JUNE 2012
QUARTERLY COMMODITY INSIGHTS
BULLETIN

Rare Earth Metal | Aluminum | Copper | Diamonds | Gold | Iron Ore | Metallurgical Coal | Nickel | Platinum | Potash/Phosphates | Thermal Coal | Uranium

KPMG
cutting through complexity

Q1 – 2012

Rare Earth Metal

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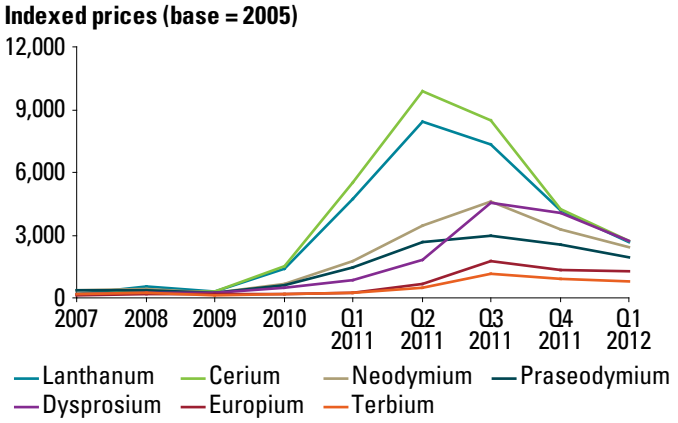
Background and outlook

Rare earth elements (REEs) consist of 15 lanthanides, yttrium and scandium, which can be categorized into light rare earth elements (LREEs) and heavy rare earth elements (HREEs). Historically, prices of individual elements have not always moved concurrently, with prices of HREEs higher than those of LREEs. Prices for many of these elements increased in the 1960s and the 1970s but remained stable in the 1980s. With the entry of Chinese players into the supply-side market, prices declined from their earlier highs to unusually low levels in the 1990s and the early 2000s. Over the last few years, China has accounted for nearly 97% of the global production of REEs. Moreover, prices have risen over the last few years as a result of mining and export quotas set by China (refer to figure 1).

Figure 1: Prices of rare earth oxides, 2007–Q1 2012



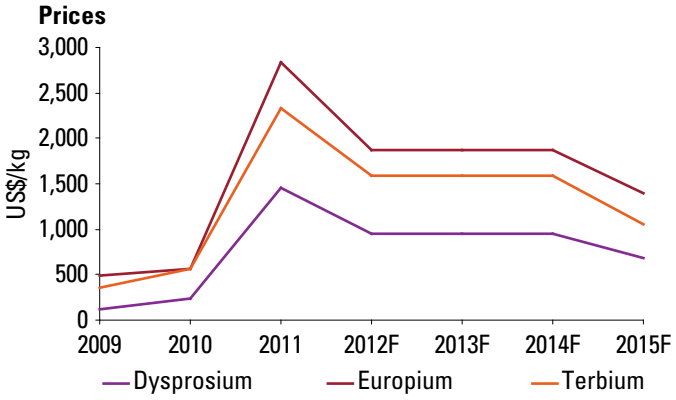
Source: Lynas Corp, Industrial Minerals Company of Australia Pty Ltd (IMCOA), Mackie Research

Prices of REEs increased by 1.2–14.0 times in the first half of 2011, depending on the element. However, prices started to decline from their mid-year highs due to several factors: a market surplus, substitution and recycling of REEs. Generally, the prices of the more abundant LREEs declined more sharply compared to the prices of HREEs. For instance, the price of dysprosium is down by about 50 percent from its July 2011 peak while the price of cerium is down by about 73 percent for the same period.

Exports from China are expected to remain constant or even decrease in the next few years. Thus, projects outside China will be expected to meet the growing international demand for REEs. This means that prices for REEs are expected to depend to a large extent on investments and production outside China.

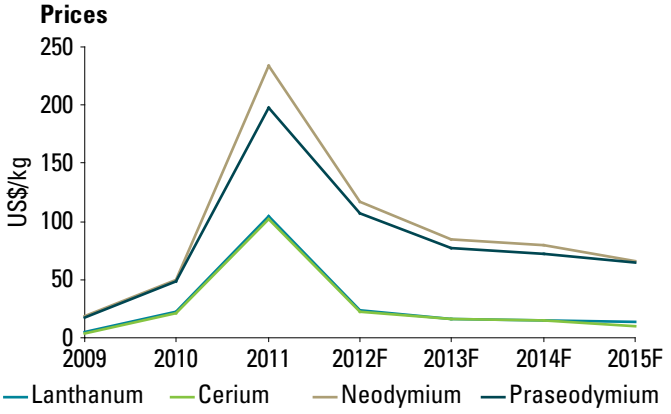
The overall demand for REEs has been forecast to increase at 7–9 percent through 2015. According to the U.S. Geological Survey (USGS), by 2015, non-Chinese supplies of REEs could reach 67 percent of expected total global supply. This increased supply could lead to a surplus in the overall market if demand lagged or fell below the projected growth rates in production. Over the medium term, prices are expected to stabilize and even slightly drop after 2014. HREEs, which are less abundant, are expected to stabilize at higher prices relative to LREEs.

