Associação Portuguesa de Geólogos (APG)
Coimbra, Portugal

Promotion of Transparency in the Global Base Metal Markets

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International Lead and Zinc Study Group (ILZSG)

11th November 2016
Presentation Outline

- Overview of the Metal Study Groups
- Main Activities of the Groups
- Groups’ Focus on Global Market Transparency
- Challenges to Transparency
- Summary
- Current Trends and Developments in the global Lead, Zinc, Nickel and Copper Markets
The Study Groups

- International Lead and Zinc Study Group
  - 30 member countries

- International Nickel Study Group
  - 15 member countries

- International Copper Study Group
  - 21 member countries
Study Groups Overview

- Intergovernmental organizations set up within the UN system
- ILZSG established by UN in 1959 in New York
- INSG established in 1990 in The Hague
- ICSG established in 1992 in Lisbon
- From start of 2006 ILZSG, ICSG & INSG co-located in Lisbon, Portugal

www.icsg.org
www.insg.org
ILZSG Membership

- Membership open to any country involved in lead and/or zinc production, usage, or trade.
- 30 members (>85% of global lead/zinc industry):
  - Australia
  - Belgium
  - Brazil
  - Bulgaria
  - Canada
  - China
  - Finland
  - France
  - Germany
  - India
  - Iran
  - Ireland
  - Italy
  - Japan
  - Korea Rep.
  - Morocco
  - Namibia
  - Netherlands
  - Norway
  - Peru
  - Poland
  - Portugal
  - Russian Fed.
  - Serbia
  - South Africa
  - Spain
  - Sweden
  - Thailand
  - United States
  - European Commission
ICSG Membership

- Membership open to any country involved in copper production, usage, or international trade.
- 24 current members:

  - Australia
  - Belgium
  - Chile
  - China
  - Finland
  - France
  - Germany
  - Greece
  - India
  - Italy
  - Iran
  - Japan
  - Luxembourg
  - Mexico
  - Peru
  - Poland
  - Portugal
  - Russian Fed.
  - Serbia
  - Spain
  - Sweden
  - United States
  - Zambia
  - European Comission
INSG Membership

- Membership open to any country involved in nickel production, usage, or international trade.
- 15 current members:
The Study Groups Overview

- Industry heavily involved in activities of Study Groups
- Governments invite industry representatives to attend meetings as part of delegations
- Each Study Group operates an Industry Advisory Panel (IAP) comprised of leading industry players
- Input/feedback regularly received from miners, refiners, consumers, analysts, consultants and traders
Observer organisations include:

- UNCTAD
- UNIDO
- UNEP
- Industry Associations - Producer (IZA, ILA, NI, ICA, Eurometaux)
- Industry Associations – Consumer (BCI, Eurobat, EGGA, ISSF, IWCC)
- International Council on Metals and Mining (ICMM)
- Common Fund for Commodities
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Study Groups’ Main Activities

- **Promote Transparency in the Metals Markets**
  Closely monitor production, consumption, prices, stocks, trade flows and market balances
  Reports and directories

- **Facilitate Co-operation Between Government and Industry**
  Twice yearly meetings
  Special conferences/seminars

- **Conduct In-depth Research into Other Issues of Interest or Concern to Members**
  Economic developments
  Environmental legislation
The Study Groups’ Activities
- Government/Industry Cooperation

- **Study Group six monthly meetings** bring together government and industry representatives in Lisbon.
  - Meetings usually held in April and October.
  - Over 200 participants attend in October.
  - Next meetings will be in April 2017 in Lisbon.
  - Industry or government delegates from non-members can request participation as observers for limited period
  - Unique forum where mining ministries can meet their global counterparts and the international metals industry
Groups also regularly organise **Special Seminars**. In recent years these have included events covering topics such as:

