Presentation of new report - Metals in a Carbon-Neutral Europe: A Blueprint for 2050

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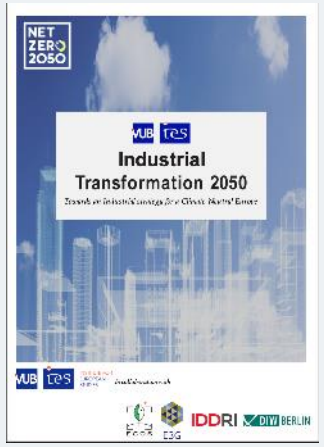

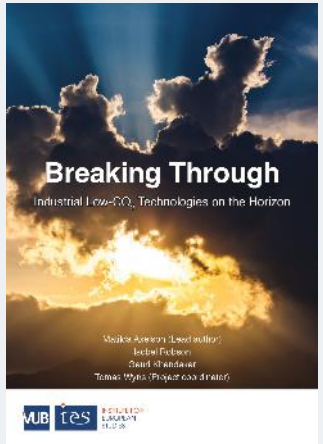

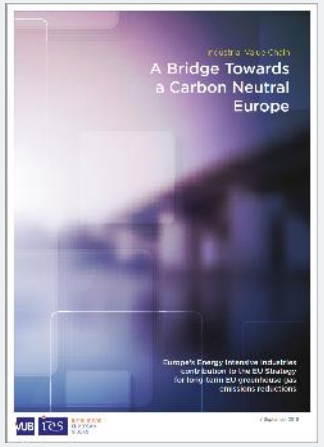

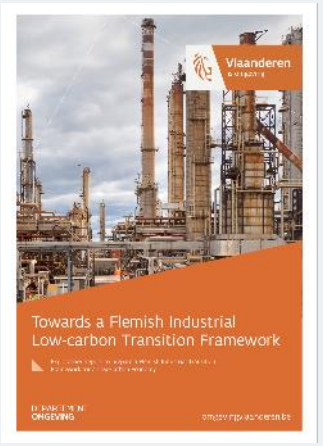

Non-Ferrous Metals: at the forefront of Europe's climate and Industry transition

Where are metals now?

Emissions

61%

GHG emissions reduction since 1990

Electrification

58%

Share of electricity in energy use

Circularity

50%

of Europe's base metals production from recycling

Metals ecosystem = indicator of direction + climate prospects of other industries

Where can metals go next?

81%

total reduction potential with decarbonised power (vs. 1990)

5X

more impacted by power costs vs. other industries

50%

more aluminium & copper available for recycling in 2050

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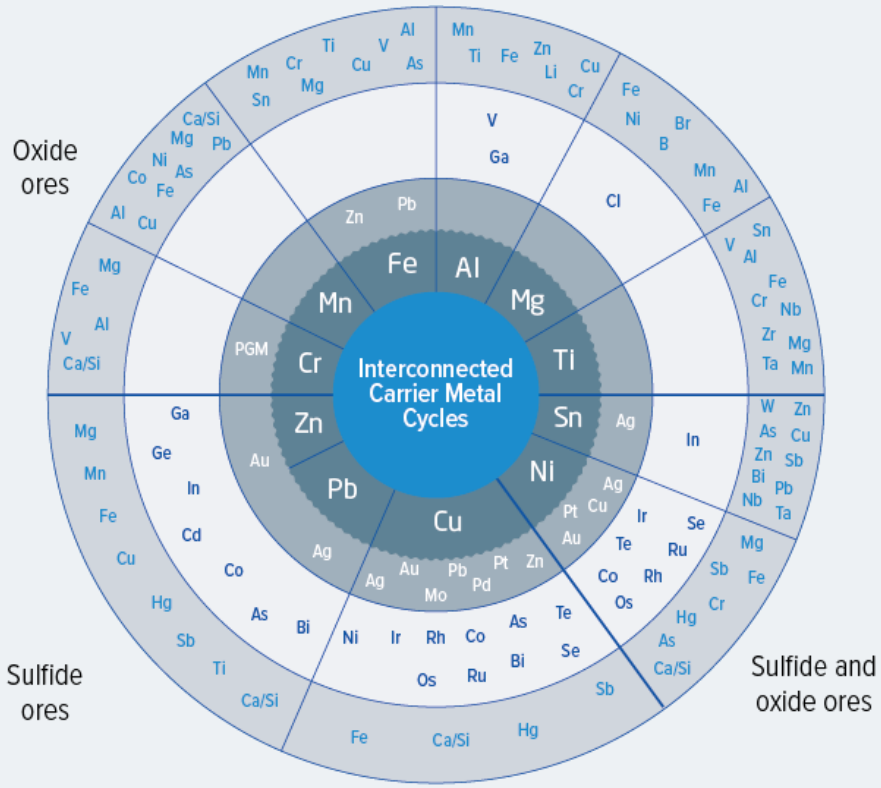
Non-Ferrous Metals: An integrated and essential EU ecosystem

An ecosystem of base, precious & specialty metals ➡
Supplying Europe's low-carbon technologies