Figure 2: Expected stabilization of HREE prices at lower levels



Source: Deutsche Bank, Lynas Corp, Arafura Resources, Avalon, KPMG analysis

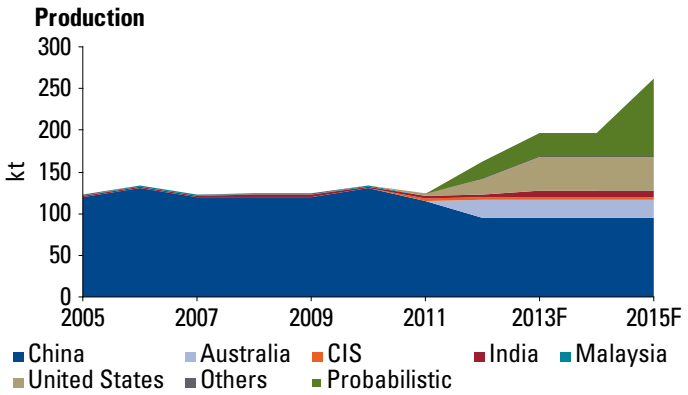
Figure 3: Sharper decline expected in LREE prices



Source: JP Morgan, Deutsche bank, Lynas Corp, Arafura Resources, Avalon, KPMG analysis

Supply and demand

Figure 4: Production of rare earth oxides, 2005–2015F



Source: USGS, IMCOA, KPMG analysis

All historical figures are estimates, as official production data are not available.

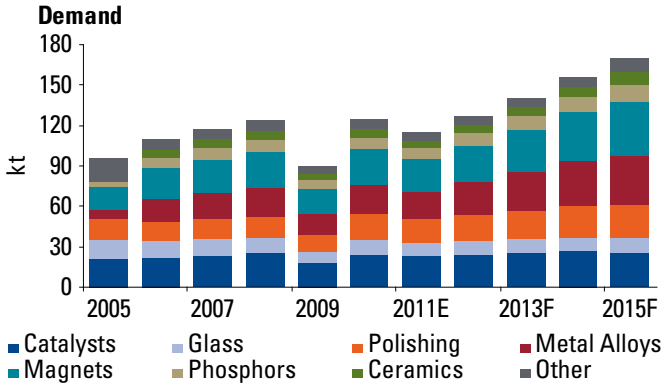
- Since China has been the major source of REEs over the past decade (contributing more than 97% of the market supply), international efforts are now focused on reducing dependence on Chinese suppliers and developing alternative sources. Furthermore, as the Chinese Government moves to restrict illegal mining, tightens production and imposes export quotas, supply is expected to decline over the short term until new mines come on line. As shown in figure 5, the REE market, outside China, is expected to be in deficit over the short term. (For more information on projects, refer to table 3.)

Figure 5: REE prices vs. availability

Source: USGS, Lynas Corp, Arafura Resources, Deutsche bank, KPMG analysis

- China has reduced export quotas for REEs from 65.61kt in 2005 to 31.13kt in 2012. With the aim to reduce market price volatility, the Chinese government has decided on separate export allocations for HREEs and LREEs versus maintaining a general export quota for all REEs. Furthermore, growth in production of REEs in China is expected to slow down as the government shuts down a few facilities because of environmental concerns. For these reasons, the USGS expects production in China to fall to 95kt in 2012, from the 2010 level of 130kt.
- In the US, Molycorp restarted operations at its Mountain Pass mine in October last year and is planning an additional output of 3.5kt in 2012. Production is expected to increase to 40kt by the mid-2013.
- With its mine at Mt. Weld in Australia already commissioned, Lynas Corp is expected to increase production to 22kt by 2013. Market analysts expect that the probability that Arafura's Nolans Bore and Alkane's Dubbo will also be commissioned in a few years is high; this is expected to increase annual production capacity in the country by another 23kt.

Figure 6: Global demand for rare earth oxides, 2005–2015F



Source: IMCOA, Roskill, Mackie Research, USGS, KPMG analysis

- Historically, magnets and catalysts have been the primary demand drivers for certain REEs. The demand for magnets has been driven by high growth rates of hard disc drives, personal audio equipment, wind turbines and small electronic motors used in some cars. The USGS expects demand to grow at 10–16 percent over the next few years, whereas Industrial Minerals Company of Australia Pty Ltd (IMCOA) expects growth rate to be in the range of 11–13 percent per annum.
- REEs are used in the manufacturing of fluid catalytic cracking catalysts (FCCs) and auto catalysts, which accounted for nearly 19 percent of the world's demand for REEs in 2011. However, with the spike in prices for LREEs last year, a number of manufacturers are developing alternative methods to reduce or eliminate the use of REEs as catalysts. The "search for substitutes" may slow the growth in prices of some REEs . IMCOA, for example, expects growth to be at 3% for the next few years — less than some other observers.
- The use of REEs in metallurgical applications is also gaining importance. Specifically their use in nickel metal hydride (NiMH) batteries (used in hybrid electric vehicles or HEVs power systems and portable electronic equipment) and as an additive in steel and magnesium industry is gaining traction and is expected to grow at 15–20 percent over the next few years.
- The demand from phosphors and pigments accounts for 7 percent of total demand for REEs but in value terms contributes about 15 percent of total turnover. This is because europium and terbium, both high-value HREEs, are used in the production of phosphors and pigments. The demand for phosphors is expected to track the trend to replace incandescent bulbs with compact fluorescent bulbs, which require the use of rare earth phosphors.

