

# **The REE situation is rapidly changing**

**Recent developments in critical materials technology & policy**

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## The cliché

- Rare earths are rare
- China's share of global rare earths is 95-97%
- Chinese REE are mostly exported...
- ...with China manipulating the price
- There are no REE substitutes
- The West's defense depends on China

# The new reality...

- In 2014, China accounts for more than 80% of world production, to fall to just > 70% by 2018: Roskill Information Services...
- ...and 'China likely to remain a key producer, potentially providing 70pct of global supplies' US Council on Foreign Relations, Apr '14
- Since the 2011 peak, REE prices keep falling dramatically
- Lynas, Molycorp on stream, many other projects developed... but Western future supply security far from being solved
- Cerium in oversupply
- HREE: China the only competitive producer today, due to cost structure; Norra Karr a candidate
- Financing difficulties

## ... The new reality

### Chinese REE exports

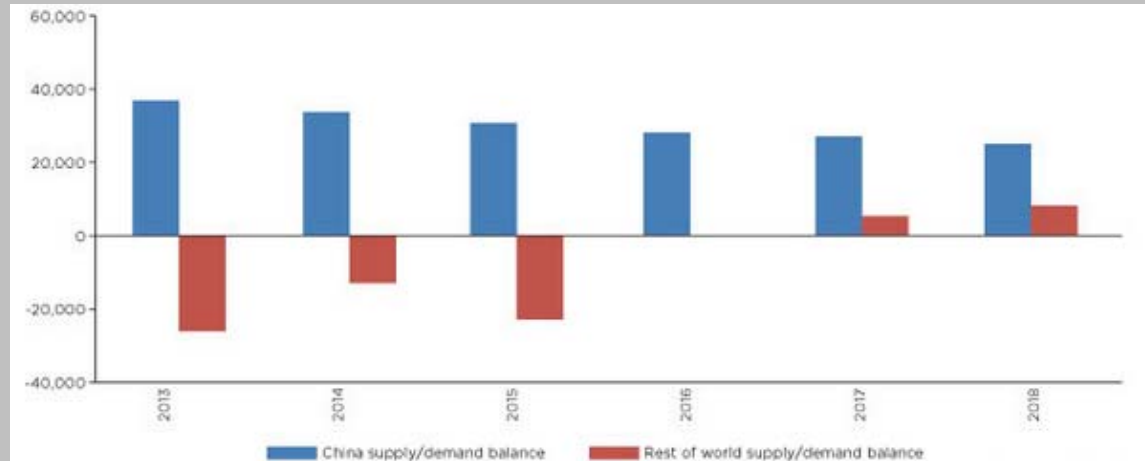
- 8 mos '14 18 kmt, ~ 60% of full-year export quota of 31kmt; export value down 7.9% y-o-y to US\$283.852 mi
- 9 mos '14 REE permanent magnet exports up by 22.9% y-o-y to 21,543.83 mt, at US\$ 1229.51 million, avg price US\$57/kg

China's Actual Volume of Rare Earth Permanent Magnet Category Products Exports in Jan-Sep 2014						
Chinese HS Code	Product Name	Volume (kg)	Growth rate (%)	Value (US\$ million)	Growth rate (%)	Average Prices (US\$/kg)
85051110	Rare earth permanent magnets	16225803	16.7	1049.04	4.4	64.7
72029912	NdFeB magnetic powder	4067976	82.7	119.49	74.5	29.4
72029919	Other NdFeB alloys	284530	-37.5	8.745	-50.1	30.7
72029911	NdFeB magnet film	965519	2.5	52.236	3.8	54.1
<b>Total</b>		<b>21543828</b>	<b>22.9</b>	<b>1229.511</b>	<b>7.7</b>	<b>57.1</b>

*Source: China General Administration of Customs*

# Supply...

## China & ROW REE: y-o-y supply/demand balance 2013-2018



- Chinese supply for domestic consumption > 70% of total REE demand. New projects in ROW forecast to contribute additional 45k tpy REO supply by 2018: Roskill
- Mark Saxon, Tasman Metals: Supply from REE scrap  $\approx$  1%

