinates, ores of rare earth metals, rare earth materials intermixed or interalloyed, etc.

⁵ Industry often divides rare earth elements into heavy rare earths (europium to lutetium) and light rare earths (lanthanum to samarium).

⁶ This is based on discussions with companies at the Raw Materials Congress of the Association of German Industries (BDI) on 26 October 2010 in Berlin, Germany.

⁷ “China Provinces to Unify Rare Earth Controls, Global Times, says”, *Bloomberg News*, 8 September 2010 (<http://www.businessweek.com/news/2010-09-08/china-provinces-to-unify-rare-earth-controls-global-times-says.html>).

⁸ “Tighter standards mulled for rare earths”, *China Daily*, 8 November 2010.

matter is that exports are first and foremost curbed by Chinese tariffs and quotas and that environmental regulation affecting production will have an auxiliary rather than primary effect.

Increasing political tensions

The world supply of rare earth metals is therefore volatile. This is particularly so in the context of changing needs. While the current demand of around 134,000 tons per year is met by an annual production of 124,000 tons, supplemented by above-ground stocks such as from inventories, a paper by the US Congressional Research Service states that :

world demand is projected to rise to 180,000 tons annually by 2012, while... by 2014, global demand for rare earth elements may exceed 200,000 tons per year. China's output may reach 160,000 tons per year.⁹

Such a rise in demand would lead to a shortage of 40,000 tons by 2014. These figures do not include the breaking-out of new technologies or innovations that require REEs, nor do they include any possible further reductions from China or a significant economic upswing.¹⁰ The latter is a real concern, particularly given that around one year ago the Chinese Ministry of Industry and Information Technology (MIIT) recommended that the export of the most valuable rare earths be completely halted.

China's rare earths strategy, however, is not simply a hard-nosed business plan that pays economic dividends; its strategic foresight is now also translating into significant political clout. After an initial period of calm following Japan's detention of the captain of a Chinese fishing boat, for example, Beijing put aside its guiding principle *tao guang yang hui* ("bide our time and build up our capabilities") and came out swinging, blocking exports of rare earths to Japanese importers.

While Chinese officials have denied claims of an official export ban, it remains the case that exports were indeed halted, either by (un)official word from Beijing or due to independent actions from provincial party bosses or local officials. In the unlikely event that central government did not give the command, this would suggest that there is more chaos in the Middle Kingdom than meets the eye, something that would be of significant concern to Beijing. At one point in this saga, even the supply to the US and Europe was supposedly curtailed, with US Secretary

⁹ Marc Humphries, *Rare Earth Elements: The Global Supply Chain*, Congressional Research Service, 28 July 2010.

¹⁰ On the other hand, it is clear that a significant economic downswing could likewise slightly reduce demand for rare earths.

of State Hillary Clinton swiftly raising the issue with her Chinese counterparts. These events significantly raised tensions and greatly harmed China's image as a reliable economic player in the world.

Western options

The lack of long-term strategic thinking has led the West and its industries to sleepwalk into a great dependency on Chinese production, lulled by the belief that the days of cheap rare earths would never end. These rare earths cut-offs should now jolt it back into action. After all, the term 'rare earths' is something of a misnomer; most rare earth elements are far more abundant than the term suggests. Deposits exist in the US, Canada, Australia, Greenland and even Sweden, where rare earths were first discovered, and actions are currently underway to access these resources. Molycorp Minerals alone, with its re-opened mine at Mountain Pass, California, expects to produce almost 20,000 tonnes of rare earth oxides (REO) by the end of 2012, while projects in Australia (Mt. Weld, Nolans, Dubbo Zirconia) and Canada (Hoidas Lake and the promising Thor Lake) are expected to be in production before 2014. Barring Chinese moves to again flush the market with cheap rare earths, which would clearly be contrary to their current strategy, non-Chinese mining can expect to experience a real boost in the coming years, which should reduce Chinese dominance in the mid- to long term.

The West should ensure that this development goes hand-in-hand with new refining, alloying and production capabilities, all of which used to be present to some degree. In 1990, for example, the US had 12 rare earth oxide magnet production factories providing 6,000 jobs, all for a global market that created \$600 million in gross revenue. Twenty years later, only four of those facilities remain with one-tenth of the previous workforce, while the market has expanded to well over \$7 billion.¹¹ Creating a secure production chain for the low-carbon high-tech sector could therefore not only take advantage of the large international market but would also provide new jobs.

