



RawMaterials

Connecting matters

Raw Materials in Europe: how to improve the supply of secondary metals and minerals

Olli Salmi | Trondheim | 06 October 2022

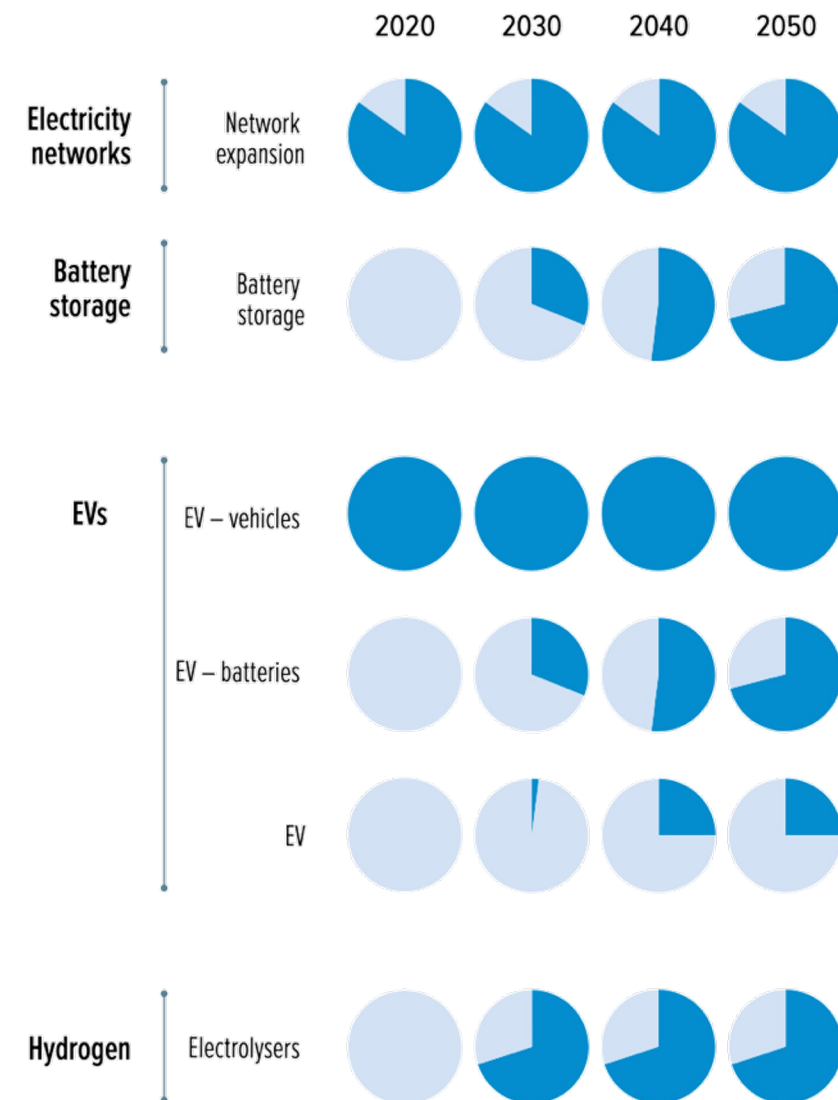
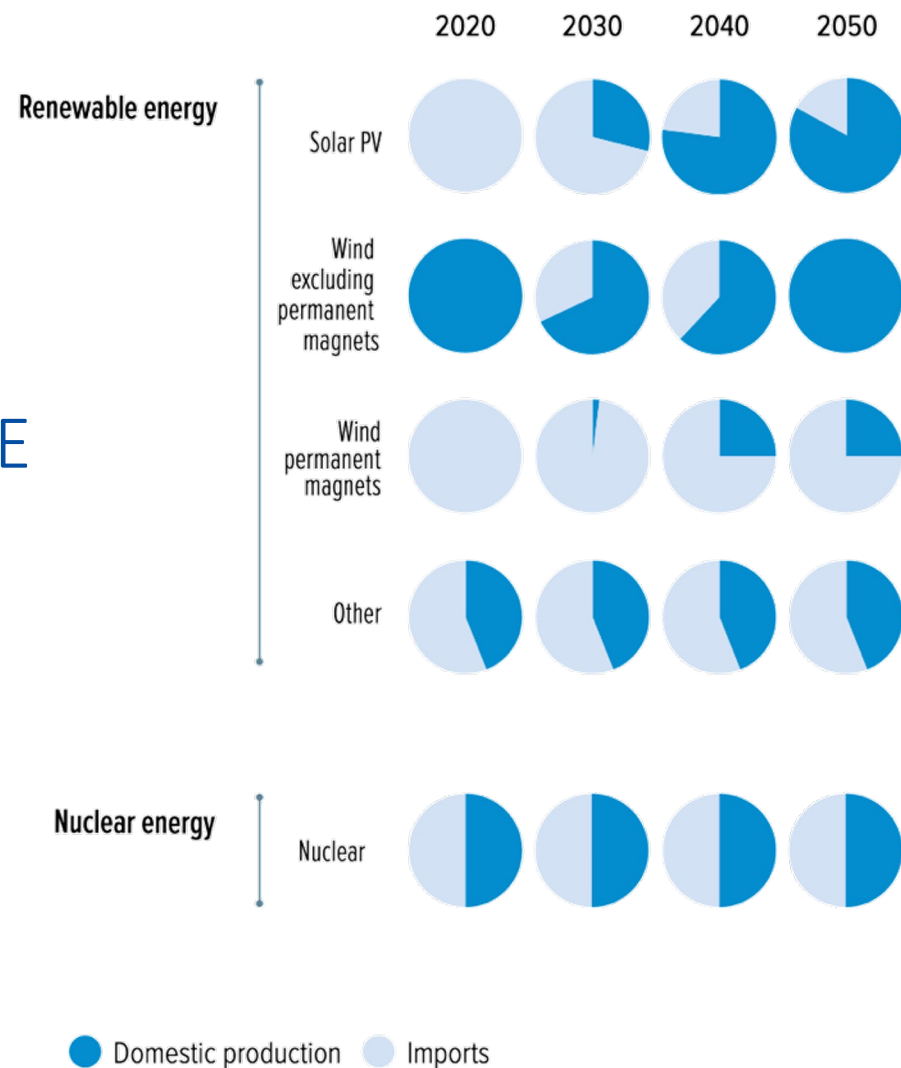