## ...Supply...

10<sup>th</sup> International REE Conference Singapore Nov '14

- REE companies facing some of the worst market conditions in industry's history
- Challenges of establishing a viable REE supply chain outside China notwithstanding, 'the need for reliable supply sources remains of paramount importance to downstream consumers'
- REE miners need to be aware of efforts to substitute & reduce specific REE consumption, but the emergence of more suppliers outside China will be a net benefit for the industry

# ...Supply...

- 2008-2013: China's share of global REO consumption from 66.1% to 75.2%, share of global REO production from 74.1% to 69.6%
- China tightens supply, mostly for EHS reasons
- China's REE permanent magnet manufacturing industry = 80% or more of world's annual production of REE permanent magnets & is in an existential crisis. Reasons include:
  - China's economy
  - Overcapacity
  - Reorganization of their supply base
  - Raw material uncertainty



## ...Supply...

### Smuggling

- Illegal REE mining ↓ from 20 ktpy 2012 to < 15 ktpy in 2013
- ERECON conf, Milan: 40% of Chinese supply used in high strength magnets is from illegal mines
- Hunan Provincial Economic & Information Commission investigation: 7 companies acquired total of 4,400 tpy illegal REE product, valued ~\$116.8m
- 20-30 ktpy REO smuggled out of China each year in late-2000s, 15-30 pct of official production

# ...Supply...

### Will WTO have an effect?

- Apr '14 China appealed against the WTO's verdict, claiming its export policies were justified by the necessity to protect natural resources
- Aug '14 WTO rejected China's appeal over its REE export quotas, following Mar '14 ruling condemning quotas as violating free trade principles
- The Chinese Ministry of Commerce [MOFCON], said it would “strengthen management for resources products in the way that conforms to WTO rules, promote resource protection, uphold fair competition & realize sustainable development”

## ...Supply...

### **Lynas**

Sep 2 '14: operating licence for controversial Malaysian REE plant

Oct 16 '14: Increased revenues...but shares down 75 pct year-to-date

Nov 28 '14: lowest equity price in group's 14-year history

### **Molycorp**

Nov 5 '14: consolidated net revenues Q3 '14 \$123.9 million, a 6% increase over Q2 '14. Sales volume Q3 '14 3,356 mt, a 12% sequential increase, at an average selling price [ASP] of \$36.93/kg, a 5% decrease over Q2 '14 ASP of \$39.02/kg

### **U.S. Rare Earths**

Nov 6 '14: 'First American underground REE miner to remove REE material in decades'

## ...Supply...

### **Russia, Kazakhstan coming up**

Russia publicizes intention to become world's largest REE producer & exporter over next few years, investing up ~\$4.5bn by 2020

Sept 12 '14: Stans Energy to apply for Russian govt grants to develop technical projects for REE processing

Sept 16 '14: Ukraine crisis pushing Russia to form REE alliance with China

Oct 30 '14: Russia assists N. Korea to build railway, in exchange for REE mining contract

