



# Battery & non-ferrous metals value chain

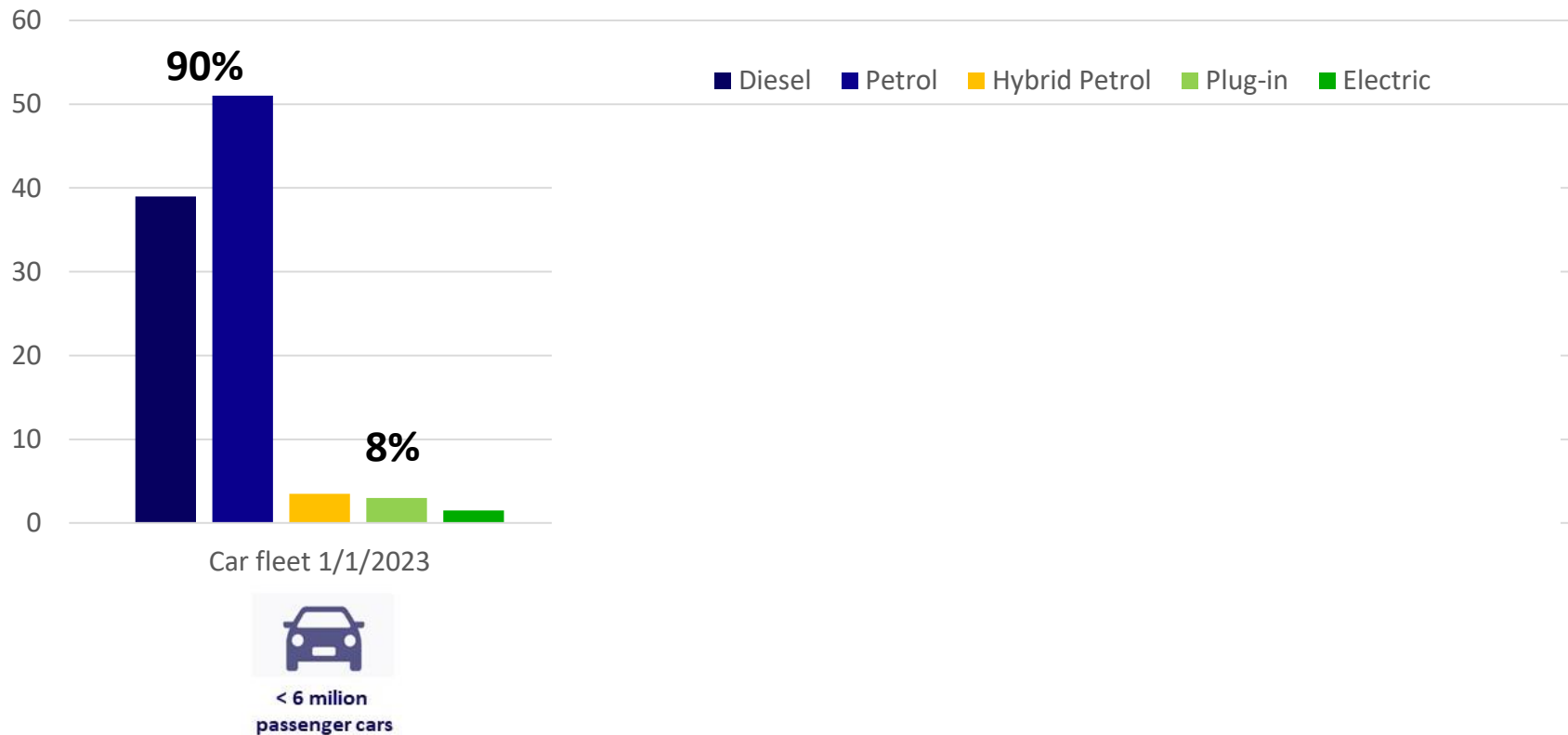
Belgian vision

FRDO – forum 30/5/2023

Embracing technology  
Embracing ambition

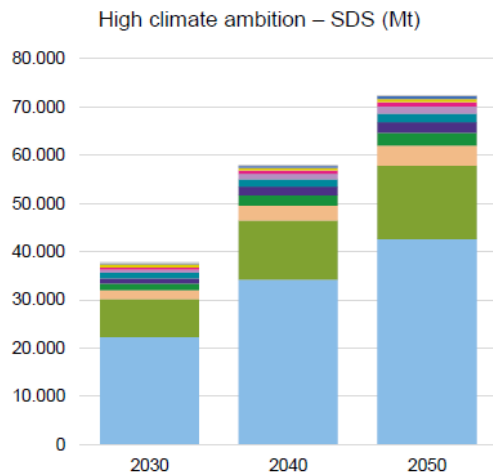
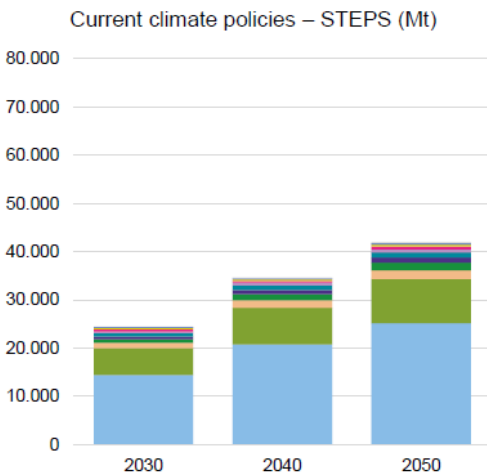
**.AGORIA**

