

UNITED NATIONS CONFERENCE ON TRADE AND DEVELOPMENT

**MULTI-YEAR EXPERT MEETING ON COMMODITIES
AND DEVELOPMENT**

9-10 April 2014

RARE EARTH METALS

by

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The views expressed are those of the author and do not necessarily reflect the views of
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RARE EARTH METALS



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9th April 2014

Key message

RE market is expected to be tight in the medium term, especially in regard to HREs



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Objectives

Present an overview of the rare earth market up to December 2013

Discuss some key issues to capture the essence of this market of highest importance to strategic sectors



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Main challenges in regard to the production of this report

- (1) **Strategic importance of RE → Sensitive topic**
- (2) Lack of authoritative source of information
- (3) Lack of systematic and accurate statistics



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Outline

- (1) Introduction
- (2) Reserves
- (3) Production
- (4) Demand
- (5) Prices
- (6) Trade policy issues
- (7) Challenges in regard to RE market



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Introduction (1)

15 lanthanides

LIGHT RE

- Lanthanum
- Cerium
- Praseodymium
- Neodymium
- Promethium
- Samarium
- Europium

HEAVY RE

- Gadolinium
- Terbium
- Dysprosium
- Holmium
- Erbium
- Thulium
- Ytterbium
- Lutetium