This, however, will take time; up to ten years according to some industry experts. In the intervening period, the West has an array of domestic and foreign policy tools at its disposal.

With regards to China on the foreign policy and trade front, a possible (although antagonistic) move could be to launch a second raw materials case to the WTO, following a first batch by the US, Mexico and the

¹¹ J. Kennedy, *Critical and Strategic Failure of Rare Earth Resources*, paper presented by the President of Wings Enterprises Inc. 2010.

European Union against China with regards to export restrictions and taxes on bauxite, fluorspar, coke, magnesium, manganese, silicon carbide, silicon metal, yellow phosphorus and zinc. According to the law firm Stewart & Stewart, a strong second case could be made for a violation by China on the basis of export taxes alone.¹² A step in this direction is already being taken, with the US United Steelworkers (USW) having filed a petition under US trade law Section 301 calling for the government to take action against China's "unfair trade practices to dominate green technology goods" by limiting access to critical raw materials. The US Senate and House of Congress were quick to pick this up, and the Office of the United States Trade Representative recently announced that the Obama administration has accepted the petition and will act on it accordingly.

Rushing into this, however, is unwise and could escalate the situation. Pascal Lamy, Director-General of the WTO, has already expressed a negative view of such an approach. This is particularly the case because the general WTO rules do not specifically prohibit export taxes.¹³ In this context, there has been some talk of using the Doha Development Agenda to launch a new multilateral WTO agreement on export taxes. Given the lack of progress in Doha, this is extremely unlikely. Export quotas, however, could be challenged under GATT (General Agreement on Tariffs and Trade) Article XI,¹⁴ although it also focuses more on import than export restrictions.

The United States and the European Union would therefore be well-advised to first wait and see what the result of their first case against China is going to be, with the next hearing on this case expected in December/January and a decision soon afterwards. Should this case fail, a second case will only aggravate the situation further, quite apart from the fact that it would also be doomed to failure. In a nutshell, it would do more harm than good.

Instead, the West should go for more co-operative approaches, which so far have gained little traction.

¹² Hearing on "Rare Earth Minerals and 21st Century Industry", US House of Representatives Committee on Science and Technology, Subcommittee on Investigations and Oversight, Testimony of Terence P. Stewart, 16 March 2010.

¹³ Supposedly around one-third of WTO members impose export duties.

¹⁴ Article XI – General Elimination of Quantitative Restrictions. "1. No prohibitions or restrictions other than duties, taxes or other charges, whether made effective through quotas, import or export licences or other measures shall be instituted or maintained by any contracting party on the importation of any product of the territory of any other contracting party or on the exportation or sale for export of any product destined for the territory of any other contracting party."

For example, it could make China an offer it would find difficult to refuse. While, in the short term at least, the West needs access to rare earths, China needs Western technology. This has been clearly shown by Chinese demands to ease Japanese high technology export controls in response to Japanese calls to ease rare earths restrictions. Making a *quid pro quo* on this issue could relieve short-term risks and allow the necessary breathing space until new mining and refining capacities are sufficiently developed. In addition, China could be provided with environmentally-friendly mining technologies, which would help the country to reduce the environmental burden associated with the production of rare earths. There could also be important best-practice sharing in this context. The European Commission, for example, has recently provided new guidelines on reconciling non-energy extraction within protected areas under NATURA 2000.¹⁵ It could share these with its Chinese counterparts, which could help them in designing policies and regulations for their mining industries and environmental heritage.

Furthermore, in the field of research and development China, together with Japan, the US and the EU could also bundle forces to some degree on mutually beneficial technologies, for example in the field of more sustainable mining, recycling or resource efficiency. China has a proud tradition in rare earth research. It has many important laboratories and centres, such as those mentioned previously in addition to the State Key Laboratory of Rare Earth Materials, Chemistry and Applications (affiliated with Beijing University) and the State Key Laboratory of Rare Earth Resource Utilization in Changchun, as well as research programmes, such as Programme 863 (National High-Tech Research and Development) and Programme 973 (National Basic Research).¹⁶ Coupling those with US research programmes and the upcoming 8th EU Research Framework Programme (FP8) could create some valuable synergies.

