

A decorative geometric pattern on the left side of the slide, composed of various colored triangles (blue, brown, grey, gold) arranged in a complex, overlapping structure.

**INNOVATIONS FOR COMPETITIVENESS**  
**THE BASIC INDUSTRIES – A DRIVE FOR GROWTH**  
**Sofia, 31 January 2018**

# Circular Economy

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### Aurubis Group

A leading worldwide provider of non-ferrous metals, Aurubis processes complex metal concentrates and diverse recycling materials.

Established in 1866 as a stock company, now the Group operates production facilities and sales network in 24 countries on three continents with over 6 400 employees.

Aurubis Group produces more than one million t of marketable copper cathodes annually, precious metals and a range of other products including sulfuric acid and iron silicate.



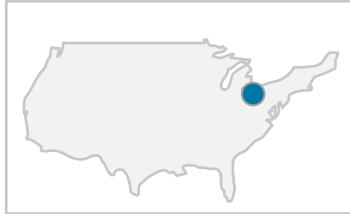
### Aurubis Bulgaria

Aurubis Bulgaria operates the copper production plant of the Group in Pirdop, Srednogorie region. The company is the **second biggest entity in Bulgaria** in annual turnover with **key contribution to overall export and country's GDP growth**.

Established in 1958, Pirdop copper plant consists of four main production units: Smelter, Refinery, Flotation, Acid plant. More than EUR 600 M has been invested since company's privatization.

With 850 direct employees and **record FY 2016/2017 figures**, Aurubis Bulgaria is the biggest copper producer in South-Eastern Europe.

## Production sites



- |               |    |              |    |
|---------------|----|--------------|----|
| » Avellino    | IT | » Olen       | BE |
| » Buffalo     | US | » Pirdop     | BG |
| » Dolný Kubín | SK | » Pori       | FI |
| » Emmerich    | DE | » Röthenbach | DE |
| » Fehrbellin  | DE | » Smethwick  | GB |
| » Hamburg     | DE | » Stolberg   | DE |
| » Lünen       | DE | » Zutphen    | NL |
| » Mortara     | IT |              |    |

» Aurubis has a service and sales network in more than 20 countries (Europe, Asia and North America)