# Decarbonization of car fleet in Belgium is happening now!



# Energy transition = commodity transition

Total metal demand by commodity in a STEPS and SDS scenario respectively (Mt)

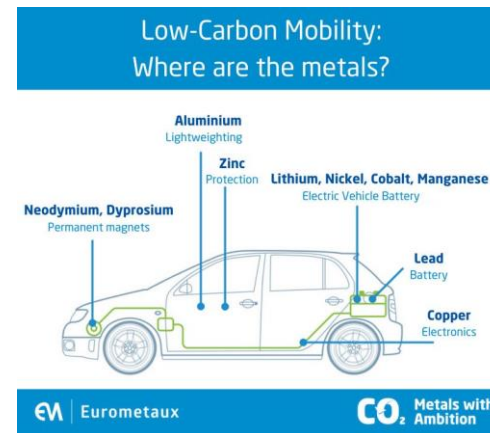


2050 Metals demand  
Current climate policy

**45 Mt**

2050 Metals demand  
Ambitious climate policy

**75 Mt**



# Massive increase in demand by 2050 for different materials



## Base metals

**Al**

Aluminium

**+33%**

**Cu**

Copper

**+35%**

**Si**

Silicon

**+50%**

**+ Zinc**

Top transition uses:



EVs



Solar



Electricity networks



## Battery materials

**Ni**

Nickel

**+103%**

**Co**

Cobalt

**+331%**

**Li**

Lithium

**+3,500%**

**+ Manganese & Graphite**

Top transition uses:



EVs



Battery storage



## Rare earths

**Pr**

Praseodymium

**+587%**

**Dy**

Dysprosium

**+827%**

**Nd**

Neodymium

**+2,666%**

Top transition uses:



EVs



Wind

# Mind the gap in a sustainable way !

**Li** **Lithium**  
+ 3 Mt global demand in 2030

**A**

Today's global  
supply

+

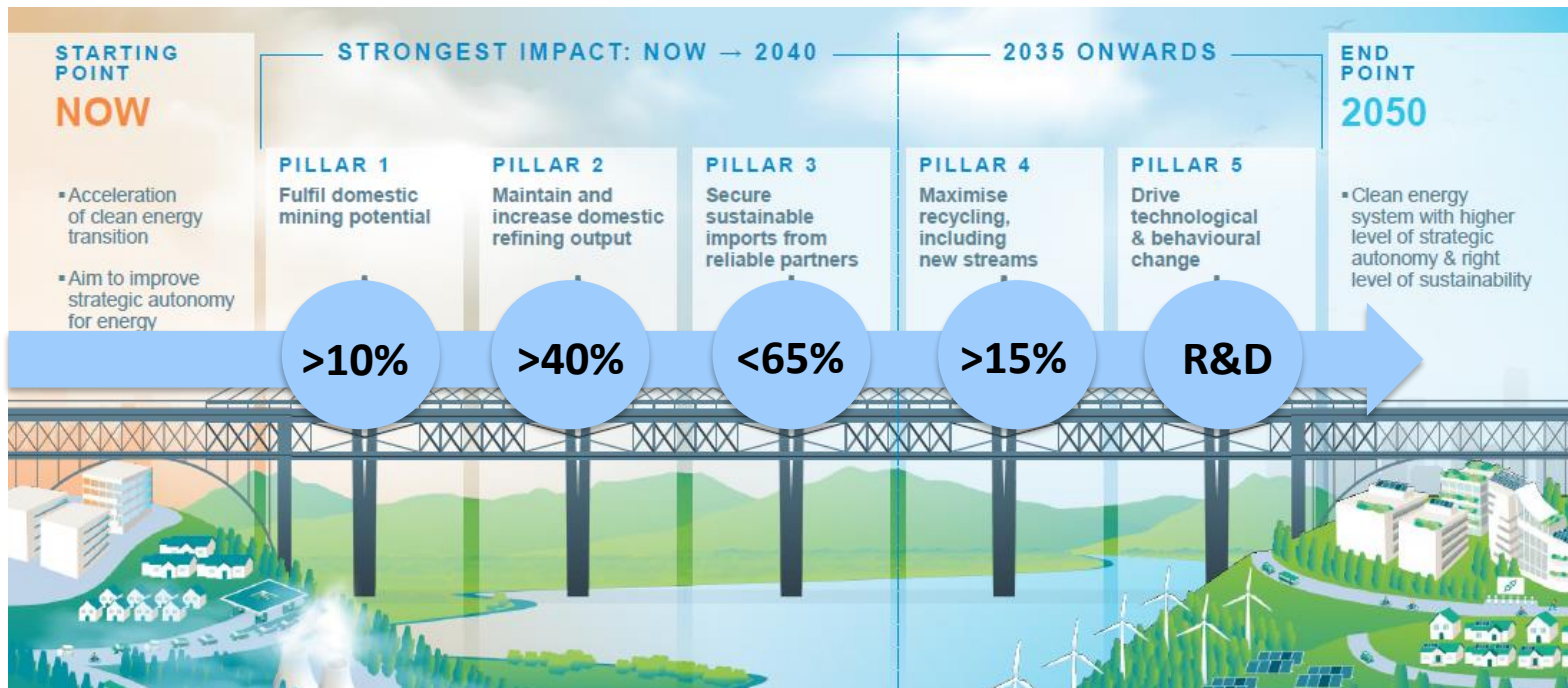
**B**

All projects announced  
in the world  
*(even unlikely projects)*

→ **37%  
Shortfall**

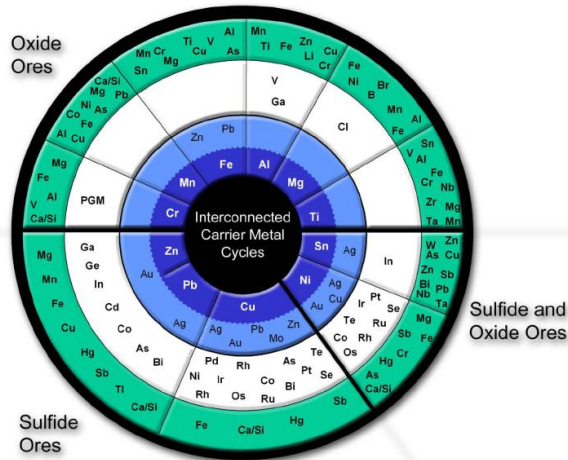
(2.3 Mt of max. supply)

# Five pillars approach to bridge the gap

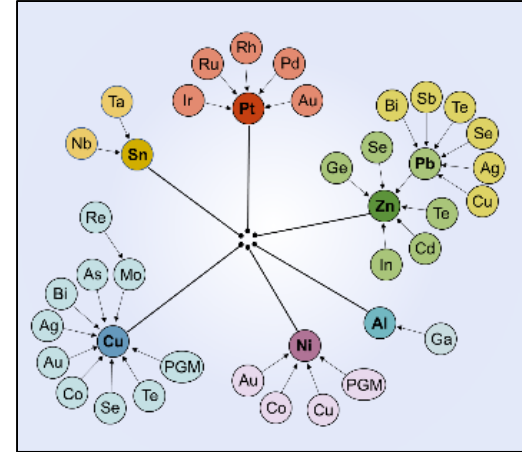
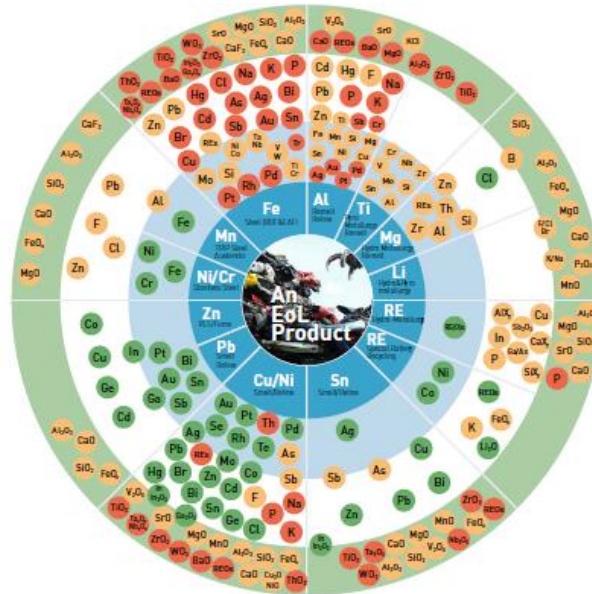


# Specificity of non-ferrous metals

- Metals are interconnected in nature & recycling
  - Complex by-products from primary & secondary materials are carriers of critical & strategic materials



- Carrier metals. Bulk metals, generally of lower value
- Co-elements that also have considerable own production infrastructure. Mostly highly valuable, high-tech metals e.g. essential in electronics
- Co-elements that end up in residues, or as emissions. Costly because of waste management or end-of-pipe measures.

