

UNITED NATIONS CONFERENCE ON TRADE AND DEVELOPMENT

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

**9-10 April 2014**

Developments and New Challenges for Base Metals:  
The Case of Copper, Zinc, Lead and Nickel

by

**Mr. Carlos Risopatron**

Director of Economics and Environment  
International Copper Study Group (\*), Lisbon Portugal

\*presentation prepared with the assistance of the  
International Lead and Zinc Study Group and  
the International Nickel Study Group

The views expressed are those of the author and do not necessarily reflect the views of  
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**UNCTAD 2014 Multi-year Expert Meeting on Commodities and Development  
Geneva 9-10 April 2014**

# **Developments and New Challenges for Base Metals: The Case of Copper, Zinc, Lead and Nickel**

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# Summary

1. Description of the Study Groups: Membership and Objectives
2. Global Use, Mining and Recycling of Refined Copper
3. Global Use, Mining and Recycling of Refined Lead and Zinc
4. World Mining, Scrap Use and Demand for Nickel
5. Regulatory Trends and Non Ferrous Metals Based Development
6. Role of China in the Use of Copper, Lead, Zinc and Nickel
7. World Metal Balances and Inventories 2013-2014
8. Metals Study Groups Activities 2014 and Publications



ICSG

International Copper  
Study Group

## ICSG Membership

- Autonomous International Governmental Organization. **Active industry involvement.**
- Main source of **unbiased information** for governments, the public and the industry.
- Membership open to countries involved in copper production, use or international trade.
- **23 member countries and the EU.** 4 recent member states. **Non-members can attend as observers.**

 Australia

 France

 Luxembourg

 Serbia

 Belgium

 Germany

 Mexico

 Spain

 Chile

 Greece

 Peru

 United States

 China

 India

 Poland

 Zambia

 European  
Community

 Italy

 Portugal

 Russian Federation

 Finland

 Japan

 Sweden



# International Lead and Zinc Study Group

- Autonomous International Governmental Organization.
- Membership open to any country involved in lead and/or zinc production, usage, or trade.
- **30 members** (>85% of global lead/zinc industry). **Key role in the industry.**

 **Australia**

 **Belgium**

 **Brazil**

 **Bulgaria**

 **Canada**

 **China**

 **Finland**

 **France**

 **Germany**

 **India**

 **Iran**

 **Ireland**

 **Italy**

 **Japan**

 **Korea Rep.**

 **Mexico**

 **Morocco**

 **Namibia**

 **Netherlands**

 **Norway**

 **Peru**

 **Poland**

 **Portugal**

 **Russian Fed.**

 **Serbia**

 **South Africa**

 **Sweden**

 **Thailand**

 **United States**

 **European Union**



# International Nickel Study Group

- Autonomous International Governmental Organization.
- Co-located with ICSG and ILZSG resulting in **significant cost savings**
- Enhancement of market transparency in the nickel market.
- Active industry involvement. Forum for discussions on nickel. **15 members.**



Australia



Brazil



Cuba



European Union



Finland



France



Germany



Greece



Italy



Japan



Norway



Portugal



Russian  
Federation



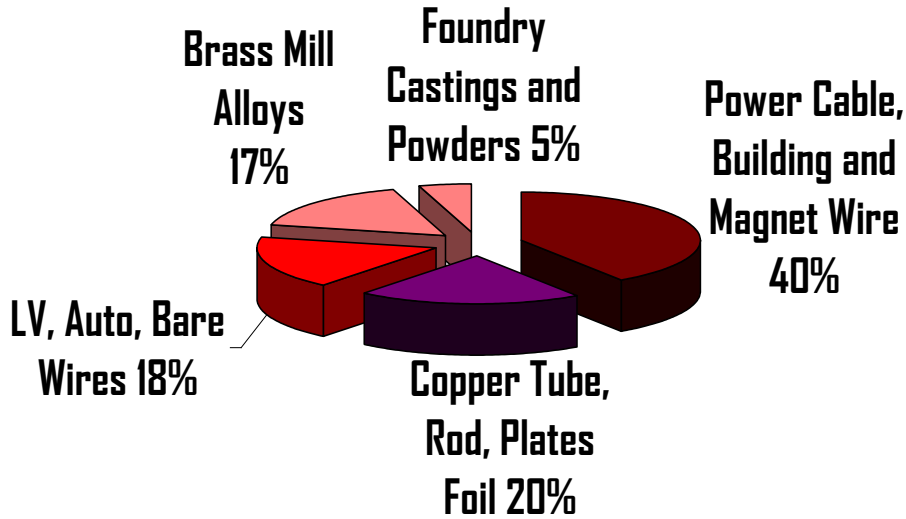
Sweden



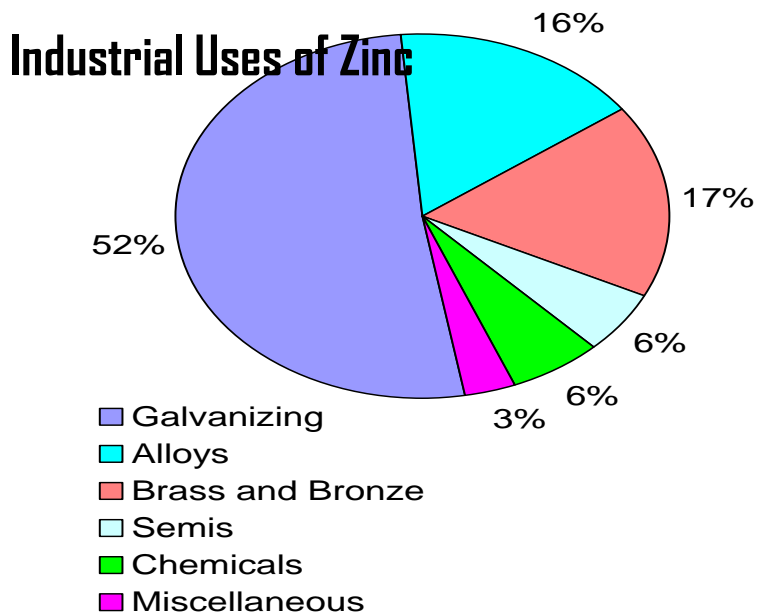
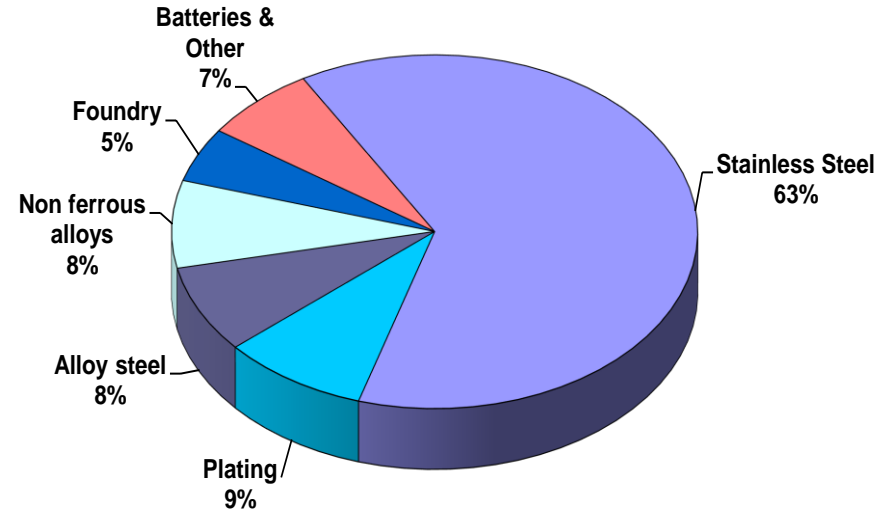
United  
Kingdom

# World industrial uses of refined and scrap copper, nickel, zinc and lead.

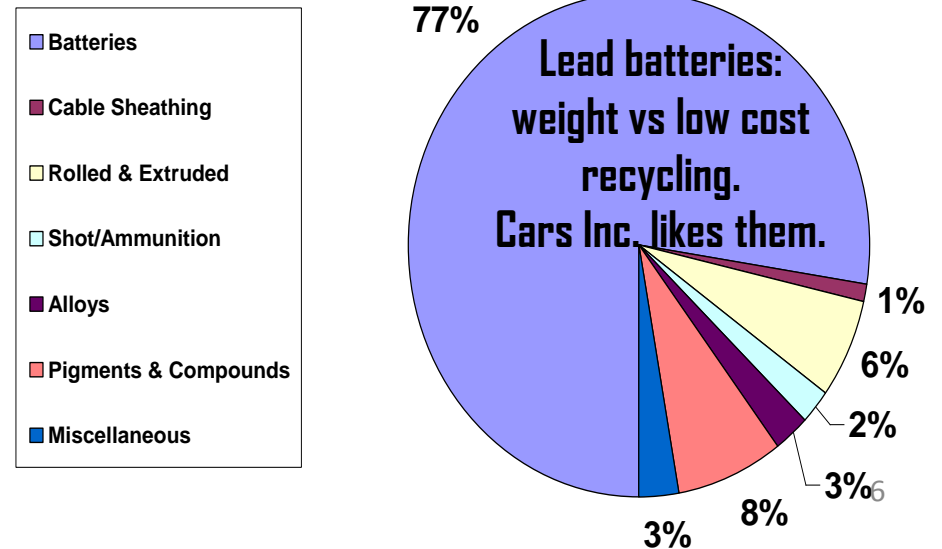
## Industrial Uses of Copper



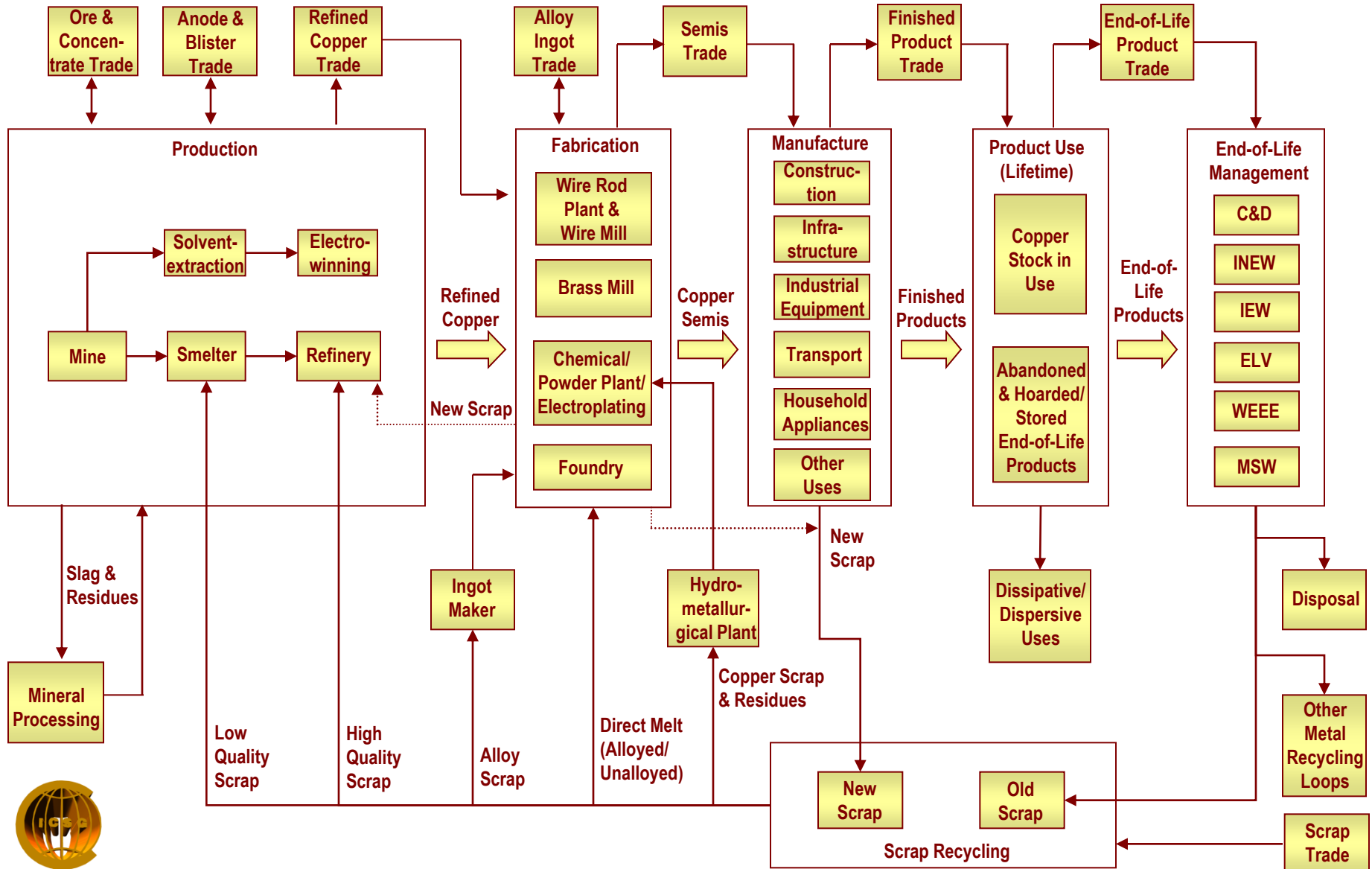
## Industrial Uses of Nickel



## Industrial Uses of Lead



# 2012 Global Copper Flows 25 Mt = 16.5 Mt Mine Refined+ 3.6 Mt Scrap Refined + 4.9 Mt Direct Scrap.





# Industrial use of copper trend 2007-2012: up just in China and a few oil economies.

## Fabrication of Copper and Copper Alloyed Products: 2012 Versus 2007

million tonnes gross weight, other alloyed metals included

Country	2007 Mt	2012 Oct* Mt	Growth %	Source
China	6.3	11.31	79.5%	ICSG
United States	2.94	2.17	-26.0%	ICSG
Germany	1.85	1.52	-17.7%	ICSG
Japan	1.75	1.33	-23.9%	ICSG
Korean Republic	1.33	1.06	-20.2%	ICSG
Italy	1.75	1.03	-41.2%	ICSG
Taiwan (China)	0.85	0.71	-16.4%	ICSG
Spain	0.34	0.32	-4.7%	ICSG
Poland	0.34	0.23	-31.4%	ICSG
France	0.54	0.19	-64.5%	ICSG
Slovakia		0.02		ICSG
India	0.71	0.64	-9.6%	Estimate
Russian Federation	0.80	0.56	-30.2%	Estimate
Turkey	0.41	0.27	-34.0%	Estimate
Thailand	0.29	0.27	-5.6%	Estimate
Brazil	0.37	0.23	-38.4%	Estimate
Indonesia	0.20	0.22	8.5%	Estimate
United Arab Emirates	0.00	0.21	100%	Estimate
Saudi Arabia	0.19	0.21	8.4%	Estimate
Iran	0.19	0.20	7.5%	Estimate
<b>Sample of Countries</b>	<b>21.1</b>	<b>22.7</b>	<b>7.4%</b>	

\* 12 months before November 2012

# In 2012 the industrial use of copper fell 2% worldwide: falling end uses, mainly in Europe.

## Global Use of Copper in Fabricated Products annual growth 2012/2011

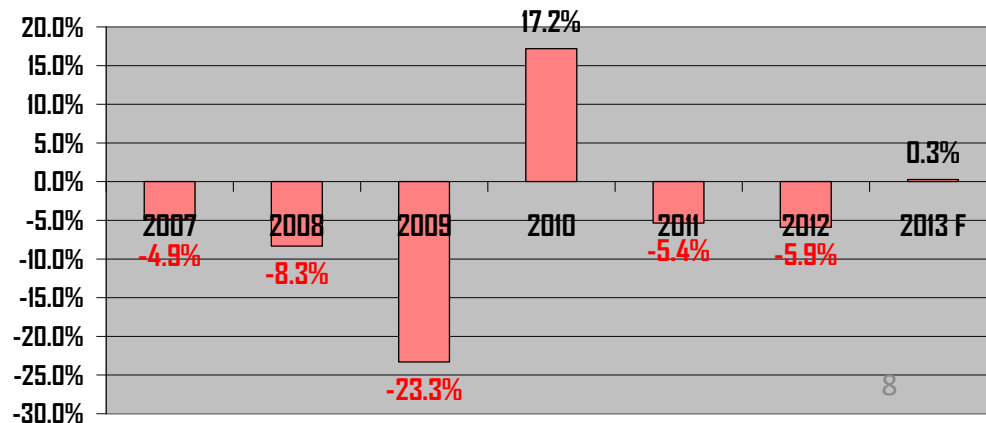
	2012 growth
Industrial Transformers	6.6%
Power Transmission	6.6%
Harnesses, Motors	2.7%
Railroad, Shipping	2.7%
Telecommunication	-0.7%
Building Architecture	-1.7%
Consumer products, tools	-2.8%
Defense, Coinage	-3.1%
Building Plumbing	-3.5%
Building Power	-3.5%
Buildings Phone Wire	-4.2%
Industry-No Electric	-5.1%
Cooling Equipment	-7.8%
Air Con Tube	-8.8%
Electronics	-9.9%
Vehicle Radiators Tubes	-15.5%

