# The World Copper Factbook 2014

International Copper Study Group

# About ICSG

The International Copper Study Group (ICSG) was formally established as an autonomous inter-governmental organization on 23 January 1992, following a series of Ad Hoc meetings sponsored by the United Nations (UNCTAD) in 1986 and 1987 to review the world situation of copper and discuss the need for such a body. ICSG serves to increase copper market transparency and promote international discussions and cooperation on issues related to copper.

In order to fulfill its mandate, the Study Group has three main objectives:

- Increase market transparency by promoting an exchange of information on production, consumption, stocks, trade, and prices of copper, by forecasting production and consumption, and by assessing the present and future capacities of copper mines, plants, smelters and refineries.
- Promote international cooperation on matters related to copper, such as health and the environment, research, technology transfer, regulations and trade.
- Provide a global forum where industry and governments can meet and discuss common problems/objectives. The ICSG is the only inter-government forum solely dedicated to copper.

The current members of ICSG are:

| | |
|---|---|
| Australia | Japan |
| Belgium | Luxembourg |
| Chile | Mexico |
| China | Peru |
| European Union | Poland |
| Finland | Portugal |
| France | Russian Federation |
| Germany | Serbia |
| Greece | Spain |
| India | Sweden |
| Iran | United States |
| Italy | Zambia |

As part of its mandate to provide a global forum where industry and governments can meet and discuss common problems and objectives, ICSG meetings are held twice per year, typically in the Spring and Fall at ICSG Headquarters in Lisbon, Portugal. The meetings of the Study Group are open to government members, their industry advisors and invited observers.

## ICSG Officers and Secretariat

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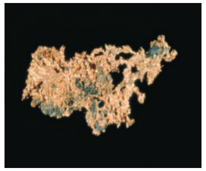
## ICSG Publications

- **COPPER BULLETIN (monthly).** The ICSG Copper Bulletin includes annual and monthly statistics on copper and copper products, their production, usage and trade by country, as well as stocks and exchange prices, providing a global view of supply and demand. Subscribers to the Copper Bulletin receive the Yearbook as part of their annual subscription.
- **ICSG 2014 STATISTICAL YEARBOOK (September 2014).** The ICSG Copper Bulletin yearbook includes annual statistics on copper and copper products, their production, usage and trade by country, as well as stocks and exchange prices, providing a global view of supply and demand for the past 10 years. The Yearbook serves as a useful tool for consultations and analysis on the longer term evolution of world copper production, usage, stocks and prices. Subscribers to the Copper Bulletin receive the Yearbook as part of their annual subscription.
- **DIRECTORY OF COPPER MINES AND PLANTS (July 2014 edition).** The Directory of Copper Mines and Plants highlights current capacity and provides a five year outlook of forecasted capacity for over 1,000 existing and planned copper mines, plants and refineries on a country by country basis, including separate tables for SX-EW plants. Salient details for each operation are included and the Directory separates operations between Operating & Developing and Exploration & Feasibility stages. The Directory is published twice per year.
- **ICSG STATISTICAL DATABASE.** The ICSG maintains one of the world's most complete historical and current databases with statistics on copper production capacities, data on copper production, consumption, stocks, prices, recycling and trade for copper products. In 2012 ICSG launched its **online statistical database** that gives subscribers direct access to ICSG historical data. It also provides subscribers with specific extraction tools for downloading the data.
- **DIRECTORY OF COPPER & COPPER ALLOY FABRICATORS (FIRST USE) (2014 edition).** This directory provides a global overview of companies and plants involved in the first use of copper. First users are mainly semis fabricators that process refinery shapes into semi-finished copper and copper alloy products. Published September 2014.
- **SURVEY OF BRASS MILLS, COPPER PRODUCTS AND FOUNDRIES IN CHINA (2014).** The survey provides a detailed overview of China's industrial use of refined copper and scrap in the brass mills and foundries sectors. Published March 2014.
- **MARKET STUDY: FABRICATION AND COPPER USE IN THE MIDDLE EAST AND NORTH AFRICA.** A study focusing on providing a complete picture of fabrication and copper use in the Middle East, Egypt and India. Published July 2014.
- **SURVEY OF WIRE ROD PLANTS AND SECONDARY COPPER SMELTERS IN CHINA (2013).** The first large scale ICSG Survey of copper wire rod plants in China. A review of wire rod plants, secondary smelters and refineries under construction in 2012 and expansion plans up to 2015 is included.
- **COPPER AND COPPER ALLOY SCRAP SUPPLY SURVEY IN EU-27 (2013).** The study compares scrap trade statistics of EUROSTAT and UN COMTRADE databases. Differences in numbers are revealed and explained by EUROSTAT and selected interviews with scrap collectors and traders. It also gives an analysis on material availability, copper content in trade and the economic logic of copper scrap dismantling.
- **TAXATION, ROYALTIES AND OTHER FISCAL MEASURES APPLIED TO THE NON-FERROUS METALS INDUSTRY (2013).** A joint report by the ICSG, ILZSG and INSG, providing information on fiscal measures applied to mining and metals across various jurisdictions with a particular focus on copper, lead, zinc and nickel.

For more information about ICSG and ICSG publications, please visit our website at www.icsg.org

# Table of Contents

# Chapter 1: Cu Basics



## What is Copper?

Copper is a malleable and ductile metallic element that is an excellent conductor of heat and electricity as well as being corrosion resistant and antimicrobial. Copper occurs naturally in the Earth's crust in a variety of forms. It can be found in sulfide deposits (as chalcopyrite, bornite, chalcocite, covellite), in carbonate deposits (as azurite and malachite), in silicate deposits (as chrysycolla and dioptase) and as pure "native" copper.

Copper also occurs naturally in humans, animals and plants. Organic life forms have evolved in an environment containing copper. As a nutrient and essential element, copper is vital to maintaining health. Life sustaining functions depend on copper.

Copper and copper-based alloys are used in a variety of applications that are necessary for a reasonable standard of living. Its continued production and use is essential for society's development. How society exploits and uses its resources, while ensuring that tomorrow's needs are not compromised, is an important factor in ensuring society's sustainable development.

Copper is one of the most recycled of all metals. It is our ability to recycle metals over and over again that makes them a material of choice. Recycled copper (also known as secondary copper) cannot be distinguished from primary copper (copper originating from ores), once reprocessed. Recycling copper extends the efficiency of use of the metal, results in energy savings and contributes to ensuring that we have a sustainable source of metal for future generations.

The demand for copper will continue to be met by the discovery of new deposits, technological improvements, efficient design, and by taking advantage of the renewable nature of copper through reuse and recycling. As well, competition between materials, and supply and demand principles, contribute to ensuring that materials are used efficiently and effectively.

Copper is an important contributor to the national economies of mature, newly developed and developing countries. Mining, processing, recycling and the transformation of metal into a multitude of products creates jobs and generates wealth. These activities contribute to building and maintaining a country's infrastructure, and create trade and investment opportunities. Copper will continue to contribute to society's development well into the future.

Images courtesy of the Copper Development Association.

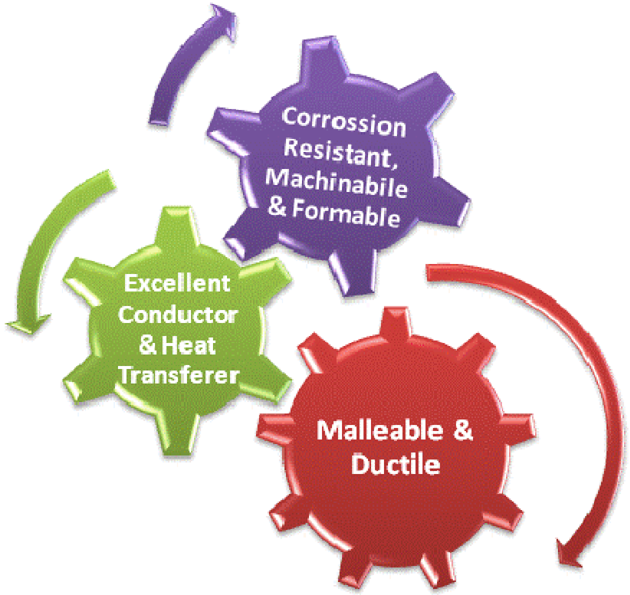
# Copper Properties and Benefits

| | |
|---|---|
| **Chemical Symbol** | **Cu** |
| **Atomic Number** | **29** |
| **Atomic Weight** | **63.54** |
| **Density** | **8960 kg m$^{-3}$** |
| **Melting point** | **1356 K** |
| **Specific Heat cp (at 293 K)** | **0.383 kJ kg-1 K-1** |
| **Thermal conductivity** | **394 W m-1 K-1** |
| **Coefficient of linear expansion** | **16.5 x 10-6 K-1** |
| **Young's Modulus of Elasticity** | **110 x 109 N m-2** |
| **Electrical Conductivity (% IACS)** | **1.673 x 10$^{-8}$ ohm-m** |
| **Crystal Structure** | **Face-Centered Cubic** |

Copper makes vital contributions to sustaining and improving society. Copper's chemical, physical and aesthetic properties make it a material of choice in a wide range of domestic, industrial and high technology applications.

Alloyed with other metals, such as zinc (to form brass), aluminum or tin (to form bronzes), or nickel, for example, it can acquire new characteristics for use in highly specialized applications. In fact, society's infrastructure is based, in part, on copper.

## Key Physical Properties of Copper




But copper's benefits extend beyond mechanical characteristics:

- Copper is **essential to the health** of plants, animal and humans. Deficiencies, as well as excesses, can be detrimental to health.
- **Antimicrobial Properties**. Due to copper's antimicrobial properties, copper and copper alloy products can be used to eliminate pathogens and reduce the spread of diseases.
- **Recycling**. Copper is one of the most recycled of all metals. Virtually all products made from copper can be recycled and recycled copper loses none of its chemical or physical properties.
- **Energy Efficiency**. Copper can improve the efficiency of energy production and distribution systems.

# Selected Copper Definitions

- **Anode.** The positive terminal in an electrolytic cell where electrons leave a device to enter the external circuit. A copper anode at 99 percent purity will dissolve.
- **Blister.** The product of a converting furnace. It is an intermediate, more concentrated (with respect to the desired metal) material than matte, from which it is made, and is usually transferred to another furnace for further concentration.
- **Cathode.** The negative terminal in an electrolytic cell where copper is plated during electrowinning or electrolytic refining. Copper so plated is referred to as "cathode" and is generally about 99.99 percent pure.
- **Contained Copper.** Contained copper is defined as the analytical amount of copper outputted in concentrates and precipitates.
- **Copper concentrate.** A product of flotation milling. It composes sulfide minerals and entrained material and contains one-third each copper, iron, and sulfur. It can be processed pyrometallurgically in a smelter to produce matte or hydrometallurgically (pressure leaching) to produce pregnant leach solution, both products requiring further processing to obtain copper metal.
- **Direct melt scrap.** Direct-melt, or re-melt scrap is secondary material that can be used directly in a furnace without cleanup through the use of fluxes and poling and re-refining.
- **Electrorefining.** An electrolytic refining process where less pure copper anode is dissolved and high-purity copper is plated at the cathode.

Sources: ICSG and USGS.

- **Electrowinning.** An electrolytic refining process where the anode is inert, and rich (copper-loaded) electrolyte continually replaces lean (copper-depleted) electrolyte as copper is plated at the cathode.
- **Fire-refined copper.** The product of a fire-refining furnace. It is an intermediate, more concentrated (with respect to the desired metal) material than blister, from which it is made. Fire-refined copper contains about 99 percent copper, the exact percentage depending on the process parameters.
- **Primary copper.** Copper extracted from ores and recovered as copper metal or copper-bearing chemicals.
- **Secondary refined material**. Secondary refined material represents scrap that has been fire-refined, or that has been converted to anode at the smelter level and then electrolytically refined.
- **Solvent extraction**. A method of separating one or more metals from a leach solution by treating with a solvent that will extract the required metal, leaving the others. The metal is recovered from the solvent by further treatment.
- **Stocks.** ICSG reports refined copper stocks as those held by the exchanges, consumers, producers and governments. Merchant stocks are included where it is certain that these are nonduplicative to those already reported. Only refined products at plant sites are included. Items such as wire rod, tube and other semifabricated forms are not included.
- **Usage.** Copper usage represents refined copper used by semifabricators. Usage data is either directly reported, or ICSG estimates an **apparent usage** using the following formula: Refined copper production + refined imports - refined exports + refined beginning stocks - ending stocks.

# Copper in History

Archaeological evidence demonstrates that copper was one of the first metals used by humans and was used at least 10,000 years ago for items such as coins and ornaments in western Asia. During the prehistoric **Chalcolithic Period** (derived from *chalkos*, the Greek word for copper), man discovered how to extract and use copper to produce ornaments and implements. As early as the 4th to 3rd millennium BC, workers extracted copper from Spain's Huelva region.

The discovery that copper, when alloyed with tin, produces bronze, led to the **Bronze Age**, c. 2,500 BC. Israel's Timna Valley provided copper to the Pharaohs (an Egyptian papyrus records the use of copper to treat infections and to sterilize water). Cyprus supplied much of the Phoenician, Greek and Roman needs for copper. "Copper" is derived from the latin *Cyprium*, literally Cyprian metal. The Greeks of Aristotle's era were familiar with brass as a valued copper alloy. In South America, the pre-Columbian Maya, Aztec and Inca civilizations exploited copper, in addition to gold and silver. During the **Middle Ages**, copper and bronze works flourished in China, India and Japan.

The discoveries and inventions relating to electricity and magnetism of the late 18th and early 19th centuries by scientists such as Ampere, Faraday and Ohm, and the products manufactured from copper, helped launch the **Industrial Revolution** and propel copper into a new era. **Today**, copper continues to serve society's needs. Although copper has been in use for at least 10,000 years, innovative applications for copper are still being developed as evidenced by the development of the copper chip by the semi-conductors industry.





Images courtesy of the British Museum, the Copper Development Association and ICSG.

# Copper Today

The global demand for copper continues to grow: world refined usage has more than tripled in the last 50 years thanks to expanding sectors such as electrical and electronic products, building construction, industrial machinery and equipment, transportation equipment, and consumer and general products. Some of the highlights of 2012 copper production and usage are listed below. In the chapters that follow, more in-depth information is presented on copper production, trade, usage, and recycling. For the most up-to-date information on the global copper market, please visit our website at www.icsg.org.

## Copper Production Highlights

Preliminary figures indicate that global **copper mine production** in 2013 reached 18.1 million tonnes. The largest producer of mined copper was **Chile** (almost 5.8 million tonnes).

**Smelter production** in 2013 reached around 16.8 million tonnes. **China** was the largest producer of blister & anode in 2013 (over 5.7 million tonnes)

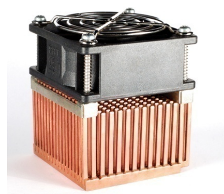
**Refinery Production** in 2013 increased to 20.9 million tonnes, including 3.8 million tonnes of secondary refined production.

## Copper Usage Highlights

**Refined copper usage** (usage by semis plants or the first users of copper) in 2013 reached 21.2 million tonnes. **China** was also the largest consumer of refined copper in 2013 with apparent usage of over 9.5 million tonnes.

According to the International Copper Association (ICA), equipment was the largest copper end-use sector last year, followed by building construction and infrastructure.

**New copper applications** being developed include antimicrobial copper touch surfaces, lead-free brass plumbing, high tech copper wire, heat exchangers, and new consumer products as well.



# Chapter 2: Copper Production

## How is Copper Produced?

Geologists look for signs and/or anomalies that would indicate the presence of a mineral deposit. Under the right geological, economic, environmental and legal conditions, mining can proceed.

Primary copper production starts with the extraction of copper-bearing ores. There are three basic ways of copper mining: surface, underground mining and leaching. Open-pit mining is the predominant mining method in the world.

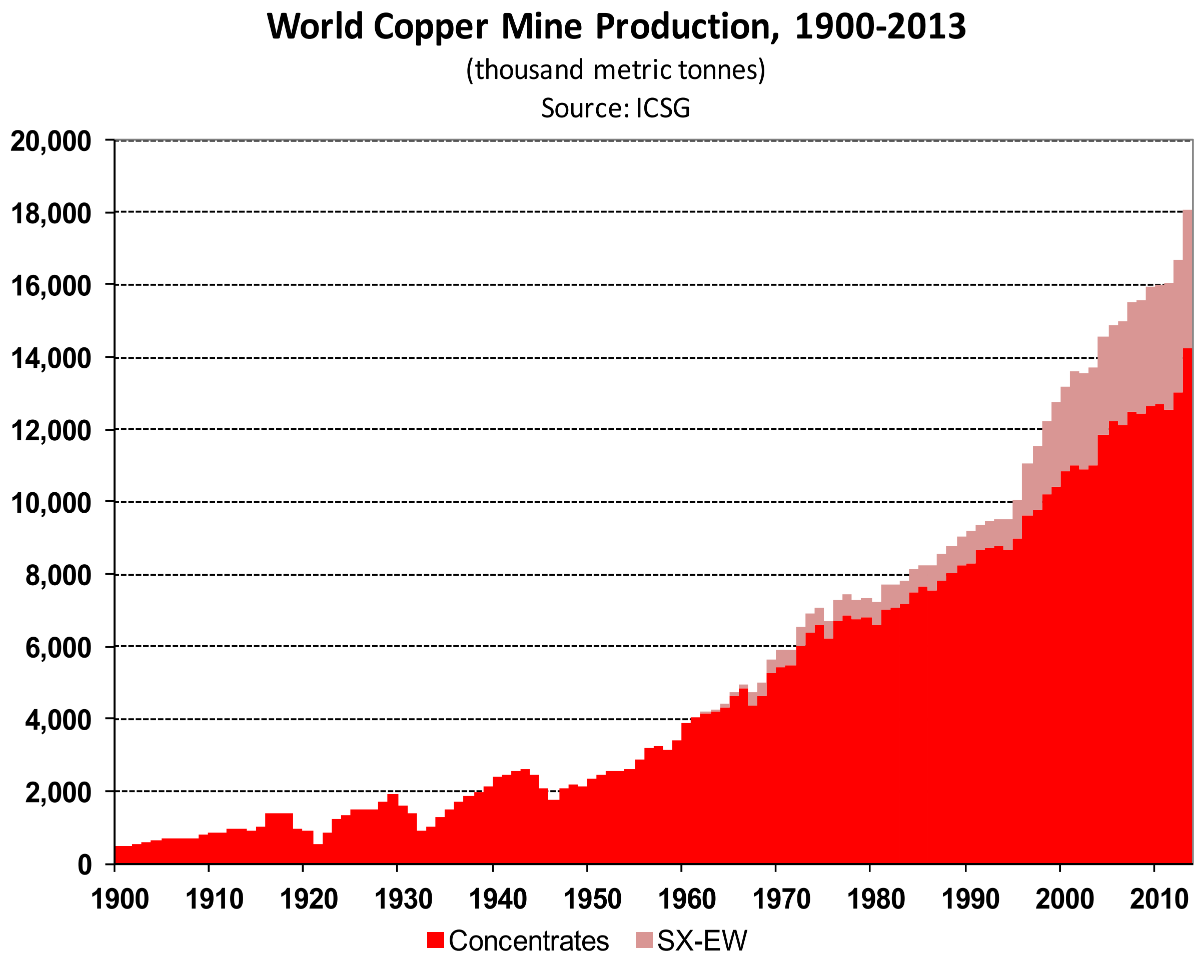
After the ore has been mined, it is crushed and ground followed by a concentration by flotation. The obtained copper concentrates typically contain around 30% of copper, but grades can range from 20 to 40 per cent. In the following smelting process, sometimes preceded by a roasting step, copper is transformed into a "matte" containing 50-70% copper. The molten matte is processed in a converter resulting in a so-called blister copper of 98.5-99.5% copper content. In the next step, the blister copper is fire refined in the traditional process route, or, increasingly, re-melted and cast into anodes for electro-refining.

The output of electro-refining is refined copper cathodes, assaying over 99.99% of copper.

Alternatively, in the hydrometallurgical route, copper is extracted from mainly low grade oxide ores and also some sulphide ores, through leaching (solvent extraction) and electrowinning (SX-EW process). The output is the same as through the electro-refining route - refined copper cathodes. ICSG estimates that in 2013, refined copper production from SX-EW represented 18% of total copper refined production.