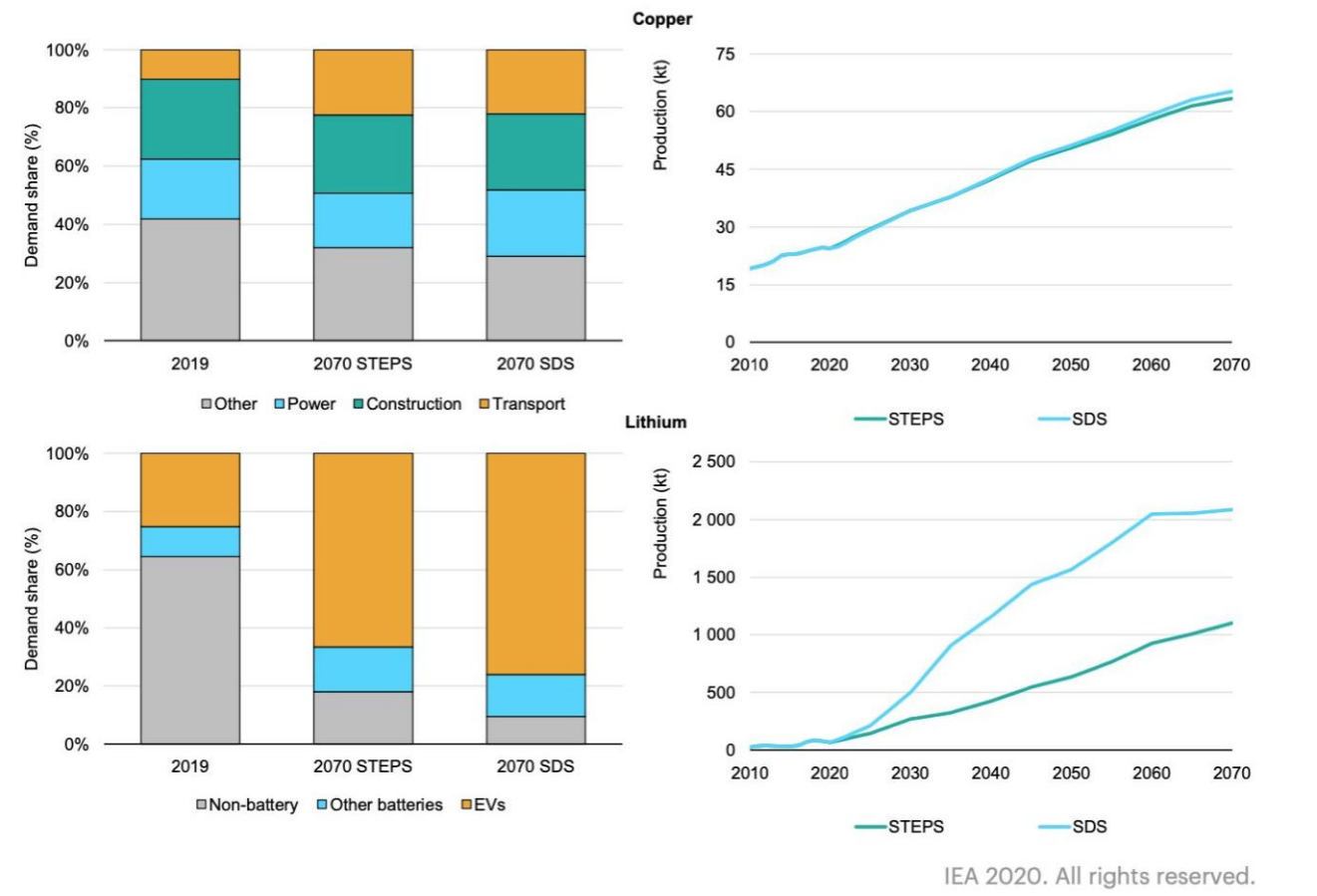


- Carrier metals, bulk metals, generally of lower value.
- Co-elements that have considerable own production infrastructure. High economic value. Some used in high tech applications.
- Co-elements that have no, or limited, dedicated production infrastructure. Mainly highly valuable, high tech metals e.g. essential in electronics.
- Co-elements that end up as residues or emissions. Costly because of waste managment and end-of-pipe measures.

Non-Ferrous Metals: crucial role in transition to climate neutrality

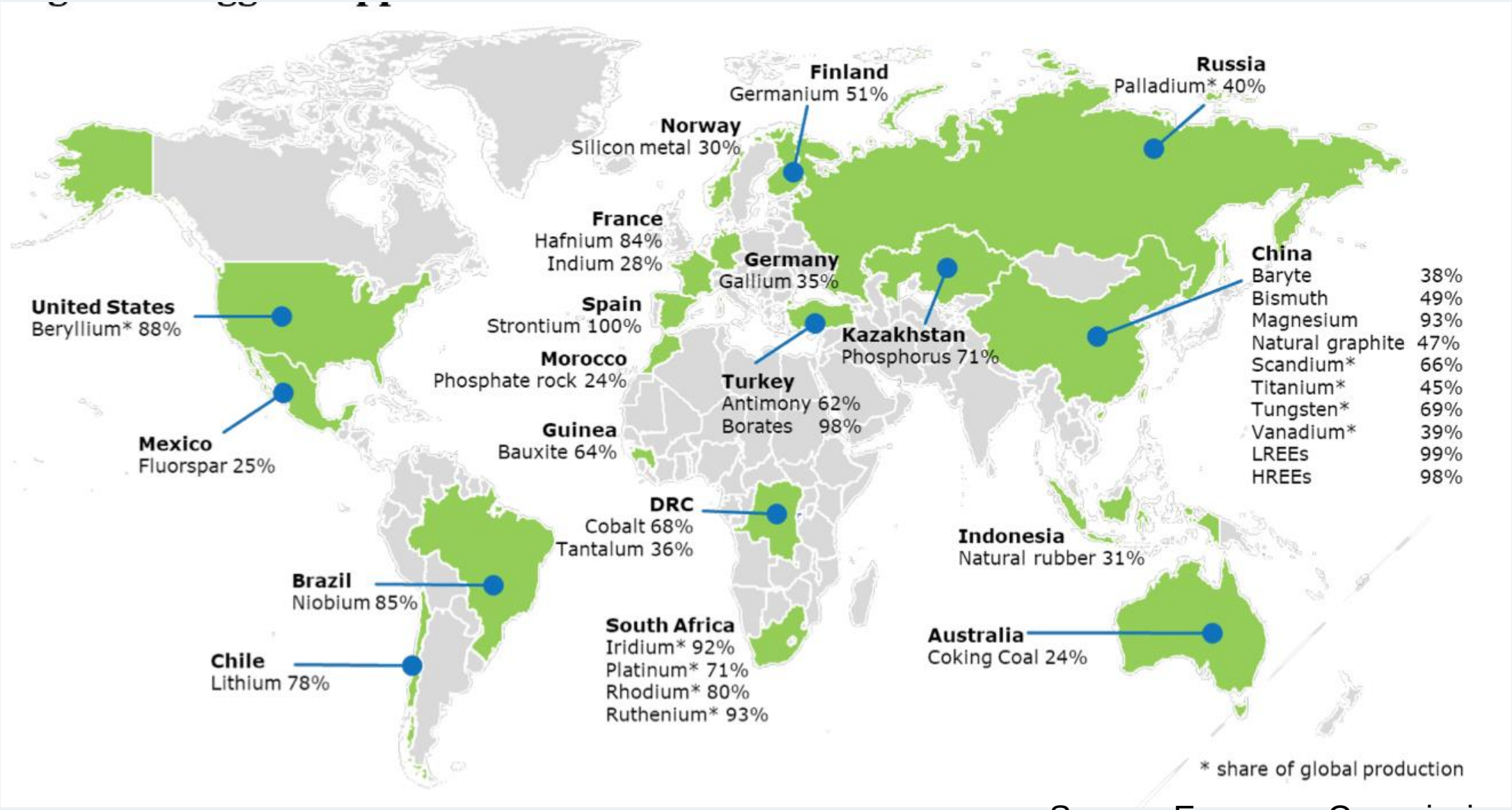
	Wind	Solar photovoltaic	Concentrating solar power	Carbon capture and storage	Nuclear power	Light-emitting diodes	Electric vehicles	Energy storage	Electric motors
Aluminum	X	X	X	X		X		X	X
Chromium	X			X	X	X			
Cobalt				X	X		X	X	
Copper	X	X		X	X	X	X		X
Indium		X			X	X	X		
Iron (cast)	X		X			X		X	
Iron (magnet)	X								X
Lead	X	X			X	X			
Lithium							X	X	
Manganese	X			X			X	X	
Molybdenum	X	X		X	X	X			
Neodymium (proxy for rare earths)	X						X		
Nickel	X	X		X	X	X	X	X	
Silver		X	X		X	X	X		
Steel (Engineering)	X								
Zinc		X				X			

