

Rare Earths

The Why & How

GE
Lighting
Cleveland, OH
July 13, 2011



⁶⁵ Tb
Terbium



Eu
Europium



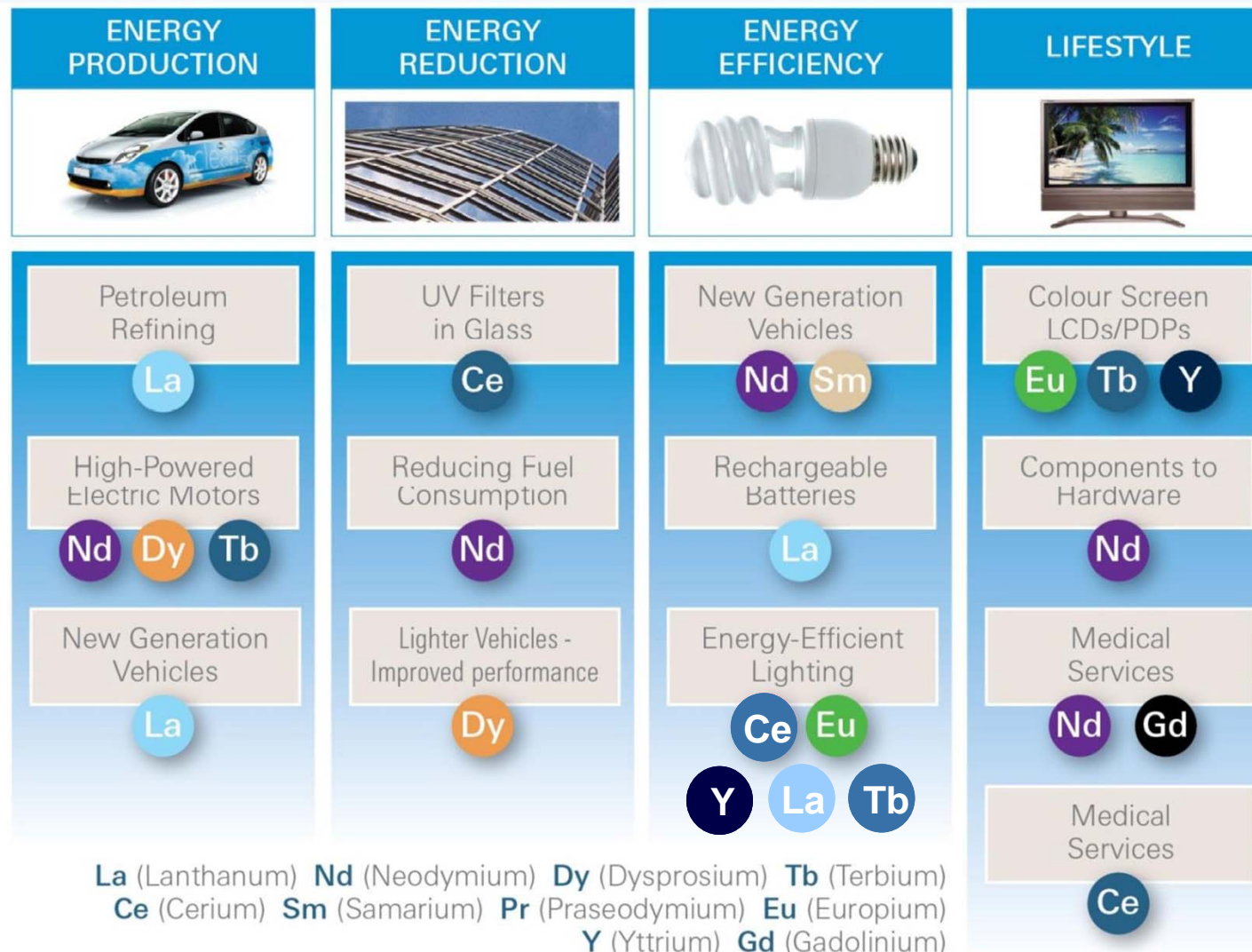
Nd
Neodymium



³⁹ Y
Yttrium



Where are Rare Earths used?



