REWIMET

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Abb:: Fotolia

# An Overview Of Metal Recycling In Germany: Challenges And Opportunities


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Federal Ministry for Economic Affairs and Climate Action

The Federal Institute for Geosciences and Natural Resources is the central geoscientific authority providing advice to the German Federal Government in all geo-relevant questions. It is subordinate to the Federal Ministry for Economic Affairs and Climate Action (BMWK).

# Agenda

- DERA‘s monitoring of primary and secondary raw materials
- Status quo of metal recycling in Germany – an overview of infrastructure and processes
- Key action tasks for improved recycling (preliminary results)
- Key messages: future opportunities and challenges of metal recycling

# Mineral raw materials monitoring of DERA@BGR


Study Raw Materials for emerging technologies
**>200 technologies**
-
**Demand by industrialisation**

DERA Raw Material List
**60 commodities &**
**200 semi finished products**
-
**ROSYS**

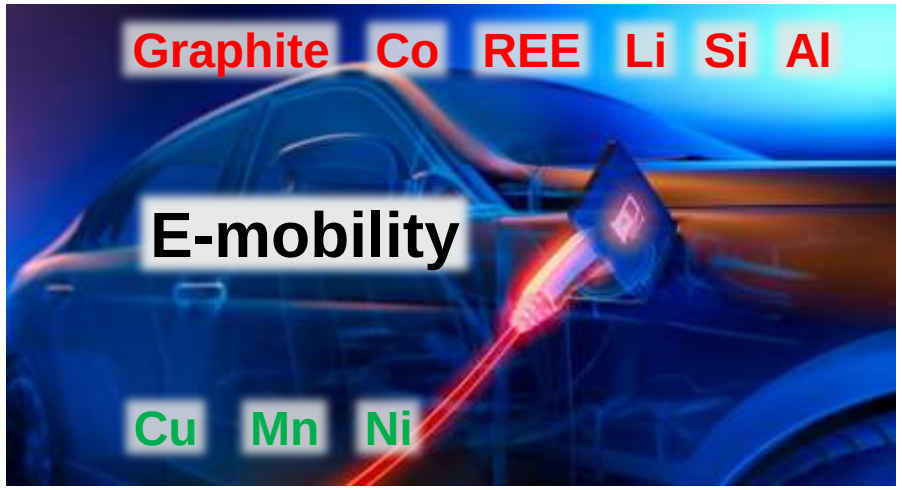
Price Monitor
-
**100 Price-specifications (primary, secondary raw materials)**

Risk Assessment
**Supply scenario**
**Demand scenario**

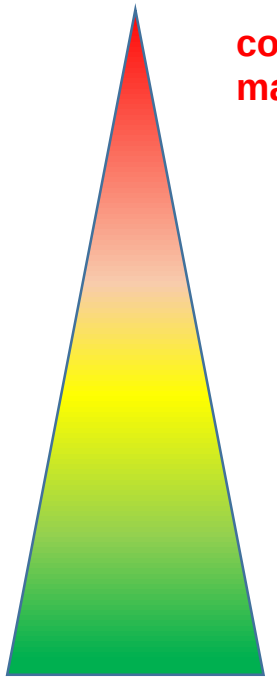
DERA advisory services for a sustainable and secure raw material supply