Source: Worldbank



Source: IEA

Main suppliers of EU's critical raw materials



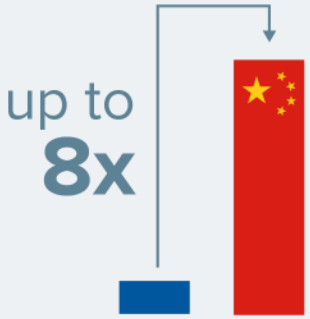
Source: European Commission

Why does Europe need its domestic metals industry?

Essential to achieve Europe's climate neutrality objective

1 Supply Security

Indispensable for production of strategic materials and products



2 Climate Leadership

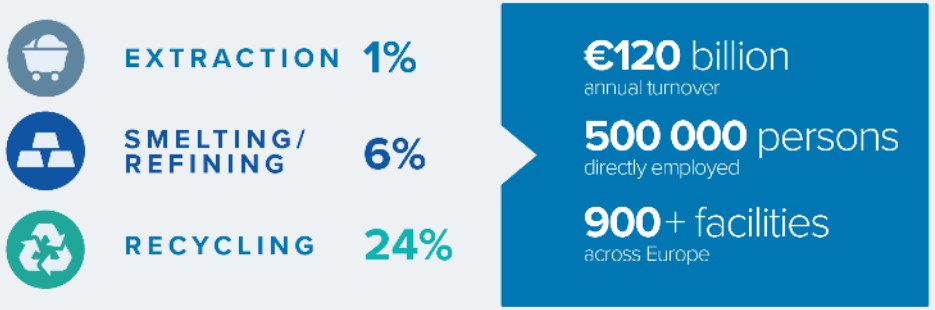
Materials will otherwise still be produced in countries with a higher CO_2 footprint

2 Ecosystem dependency

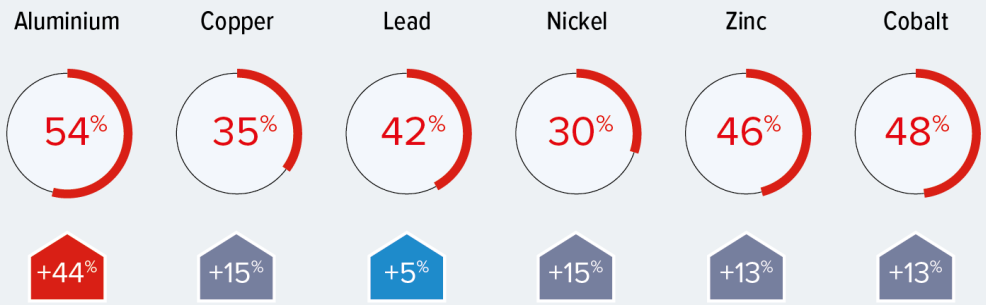
As an ecosystem, if you take 1 piece out, everything stops

Where is Europe's non-ferrous metals industry today?

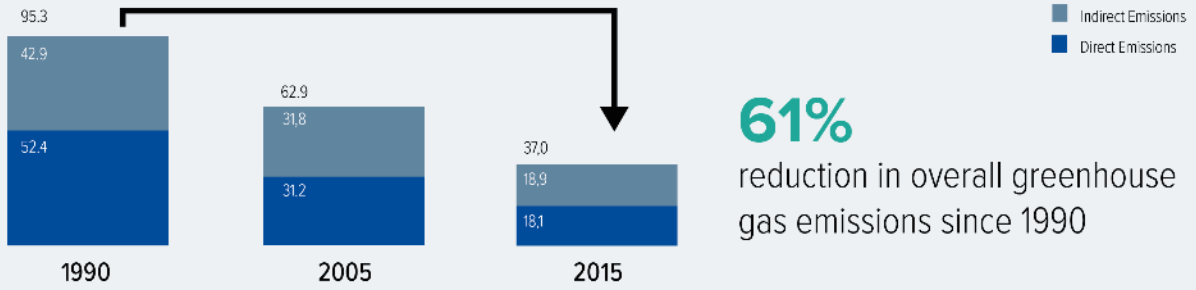
Reducing global share for primary production