GE Rare Earth Usage



Y, Ce, Tb
La, Eu

Fluorescent lamp phosphors



Nd

Reveal incandescent lamps



Y, Ce, Tb
La, Eu

Compact fluorescent lamp phosphors



Y

Thermal barrier coatings for aircraft engines



Y

Thermal barrier coatings for gas turbines



Nd, Dy, Tb

Industrial motors (future)



Y, Ce, Tb
Gd, Eu, Lu

Scintillators for CT & PET imaging



Gd

MR contrast agents



Nd, Dy, Tb

Generators for 2.5MW+ wind turbines

Broad and increasing usage across GE



Global Challenge, Not Just GE

GreenBiz
.com

Rare Earth Prices Spike, Relief May be Years Away

Published May 05, 2011

Global demand for rare earth minerals has skyrocketed in recent years, in no small part by the popularity of hybrid cars like the Toyota Prius.

At the same time, China -- which is home to the vast majority of the world's rare earth mining operations -- has been tightening its hold on the elements in a classic supply-and-demand price spike. Since 2009, prices for rare earth minerals have climbed to dizzying heights.

RARE EARTH INVESTING NEWS

...the cost of many rare earth elements has defied analysts' predictions with steep price increases since the beginning of the month. For instance in the last week, the price of dysprosium has risen from around \$700 per kilogram up to \$1,470.

Bloomberg

Rare Earth Prices Double in Two Weeks as China Seeks to Increase Control

By Jason Scott - Jun 17, 2011 1:47 AM ET

TVs, Bulbs

The price of europium oxide, used for its phosphorescent properties found in plasma TVs and light bulbs, has risen to as much as \$3,400 a kilogram from between \$1,260 and \$1,300, Industrial Minerals said.

Hitachi Metals Ltd., Japan's largest rare-earth magnet-maker, said it will pass on the increases to its customers, which include makers of motors used in hybrid cars.

THE WALL STREET JOURNAL

China Tightens Rare Earth Rules

May 19, 2011

BEIJING—China moved to tighten its control over rare-earth metals Thursday by expanding its export-quota system and imposing higher taxes on the minerals, which are used in such high-tech applications as laser-guided weapons and hybrid-car batteries.

It also said it will get tough with companies that resell export quotas and won't approve any new projects—or the expansion of existing ones—in rare-earth separation over the next five years.

Chinese rare earth metals prices soar

By Leslie Hook

Published: May 26 2011 18:20 | Last updated: May 26 2011 19:22

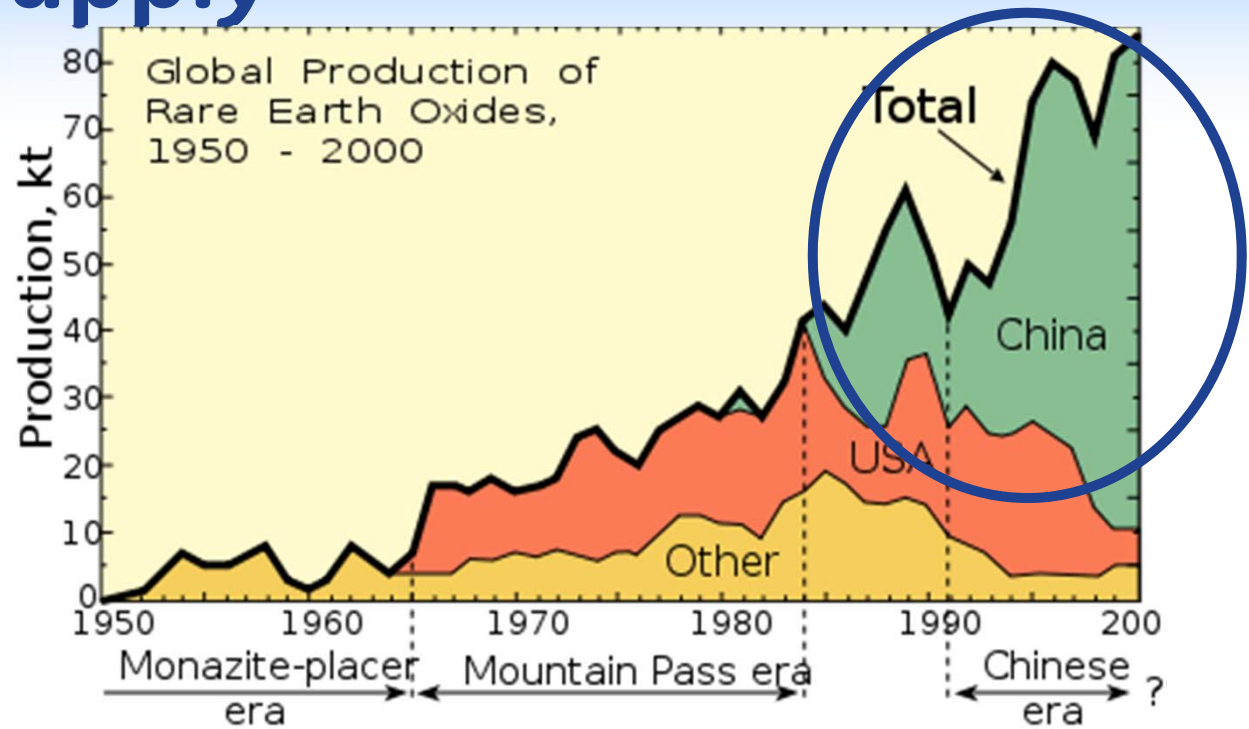
A gravity-defying leap in the price of Chinese rare earth metals has triggered fears that the cost of components used in a range of goods from mobile phones to hybrid cars could soar.