Global Use of Copper in 2012

Source: ICA/IWCC/ICSG

**-1.9%**

## Copper and Alloys Gross Semifabrication in Europe ICSG Reported Annual % Growth



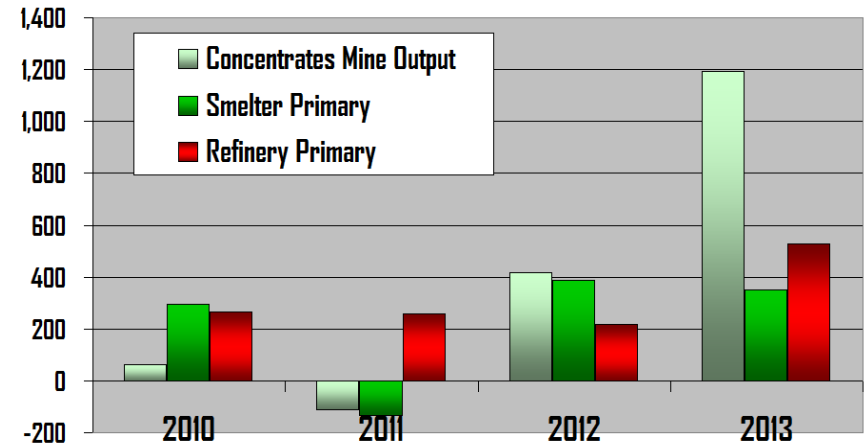
**In 2012-2013 more mine production caused copper oversupply and reduced prices. But ~840 Kt of these concentrates to stock. China reported +630 Kt of concentrate imported in 2013.**

**Copper Mine Production: Recent Additions**

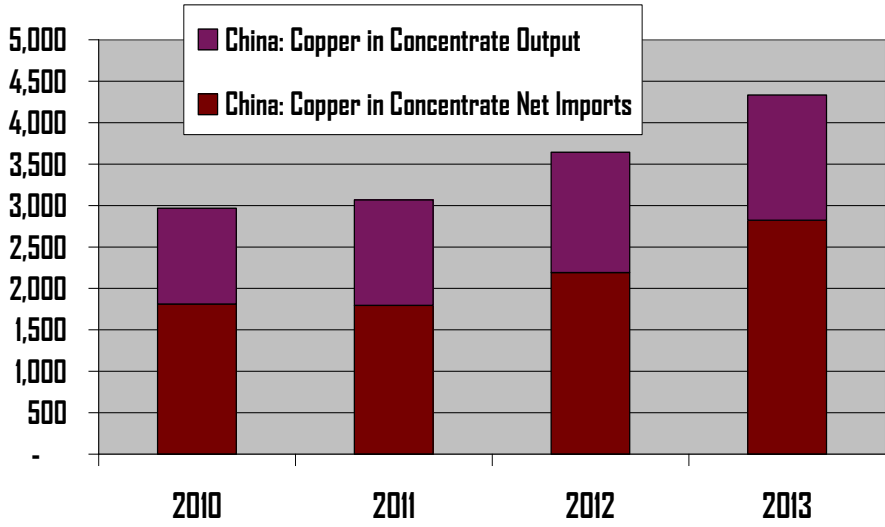
	Kt-Cu		
	2012	2013	2014
Chile	171	342	513
China	195	71	266
DRC	104	282	386
USA	55	63	118
Peru	63	78	141
Zambia	31	53	84
Mongolia	-	4	71
Australia	-	47	14
Mexico	56	-	45
Indonesia	-	144	34
Canada	10	52	62
Brazil	7	50	57
ROW	124	121	245
<b>World</b>	<b>621</b>	<b>1,347</b>	<b>1,968</b>
<b>Growth</b>		<b>117%</b>	

Source: ICSG

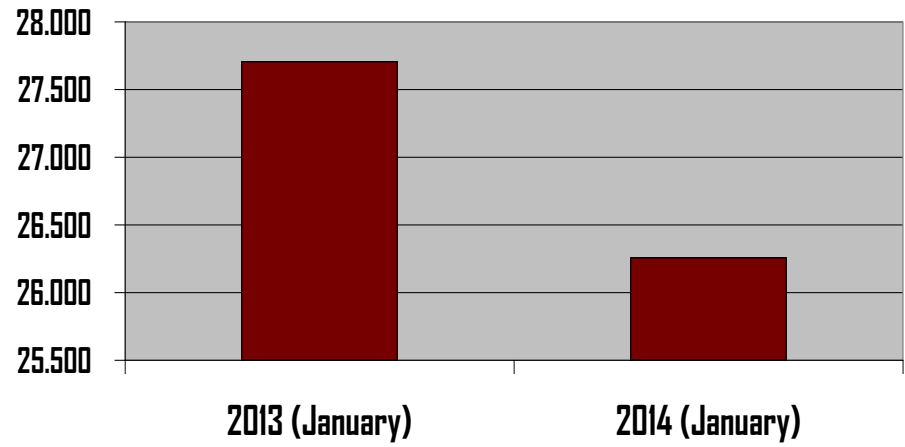
World Annual Growth in Tonnes of Copper Concentrate Mined, Smelted and Refined. Kt-Cu



China: Copper Concentrate Available 2010-2013 Kt-Cu



2016 Global Copper Mine Capacity Forecast, thousand tonnes copper Kt.



**It might be not enough stock: 2015-2017 new copper mine capacity plans down 1.5 Mt-Cu on 2013 CAPEX cuts!**

**Observed industrial copper use up ~7.6% in 2013, up just ~2% out of China, partly led by lower prices. So in 2013 the industrial use of refined copper and copper scrap was not far than 27 Mt-Cu worldwide.**

## Copper and Copper Alloy Products Semifabrication

Kt-Cu Copper Content, Surveys and Estimates

	2012	2013	Vol Change Kt	% Change	
China	9,408	10,600	1,192.0	12.7%	Jan-Dec
United States	1,748	1,755	7	0.4%	Forecast
Germany	1,209	1,235	26	2.2%	Jan-Dec
Japan	1,073	1,084	11	1.1%	Forecast
Korean Rep.	938	975	37	3.9%	Forecast
Italy	834	845	11	1.3%	Jan-Dec
Taiwan (China)	494	493	(1)	-0.2%	Jan-Dec
Turkey	457	485	28	6.2%	Jan-Dec
United Arab Emirates	285	375	90	31.4%	Jan-Dec
Spain	258	250	(8)	-3.0%	Forecast
India Wire Rod	330	306	(25)	-7.5%	Forecast
Poland	263	251	(11)	-4.3%	Jan-Dec
Saudi Arabia	204	205	1	0.5%	Jan-Dec
France	166	155	(10)	-6.2%	Jan-Dec
Egypt	145	155	10	6.9%	Jan-Dec
Iran	95	100	6	5.9%	Jan-Dec
Oman	14	14	0	0.0%	Jan-Dec
Kuwait	9	9	0	0.0%	Jan-Dec
Morocco	1	-	(1)		Jan-Dec
<b>Reported Ex-China</b>	<b>8,521</b>	<b>8,692</b>	<b>170.8</b>	<b>2.0%</b>	
<b>All Reporting</b>	<b>17,929</b>	<b>19,292</b>	<b>1,362.8</b>	<b>7.6%</b>	

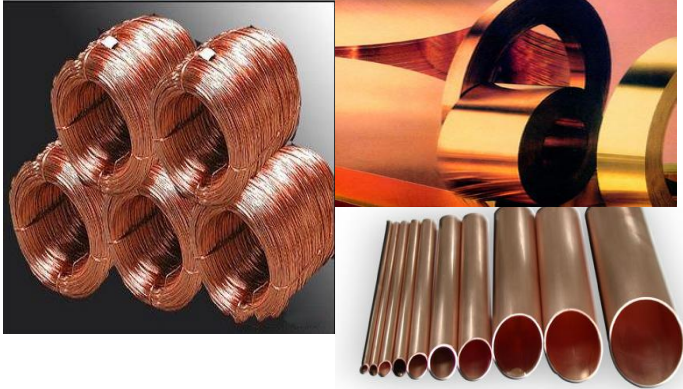
## 2013 Annual Growth %

United Arab Emirates	31.4%
China	12.7%
Egypt	6.9%
Turkey	6.2%
Iran	5.9%
Korean Rep.	3.9%
Germany	2.2%
Italy	1.3%
Japan	1.1%
Saudi Arabia	0.5%
United States	0.4%
Oman	0.0%
Kuwait	0.0%
Taiwan (China)	-0.2%
Spain	-3.0%
Poland	-4.3%
France	-6.2%
India Wire Rod	-7.5%

**Recycled copper use <8.5 Mt-Cu in 2013. The global copper scrap shortage deepening in 2014. Why? If the economic value of the metal is high enough, no much recycling regulation/enforcement needed.**

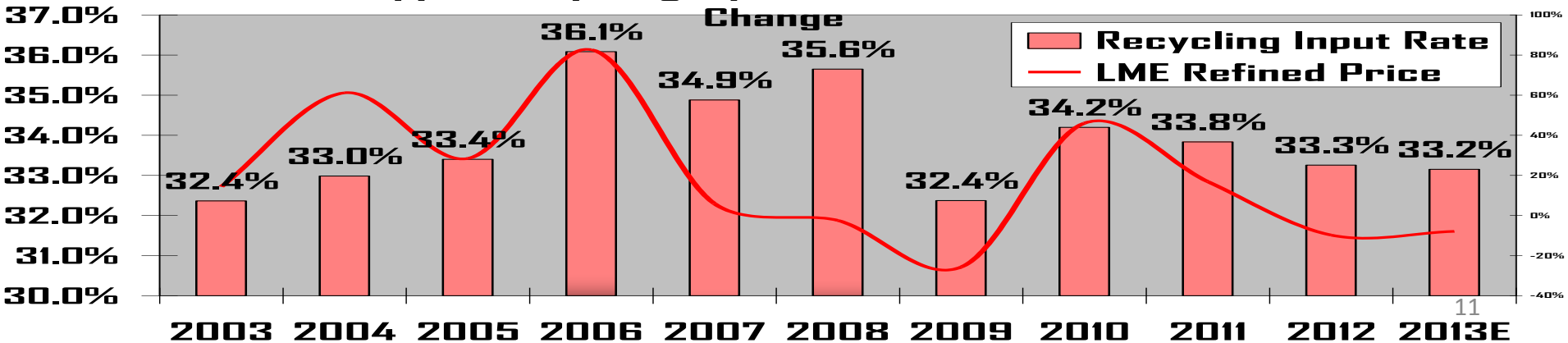


**Scrap Directly Melted by Fabricators 2013: 4.7 Mt-Cu**



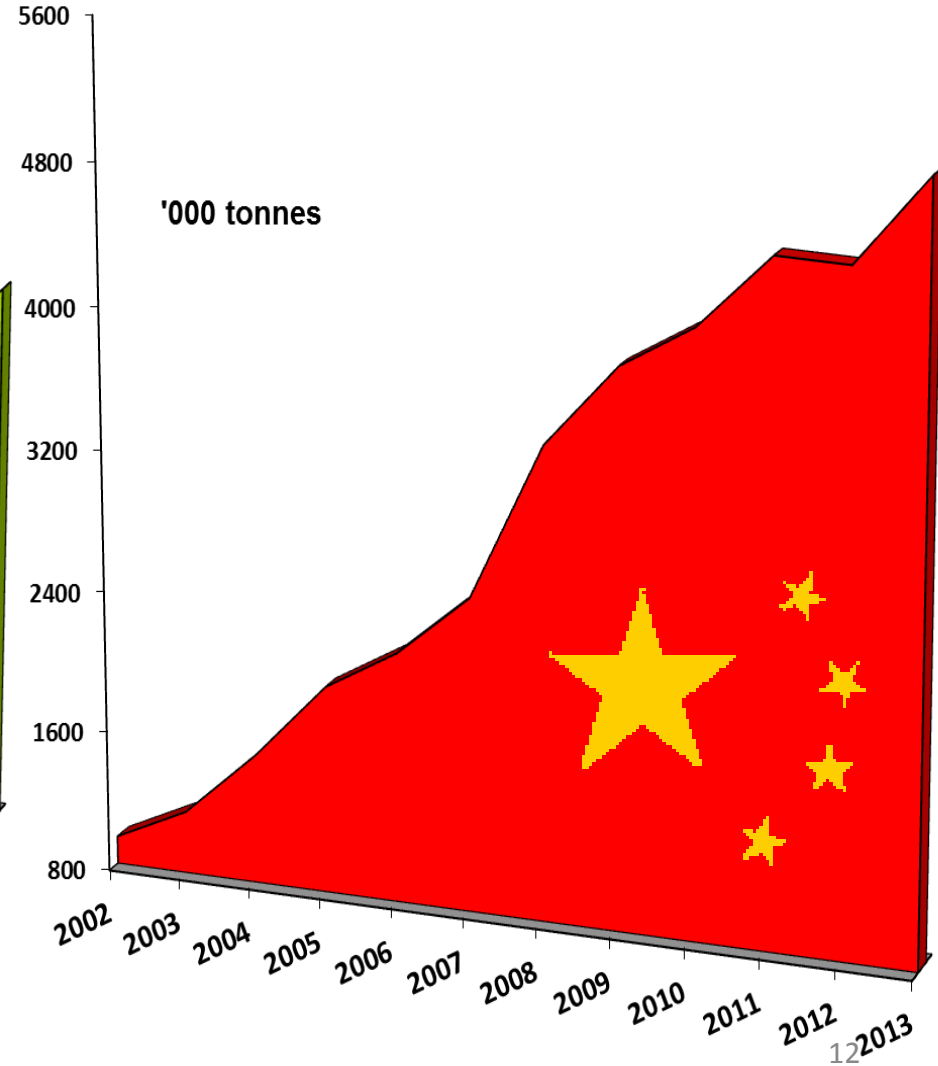
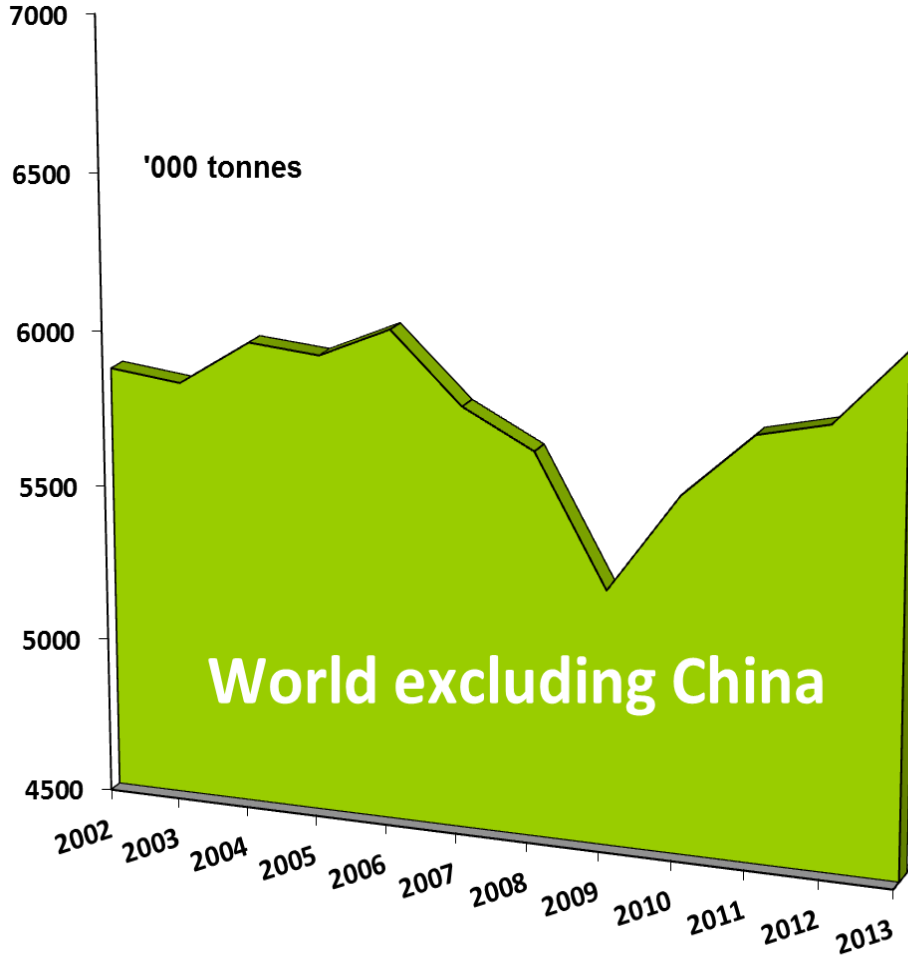
**Copper Cathode Refined from Scrap 2013 = 3.8 Mt-Cu**

**World Copper Recycling Input Rate and LME Refined Price Change**



# Lead Demand Growth

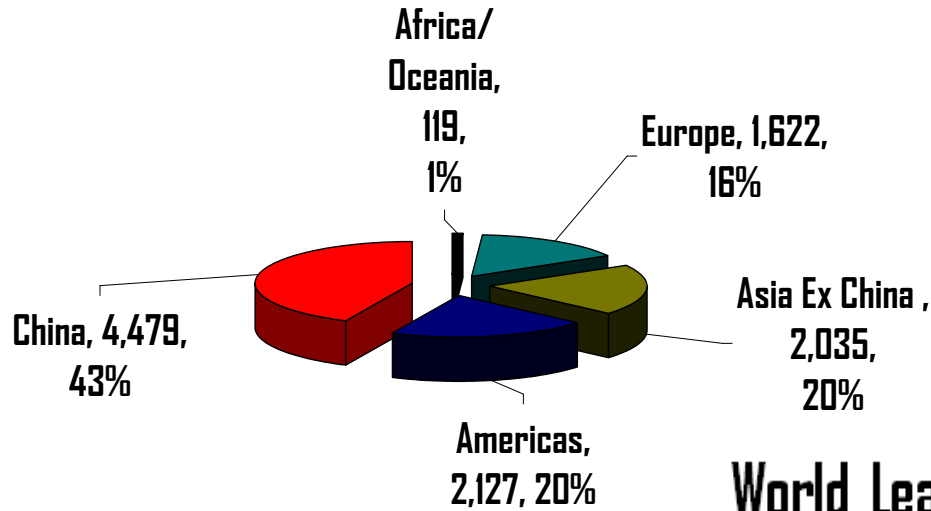
## China vs Rest of the World 2002-2013



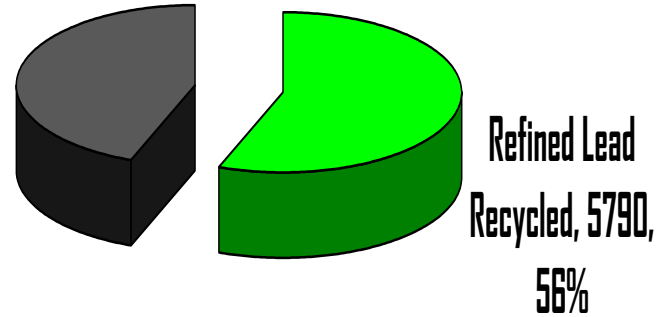
Source: ILZSG

The global demand for lead critically depends from recycling, mainly lead-acid batteries scrap. America still #1 lead recycler. In China, vehicles, e-bikes and 4G telcos are driving lead use up fast.