Refined copper production derived from mine production (either from metallurgical treatment of concentrates or SX-EW) is referred to as "primary copper production", as obtainable from a primary raw material source. However, there is another important source of raw material which is scrap. Copper scrap derives from either metals discarded in semis fabrication or finished product manufacturing processes ("new scrap") or obsolete end-of-life products ("old scrap"). Refined copper production attributable to recycled scrap feed is classified as "secondary copper production". Secondary producers use processes similar to those employed for primary production. ICSG estimates that in 2013, at the refinery level, secondary copper refined production reached 18% of total copper refined production.

# Copper Mine Production

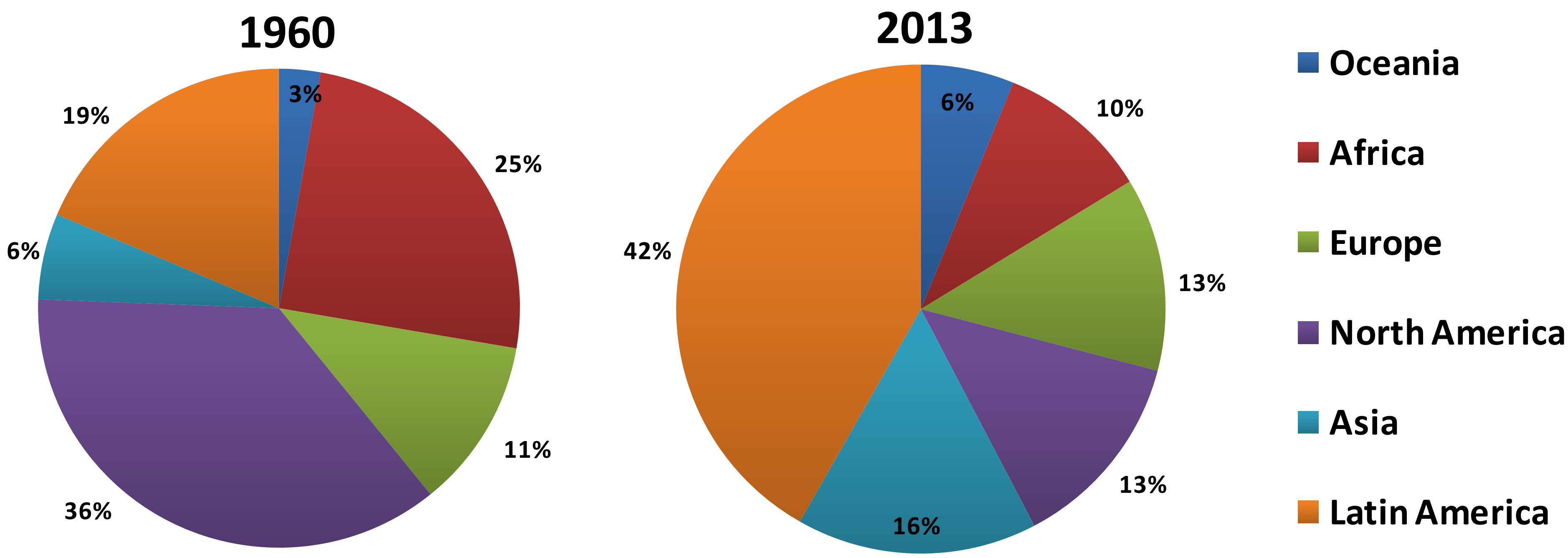



**Since 1900, when world production was less than 500 thousand tonnes copper, world copper mine production has grown by 3.2% per year to 18.1 million tonnes in 2013. SX-EW production, virtually non-existent before the 1960s, reached nearly 3.8 million tonnes in 2013.**

## Copper Mine Production by Region, 1960 versus 2013

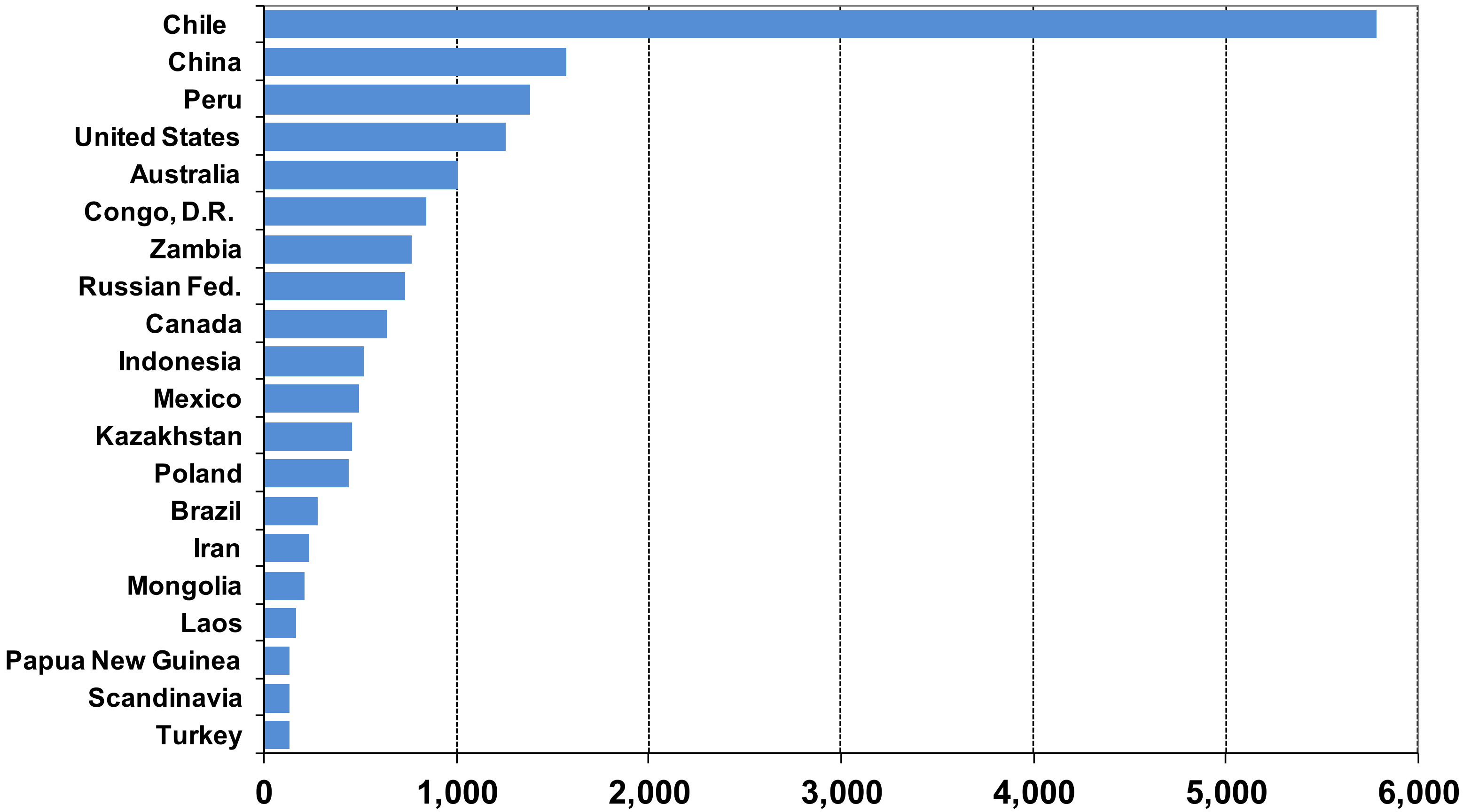
Thousand metric tonnes copper

Source: ICSG




**From less than 750,000 tonnes copper in 1960, copper mine production in Latin America surged to over 7.5 million tonnes in 2013, representing 42% of the global total. Asia has also exhibited significant growth. The region's share of global production has increased from just 6% to 16% over the respective period.**

## Copper Mine Production by Country: Top 20 Countries in 2013
(Thousand metric tonnes)
Source: ICSG

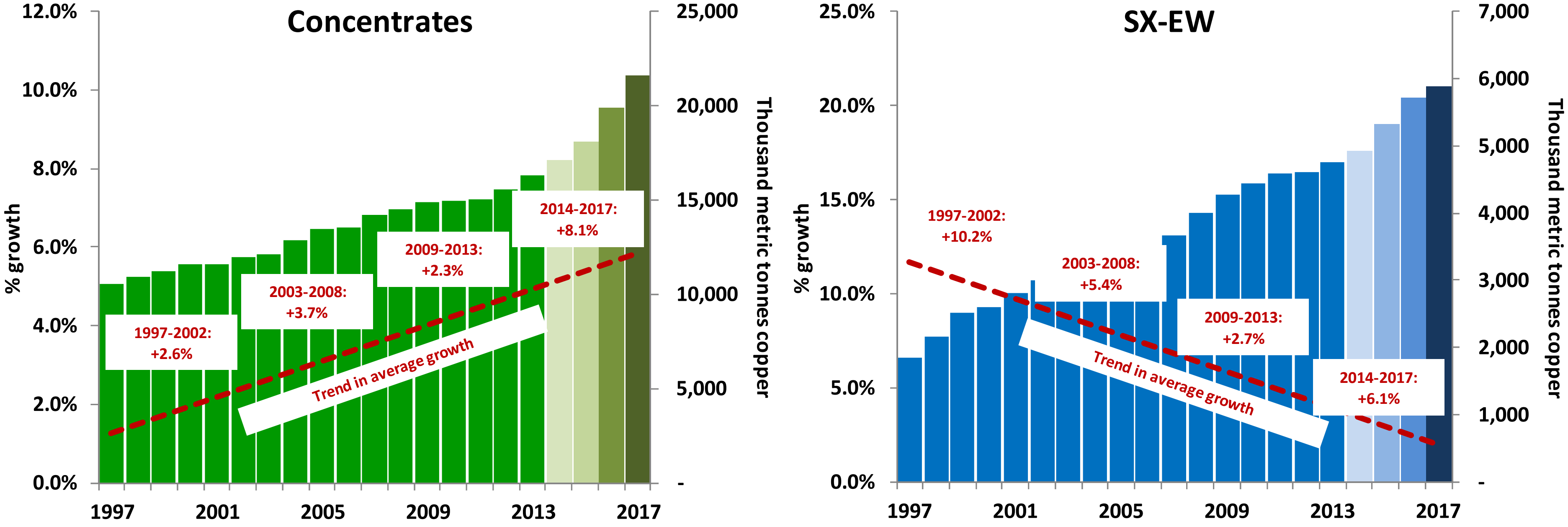



**Chile accounted for almost one-third of world copper mine production in 2013 with mine output of almost 5.8 million tonnes copper.**

## Trends in Copper Mining Capacity, 1997-2017

Thousand metric tonnes (Bars) and Annual percentage change (Line)

Source: ICSG Directory of Copper Mines and Plants – July 2014




**Copper mining capacity is estimated to reach 27.5 million tonnes copper in 2017, with 21% being SX-EW production. This will be around 30% higher than capacity of 21.0 million tonnes copper recorded in 2013. As the charts illustrate, growth in concentrate capacity has generally been rising, while growth in SX-EW capacity has been falling. This trend should reverse going forward as new capacity is added at existing and some new operations.**

# Top 20 Copper Mines by Capacity (basis 2014)

Thousand metric tonnes copper

Source: ICSG Directory of Copper Mines and Plants – July 2014

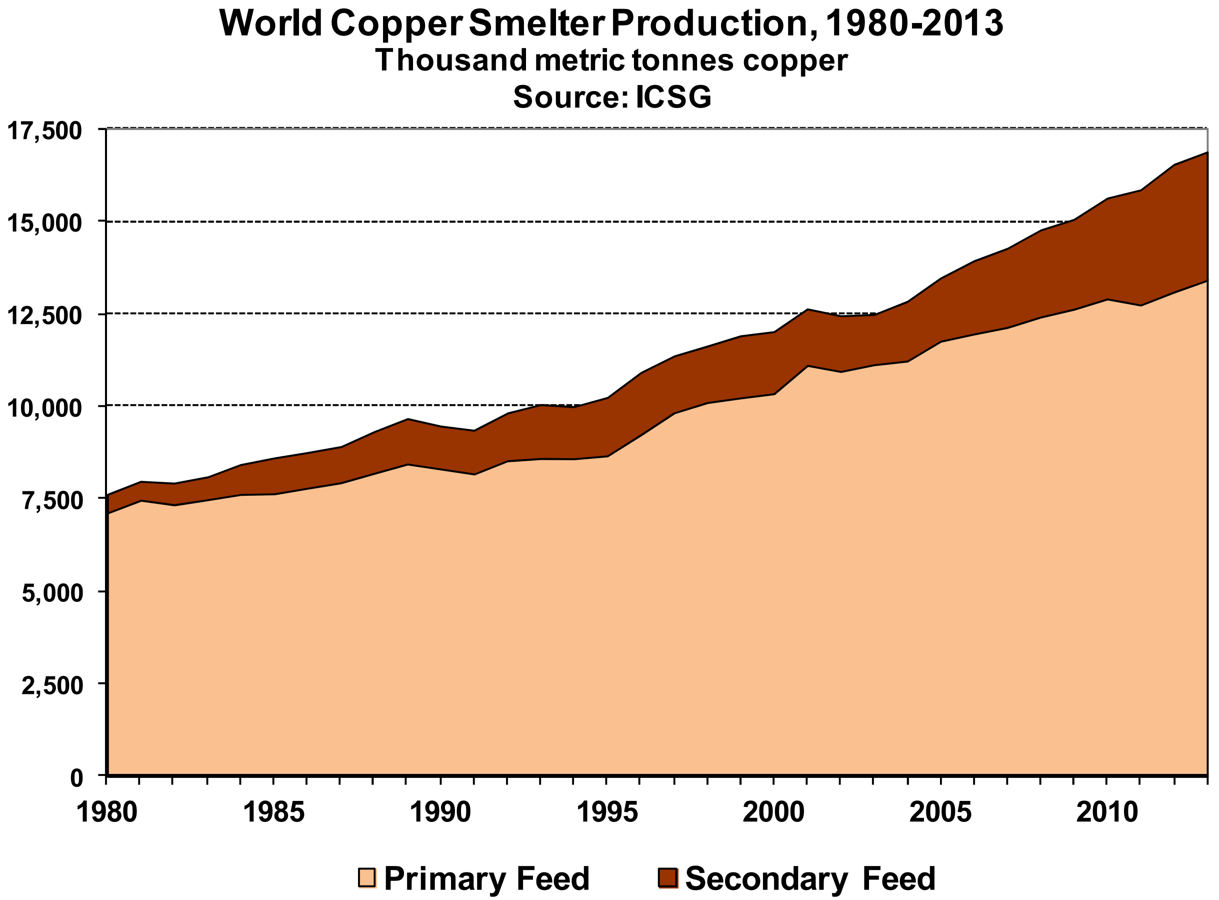
| Rank | Mine | Country | Owner(s) | Source | Capacity |
|---|---|---|---|---|---|
| 1 | Escondida | Chile | BHP Billiton (57.5%), Rio Tinto Corp. (30%), Japan Escondida (12.5%) | Concs & SX-EW | 1,050 |
| 2 | Grasberg | Indonesia | P.T. Freeport Indonesia Co. (PT-FI), Rio Tinto | Concentrates | 790 |
| 3 | Collahuasi | Chile | Anglo American (44%), Glencore plc (44%), Mitsui + Nippon (12%) | Concs & SX-EW | 520 |
| 4 | Los Bronces | Chile | Anglo Amercian 75.5%, Mitsubishi Corp. 24.5% | Concs & SX-EW | 490 |
| 5 | Codelco Norte | Chile | Codelco | Concs & SX-EW | 450 |
| 6 | Antamina | Peru | BHP Billiton (33.75%), Teck (22.5%), Glencore plc (33.75%), Mitsubishi Corp. (10%) | Concentrates | 450 |
| 7 | Morenci | United States | Freeport-McMoRan Inc 85%, 15% affiliates of Sumitomo Corporation | Concs & SX-EW | 450 |
| 8 | El Teniente | Chile | Codelco | Concs & SX-EW | 443 |
| 9 | Taimyr Peninsula (Norilsk/ Talnakh Mills) | Russia | Norilsk Nickel | Concentrates | 430 |
| 10 | Los Pelambres | Chile | Antofagasta Plc (60%), Nippon Mining (25%), Mitsubishi Materials (15%) | Concentrates | 400 |
| 11 | Radomiro Tomic | Chile | Codelco | SX-EW | 400 |
| 12 | Andina | Chile | Codelco | Concentrates | 300 |
| 13 | Kansanshi | Zambia | First Quantum Minerals Ltd (80%), ZCCM (20%) | Concs & SX-EW | 285 |
| 14 | Bingham Canyon | United States | Kennecott | Concentrates | 280 |
| 15 | Batu Hijau | Indonesia | Pt Newmont Nusa Tenggara (PT Pukuafu 20%, Newmont 41.5%, Sumitomo | Concentrates | 250 |
| 16 | Sarcheshmeh | Iran | National Iranian Copper Industry Co. | Concs & SX-EW | 249 |
| 17 | Cerro Verde II (Sulphide) | Peru | Freeport-McMoRan Copper & Gold Inc.53.5%, Compañia de Minas Buenaventura 18.5%, Sumitomo 21% | Concentrates | 240 |
| 18 | Olympic Dam | Australia | BHP Billiton | Concs & SX-EW | 225 |
| 19 | Cuajone | Peru | Grupo Mexico (54.1%), Marmon Corp. (15%), Freeport-McMoRan Copper & | Concs & SX-EW | 212 |
| 20 | Konkola | Zambia | Konkola Copper Mines (Vedanta 79.4%, ZCCM 20.6%) | Concentrates | 200 |

# Constraints on Copper Supply

With copper concentrate in strong demand, there has been growing interest in understanding the obstacles that can prevent copper mine supply from coming on-stream. Below are some of the **operational and financial constraints** identified from the study. For more information about ICSG research related to constraints on copper supply, please contact the ICSG Secretariat at mail@icsg.org

- Declining ore grades: a serious issue in developed copper areas such as the USA and Chile
- Project finance: prolonged economic and price volatility may have significant impact on cost of capital
- Tax & investment regimes: recent research indicates these are less important than geological endowments
- Other cost issues: lower capital expenditure may have adverse long term effect on copper supply; operating cost escalation
- Water supply: a critical issue in dry mining districts
- Energy: coal is the fuel chosen to power main copper mines and processes… climate change may increase costs
- Other environmental issues: governments are becoming more aware of the impact of mining to the surrounding environment in recent years. In countries like Peru and the Philippines, the relationship with indigenous community is also a key factor.
- Resource nationalism: It has become a priority for certain governments to develop their mineral resources that have not been exploited until now. While willing to develop their natural resources, countries might be seeking to extract strong revenue flows from them. It will be important to balance royalty/taxation levels with the need to encourage capital investment to develop their rising industries.
- Sulphuric acid supply and price: 16% cost factor for SX-EW projects
- Skilled labor: open labor markets would help address this constraint
- Labor strikes: tend to increase when refined prices are high and GDP is growing faster, but tend to be longer and less frequent otherwise
- High domestic costs if there is “Dutch disease” (resulting in higher exchange rates due in part to strong exports)
- Rate between imported inputs and domestic input costs affected by the currency strength of the producer
- Political risks: Security and transport accessibility is crucial to mine operation