- Metals Recycling
- The Outlook for Metals in China
- Mining Investment Policy in Southern Africa
- The Impact of the Financial Crisis on Metals Supply and Demand
- Materials Stewardship for Mining and Metals
- New and Innovative Applications for Metals
- Energy Issues and Climate Change Policies Impacting on the Non-Ferrous Metals Industries
- The Contribution of Metals to our Sustainable Future
The Study Groups Activities
- Economic and Environmental Issues

Economic Issues

- Study of the Main By-Products of Copper, Lead, Zinc and Nickel
- The Impact of the Financial Crisis on Metals Exploration
- The Potential Impact of Electric Vehicles on Lead Demand
- The Impact of Investment Legislation on Global Copper Supply
- Metals Taxation and Royalty Policies
- Substitution in China’s Copper Industry
- Lead and Zinc: the Supply-Side Response to the Economic Crisis
- Estimating Value Added by the European Lead and Zinc Industries
- Lead and Zinc: National Trade Tariffs and Measures
The Study Groups Activities
- Economic and Environmental Issues

- Environmental Legislation
  - Energy Emissions in Nickel Production
  - Copper, Carbon Trading and Climate Change
  - The Development of Stewardship for Non-ferrous Metals
  - Overview of the Extractive Industries Transparency Initiative
  - Environmental Health Controls on Lead
  - Environmental Health Controls on Zinc
  - The Economic and Environmental Role of Zinc
  - The Lead Fact Book
  - Environment, Health and Safety Regulations for Nickel
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The Study Groups
- Promotion of Transparency

- Publication of detailed and accurate global statistics

- ILZSG, INSG, ICSG publish **statistical Bulletins** every month

- These provide comprehensive overview of current situation in global lead, zinc, nickel and copper markets
Monthly Statistical Bulletins include detailed country by country statistics on:

- mine supply
- refined metal supply
- refined metal usage
- concentrate and metal trade flows

This information is used to calculate global market balances which allow users to determine whether markets are in surplus or deficit.

They also contain the latest information on

- LME, SHFE, producer and consumer stocks
- prices
The Study Groups
- Promotion of Transparency

- Very detailed supply and demand forecasts published on twice yearly basis – in April and October
- Information provided mainly by industry representatives in member countries in response to global survey
- October forecasts released at beginning of LME week
- Consensus unbiased view provides unique insight into the plans of miners and smelters
- Also provide useful assessment of economic trends
- Results widely covered in global metals press
- Accuracy carefully monitored and reported on
The Study Groups - Promotion of Transparency

Data Sources – Worldwide Network

- Member governments
- Industry – producers and consumers
- United Nations
- European Union
- Industry Associations - IZA, ICA, ECI, NI
- National Metals Associations – USGS, CNIA, JOGMEC
- End User Representatives – ZOPA, EGGA, AGA, IWCC, ISSF, World Steel
- Specialist Consultancies – BGRIMM, CBI, Antaike
- Private consultants (swap arrangements) – CRU, Wood Mackenzie, Metal Bulletin
Who Uses This Data?

- **Governments** – members receive automatically as part of their membership
- **Miners and Smelters** – some receive via their governments and other subscribe
- **End Users** – companies who are major users of metals need reliable data on supply and demand
- **Analysts** – many of the major banks track the metals markets on behalf of their clients
- **Consultants** – the Study Groups work closely with the major consultants such as CRU, Wood Makenzie and Metal Bulletin
- **Traders** – now major players in the markets
Selected ILZSG Publications

- Lead and Zinc New Mine and Smelter Projects 2016
- World Directory: Continuous Galvanizing Lines
- China Lead Acid Battery Market
- China Zinc Recycling Industry
- Principal Uses of Lead and Zinc
- World Zinc Oxide and Zinc Dust Production
- World Directory: Primary & Secondary Zinc Plants
- The Market for Lead: Fundamentals Driving Change
- The Use of Zinc in Construction and Public Infrastructure
- The Market for Zinc: Fundamentals Driving Change
SELECTED ICSG PUBLICATIONS