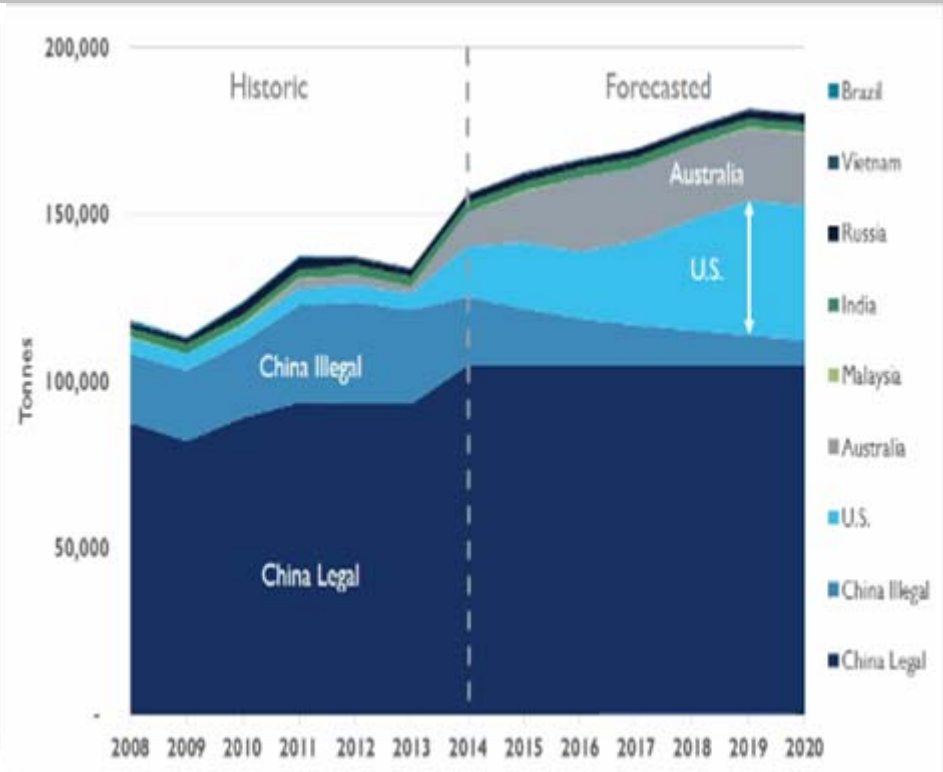
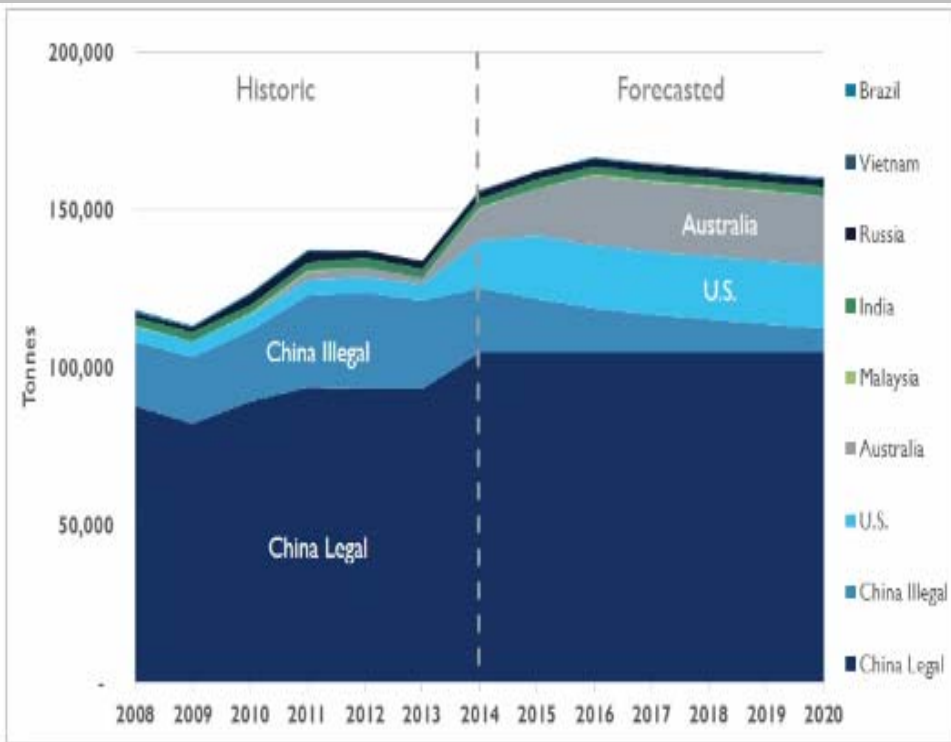
Oct 29 '14: Sumitomo test production of REE elements in jv w/ Kazakhstan's national atomic energy Co