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STRATEGIC DEMAND DRIVER #1:

EUROPEAN SHARE OF ENERGY STORAGE AND CONVERSION



Source: Eurometaux

METALS & MINERALS OF WIND POWER TECHNOLOGY

Wind power is rapidly advancing to meet climate neutrality goals. The global demand for wind energy will increase by up to 63% by 2023. Significant amounts of strategic mineral and metal resources are required to power this demand.

Responsible mining, processing and recycling are needed for wind and other green technologies to power the circular economy as a whole.

Reliable, sustainable supplies of rare earth and other elements including Copper, Nickel, Chromium, Cobalt are the future of green energy.



METALS & MINERALS OF SOLAR POWER TECHNOLOGY

Global solar energy capacity will grow by over 1 terawatt between 2018 and 2023.

Manufacturing photovoltaic cells requires significant amounts of high-demand Rare Earth Elements, and advances in technology could push the demand even higher.

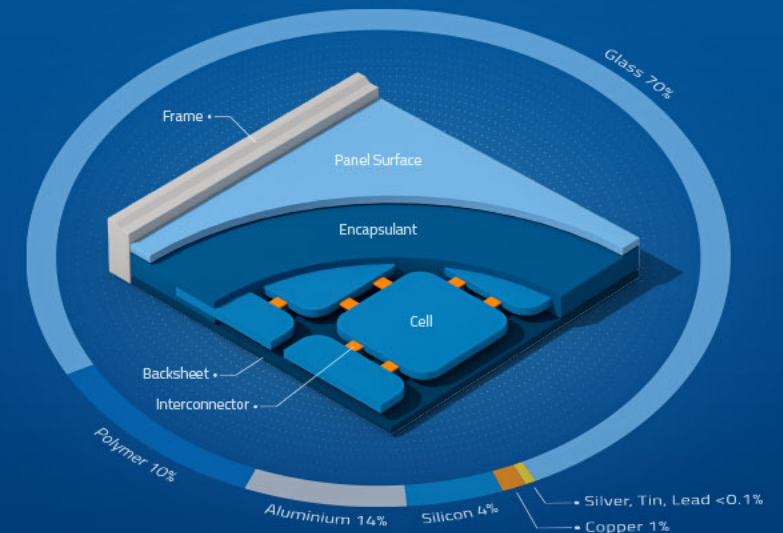
Securing a sustainable supply of materials such as Germanium, Tellurium, Gallium, Indium, Selenium and Silicon for solar technologies is crucial for the EU transition to green energy.

Investment, innovation, and processing know-how for EU industrial ecosystems are paramount.

Total Renewable Solar Energy Capacity Expected Increase



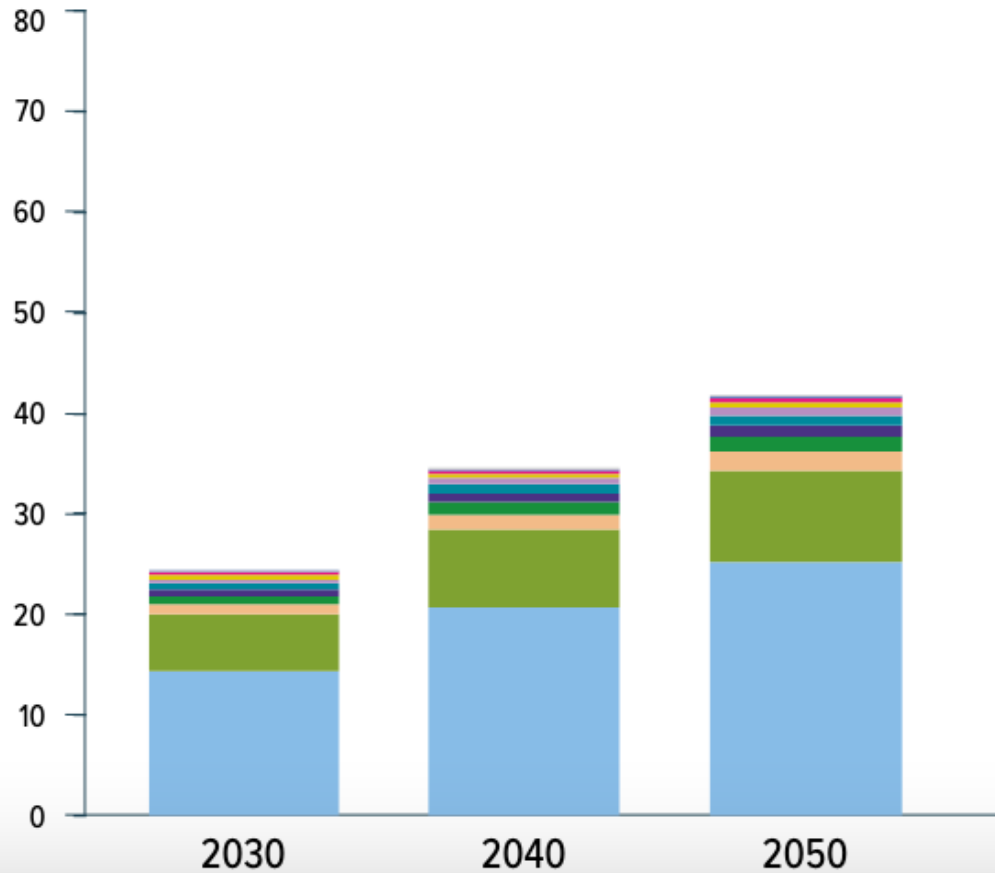
Solar photovoltaic (PV) cell technology requires a number of minerals