• The Indian Copper Market – Focus on recycling
• Directory of Copper Mines and Plants
• Directory of Copper and Copper Alloy Fabricators
• The China Factor in Global Copper Usage and its Consequences
• The Russian Copper Market”
• The World Copper Factbook
• Currently undertaking studies on the Scrap Market in China, India and Russia
Selected INSG publications

- **World Nickel Statistics Bulletin**
- **World Nickel Statistics Annual Special Issue**
  - *Special issue* published once a year in November; annual data for the latest available 11-year period.
- **World Directory of Nickel Production Facilities**
  - Nickel Mines, Nickel Smelters and Refineries, New Nickel Industry Developments (Committed Developments, Likely Project Developments, Potential Project Developments) and Contact details.
- **Nickel Market Report**
  - Comprehensive analysis of drivers for change in the world nickel market
  - First issue in 2008. Published each year
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The Study Groups
- Market Transparency Challenges

China

- Metals production is very fragmented, consisting of hundreds of small mines and smelters spread throughout the country
- Industry is expanding very rapidly
- Major re-organisation of the Chinese metals sector in recent years with a reduction in central control
- Data collection in China is a highly complex operation
China

• Have been working closely with Chinese authorities to improve data - CNIA regularly send delegations to Study Group meetings
• Groups have commissioned number of studies on aspects of Chinese metals markets
• Joint seminars on China organised in 1996 (Beijing), 2002 (Stockholm), 2009 (Wuhan), 2011 (Lisbon), 2012 (Nanjing)
• ILZSG/CNIA are continuing to actively co-operate in a number of key areas
The Study Groups
- Market Transparency Challenges

Quantity of Metal Recycled

- Lack of a set of recycling rates that can be used across the metals was causing confusion.
- The Metal Study Groups’ established a Recycling Project Team (RPT) to address this issue.
- Many associations/organisations involved.
- After much work methodology agreed.
- Work to determine rates for different metals ongoing.
- Integrating highly regarded flow work of Yale University.
Recycling Input Rate = \frac{\text{Metal Recycled (from EOL & New Scrap)}}{\text{Metal Produced}}

EOL Recycling Rate = \frac{\text{Metal Recycled (from EOL Scrap)}}{\text{Metal Available for Recycling (EOL Scrap)}}

EOL Collection Rate = \frac{\text{Metal Collected (EOL Scrap)}}{\text{Metal Available for Recycling (EOL Scrap)}}

EOL Processing Rate = \frac{\text{Metal Recycled (from EOL Scrap)}}{\text{Metal Collected (EOL Scrap)}}
Price Distortion

- Fund activity in commodities markets has increased in recent years.
- Due to large amounts of money invested, prices sometimes move in a direction which is contrary to fundamentals.
- However, these distortions tend to be short term and the main impact of funds is to increase volatility.
Price Distortion

- Similar distortions have taken place in the past and, up to now, market dynamics have always returned to follow the basic fundamentals.
- Important to remember that most funds and investors closely track fundamentals themselves.
- Low interest rates and anticipation of possible future global commodity shortage are added complications to the current situation.
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Overview

• The non-ferrous metals industry must ensure the continued supply of concentrates, secondary material and refined metal to meet evolving demand, both in the near term and the long term

• At the same time supply must respond flexibly to changing demand for the industry to remain profitable

• New technologies must be developed and implemented to maintain the competitiveness of the non-ferrous metals industry, enhance environmental performance and reduce energy intensity
Overview (2)

• The industry must rise to the challenges presented by the three strands of sustainable development – economic, environmental and social

• The industry must also respond to the challenges that are created by a carbon-constrained regulatory environment

• In this environment it is essential to ensure transparency in the markets for raw materials, metals and products

• The International Metal Study Groups recognise that they have an important role here in meeting the data and analysis needs of governments and industry
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LEAD Pb
World Lead Demand 1965 to 2015