# ...Supply...

## Global TREO production: Adamas 10/12

### Scenario 1

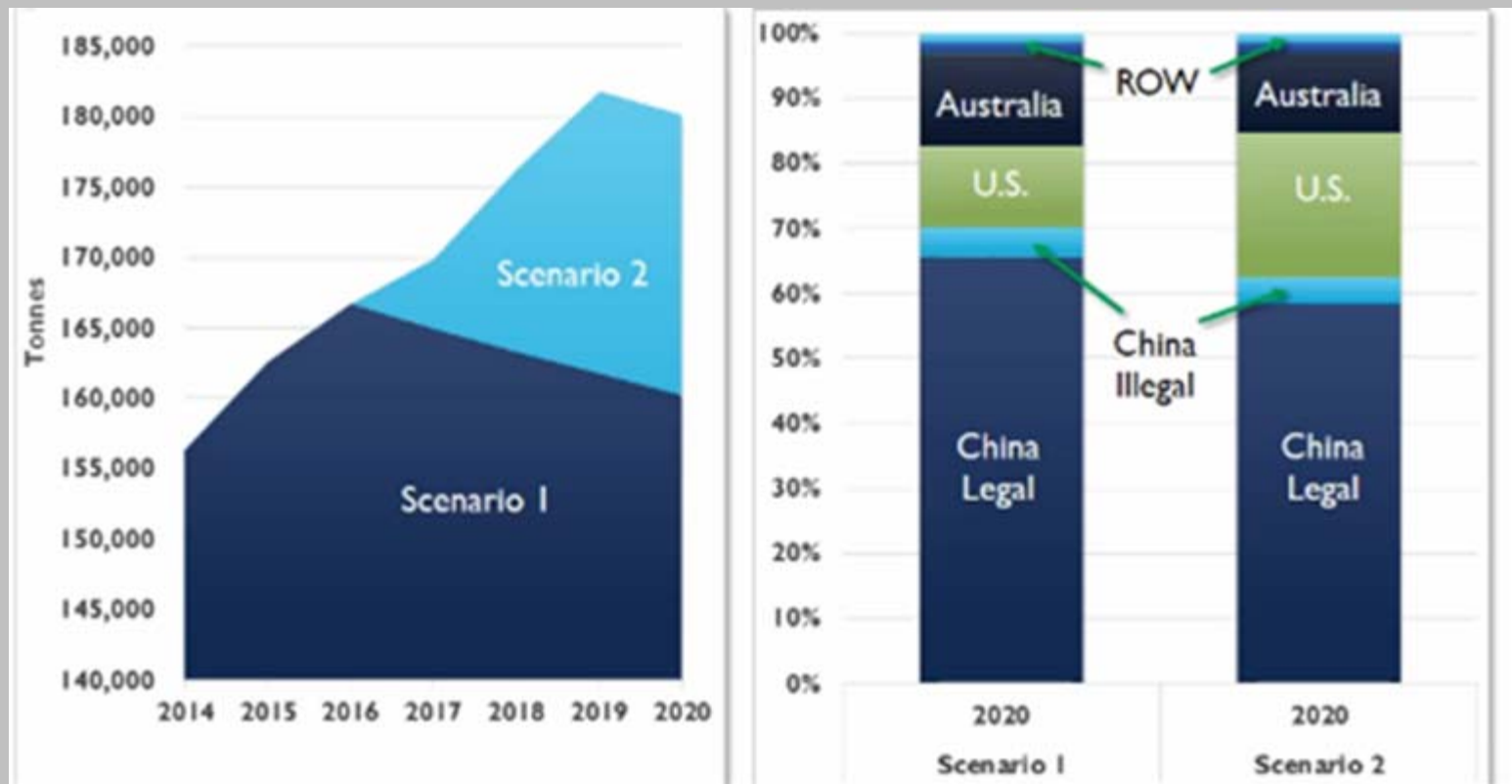
### Scenario 2



Source: Adamas Intelligence

# ...Supply...

## Production scenario comparison: Adamas 10/12

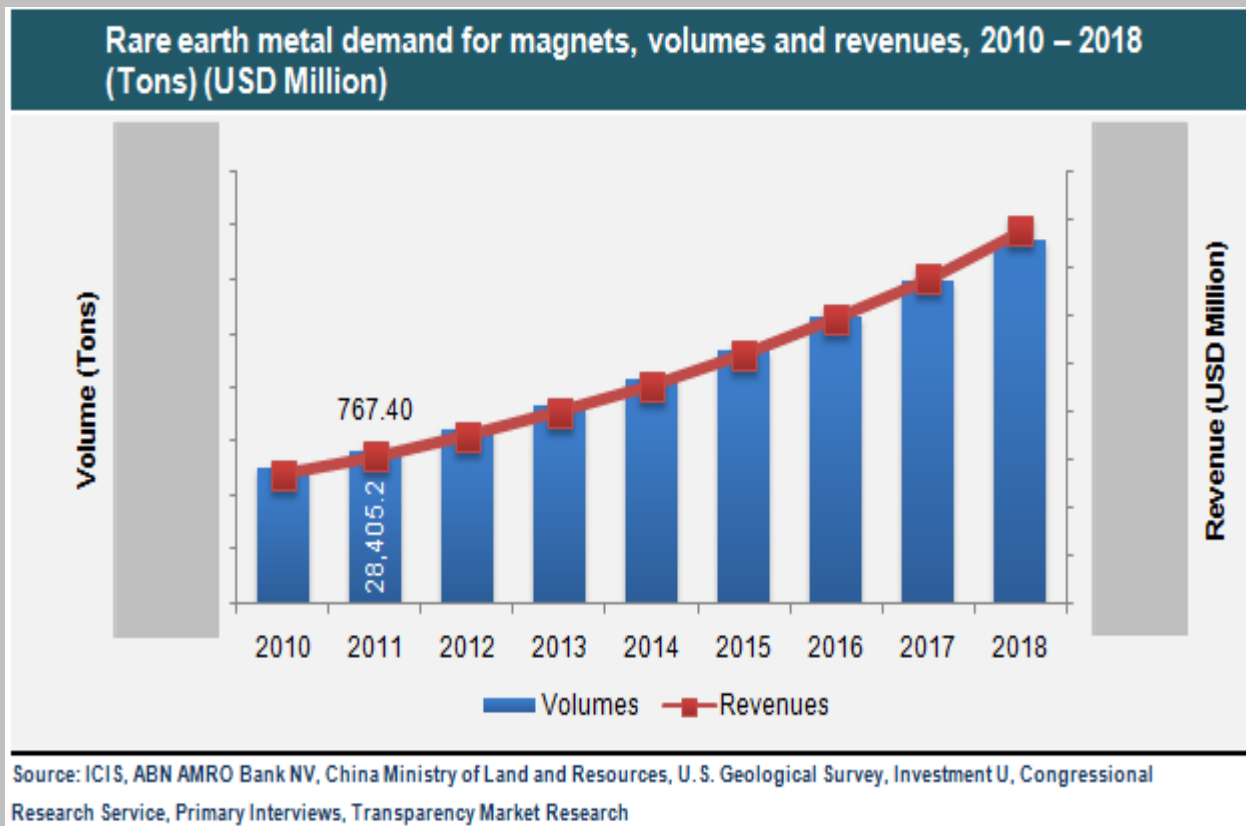


## ...Supply

- But there could be a **Scenario 3**, with Lynas and Molycorp less important...
- ...and Russia, Kazakhstan, India, Brazil, [N.Korea?] etc only partially filling the gap
- Unless world demand, incl. new uses grows more rapidly...
- ...and substitution/recycling remain low
- See next section on demand