Conferences / Industry Workshops / Networking

# Impact of transition on raw material demand







concentrated markets, high HHI

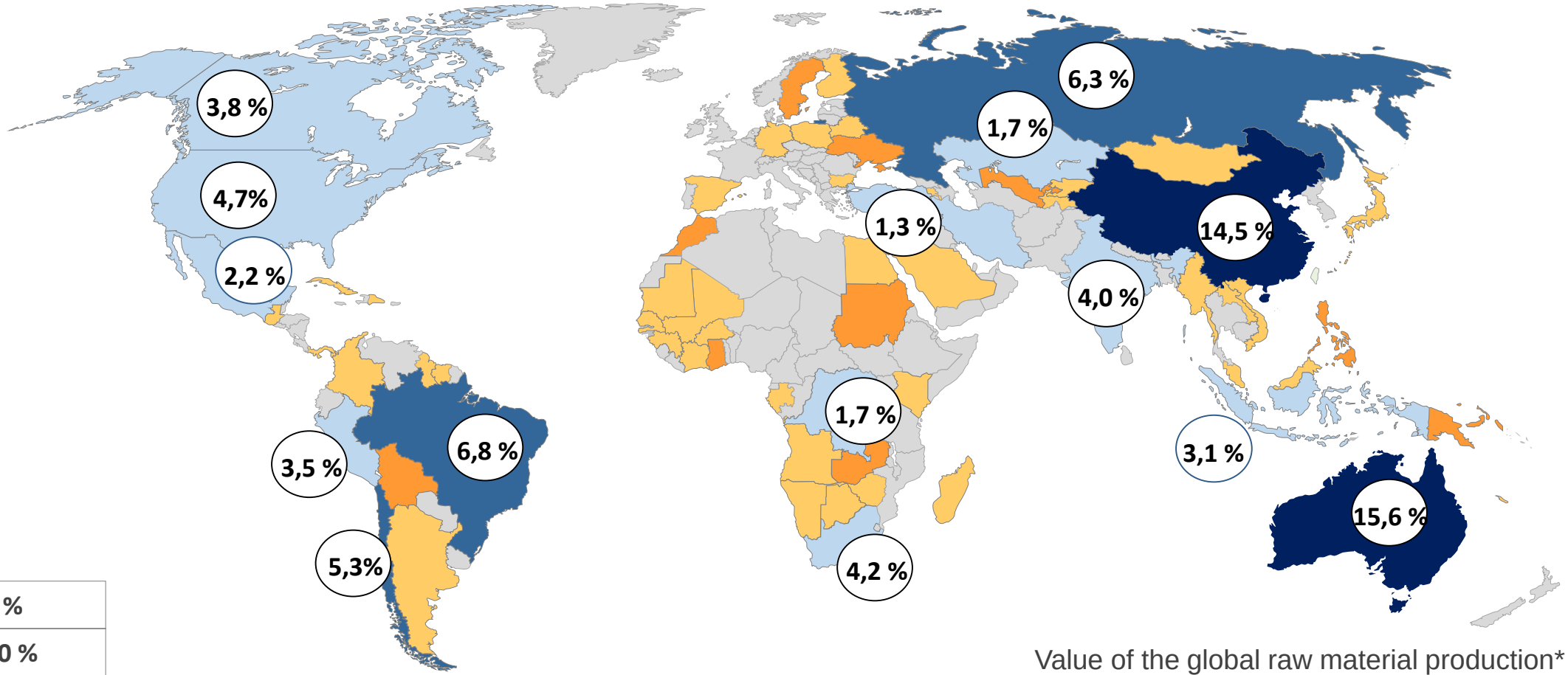
less concentrated markets, low HHI

→ dependence on metals
→ few countries/ concentrated markets



Abb. Fotolia; iStock

# Most important mining countries (by value)




**Production**

| |
|---|
| > 10 % |
| 5 - 10 % |
| 1 - 5 % |
| 0,5 - 1 % |
| 0,1 - 0,5 % |

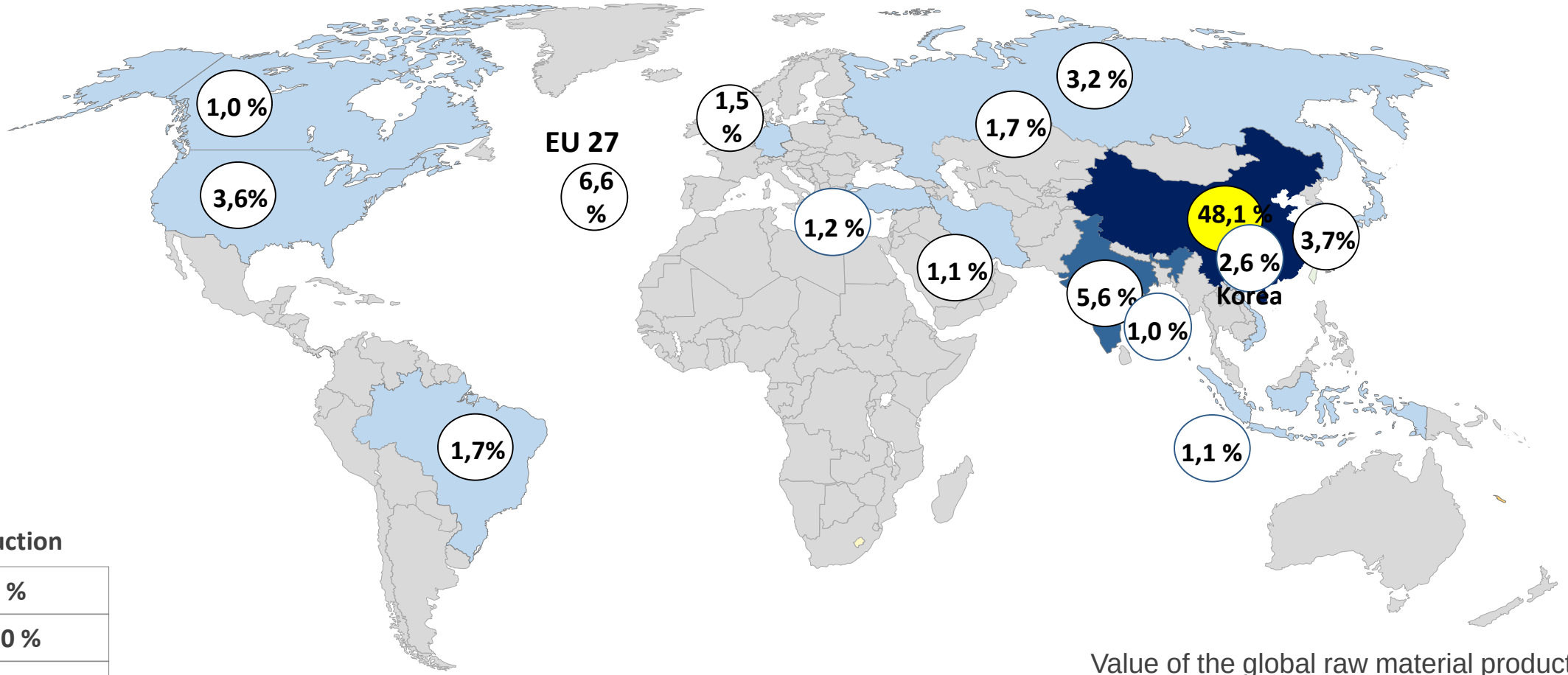
→ **15 countries cover ~ 80 % of global mineral raw material production**

Value of the global raw material production* (mine production) **773 Bn US$** (2019)

*Metals, industrial minerals, diamonds, phosphate, potassium

Source: BGR database, Drobe 2021

# Most important refining countries (by value)




**Production**

| |
|---|
| > 10 % |
| 5 - 10 % |
| 1 - 5 % |
| 0,5 - 1 % |
| 0,1 - 0,5 % |

→ **China dominates with almost 50 %**

Value of the global raw material production (refined production) **2.075 Mrd. US$ (**2019)

Metals, ferroalloys, cement

Source: BGR database, Drobe 2021

# Metals – German Dependencies

## German mineral raw materials imports in 2021 by value:

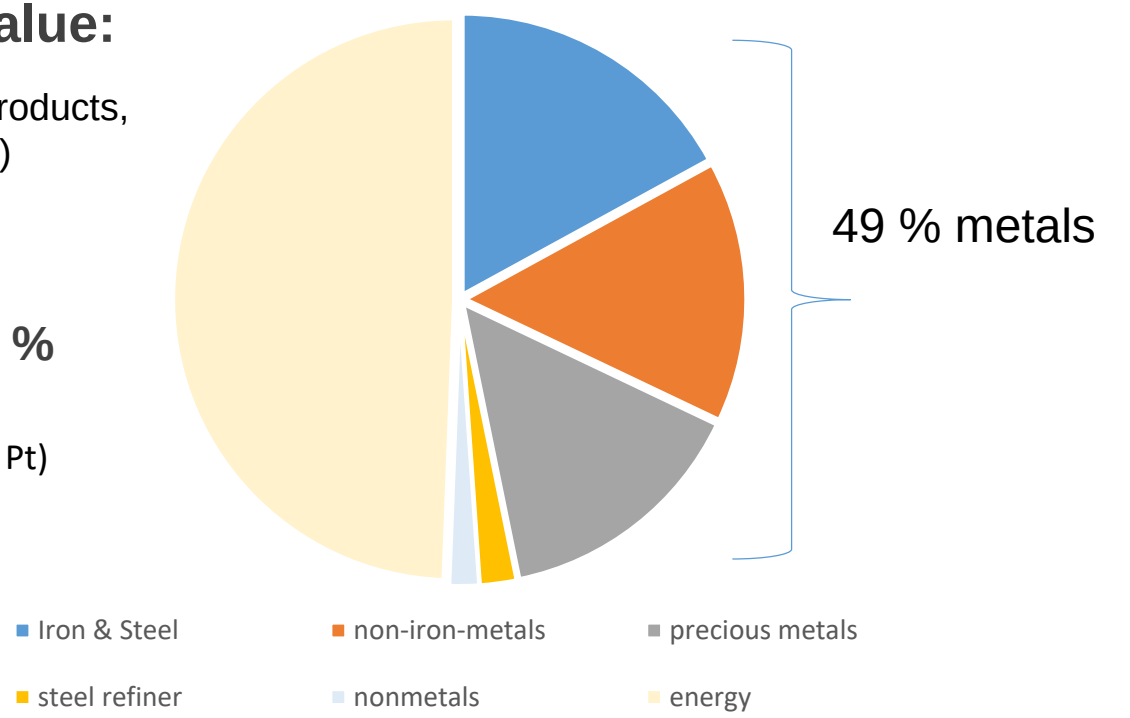
**€ 211.2 bn**

(ores, concentrates, semi-finished products, fossil fuels, petro-chemical products)