# Copper Smelter Production

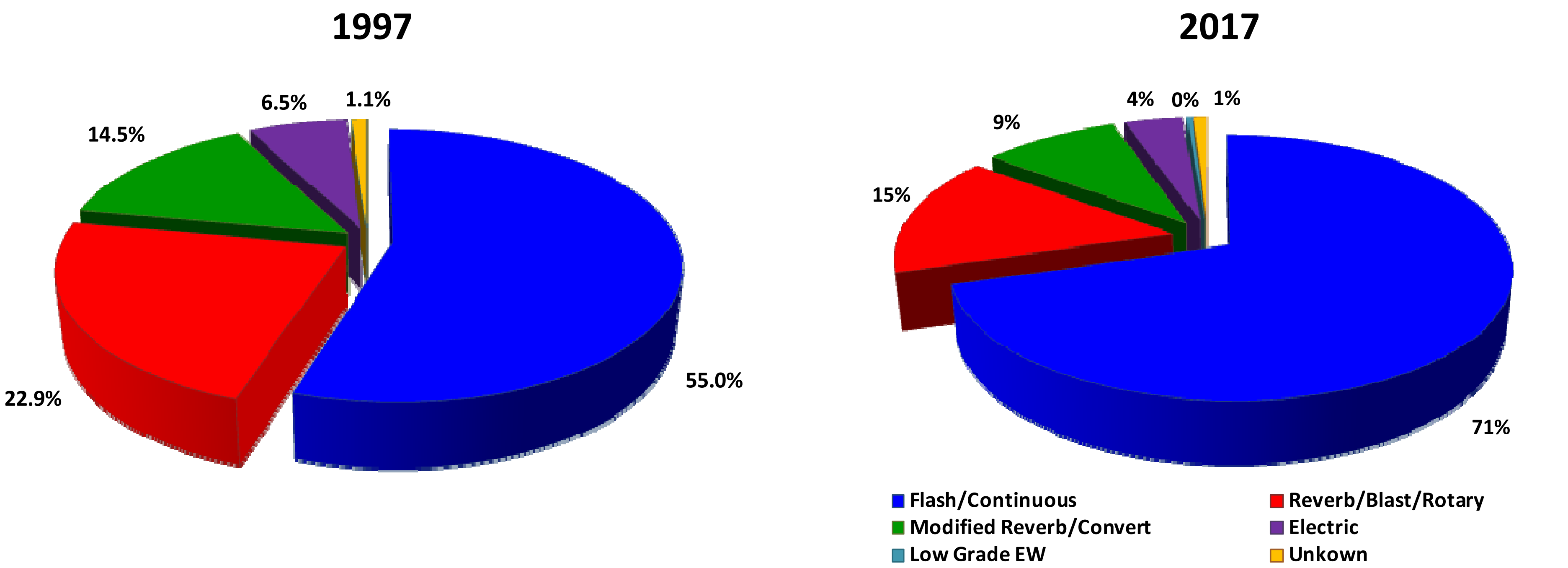



**Smelting is the pyrometallurgical process used to produce copper metal. In 2013, world copper smelter production reached 16.8 million tonnes copper. Recently, the trend to recover copper directly from ores through leaching processes has been on the increase. Primary smelters use mine concentrates as their main source of feed (although some use copper scrap as well). Secondary copper smelters use copper scrap as their feed.**

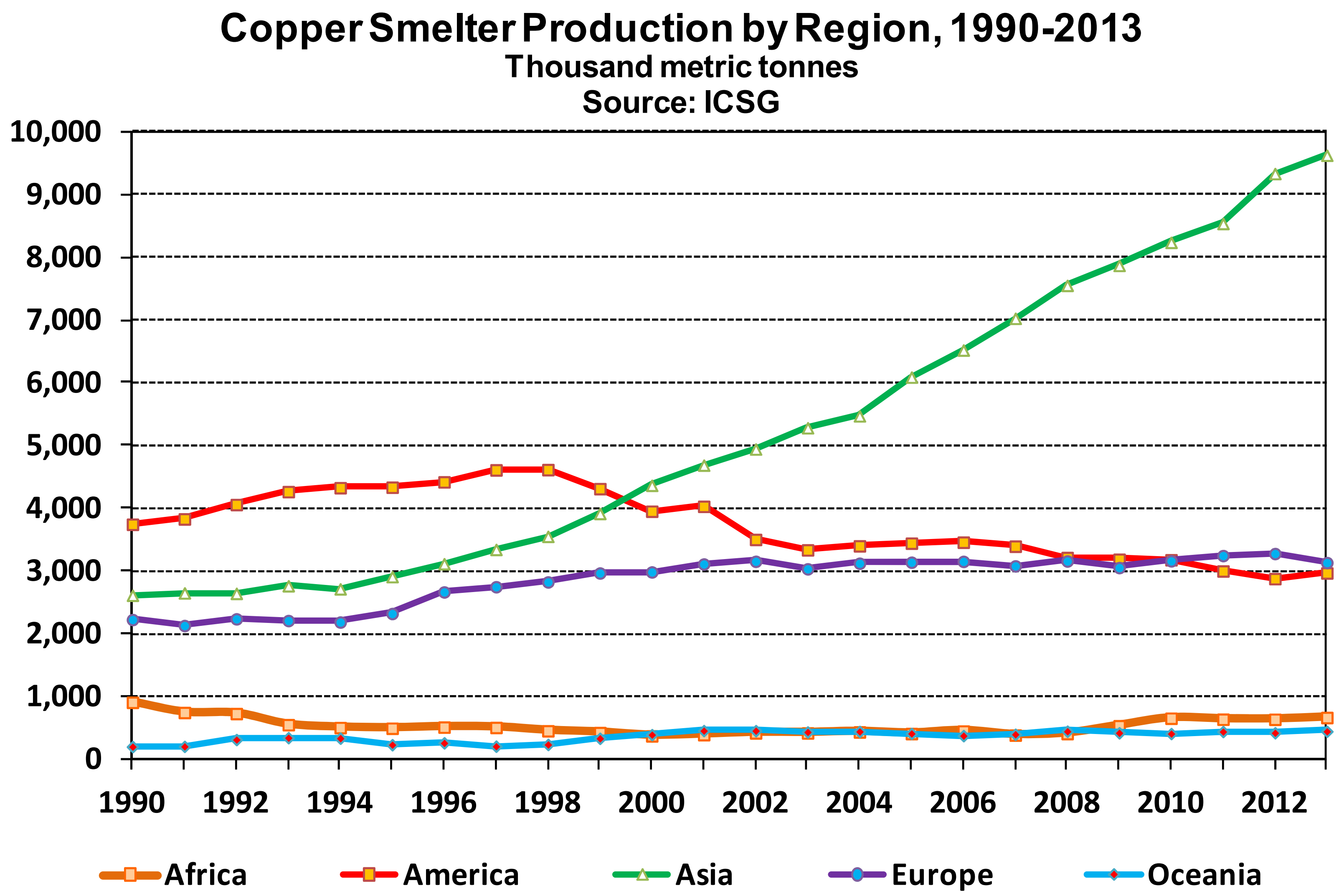
# Trends in Copper Smelting Capacity, 1997 and 2017

**Percentage share of total capacity, by technology type**

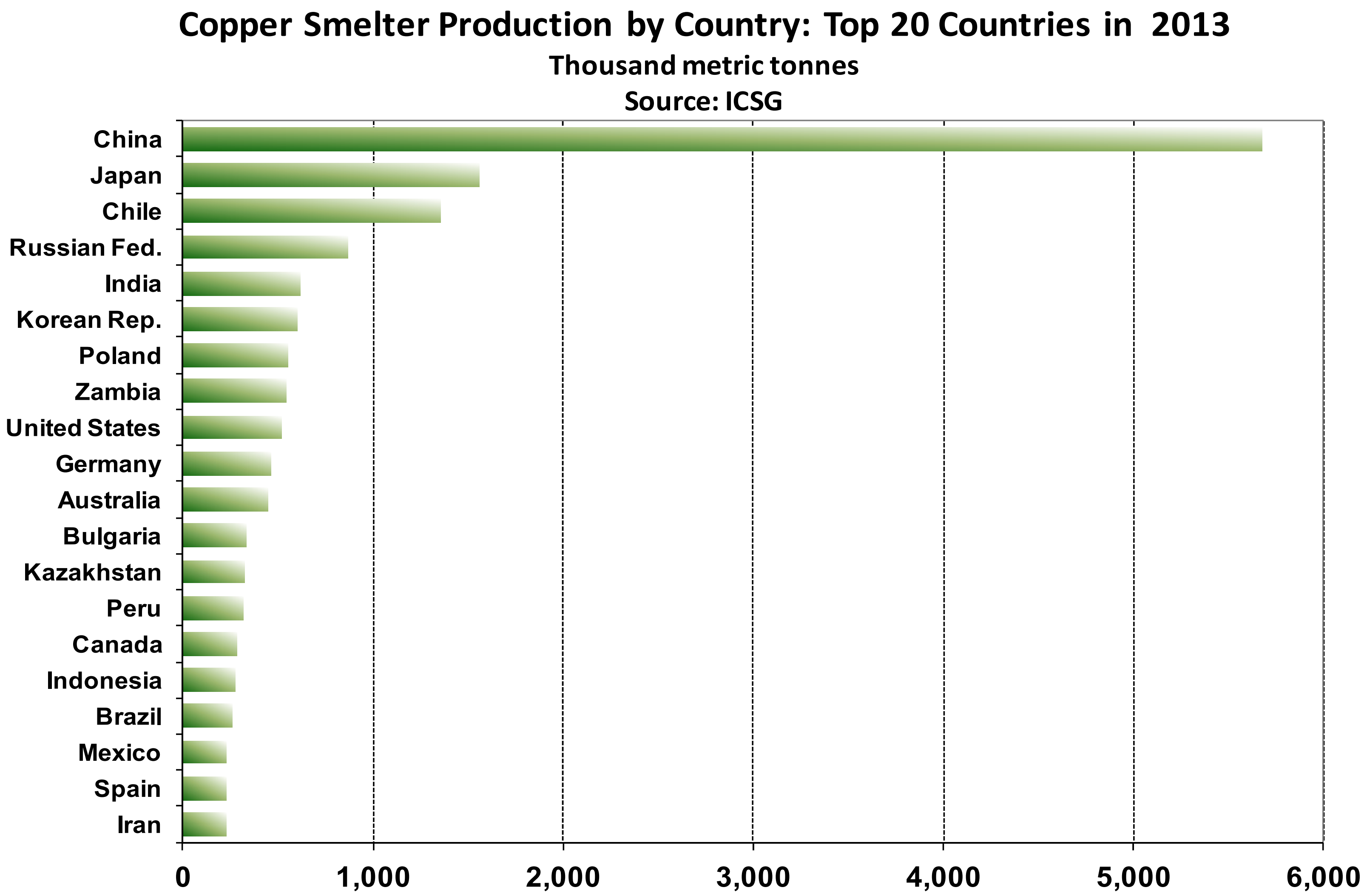
**Source: ICSG Directory of Copper Mines and Plants – July 2014**




**The use of Flash/Continuous technology accounted for 55% in total copper smelting capacity in 1997. This share rose to almost 70% in 2013. It is expected to remain around this level until 2017.**




**Asia's share of world copper smelter output jumped from 27% in 1990 to 57% in 2013 as smelter production in China expanded rapidly.**




**In 2013, China accounted for over a third of world copper smelter production, followed by Japan (9%), Chile (8%) and the Russian Federation (5%).**

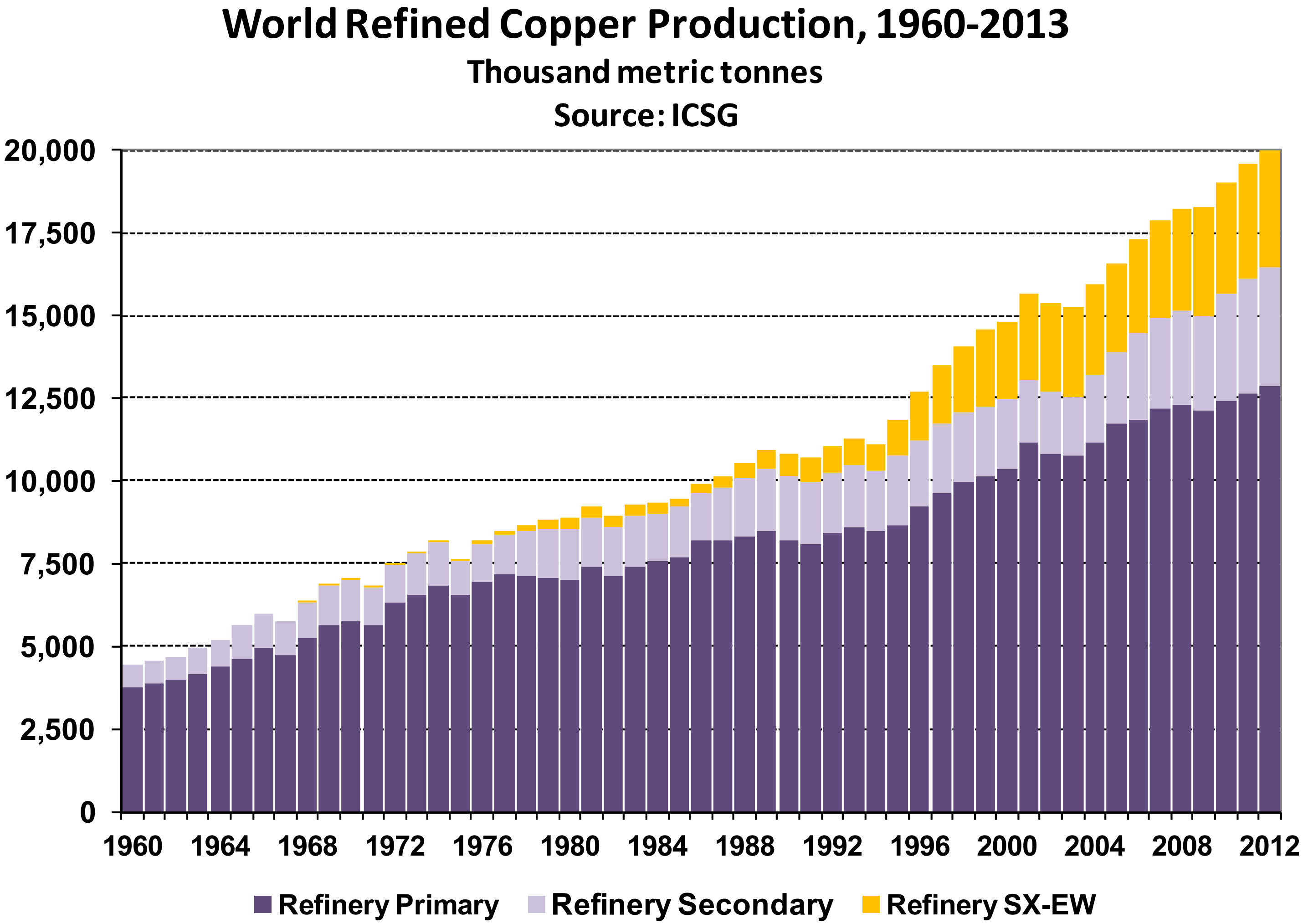
# Top 20 Copper Smelters by Capacity (basis 2014)

Thousand metric tonnes copper

Source: ICSG Directory of Copper Mines and Plants – July 2014

| Rank | Smelter | Country | Operator/Owner(s) | Process | Capacity |
|---|---|---|---|---|---|
| 1 | Guixi (smelter) | China | Jiangxi Copper Corp. | Outokumpu Flash | 900 |
| 2 | Birla Copper (Dahej) | India | Birla Group | Outokumpu Flash, Ausmelt, Mitsubishi Continuous | 500 |
| 3 | Codelco Norte (smelter) | Chile | Codelco | Outokumpu/ Teniente Converter | 450 |
| 3 | Hamburg | Germany | Aurubis | Outokumpu, Contimelt, Electric | 450 |
| 3 | Besshi/ Ehime (Toyo) | Japan | Sumitomo Metal Mining Co. Ltd. | Outokumpu Flash | 450 |
| 3 | Saganoseki/ Oita (smelter) | Japan | Pan Pacific Copper Co. Ltd | Outokumpu Flash | 450 |
| 7 | El Teniente (Caletones) | Chile | Codelco Chile | Reverberatory/ Teniente Conv. | 400 |
| 7 | Jinchuan (smelter) | China | Jinchuan Non- Ferrous Metal Co. | Reverberatory/ Kaldo Conv. | 400 |
| 7 | Xiangguang Copper | China | Xiangguang Copper Co. Ltd. | Outokumpu Flash | 400 |
| 7 | Norilsk (Nikelevy, Medny) | Russia | Norilsk G-M | Reverb, Electric, Vanyukov | 400 |
| 7 | Sterlite Smelter (Tuticorin) | India | Vedanta | Isasmelt Process | 400 |
| 7 | Jinguan (smelter) | China | Tongling Nonferrous Metals Group | Flash Smelter | 400 |
| 13 | Ilo Smelter | Peru | Southern Copper Corp. (Grupo Mexico 75.1%) | Isasmelt Process | 360 |
| 14 | Onahama/ Fukushima | Japan | Mitsubishi Materials Corp. (49.29%), Dowa Metals & Mining Co. Ltd.(31.15%), Furukawa Metals & Resources Co. Ltd. (12.67%) | Reverberatory | 354 |
| 15 | Altonorte (La Negra) | Chile | GlencoreXstrata plc | Noranda Continuous | 350 |
| 15 | Jinlong (Tongdu) | China | Tongling Nonferrous Metals Corp. (57.4%), Sumitomo (35%), Pingguo Aluminium Co. | Flash Smelter | 350 |
| 15 | Yunnan | China | Yunnan Copper Industry Group (Local Government) | Isasmelt Process | 350 |
| 15 | Tongling | China | Tongling Nonferrous Metals Group | Outokumpu Flash | 350 |
| 19 | Naoshima/ Kagawa | Japan | Mitsubishi Materials Corp. | Mitsubishi Continuous | 342 |
| 20 | Baiyin | China | Baiyin Non-Ferrous Metals | Flash Smelter | 340 |

## Refined Copper Production

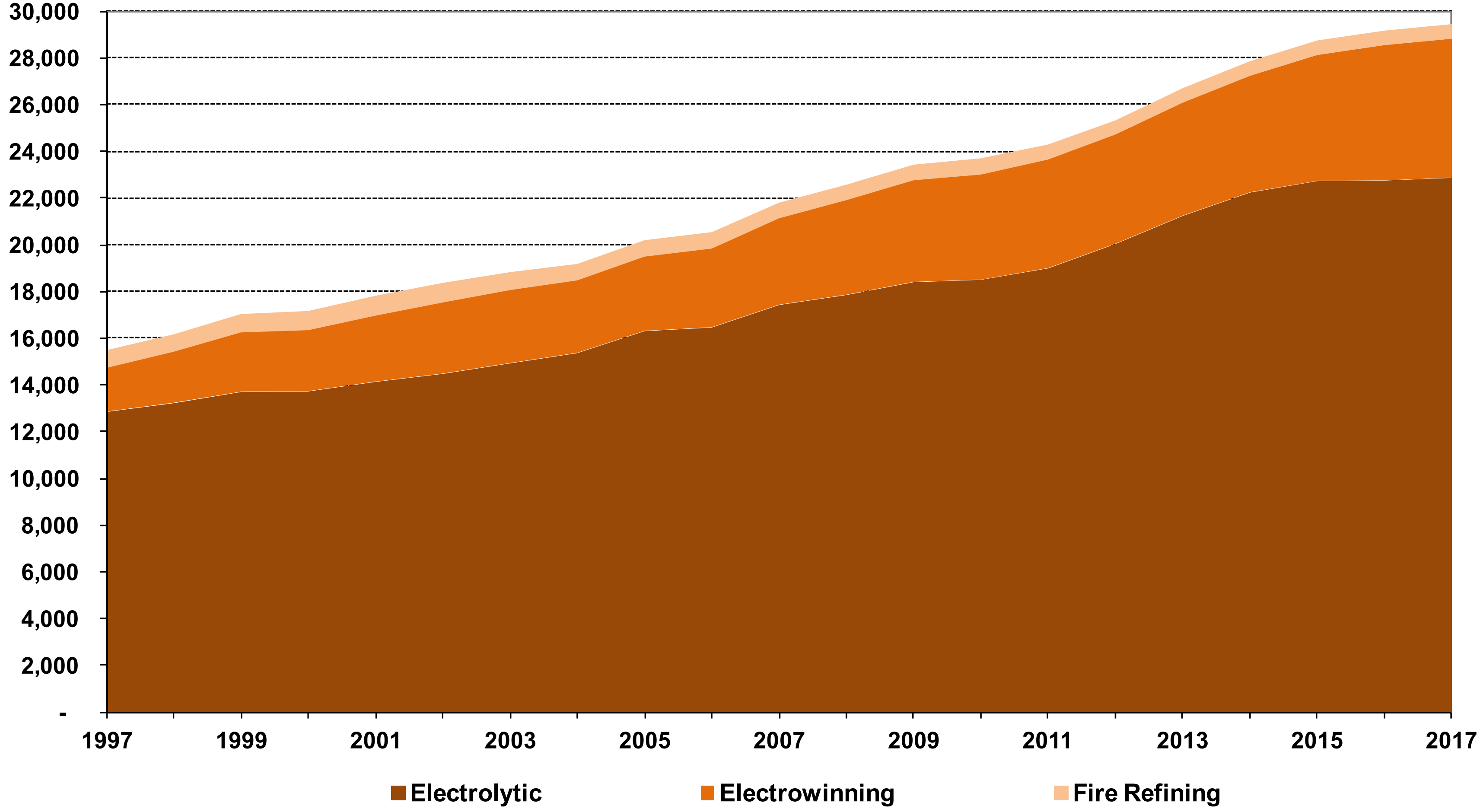



**With the emergence of solvent extraction-electrowinning, (SX-EW) technology, refined copper produced from leaching ores has been on the rise, increasing from less than 1% of world refined copper production in the late 1960's to 18% of world output in 2013.**