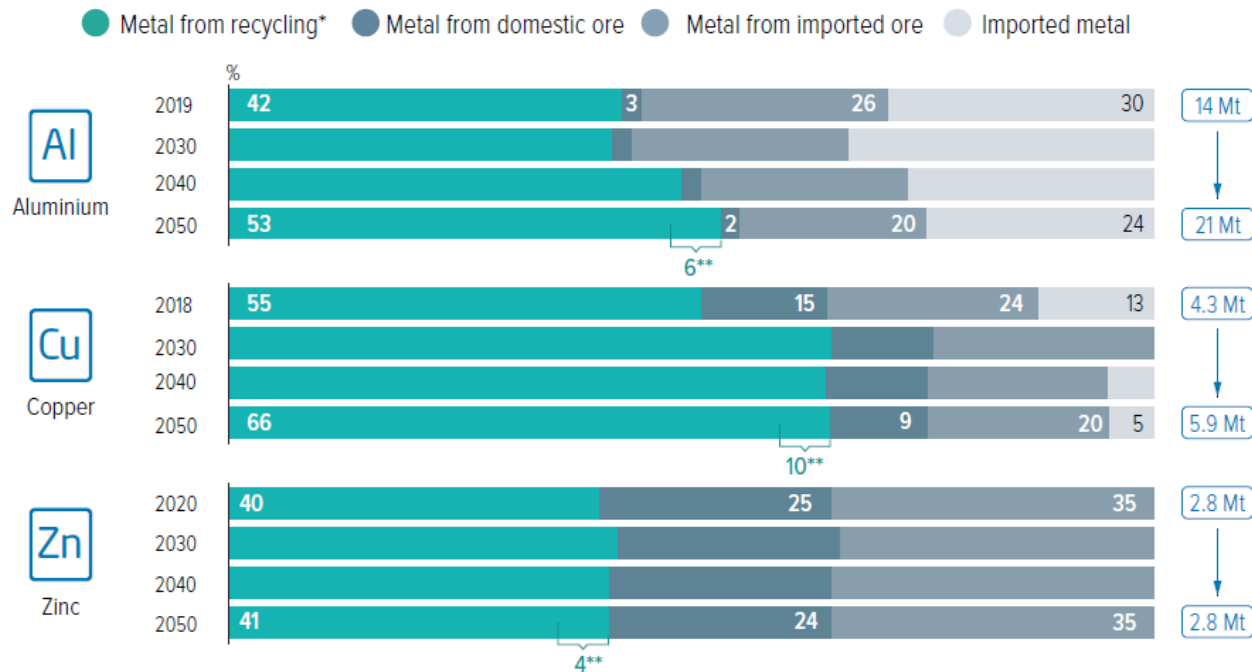


- Essential Carrier Metals: Primary Product**  
Metallurgy is Backbone (primary and recycling). The metallurgy infrastructure makes a "closed" system and recycling possible.
- Mainly Recovered Element** Compatible with Carrier Metal as alloying Element or that can be recovered in subsequent Processing.
- Mainly Element in Alloy or Compound in Oxidic Product, probably Lost** With possible functionality, not detrimental to Carrier Metal or product (if refractory metals as acidic in EoL product then to slag/slag also intermediate product for cement etc.).
- Mainly Element Lost, not always compatible with Carrier Metal or Product** Detrimental to properties and cannot be economically recovered from e.g. slag unless e.g. iron is a collector and goes to further processing.

- Mainly to Dust, Slime, Spiege, Slag (Mainly to Slurry)** Collector of valuable minor elements as oxides etc. and mainly recovered in appropriate infrastructure if economic (EoL material and emissions also affect this).
- Design Low Value Products** Low value but inevitable e.g. materials processing. A sink for metals and system as oxides and other compounds. Comply with environmental legislation.

# What is the outlook on base metals?

Base metals: recycling is already well established & will grow further, primary production will always be needed



**50%**

EU aluminium  
& zinc capacity  
offline in 2023

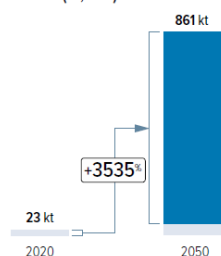




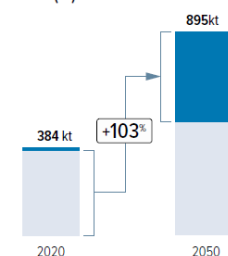
# How to ensure EU's independency of raw materials need?