Better and more reliable data are also acquired for rare earths elements. The supply situation regarding rare earths remains patchy at best, with some claiming the resource crunch is nigh and others stating that new mines will stave off such a scenario. More concrete information is needed for each individual rare earth as the price and supply situation is very different for each one.

A report by the European Commission on critical raw materials, for example, was unable to distinguish between the different rare earths, which demonstrates

¹⁵ See http://ec.europa.eu/environment/nature/natura2000/management/guidance_en.htm

¹⁶ C. Hurst, "China's Ace in the Hole: Rare Earth Elements", *Joint Force Quarterly*, issue 59, October 2010.

the difficulty but also the need of doing so.¹⁷ Regrettably, this report also judged the criticality of rare earths for a ten-year horizon only by the supply concentration, economic demand and last but not least, the political stability of the producing countries. Had the report taken into account all new projects coming on-line and the reserves in general, the outlook on rare earths supply could have been different. Be that as it may, what it demonstrates is a real lacuna in this field, which needs to be addressed. International co-operation, particularly between the US, the EU and Japan will be crucial here. These three actors, forming a strategic triangle, could build up a common database with reliable supply and demand figures as well as their projections. This could help in the development of an early-warning system and policy options to address supply risks (as is the case for oil).

Domestically, a rare earths production chain would obviously benefit from state loan guarantees, which would quicken the development. This is already envisioned in a legislative bill in the US, which could see the formation of a Rare Earth Cooperative with Department of Defence backing possibly at the Pea Ridge mine in Missouri.¹⁸

In the medium- to long term, however, increased efforts in raising resource efficiency, recycling and the substitution of rare earths will be most important. With regards to substitution and recycling, Japan has already taken a clear lead. Hitachi has claimed to have produced an electric engine that runs on cheaper and more abundant ferric oxides. While this is not currently large enough to power a vehicle, it has been successful in reaching almost the same performance level as a rare earths engine. In terms of recycling, Japan has also made large investments in research and development in this field. According to government-affiliated experts, the electronic products currently in Japanese waste streams could contain up to 300,000 tons of rare earths. This is the equivalent of about ten years of Japanese imports.

The European Union should also play a leading role in resource and energy efficiency, recycling and substitution efforts. These aspects are after all crucial for the future competitiveness of European industry. Given the fact that Europe's industry cannot compete with wages against developing and emerging economies it must use its technological and innovation capacity in the field of raw materials to boost its competitiveness. This is particularly

important because resources, materials and energy are responsible for over 50% of production costs. Increasing the efficient use of these resources would therefore lower costs. The same holds true for the recycling of many resources, as secondary material is cheaper and has a more positive CO₂ balance than virgin material.

Unfortunately, the Commission is currently only paying minimal attention to these aspects in its forthcoming Raw Materials strategy (publication envisaged for 1 December 2010). In a current draft, the Commission has as its first priority the trade dimension, which overwhelmingly focuses on the WTO and retaliatory measures against export restrictions, immediately followed by a great focus on mining inside the European Union, particularly addressing the NATURA 2000 protected site. Only near the end of the report are industrial measures such as resource efficiency and recycling mentioned, in spite of the fact that these measures are crucial for Europe's industrial competitiveness.

Again, looking at the example of Japan, their focus is exactly the inverse of that of the EU. At a recent meeting with representatives from Japan's Ministry of Economy, Trade and Industry (METI) their approach was outlined as first recycling, second efficiency and substitution, and then finally securing international supplies. If the European Union fails to invest in the first two fields adequately it will fail to open up new business opportunities and enhance its competitiveness. A strategy that does not acknowledge this is not worthy of the name.

Ultimately, it is clear that China's caught the West completely off-guard as it built up strategic strength in this sector over the years. The recent rare earths cut-offs and continuing restrictions have put the spotlight on this issue and are an impetus to action. We should not let it go to waste.

¹⁷ *Defining Critical Raw Materials*, Report by the ad hoc group of the Raw Materials Supply Group, European Commission, June 2010 (http://ec.europa.eu/enterprise/policies/raw-materials/files/docs/report-b_en.pdf).

¹⁸ "Bond backs funding for rare earth elements production", *St Louis Today*, 29 October 2010 (http://www.stltoday.com/business/article_8c1d99f7-7c14-5fb4-99e4-ef9214f59562.html)