China now dominates global market



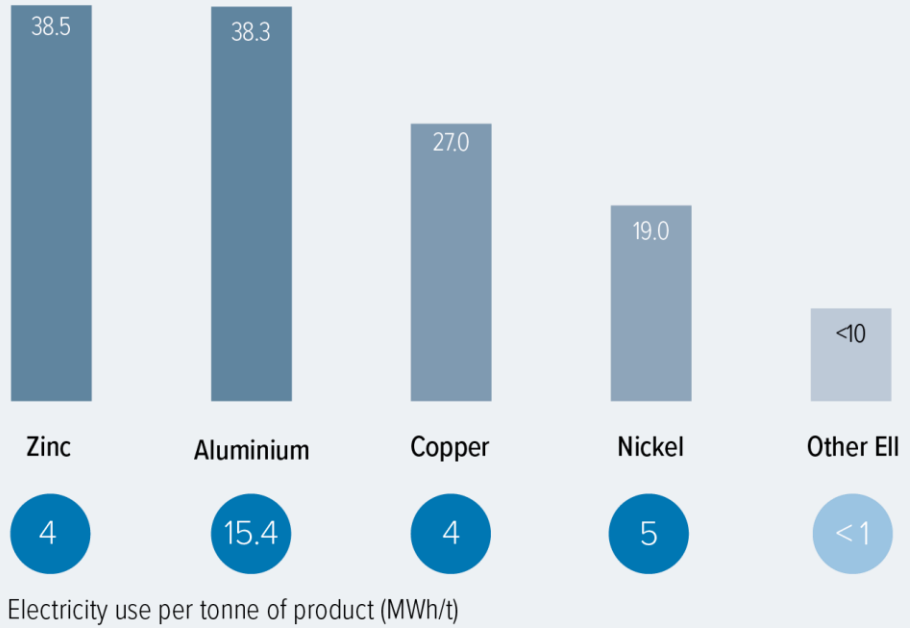
But EU industry = a frontrunner in reducing GHG emissions

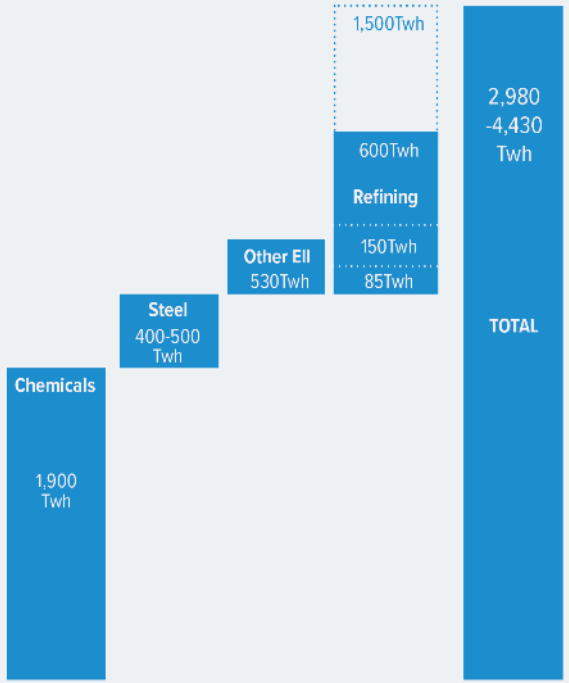


61%
reduction in overall greenhouse gas emissions since 1990

Electrification: Where the metals industry is a real bellwether

High levels of electrification vs. other energy-intensives





& Other Energy-Intensive Industries are expected to follow

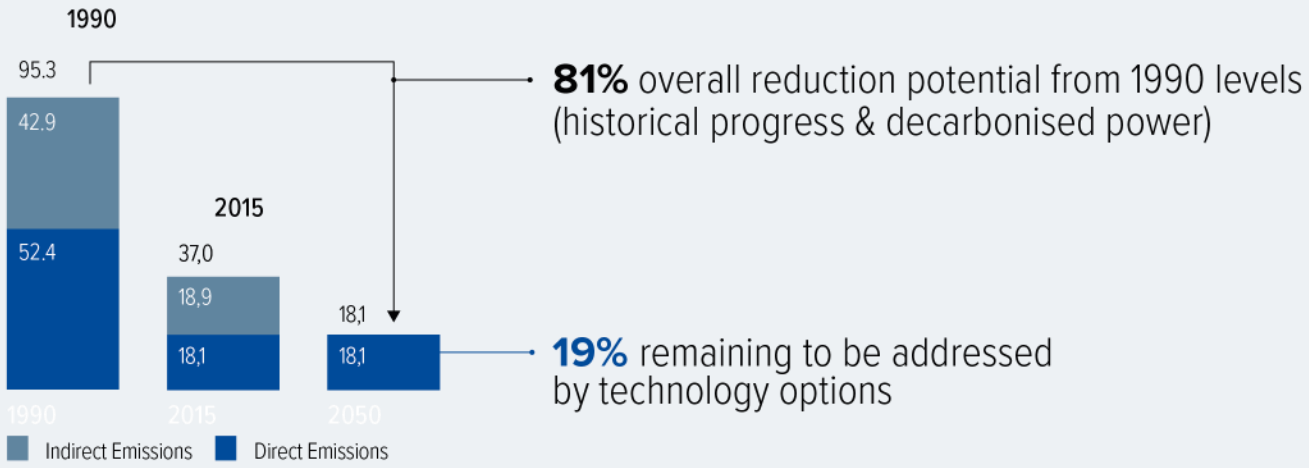
(NB Chlorine is the one EII exception with equivalent electricity use)

How can the non-ferrous metals industry reach climate-neutrality?

Decarbonisation of power sector is essential

= 81%

reduction of overall GHG emissions vs. 1990



Remaining 19% requires a mix of mitigation technologies

- Energy Efficiency
- Anode technology aluminium
- Electrification
- Fuel shift bio-based
- Non-carbon reducing agents/hydrogen
- CC(U)S