**Import dependency for metal ores and concentrates: 100 %**

**Recycling value: approx. €38 bn** (Al, Cu, Fe, Mg. Ni, Pb, Sn, Zn, Ag, Au, Pt)

**shares of import value**




Data: BGR 2022

→ **Secure raw material sourcing is crucial for the competitiveness of the German economy**

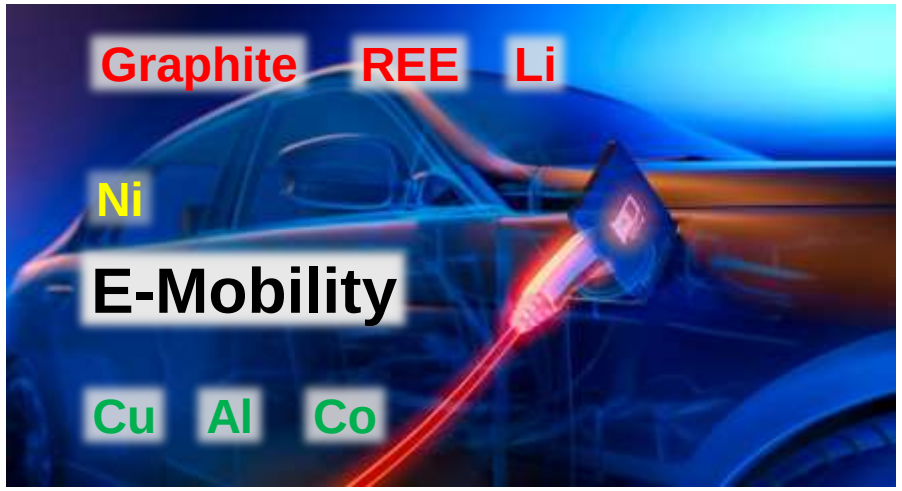
→ **Recycling can reduce import dependencies (but cannot replace primary raw materials yet)**

# The pillars of the German supply of raw materials

The three major pillars of commodity supply in Germany at present are:

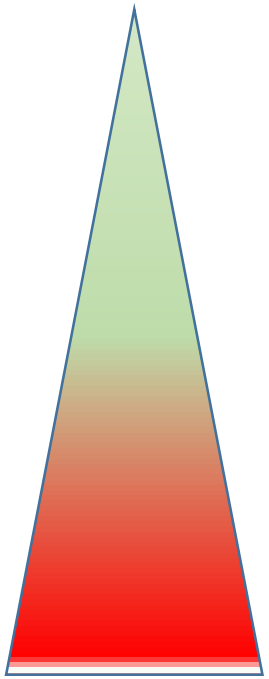
- Use of domestically sourced primary raw materials
- Commodity imports
- Use of secondary raw materials from recycling

# Transition also requires more recycling …and better data





**RIR (Ger)**



**> 40 %:**
- Cu, Al, Fe
- Pb, Pt, Au

**< 1 %:**
SEE, Ga, Ge, In, Ta, Te, Graphit

**No data (Ger):**
Li, Cr, Mo, Mn, Zn, Co, Sn, Si, Mg

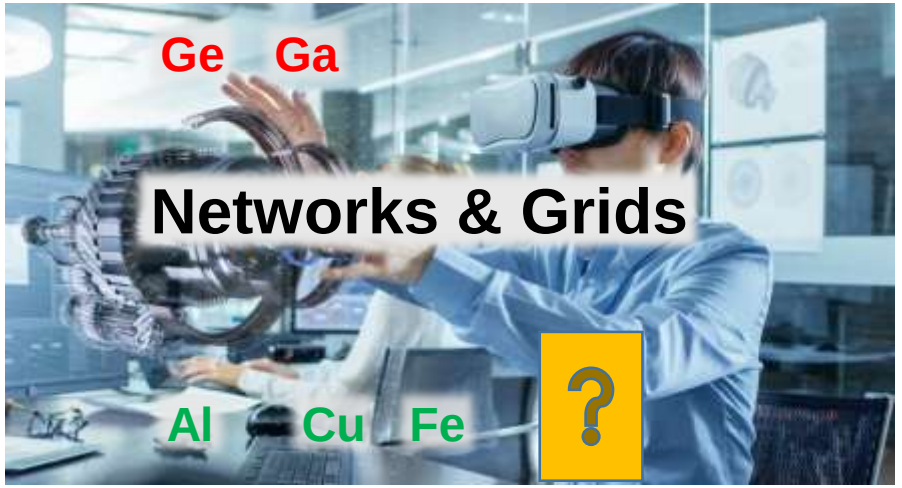




Abb. Fotolia; iStock

# Barriers for Recycling (metals)

“At least 20 % of the EU's annual consumption for recycling”

(EU Critical Raw Materials Act, 2023)

