Eurometaux

METALS: AT THE HEART OF EUROPE

Circular examples from the non-ferrous metals industry contributing to climate change mitigation

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Al Cu Ni Pb Zn Au Ag Pt Sb Be Si Co Mo V Sn Pd Ru As Os Ir W Ta Ge Se Ga Cd Mg

Structure of today's presentation

1

3 principles of metals circularity & climate

How does EU metals recycling contribute to climate priorities?

2

Innovation needs for metals circularity & climate

4 priority areas, plus project examples

3

Wrap-up of main messages

What support do we need from EU?

3 principles of metals circularity & climate

1/3 Recycling and circularity is already in the business model of Europe’s metals industry

- Metals are permanent materials which can be endlessly recycled

- Over 50% of all base metals produced in Europe are from recycled sources

- State of the art recyclers recover 25+ metals from complex products

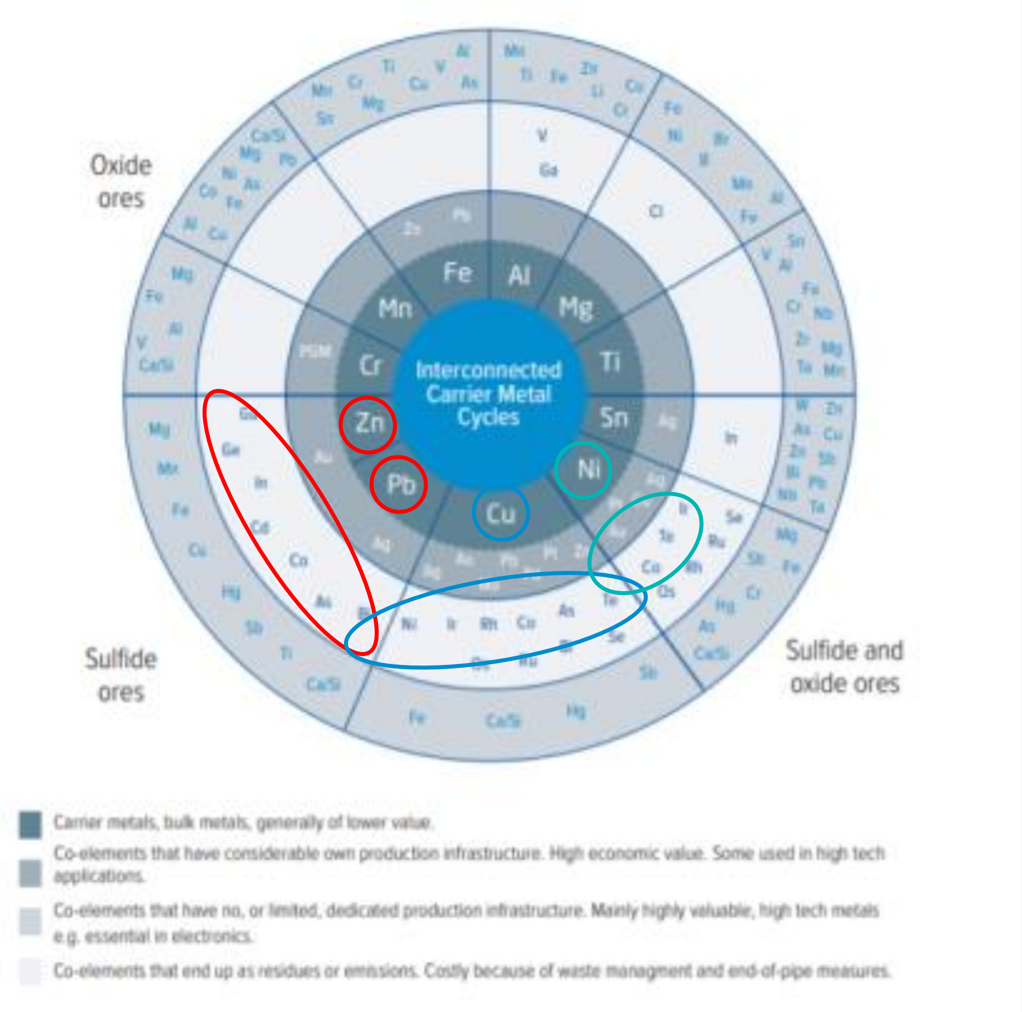
Recycling of base metals: Europe versus Rest of World