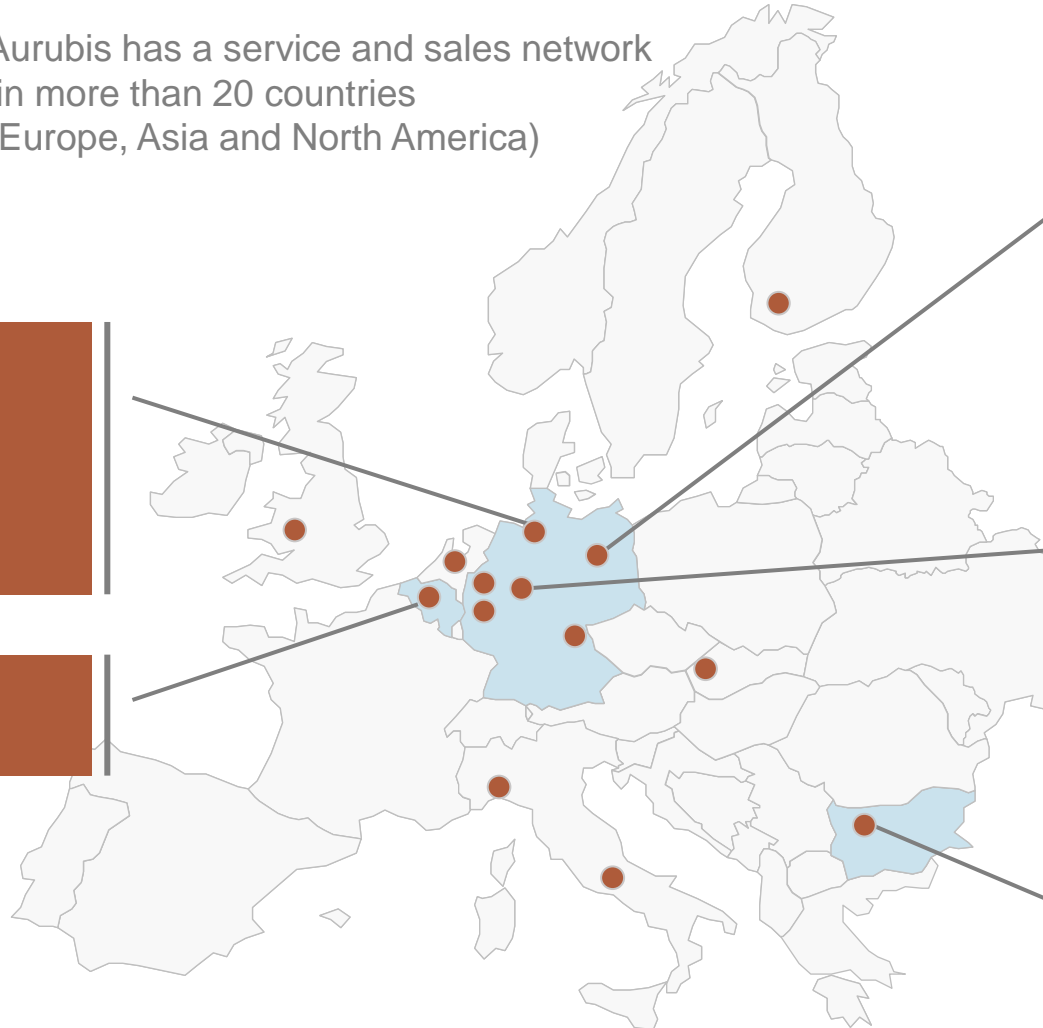
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## Hamburg

- » Copper scrap
- » Intermediates
- » E-scrap
- » Others

## Olen

- » Copper scrap



## Fehrbellin

- » Cable scrap

## Lünen

- » Copper scrap
- » Alloy scrap
- » Shredder materials
- » Industrial residues
- » E-scrap
- » Copper-iron material
- » Others

## Pirdop

- » Copper scrap

- » Biggest SEE copper operation and second biggest company in Bulgaria in turnover
- » Leading producer of copper cathodes: 99.9 percent purity
- » London Metal Exchange certified cathodes: class A, brand Pirdop
- » Leading producer of copper anodes and sulfuric acid
- » Over EUR 600 M of direct investment in Bulgaria
- » ISO 9001 Quality management system and ISO14001 Environmental management system
- » Largest user of Bulgarian rails and ports
- » Storage facilities at Burgas ports
- » Four main production units at Pirdop plant