# Demand...

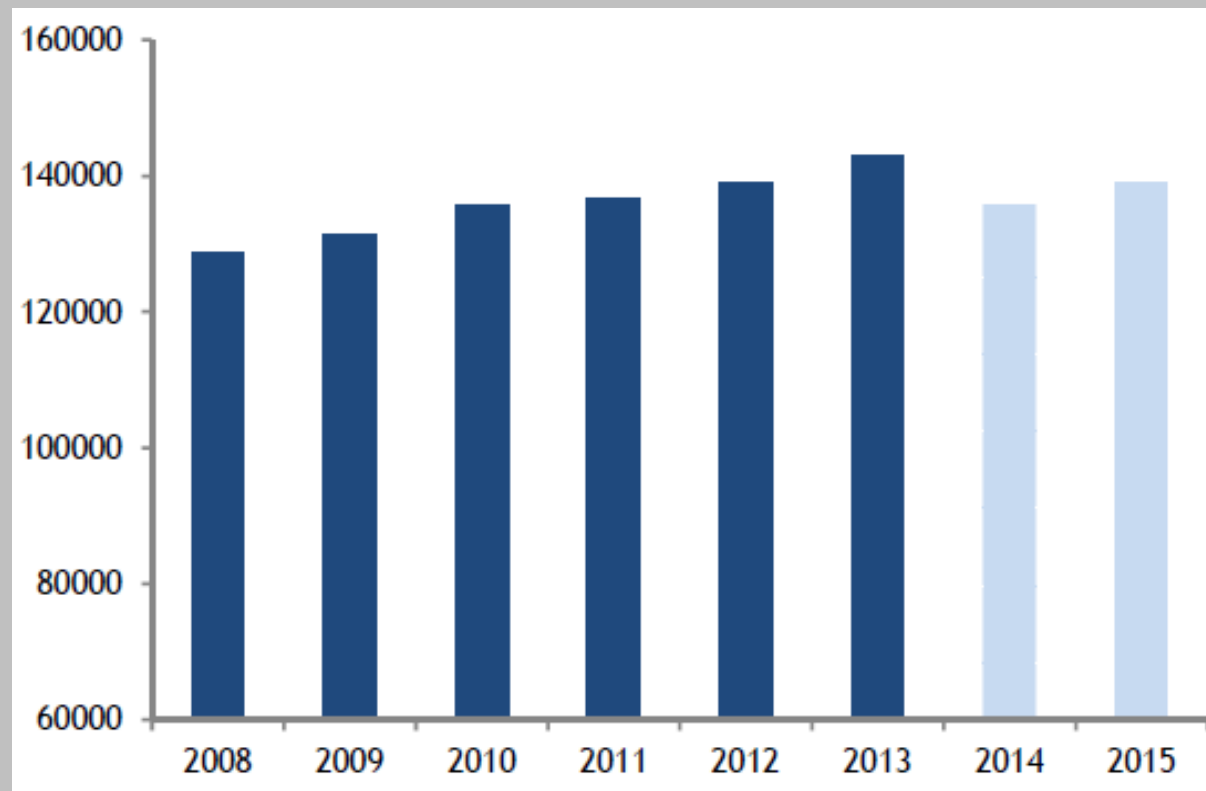
Global REE market '12-'18 to grow @13% CAGR. Market valued \$3.93 bil in '12, to reach \$8.19 bil by '18. Global REM volumes to go to >290 ktpy by '18: Transparency Market Research, Aug '14





## ...Demand...

Argus Nov 3'14: Global REE demand, 2008-15 mt REO



# ...Demand...

*Adamas Intelligence Report Oct '14*

## Value of global consumption and demand [2014-2020]

Global REO demand 120ktpy 2014 -> 151ktpy 2020: 3.9% CAGR

Value Scenario 1 \$3,8 bil 2014 -> \$9,5 bil 2020: 16.7% CAGR; Scenario 2 \$3,8 bil 2014 -> \$8,3 bil 2020: 14.0% CAGR.