** Figures excluding 700,000t zinc recycled by remelting*

Europe’s metals recycling operates in an integrated ecosystem

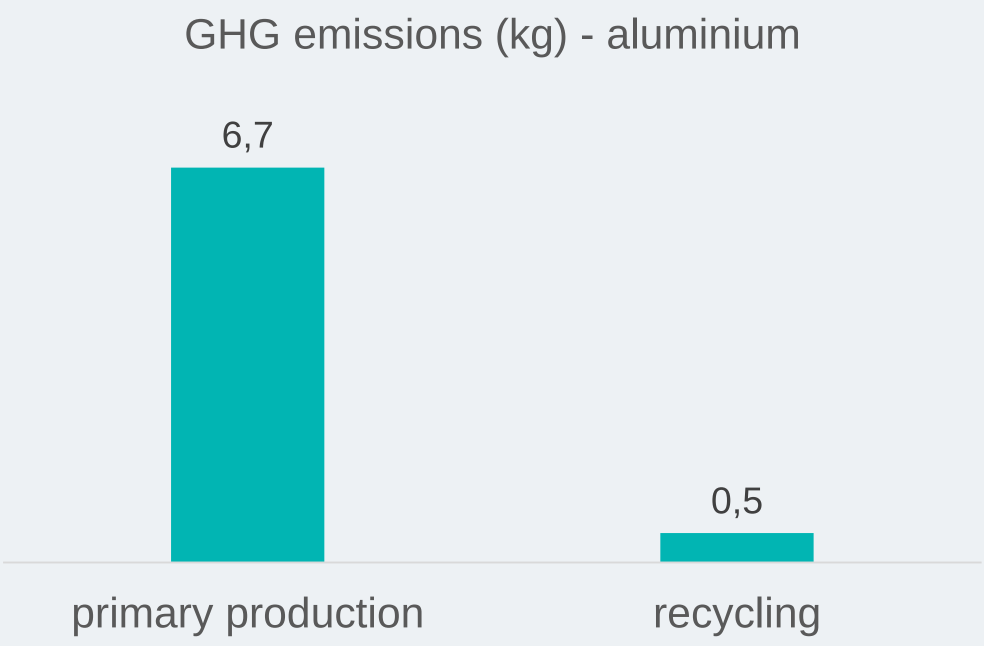
UNEP “Metals Wheel”

- Recycling of base metals is Europe’s major route to access precious & critical metals
- Copper, lead, zinc & nickel metallurgy is used for recycling e-waste & other complex products
- Recovery of small-volume metals has a higher energy requirement



Replacement of primary raw material has climate benefits on a lifecycle basis

- Pure metals scrap recycling has a high energy saving (e.g. 95% for aluminium and zinc, 85% for copper vs. primary)
- Complex waste fractions recycling could incur a higher energy requirement due to low concentrations/volumes
- Overall, metals recycling processes require less energy than extraction & primary production



Source: Environmental profile report – European Aluminum

Innovation needs for metals circularity & climate

Four priority areas for circularity innovation in the metals industry, where ETS innovation fund could support

1. Sorting and recovery of scrap
2. Better use of primary by-products
3. Metals recovery from low-grade ores, sludges and slags
4. Lowering energy requirements of certain recycling processes

Aim: maximise metals recovery, while tackling the challenge of higher energy consumption from increasingly complex waste fractions

1 Sorting and recovery of scrap – *Aluminium example*

Issue:

- Metal scrap contains variety of grades and quality (+ impurities) → economic barrier
- Physical sorting of metal is more economical than melt refining technology
- The higher quality of scrap sorting = the more efficient recycling operations

Case-study: Hydro's state-of-the-art aluminum scrap sorting plant in Dormagen (DE)

- Using X-ray transmission and other sorting technology elements
- 36.000 t of Al scrap sorted/year

Added value:

- Saving: 200.000 t of CO_2/year
- Technology transfer also to other Hydro recycling plants

Metal industry continues to improve existing and to develop new sorting technologies

2 Better use of primary by-products – ‘*Red mud’ example*

The issue:

- Primary metals production has significant quantities of by-products
- Example: 6.8 Mt/year bauxite residue (red mud) from alumina production, only 1,5% re-used (in clinker cement)
- There is more value in the bauxite residue, including rare earths

Case study: RemovAL project (Removing waste from alumina production)

- Project taking technologies validated at the lab (min. TRL 4) aiming to demonstrate them in industrial environment (TRL 7-8) to get products like i.e. cement raw materials, mineral wool, ferro alloys, REE
- Time frame: 2018 – 2022 (→ no results yet)

Added value (generic level):

- Overall reduction in use of virgin raw material and avoidance of emissions related to their extraction.
- Avoidance of bauxite residue landfilling.
- Materials that can be produced from the bauxite residue:
    - Iron ore products → offering possible 18% increase of the EU domestic production
    - Industrial mineral wool, aluminate cement, geopolymer and slag cement → offering 2-3 Mt possible recovery/year
    - Rare Earth Elements (i.e. Sc, Y, La, Nd) → extracting REE from Greece’s annual bauxite residue production can in theory cover approx. 10% of EU demand