Special metals – building up of market – recycling kicks in > 2035-2040

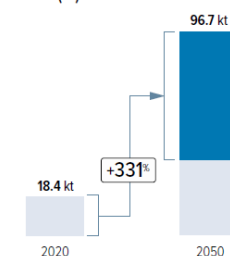
Lithium (kt, LCE)



Nickel (kt)



Cobalt (kt)



Top transition uses (all battery metals):

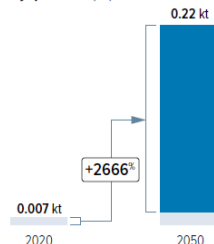


EVs

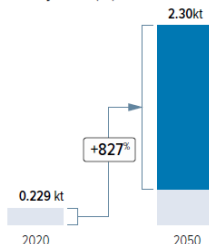


Battery storage

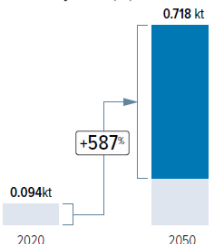
Dysprosium (kt)



Neodymium (kt)



Praseodymium (kt)



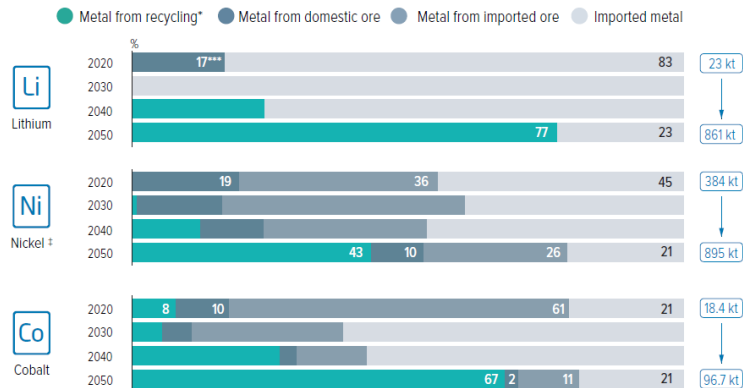
Top transition uses (rare earth elements):



EVs



Wind



\*\*\* This does not represent battery grade lithium, but spodumene destined for the ceramics market  
 † Today nickel is recycled as part of stainless steel but not as pure nickel

Dy Nd Pr  
Rare Earth Elements



\* By 2050 • 208%

excess secondary rare earth elements available in 2050 compared with Europe's current industrial ambitions for permanent magnets.

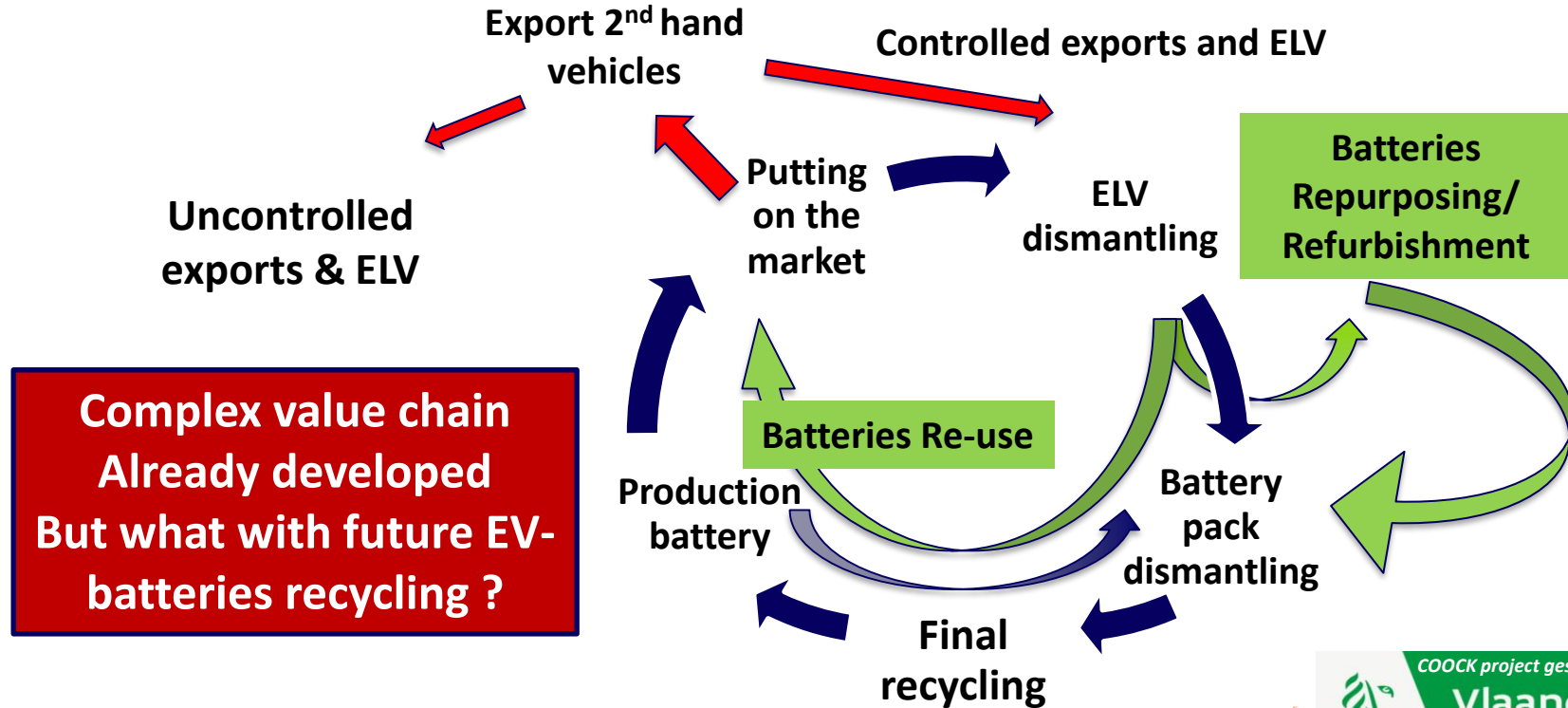
# Some projections to 2030 (incl. uncertain projects)