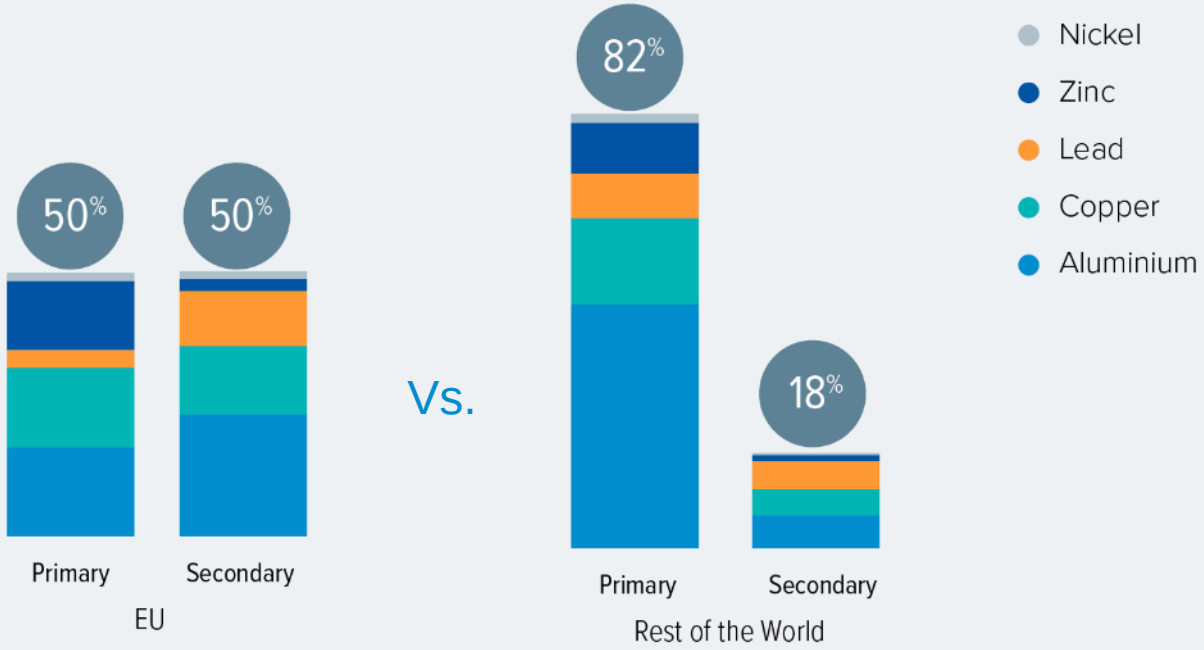
+ Higher metals recovery

+ Sector coupling

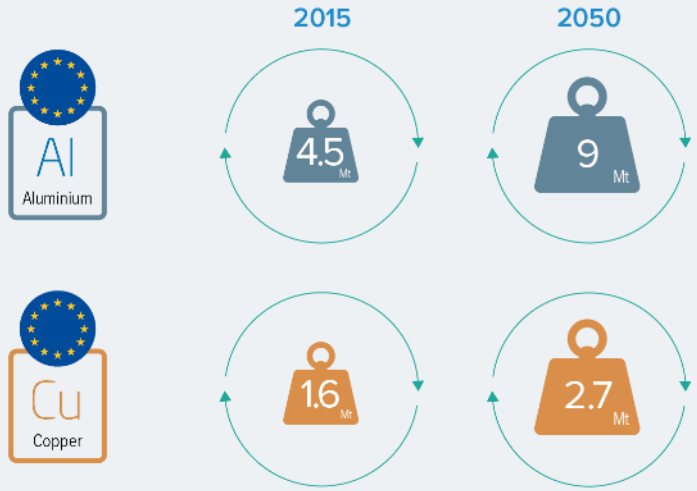
Technology options	Description - impact	Enabling conditions	Relevance
Decarbonisation EU power	Large impact for non-ferrous metals industry. Can bring total (direct + indirect) emissions down by 81% ref. 1990.	This evolution will happen outside of non-ferrous metals industry. Transition to low-carbon electricity will have to go with affordable and secure electricity. Non-ferrous metals can help by higher levels of demand response/ancillary grid services.	All metals +++
Energy efficiency	Important energy savings are possible mostly related to digitisation and automated process management and efficiency in furnaces.	Not all energy savings technologies are compatible with new breakthrough technologies. Favourable investment climate required for continuous investments.	All metals +++
Anode technology aluminium	Innovation in electrolysis process can bring further efficiency gains of up to 20%. Inert anode technology can eliminate direct emissions while reducing energy use.	Major R&D effort needed, including support for pilot and demonstration. Investments can be capital intensive but likely with lower operational costs.	Al +++
Further Electrification	Further electrification of pyrometallurgical processes and/or shift to hydrometallurgical processes in some smelting processes. Electrification (heat) in downstream processes.	High temperature electrification might not yet be mature or too expensive compared to natural gas-based heating. Shift to hydrometallurgical processes can be limited and will most likely be applied in secondary and waste streams	Cu, Zn, Pb, Ni Al (& downstream all metals) +++
Fuel shift – bio-based inputs	Fuel shift from fuels/coal to gas has occurred in non-ferrous metals industry where possible. Further shifts to natural gas and bio-feed (including reducing agents) are possible. Can be relevant for recovery of metals from smelting slag or leaching residues	Fuel shift must be economically viable and bio-based fuels must meet required quality.	Cu, Ni, Pb, Zn, Ferro-alloys, Si +++
Hydrogen as reducing agent	Can be relevant for some pyro smelting processes (e.g. copper). Limited application of H_2 in ferro-alloys. Can be relevant for recovery of metals from smelting slag or leaching residues	Will depend on economic development of H_2 production by other sectors and available infrastructure. Smelters already requiring a lot of O_2 might have better business case for use of H_2 via electrolysis, which has O_2 as a by-product.	Cu, Zn, Pb, Si ++
CC(U)S	Due to relative low level of GHG emissions compared to e.g. steel, chemicals and cement not priority for non-ferrous metals but can be linked to other sectors when technology is ready. Can become important for silicon and alloys production.	Will depend on capture, transport and storage technology and infrastructure developed by other larger industries.	Ferro-alloys, Si, Zn, Cu ++
Higher metals recovery (residues, slag and scrap)	New technologies (mostly hydrometallurgical but also new pyro) can enable recovery of high amount of metals (incl. precious and rare) from waste and secondary streams. Important potential for improvements. Greenhouse gas impact can be limited (over-all) but important environmental and economic co-benefits possible.	Further R&D support needed including scaling up to pilot and demonstration stage. Can be regulatory conflict with regulations on waste and hazardous materials.	Cu, Zn, Ferro-alloys, Ni, Pb Alunina +++
Sector coupling: demand response and waste heat	Important potential by non-ferrous metals for increased demand response services. Waste heat recovery by e.g. buildings sector can help reduce emissions there	Market conditions need to be favourable. More variable load profiles cannot be punished with higher grid tariffs.	Al, Cu, Zn, Ni, Pb, Si, Ferro-alloys +++