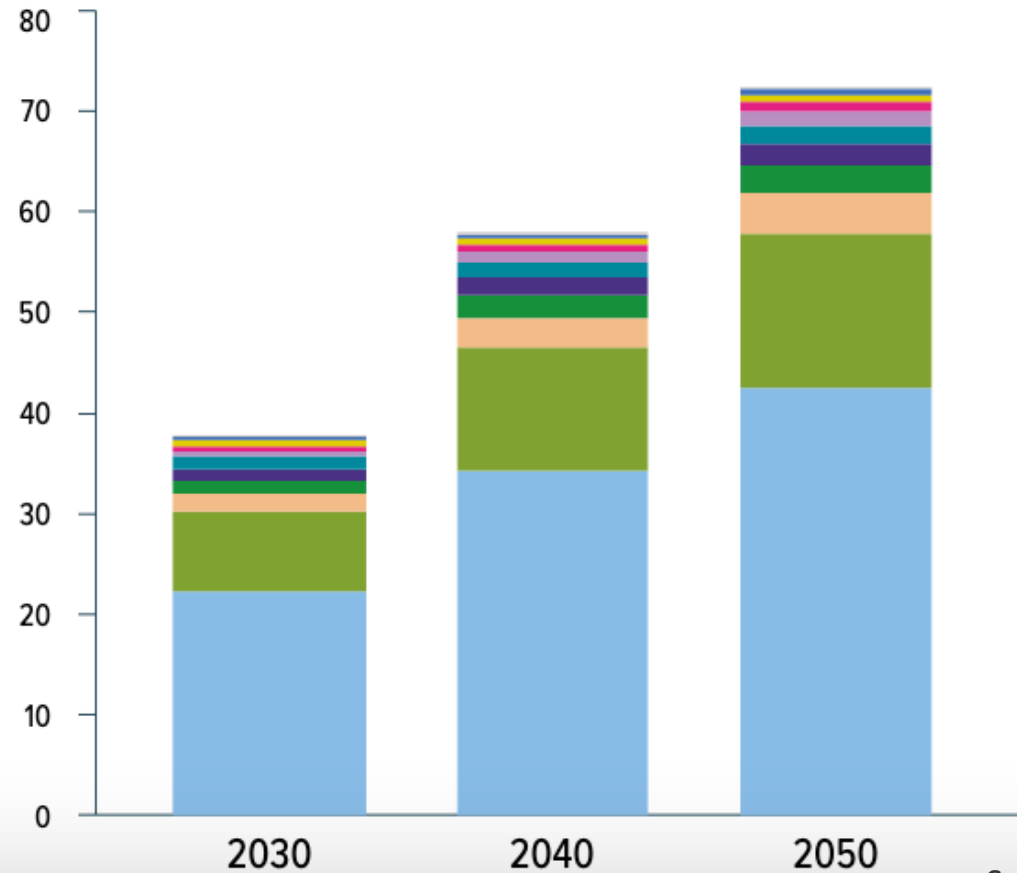
Source: World Bank Group 2019 "Climate Smart Mining" infographic

COMMODITY DEMAND RELATED TO ENERGY STORAGE AND CONVERSION

STEPS (Mt)