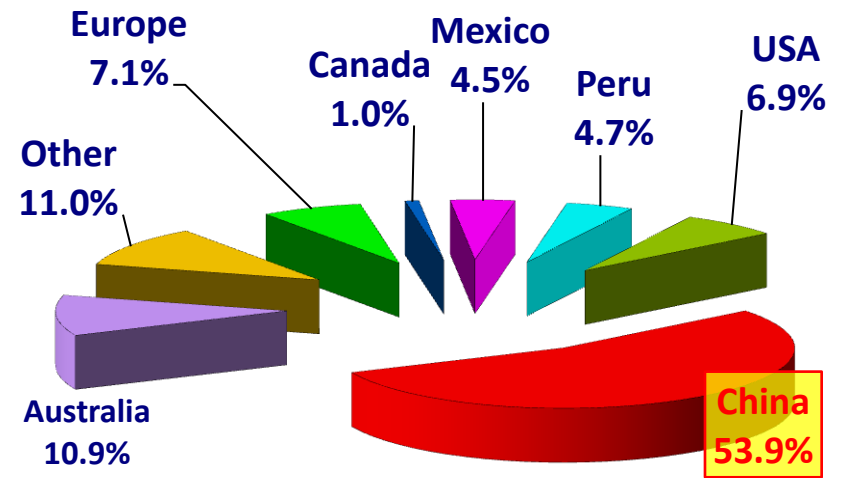
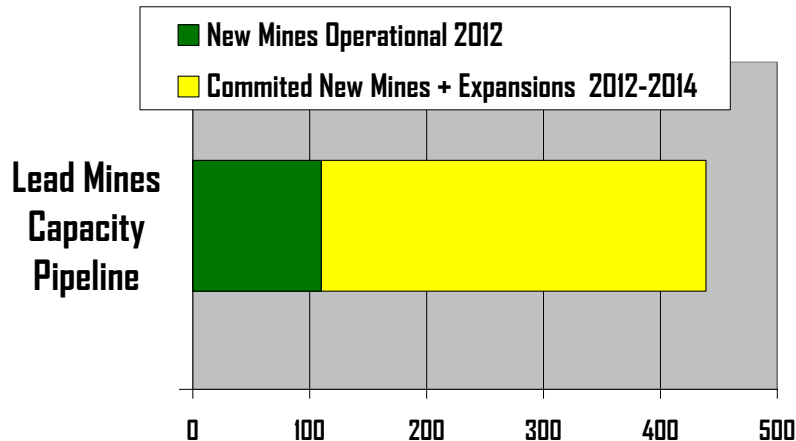
### World Refined Lead Demand 2012



Refined Lead from  
Mines, 4,592,  
44%



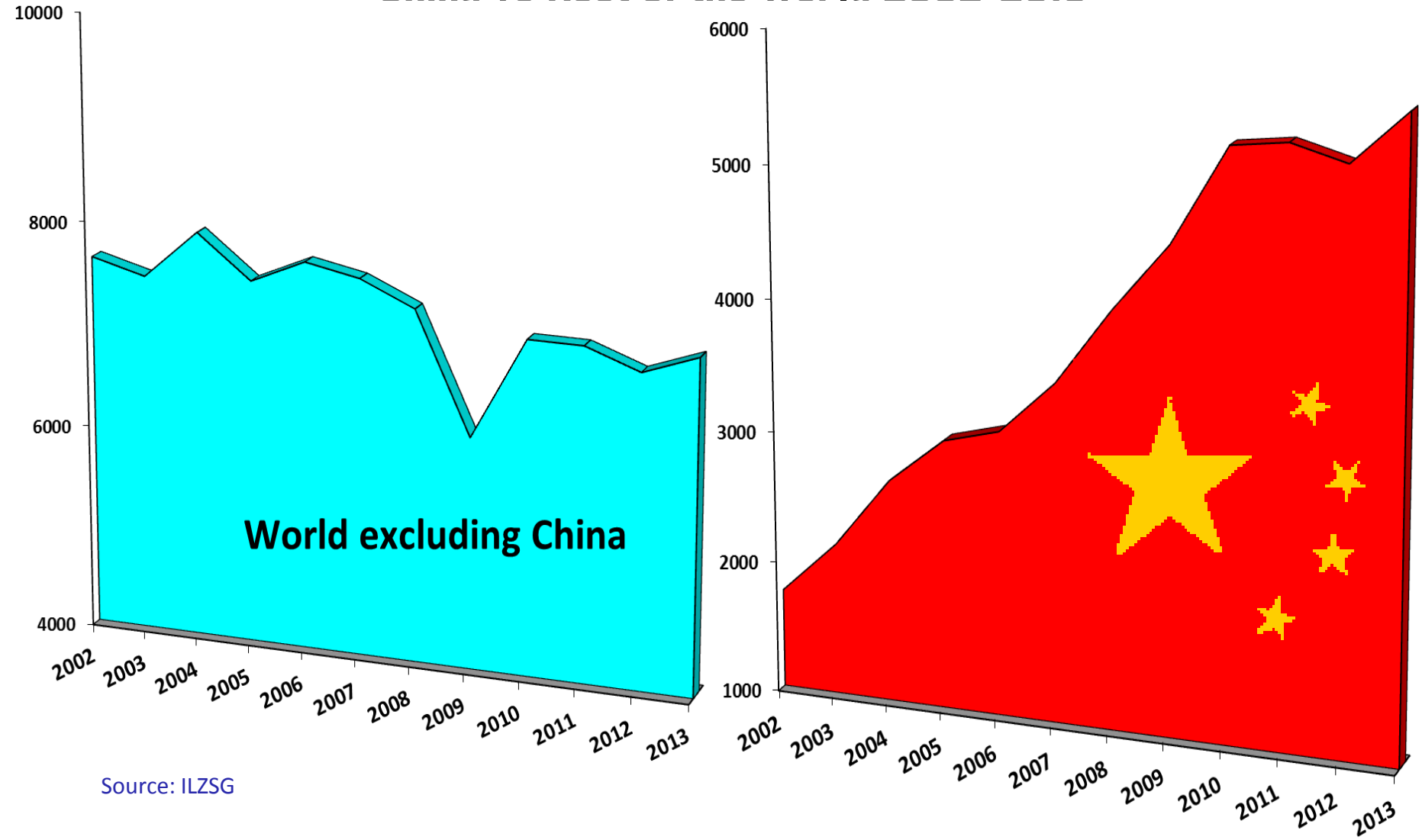
### World Lead Mine Production (2012)



Lead supply constraints: slow lead mine capacity expansion, grades down. China remains #1 lead mine producer.

# Zinc Demand Growth

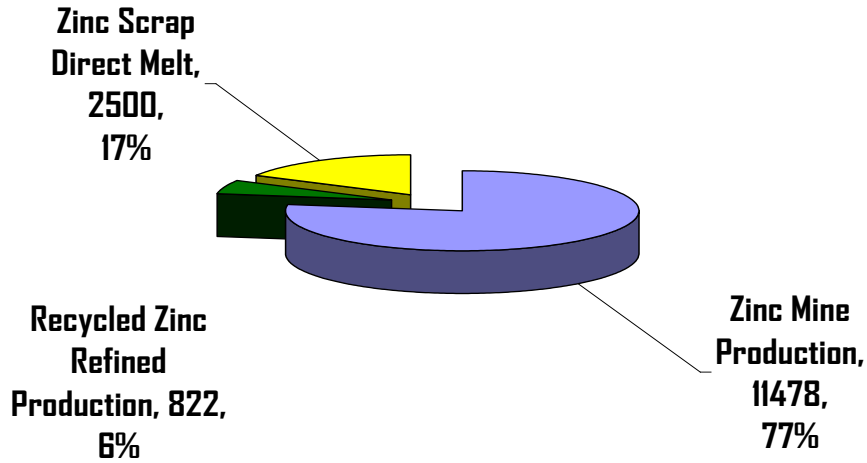
## China vs Rest of the World 2002-2013



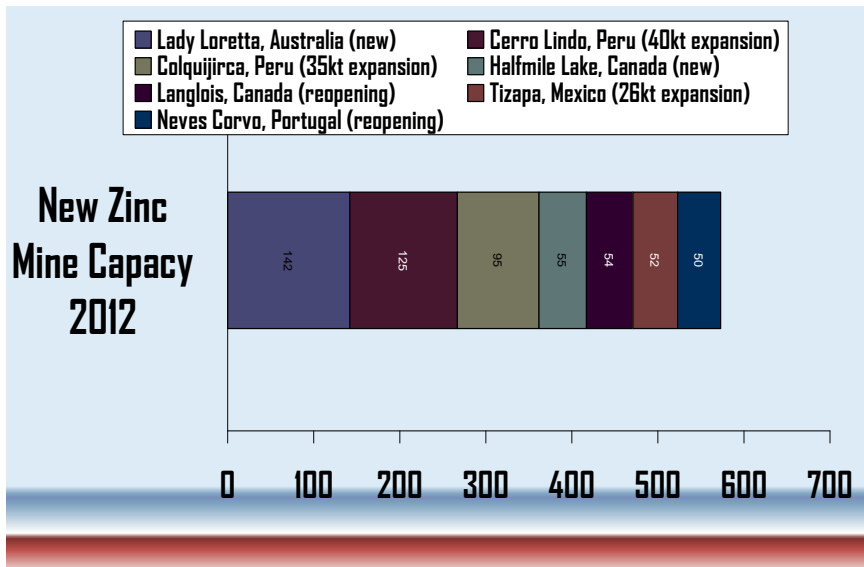
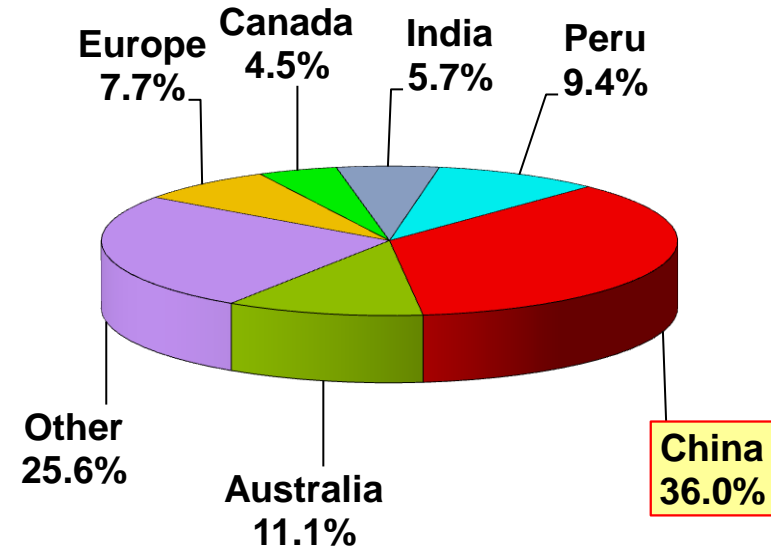
Source: ILZSG

# Zinc mines: main source of oversupply. Refined use 13 Mt in 2013. Mine closures 2013-2016: 1 Mt.

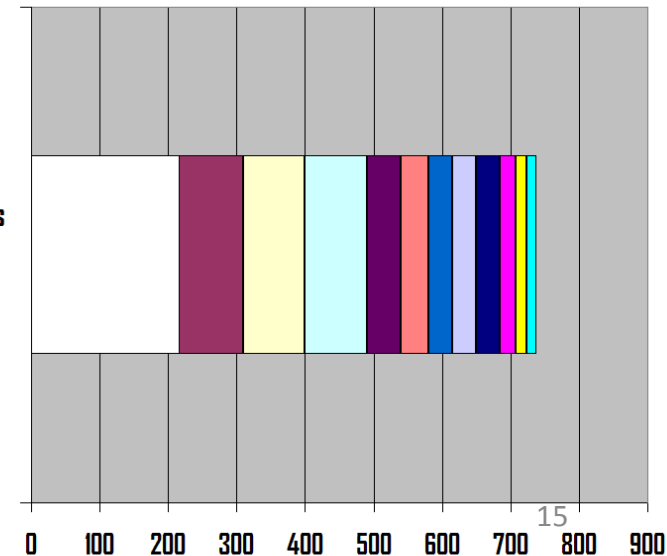
World Zinc Mine and Recycled Supply  
Kt of Metal Content in 2012