'000 tonnes

Source: ILZSG
Lead End Uses

Source: ILZSG
Variations in Car Sales

Car Sales per 1,000 population 2015

Source: LMC Automotive

India
Indonesia
Turkey
Mexico
China
Brazil
Russia
EU
Japan
USA

www.ilzsg.org International Lead and Zinc Study Group

Source: ILZSG
Distribution of Refined Lead Usage

2005

- China: 20%
- USA: 20%
- Europe: 27%
- Other: 24%
- Korea Rep: 5%
- Japan Rep: 4%

2015

- China: 41.5%
- USA: 14.9%
- Europe: 16.0%
- Other: 19.7%
- Korea Rep: 5.4%
- Japan Rep: 2.5%

Source: ILZSG
Steady Rise in Environmental Legislation

- Restrictions on Hazardous Substance directive (Directive 2002/95/EC)
- Directive on battery and accumulators (Dir. 2006/66/EC)
- Basel Convention
- CLP Regulation / Reg 1272/2008
- Limitation of EU Policy for regulating use of lead shot and sinkers
- Lead Poisoning
- End Of Life vehicle (Dir. 2000/53/EC)
Growth in Lead Mine Output has been in China

Source: ILZSG
59% of Refined Lead Metal Produced in 2015 was from Recycled Material

Source: ILZSG
World Refined Lead Metal Balance – Small Surplus in 2016 and 2017

Source: ILZSG
World Zinc Reserves 2015

Resources: about 1900 million tonnes (Mt)

Reserve Base
480 Mt

Reserves
200 Mt

Mine Production
13.5 Mt

Sources: USGS, ILZSG

contained zinc metal
World Zinc Reserves
2015 Breakdown

• According to the USGS total global zinc reserves amounted to 200 million tonnes in 2015.
Zinc First and End Uses

Zinc First Uses

- Galvanizing: 54%
- Alloys: 15%
- Brass and Bronze: 14%
- Chemicals: 6%
- Semis: 3%
- Miscellaneous: 8%

Zinc End Uses

- Construction: 25%
- Transport: 23%
- Consumer products & Electrical Appliances: 7%
- Industrial Machinery: 45%

Source: Brook Hunt / ILZSG
European Zinc Demand Remains Well Below Peak

'000 tonnes

Source: ILZSG
A Significant Tonnage of Zinc Demand has been lost in the US since 2004

Source: ILZSG

‘000 tonnes

Source: ILZSG
Zinc Demand Growth
China vs Rest of the World 2003-2015

Source: ILZSG
Spread of Urbanisation in China

Source: China National Bureau of Statistics, Wood Mackenzie
Distribution of Refined Zinc Usage

2000
- China: 15.6%
- USA: 14.9%
- Europe: 31.4%
- Other: 23.2%
- Korea Rep: 4.8%
- Japan: 7.5%
- India: 2.7%

2015
- China: 46.8%
- USA: 6.7%
- Europe: 17.6%
- Other: 16.6%
- Korea Rep: 4.2%
- Japan: 3.5%

Source: ILZSG
China Continues to Import Significant Quantities of Zinc Concs & Metal

Exports and Imports of Zinc Concs & Metal from 1997 to 2017f

- Reversal in trend

Data source: www.ilzsg.org
Strong Growth in Indian Zinc Mine Output

Source: ILZSG

- 1st Expansion of Rampura Agucha by 63%
- 2nd Expansion of Rampura Agucha by 33%
- 3rd Expansion of Rampura Agucha by 20%
- Debottlenecking of Rampura Agucha
- Opening of Sindesar Khurd
- Conversion of Rampura Agucha to u/g starts
- Opening of Kayar
Zinc Metal World Balance – Significant Deficits in 2016 and 2017

Source: ILZSG
NICKEL
Ni
Relative Size of Refined Metal Markets

Source: ILZSG / INSG / ICSG
Plenty of nickel reserves available to the world

Resources:
130 million tonnes (Mt)