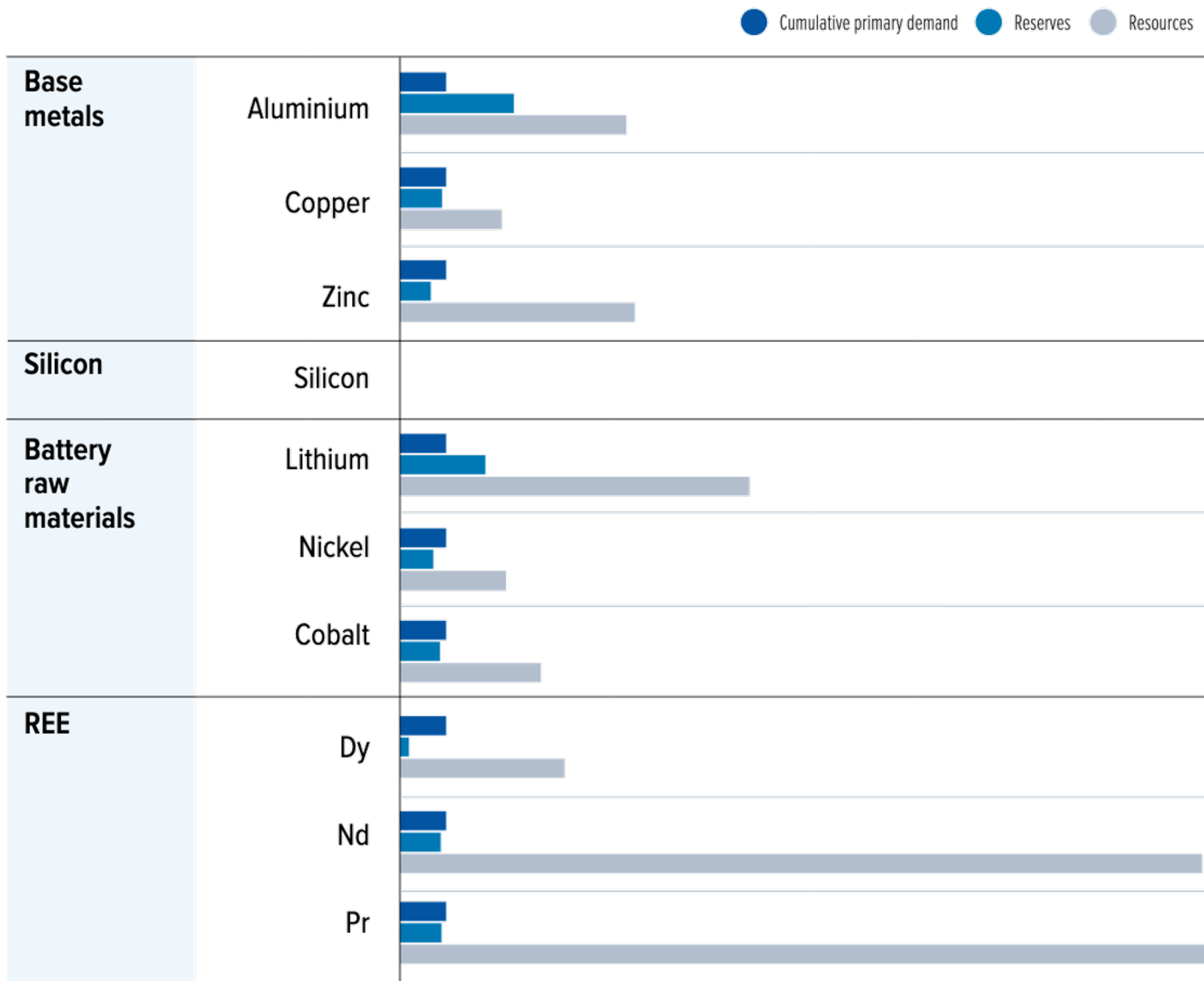
SDS (Mt)