**Smelter**



**Refinery**



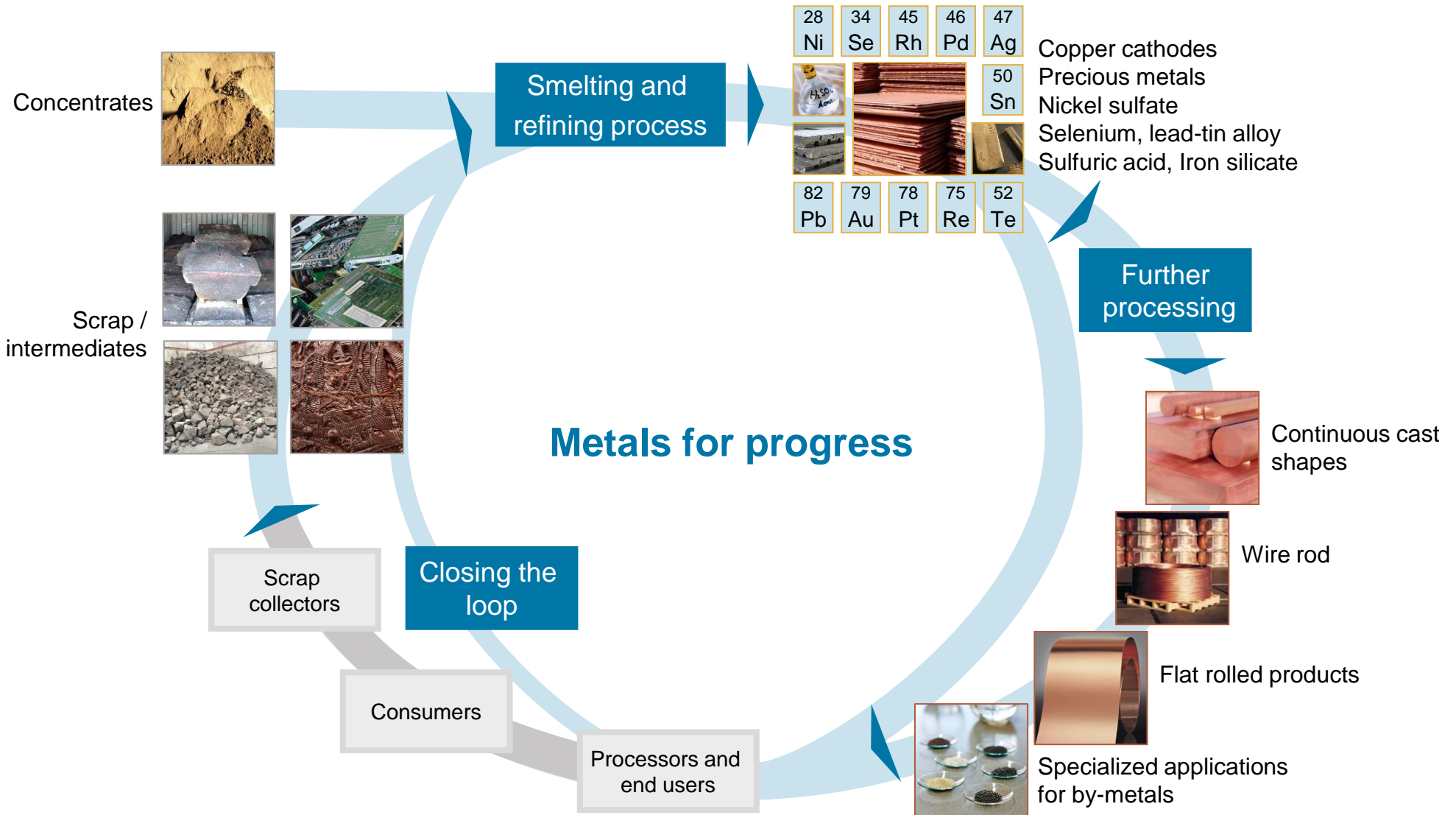
**Acid plant**



**Flotation plant**



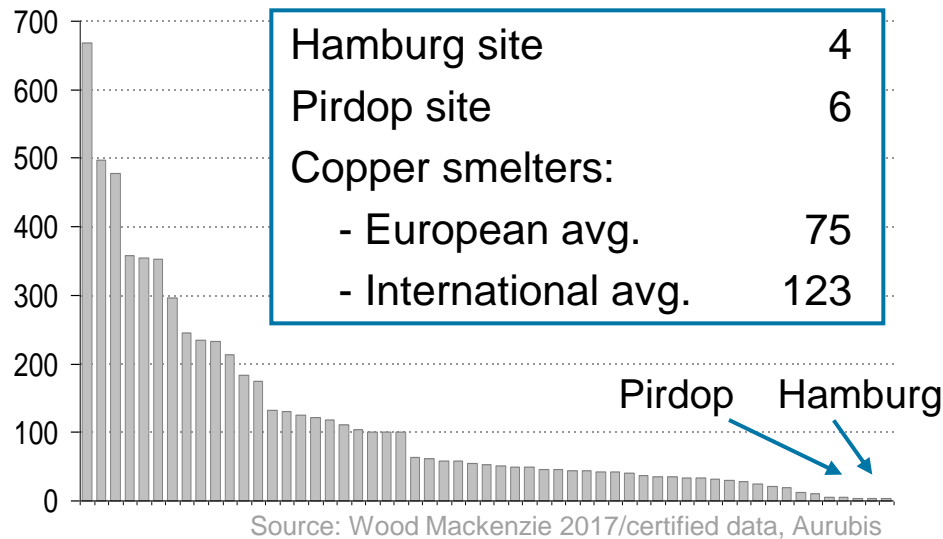
# Aurubis' strengths include productivity, efficiency, environmental protection and processing expertise