## World Zinc Mine Supply 2012



12 New Zinc Mines and Expansions  
2013-2014

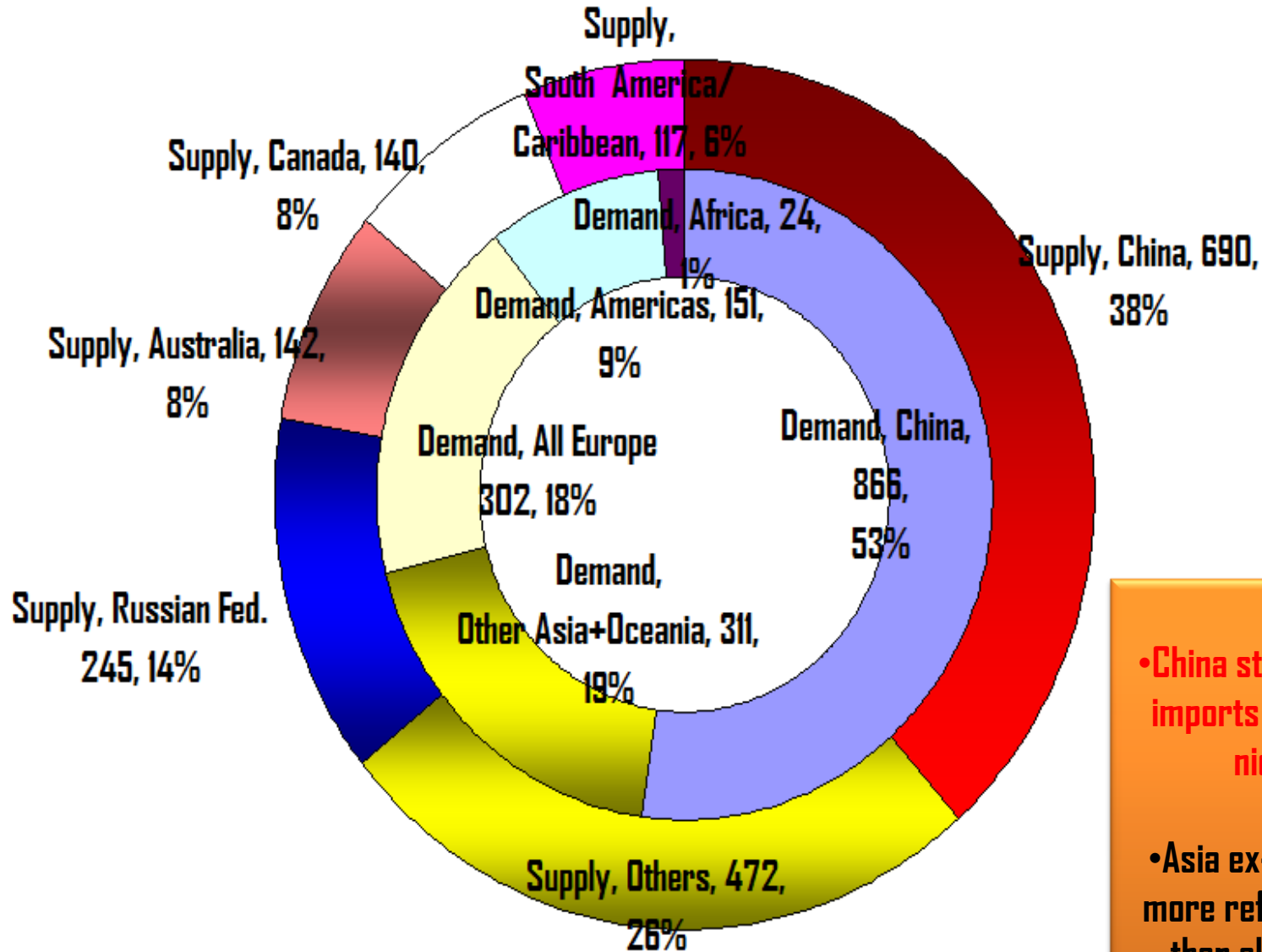




# World Refined Nickel Metal Flows 2013 = 1.8 Million Tonnes

68% of world nickel supply from 4 countries. 53% of demand from China

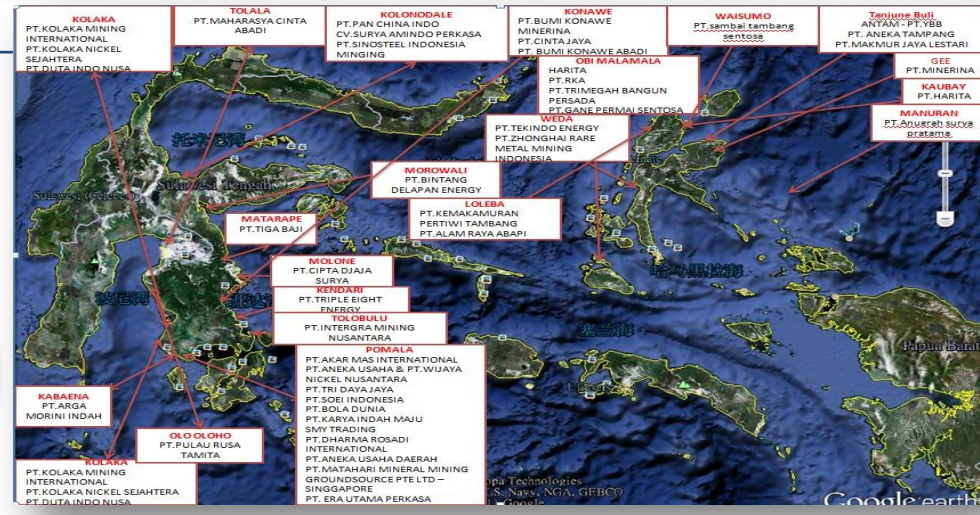
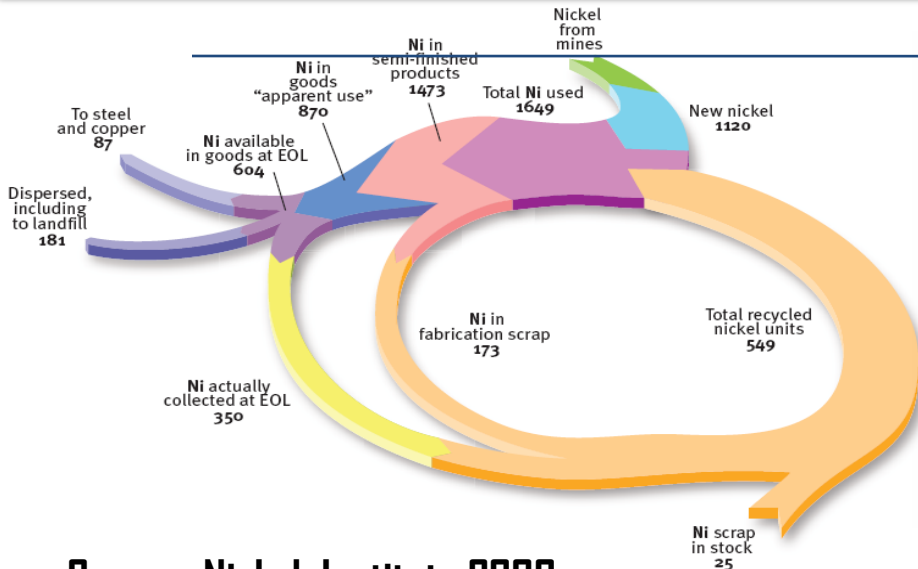
Just 22 Kt of refined nickel coming from scrap. Most recycled nickel from stainless steel scrap.



• China still relies on imports of refined nickel.

• Asia ex-China use more refined nickel than all Europe.

**With high prices pre-2009, recycled nickel scrap provided 33% of world nickel uses.**

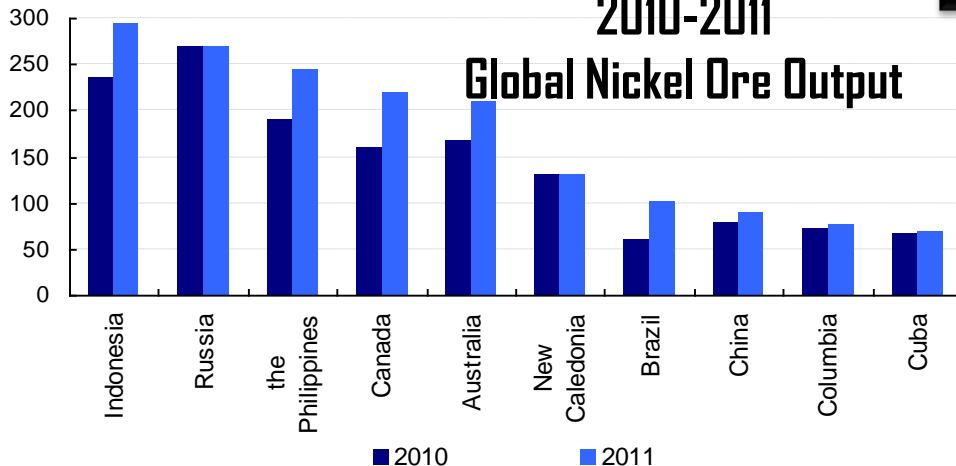


Source: Nickel Institute 2008

Unit: kt (Nickel Content)

2010-2011

Global Nickel Ore Output

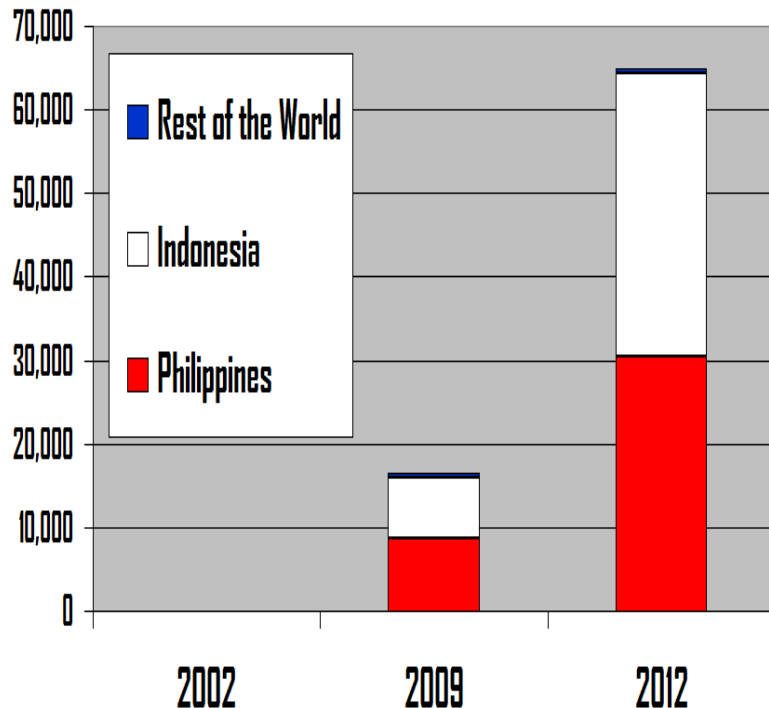


**Ferronickel mine projects: Australia, New Caledonia and Brazil.**  
**Nickel mines and smelter projects in PNG, Myanmar + Salomon Islands.**

**Chinese imports of nickel ore from Indonesia and Philippines ended the shortage in 2009-2012.**  
**More nickel in the pipeline, but when? Massive CAPEX requirements and major technical difficulties.**

# Changes In Trade Regulations Cause Price Volatility And Can Reduce Global Non Ferrous Metals Mine/Scrap Supply

China: Imports of Nickel Ores and Concentrates Kt. Gross Weight



**Is China stainless steel production vulnerable in 2014? Or enough stocks?**

## Indonesia - Local Content for Mineral Exports \*

January - 2014

nickel pig iron 4%;  
ferro-nickel 10%;  
Copper concentrate 15%;  
manganese concentrate 49%;

lateritic iron 51%;  
zinc concentrate 52%;  
lead concentrate 57%;  
ferro-manganese 60%;  
manganese silica 60%;  
chromium alloy 60%.  
alumina; iron ore concentrate 62%;

nickel matte 70%;  
sponge iron 75%;  
bauxite - 90% chemical  
pig iron 90%;

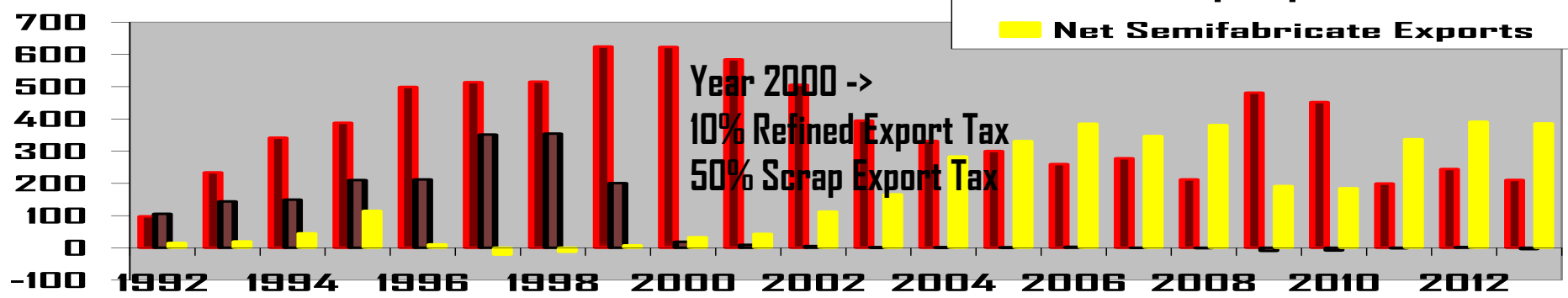
alumina, 98% smelter  
gold 99%;  
silver 99%;  
chromium 99%;  
tin metal 99.9%;

\* A progressive export tax will be implemented

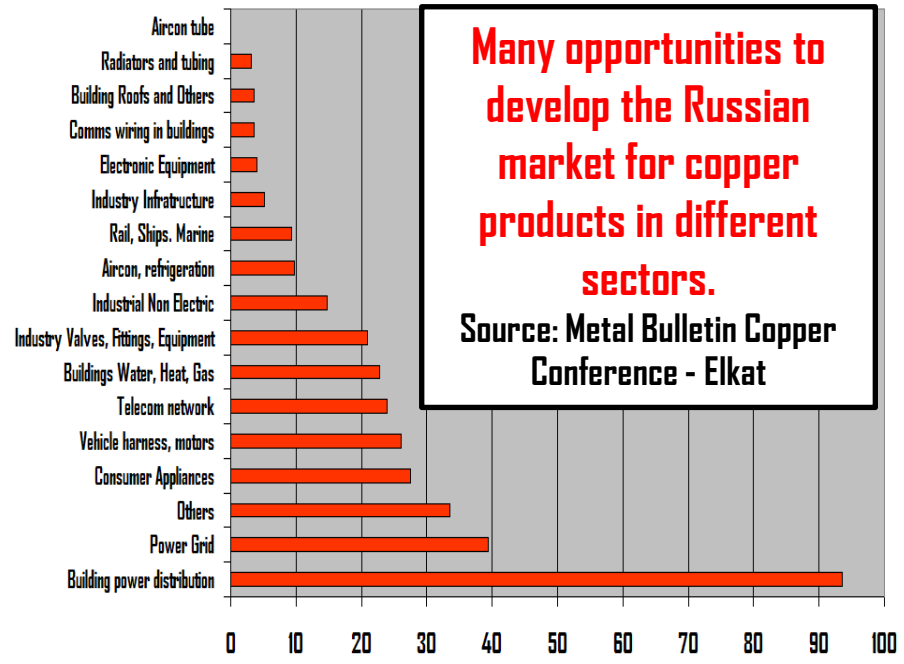
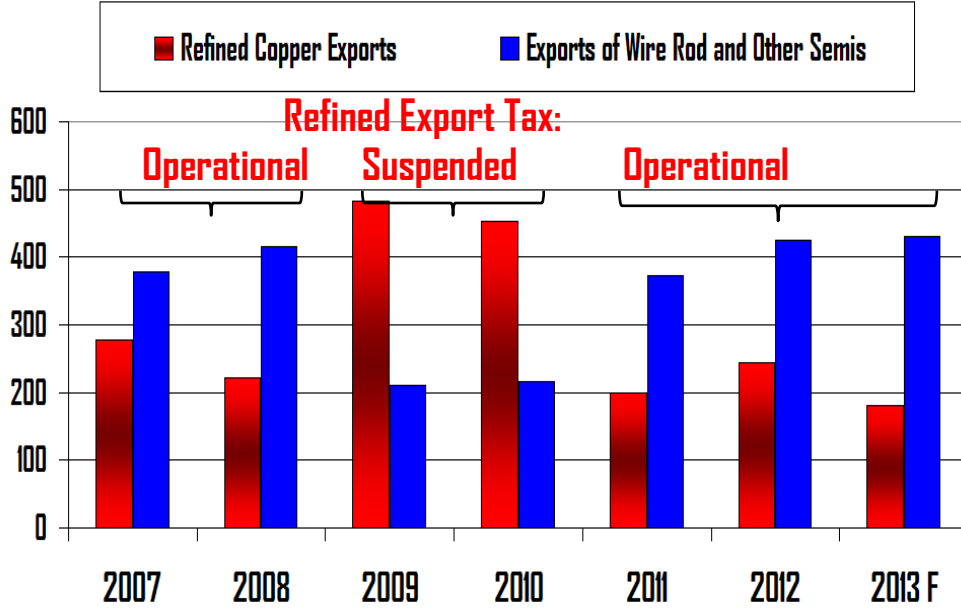
# Export Taxes Can Induce Investments for Exports, But Not Develop Domestic Markets.

Russian Federation: from scrap and refined exporter to wire rod exporter. WTO 2015 to affect flows.

**Russian Federation: Net Exports of Copper Scrap, Refined and Fabricated Products Kt.**



**Russian Federation Exports of Refined Copper and Semis.**



**Many opportunities to develop the Russian market for copper products in different sectors.**  
Source: Metal Bulletin Copper Conference - Elkat

February 2014 Kazakhstan extended ban on export of scrap and ferrous metals waste to prevent a critical domestic shortage.

# Some Environmental Regulations Can Reduce World Metal Supply More than Others

IMO: some metal ores cargo can be harmful to marine environment now.

Air quality and lead recycling:

Mexico: 15 ug/dL . US EPA: 1.5 ug/dl.