China's % of global REO demand 73.4 -> 2014 to 77.5 in 2020. Its % of global REO production 67.2 in 2014 -> 65.5 in 2020 Scenario 1, or -> 58.3 in 2020 Scenario 2



## ...Demand, technology...

### US

- Demand for REE believed to be strengthening, import stats show increase in volumes imported in Aug '14, to 433,567kg, up from 375,536kg Aug '13
- Oct '14: US Defense Logistics Agency (DLA) publishes raw materials sales plan for FY 2015, considers purchasing half 150kg each of lithium-cobalt oxide & lithium-nickel-cobalt

# ...Demand, technology...

## Substitution, recycling...

- Lifton, Nov 11 '14: The traditional processing technique for separating REEs from each other & purifying them hasn't evolved much in last century: a little easier, but still very slow & very expensive
- Jun 27 '14: University of Leuven, Belgium--the potential to exploit red mud waste from bauxite mining as a secondary REE source
- Nov 5 '14: China's REE industry moves towards further consolidation & recycling, by setting up a number of REE regional waste recycling centres
- Jean Goldschmidt International SA (JGI), Nov '14: < 5% REM contained in waste are recovered

## ...Demand, technology

### ...Substitution, recycling...

- University of Houston, Sept 23 '14: commercializing a novel method to recycle REE neodymium & dysprosium from waste electronics
- Covanta Energy, Oct 6 '14: its rare earth-based magnetic sorting system will allow for more efficiency in waste management & metals recycling

### New Uses

- Solvay SA, Nov '14: launches advanced diesel catalyst made fm REE, hopes will allow consumers to comply w/ strong emission limits
- Potential REE use in remote phosphor LEDs, PVC stabilizers,...?

# Policies...

## China

**Rare Earth Products Exchange:** Apr 1 '14 to rectify irregular pricing among Chinese firms, standardize spot trading, create transparent information system  
Sept '14: 1st REE exchange, >9,700 tonnes REE traded,  $\Sigma$  turnover RMB 1.7bn (\$277m)

**Oct 3 '14:** China after WTO to reshape REE export/production policies, ease export controls

**Oct 11 '14:** Ministry of Industry & Information Technology: 'eight authoritative bodies have co-launched a nationwide special campaign to fight REE illegal activities'

**Oct 29 '14:** Launching 5-month campaign against illegal REE mining, smuggling

**Nov 5 '14:** 3 REE producers receive MIIT's consolidation plans

**Nov 26 '14:** Govt to impose new REE resource taxes: 22% on LRE, 35% on HREE

## ...Policies

### Worldwide

**EU** New Critical Raw Materials list

**US Defense Logistics Agency Strategic Materials** may seek to purchase a number of metals in its fiscal year 2015, incl REE

Sept 16 '14: Ukraine crisis pushing **Russia** to form REE alliance w/ China

**Quebec**, Nov 6 '14: First Nations petition province to include REE under uranium ban

**UK**, Nov 18'14: High Court shuts down two REE traders which sold REE as investments to British public

**Greenland** Dec 1'14: Did its tough stance on REE cost the opposition the Greenlandic election?

# **Open questions**

- **Why did China become a monopoly?**
- **Where is the downstream REE market located?**
- **Why did prices rise and fall – both times dramatically?...and can they rise again? LREE vs HREE**
- **Can Lynas and Molycorp survive? What about new projects?**
- **Will there be new uses or, on the contrary, will economizing/substitution/recycling diminish demand?**
- **Who gains from stockpiling?**



# **Relevant work by Natural Resources GP**

- **‘Rare Earths Worldwide: An Industry and Policy Analysis’, Study, 2011**
- **‘REE: Light to Heavy?’, Study, 2014**
- **Articles in Industrial Minerals Magazine**
- **Presentations in international conferences: Athens, Bologna, Brussels, Budapest, Milan, Milos, Osaka, Plovdiv etc**

**Thank you very much!**  
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