## Primary copper

SO<sub>2</sub> emissions of copper smelters  
(in kg SO<sub>2</sub> per t of copper)



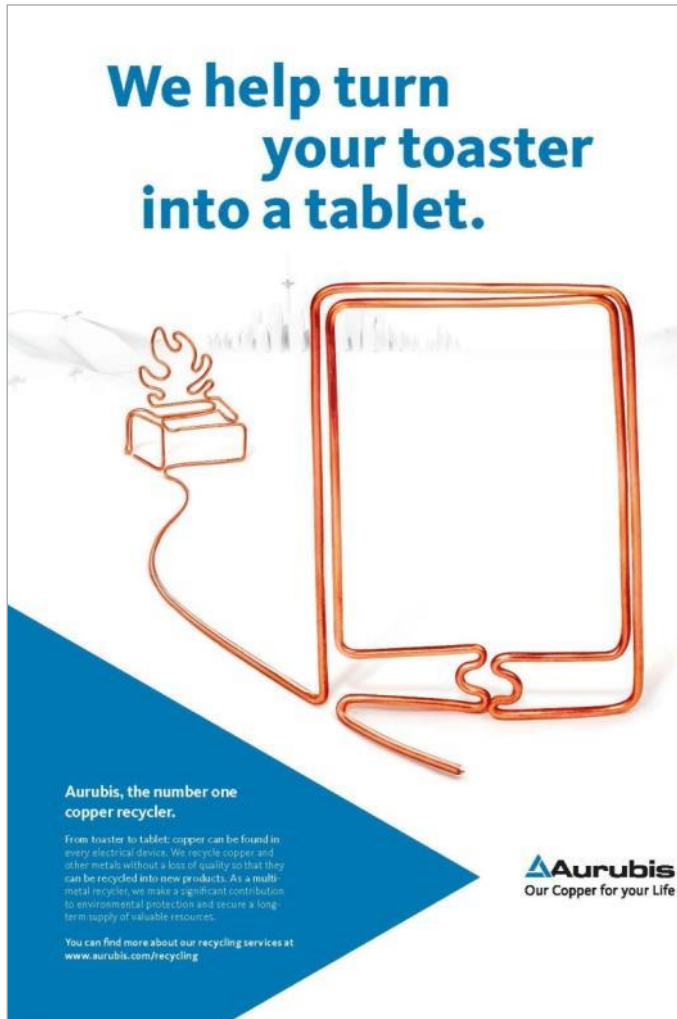
- » Outstanding success in environmental and climate protection
- » One of the most environmentally friendly copper producers in the world today

## Recycling



Kayser Recycling System (KRS)

- » Innovative recycling solutions with state-of-the-art recycling technologies
- » High metal recovery rates while observing stringent environmental standards with its multi-metal recycling process




**We help turn  
your toaster  
into a tablet.**

Aurubis, the number one copper recycler.

From toaster to tablet: copper can be found in every electrical device. We recycle copper and other metals without a loss of quality so that they can be recycled into new products. As a multi-metal recycler, we make a significant contribution to environmental protection and secure a long-term supply of valuable resources.