- Al
- Cu
- Ni
- Zn
- Pb
- Si
- Li
- Mn
- Cr
- Co
- Other

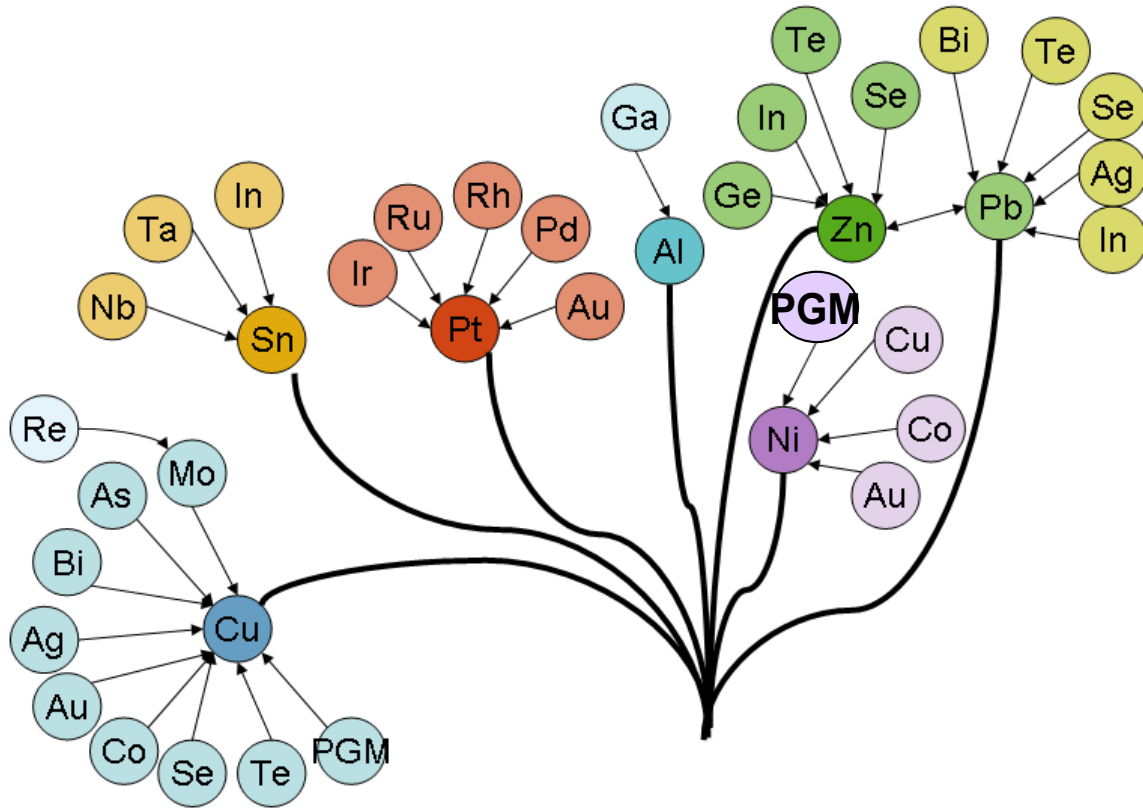
Source: Eurometaux, IEA

DEMAND (STEPS) VS RESOURCES



Note: Resources can be assessed with different methodologies. Other studies indicate that the full state of extractable resources should be considered (e.g. for zinc, these amount to 63 Bt).