Reserves
79 Mt

Mine Production
2.15 Mt

2015

Australia 24%
United States 0.2%
South Africa 5%
Other countries 8%
Russia 10%
Philippines 4%
New Caledonia 10%
Madagascar 2%
Indonesia 6%
Brazil 13%
Canada 4%
China 4%
Colombia 1%
Cuba 7%
Guatemala 1%

Source: USGS, INSG
World Nickel Ore Production

(f) forecast October 2016

2007
- Americas: 32%
- Africa: 5%
- Asia: 22%
- Oceania: 19%
- Europe: 22%

2017 f
- Americas: 23%
- Africa: 6%
- Asia: 38%
- Oceania: 22%
- Europe: 11%
- Indonesia: 13%
- Philippines: 5%
- Other Asia: 4%
NPI Production
China and Indonesia (Kt)

Source: Antaike, SMM, INSG

in 1000 tonnes

(f) forecast October 2016

Source: Antaike, SMM, INSG
Principal End Uses of Primary Nickel in 2016

- Stainless Steel: 63%
- NF Products (incl. Castings): 13%
- Plating: 7%
- Steel castings (alloyed): 4%
- Other alloy steels: 6%
- Other uses: 7%
- Other uses: 7%

International Lead and Zinc Study Group

www.ilzsg.org
World Stainless Steel Melting

Source: ISSF, INSG estimates, Antaike

Ex-China | China
---|---
2013: 19270 | 38353
2014: 21823 | 41648
2015: 21532 | 41404
2016 (e): 23615 | 43814
2017 (f): 24000 | 45300

in 1000 tonnes

Source: ISSF, INSG estimates, Antaike
World Primary Nickel Usage (consumption)

(f) forecast October 2016

2007

- Europe: 32%
- Asia: 42%
- Americas: 13%
- Africa: 3%
- Other Asia: 27%
- China P.R.: 25%
- Oceania: 0.2%

2017 f

- Asia: 73%
- China P.R.: 52%
- Other Asia: 21%
- Europe: 17%
- Americas: 9%
- Africa: 1%
- Oceania: 0.1%

www.ilzsg.org

International Lead and Zinc Study Group
World Primary Nickel Balance - annual

Cumulative surplus 2007-2015
~680 kt

(f) forecast October 2016
Copper

Cu
A mineral resource is a natural occurrence of material in the earth's crust for which there is reasonable prospect for current or eventual economic extraction.

A mineral reserve is that part of a measured or indicated resource for which current economic extraction has been demonstrated.

**Total Resources**
(identified and undiscovered)
5,600 million tonnes (Mt)

**Identified Resources**
2,100 Mt

**Reserves**
720 Mt

1/ Source: USGS (resources/reserves data) and ICSG (production data)
2/ Identified and Undiscovered Copper Resources in Porphyry and Sediment-hosted Stratabound Copper Deposits

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19 Mt

China Copper Mine Production 1.7 Mt Cu

World Mine Production 19 Mt

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Not to scale

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2015 World Copper Reserves & Production
(contained copper metal)
Despite increased demand for copper produced from ore in recent years, reserves have grown more, and there is more copper available to the world than at any other time in the past.

In the period 2005-2015, 180 Mt of copper were mined and in the same period however, reserves grew by 250 Mt.

Copper will continue to contribute to society’s sustainable development due to geological availability and industry innovation.
World Copper Mine Production, 1900-2015
(thousand metric tonnes copper)
Source: ICSG

Average annual grow rate in the last century: 4%
Average annual grow rate in the last decade: 2.3 %
Average annual grow rate in this decade: 3%
Distribution of World Copper Mine Production by Country (1990 vs 2017)

- Chile to continue as the biggest copper mine producer in the world
- United States losing share and Peru and China increasing their share significantly
- ICSG commissioning a study on the Copper Mining Industry in China (Nov 2016)
Looking into the future mining companies are starting now to look at possible offshore deep-sea minerals exploration. The oceans represent around 70% of the world surface and its floor is believed to contain important mineral resources among which are copper, zinc, nickel, manganese, gold and silver.