You can find more about our recycling services at [www.aurubis.com/recycling](http://www.aurubis.com/recycling)



**Aurubis**  
Our Copper for your Life

- » It returns copper, precious metals and other elements back to the economic cycle
- » Copper and most other metals can be recycled an unlimited number of times without losses
- » Copper and other metals produced from secondary sources have exactly the same quality as primary material
- » Preserves natural resources
- » Saves energy
- » Continuous investments and adaptations to changing recycling materials are required
- » High EHS requirements must be implemented on a continuously ambitious level
- » International competitiveness

The Aurubis solution: primary and secondary copper production complement one another and ensure the highest flexibility

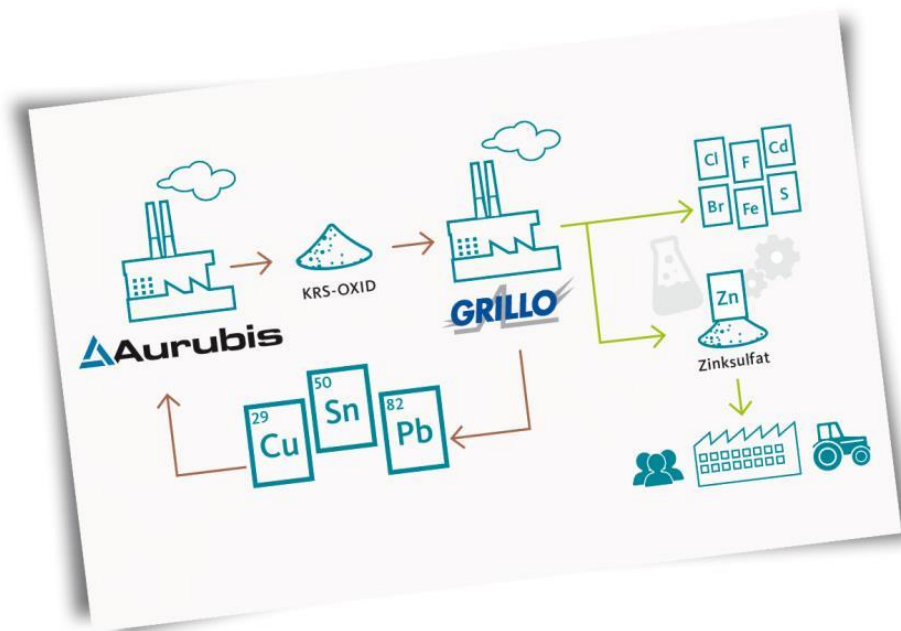




**Aurubis and Telekom:**  
**Aurubis subsidiary CABLO extracts high-purity copper granules from cable scrap**

- » Aurubis receives cable scrap with a copper content of about 50 % and processes it in a professional and environmentally sound manner
- » After separating the copper core from the plastic fraction, the material is processed into high-purity copper granules
- » The copper granules are re-processed at Aurubis into copper products such as continuous cast rod, which is necessary for electric lines, among other things – the copper cycle comes full circle
- » Using injection molding technology, the plastics are used to produce products with a high surface quality that hold their shape well, e.g. bases for traffic signs

## Closing the loop beyond – an example of a mutual relationship between Aurubis AG and Grillo Werke AG



- » Aurubis Lünen's Kayser Recycling System (KRS) produces KRS oxide, a complex, zinc-bearing (approx. 50 % Zn) residue
- » Grillo Werke AG takes KRS oxide as a raw material to process environmentally friendly zinc sulfate (fiber, feed and fertilizer industries)
- » Additional elements are chemically separated. Considered from e-scrap recycling – **bromine from flame retardants returns to the economic cycle**
- » A resulting residue with copper, tin and lead is again taken back into Aurubis facilities

Aurubis and Grillo: Cooperation on the highest standard for implementation of a transparent, consistent value chain cycle



- » Application of secondary aggregates ( final iron silicate slags) as construction materials contribute to conservation of natural mineral resources (natural aggregates), saving of energy and CO<sub>2</sub> emissions, and reduction of environmental burdens of landfilling.