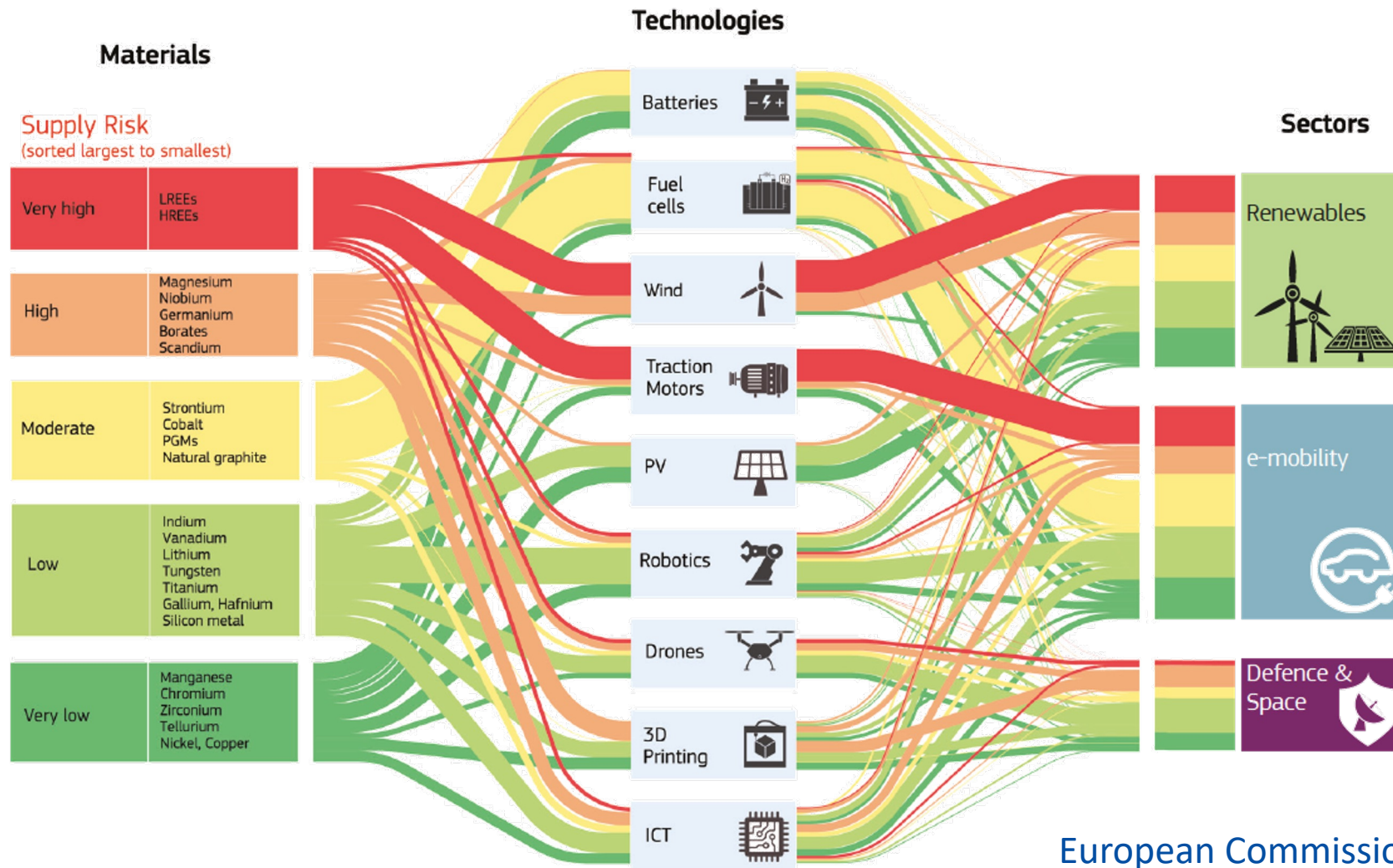
METALS AND BY-PRODUCTS: POTENTIAL FOR RECOVERY



Commodity	By-product	Share of total production as by-product (%)
Pb	Largely (Zn, Ag, Au, Cu, Sb)	84%
Au	In small part (Cu, Zn, Pb)	5%
Cd	Exclusively (Zn, Cu, Pb)	100%
Pd	Largely (Ni, Cu)	-
Ge	Exclusively (Zn)	100%
Ag	Partially (Zn, Pb, Cu)	70%
Mn	No	0%
Pt	Partially (Ni, Cu)	-
Sn	No	0%
V	Largely (co-product or by-product of iron ore)	-
Mo	Partially (Cu)	60%
Cr	In small part (chromite recovered from PGM tailings)	14%
In	Exclusively (Zn, Cu)	100%
Ga	Exclusively (Al, Zn)	100%
Te	Exclusively (Cu electrolytic refining mainly)	100%
Ir	Exclusively (as co-products of Pt & Pd)	100%
Sc	Exclusively (ores or tailings of Fe, Ti, REE, Zr, Ni, U, W)	100%