|  2030 EU supply projection (max) |                       |                           |                          | Diversification               |                                   |
|-------------------------------------------------------------------------------------------------------------------|-----------------------|---------------------------|--------------------------|-------------------------------|-----------------------------------|
|                                                                                                                   | MINING<br>(>10% GOAL) | PROCESSING<br>(>40% GOAL) | RECYCLING<br>(>15% GOAL) | MINING<br>(<65% TOP IMPORTER) | PROCESSING<br>(<65% TOP IMPORTER) |
| <b>Ni</b> Nickel                                                                                                  | 22%                   | 50%                       | 10%*                     | 50% (Canada)                  | 30% (Russia)                      |
| <b>Li</b> Lithium                                                                                                 | 39%                   | 54%                       | 8%*                      | -                             | 55% (Chile)                       |
| <b>Co</b> Cobalt                                                                                                  | 7%                    | 40%                       | 20%*                     | 75% (DRC)                     | 20% (USA)                         |



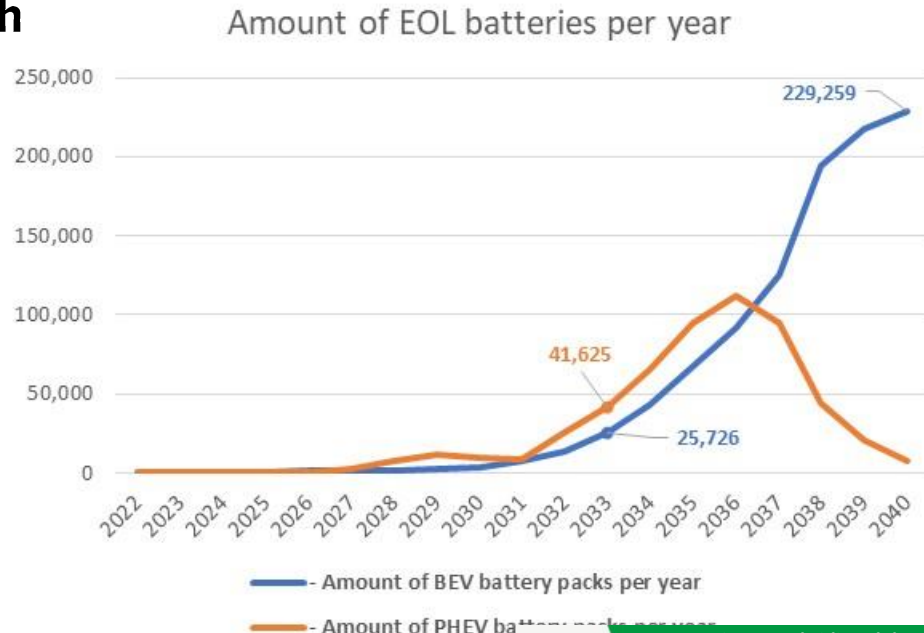
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| <b>Mn</b> Manganese (high purity)                                                                                  | 20%                   | 20%                       | 10%                      | -                             | 90+% (China)                      |
| <b>C</b> Graphite (battery)                                                                                        | 20+%                  | 20%                       | <5%                      |                               | 100% (China)                      |
|  Rare earths                      | 20-80%*               | 20%                       | <5%                      |                               | 99% (China)                       |
| <b>Mg</b> Magnesium                                                                                                | 25%                   | 25%                       | 15%                      |                               | 93% (China)                       |