USA ->Mexico scrap battery exports: +500%

My Name zinc concentrate			
<b>INPUT DATA</b>			
%			
Zn	55,000%		
Pb	3,200%		
As	0,120%		
Cd	0,300%		
Cu	0,100%		
Ni	0,010%		
Ag	0,000%		
<b>Individual impact</b>			
acute	chronic		
22%	20%		
74%	28%		
0%	0%		
4%	49%		
0%	0%		
0%	2%		
0%	0%		
		4	
		3	
		2	
		1	
		CHRONIC	
		ACUTE	
<b>Hazard</b>	<b>Classification</b>	<b>Label statement</b>	
<b>Aquatic toxicity</b>			
Acute	2	H401	
Chronic	3	H412	
<b>Reproductive toxicity</b>			
Specific target organ toxicity - repeated exposure	Cat. 1A	H360	
Specific target organ toxicity - repeated exposure	Cat 2	H373	
Carcinogenicity (Pb compounds)	Cat 2	H351	
<b>IMO notification:</b>			
Not harmful to the marine environment			
<b>UN-GHS classification (4<sup>th</sup> revision 2011)</b>			
acute 2	chronic 3	H401	H412
<b>EU-CLP-2 classification</b>			
chronic 3	H412		
<b>Hazard phrases (GHS) to be added to Safety Data Sheet, section 2.1.</b>			
H401 - Toxic to aquatic life			
H412 - Harmful to aquatic life with long lasting effects			
H373 - May cause damage to organs through prolonged or repeated exposure through prolonged or repeated exposure			
H351 - Suspected of causing cancer			

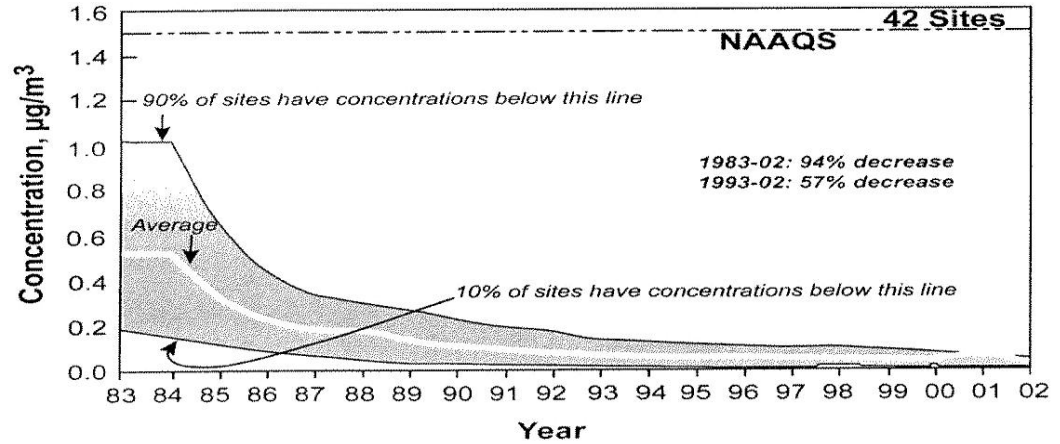


Figure 2-10. Airborne Pb (TSP) concentrations, averaged across continuously operating monitoring sites: 1980-2002.

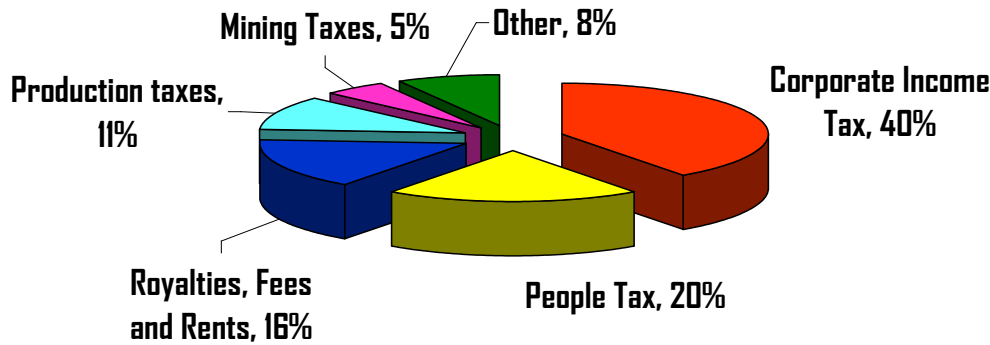
## Chile: New Emission Standard for Copper Smelters And Sources of Arsenic Emissions (H2SO4 Plants).

Law Published: 12/December/2013

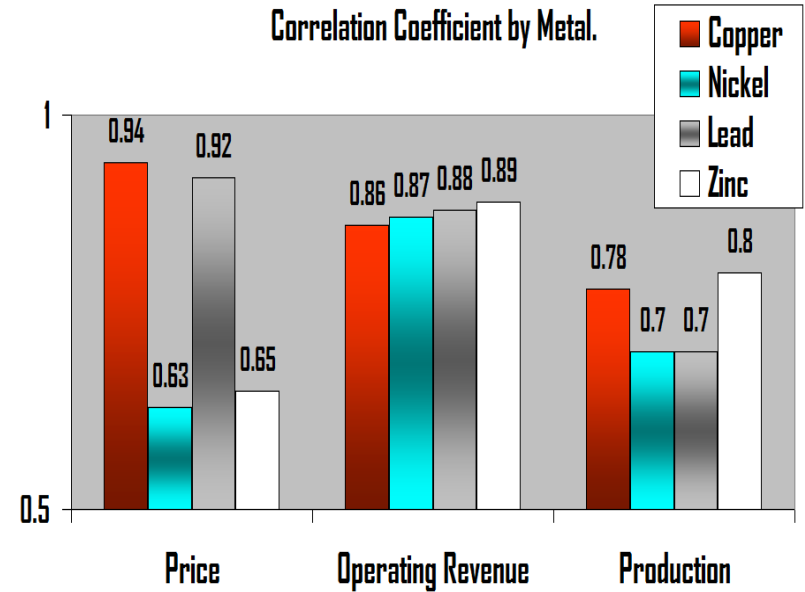
	Maximum Emission Limits On Existing Sources At the End of the Transition Period*		Maximum Emission Levels On Existing Sources Effective 12/December/2013	
	Tonnes / Year*		Tonnes / Year*	
	SO2	As	SO2	
Chuquicamata	49,700	476	96,500	
Potrerosillos	24,400	157	89,500	
Caletones	47,680	130	80,000	
Altonorte	24,000	126	Regional Authority Law 193	
Ventanas	14,650	48	16,500	
Chagres	14,400	35	13,950	
Hernan Videla Lira	12,880	17	24,500	
<b>Chile</b>	<b>187,710</b>	<b>989</b>	<b>320,950</b>	
<b>Existing H2SO4 Plants</b>	<b>SO2</b> 400 ppm	<b>As</b> 1 Mg/Nm3	<b>PM</b>	<b>Hg</b>

# Public Sector Rent from NF Minerals: Not All Taxes Equal, Not All Companies Equal

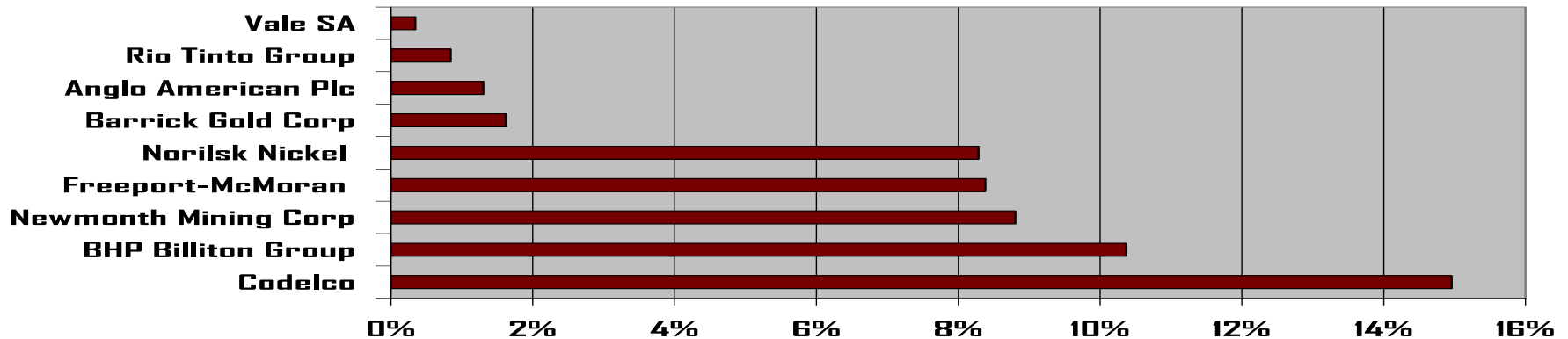
2012 Global Contribution of the Metals Industry to Government Revenues by Instrument %



Taxation Expenses for 400 Base Metal Corporations.  
Correlation Coefficient by Metal.

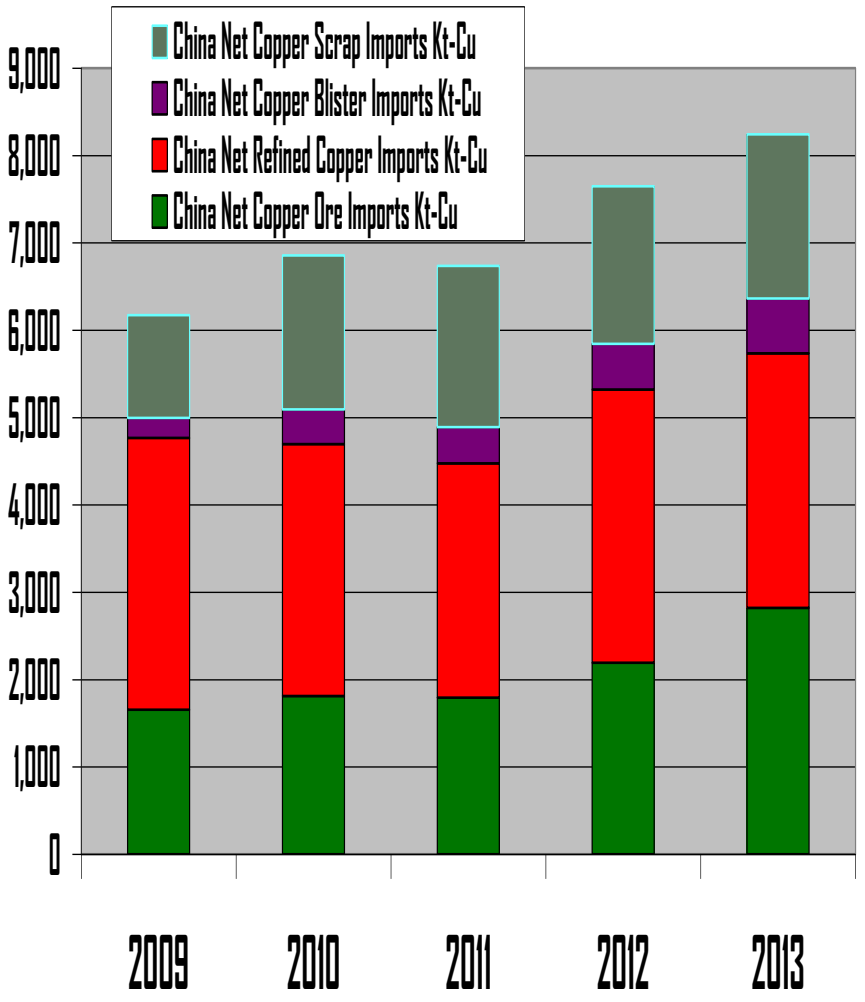


Top Global Mining Companies  
2012 Tax Payments as % Of Operational Revenues

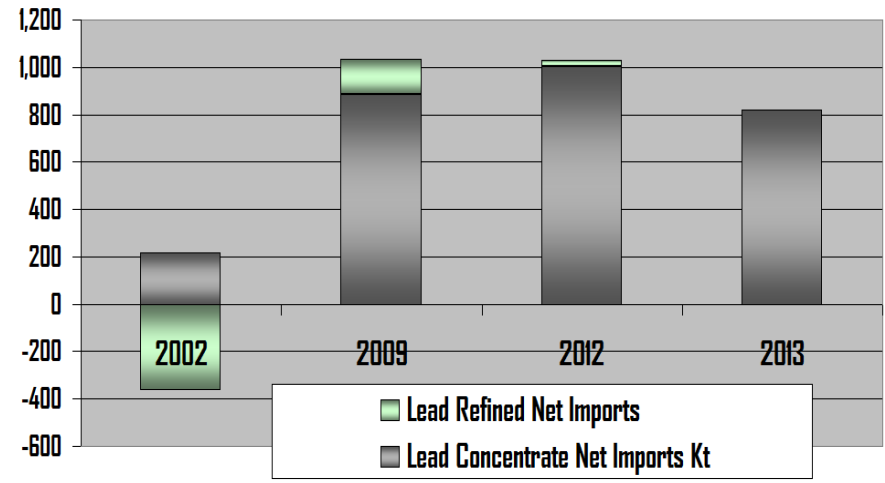


**In 2002 China was still an exporter of refined lead and zinc.**  
**In 2014 is the main importer of refined, ore and scrap copper, nickel, lead and zinc.**

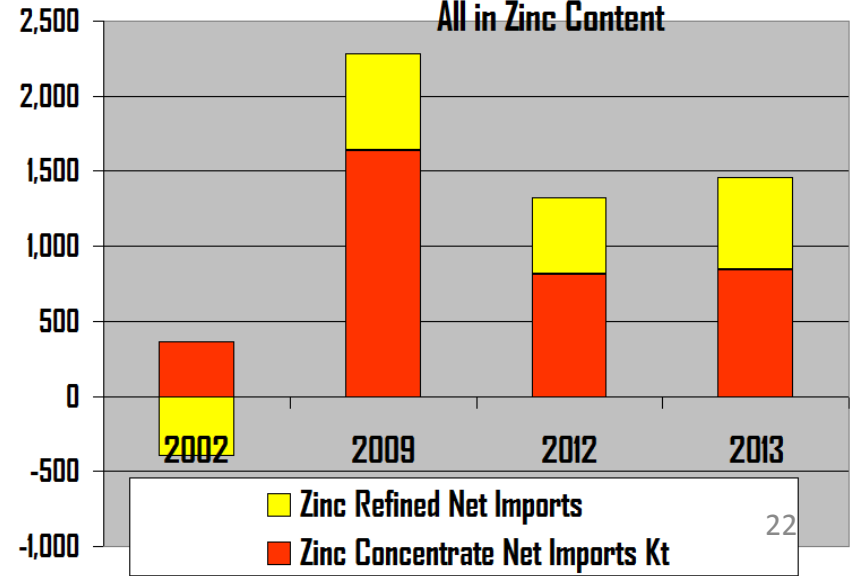
**China: Net Imports of Copper Raw Materials - Kt-Cu.**



**China Lead Imports. All in Lead Content.**



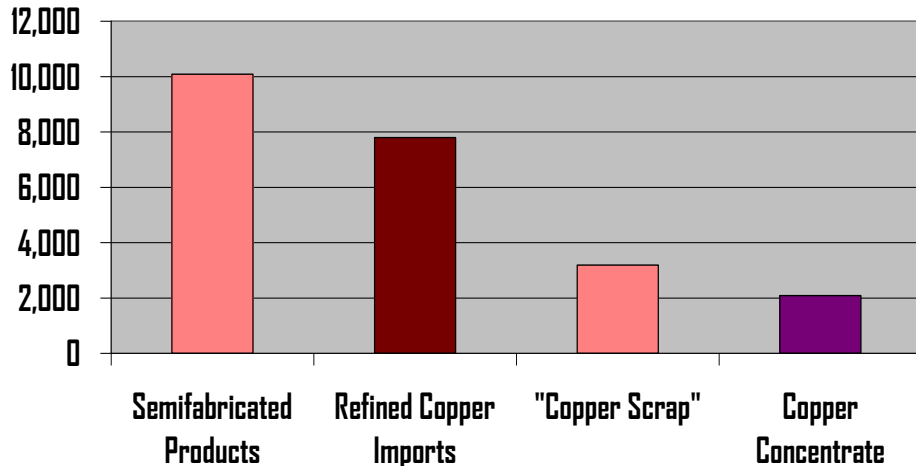
**China: Net Imports of Zinc. Selected Years All in Zinc Content**



# Instead of a rent from mineral exports, China invest in value added products using refined metal

## Export taxes to raw materials and VAT tax rebates support valuable exports or inputs in short supply

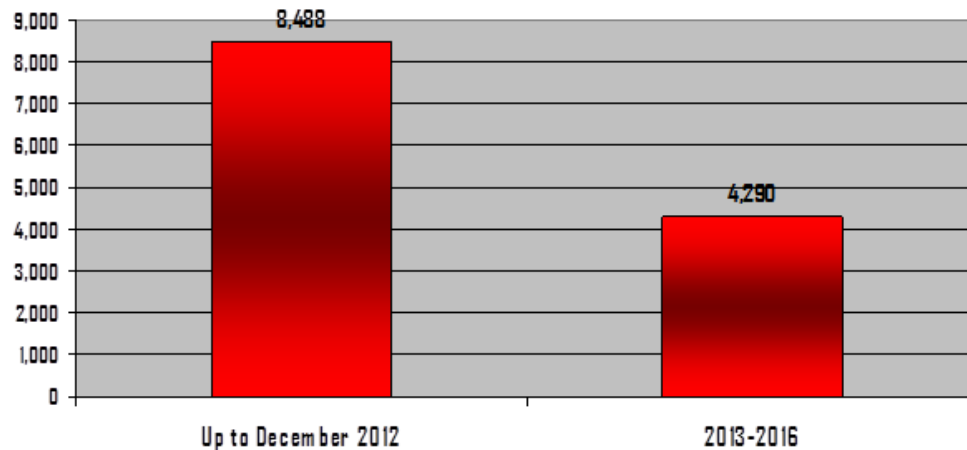
China Average Import Price Paid in USD per Tonne:  
Reported, January-June 2013.



