



Phosphor—a critical component in fluorescent lamps

Navigating through market fluctuations

PHILIPS

sense **and** simplicity



What are rare earth oxides?

Global supply issue and the impact on phosphor based fluorescent lighting

There are 17 rare earth elements (REEs). These elements, distributed in rare earth oxide (REO) form, are critical to a variety of high-tech products and manufacturing processes, including catalytic converters, petroleum refining, color TV and flat panel displays, permanent magnets, batteries for hybrid and electric vehicles, medical devices, and phosphor powders used in fluorescent lamps.

Light Rare Earths (More Abundant)	Major End Use	Heavy Rare Earth (Less Abundant)	Major End Use
Lanthanum	phosphors, hybrid engines, metal alloys	Terbium	phosphors, permanent magnets
Cerium	phosphors, auto catalyst, petroleum refining, metal alloys	Dysprosium	permanent magnets, hybrid engines
Praseodymium	magnets	Erbium	phosphors
Neodymium	auto catalyst, petroleum refining, hard drives in laptops, headphones, hybrid engines	Yttrium	red color, phosphors, ceramics, metal alloy agent
Samarium	magnets	Holmium	glass coloring, lasers
Europium	phosphors, red color for TV and computer screens	Thulium	medical x-ray units
Gadolinium	magnets	Lutetium	catalysts in petroleum refining
Scandium	aerospace components	Ytterbium	lasers, steel alloys
Promethium	nuclear batteries		

U.S Department of Energy 2010 Critical Materials Strategy Summary, http://www.energy.gov/news/documents/Critical_Materials_Summary.pdf; "GTSO: Goldman Sachs Analyst Predicts 'Severe' Rare Earths Deficit." BusinessWire.com. 6 May 2011.



“Over the past eight months, FOB prices of various light rare earth elements (LREEs) have spiked by between 300% and 2500%.”¹

REO phosphors in fluorescent lighting

Rare Earth Elements	Lighting	
	Material	Phosphors
	Lanthanum	●
	Cerium	●
	Praseodymium	
	Neodymium	
	Samarium	
	Europium	●
	Gadolinium	
	Scandium	
	Promethium	
	Terbium	●
	Dysprosium	
	Erbium	
	Yttrium	●
	Holmium	
	Thulium	
	Lutetium	
	Ytterbium	

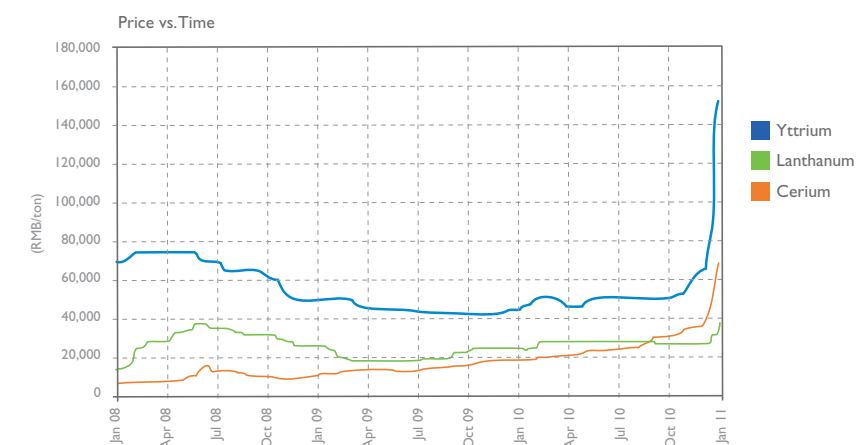
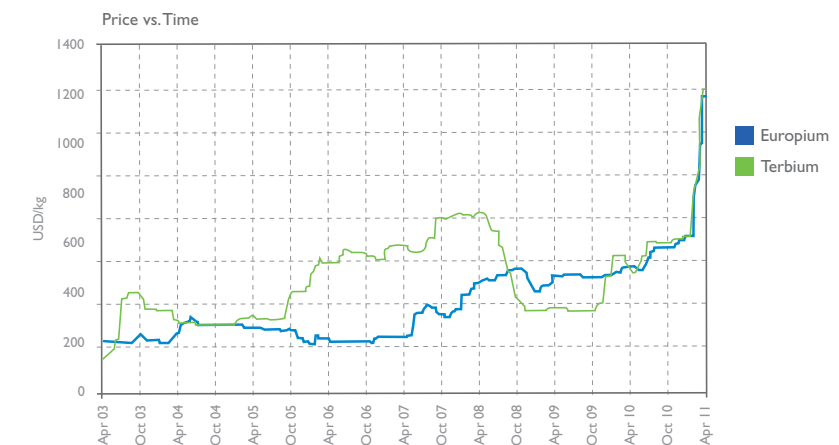
Rare Earth Oxides (REOs) are a critical component of fluorescent based lighting systems. The global shortage of these materials is currently having a direct impact on phosphor availability and pricing.