The three to fivefold jump in prices since January comes after China, the world's biggest producer of rare earths, has clamped down on domestic output.

The implications could be far-reaching. Although annual consumption of the metals is small relative to that of other commodities, rare earths are found in everything from fluorescent lights to wind turbines. They are very difficult, if not impossible, to substitute.

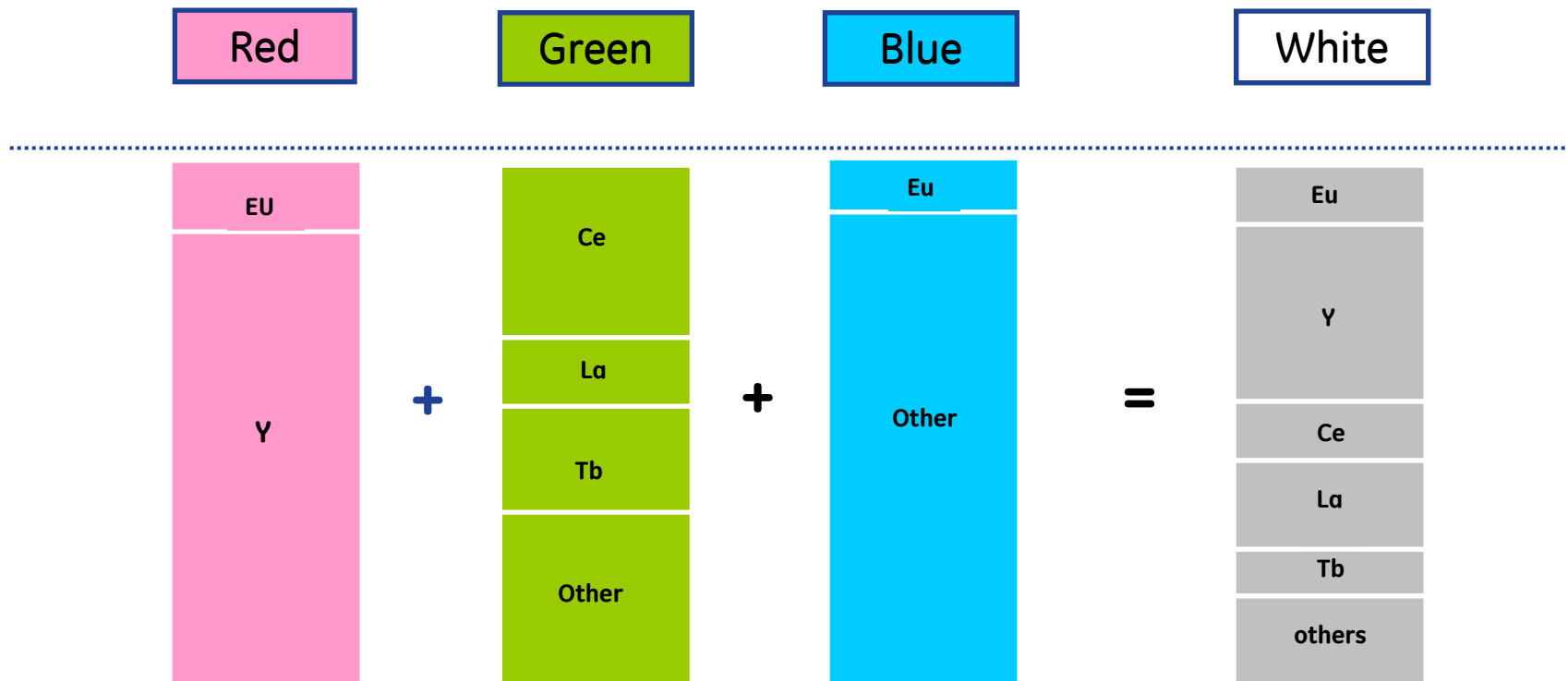


Sources of Supply



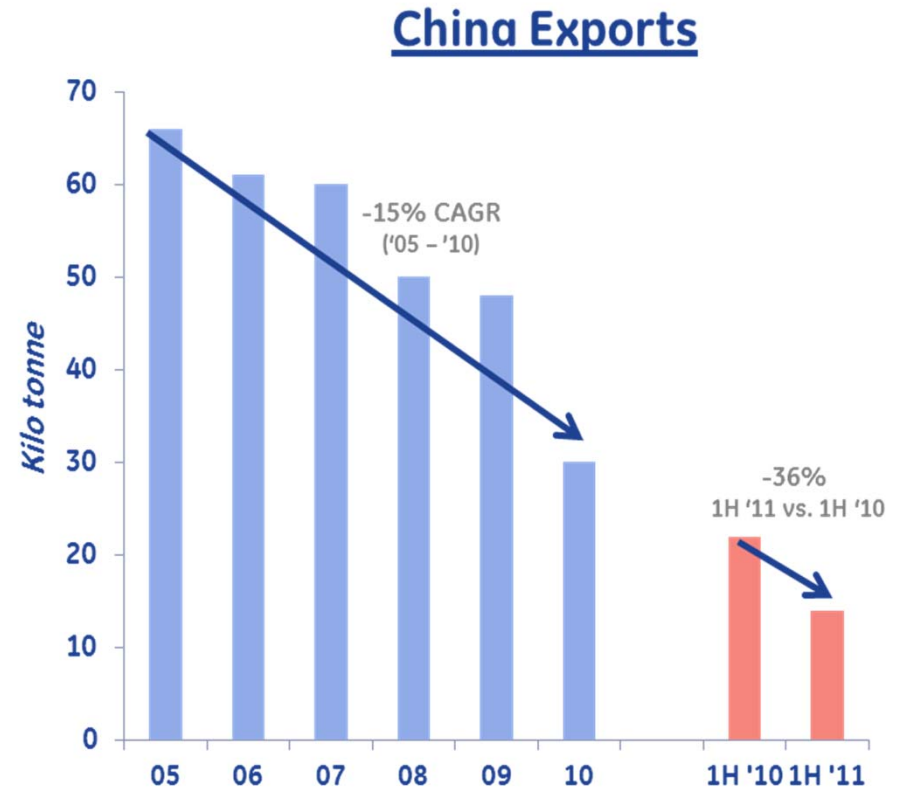
Mighty mine: This 50-acre mine on the eastern edge of California's Mojave Desert was once the world's leading supplier of rare-earth