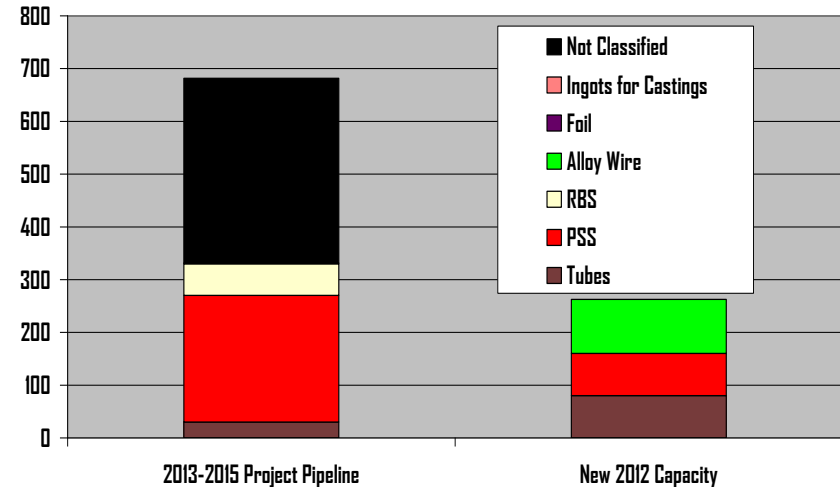
Chinese export measures along the copper value chain: 2010



Copper Wire Rod Capacity in China in 2012  
and 2013-2016 Wire Rod Projects Pipeline in Kt



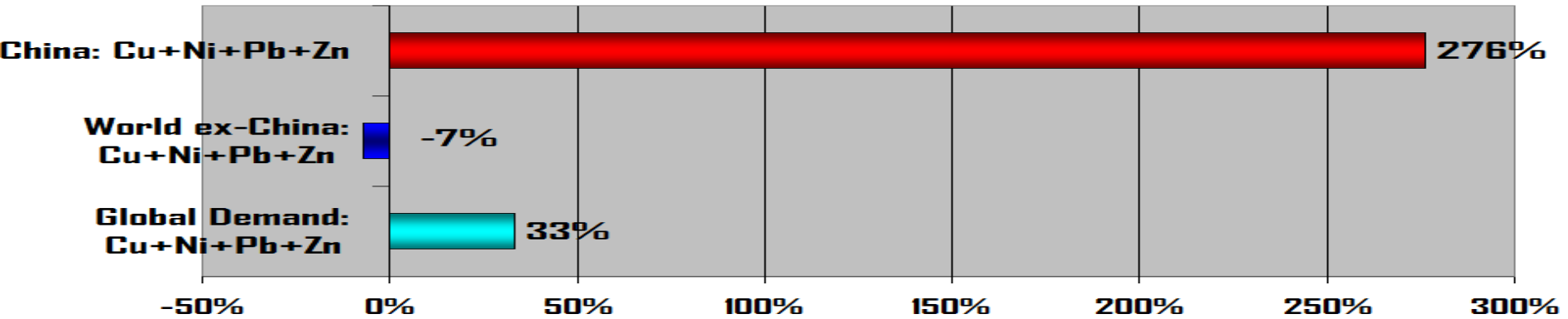
China Copper and Alloy Semis Capacity ex Wire Mills  
2012-2016 Kt





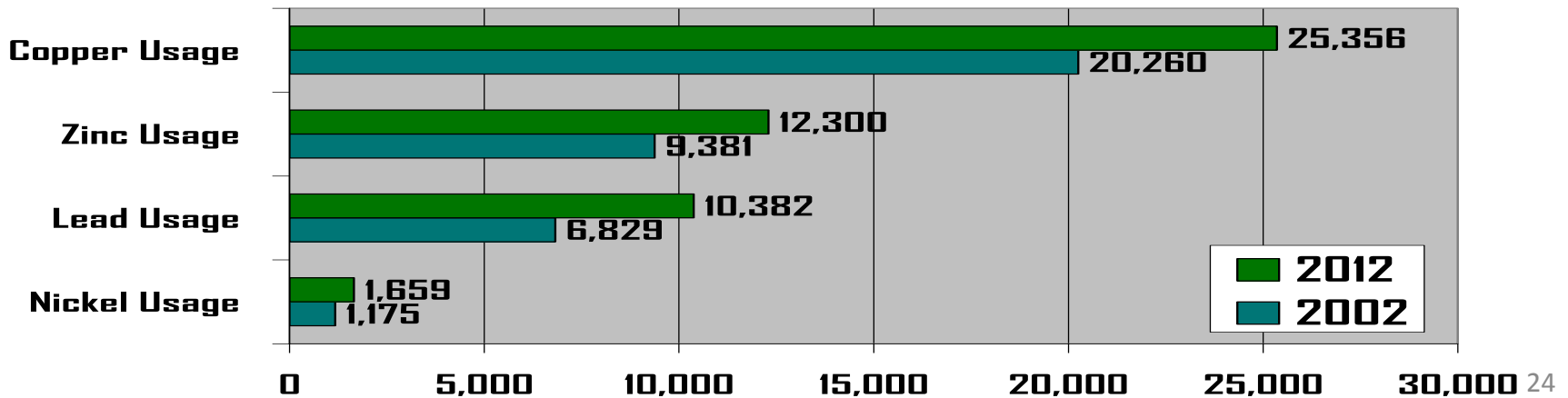
# Rapid urbanization and industrialization in China: key driver of non ferrous metal use growth globally in the past 10 years...

**2002-2012 Joint Copper, Lead, Zinc and Nickel Demand Growth: China and Rest of the World. %**



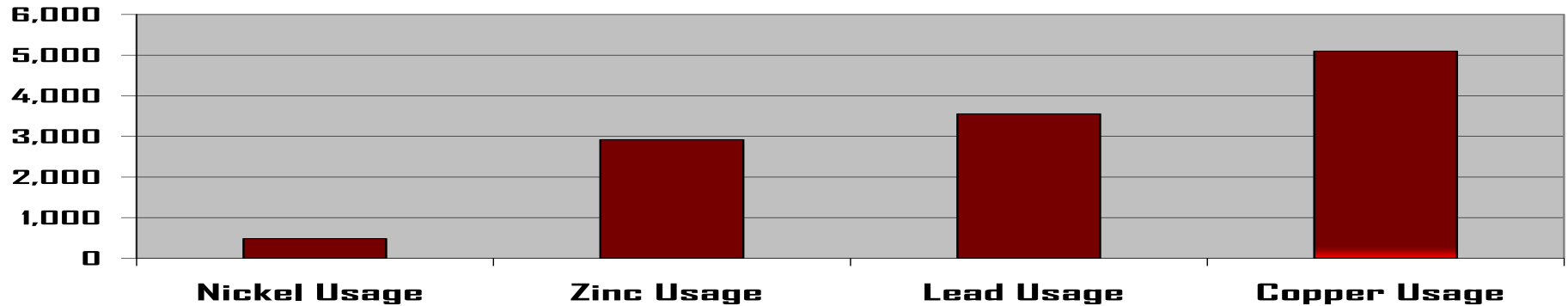
...and reason behind 4 base metals use up >12 million tonnes in 2002-2012

**World Non Ferrous Metal Usage 2002-2012.  
Thousand Tonnes of Metal Kt**



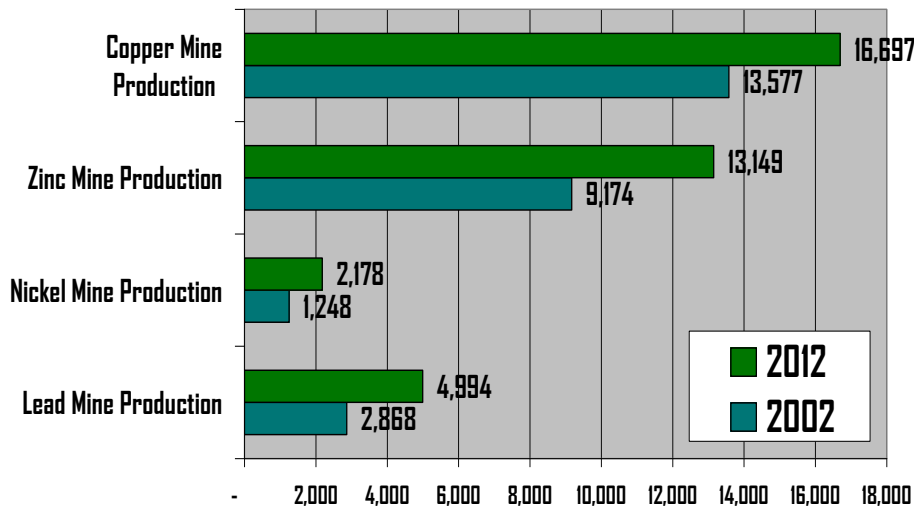
# Global non ferrous use expansion is driven by copper, lead, zinc, and less by nickel.

**World Usage Volume Growth 2002-2012  
Key Non Ferrous Metals Kt.**

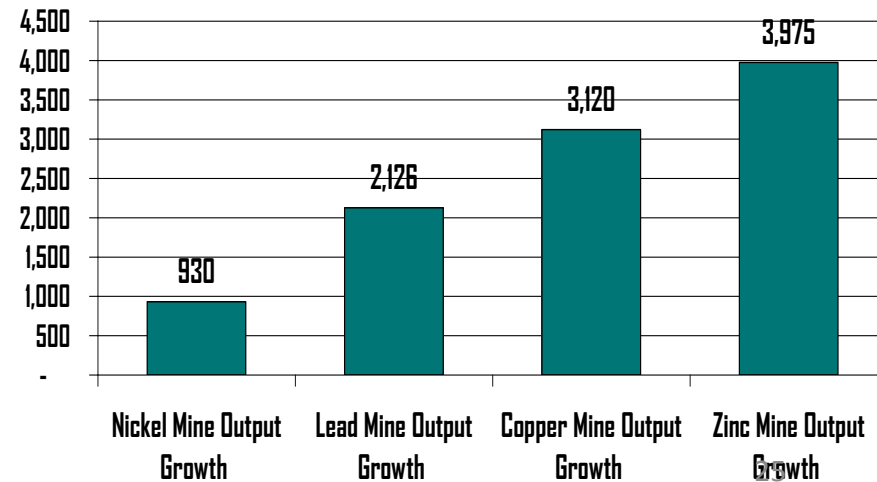


## Global mine supply response to higher Chinese demand: >10 million tonnes in 10 years.

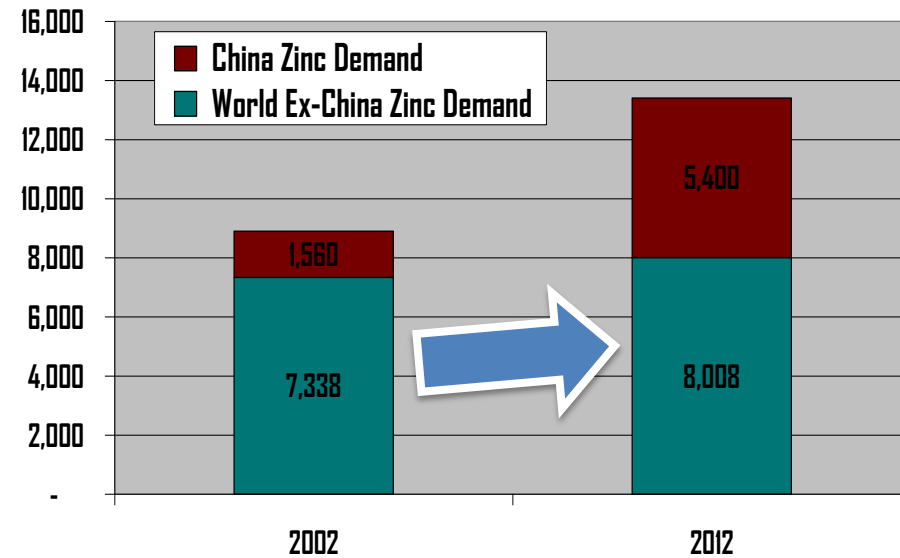
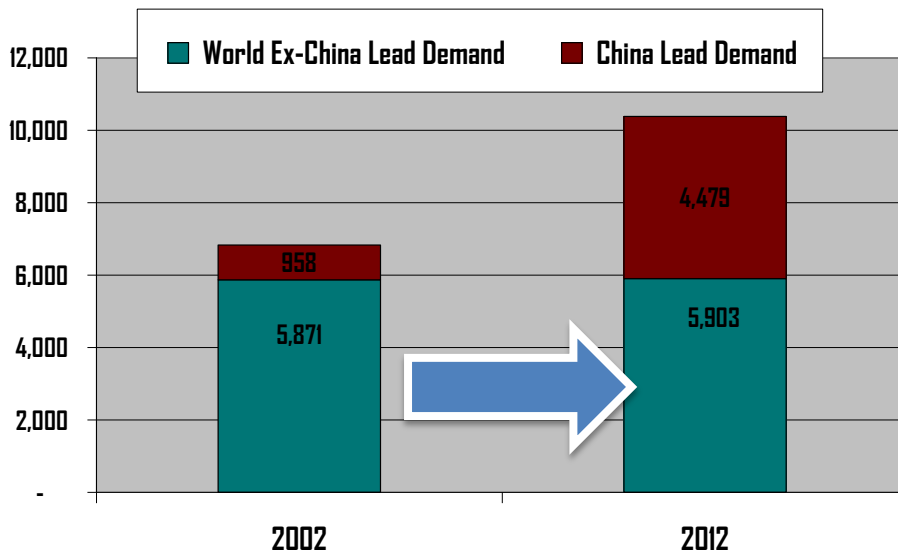
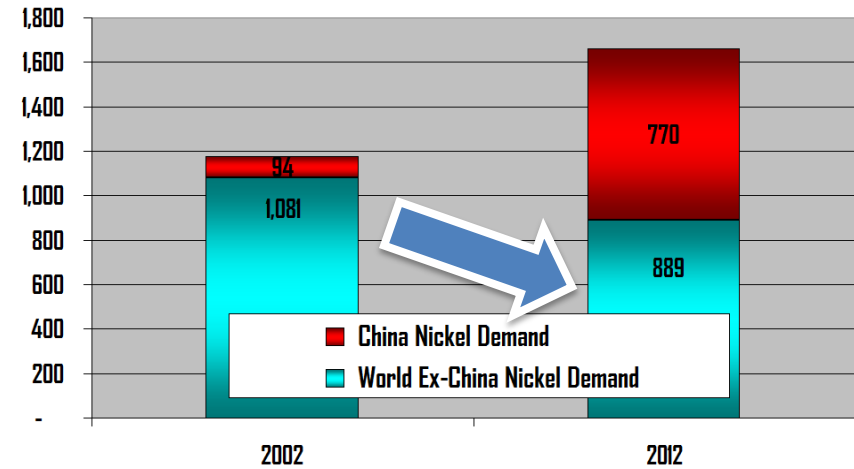
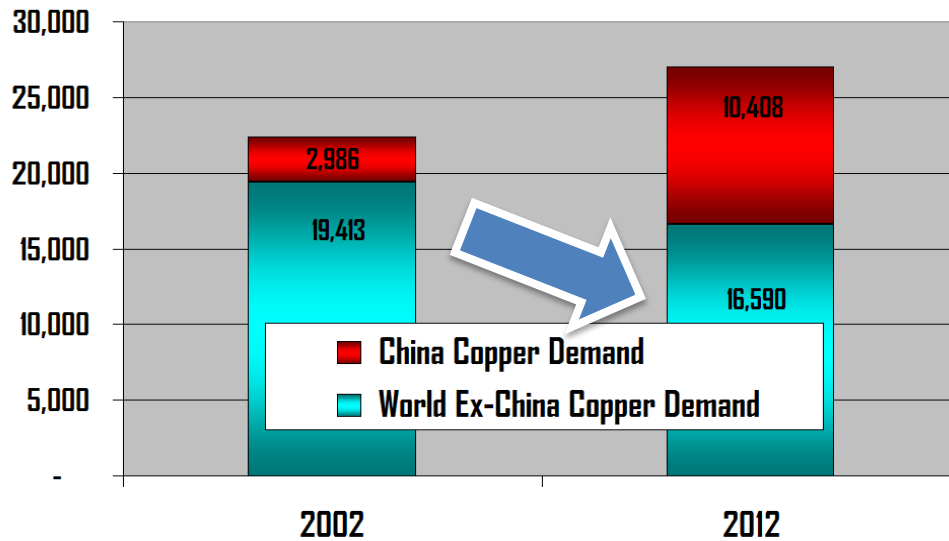
**World Mine Production 2002-2012 Cu, Ni, Zn and Pb.  
Kt. Metal Content.**