## Trends in Refined Capacity, 1997-2017

**Thousand metric tonnes copper**

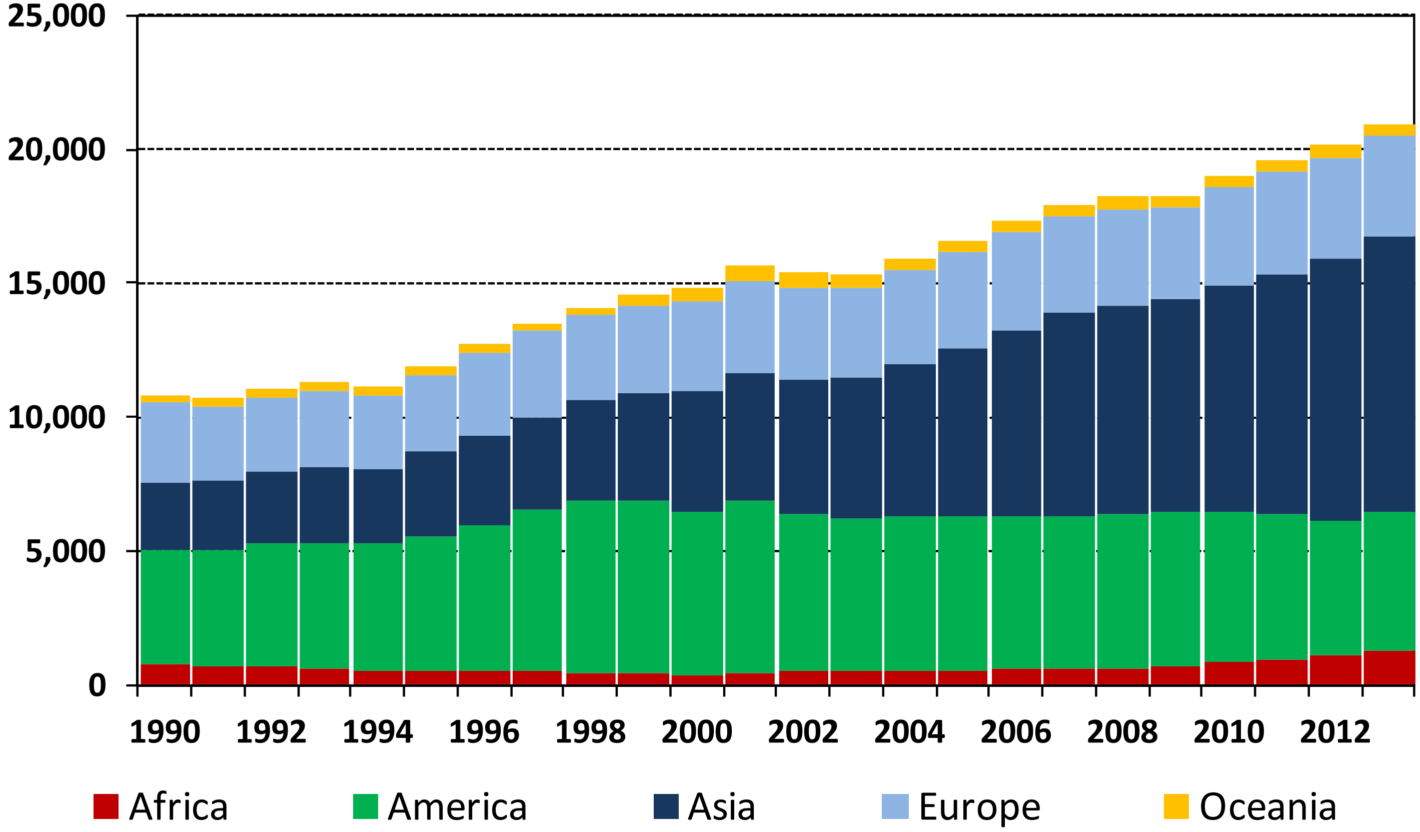
**Source: ICSG Directory of Copper Mines and Plants - July 2014**




**This chart shows world copper refinery capacity by refining process. The ratio between production and capacity is called the capacity utilization rate. The world refinery capacity utilization rate was around 79% in 2013.**

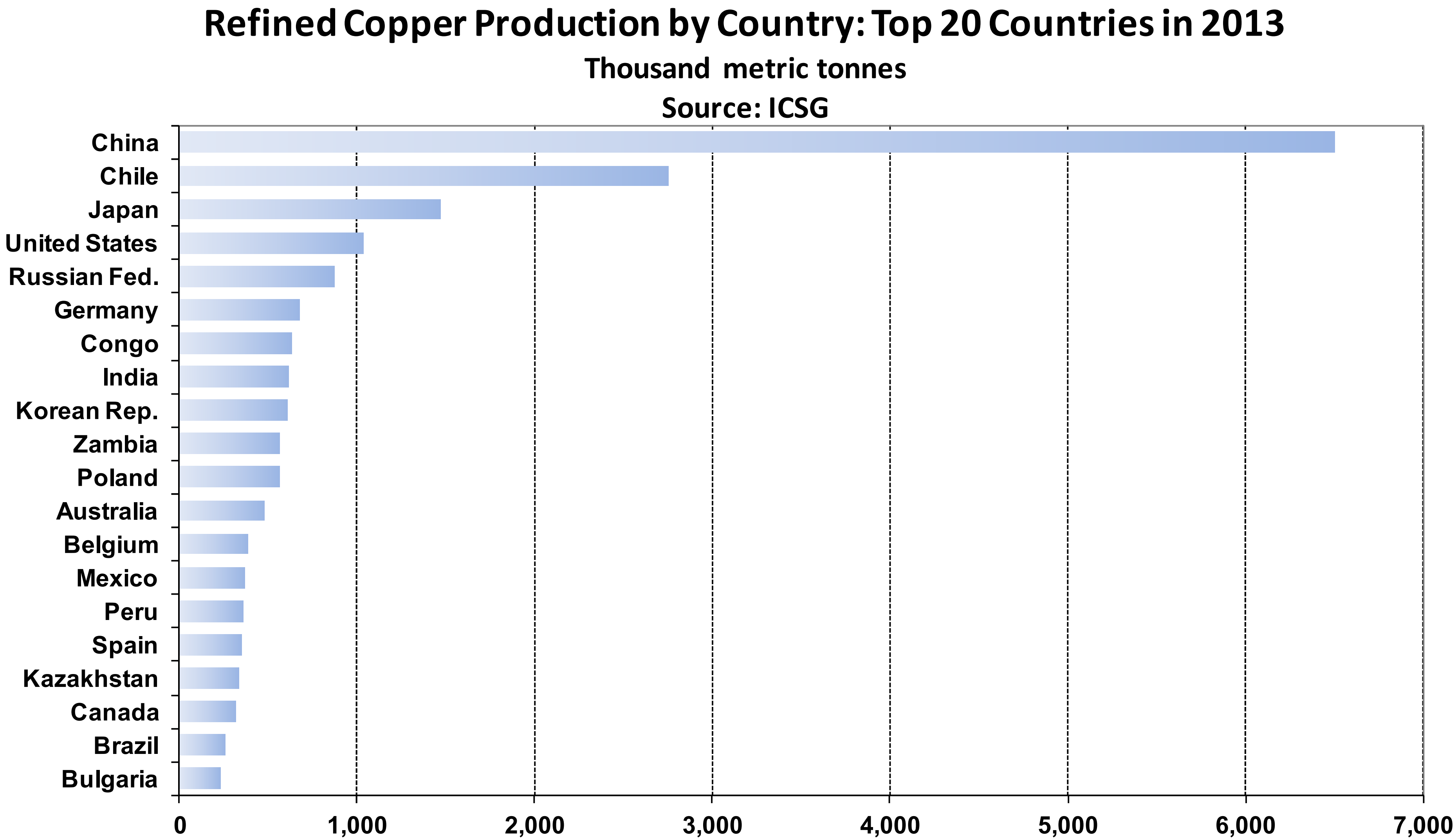
## Refined Copper Production by Region, 1990-2013

**Thousand metric tonnes**
**Source: ICSG**




Region with the highest output of refined copper in **1990**: the **Americas** (4,250 kt), followed by **Europe** (3,000 kt)

Leading region in the world in **2013**: **Asia** (10,340 kt) as compared to 2,500kt in 1990.


Refined Copper Production by Country: Top 20 Countries in 2013
Thousand metric tonnes
Source: ICSG
China
Chile
Japan
United States
Russian Fed.
Germany
Congo
India
Korean Rep.
Zambia
Poland
Australia
Belgium
Mexico
Peru
Spain
Kazakhstan
Canada
Brazil
Bulgaria
0
1,000
2,000
3,000
4,000
5,000
6,000
7,000

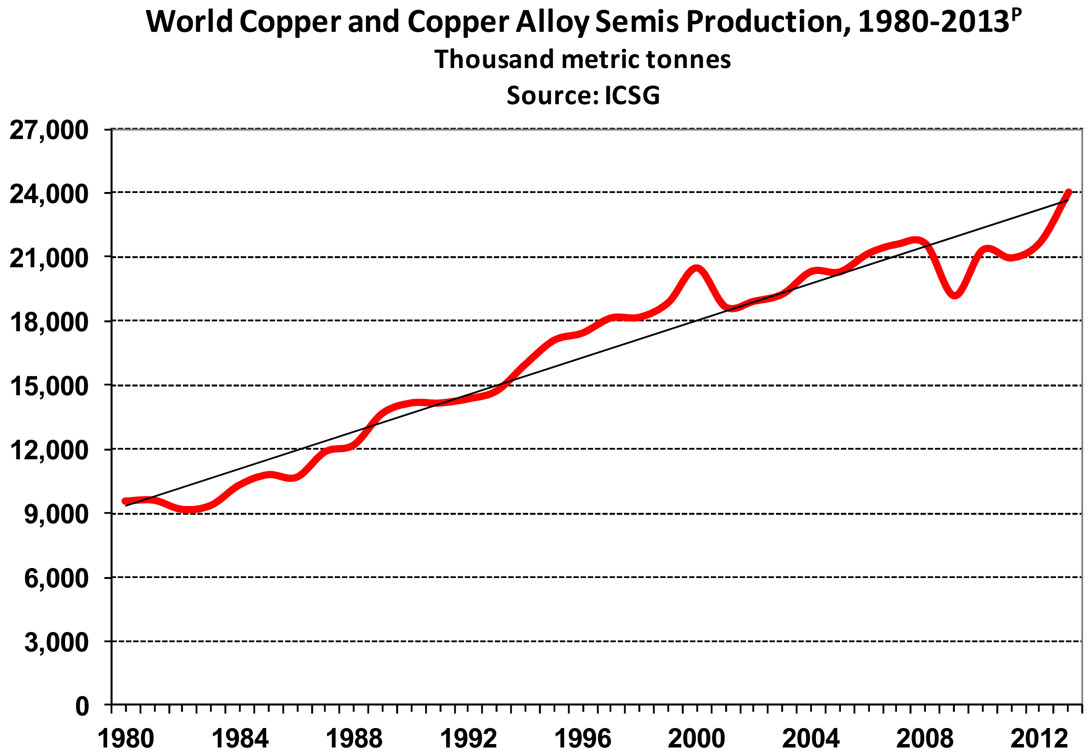
# Top 20 Copper Refineries by Capacity (basis 2014)

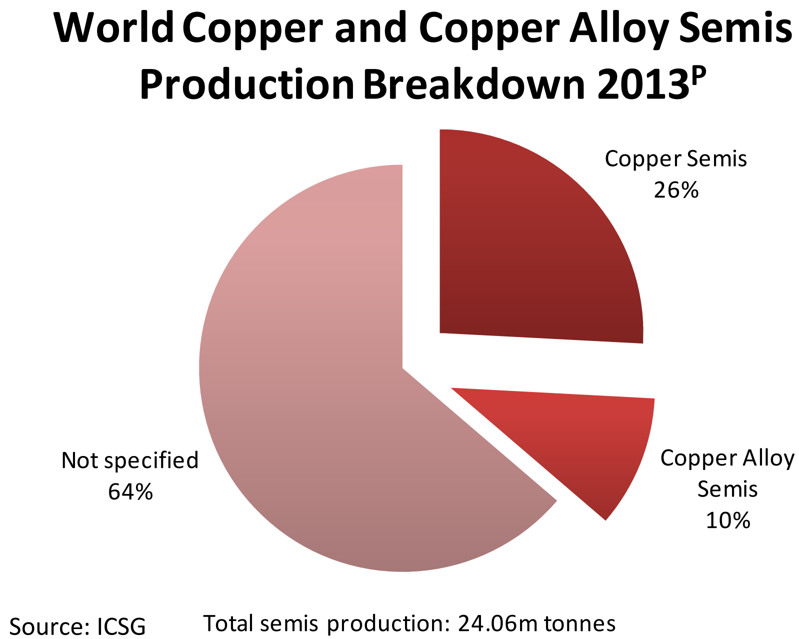
Thousand metric tonnes copper

Source: ICSG Directory of Copper Mines and Plants – July 2014

| Rank | Refinery | Country | Owner(s) | Process | Capacity |
|---|---|---|---|---|---|
| 1 | Guixi | China | Jiangxi Copper Corporation | Electrolytic | 900 |
| 2 | Jinchuan | China | Jinchuan Non Ferrous Co. | Electrolytic | 650 |
| 3 | Daye/ Hubei (refinery) | China | Daye Non-Ferrous Metals Co. | Electrolytic | 600 |
| 3 | Chuquicamata Refinery | Chile | Codelco | Electrolytic | 600 |
| 5 | Yunnan Copper | China | Yunnan Copper Industry Group (64.8%) | Electrolytic | 500 |
| 5 | Birla | India | Birla Group Hidalco | Electrolytic | 500 |
| 5 | Pyshma Refinery | Russia | Uralelectromed (Urals Mining & Metallurgical Co.) | Electrolytic | 500 |
| 8 | Toyo/Niihama (Besshi) | Japan | Sumitomo Metal Mining Co. Ltd. | Electrolytic | 450 |
| 8 | Amarillo | United States | Grupo Mexico | Electrolytic | 450 |
| 10 | Onsan Refinery I | Korean Republic | LS-Nikko Co. (LS, Nippon Mining) | Electrolytic | 440 |
| 11 | Hamburg (refinery) | Germany | Aurubis | Electrolytic | 416 |
| 12 | El Paso (refinery) | United States | Freeport-McMoRan Copper & Gold Inc. | Electrolytic | 415 |
| 13 | Baiyin | China | Baiyin Nonferrous Metals | Electrolytic | 400 |
| 13 | Jinguan (refinery) | China | Tongling Non-Ferrous Metals Group | Electrolytic | 400 |
| 13 | Jinlong (Tongdu) (refinery) | China | Tongling NonFerrous Metal Corp. 52 %, Sharpline International 13%, Sumitomo Corp. 7.5%, Itochu Corp. 7.5% | Electrolytic | 400 |
| 13 | Xiangguang Copper (refinery) | China | Yanggu Xiangguang Copper Co | Electrolytic | 400 |
| 13 | Shandong Fangyuan (refinery) | China | Dongying, Shandong | Electrolytic | 400 |
| 13 | Sterlite Refinery | India | Vedanta | Electrolytic | 400 |
| 13 | Las Ventanas | Chile | Codelco | Electrolytic | 400 |
| 13 | Radomiro Tomic (SX-EW) | Chile | Codelco | Electrowinning | 400 |

# World Copper and Copper Alloy Semis Production



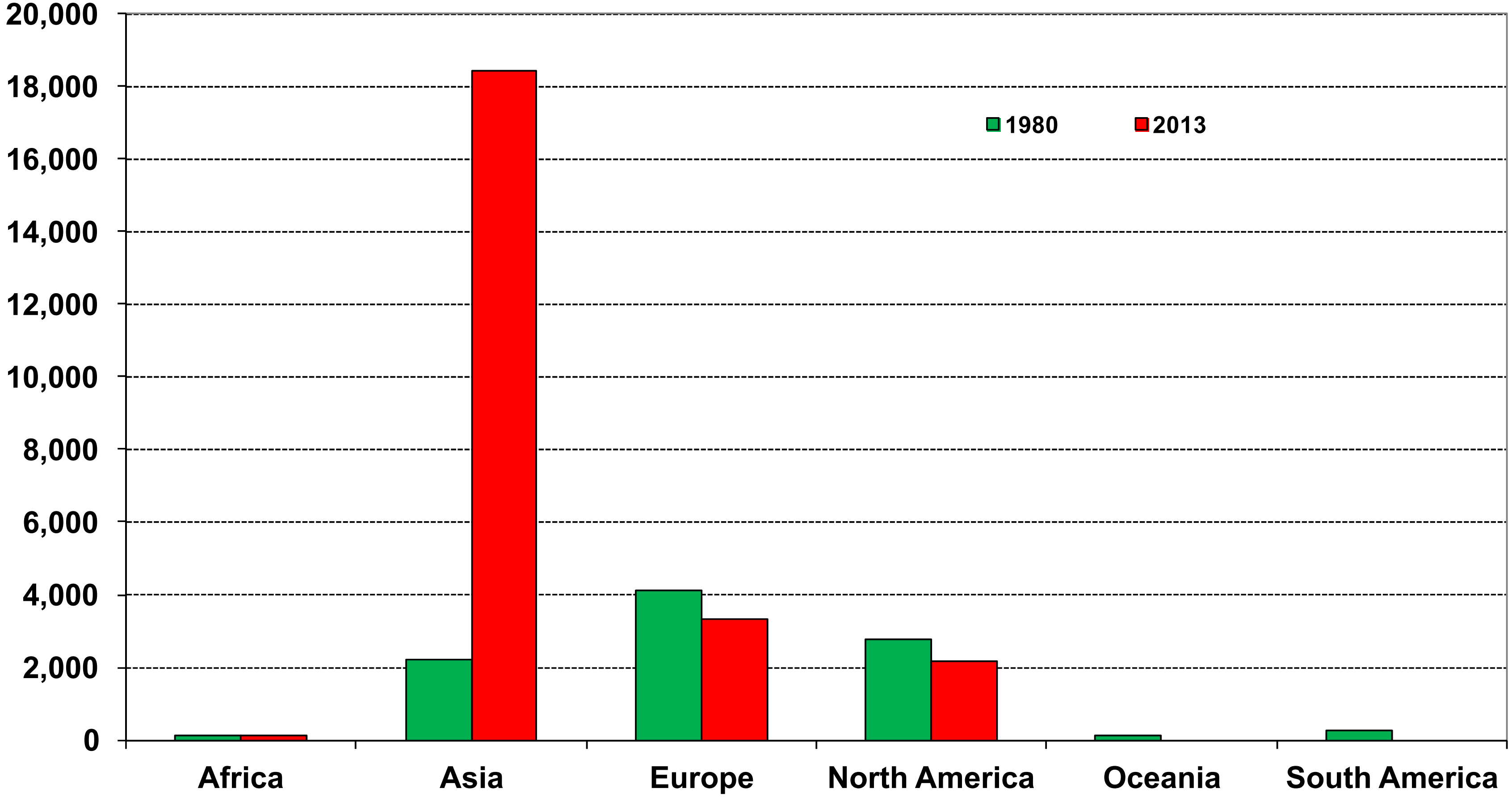

**Semis fabricators** process refinery shapes such as cathodes, wire bar, ingot, billet slab and cake into semi-finished copper and copper alloy products using both unwrought copper materials and direct melt scrap as raw material feed. Semis fabricators are considered to be the "first users" of refined copper and include wire rod plants and brass mills.