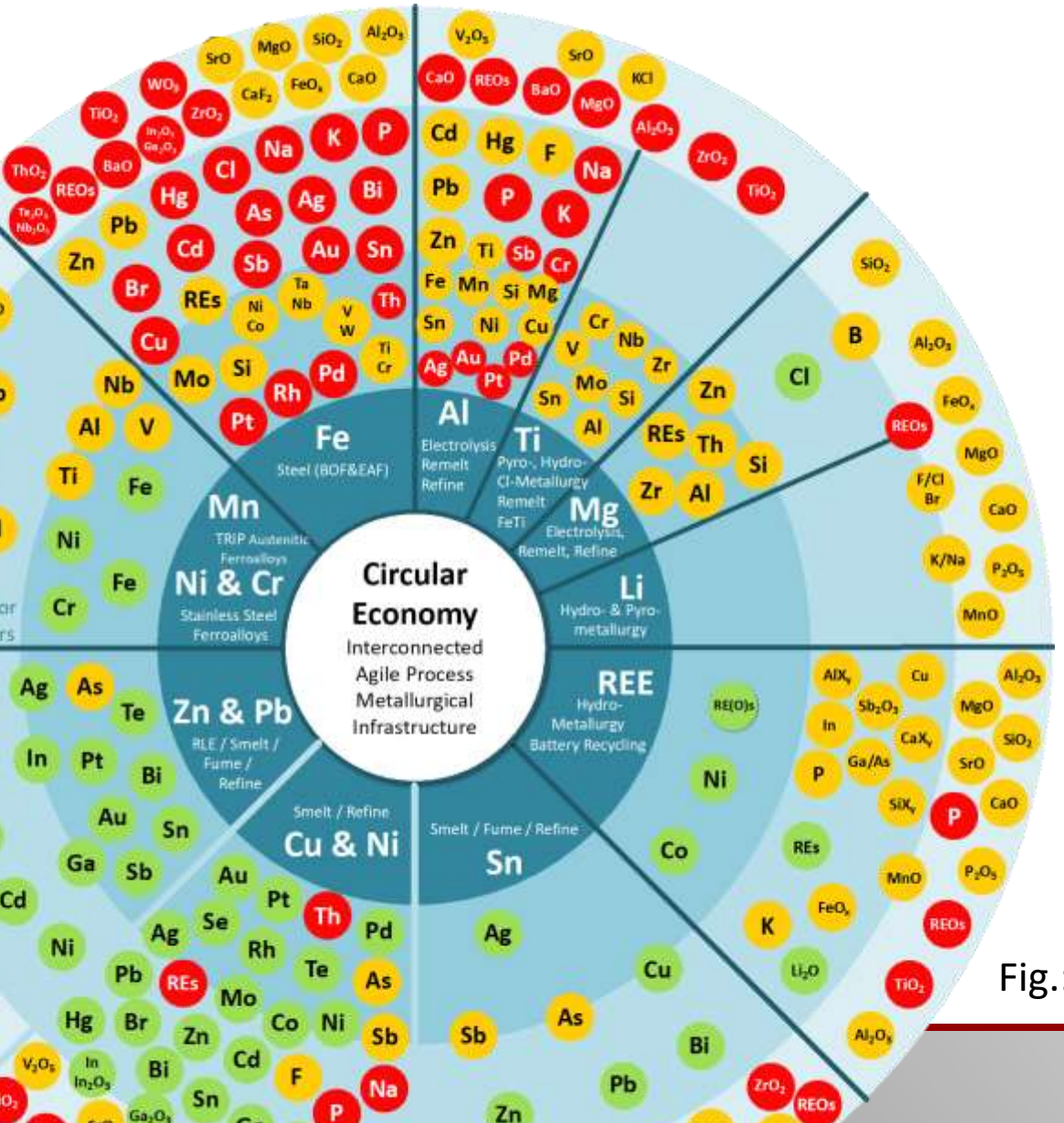
→ Planning new recycling processing plant requires

time, permitting and public acceptance

→Recycling has to be economically viable, considering

- price volatilites
- predictable, constant input flows
- infrastructure and transport (collection, consumer awareness)
- market demand/customer for the material

# Limitations for Recycling




Physical limits of Closed-Loop Recycling

- Imperfect material separation and liberation
- Physical limits / Thermodynamics /Entropie
- Economic/ ecologic considerations

Fig.: Reuter at el, 2019

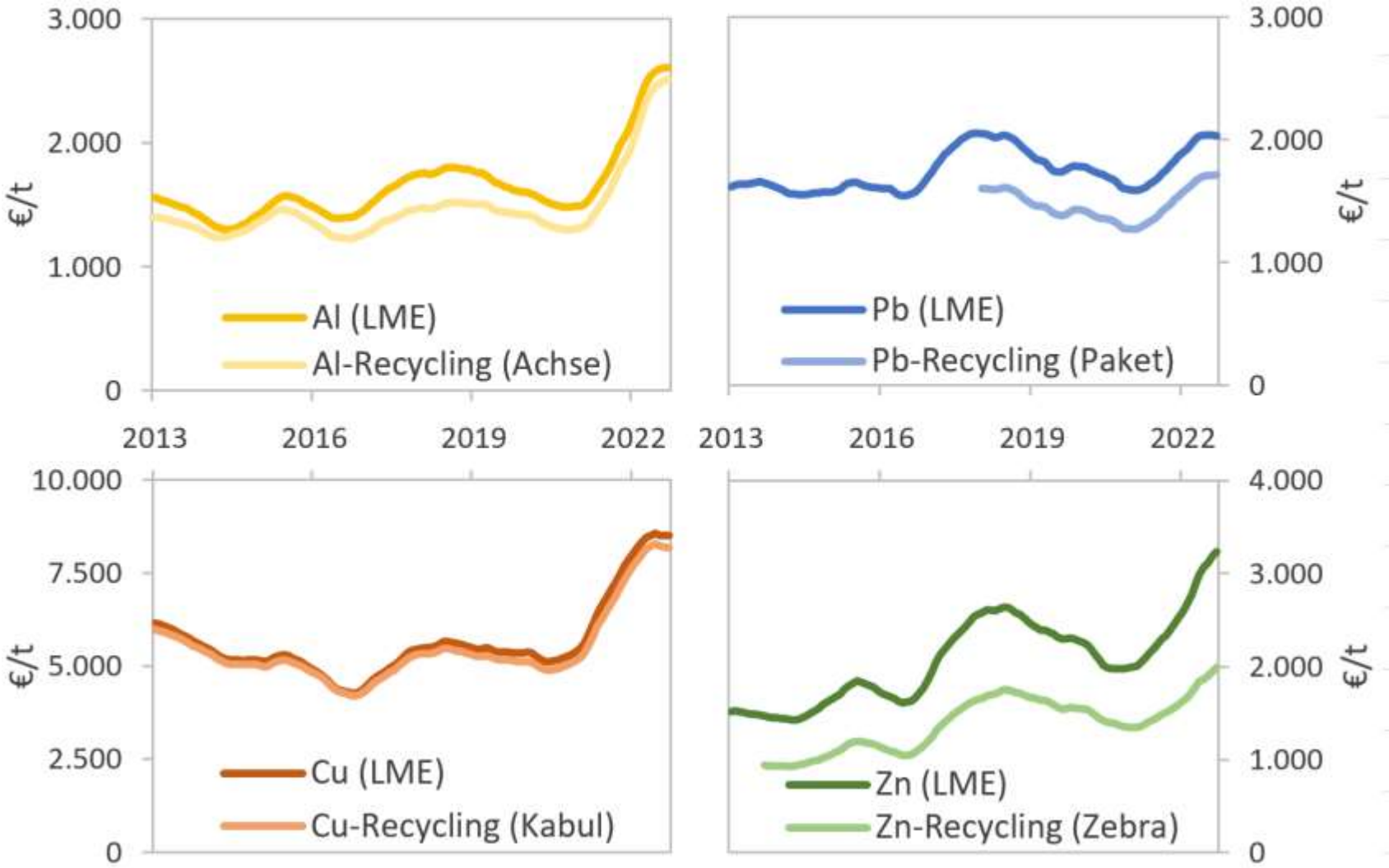
# Reasons for Status Quo

→ Historical grown industry for base metals (Cu, Al, Fe, ..)