Linear fluorescent (TL), Compact Fluorescent Non-Integrated (CFLni), and Compact Fluorescent Integrated (CFLi) phosphors are all experiencing unprecedented shortages in global supply, resulting in Philips price increases of over 300% as of July 2011.

As a result of REO shortages, the cost is increasing and is having a direct impact on a global and industry wide scale. Experts predict that these shortages will continue through 2014 until new sources of supply will be able to ease the current situation.²

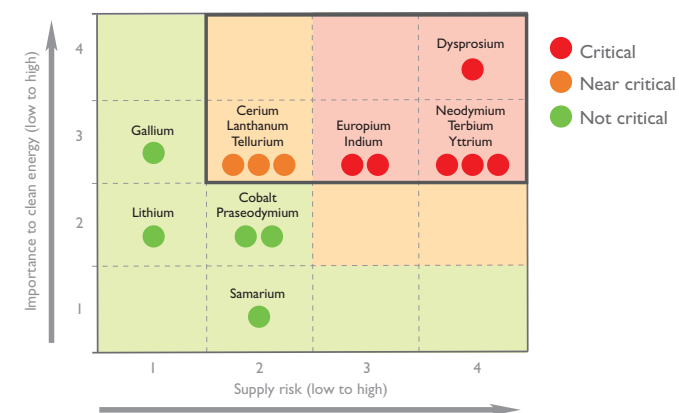
With manufacturing costs on the rise, Philips is forced to implement pricing actions on all Fluorescent based lighting products. Philips has executed global procurement programs to insure sourcing and is undertaking all strategies to best mitigate cost increases.

Price trend of REO phosphors used in fluorescent lighting in the last 3 years



All REO phosphors are near critical or in critical supply

Short Term Criticality (0–5 years)



Source for top and middle charts: China Commodity Marketplace, Sealand Securities, Mar 2011.
Source for bottom chart: U.S. Department of Energy 2010 Critical Materials Strategy. <http://www.energy.gov/news/documents/criticalmaterialsstrategy.pdf>



Source for chart: U.S. Department of Energy 2010 Critical Materials Strategy Summary. http://www.energy.gov/news/documents/Critical_Materials_Summary.pdf
1) Chan, Vincent. "Baotou Rare Earth," Equity Research, Credit Suisse, 13 April 2011. <http://doc.research-and-analytics.csfb.com>.
2) U.S. Department of Energy 2010 Critical Materials Strategy Summary. http://www.energy.gov/news/documents/Critical_Materials_Summary.pdf.
"GTSO: Goldman Sachs Analyst Predicts 'Severe' Rare Earths Deficit." BusinessWire.com, 6 May 2011.

Rare earths: A dwindling resource

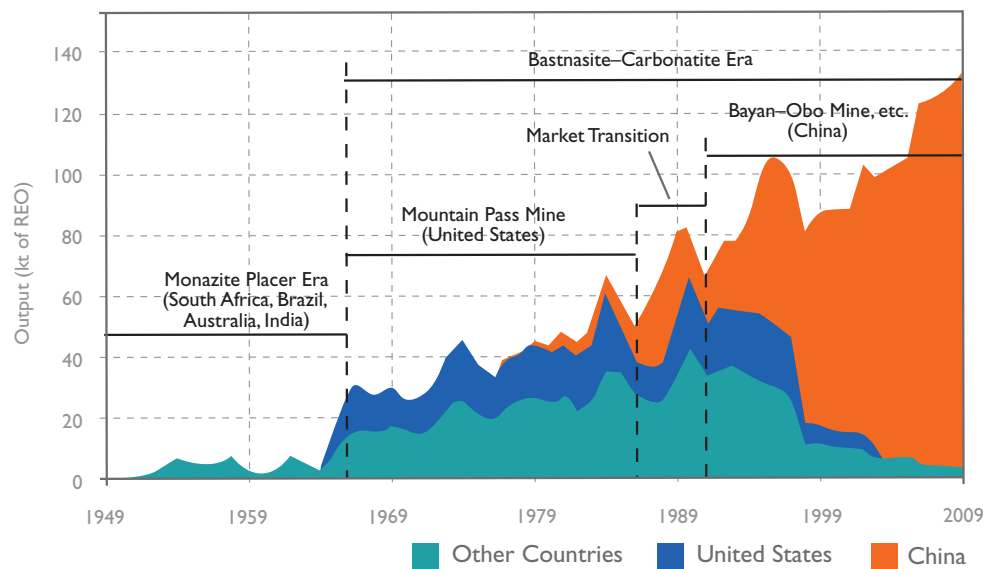
Since the 1990s, the low cost of mining operations in China, combined with costly environmental and permit regulations in the US and other nations, has driven almost all non-Chinese rare earth operations out of business. China mines and produces about 97% of the world's supply of rare earth metals, and announced it is cutting its exports because of its own rising demand and new environmental restrictions.¹