metals. Water pooled at the bottom of the mine while it lay idle after being shut down a decade ago. Credit: Photography by Daniel Hennessy Technology Review May/ June 2011 Published by MIT

Rare Earth content - phosphors



Why Do RE Costs Continue to Rise?

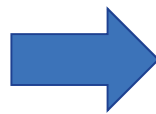
1. Increased demand for rare earths in widely used products
2. China has enacted new policies:
 - Domestic stockpiles
 - Export duties, taxes & tariffs
 - Imposing export quotas
3. New mines outside of China not yet operational



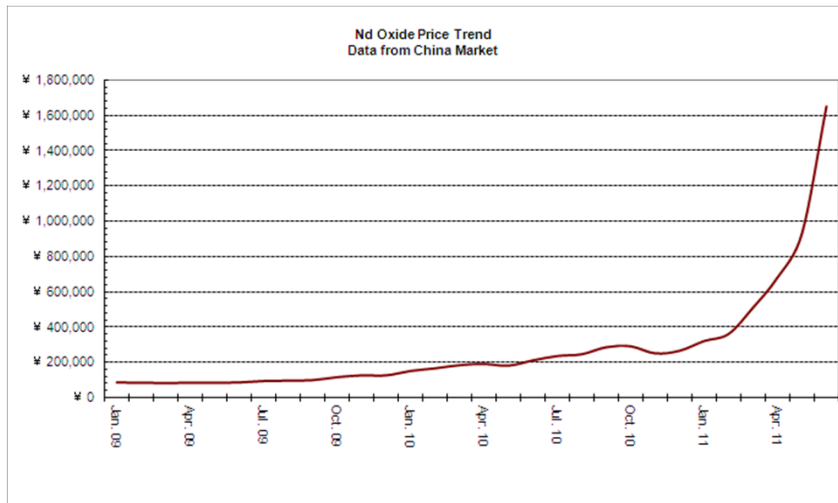
Rare Earth Costs

Neodymium, used in Reveal[®] glass, has increased in cost **19x** since 2009!