P / Preliminary. For some countries still incomplete

## Copper and Copper Alloy Semis Production by Region, 1980 & 2013^P

**Thousand metric tonnes**

**Source: ICSG**



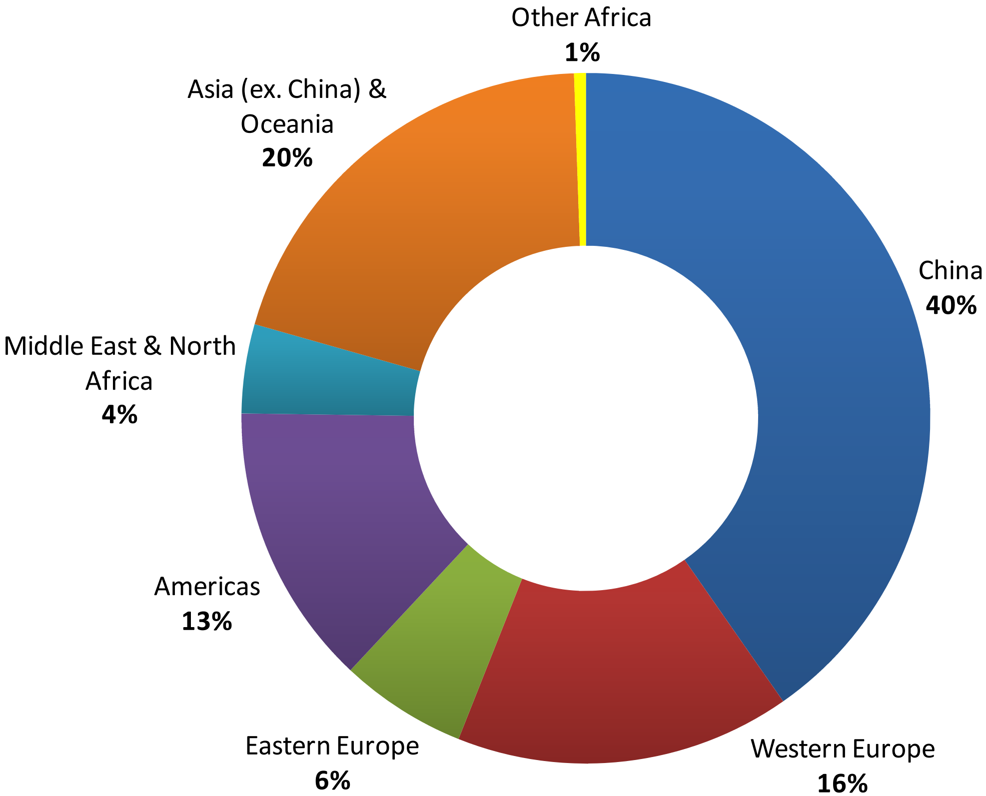

**Asia accounted for 77% (or almost 18.5 million metric tonnes) of semis output in 2013, compared to 23% in 1980.**

P / Preliminary. For some countries still incomplete

# Copper & Copper Alloy Semis Production Capacity by Region & Product

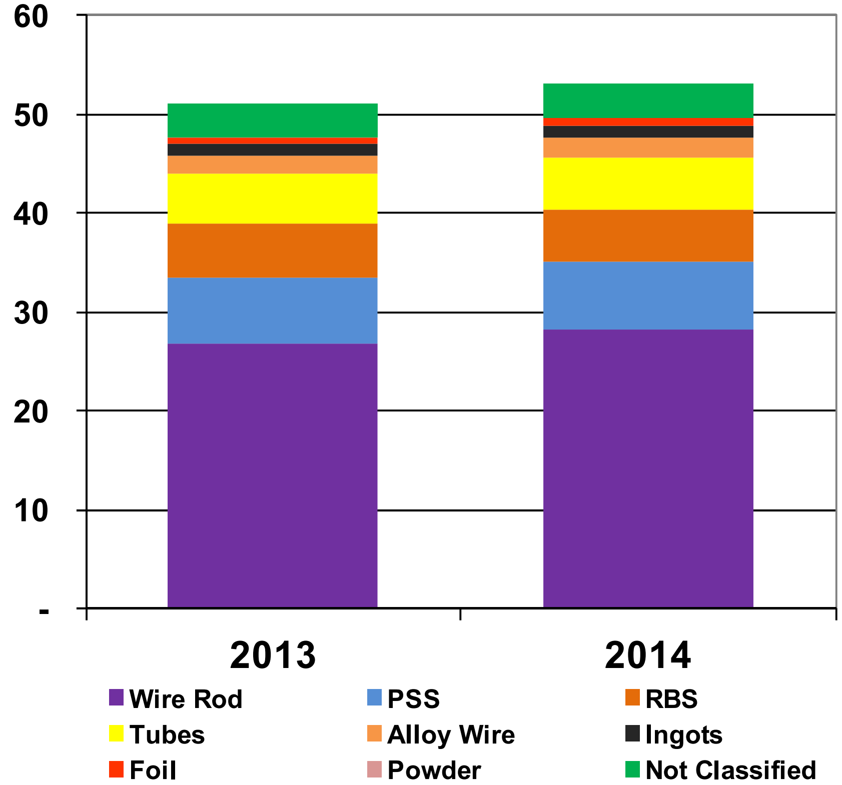
**Source: ICSG Directory of Copper and Copper Alloy Fabricators 2014**

**Semis Production Capacity by Region, 2014 (%)**
**Source: ICSG**




In 2014, **China** accounts for the largest share of world semis production capacity (40%) and the largest number of semis plants (563).

**Semis Production Capacity by Product, 2013 vs 2014 (million tonnes gross weight)**
**Source: ICSG**

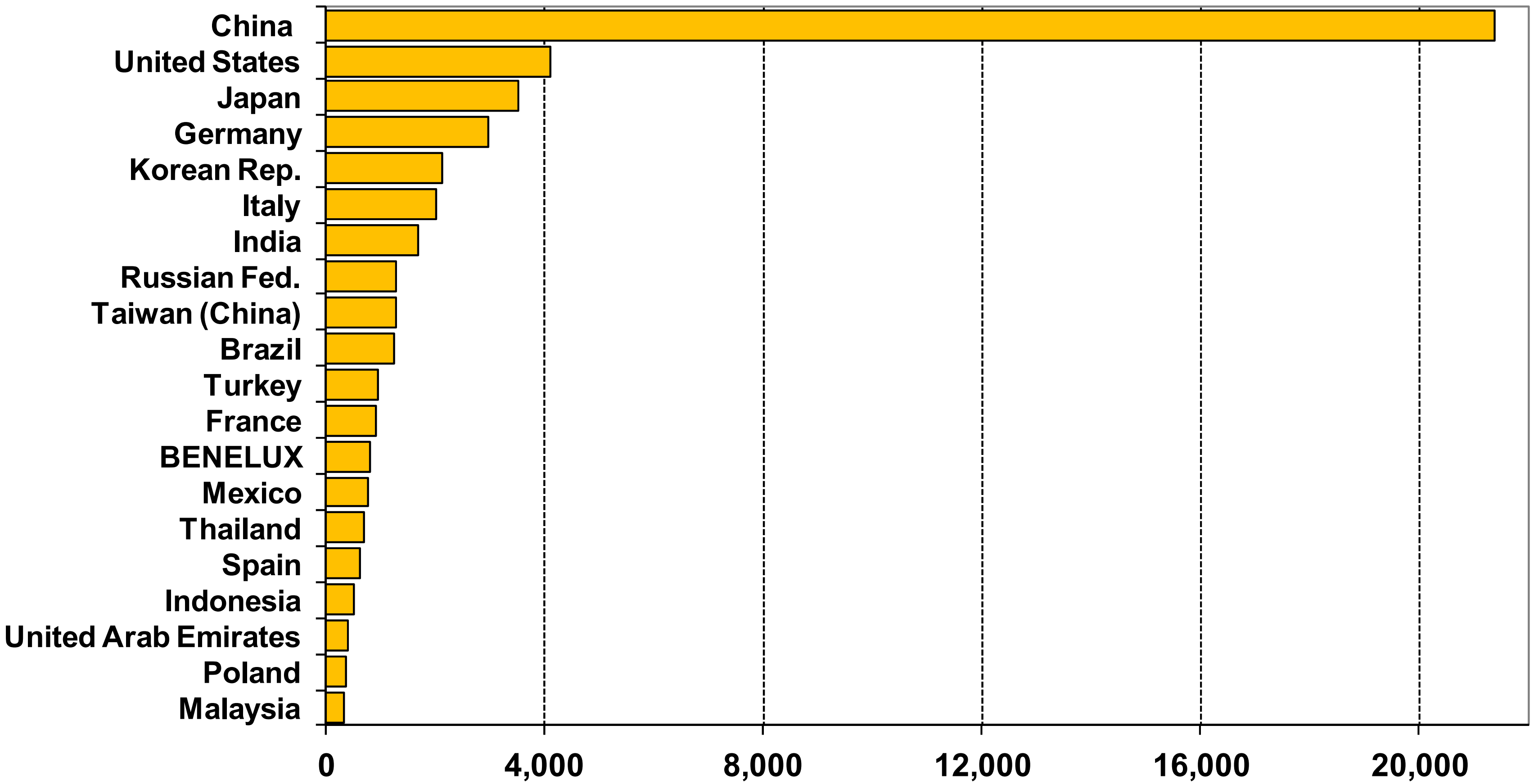



**Wire rod plants** are estimated to account for 53% of world first use capacity in 2014, or over 28.0 million tonnes.

## Copper and Copper Alloy Semis Production Capacity by Country: Top 20 Countries, 2014

**Thousand metric tonnes**

**Source: ICSG Directory of Copper and Copper Alloy Fabricators 2014**

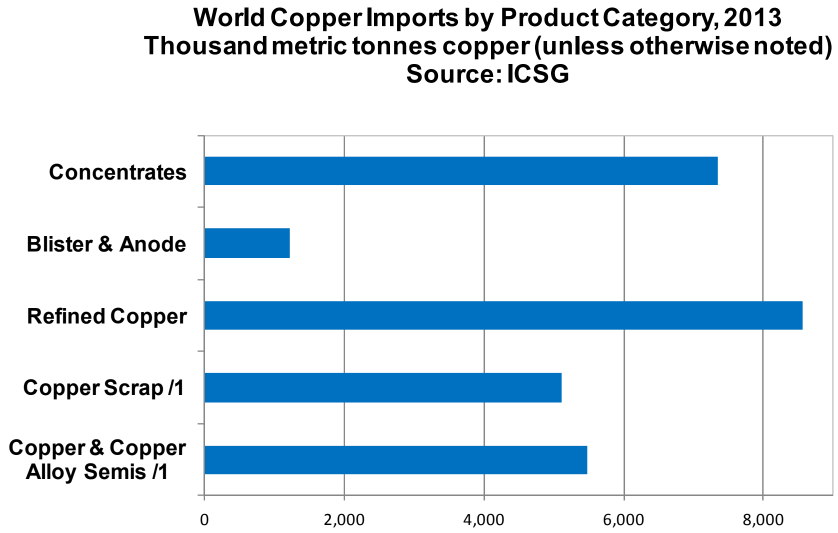


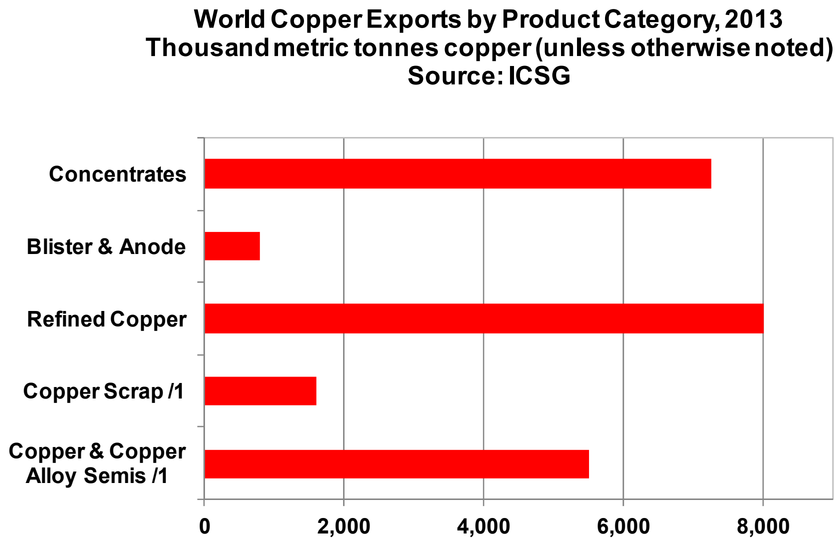
# Chapter 3: Copper Trade

Copper products across the value chain are traded internationally. Often, countries where upstream copper production capacity exceeds downstream production capacity will import the raw materials needed to meet their production needs, and vice versa. **Major product categories** of copper traded internationally include:

- Copper concentrates
- Copper blister and anode
- Copper cathode and ingots
- Copper scrap and
- Copper semis

Copper powders and compounds are also traded globally, but typically in much smaller quantities. In additional, copper is contained in end-use products that are traded globally including automobiles, appliances, electronic equipment and other products. Changes in **trade regulations**, such as import duties or export quotas, can have significant impacts on the international trade of copper. For more information about the international trade of copper and changes in regulations that can affect the trade of copper, please contact the ICSG Secretariat at mail@icsg.org




[1] Gross metal weight.

# Major International Trade Flows of Copper Ores and Concentrates[1]

Major **Exporters** of Copper Ores and Concentrates, 2013

1. Chile
2. Peru
3. Australia
4. Canada
5. Indonesia
6. United States
7. Brazil
8. Spain
9. Mexico
10. Mongolia

Major **Importers** of Copper Ores and Concentrates, 2013

1. China
2. Japan
3. India
4. Korean Rep.
5. Spain
6. Germany
7. Bulgaria
8. Brazil
9. Finland
10. Philippines

Image courtesy of the Copper Development Association.

[1]Figure is intended to illustrate trade flows but not actual trade routes. Detailed trade matrices are available in ICSG Statistical Yearbook.

## Major International Trade Flows of Copper Blister and Anode[1]

Major **Exporters** of Copper Blister and Anode, 2013

1. Chile
2. Bulgaria
3. Spain
4. Belgium
5. Netherlands
6. Finland
7. United States
8. Armenia
9. Peru
10. Germany

Major **Importers** of Copper Blister and Anode, 2013

1. China
2. Belgium
3. Germany
4. Australia.
5. Korean Rep.
6. Canada
7. Austria
8. Netherlands
9. India
10. Sweden

[1]Figure is intended to illustrate trade flows but not actual trade routes. Detailed trade matrices are available in ICSG Statistical Yearbook.

## Major International Trade Flows of Refined Copper[1]

Major **Exporters** of Refined Copper, 2013

1. Chile
2. Japan
3. Australia
4. Kazakhstan
5. Poland
6. China
7. Peru
8. Malaysia
9. India
10. Belgium

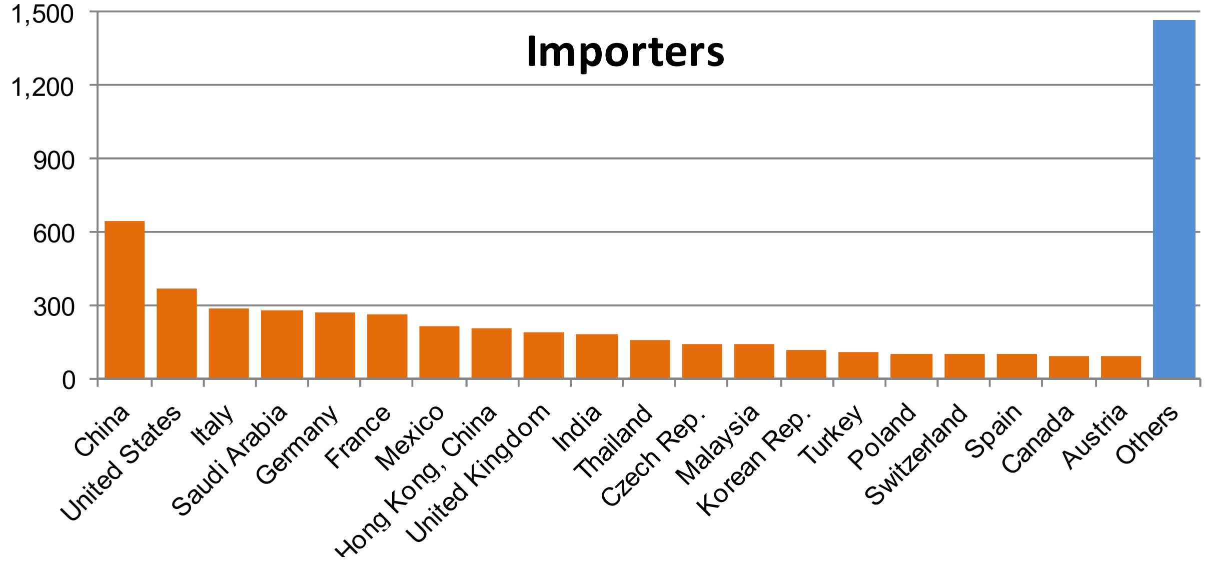
Major **Importers** of Refined Copper, 2013

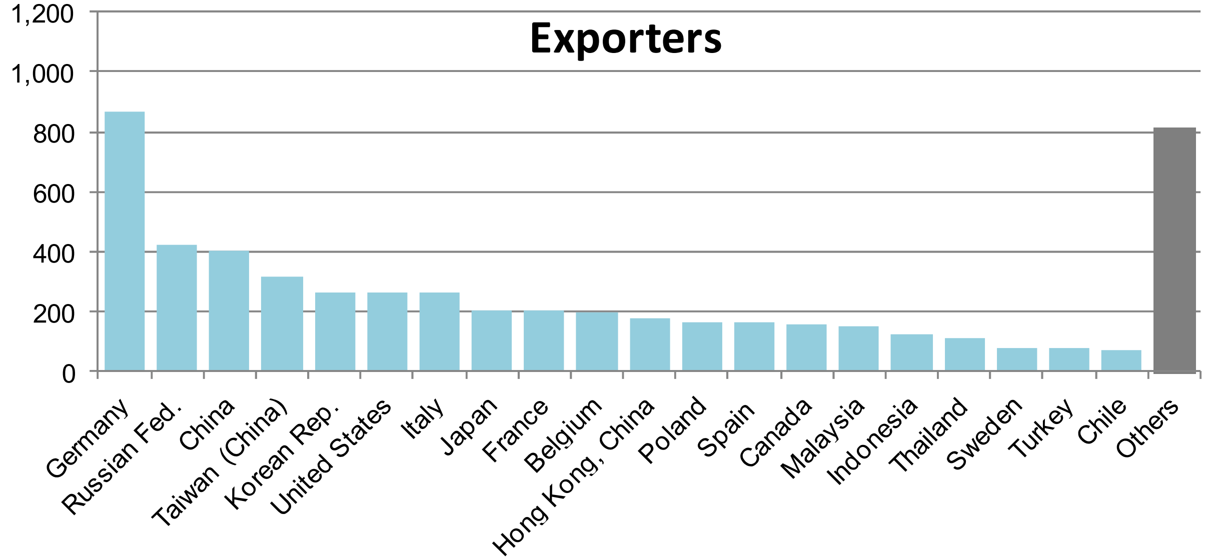
1. China
2. United States
3. Germany
4. Italy
5. Malaysia
6. Taiwan
7. Turkey
8. Korean Rep.
9. Thailand
10. Brazil

[1] Figure is intended to illustrate trade flows but not actual trade routes. Detailed trade matrices are available in ICSG Statistical Yearbook.

## Leading Exporters and Importers of Semi-Fabricated Copper Products, 2013

Thousand metric tonnes. Source: ICSG



# The Global Copper Market and the Commodity "Copper"

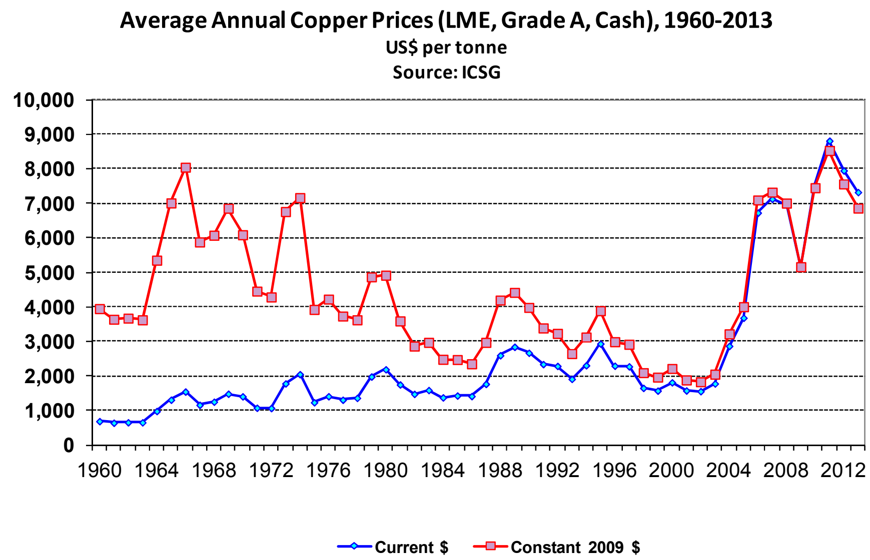
Copper, as any other good or merchandise, is traded between producers and consumers. Producers sell their present or future production to clients, who transform the metal into shapes or alloys, so that downstream fabricators can transform these into different end-use products. One of the most important factors in trading a commodity such as copper is the settlement price for the present day (spot price) or for future days.