Table 1: Application vs. availability of REEs

Rare earth oxide	Application	Nolans Bore (%)	Mount Weld (%)	Mountain Pass USA (%)	Baiyunebo China (%)
Lanthanum	Petroleum cracking catalysts, batteries (NiMH)	19.74	25.60	33.20	27.10
Cerium	Auto catalyst, glass, polishing	47.53	45.74	49.10	49.86
Praseodymium	Magnets, glass	5.82	5.42	4.34	5.15
Neodymium	Magnets (NdFeB)	21.2	18.62	12.00	15.40
Samarium	Magnets (SmCo)	2.37	2.44	0.80	1.15
Europium	Phosphors, nuclear control applications	0.40	0.55	0.12	0.19
Gadolinium	Intravenous contrast agents, phosphors	1.00	0.97	0.17	0.40
Terbium	Phosphors	0.08	0.09		
Dysprosium	Magnets (NdFeB), lasers	0.33	0.16		0.30
Other rare earths (Ho, Er, Tm, Yb, Lu)		0.21	0.04	0.16	0.03
Other elements – Yttrium	Phosphors, metal alloys	1.32	0.37	0.10	0.20

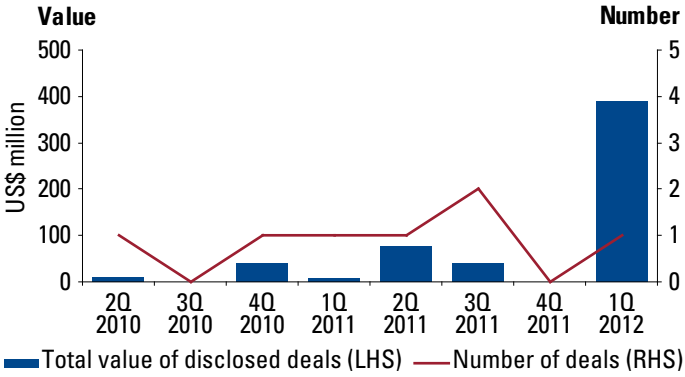
Source: Australian Mine Atlas

Key developments

Ownership changes

In a much-noticed cross-border acquisition in the first quarter of 2012, Molibdenos y Metales SA acquired a 13 percent stake in Molycorp for US$390. This was the only sizable deal announced in the first quarter of 2012, compared to smaller transactions in 2011.

Figure 7: Value of deals disclosed in REE industry



Source: Mergermarket, Intierra, KPMG analysis

Regulatory updates

Recent regulations in this segment have largely focused on securing supplies of REEs for domestic industries in various countries.

Table 2: List of recent regulations in REE industry

Country	Regulation	Description
China	Export quota of REEs	Reduced quota of REE exports by 27% year-on-year to 10,546t for the first half of 2012, to stabilize prices and preserve domestic stock.
Japan, EU, US	REE supply security	Intensified research to identify substitutes for some REEs; accelerated work to collaborate more with Australia and Canada to reduce dependency on China.
Malaysia	Approval of Lynas Corp's advanced material plant	Lynas Corp awarded — by the country's Atomic Energy Licensing Board (AELB) — two-year temporary license to process REEs in Gebang, Malaysia

Future projects

Table 3: Major REE projects

Project	Country/Region	Operators	Capex (US$ million)	Production year	Rare earth capacity (kt)
Mountain Pass	US	Molycorp Minerals	895	2012	40
Mount Weld	Australia	Lynas Corp	1,034	2012	22
New Monazite processing plant	India	Indian Rare Earth Limited	NA	2012	10
Steenkampskraal	South Africa	Great Western minerals group	NA	2013	5
Dubbo Zirconia	Australia	Alkane Resources	759	2014	7
Kvanefjeld	Greenland	Greenland Minerals & Energy Ltd	1,535	2015	41
Nolans Bore	Australia	Arafura Resources	903	2015	20
Zandkopsdrift	South Africa	Frontier Rare Minerals	938	2015	20
Nechalacho	Canada	Avalon Ventures Ltd	884	2015	10
Bear Lodge	US	Rare Element resource	446	2016	10
Hoidas Lake	Canada	Great Western minerals group	NA	2016	3-5
Strange Lake	Canada	Quest Rare Minerals	548	2017	12

Source: Intierra, IMCOA, USGS, Dundee Securities Ltd, Company data, KPMG analysis

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