→ Legislative focus on mass rather than quality

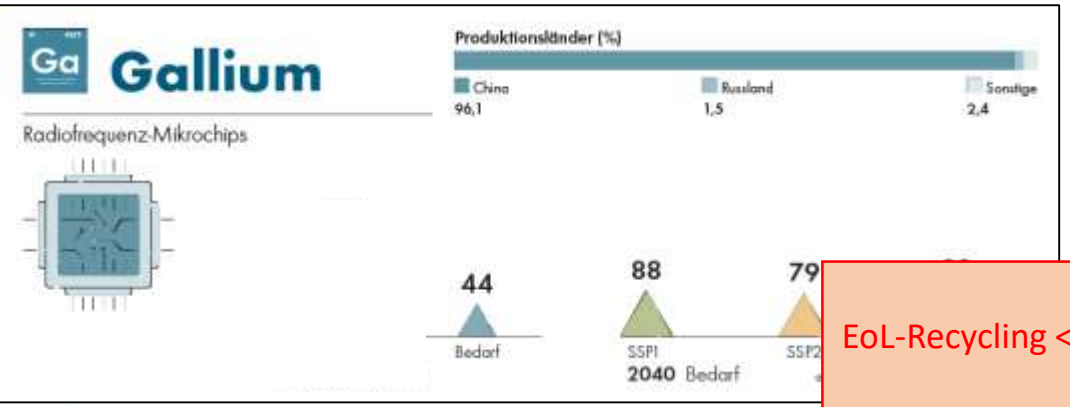
→ New processes complicated to implement (requires planning security, mass flows, infrastructure and logistics, permitting, acceptance, time, …)

# Recycling has to be economically viable…

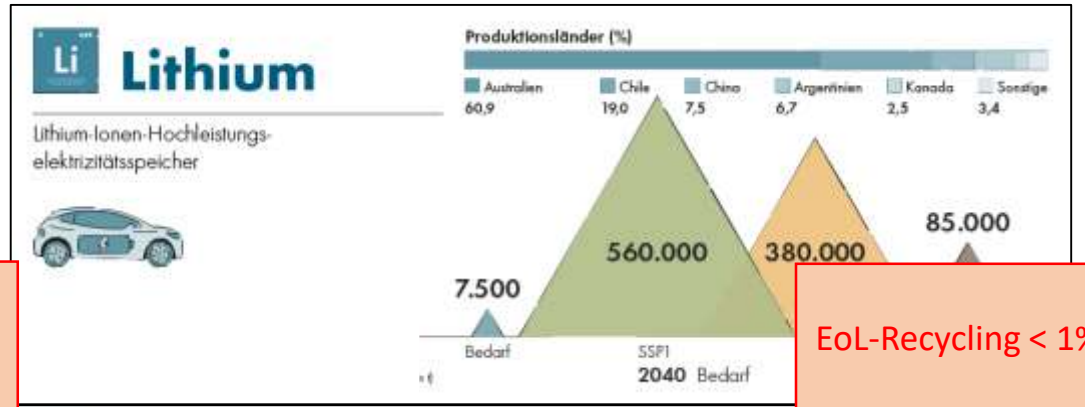



Interdependence of prices for primary and secondary raw materials

# …or strategic: **Emerging and key technologies – demand and recycling**




EoL-Recycling < 1%

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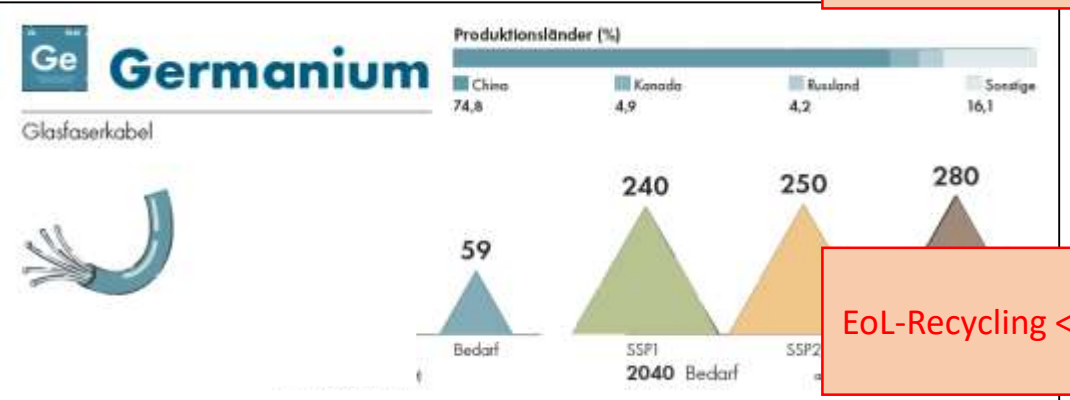


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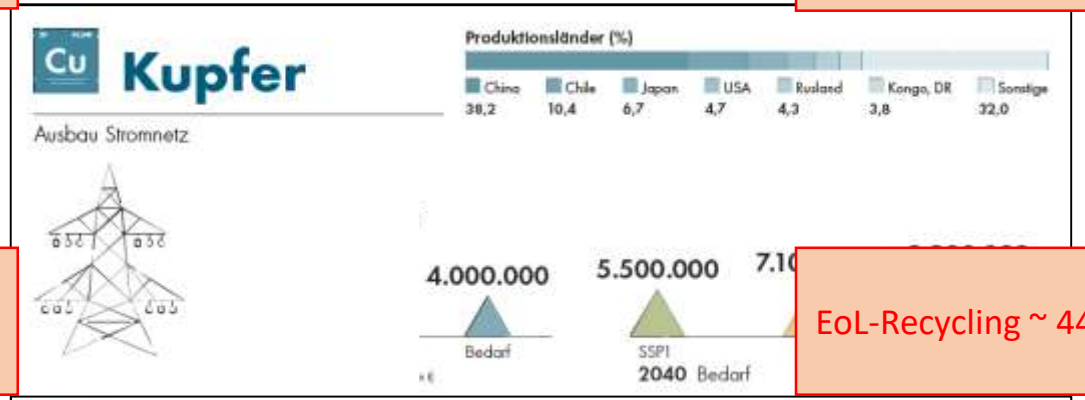
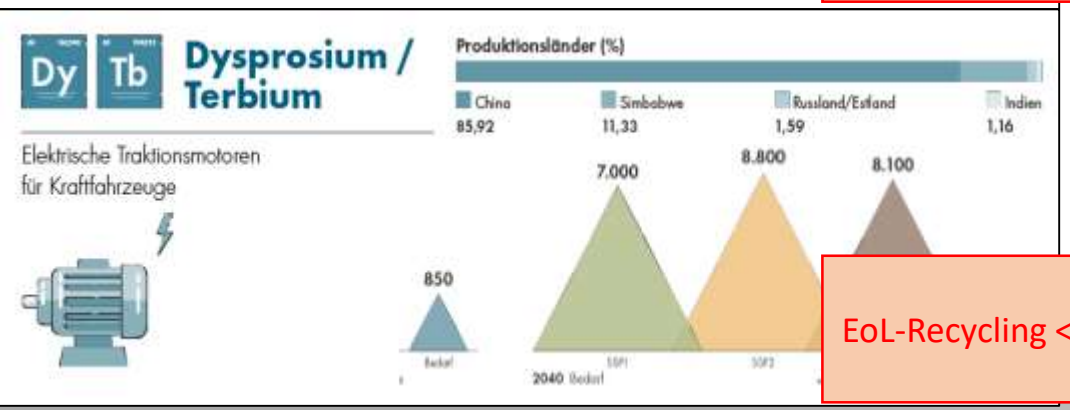