To meet increasing copper demand, the discovery and exploration of new resources will be crucial and sea floor deposits could represent an important opportunity for additional supply.

However, the challenge is to be able to exploit those deposits efficiently and turn them into economically-viable operations.

Source: Nautilus Minerals Inc website
Distribution of World Copper Refined Usage by Country (1990 vs 2017)

- Strong growth in Chinese apparent refined usage, up from 5% of world share in 1990 to around 49% by 2017
- EU share in world usage declining from around 30% in 1990 to 15% by 2017 but in tonnage terms only slightly lower
- United States share in world usage declining from 20% in 1990 to 8% in 2017
Around 30% of the total copper demand is used in the building construction and equipment sectors respectively.

Asia is the major copper end use region representing 63% of the
ICSG World Copper forecast (Oct 2016) – summary table

The International Copper Study Group recognizes that numerous factors create significant uncertainty, and that the global market balances could vary from those projected currently.

ICSG projections for 2016 indicate that the market is expected to remain balanced with a small surplus expected for 2017.

<table>
<thead>
<tr>
<th>REGIONS</th>
<th>MINE PRODUCTION</th>
<th>REFINED PRODUCTION</th>
<th>REFINED USAGE</th>
<th>World adjusted 1/ 2/</th>
<th>% change</th>
</tr>
</thead>
<tbody>
<tr>
<td>Africa</td>
<td>1,896</td>
<td>1,829</td>
<td>1,901</td>
<td>1,384</td>
<td>1,222</td>
</tr>
<tr>
<td>N.America</td>
<td>2,708</td>
<td>2,880</td>
<td>2,885</td>
<td>1,906</td>
<td>2,043</td>
</tr>
<tr>
<td>Latin America</td>
<td>7,895</td>
<td>8,266</td>
<td>8,664</td>
<td>3,312</td>
<td>3,273</td>
</tr>
<tr>
<td>Asean-10 / Oceania</td>
<td>1,906</td>
<td>2,119</td>
<td>2,272</td>
<td>979</td>
<td>1,063</td>
</tr>
<tr>
<td>Asia ex Asean/CIS</td>
<td>2,376</td>
<td>2,449</td>
<td>2,474</td>
<td>11,110</td>
<td>11,664</td>
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<tr>
<td>Asia-CIS</td>
<td>618</td>
<td>677</td>
<td>738</td>
<td>398</td>
<td>420</td>
</tr>
<tr>
<td>EU</td>
<td>857</td>
<td>880</td>
<td>896</td>
<td>2,731</td>
<td>2,675</td>
</tr>
<tr>
<td>Europe Others</td>
<td>872</td>
<td>837</td>
<td>872</td>
<td>1,062</td>
<td>1,032</td>
</tr>
<tr>
<td>TOTAL</td>
<td>19,128</td>
<td>19,936</td>
<td>20,702</td>
<td>22,883</td>
<td>23,393</td>
</tr>
<tr>
<td>% change</td>
<td>3.8%</td>
<td>4.0%</td>
<td>0.0%</td>
<td>1.8%</td>
<td>2.2%</td>
</tr>
<tr>
<td>World Refined Balance (China apparent usage basis)</td>
<td>-153</td>
<td>-8</td>
<td>163</td>
<td></td>
<td></td>
</tr>
<tr>
<td>World Refined Balance Adjusted for Chinese Bonded Stocks Change 3/</td>
<td>-256</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1/ Based on a formula for the difference between the projected copper availability in concentrates and the projected use in primary refined production; 2/ based on average ICSG forecast deviations for preceding 5 years. 3/ Estimated Chinese bonded stock changes; averaged from multiple sources.
THANK YOU!
To learn more about the Groups:

www.icsg.org
www.insg.org
www.ilzsg.org