- World demand for rare earth elements is estimated at 134,000 tons per year, with global production around 124,000 tons annually²
- World demand is projected to rise to 180,000 tons annually by 2012, and by 2014 may exceed 200,000 tons per year²
- China's output may reach 160,000 tons per year (up from 130,000 tons in 2008) in 2014, still a capacity shortfall of 40,000 tons per year²



China controls 97% of the world supply of REO

Global rare earth oxide production trends



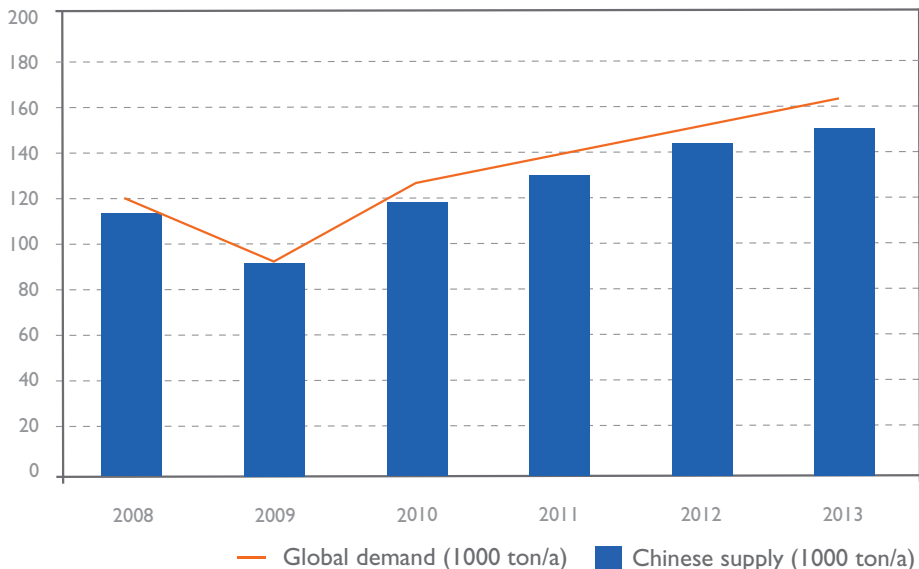
Source of graph: Tse, Pui-Kwan. China's Rare Earth Industry. US Geological Survey. U.S. Department of the Interior. 2011.

1) Hanson, David J. Concern Grows Over Rare-Earths Supply. Chemical & Engineering News, 89(20), May 16, 2011.

2) Congressional Research Service. Energy Policy. Rare Earth Elements: The Global Supply Chain. By Marc Humphries. CRS Report For Congress, 2010.

Global demand is expected to exceed Chinese supply

Supply/demand forecast (1000 tons/annum)



Source: Chan, Vincent. "Baotou Rare Earth." Equity Research. Credit Suisse. 13 April 2011. <http://doc.research-and-analytics.csfb.com>



Media coverage of REO global supply issue

“Supplies Squeezed, Rare Earth Prices Surge”

New York Times. May 2, 2011

“At the beginning of this year China reduced its rare earth export quotas to all countries, while raising export taxes on some rare earths to 25 percent, from 15 percent previously.”

“China May Further Reduce Rare Earth Quotas, Goldman Sachs Says”

Bloomberg. May 4, 2011

“We suspect that export quotas will shrink further... The market will remain in ‘severe’ deficit this year and next... We are of the view that rare earth prices have not yet peaked.”