SCANDIUM

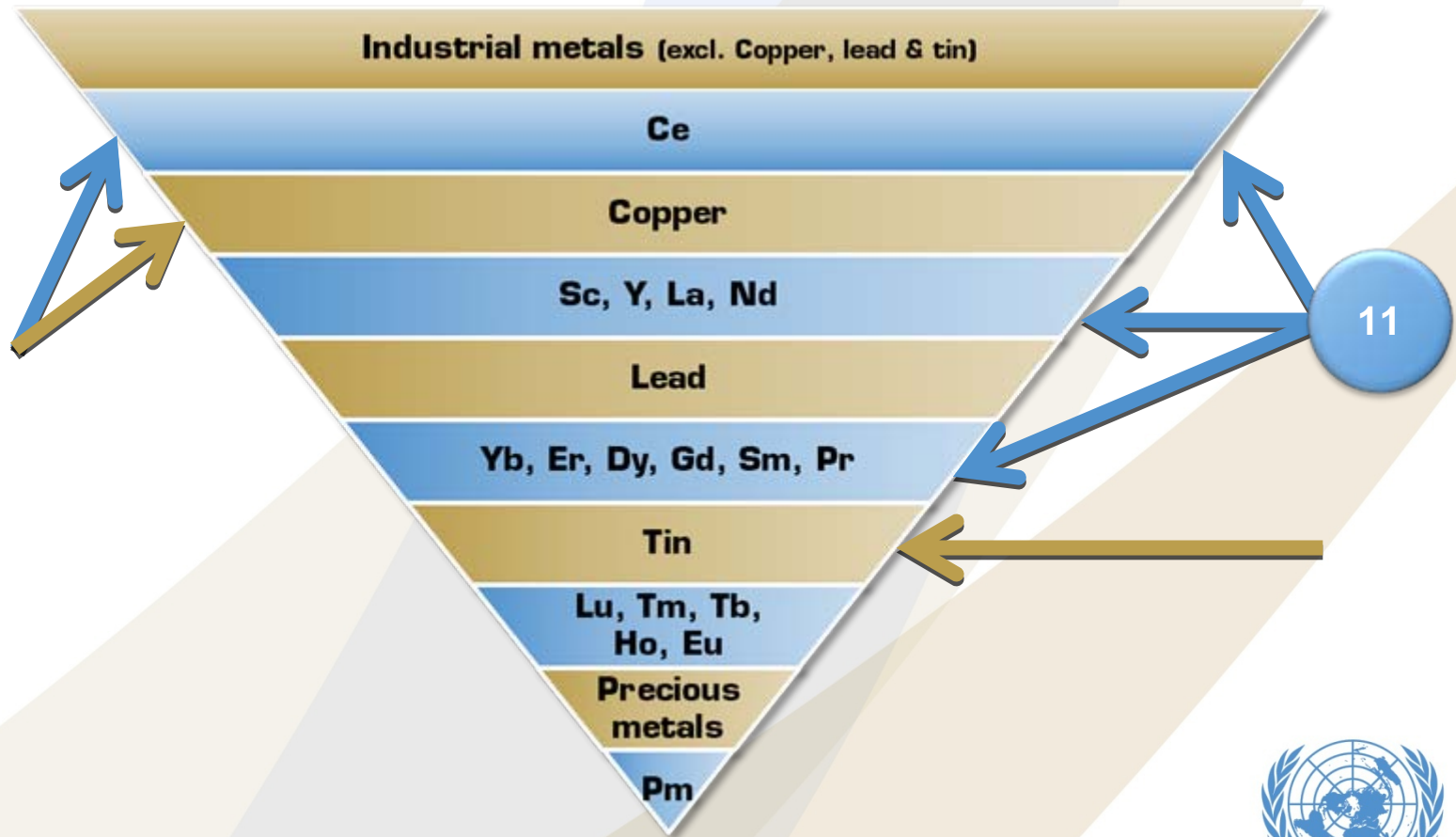
YTTRIUM



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Introduction (2)

Rare earths, not as rare as the name would suggest



(Ce) Cerium, (Dy) Dysprosium, (Er) Erbium, (Eu) Europium, (Gd) Gadolinium, (Ho) Holmium, (La) Lanthanum, (Lu) Lutetium, (Nd) Neodymium, (Pr) Praseodymium, (Pm) Promethium, (Sm) Samarium, (Sc) Scandium, (Tb) Terbium, (Tm) Thulium, (Yb) Ytterbium, (Y) Yttrium

Introduction (3)

(1) Use in 9 main industries

- Permanent magnets
- Phosphors
- Battery alloys
- Fluid catalytic cracking
- Ceramics
- Glass additives
- Polishing powders
- Auto catalysts
- Metallurgy (excluding batteries).

(2) LREE more widely and largely used than HREE

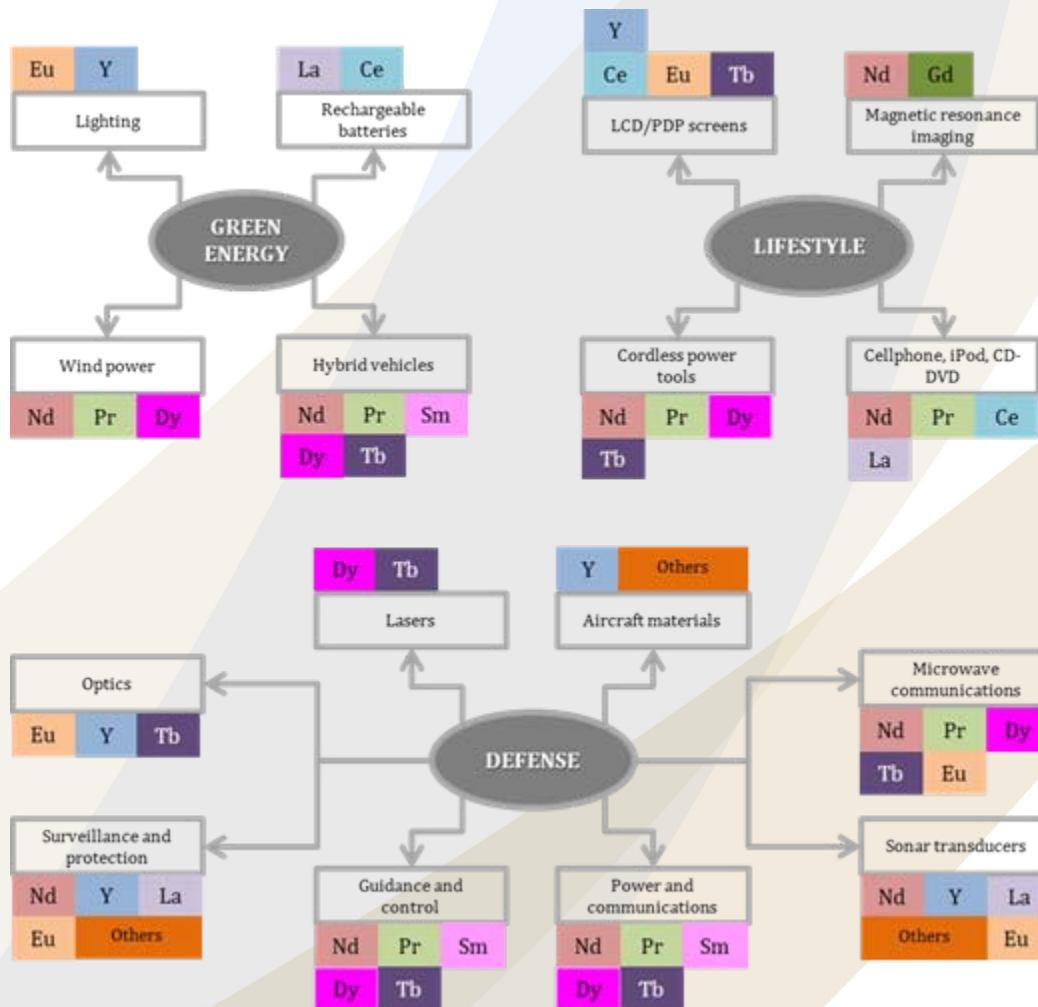
(3) **HOWEVER**, HREE are critical in sectors where they are used