**World Mine Output Growth 2002 - 2012  
in Thosand Tonnes of Metal Content (Kt)**



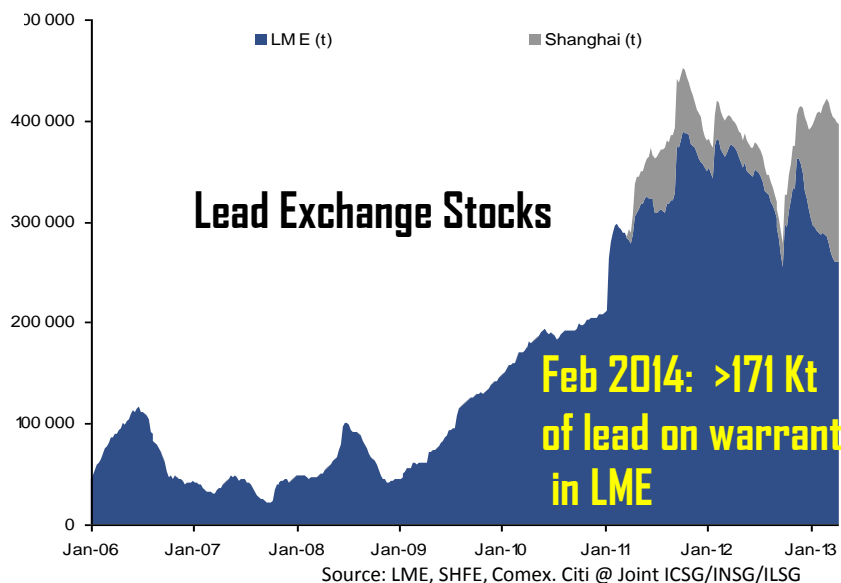
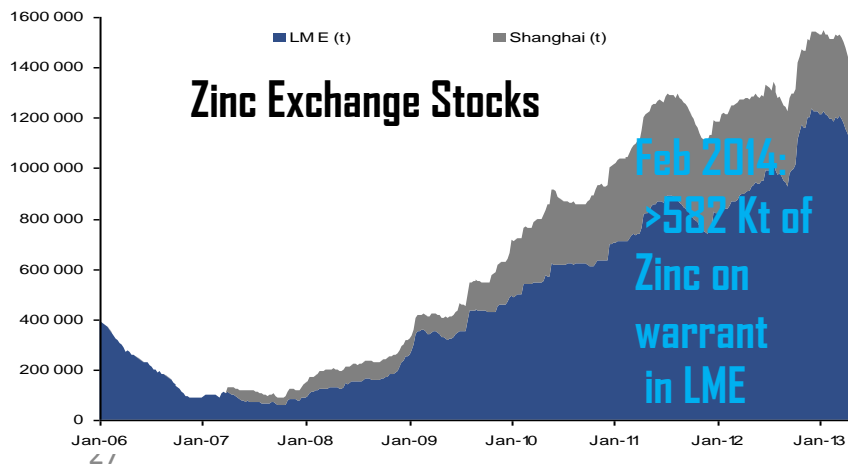
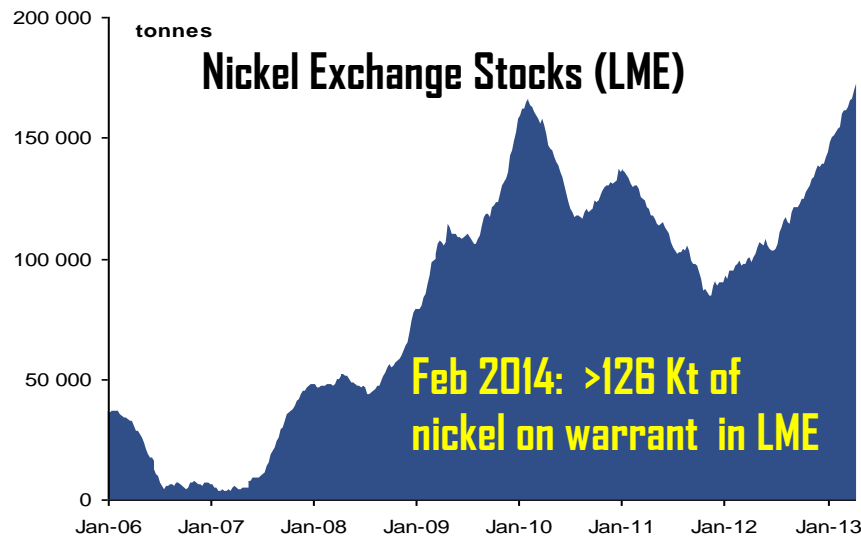
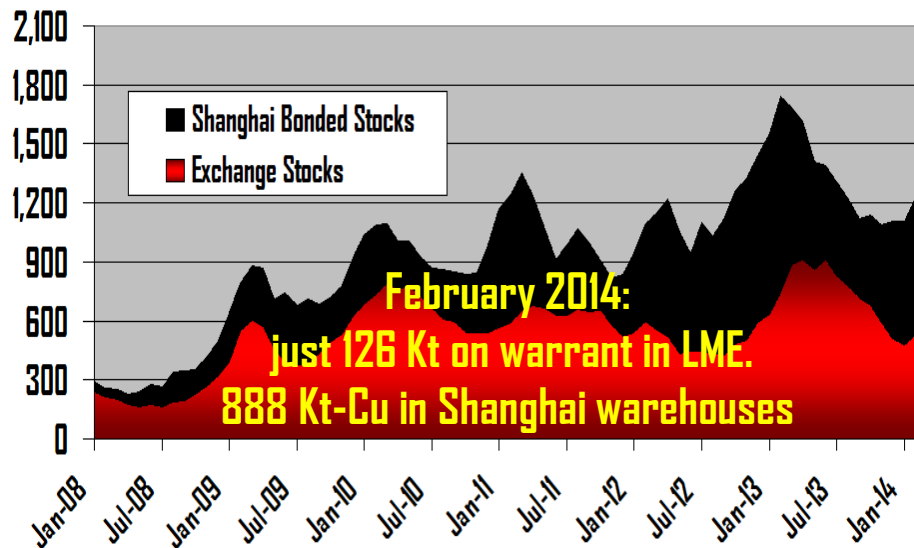
# The world uses more of the 4 metals, but less copper and nickel use outside China.



2002-2012: the growth of lead and zinc used out of China was really marginal.

**More stocks in metal exchanges now, but copper and nickel stocks very volatile.**  
**In 2013 copper left LME-COMEX and moved from Chinese refineries to Shanghai ports, sold-off in 2014.**

**Visible Refined Copper Inventories Kt-Cu.**  
 January 2008 to February 2014. Deliverable and On-Warrant.



# Refined Stocks On Warrant in LME in January 2014 as a % of Output:

Copper 0.6%  
Lead 1.6%  
Zinc 4.5%  
Nickel 7.0%

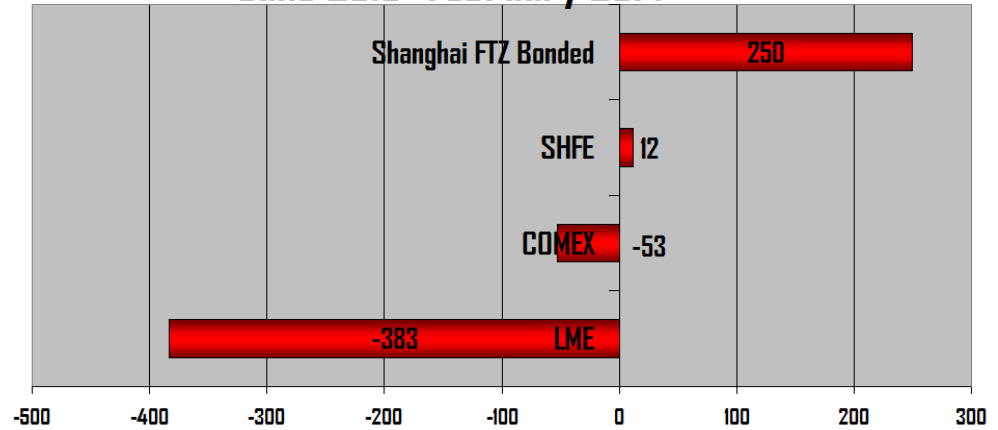
## World Refined Production 2013 \*

Copper 20,991  
Lead 11,022  
Zinc 13,013  
Nickel 1,806

\* preliminary

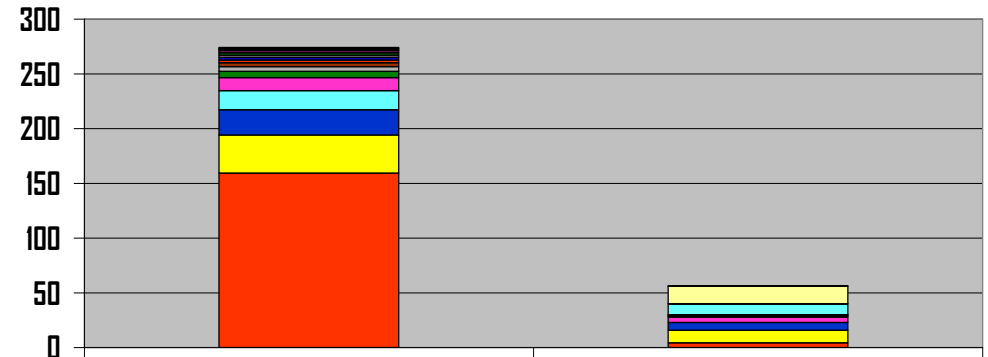
# Small % of copper inventories in metal exchanges now.

## Refined Cu Stock Change June 2013 -February 2014



# Official export data not always matching import data.

## Refined Copper Exports Reported from China in 2012. Kt-Cu



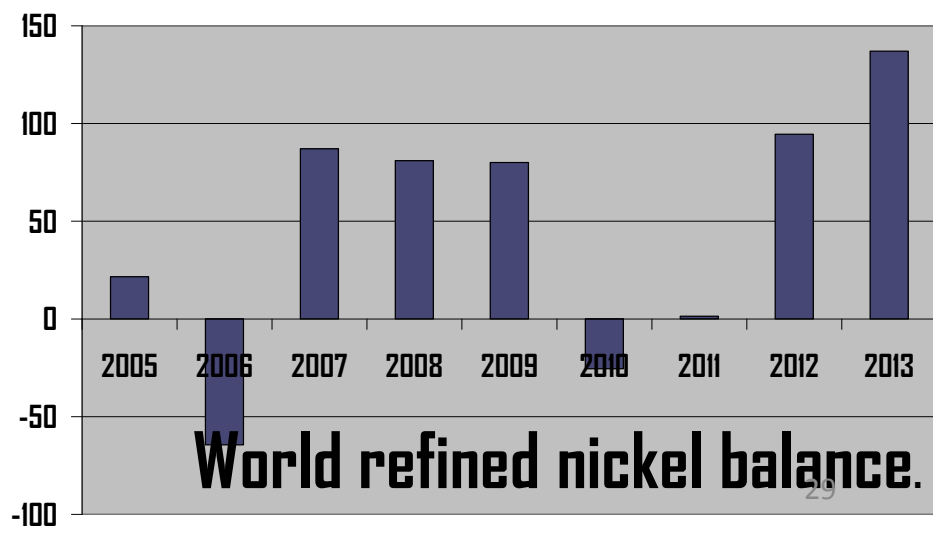
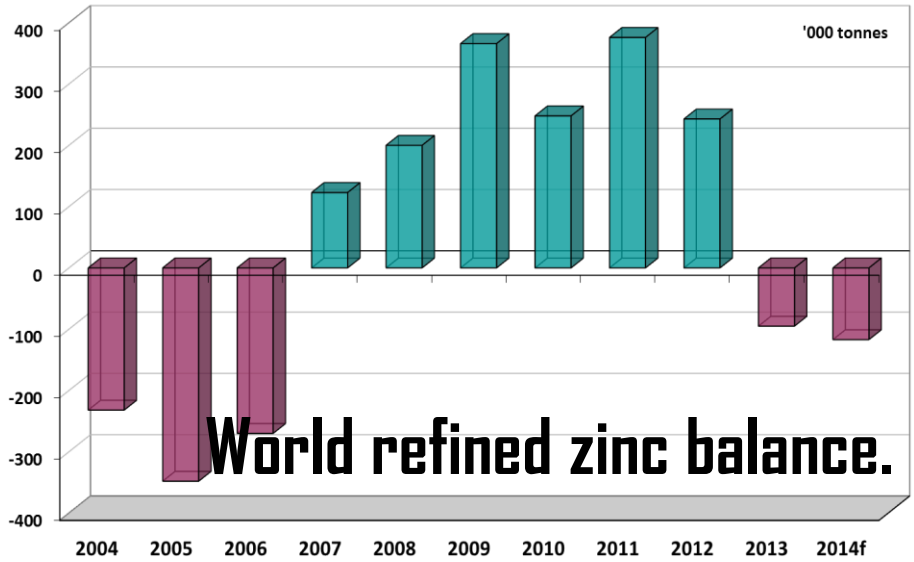
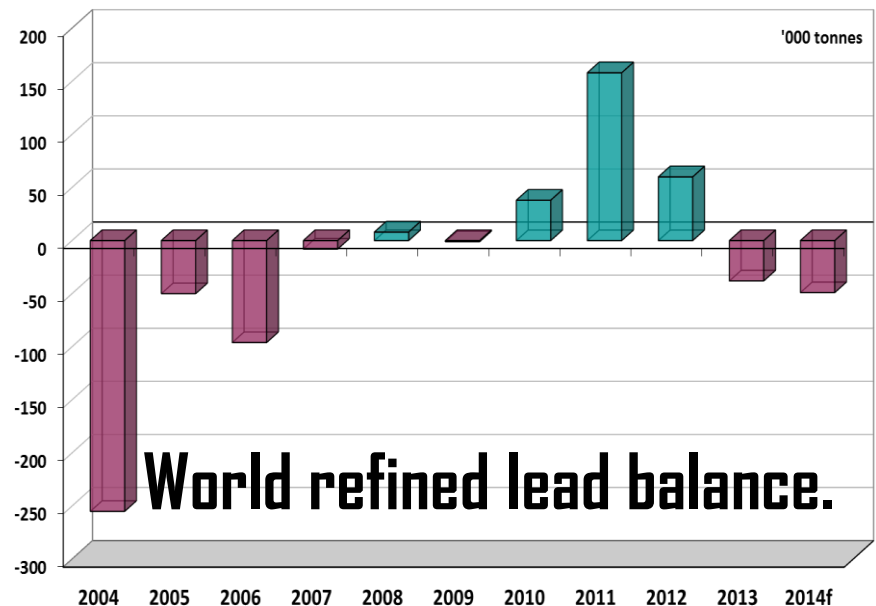
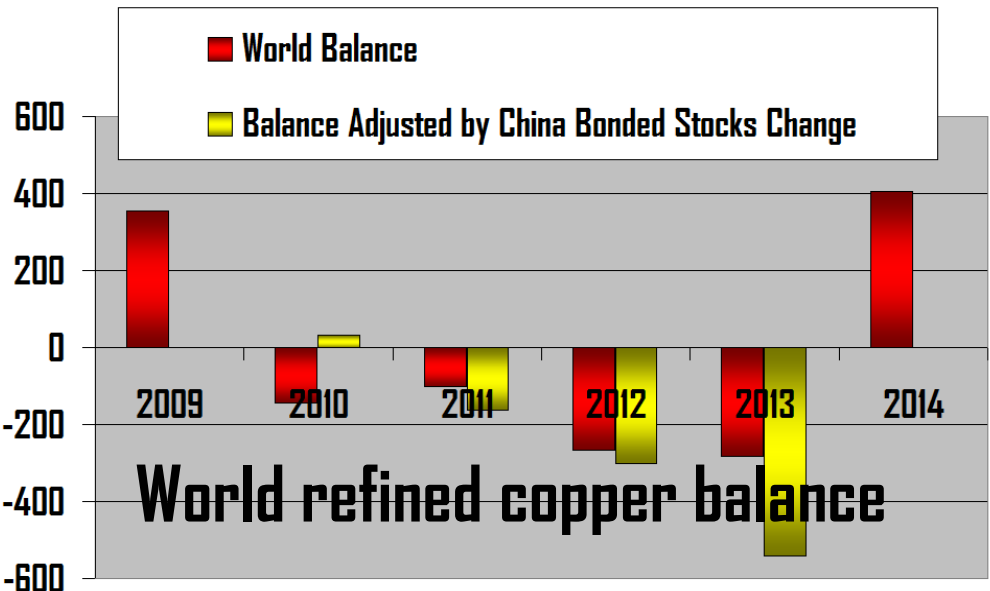
### Refined Exports Reported by China

### Importers: Refined from China

Korean Republic	Malaysia	Singapore	Saudi Arabia	Taiwan	UAE
Others	Hong Kong	Vietnam	Thailand	Belgium	Netherlands
Japan	Egypt	Brazil	India	Turkey	Indonesia
United Kingdom	China	South Africa	United States		

# If we account changes in Shanghai port inventories: global copper deficit 2011-2013

## No more global surplus of lead and zinc. Small nickel surplus ...to end in 2014?



With a growing world economy in 2013, recyclers and miners struggled to supply metal at low prices, so copper, zinc and lead markets in deficit.