Jan. 2009
85k RMB/MT



Today
1700k
RMB/MT



RE prices are rapidly inflating costs of *phosphors* used in LFL & CFL products

Y Oxide



Tb Oxide



Eu Oxide



Ce Oxide



(\$/Kg in China; 99% purity)
Source: metals-pages.com

RE-Like Inflation on Everyday Items

What would prices be if you experienced Europium oxide inflation rates on some common everyday items?

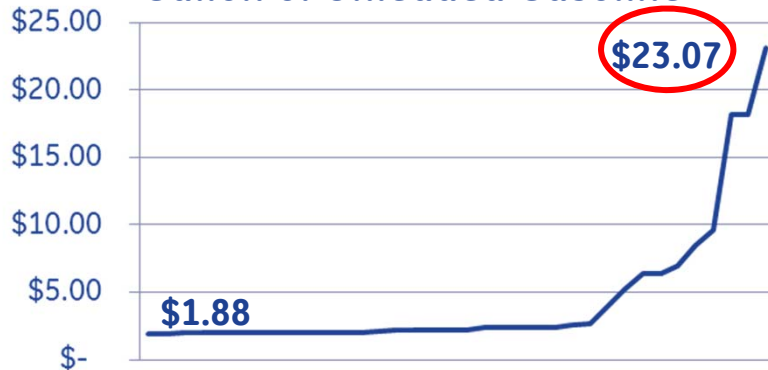
Gallon of Milk



Cup of Coffee



Gallon of Unleaded Gasoline



Movie Ticket



What is the U.S. Government Doing?

- **H.R. 4866: Rare Earths Supply-Chain Technology and Resources Transformation Act of 2010**

Status: Introduced - March 17, 2010

Content:

- Establishes interagency working group to reestablish US RE supply chain
- Stockpiling of REs established as critical to Defense
- Review of trade practices - initiate WTO action as result of review
- Consider loan guarantees to reestablish RE supply chain

- **H.R. 6160: Rare Earths and Critical Materials Revitalization Act of 2010**

Status: Passed by House (325-98) - September 29, 2010

Content:

- Establishes R&D in DOE for sustainable supply of REs (\$70M over 5 years)
 - Supporting new or improved processes and technologies
 - RE training programs
 - RE information center
- Loan guarantees for new or improved technologies

- **S. 3521: Rare Earths Supply Technology and Resources Transformation Act of 2010**

Status: Introduced - June 22, 2010

Content:

- RE Policy Task Force in DOI
- Assess and report on supply chain, REs critical to energy and defense, and what should be stockpiled
- Loan guarantees
- Expresses sense of congress that
 - US faces RE shortage
 - Urgent need to reestablish RE supply chain with statutory prioritization of projects
 - Pressing need to support innovation and training
 - DOE, DOI, DOC, and DOD should provide funds to ... private entities... for innovation, training, and workforce development

- **National Defense Authorization Act SEC.843**

Assessment and Plan for Critical Rare Earth Materials in Defense

Content: Stockpiling, WTO action, Defense Production Act

- **Hearings in the Legislative Branch**

Six from March '10 through June 14, 2011

- **112th Congress**

- Six House Bills presented by both Democratic and Republican representatives
- Two Senate Bills, both Democratic and Republican representation

- **Activity in Departments of Commerce, Defense, Energy, State, US Geological Survey, and Office of Science & Technology Policy (OSTP)**

- ***Key takeaways:***

- Congress has recognized the need for a domestic supply chain for Rare Earths
- Several government agencies are working to address rare earths supply issues and future prospects
- The US Government needs a comprehensive strategic materials strategy for the entire value chain

What is GE doing?

- Securing current sources of supply
- Qualifying alternative sources
- Investigating recycling programs
- Investing in alternate technologies
- Increasing communication to distribution channel
- Creating FAQ / leave behind document

Communication Plan

- Account Manager communications May/June
- Price increase letters June
- Today's webinar Jul 13
- FAQ & leave behind Jul 13
- Website Jul 18
- GE field communications Ongoing