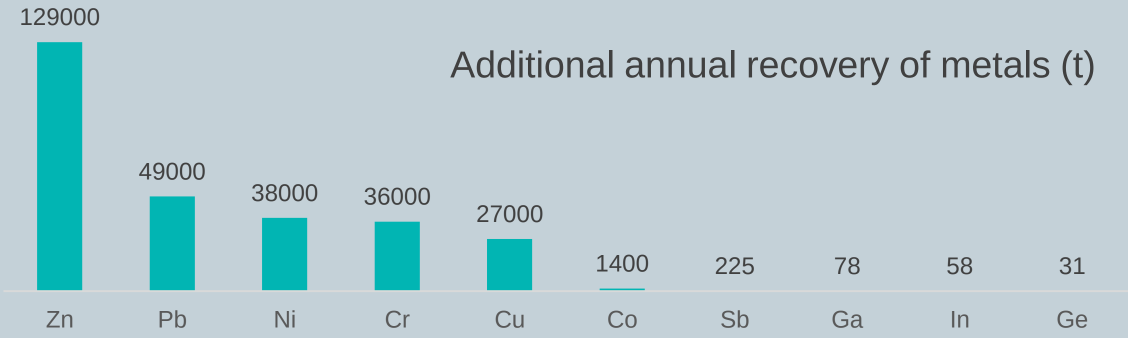
3 Metals recovery from wider low-grade ores, sludges and slags

Issue:

- Treating additional residues from metals mining, production, recycling would increase metals recovery, but there are challenges of economic cost and potential higher energy requirement
  - Examples: low-grade ores (e.g. laterite); fine grained landfilled sludges (i.e. jarosite sludges from Zn production); fayalitic slag (mostly from primary and secondary Cu production)

Case-study: METGROW+ project (Metals recovery from low grade ores and waste)

- Additional recovery of metals from above examples would increase Europe's annual metals production



Added value:

- Avoidance of landfilling and reduced need for additional primary raw materials
- High potential for additional annual metals production through circular processes
- But: additional energy requirements must be tackled (carbon free electricity as a long term solution)

4

Lowering energy requirements from recycling processes – *e-waste example*

Issue:

- Example: Electronic products are getting increasingly complex with a short life-span
- Recovery of metals is more carbon-intensive than simple waste streams, due to high CO_2 content
- Lower metals concentrations in e-waste fractions further increases energy requirements of recovery process

Case-study: Options to reduce energy requirements of e-waste recycling processes

- In research stage:
  - Hydrometallurgical process in which shredded WEEE is not incinerated but dissolved
  - Use of a new two stage bio-leaching process to reduce costs and energy consumption

Added value (expected for bio-leaching):

- Reduced energy consumption and processing costs in comparison to other treatment processes like pyrometallurgy, hydrometallurgy or one-step bioleaching
- Cutting the processing costs of: 50% hydrometallurgical and 35-40% one-step bioleaching processes
- Fourfold increase in the amount of Au recovered
- 8% less of CO_2 emissions than during hydrometallurgical processes

Other examples

Industrial symbiosis: Aurubis and Grillo-Werke

- Aurubis plant (Lünen, DE) uses the “Kayser-Recycling-System (KRS)” to produce Cu
- Zinc-containing filter dust appears as a by-product (“KRS oxide”) that contains valuable metals like Cu, Sn and Pb.
- Grillo-Werke takes the KRS oxide as raw material for the production of zinc sulphate (used in the animal feed and fertilizer industries).
- After production of zinc sulphate from KRS oxide, we get a residue containing Cu, Sn and Pb in an enriched form which is returned to Aurubis’ production process

CO_2 reduction in other industries: use of iron silicate as a substitute of natural aggregates

- Final slags from copper production consisting primarily of e.g. iron silicate and/or calcium aluminum silicates (→ metals content reduced to the lowest, technically and economically viable, levels)
- Iron silicates are used in construction sectors (roads, embankments, mine backfill, concrete, cement & asphalt applications)
- It saves natural construction resources, reduces environmental emissions (e.g. CO_2), energy and land use from the extraction of the virgin material.
- Use of iron silicate as additives in the clinker production or mineral addition to blended cements has the potential to save cement’s industry carbon footprint.


Wrap-up of main messages

Main messages

- **Metals circularity is a tool for climate change mitigation**
    - ETS innovation fund can support development of climate friendly technologies and techniques that enhance:
        - the recovery of metals and alloys from secondary raw material streams
        - the use of by-products from primary and secondary metals production
- **Four priority areas identified:**
    1. Sorting and recovery of scrap
    2. Better use of primary by-products
    3. Metals recovery from low-grade ores, sludges and slags
    4. Reducing energy requirements from certain recycling processes
- **Innovation and regulation must work together to maximise metals recovery, while tackling the challenge of higher energy consumption from increasingly complex products**

More information? Read our 2050 Metals Blueprint

bit.ly/metals2050

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Al Aluminium | Cu Copper | Ni Nickel | Pb Lead | Zn Zinc | Au Gold | Ag Silver | Pt Platinum | Sb Antimony | Be Beryllium | Si Silicon | Co Cobalt | Mo Molybdenum | V Vanadium | Sn Tin | Pd Palladium | Ru Ruthenium | As Arsenic | Os Osmium | Ir Iridium | W Tungsten | Ta Tantalum | Ge Germanium | Se Selenium | Ga Gallium | Cd Cadmium | Mg Magnesium