# RE<sub>2</sub>LIVE – future business model for EV batteries



# Development of business model (Belgium)

- **Overarching business model (excel) with different scenario's**
  - #batteries end-of-life available
  - Amount to 2<sup>nd</sup> life versus recycling
- **Some estimations of costs:**
  - Removal, packaging, transportation
  - Assessment & dismantling
  - Cost & revenues of re-use and 2<sup>nd</sup> life
  - Cost & revenues of recycling
  - ...
- **Gives some insight in future challenges**



# Collection & logistics

- **Strong existing network of dismantling of End-of-Life vehicles (Febelauto)**
  - Collection & dismantling of ~104.000 cars versus 383.000 new cars in 2021
  - Delta of ~280.000 cars – where are they ? Export ?
- **Logistics challenges:**
  - Transport of complete battery packs/dismantled/black mass
  - Hub versus centralized model
- **Adequate transport, storage of end-of-life batteries, incl. policy obligations:**
  - Transport containers/ADR/Waste shipment regulation ...

## Dismantling

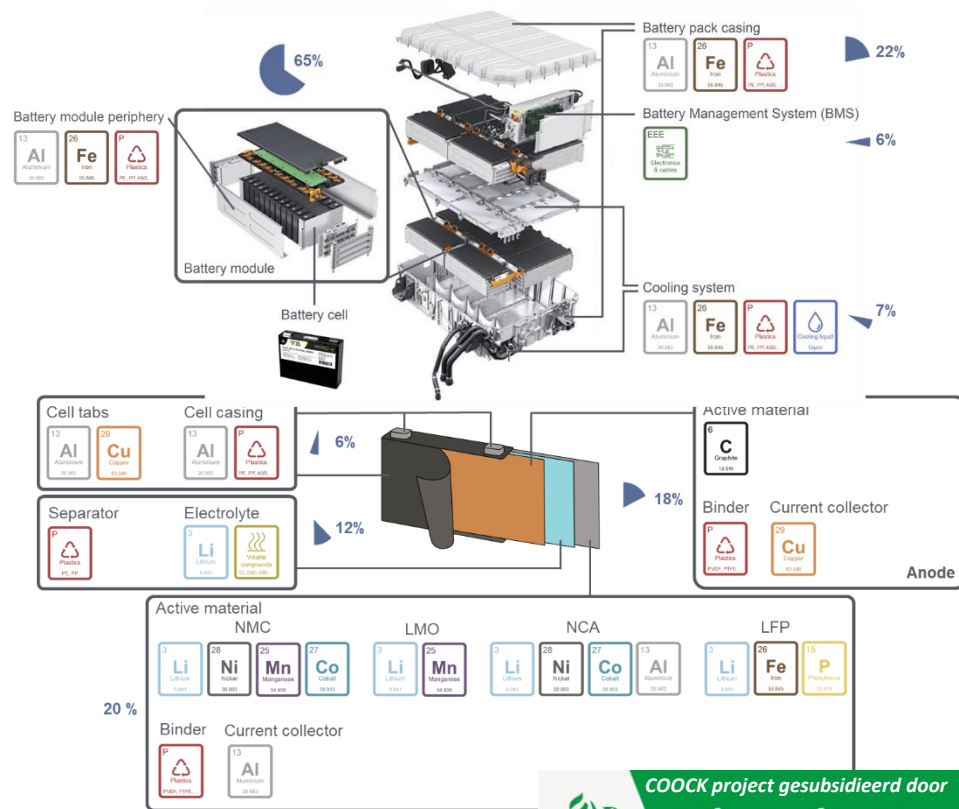
- Material recovery information



- Material recovery technology



- Life cycle assessment



# Non-ferrous metals industry in Belgium

## Nearly all non-ferrous metals are produced :

- Base metals: Al, Cu, Zn, Pb, Sn & Ni
- Precious metals: Ag, Au, Ir, Pt, Pd, Rh, Ru...
- Special metals: Co, Ge, Se, Sb, Te, As, ...

## Different shapes:

- Raw metals (ingots, cathodes, ...)
- Semi-finished (rolled, extrusion, wire rod, ...)
- Different high-tech applications, by-products and compounds

## Broad range of different raw materials:

- Concentrates (Zn)
- Materials for recycling (scrap/end-of-life products)
- Complex metal bearing material (by-products, complex products for recycling)