Introduction (4)

Given their versatility, REs are essential to the day to day life of people inhabiting developed and developing countries alike

Figure 6. Final sectors using rare earth materials as an input



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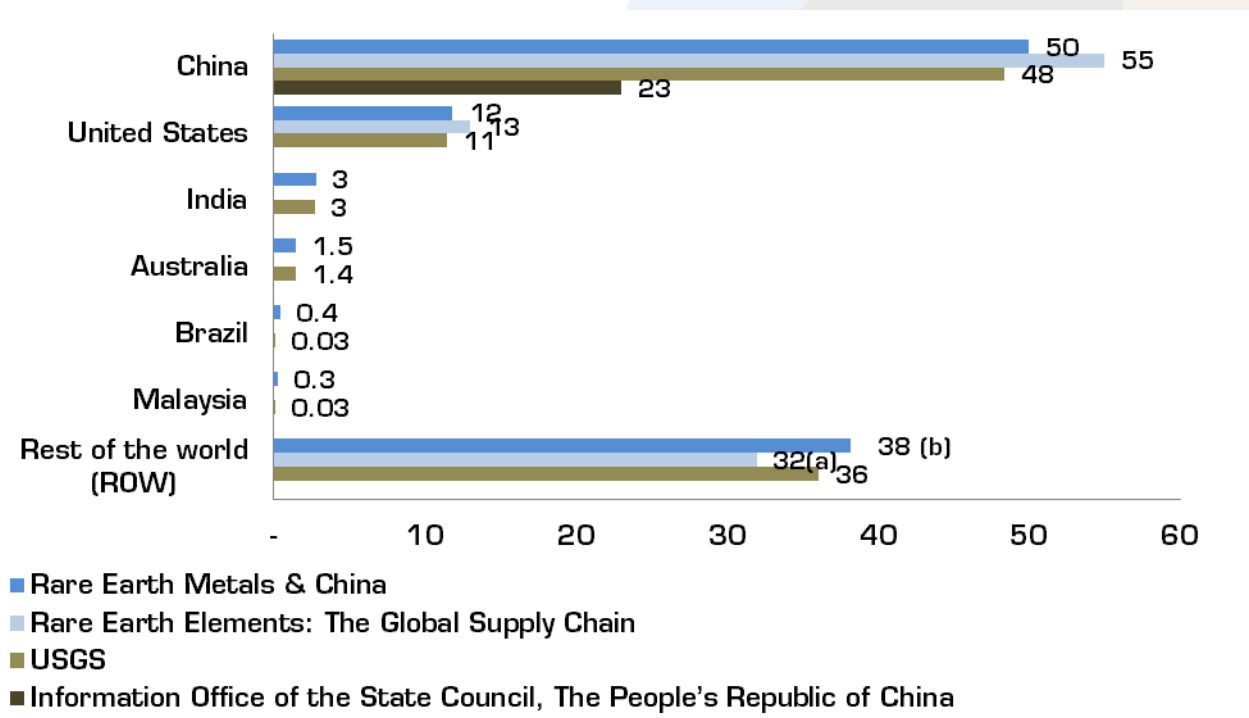


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Reserves (1)

Figure 1. Distribution of world rare earth reserves, 2012 (per cent): different estimates



2013: 110 million tons (USGS) - 2014: 140 Million tons (USGS)