Increased circularity will help to mitigate lifecycle CO2

EU is already a world circularity leader



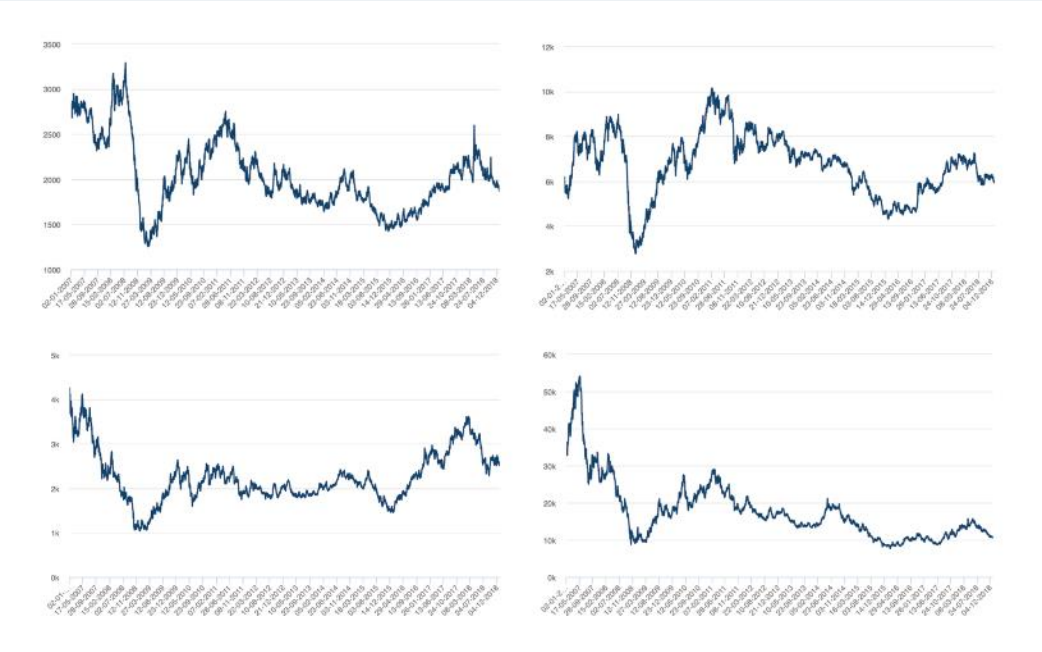
+ EU base metal scrap volumes will almost double by 2050



E-waste *Vehicles* *Scrap*

+ High potential for improving recycling rates in key applications

The ‘bellwether’ non-ferrous metals industry will also be the first to face specific challenges

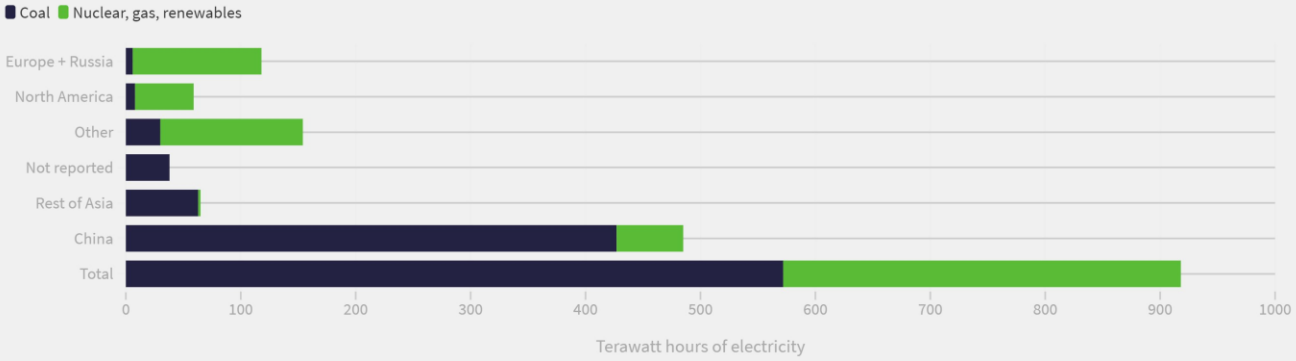


Evolution of global price for aluminium, copper, zinc, and nickel

- *Metals prices are set globally by the London Metals Exchange*
- *Industry has high sensitivity to electricity prices and costs*
- *Unfair trade (china subsidies)*
- *Regulatory misalignment (energy/CO_2 vs circularity)*

Aluminium electrolysis is reliant on coal-fired electricity

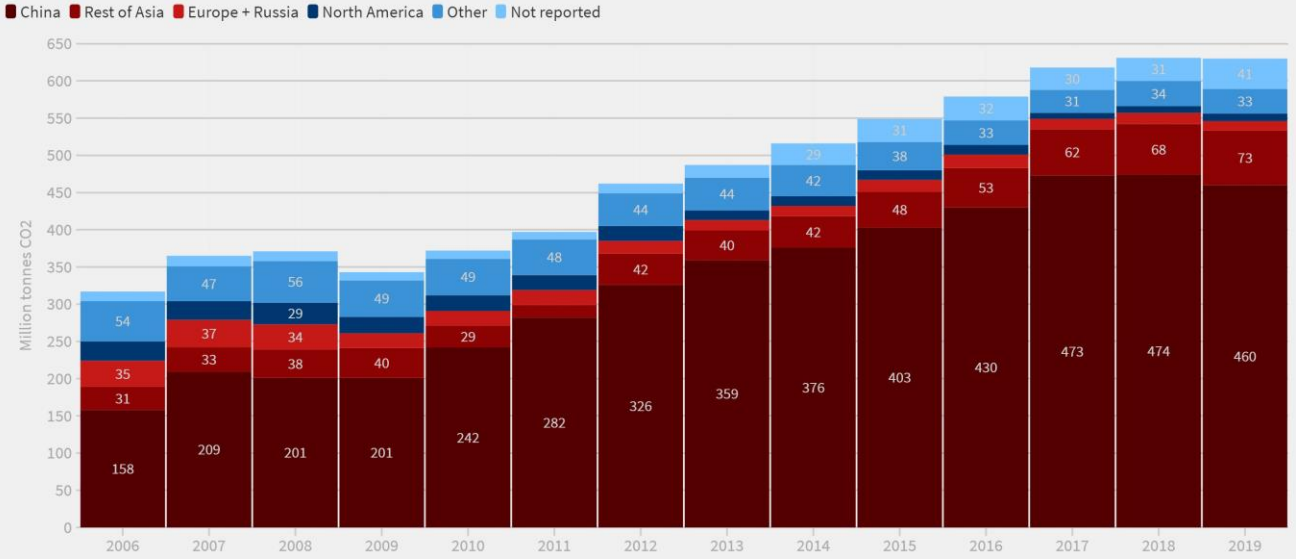
Electricity used in aluminium electrolysis