EoL-Recycling ~ 44 %

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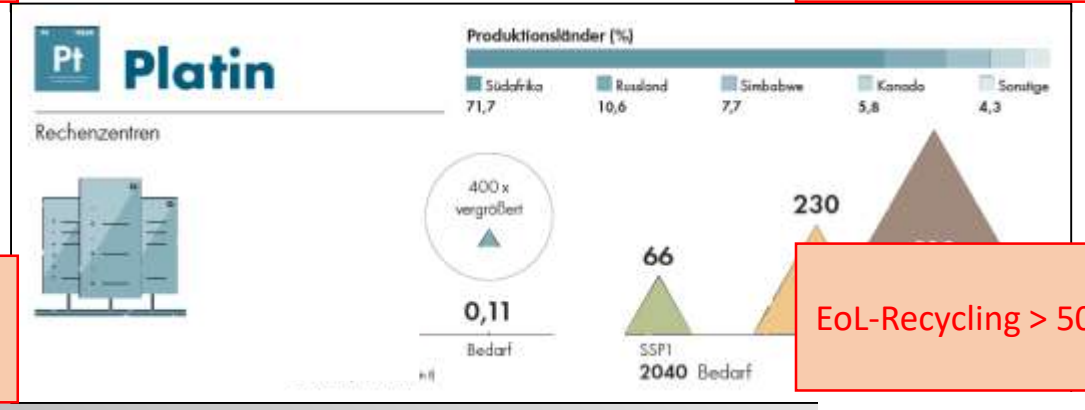



EoL-Recycling > 50 %

DERA 2021: Raw materials for future technologies

# DERA Multi-Stakeholder Dialogue for Optimized Recycling

Dialogplattform Recyclingrohstoffe

**Head office**

**Coordination and scientific support**

DERA Deutsche Rohstoffagentur
Bundesanstalt für Geowissenschaften und Rohstoffe

acatech
DEUTSCHE AKADEMIE DER TECHNIKWISSENSCHAFTEN

**Arbeitskreise**
superordinate topics

Metals

Industrial minerals

**Unterarbeitskreise**
Issues related to specific material flows and specific case studies

- Iron and steel
- Copper
- Constr.mat.
- Gypsum
- Tech.metals
- Aluminium
- Ind. residues
- Ceramics

**Quality assurance**
External processes

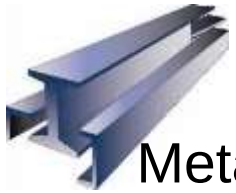
**1x per year Round table**

Consultation process with external experts (administration, science, NGOs,..)

**Reviewprocess**

External reviewers evaluate options for action at the end of the dialog process

# Bariers and Obstacles (current status)



## Metals

- Product design for recycling
- Mandatory uniform standards for collection, separation and sorting
- Legislation promoting recycling
- Data: transparency of material flows
- Standard terms and definitions

## Industrial minerals

- Revise legislation for the circular economy to prioritise the recovery of raw materials (end of waste)
- (Legal certainty that) preference is … secondary raw materials
- Classification of second… for digital records and a…
- Segregation of waste flows… deconstruction

19. Oct 2023
In Berlin

# Status Quo of Metal Recycling in Germany (metal processing and refining only!)

**Data base for refineries, smelters and producers**

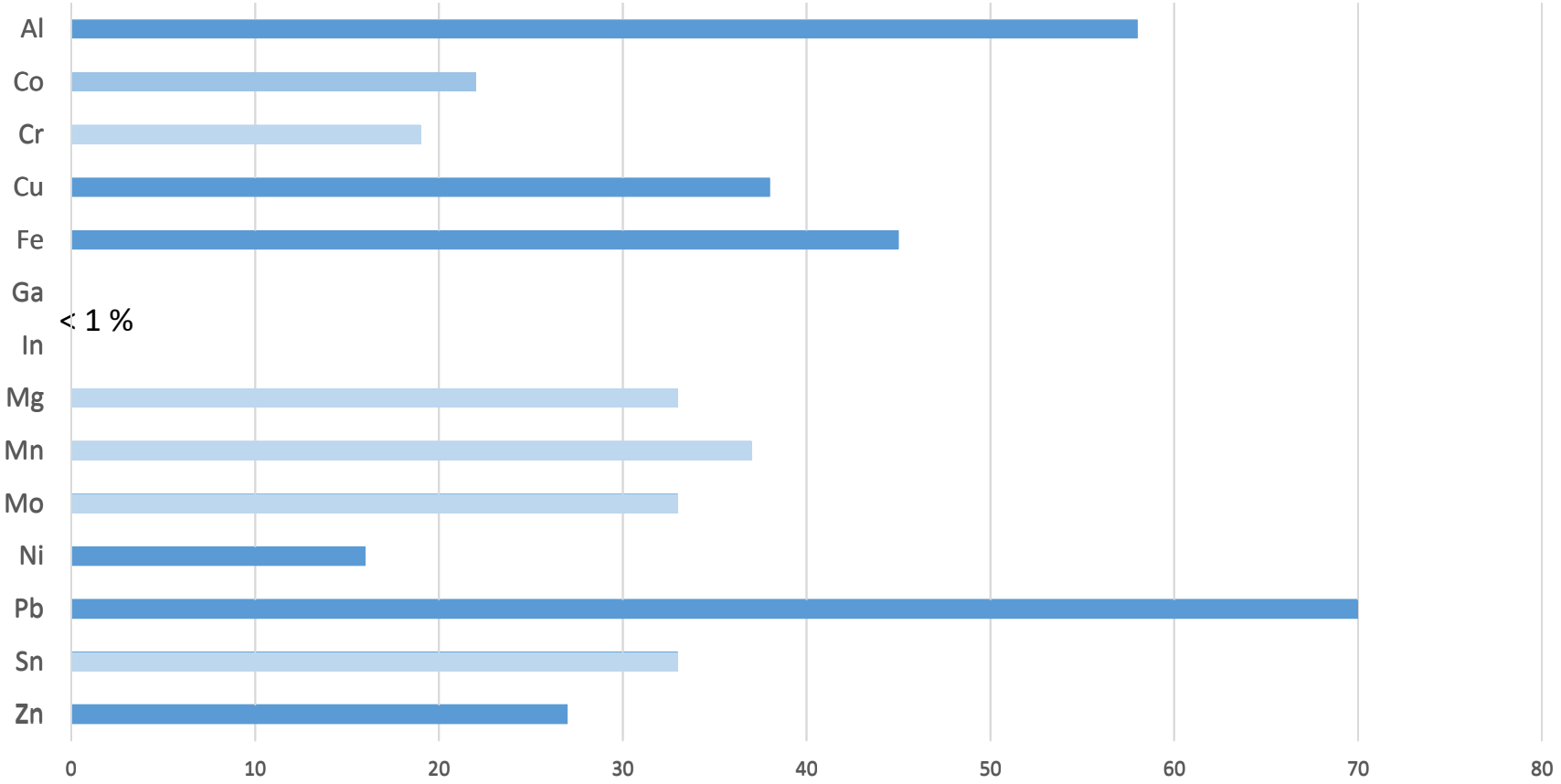
Status quo of metal production in Germany for secondary metals