- Decreasing role of China in world reserves
- Not all reserves are developed

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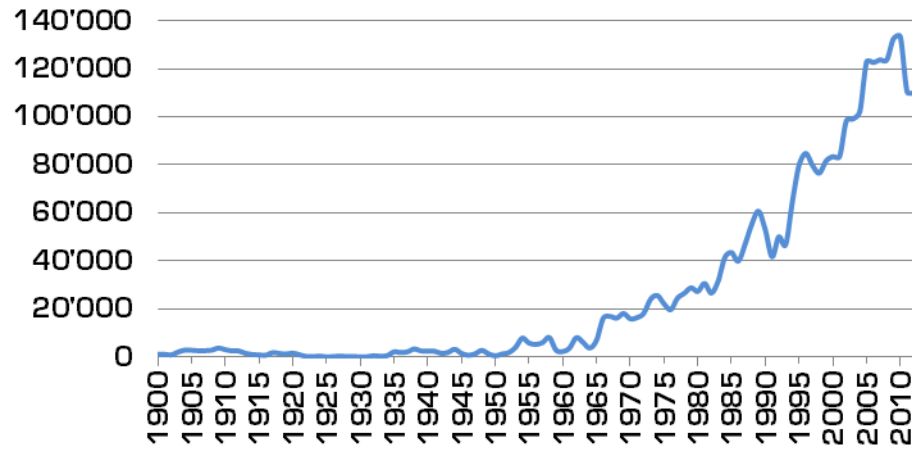
(7) Challenges in regard to RE market



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Production (1)

Figure 3. Long term evolution of world rare earth production, 1900-2012 (tons)



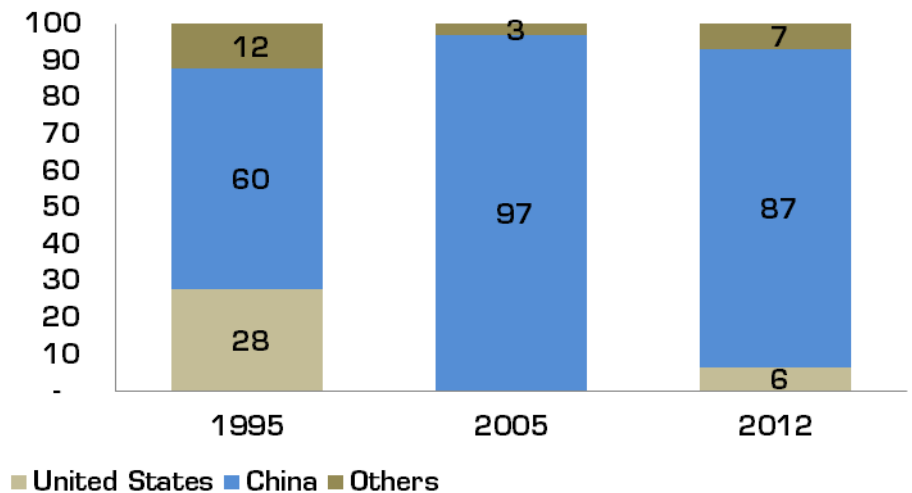
(1) 1900 - 1965: ~ 2,000 tons per year

(2) 1966-1984: ~25,000 tons per year

(3) 1985-1995: ~50,000 tons per year

(4) 1995 - 2012: ~ 100,000 tons per year

From figure 4. Distribution of producing countries, 1995, 2005, 2012 (per cent)



Production (3)

China recognizes that some challenges have to be taken up in regard to its domestic RE value chain. Among the most important are:

→ The impacts of RE activities on its environment and on human health



Actions taken by the Chinese government

PROSPECTS → 2015



Production in China: 130-140,000 tons in 2015
(70-75% of world production)