- » Safe use of final slags during whole life cycle is demonstrated through REACH



- In order to ensure material efficiency and reduction of environmental burden, Aurubis looks and evaluates the impact of copper products on environment throughout their whole life cycle in an integrated way:
  - fact based decision making and basis to identify improvement potentials
  - assess the entire supply chain for environmental hotspots
  - benefits of using recycled materials as input to copper products, and the recyclability of copper at their end-of-life stage
  - product design for easier recycling , improved material efficiency, reduction residual waste and overall lifecycle impact

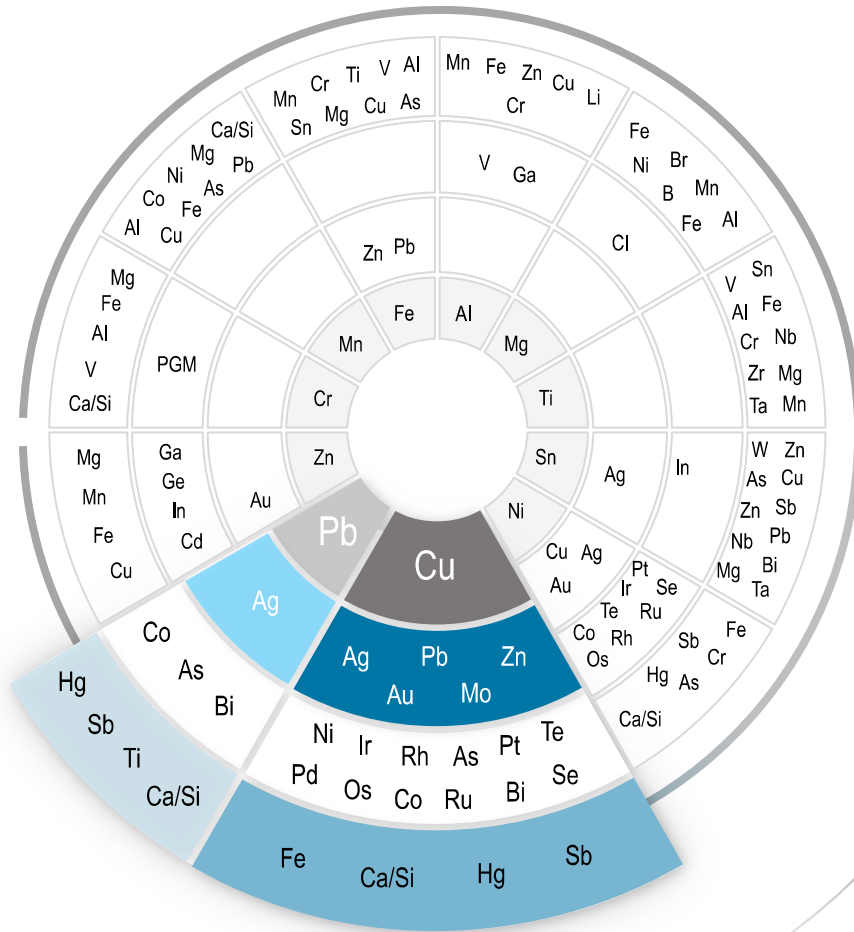


# Benefits of the development of Copper Organizational Environmental Footprint



- » Information on performance through the life cycle is an important aspect to be taken into account in the environmental management system and indicators
- » The Environmental Footprint develops a binding method to measure and communicate the life cycle environmental performance of organizations on a harmonized basis
- » OEF is focused on identification of opportunities for improvement
- » Demonstrate the positive aspects of copper metallurgy and multi-metal recycling
- » Communication of EF results can strengthen existing reporting