**WAARDEVOLLE METALEN\*** DIE IN **VLAANDEREN** WORDEN **GERECYCLEERD**

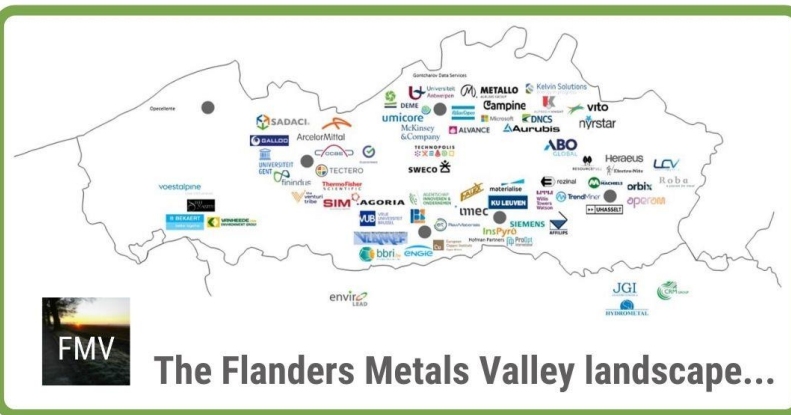


**VOOR DEZE METALEN IS ER  
RECYCLAGE CAPACITEIT  
AANWEZIG IN VLAANDEREN**

VOOR DEZE METALLEN IS ER RECYCLAGE CAPACITEIT AANWEZIG IN VLAANDEREN

|    |    |    |    |    |    |    |    |    |    |    |     |     |     |     |     |
|----|----|----|----|----|----|----|----|----|----|----|-----|-----|-----|-----|-----|
| 57 | 58 | 59 | 60 | 61 | 62 | 63 | 64 | 65 | 66 | 67 | 68  | 69  | 70  | 71  | 72  |
| La | Ce | Pr | Nd | Pm | Sm | Eu | Gd | Tb | Dy | Ho | Er  | Tm  | Yb  | Lu  |     |
| 89 | 90 | 91 | 92 | 93 | 94 | 95 | 96 | 97 | 98 | 99 | 100 | 101 | 102 | 103 | 104 |
| Ac | Th | Pa | U  | Np | Pu | Am | Cm | Bk | Cf | Es | Fm  | Md  | No  | Lr  |     |

### Production capacity in Belgium



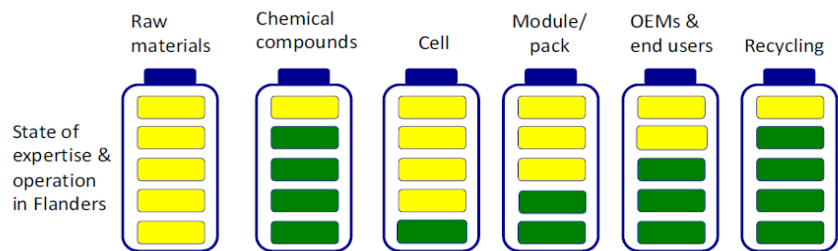
### 2023 Critical Raw Materials (*Strategic Raw Materials in italics*)

|                    |             |                  |                |
|--------------------|-------------|------------------|----------------|
| aluminium/ bauxite | coking coal | lithium          | phosphorus     |
| antimony           | feldspar    | LREE             | scandium       |
| arsenic            | fluorspar   | magnesium        | silicon metal  |
| baryte             | gallium     | manganese        | strontium      |
| beryllium          | germanium   | natural graphite | tantalum       |
| bismuth            | hafnium     | niobium          | titanium metal |
| boron/ borate      | helium      | PGM              | tungsten       |
| cobalt             | HREE        | phosphate rock   | vanadium       |
|                    |             | copper*          | nickel*        |

\* Copper and Nickel do not meet the CRM thresholds, but are included as SRMs.



# Existing Belgian battery ecosystem



| Raw & advanced materials                                                                                                                 | Cells & modules | Battery systems | Recycling & sustainability                                                        |
|------------------------------------------------------------------------------------------------------------------------------------------|-----------------|-----------------|-----------------------------------------------------------------------------------|
| <ul style="list-style-type: none"> <li>• Hydrometal</li> <li>• Nanocyl</li> <li>• Prayon</li> <li>• Solvay</li> <li>• Umicore</li> </ul> |                 |                 | <ul style="list-style-type: none"> <li>• Hydrometal</li> <li>• Umicore</li> </ul> |

Important Project of Common European Interest (IPCEI) on batteries

- Deep knowledge on raw & advanced materials
- Increasing use of batteries (OEM's - no gigafactory/battery assembly)
- Some projects on 2<sup>nd</sup> life application / pilots on recycling

**What are the opportunities  
for Belgium?**



# Solve existing problems

## Ensure **consistency** in the policy framework:

- Waste shipment versus access to recyclables
- Limit illegal/lower quality recycling export
- PFAS restriction vs upscaling battery production

## Foresee proper **funding** for strategic projects

## Work on **competitiveness** :

- Non-ferrous metals industry is price taker
- Labour / energy & environmental costs

## Create **legal certainty** on permits

Embracing technology  
Embracing ambition

# Thank you

For your attention



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**.AGORIA**