⇒ Increase mainly due to the development of mining activities worldwide

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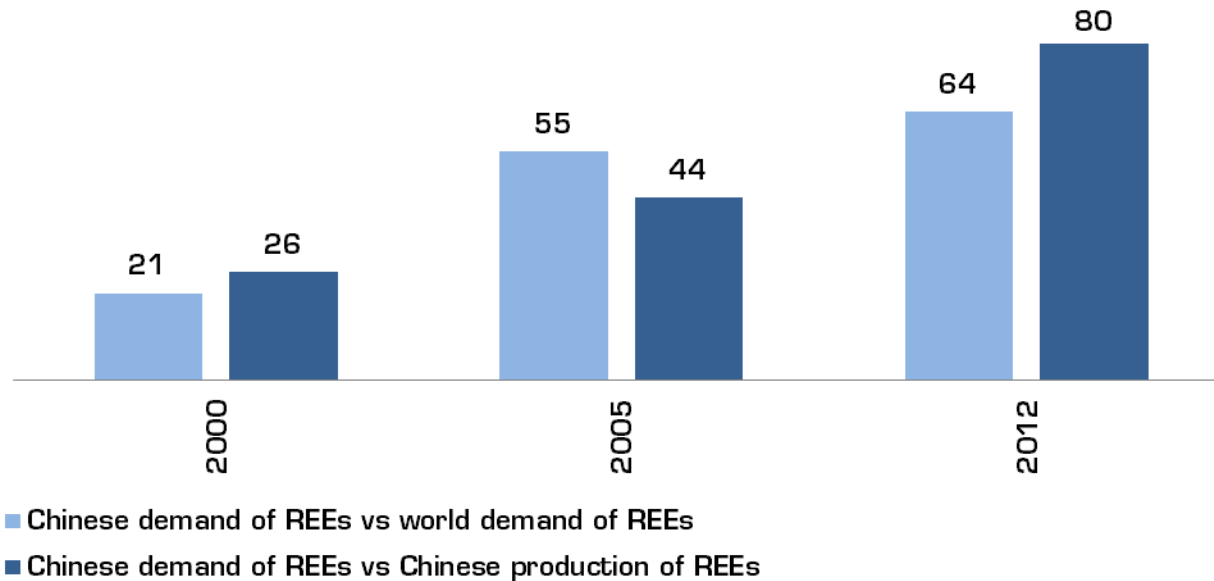


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Demand (1)

- (1) 1990 - 2010: Continuous increase of RE demand
- (2) 2011 - 2012: Slight contraction of the demand
- (3) Largest historical RE demanding country: China (+ Japan, the US and the EU)

Figure 10. Chinese REEs demand as a percentage of: (1) world RE demand and (2) Chinese REs production, 2000, 2005, 2012 (per cent)



Demand (2) - Outlook

Smart phones
4-fold by 2015

**Personal
tech.
devices**

**Electric
vehicles**

**Increase of
the RE
demand**

**standard
of living**

E-V deployment
2012=180,000
2020 = 20 million

**Wind
energy**

**world
population**

Global electricity
demand
3.5% → 6%/12%

According to most sources, the increase in demand (especially outside China) will have to be met by production outside China by 2015



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Prices (1)

(1) 2001-2009: REE prices remained relatively stable

(2) End of 2010 - mid-2011: dramatic rise of RE prices. The year 2011 recorded the highest prices, historically and notably for HREE.

Reasons

- Contraction of Chinese REE exports
- Anticipation of possible market shortages

(3) End of 2011 – 2012: contraction of RE prices

Reasons

- Supply side (Resurgence and/or development of production facilities worldwide)
- R & D
- Sluggish economic situation
- Tsunami in Japan in March 2011



Prices (2), Outlook 2015

BULLISH FACTORS

HREE

- Strong demand to come
- Pessimistic outlook regarding Chinese HREE reserves (depletion)
- Low content in mines outside China

- China to become a net importer of rare earths in the medium term instead of a net exporter, as it is today
- Increase of production costs

- Potential strong demand for Neodymium and Europium

LREE

BEARISH FACTORS

HREE

- Development of Recycling solutions
- Development of substitutes
- Optimization of REE use

- Development on mines sites and processing facilities outside China
- Abundance of LREEs (e.g. Lanthanum and Cerium)



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LREE

Prices (3), Outlook 2015



Yttrium
Erbium (H)
Dysprosium (H)
Terbium (H)
Samarium (L)
Neodymium (L)
Europium (L)
Gadolinium (H)
Holmium(H)
Yttrbium (H)
Scandium

Preasodymium (L)
Cerium (L)
Lanthanum (L)



H stands for Heavy rare earth, L for Light rare earth



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Trade policy issues

- (1) The main RE producing country: China is intended to reorganize its value chain -->
Changes in its trade policy to streamline its VC
- (2) WTO trade dispute between China / Japan, US and EU
- (3) Prospects



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Challenges in regard to RE market

- (1) It is highly likely that RE production will not meet demand in the medium term**
- (2) Information availability and access**



FURTHER QUESTION ABOUT RARE EARTHS?



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