“GTSO: Goldman Sachs Analyst Predicts ‘Severe’ Rare Earths Deficit”

BusinessWire.com. May 6, 2011

“The global rare earths market likely faces a 18,734 metric-ton deficit of the rare metals this year, equivalent to 13.2 percent of worldwide demand.... the market for rare earths will remain in severe deficit in 2011 and 2012, and that prices will trend higher over the next 18 months.”

"Rising Demand for Rare Earth Elements Leads to Doubling of Prices | Gadget Manufacturers See Soaring Costs for Rare Earth Minerals"

Tech News Daily. May 3, 2011

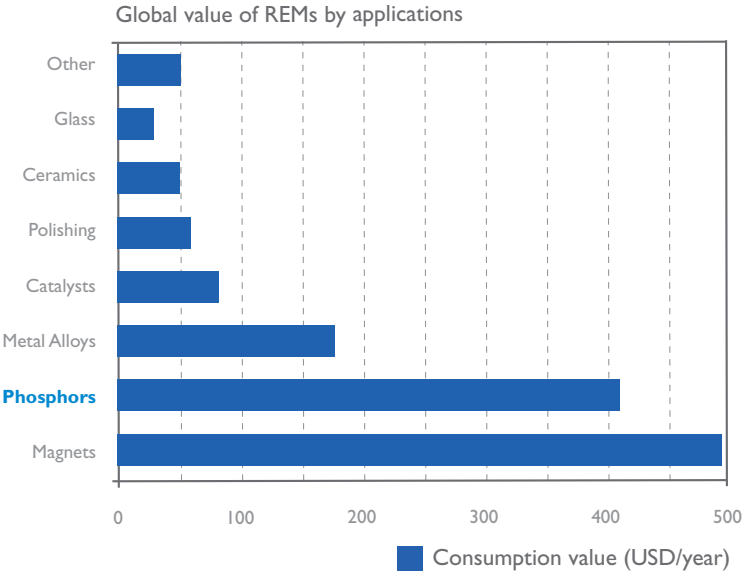
“The doubling in rare earth prices over the past four months comes on top of a fourfold price increase in 2010—and the pressure won’t lift anytime soon.”

U.S Department of Energy 2010 Critical Materials Strategy Summary

www.energy.gov/news/documents/Critical_Materials_Summary.pdf

“Several components of the clean energy technologies...depend on materials at risk of supply disruptions in the short term (0–5 years). Those risks will likely decrease in the medium (5–15 years) and long term.”

Phosphors utilizing REOs are second in demand only to magnets



Source: 2008—Chan, Vincent. “Baotou Rare Earth,” Equity Research, Credit Suisse. 13 April 2011. <http://doc.research-and-analytics.csfb.com>



Many analysts believe current shortages may be either eased or alleviated by 2013–2015 as new mines and processing facilities come online, but there is no certainty to this prediction.¹

A quick recap

- Technology-driven companies such as Philips are dependent on Chinese export decisions, as there are few other main suppliers
- Severe supply deficits are expected to occur over the next few years as China increasingly lowers export quotas
- As a result in supply deficit concerns, prices of these needed minerals have skyrocketed and has led to increases in product costs

The Future Outlook

Many analysts believe current shortages may be either eased or alleviated by 2013–2015 as new mines and processing facilities come online, but there is no certainty to this prediction.¹

As a world leader in lighting, Philips continues to lead the way in making improvements in areas that remain within our control. With this commitment in mind, Philips makes every effort to aggressively pursue optimization of designs which require REO, reduce waste in the manufacturing process, recycle various materials, and explore additional opportunities intended to defray cost increases experienced from REO materials. These vigorous initiatives continue to deliver improvements, but are not enough to offset the ongoing and substantial cost impact resulting from the current global REO supply and escalating demand pressures.

How does this affect you?

- Expert opinions vary, however, market conditions will remain unstable for the near future
- Fluorescent based lighting products will have continued price fluctuations
- Philips Lighting is working diligently to relieve the current supply issues on phosphors
- Philips Lighting is committed to:
 - Sound supply chain practices on a global scale in order to secure materials
 - Keeping you updated and informed on all market conditions and changes
- Philips Lighting highly values you, our customer, and appreciates your patience as we together work through these market conditions
- Please stay in contact with your local Philips Lighting Account Manager for any questions and updates, or for more information please visit <http://www.philips.com/phosphor>

¹) U.S Department of Energy 2010 Critical Materials Strategy Summary.
http://www.energy.gov/news/documents/Critical_Materials_Summary.pdf





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