**Exchanges**

The role of a commodity exchange is to facilitate and make transparent the process of settling prices. Three commodity exchanges provide the facilities to trade copper: The London Metal Exchange (LME), the Commodity Exchange Division of the New York Mercantile Exchange (COMEX/NYMEX) and the Shanghai Futures Exchange (SHFE). In these exchanges, prices are settled by bid and offer, reflecting the market's perception of supply and demand of a commodity on a particular day. On the LME, copper is traded in 25 tonne lots and quoted in US dollars per tonne; on COMEX, copper is traded in lots of 25,000 pounds and quoted in US cents per pound; and on the SHFE, copper is traded in lots of 5 tonnes and quoted in Renminbi per tonne. More recently, mini contracts of smaller lots sizes have been introduced at the exchanges.

Exchanges also provide for the trading of futures and options contracts. These allow producers and consumers to fix a price in the future, thus providing a hedge against price variations. In this process the participation of speculators, who are ready to buy the risk of price variation in exchange for monetary reward, gives liquidity to the market. A futures or options contract defines the quality of the product, the size of the lot, delivery dates, delivery warehouses and other aspects related to the trading process. Contracts are unique for each exchange. The existence of futures contracts also allows producers and their clients to agree on different price settling schemes to accommodate different interests.

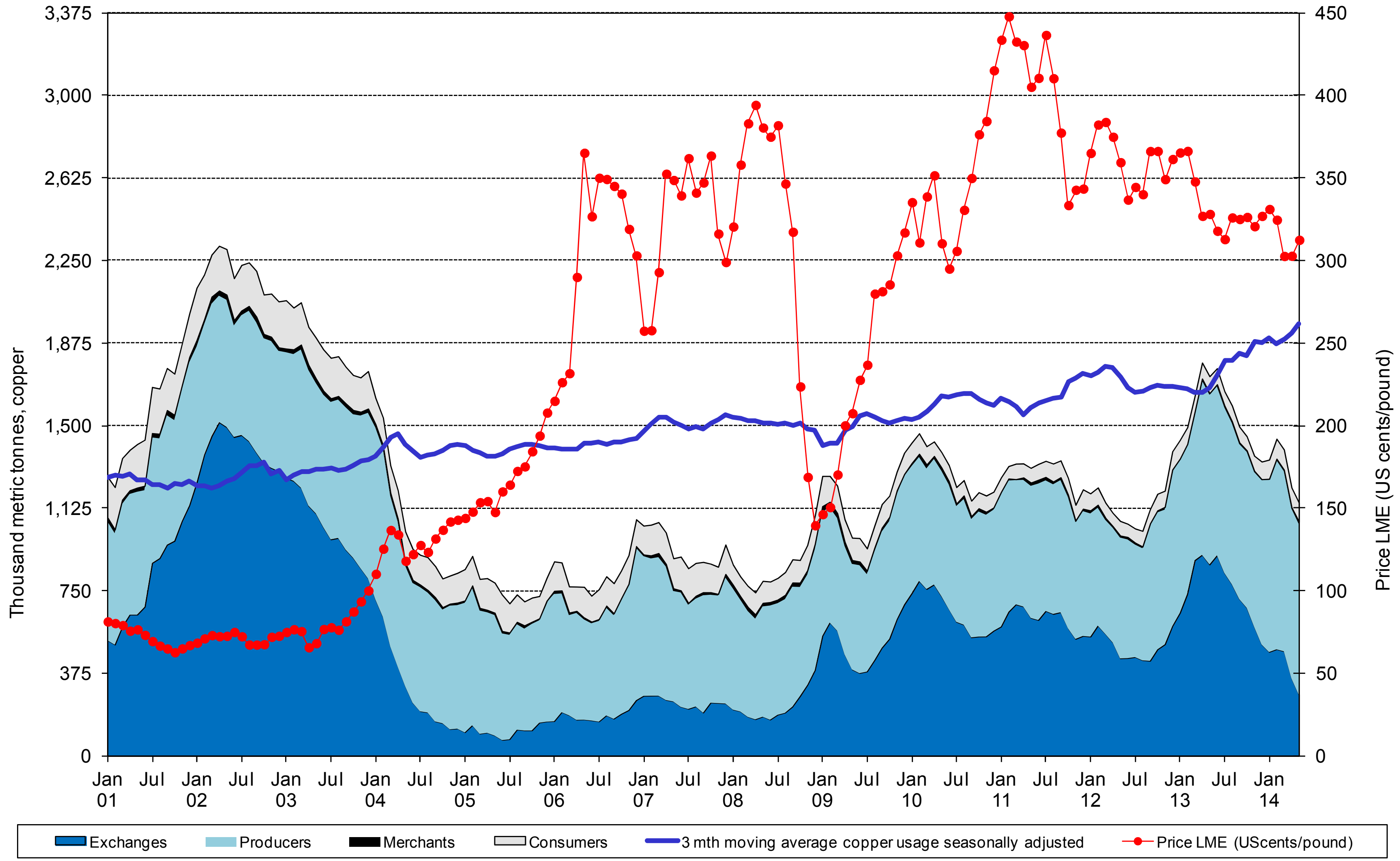
Exchanges also provide for warehousing facilities that enable market participants to make or take physical delivery of copper in accordance with each exchange's criteria.



# Copper Stocks, Prices and Usage (Jan 2001-Jun 2014)

Thousand metric tonnes and US cents/pound

Source: ICSG



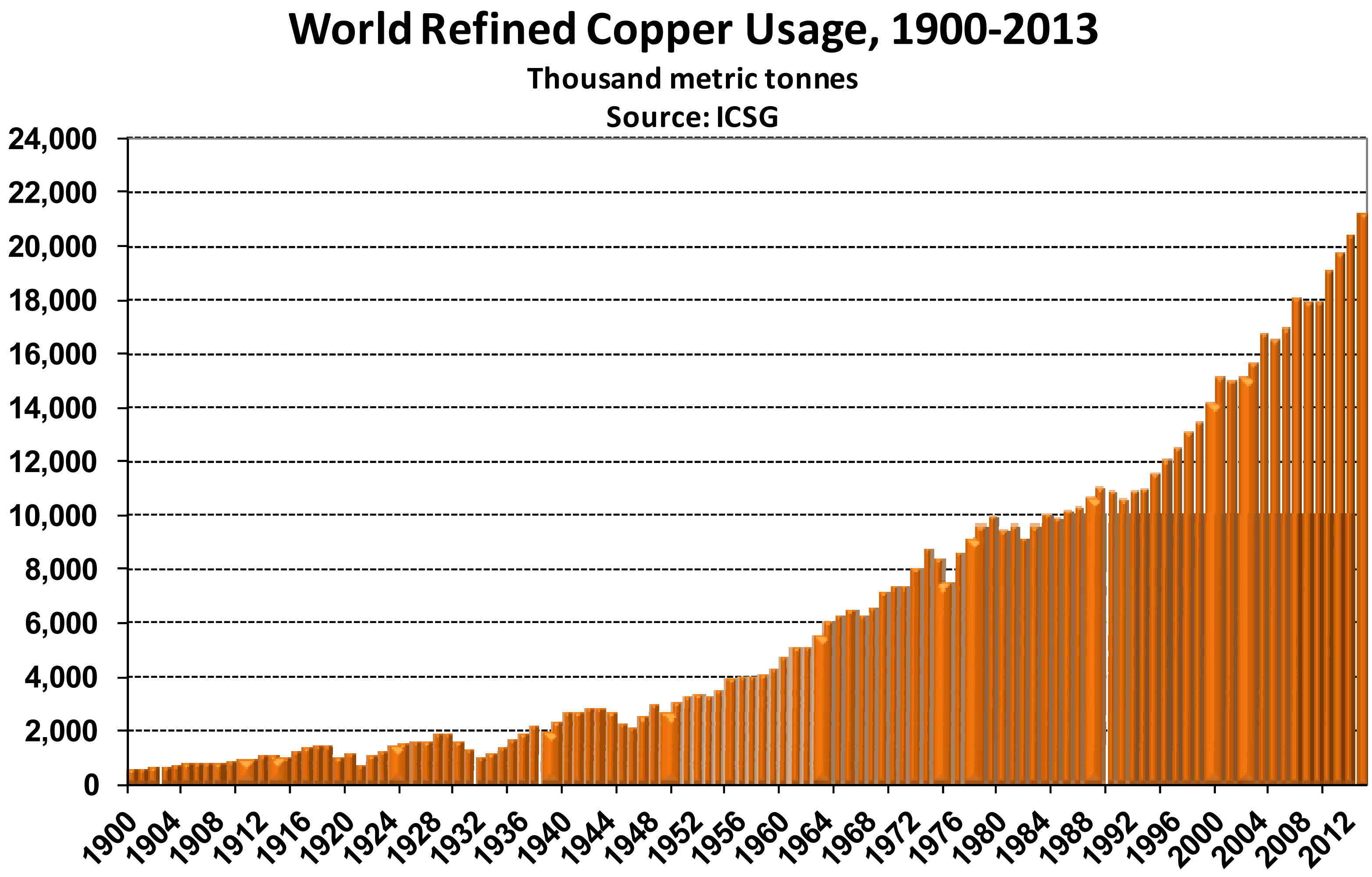
# Chapter 4: Copper Usage

## How Is Copper Used?

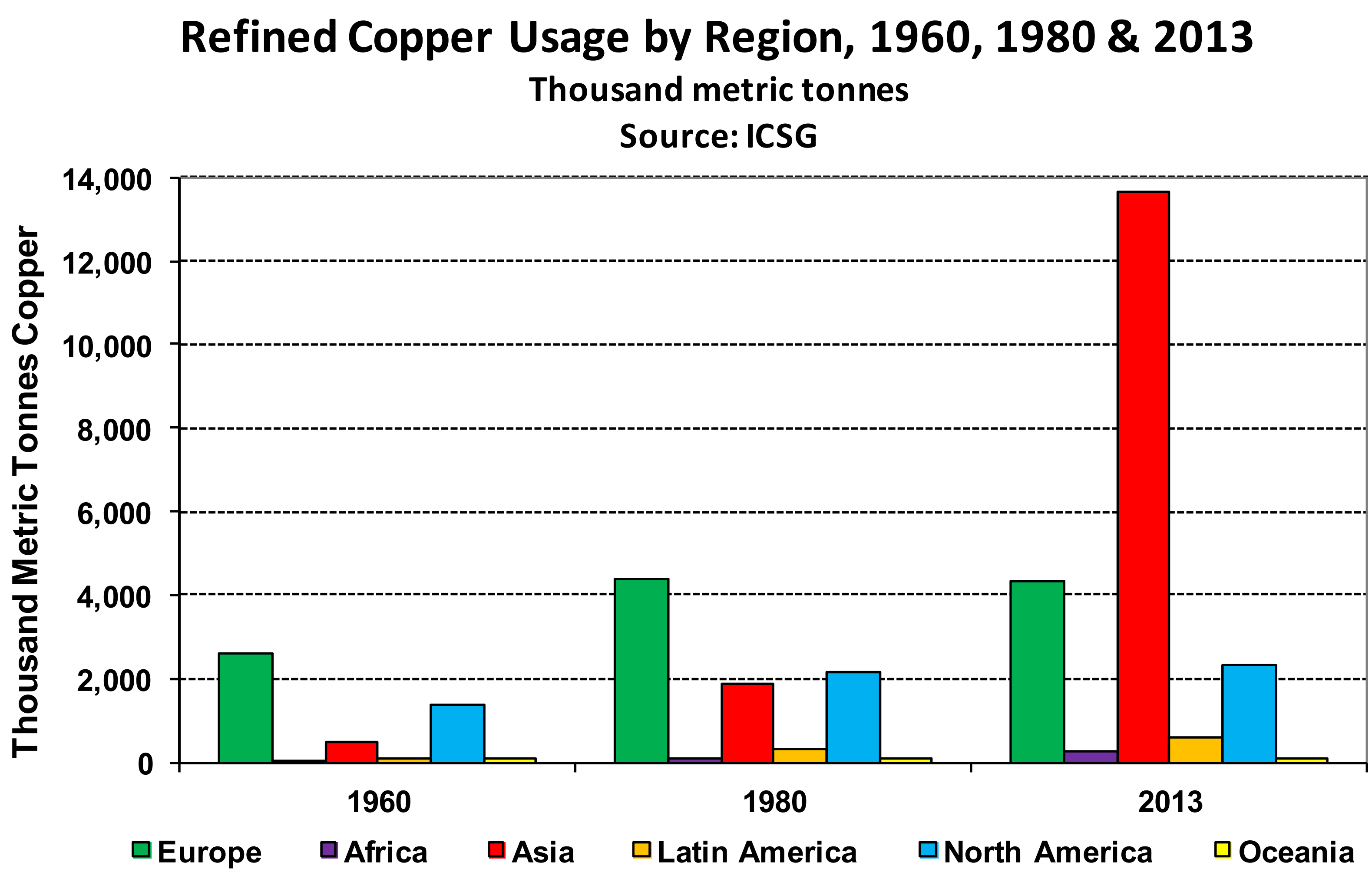
Copper is shipped to fabricators mainly as cathode, wire rod, billet, cake (slab) or ingot. Through extrusion, drawing, rolling, forging, melting, electrolysis or atomization, fabricators form wire, rod, tube, sheet, plate, strip, castings, powder and other shapes. The fabricators of these shapes are called the first users of copper. The total use of copper includes copper scrap that is directly melted by the first users of copper to produce copper semis.

Copper and copper alloy semis can be further transformed by downstream industries for use in end use products such as automobiles, appliances, electronics, and a whole range of other copper-dependent products in order to meet society's needs. This section provides a range of information about refined copper usage, total use, major uses of copper and end-use.

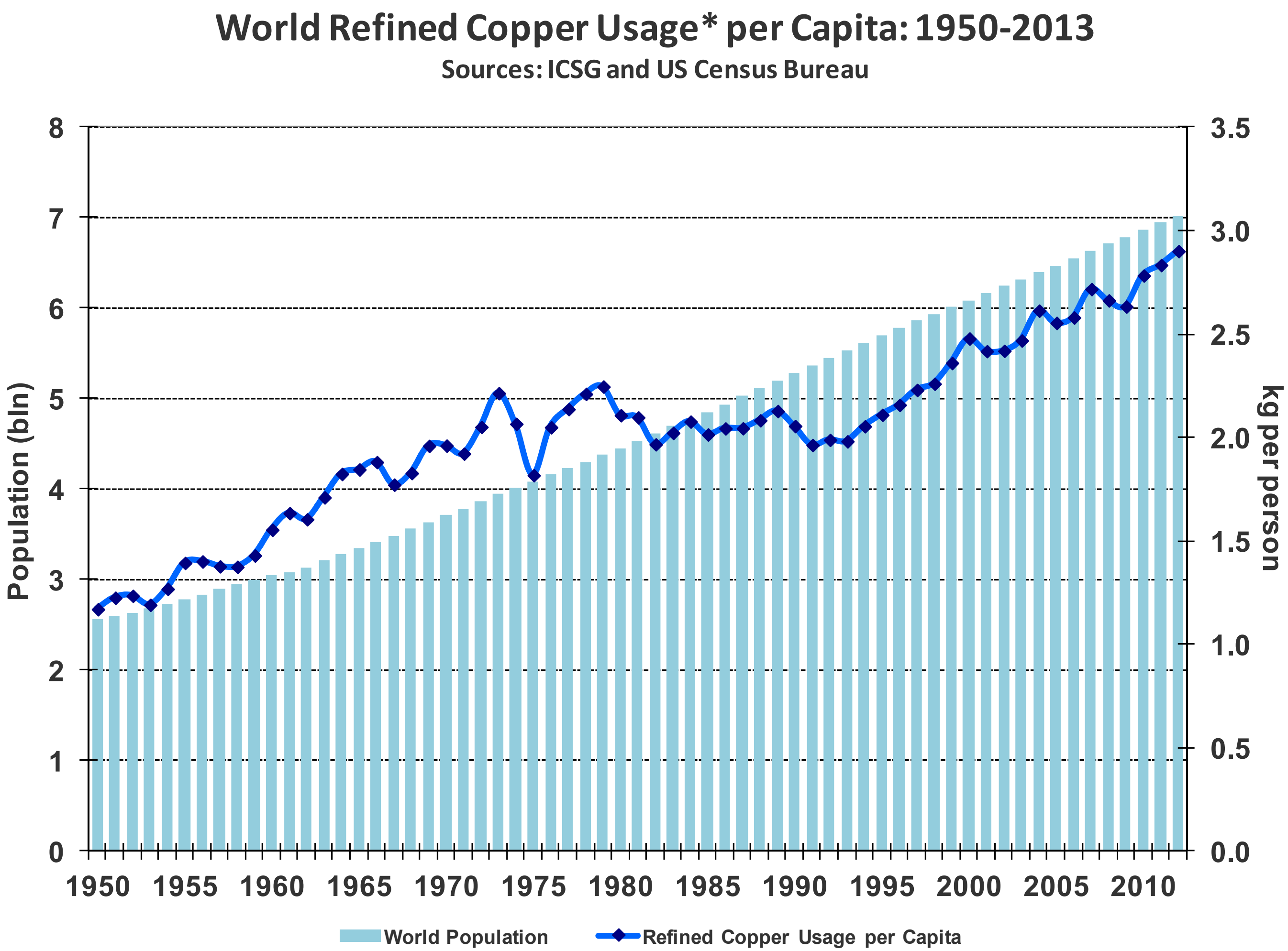
For the most up-to-date information on refined copper usage, please visit the ICSG website at www.icsg.org




**Since 1900, apparent usage for refined copper has increased from less than 500 thousand tonnes to 21.2 million metric tonnes in 2013 as usage over the period grew by a compound annual growth rate of 3.4% per year.**




The key driver to global refined copper usage has been Asia, where demand has expanded more than fivefold over the last 30 years.

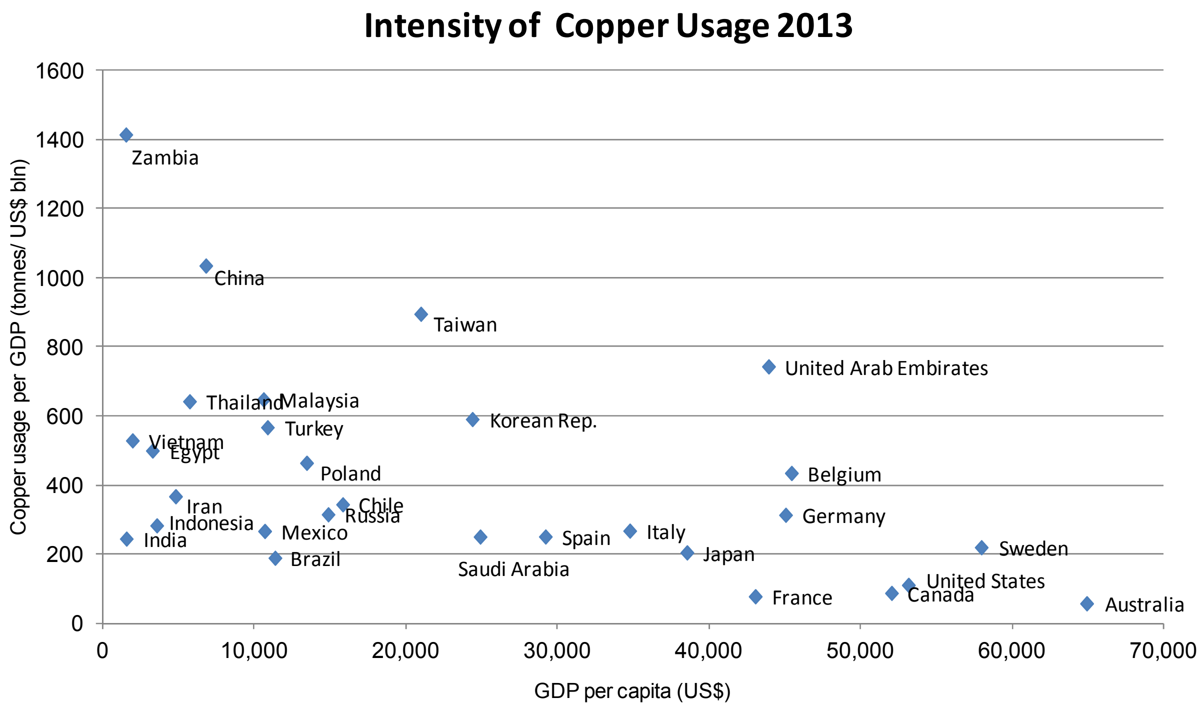



*Refined copper is typically consumed by semis fabricators or the "first users" of refined copper, including ingot makers, master alloy plants, wire rod plants, brass mills, alloy wire mills, foundries and foil mills. As a result, per capita consumption of refined copper refers to the amount of copper consumed by industry divided by the total population and does not represent consumption of copper in finished products per person.