## Base metals and their by-metals



“Base metals – Cu, Pb, Ni, Sn and Zn and their processing infrastructure all play a crucial part in present society acting as enablers in any recycling efforts, as they carry and release important and vital minor elements. The metallurgical infrastructure and technology is critical to enable the economically viable recovery of elements and compounds from complex products and materials.” *(Markus A. Reuter, Prof. Dr. Dr. h.c., Lead author of the UNEP report on metal recycling)*



# Hazard driven framework for chemicals management creates burden to metals recycling

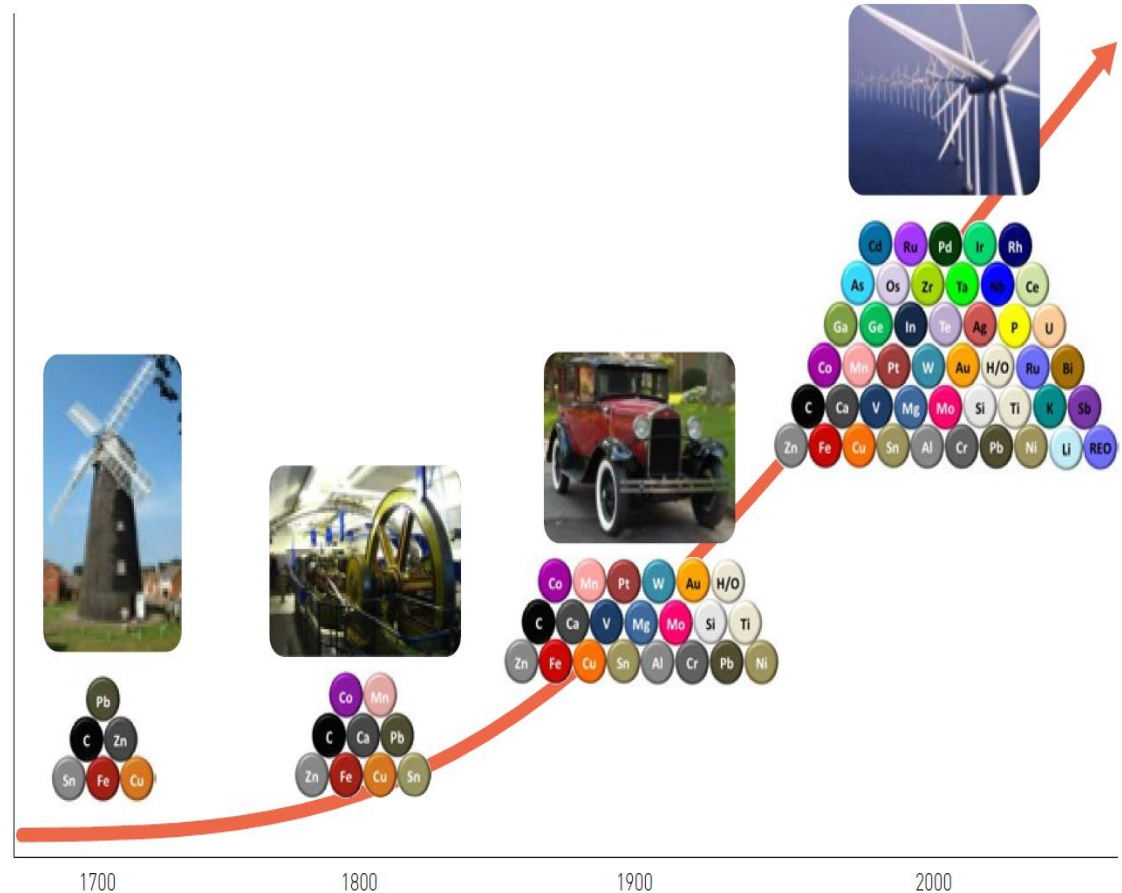
## Facts

- » Complexity of modern recycling materials is increasing. Miniaturisation results in less metal weight
- » Recycling of complex materials is a challenge

## Objectives

- » **Risk control** .Develop and implement a **value-based industrial network**.
- » **Multi-metal recycling has a key role**

Metal/Element Use Intensity in Products



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