→ Fact sheets, short study and interactive map display

# Status Quo of Metal Recycling in Germany (preliminary study results)

## Recycling rates (RIR) in Germany for 14 metals




global: Sn, Mo, Mn, Mg, Cr
EU: Co

# Status Quo of Metal Recycling in Germany (preliminary study results)

| Element (group) | Number of companies | Number of employees* | Total capacities** [t/a] |
|---|---|---|---|
| Aluminium | 28 | 11,289 | 4,024,412 |
| Lead | 18 | 17,568 | 551,000 |
| Iron/steel | 160 | 12,0129 | 50,225,270 |
| Copper | 19 | 12,080 | 2,857,500 |
| Magnesium | 4 | 4,108 | 25,492 |
| Multi-metal | 15 | 4,300 | 874,200 |
| Multi-metal battery | 15 | 9,349 | 130,800 |
| Nickel | 6 | 6,460 | 323,000 |
| Zinc | 11 | 2,650 | 1,157,900 |
| Tin | 14 | 1,450 | 12,730 |
| *Total**** | *290* | *189,383* | *60,182,304* |

* * Employees at the sites (not only in recycling)
** Capacity for recycling wherever possible, otherwise general metal output
*** Incl. double counts for companies with multiple elements/element groups

# Status Quo of Metal Recycling in Germany (metal processing and refining only!)

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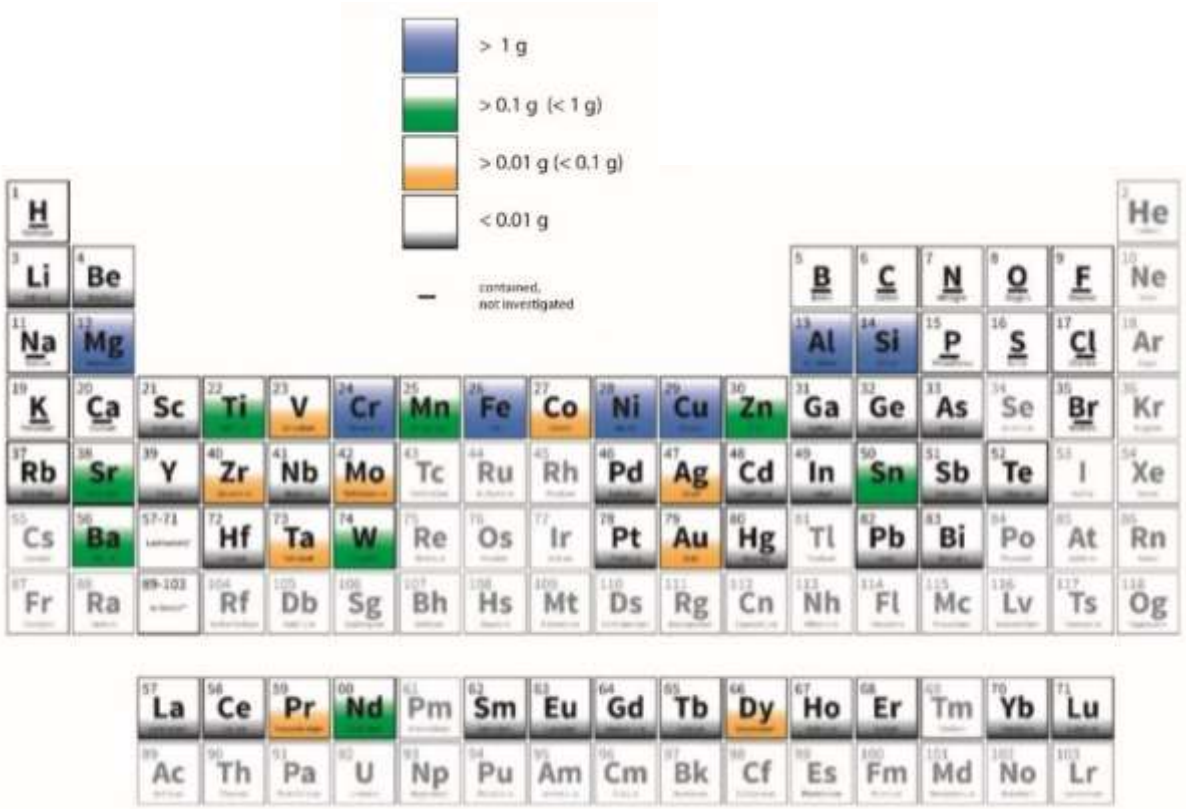
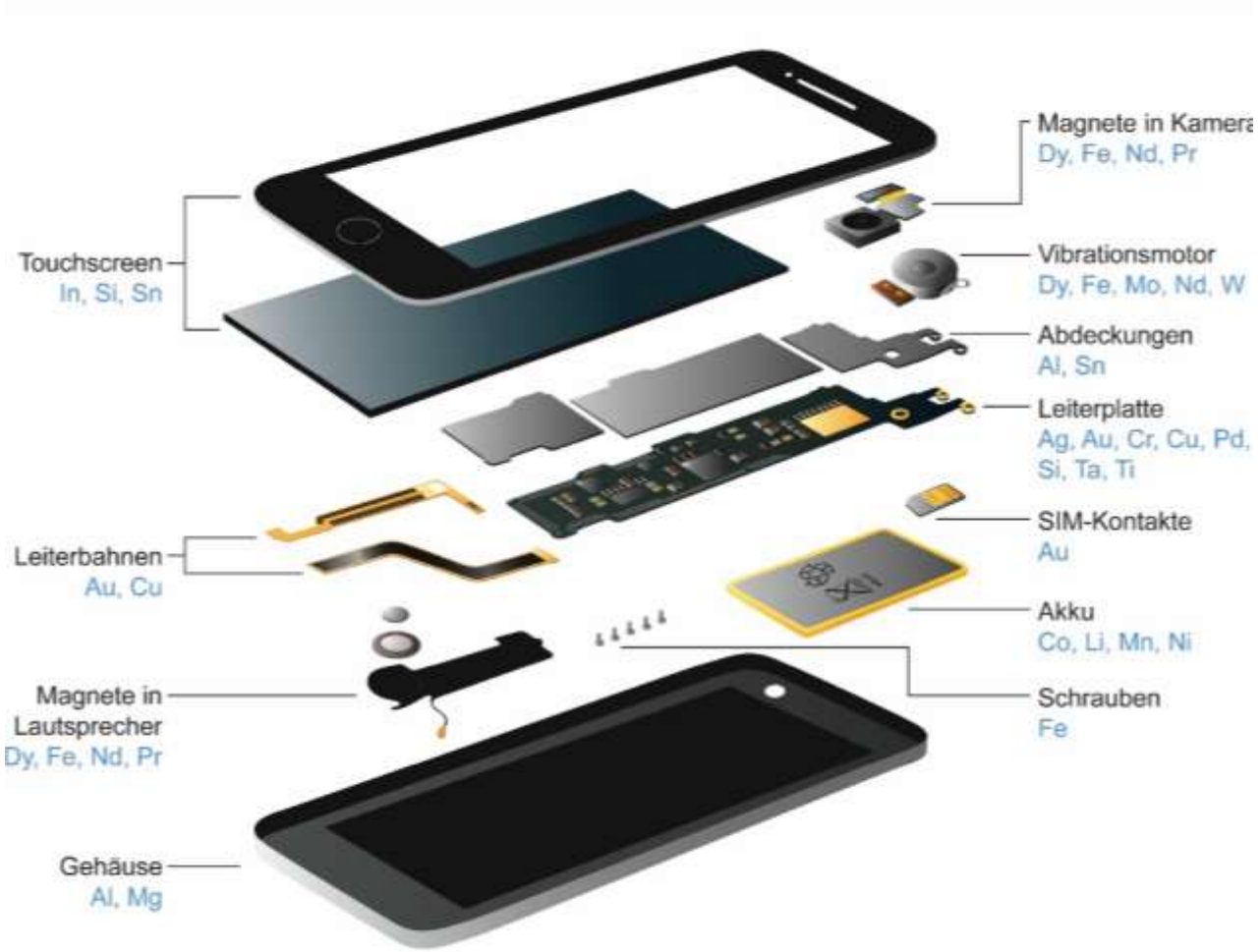
Status quo of metal production in Germany for secondary metals