Source: Ember analysis of data from International Aluminium Institute

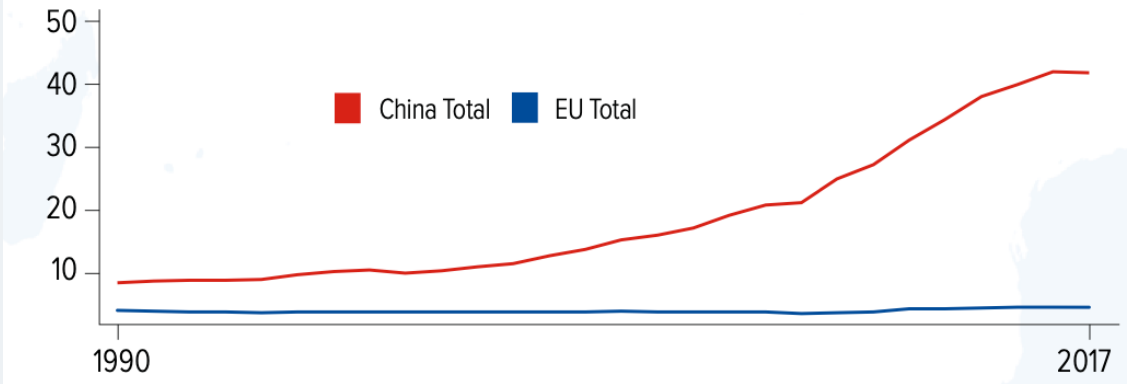
China, aluminium and coal

CO2 emissions from coal-fired electricity used in aluminium electrolysis

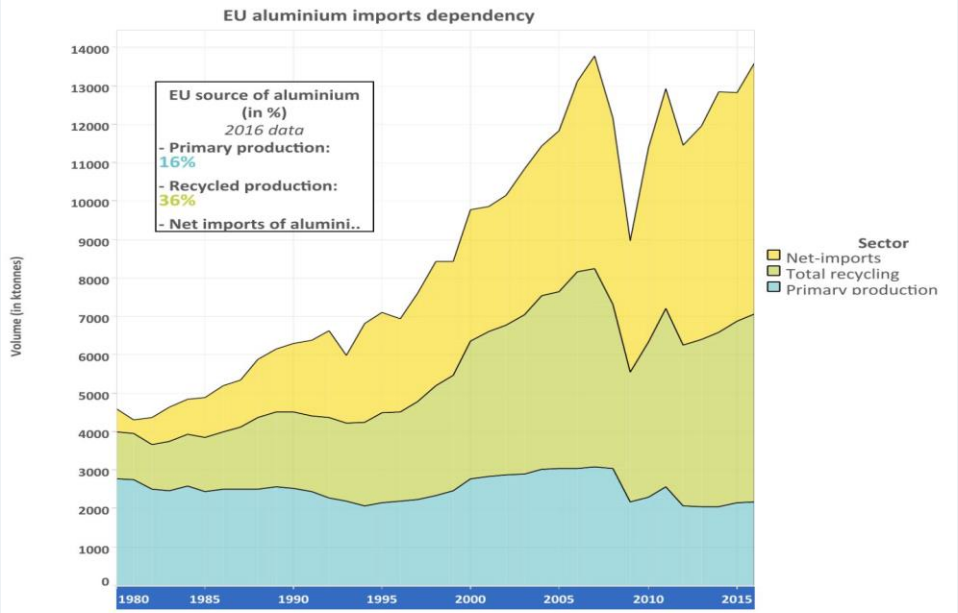


Source: Ember analysis of data from International Aluminium Institute

Production of Non-Ferrous Metals, EU vs China (Millions of tonnes)



Source: British Geological Survey

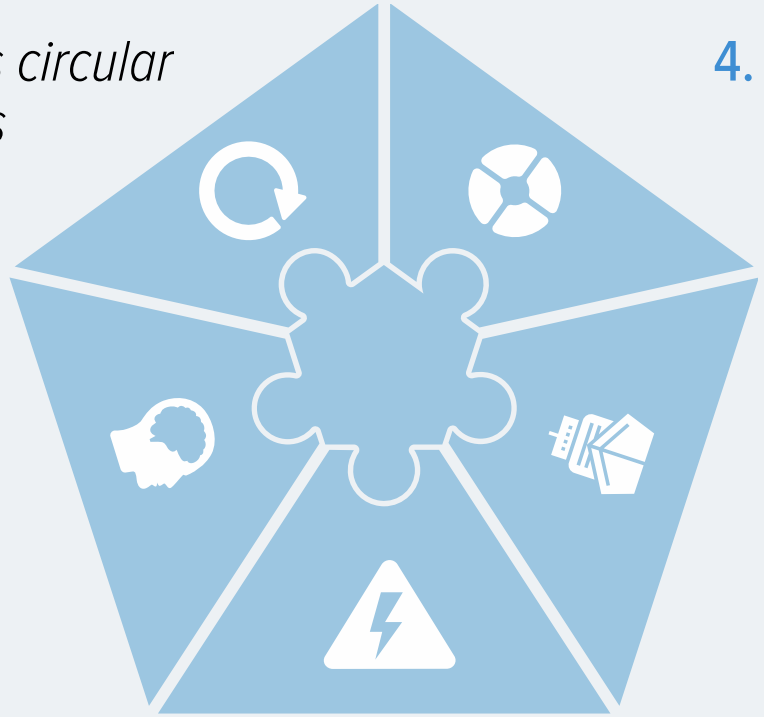


Source: European Aluminium Statistics
EU 15 data until 1999, EU25 data for 2000-2004 and EU27 data for 2005-2015

A five-part Industrial Strategy is needed to grow Europe's metals ecosystem alongside EU 2050 climate-neutral strategy

3. *Pursue ambitious circular economy policies*

4. *Nurture value chains & industrial symbiosis*



2. *Mobilise climate innovation & investments*

5. *Be assertive with trade & competition policies*

1. *Unlock competitively priced carbon-free electricity*

Addendum: New EU action plan on critical raw materials (Sept. 2020)

The Action Plan on Critical Raw Materials is aimed to:

1. Develop resilient value chains for EU industrial ecosystems;
2. Reduce dependency on primary critical raw materials through circular use of re-sources, sustainable products and innovation;
3. Strengthen domestic sourcing of raw materials in the EU;
4. Diversify sourcing from third countries and remove distortions to international trade, fully respecting the EU's international obligations.