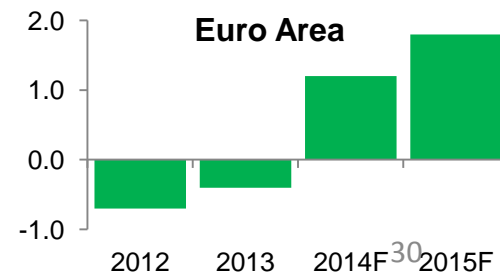
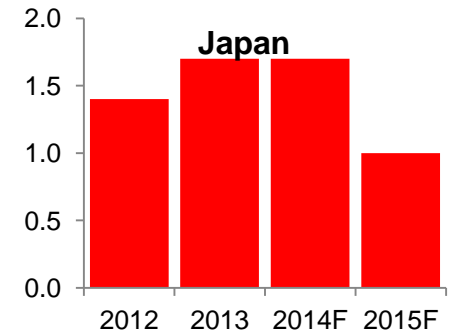
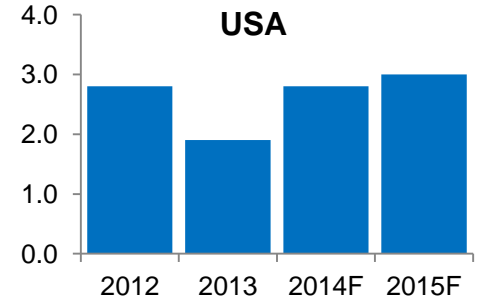
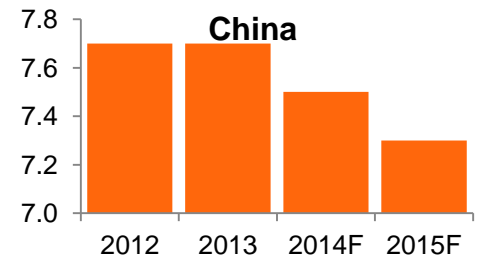
## ICSG, INSG, ILZSG 2013 World Balance and 2014 Refined Metals Forecast

Million Tonnes of Refined Metal

	2013 Output	2013 Usage	2013 Balance
<b>Copper*</b>	21	21.3	<b>-0.536</b>
Zinc	12.9	13	<b>-0.100</b>
Lead	11.2	11.2	<b>-0.040</b>
Nickel	2	1.8	0.200
<b>* Change in Shanghai bonded cathode stocks included</b>			
<b>4 NFM 2013</b>	<b>47.1</b>	<b>47.3</b>	<b>-0.476</b>

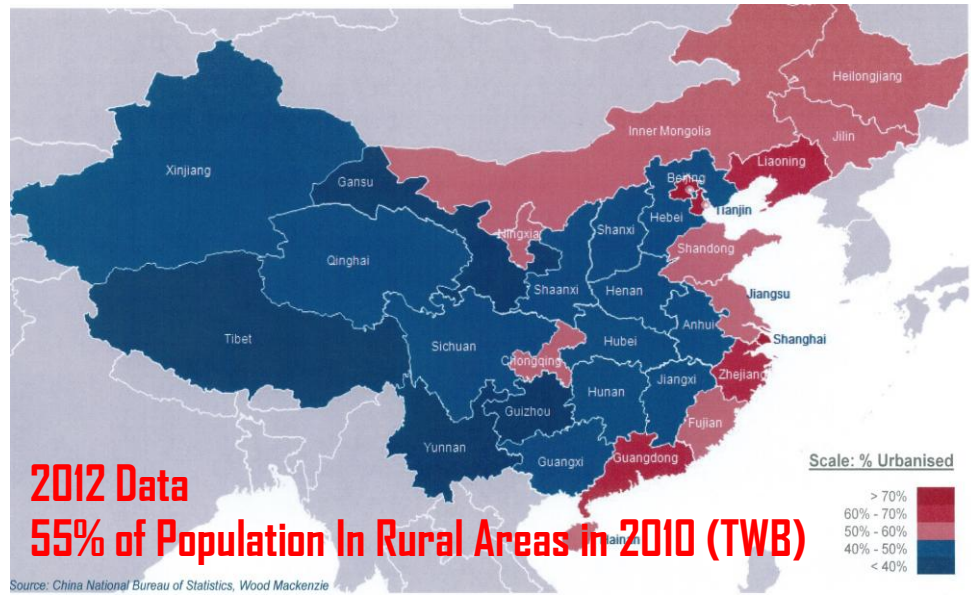
	2014 F Output	2014 F Usage	2014 F Balance
Copper	22.3	21.9	0.435
Zinc	13.5	13.6	<b>-0.040</b>
Lead	11.7	11.7	<b>-0.050</b>
Nickel	1.93	1.89	0.047
<b>4 NFM Forecast</b>	<b>49.43</b>	<b>49.09</b>	<b>0.392</b>

### GDP: IMF, EU

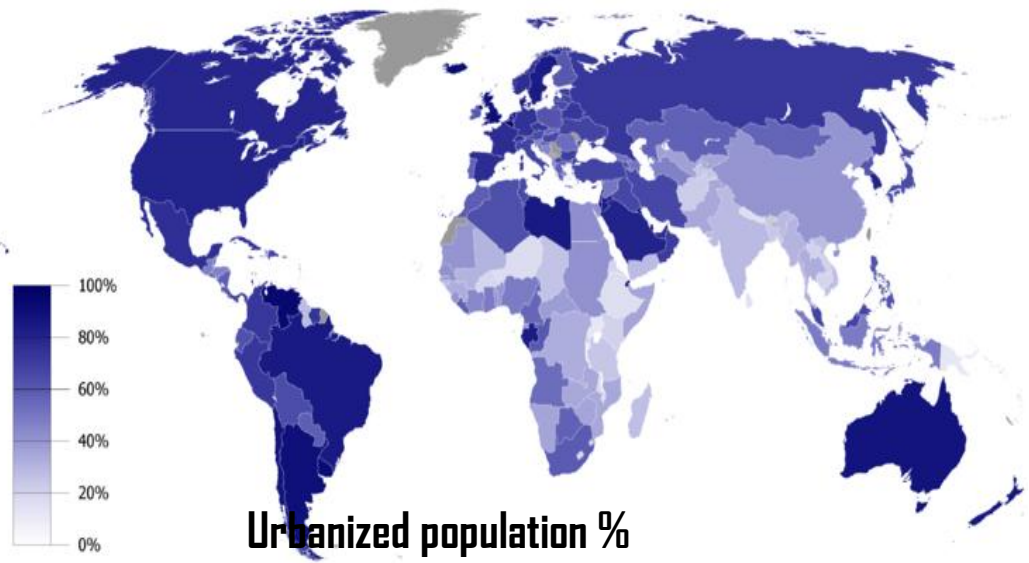
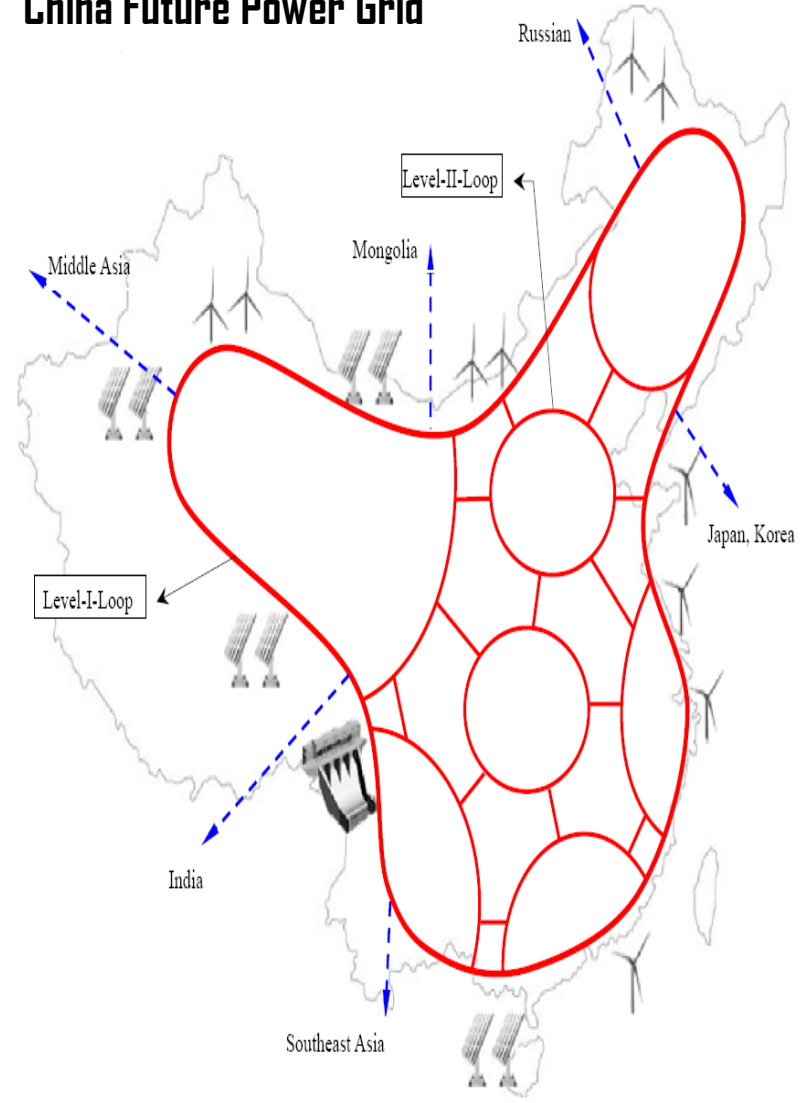


- Will copper mine oversupply deepen in 2014?
- Will the global copper scrap shortage end in 2014?
- Will Indonesia ore ban allow a refined nickel surplus in 2014?
- Or ore stocks in Chinese ports, users and exchanges are enough?
- Will lead recycling flows allow a perfect global balance again?
- Will the expected zinc mine closures restrict supply? Or be delayed?

**China urbanization rate >70% just in 4 regions. Below 50% in Central and West China**  
**The plan: urbanize ~100 million people 2014-2020 = high metal end uses to continue**



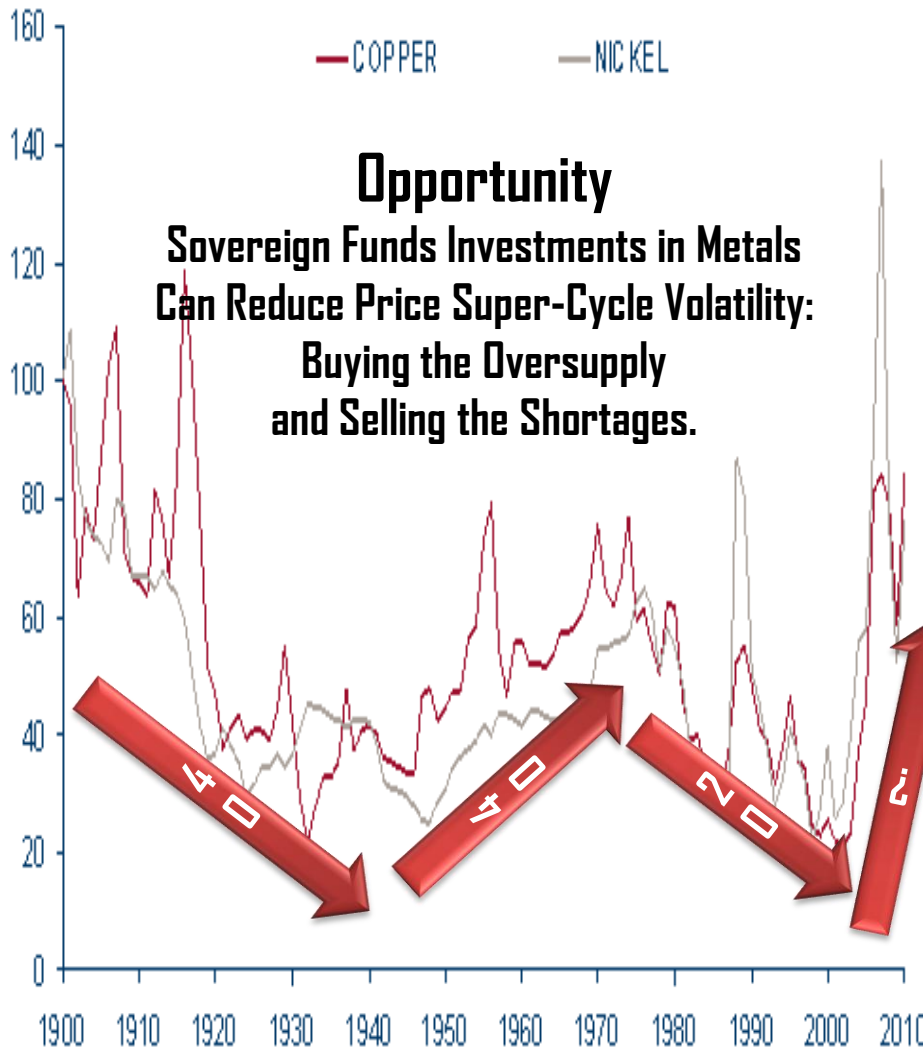
**China Future Power Grid**



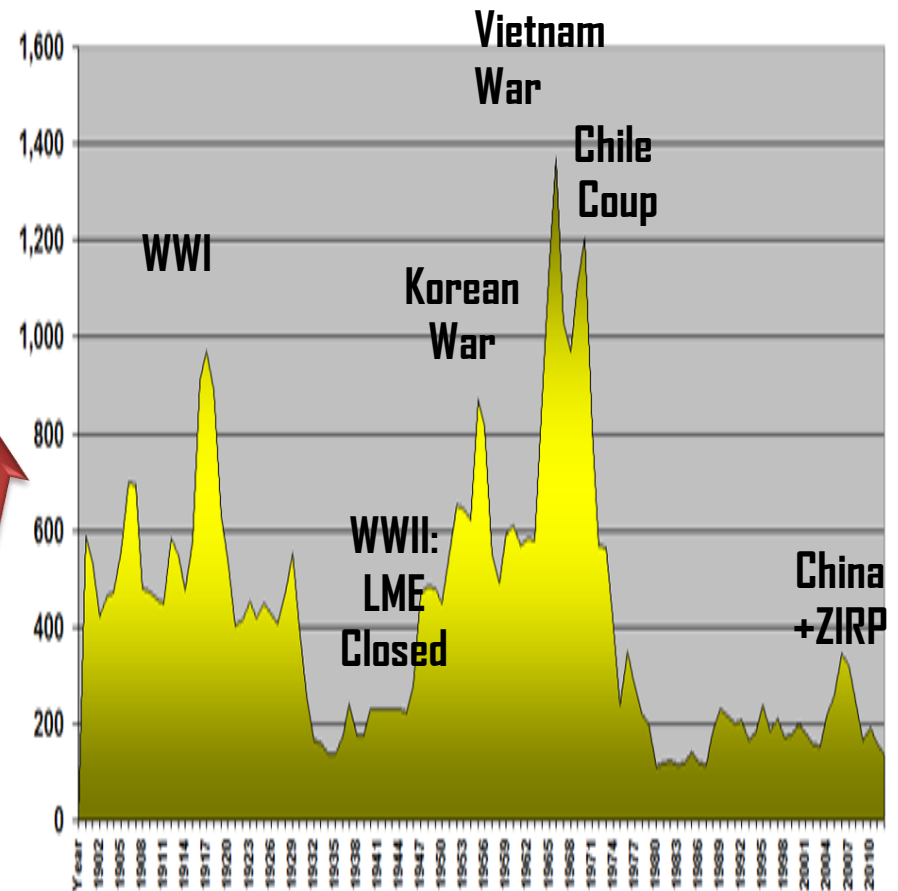
Source: UNICEF, China National Bureau of Statistics, Wood Mackenzie, China Academy of Sciences.



# Copper and nickel cheaper now than 100 years ago: in "constant US dollars" and in gold



Copper Price in Gold Grams per Tonne.  
Source: ICSG based in LME Copper Price and USGS Gold Price.  
Year 1900 to September 2012.



1966-1973 >one kg of gold per tonne of copper. 1974-2014, < 200 grams of gold per tonne of copper.

# International Copper, Lead, Zinc and Nickel Study Groups Next Refined Markets Forecast 2014-2015: October 2014.

## Next Sessions

Copper and Nickel: 13-14 October 2014

Lead and Zinc: 16-17 October 2014

Join Metals Recycling Seminar: 15 October 2014  
in Lisbon, Portugal

For more information please visit our websites:

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