→ Fact sheets, short study and interactive map display

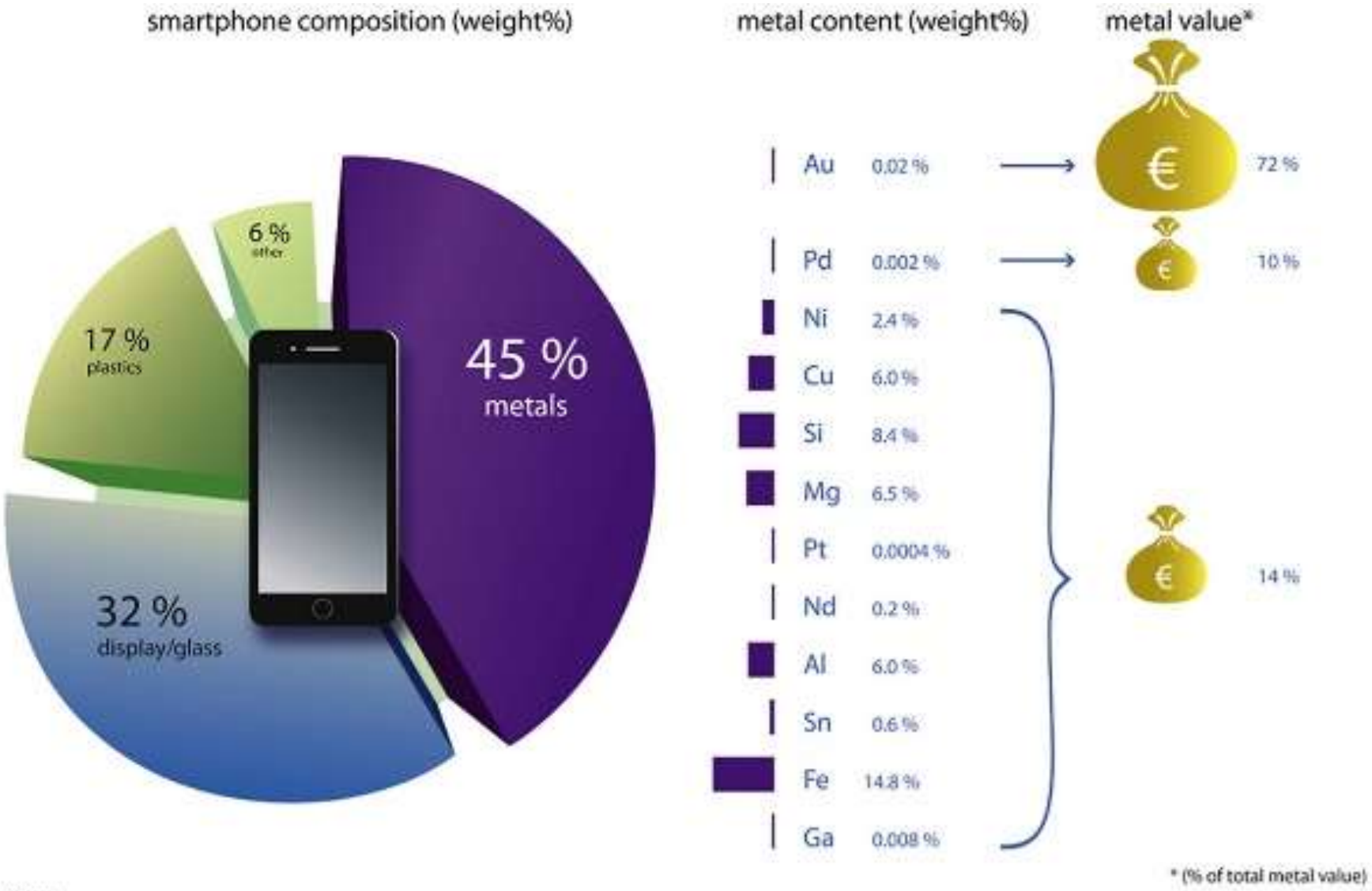
# Design for Recyling - Example Smartphone




DERA 2021

# Design for Recyling - Example Smartphone




- Only **5-6** metals of the 56 metals used are recycled **
- But together they account for **95 % of the** metal value

* in % of the metal value total: €1.11
** in most recycling facilities

Bookhagen et al., 2020

# Conclusion

- Recycling cannot (yet) replace primary mining

  → they should not be pitted against each other, **we need both**
- There is no 100 % recycling
- Existing production must be preserved, need to further develop recycling and circular economy
- Regulations promoting recycling are necessary to support the circular economy (design for circularity)
- Databases must be improved

Thank you for your attention

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