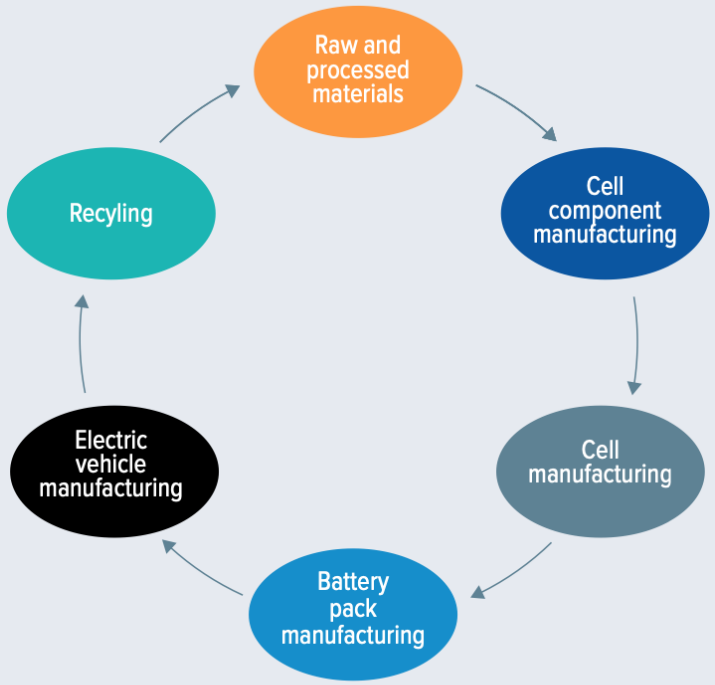
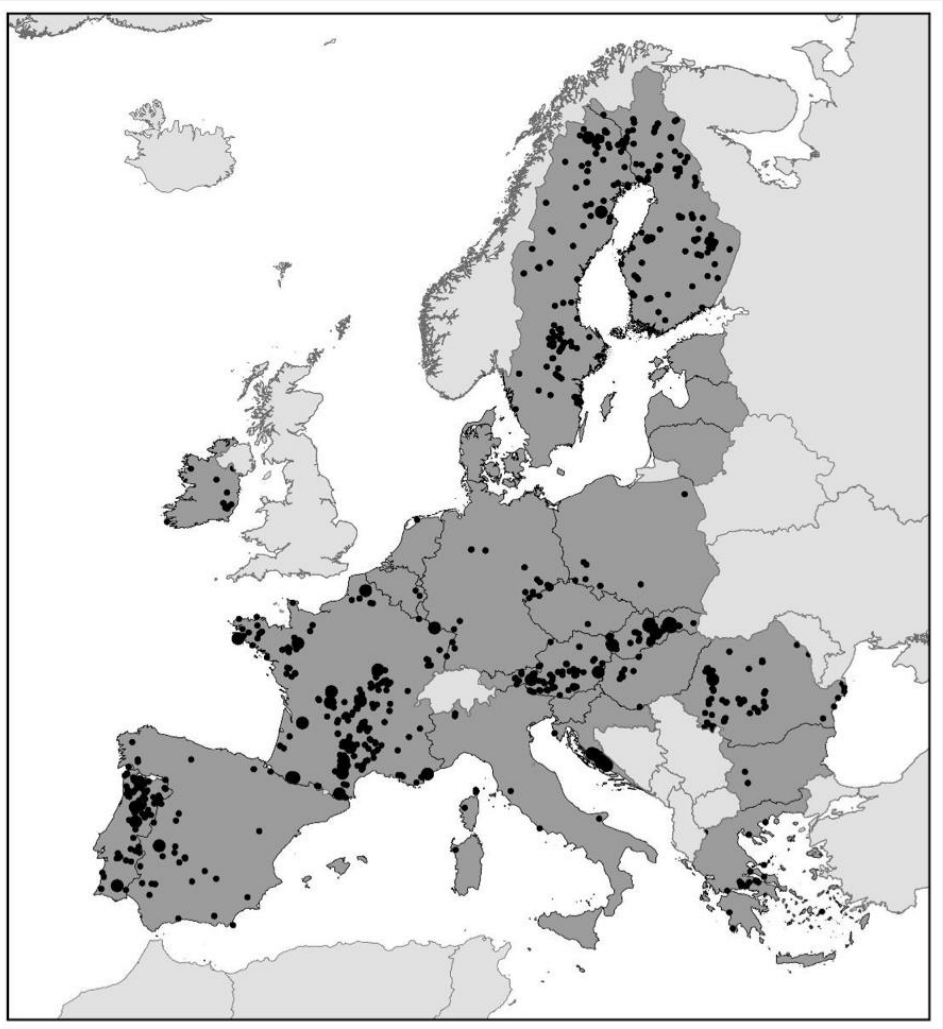


Figure 13: EU Battery Alliance Action Plan [69]

10 Actions in EU action plan



Critical raw materials potential in the EU (Source: European Commission – Geosurveys)

1. Launch an industry-driven European Raw Materials Alliance
2. Develop sustainable financing criteria for the mining, extractive and processing sectors
3. Launch critical raw materials research and innovation on waste processing, advanced materials and substitution
4. Map the potential supply of secondary critical raw materials from EU stocks and wastes and identify viable recovery projects
5. Identify mining and processing projects and investment needs and related financing opportunities for critical raw materials in the EU that can be operational by 2025,
6. Develop expertise and skills in mining, extraction and processing technologies
7. Deploy Earth-observation programmes and remote sensing for resource exploration, operations and post-closure environmental management
8. Develop Horizon Europe R&I projects on processes for exploitation and processing of critical raw materials to reduce environmental impacts
9. Develop strategic international partnerships and associated funding to secure a diversified and sustainable supply of critical raw materials
10. Promote responsible mining practices for critical raw materials through the EU regulatory framework and relevant international cooperation

You can download the full report here!

bit.ly/metals2050