# Intensity of Refined Copper Usage*

Sources: ICSG and International Monetary Fund

| 2013 data | GDP per capita (US$) | Intensity (tonnes/US$bln) |
|---|---|---|
| Australia | 64863 | 55.871 |
| Belgium | 45383 | 433.315 |
| Brazil | 11311 | 187.839 |
| Canada | 51990 | 85.968 |
| Chile | 15776 | 342.630 |
| China | 6747 | 1,033.996 |
| Egypt | 3226 | 498.355 |
| France | 43000 | 76.254 |
| Germany | 44999 | 312.158 |
| India | 1505 | 243.263 |
| Indonesia | 3510 | 281.516 |
| Iran | 4751 | 365.861 |
| Italy | 34715 | 266.318 |
| Japan | 38491 | 203.276 |
| Korean Rep. | 24329 | 589.458 |
| Malaysia | 10548 | 646.615 |
| Mexico | 10630 | 265.386 |
| Poland | 13394 | 462.724 |
| Russian Fed. | 14819 | 313.661 |
| Saudi Arabia | 24847 | 249.240 |
| Spain | 29150 | 249.393 |
| Sweden | 57907 | 218.338 |
| Taiwan | 20930 | 894.242 |
| Thailand | 5674 | 641.003 |
| Turkey | 10815 | 565.758 |
| United Arab Emirates | 43875 | 741.984 |
| United States | 53101 | 109.228 |
| Vietnam | 1902 | 527.658 |
| Zambia | 1474 | 1,413.491 |

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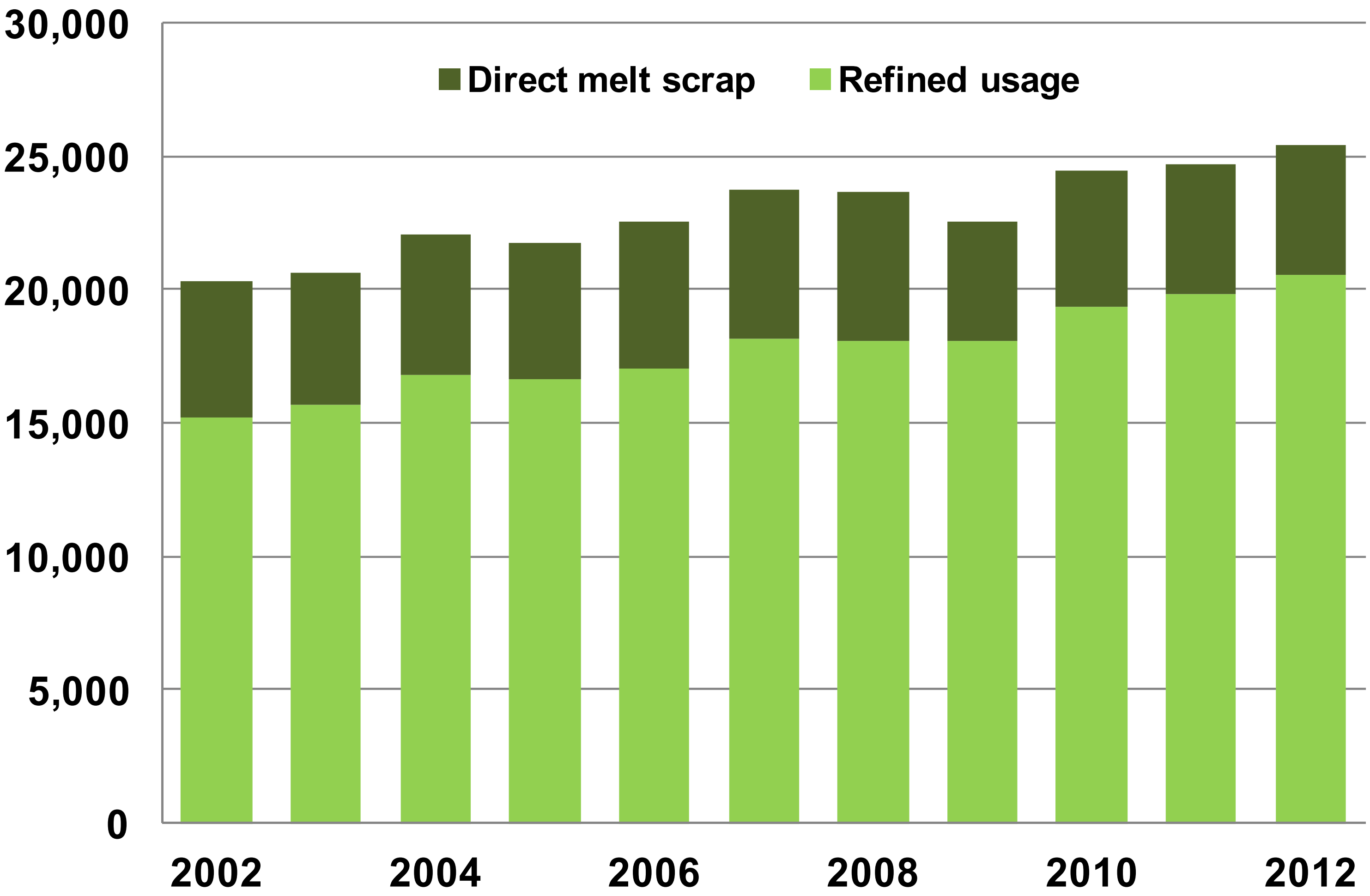
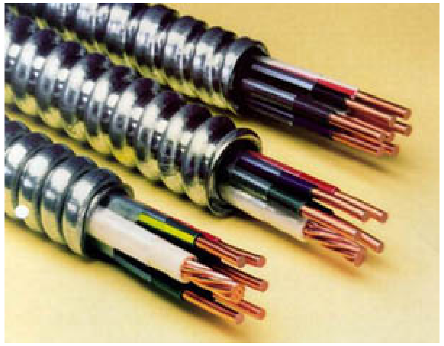
## Total Copper Usage, Including Direct Melted Copper Scrap, 2002-2012

Thousand metric tonnes copper

Source: ICSG Recyclables Survey March 2014



## Major Uses of Copper: Electrical



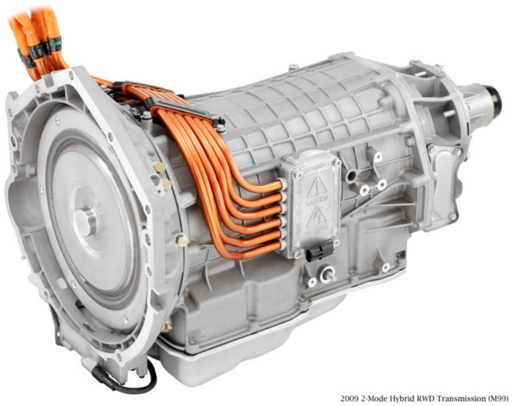
Copper is the **best non-precious metal conductor** of electricity as it encounters much less resistance compared with other commonly used metals. It sets the standard to which other conductors are compared.

Copper is also used in power cables, either insulated or uninsulated, for high, medium and low voltage applications.

In addition, copper's exceptional strength, ductility and resistance to creeping and corrosion makes it the preferred and safest conductor for commercial and residential building wiring.

Copper is an essential component of **energy efficient** generators, motors, transformers and renewable energy production systems. **Renewable energy** sources such as solar, wind, geothermal, fuel cells and other technologies are all heavily reliant on copper due to its excellent conductivity.

**ICSG, in partnership with the Common Fund for Commodities, the International Copper Association and the International Copper Promotion Council (India), is supervising the Transfer of Technology for High Pressure Copper Die Casting in India project. The project is designed to facilitate the transfer of technology related to the manufacture of rotors, motors and motor systems using more energy efficient high pressure copper die castings.**

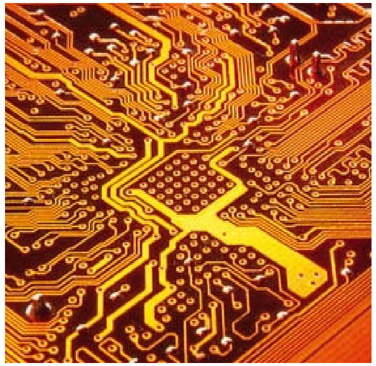



Images courtesy of the Copper Development Association.

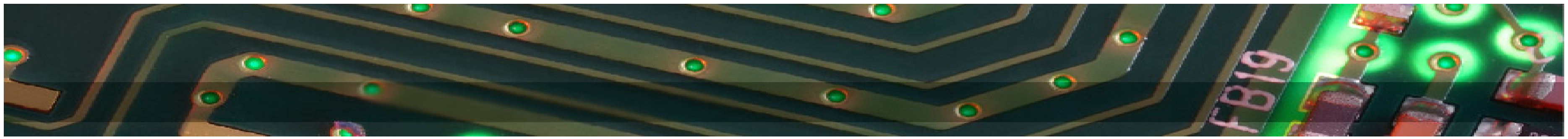
# Major Uses of Copper: Electronics and Communications

**Copper plays a key role in worldwide information and communications technologies**. HDSL (High Digital Subscriber Line) and ADSL (Asymmetrical Digital Subscriber Line) technology allows for high-speed data transmission, including internet service, through the existing copper infrastructure of ordinary telephone wire.

Copper and copper alloy products are used in domestic subscriber lines, wide and local area networks, mobile phones and personal computers.



Semiconductor manufacturers have launched a revolutionary "copper chip." By using copper for circuitry in silicon chips, microprocessors are able to operate at higher speeds, using less energy. Copper heat sinks help remove heat from transistors and keep computer processors operating at peak efficiency. Copper is also used extensively in other electronic equipment in the form of wires, transformers, connectors and switches.



Images courtesy of the Copper Development Association and European Copper Institute.

## Major Uses of Copper: Construction

Copper and brass are the materials of choice for plumbing, taps, valves and fittings. Thanks in part to its aesthetic appeal, copper and its alloys, such as architectural bronze, is used in a variety of settings to build facades, canopies, doors and window frames.

Unlike plastic tubing, copper does not burn, melt or release noxious or toxic fumes in the event of a fire. Copper tubes also help protect water systems from potentially lethal bacteria such as legionella. Copper fire sprinkler systems are a valuable safety feature in buildings.

The use of copper doorknobs and plates exploits copper's **biostatic properties** to help prevent the transfer of disease and microbes.

Copper roofing, in addition to being attractive, is well known for its resistance to extreme weather conditions. Major public buildings, commercial buildings and homes use copper for their rainwater goods and roofing needs. The telltale green patina finish, that gives copper the classic look of warmth and richness, is the result of natural weathering.

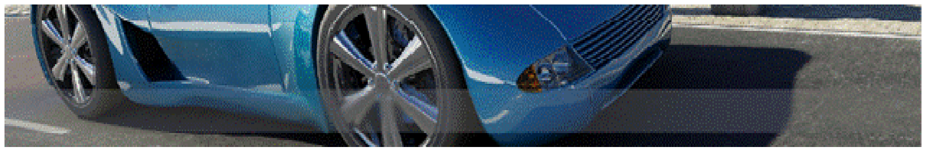
Images courtesy of the Copper Development Association and the International Copper Association.

# Major Uses of Copper: Transportation

All major forms of transportation depend on copper to perform critical functions.

Copper-nickel alloys are used on the hulls of boats and ships to **reduce marine biofouling**, thereby reducing drag and improving fuel consumption.

Automobiles and trucks rely on copper motors, wiring, radiators, connectors, brakes and bearings. Today, the average mid-size automobile contains about 22.5 kg (50 lbs) of copper, while luxury cars on average contain around 1,500 copper wires totaling about 1.6 km (1 mile) in length.



**Electric and hybrid vehicles** can contain even higher levels of copper. Copper's superior thermal conductivity, strength, corrosion resistance and recyclability make it ideal for automotive and truck radiators. New manufacturing technologies, processes and innovative designs are resulting in lighter, smaller and more efficient radiators.

Copper is also used extensively in **new generation airplanes and trains**. New high-speed trains can use anywhere from 2 to 4 tonnes of copper, significantly higher than the 1 to 2 tonnes used in traditional electric trains.

Images courtesy of the Copper Development Association and the European Copper Institute.

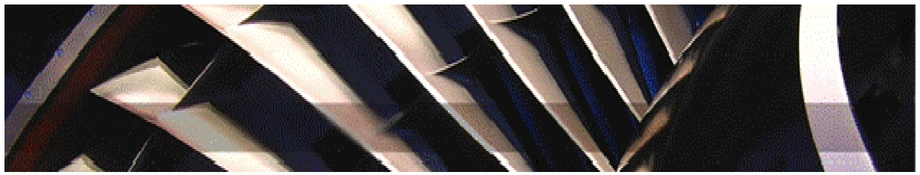
# Major Uses of Copper: Industrial Machinery and Equipment

Wherever industrial machinery and equipment is found, it is a safe bet that copper and its alloys are present. Due to **their durability, machinability** and **ability to be cast with high precision** and tolerances, copper alloys are ideal for making products such as gears, bearings and turbine blades.

Copper's superior heat transfer capabilities and ability to withstand extreme environments makes it an ideal choice for heat exchange equipment, pressure vessels and vats.

The **corrosion resistant properties** of copper and copper alloys (such as brass, bronze, and copper-nickel) make them especially suitable for use in marine and other demanding environments.

Vessels, tanks, and piping exposed to seawater, propellers, oil platforms and coastal power stations, all depend on copper's corrosion resistance for protection



Images courtesy of the Copper Development Association.

## Major Uses of Copper: Consumer and General Products

From the beginning of civilization copper has been used by various societies to make **coins** for currency.


Today, countries are replacing lower denomination bills with copper-based coins, as these coins last 10, 20 and even 50 times longer.

In the United States, one cent coins and five cent coins contain 2.5% and 75% copper, respectively, while other U.S. coins contain a pure copper core and 75% copper face.[1] In the recently expanded European Union, the Euro coins, first introduced in 2002, also contain copper.

Copper and copper-based products are used in offices, households and workplaces. **Computers**, **electrical appliances**, **cookware, brassware**, and **locks** and **keys** are just some of the products exploiting copper's advantages.

In addition, in areas known to be copper deficient, copper is used by farmers to supplement livestock and crop feed.

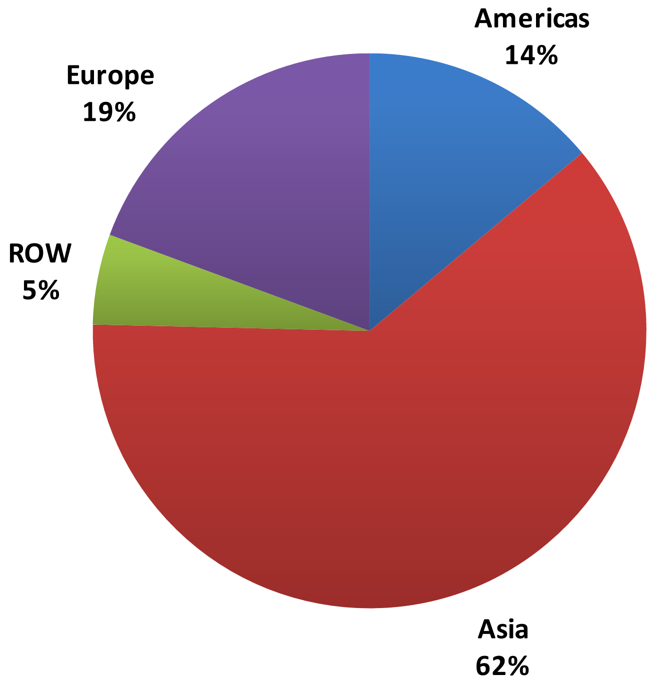
Images courtesy of the International Copper Association and the Copper Development Association.

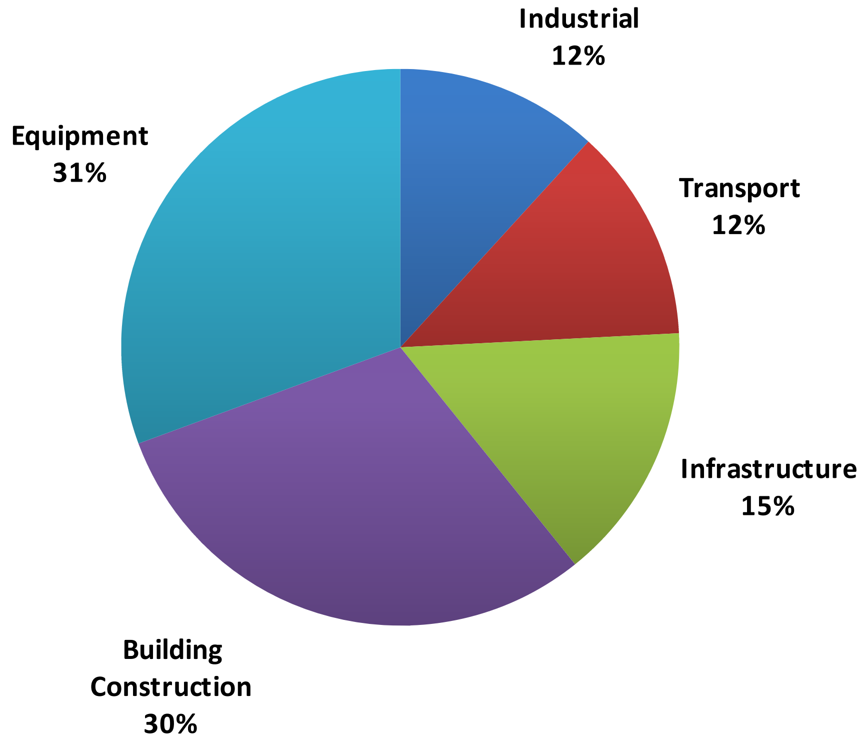
[1] Source: U.S. Department of the Treasury.

## Major Uses of Copper: Usage by Region and End Use Sector, 2013

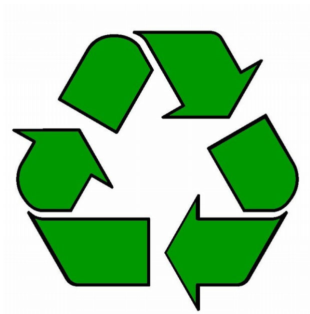
Basis: copper content, thousand metric tonnes

Source: International Wrought Copper Council (IWCC) and International Copper Association (ICA)



# Chapter 5: Copper Recycling



Copper is among the few materials that do not degrade or lose their chemical or physical properties in the recycling process. Considering this, the existing copper reservoir in use can well be considered a legitimate part of world copper reserves. In the recent decades, an increasing emphasis has been placed on the sustainability of material uses in which the concept of reuse and recycling of metals plays an important role in the material choice and acceptance of products. If appropriately managed, recycling has the potential to extend the use of resources, and to minimize energy use, some emissions, and waste disposal.

Closing metal loops through increased reuse and recycling enhances the overall resource productivity and therefore represents one of the key elements of society’s transition towards more sustainable production and consumption patterns. It is widely recognized that recycling is not in opposition to primary metal production, but is a necessary and beneficial complement.

In 2012, ICSG estimates that more than 30% of copper consumption came from recycled copper. Some countries' copper requirements greatly depend on recycled copper to meet internal demands. However, recycled copper alone cannot meet society's needs, so we also rely on copper produced from the processing of mineral ores.

Images courtesy of the European Copper Institute.

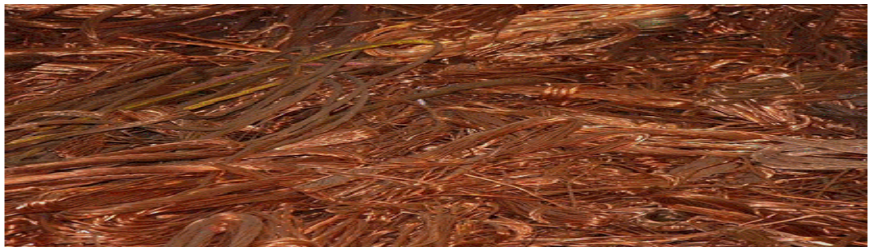
## Copper Recycling Rate Definitions

The recycling performance of copper-bearing products can be measured and demonstrated in various ways – depending, among other things, on objectives, scope, data availability and target audience. The three International Non-Ferrous Metal Study Groups in conjunction with various metal industry associations agreed on the common definitions of the three following metal recycling rates:

- The **Recycling Input Rate** (RIR) measures the proportion of metal and metal products that are produced from scrap and other metal-bearing low-grade residues. The RIR is mainly a statistical measurement for raw material availability and supply rather than an indicator of recycling efficiency of processes or products. The RIR has been in use in the metals industry for a long time and is widely available from statistical sources. Major target audiences for this type of “metallurgical” indicator are the metal industry, metal traders and resource policy makers. However, given structural and process variables, it may have limited use as a policy tool.

- The **Overall Recycling Efficiency Rate** (Overall RER) indicates the efficiency with which end of life (EOL) scrap, new scrap, and other metal-bearing residues are collected and recycled by a network of collectors, processors, and metal recyclers. The key target audiences of this particular indicator are metal industry, scrap processors and scrap generators.

- The **EOL Recycling Efficiency Rate** (EOL RER) indicates the efficiency with which EOL scrap from obsolete products is recycled. This measure focuses on end-of-life management performance of products and provides important information to target audiences such as metal and recycling industries, product designers, life cycle analysts, and environmental policy makers.



## ICSG Global Copper Recyclables Use, 2004-2012

Thousand metric tonnes

Source: ICSG Recyclables Survey March 2014

| | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 |
|---|---|---|---|---|---|---|---|---|---|
| Americas | 1,324 | 1,325 | 1,395 | 1,441 | 1,275 | 1,143 | 1,198 | 1,256 | 1,213 |
| Asia | 3,279 | 3,468 | 4,132 | 4,244 | 4,706 | 4,192 | 4,913 | 4,951 | 4,993 |
| Europe | 2,624 | 2,440 | 2,585 | 2,556 | 2,424 | 1,927 | 2,226 | 2,119 | 2,177 |
| Africa & Oceania | 37 | 37 | 25 | 29 | 24 | 23 | 24 | 33 | 56 |
| **World / Total Scrap Use** | **7,269** | **7,279** | **8,141** | **8,279** | **8,437** | **7,290** | **8,365** | **8,366** | **8445** |
| Scrap use Annual Growth | 9% | 0% | 12% | 2% | 2% | -14% | 15% | 0% | 1% |
| Secondary refined production | 2,069 | 2,161 | 2,613 | 2,738 | 2,823 | 2,841 | 3,250 | 3,470 | 3,580 |
| Cu content of Direct Melt | 5,199 | 5,118 | 5,528 | 5,541 | 5,614 | 4,448 | 5,116 | 4,896 | 4,865 |
| Refined Usage | 16,838 | 16,674 | 17,034 | 18,196 | 18,053 | 18,070 | 19,346 | 19,830 | 20,550 |
| Total copper usage | 22,037 | 21,792 | 22,563 | 23,737 | 23,667 | 22,518 | 24,462 | 24,726 | 25,415 |
| **Recycling Input Rate (RIR)** | **33%** | **33%** | **36%** | **35%** | **36%** | **32%** | **34%** | **34%** | **33%** |
| Asia | 31% | 32% | 37% | 34% | 36% | 30% | 33% | 33% | 31% |
| Europe | 42% | 41% | 41% | 41% | 42% | 44% | 45% | 42% | 45% |
| North America | 29% | 29% | 32% | 33% | 32% | 34% | 33% | 34% | 33% |
| Rest of the World | 13% | 15% | 15% | 18% | 16% | 14% | 12% | 14% | 14% |

# ICSG Global Copper Scrap Research Project and recent scrap reports

Based on interest expressed by member countries, ICSG launched the copper scrap market project in 2007 in order to provide greater transparency on an increasingly vital component of the world copper market at a time when globalization is reshaping the copper scrap and copper alloy recycling business. The final report of the project was published in August 2010. In addition, ICSG has completed a number of new detailed reports on NAFTA, European, Middle Eastern and Chinese scrap recovery and scrap supply in recent years. For more information about ICSG work related to copper scrap, please contact the ICSG Secretariat at mail@icsg.org

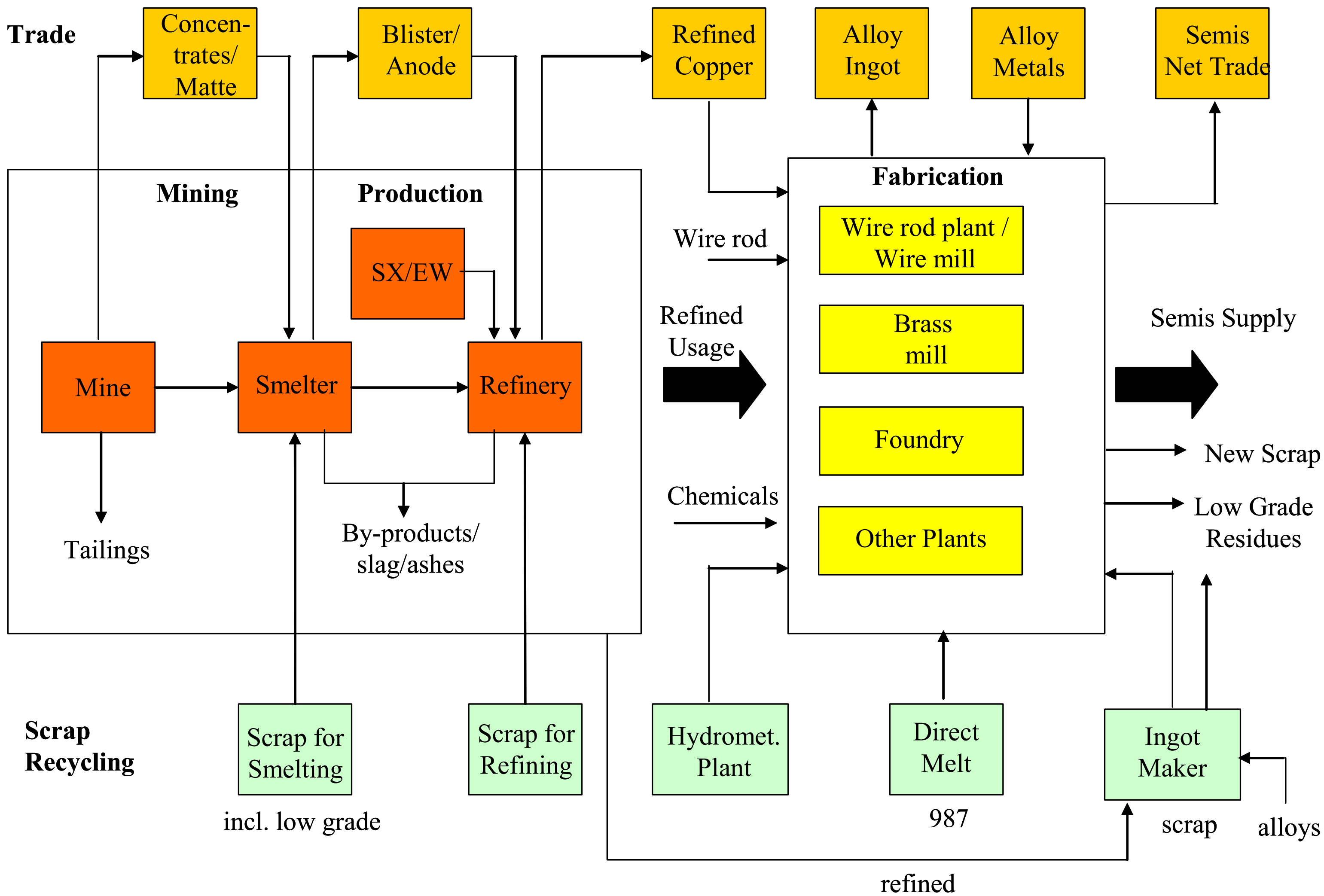
## Key Drivers of the Global Copper Scrap Market

- Expanding Copper Mine Production and Refined Copper Substitution
- Industrialization and Economic Growth
- Prices
    - Copper Scrap Prices and Spreads
    - Refined Copper Prices and the Demand for Scrap
- Chinese scrap market developments
- The Shift in Regional Scrap Processing Capacity
- Regulations on Recycling and Trade
- Technology

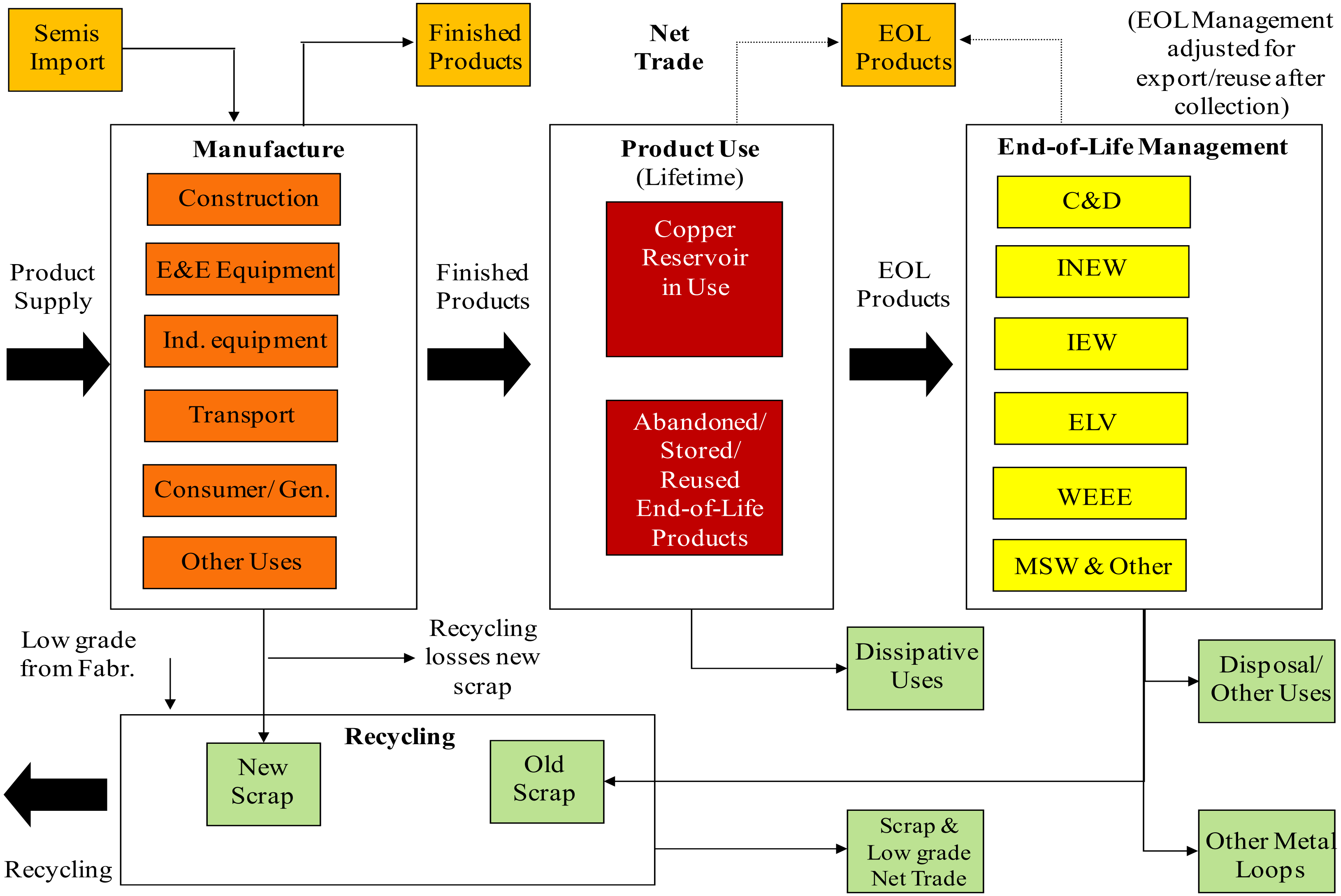
## ICSG Global Copper Scrap Project Reports

- Survey of Brass Mills, Copper Products and Foundries in China (2014)
- Middle East and North Africa Copper Use Study (2014)
- Copper and Copper Alloy Scrap  Supply Survey in EU-27 (2013)
- Copper Scrap Market Recovery in NAFTA (2012)
- Copper Scrap Supply Survey in China (2012)
- Survey on Nonferrous Metal Scrap and Refined Inputs & Production in Chinese Semis Plants (2012)
- ICSG Global Copper Scrap Research Project Final Report (2010)
- Japan Scrap Market Report
- China Scrap Usage Survey

## The Flow of Copper

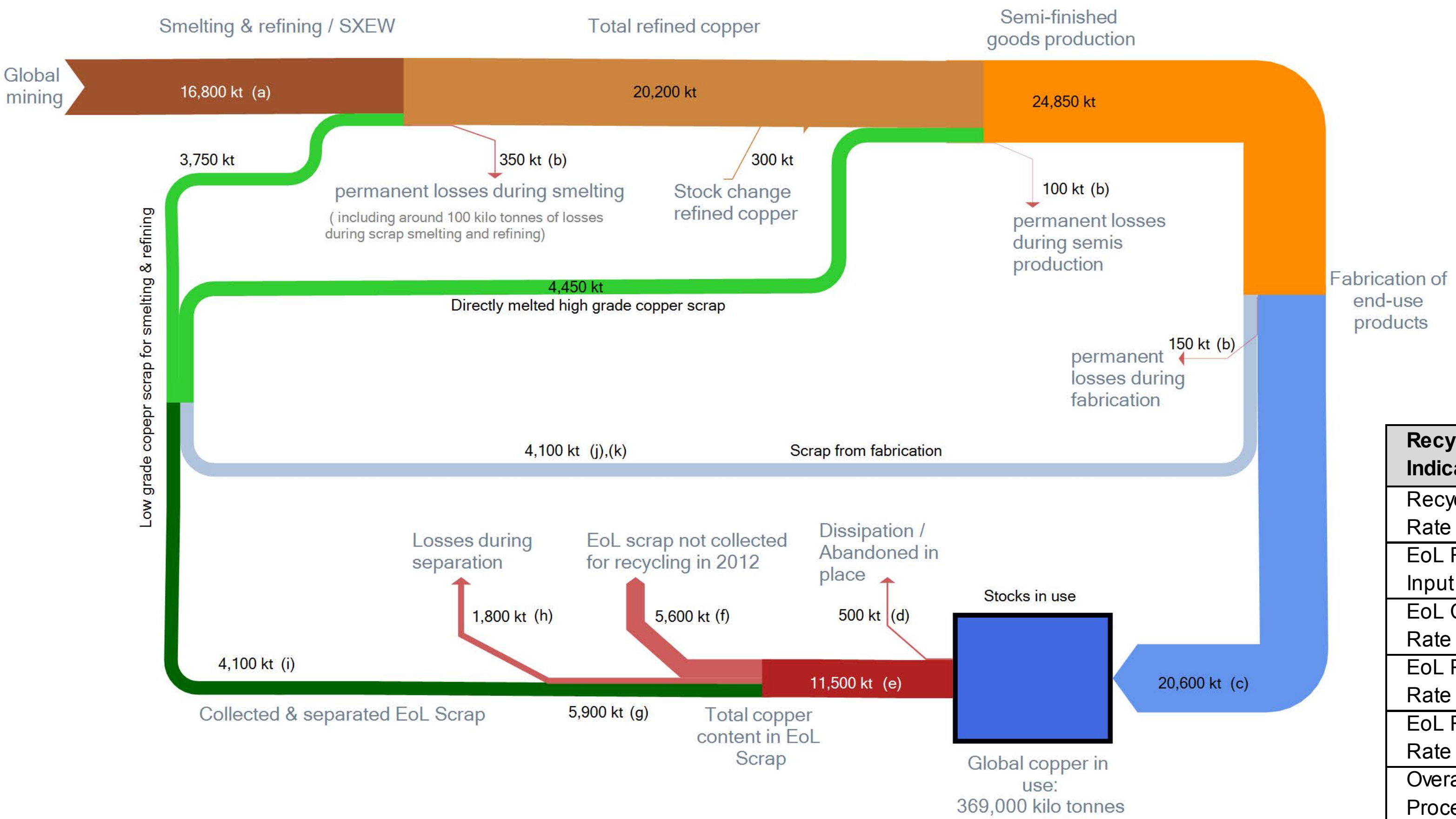


## The Flow of Copper (cont.)



# Industry Global Flows of Copper (2012) and Derived Recycling Rates

Figures produced for the International Copper Association by Fraunhofer ISI based on Environ. Sci. Technol. **47** (12), pp. 6564–6572 (freely available under http://dx.doi.org/10.1021/es400069b).




| Recycling Indicator | Indicator value (10-year avg.) |
|---|---|
| Recycling Input Rate | 35% |
| EoL Recycling Input Rate | 19% |
| EoL Collection Rate | 65% |
| EoL Processing Rate | 68% |
| EoL Recycling Rate | 44% |
| Overall Processing Rate | 80% |
| Overall Recycling Efficiency Rate | 61% |
| Old Scrap Ratio | 53% |

# ANNEX

## World Copper Production and Usage, 1960-2013

Thousand Metric Tonnes

Source: ICSG

| | Mine Production | Refined Production | Refined Usage | | Mine Production | Refined Production | Refined Usage | | Mine Production | Refined Production | Refined Usage |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **1960** | 3,924 | 4,998 | 4,738 | **1978** | 7,306 | 9,030 | 9,527 | **1996** | 11,099 | 12,677 | 12,489 |
| **1961** | 4,081 | 5,127 | 5,050 | **1979** | 7,371 | 9,200 | 9,848 | **1997** | 11,538 | 13,478 | 13,082 |
| **1962** | 4,216 | 5,296 | 5,048 | **1980** | 7,230 | 9,261 | 9,396 | **1998** | 12,251 | 14,075 | 13,435 |
| **1963** | 4,286 | 5,400 | 5,500 | **1981** | 7,721 | 9,573 | 9,522 | **1999** | 12,775 | 14,578 | 14,213 |
| **1964** | 4,443 | 5,739 | 5,995 | **1982** | 7,745 | 9,319 | 9,090 | **2000** | 13,206 | 14,793 | 15,112 |
| **1965** | 4,769 | 6,059 | 6,193 | **1983** | 7,843 | 9,541 | 9,510 | **2001** | 13,633 | 15,638 | 14,928 |
| **1966** | 4,987 | 6,324 | 6,445 | **1984** | 8,137 | 9,440 | 9,930 | **2002** | 13,577 | 15,354 | 15,123 |
| **1967** | 4,743 | 6,004 | 6,195 | **1985** | 8,288 | 9,616 | 9,798 | **2003** | 13,757 | 15,272 | 15,626 |
| **1968** | 5,010 | 6,653 | 6,523 | **1986** | 8,266 | 9,920 | 10,112 | **2004** | 14,592 | 15,918 | 16,738 |
| **1969** | 5,682 | 7,212 | 7,137 | **1987** | 8,592 | 10,148 | 10,293 | **2005** | 14,923 | 16,572 | 16,554 |
| **1970** | 5,900 | 7,592 | 7,291 | **1988** | 8,775 | 10,512 | 10,668 | **2006** | 14,984 | 17,291 | 16,924 |
| **1971** | 5,941 | 7,404 | 7,296 | **1989** | 9,084 | 10,908 | 11,081 | **2007** | 15,516 | 17,903 | 18,039 |
| **1972** | 6,541 | 8,100 | 7,942 | **1990** | 9,226 | 10,804 | 10,886 | **2008** | 15,571 | 18,214 | 17,888 |
| **1973** | 6,915 | 8,544 | 8,740 | **1991** | 9,372 | 10,686 | 10,563 | **2009** | 15,950 | 18,249 | 17,894 |
| **1974** | 7,097 | 8,759 | 8,310 | **1992** | 9,497 | 11,042 | 10,866 | **2010** | 16,038 | 18,986 | 19,129 |
| **1975** | 6,735 | 8,187 | 7,445 | **1993** | 9,553 | 11,249 | 10,992 | **2011** | 16,053 | 19,596 | 19,697 |
| **1976** | 7,289 | 8,632 | 8,539 | **1994** | 9,549 | 11,124 | 11,560 | **2012** | 16,700 | 20,137 | 20,387 |
| **1977** | 7,444 | 8,884 | 9,057 | **1995** | 10,085 | 11,832 | 12,043 | **2013p** | 18,082 | 20,930 | 21,230 |

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