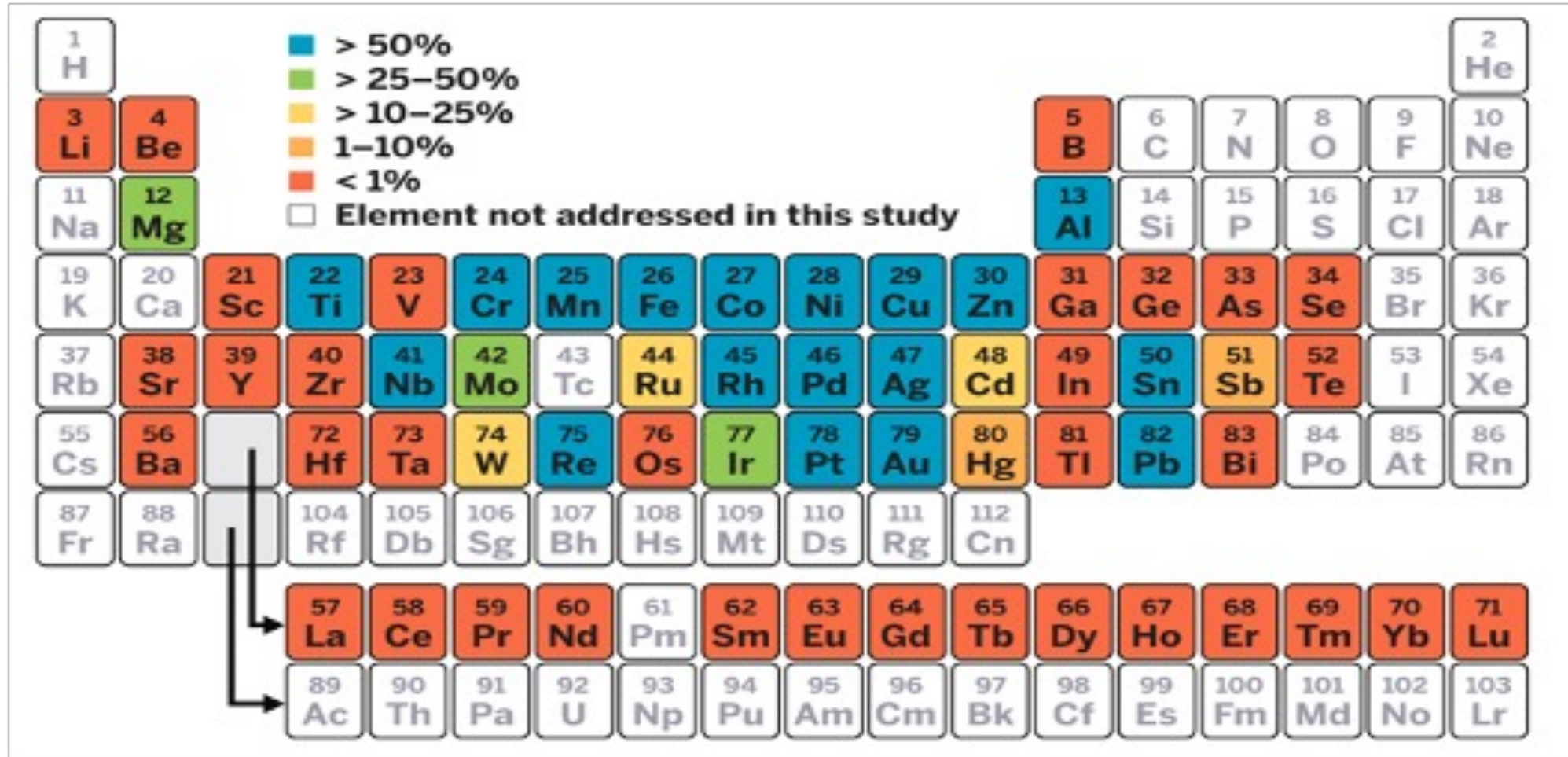
Source: Eurometaux & Reller 2012

STRATEGIC VALUE CHAINS



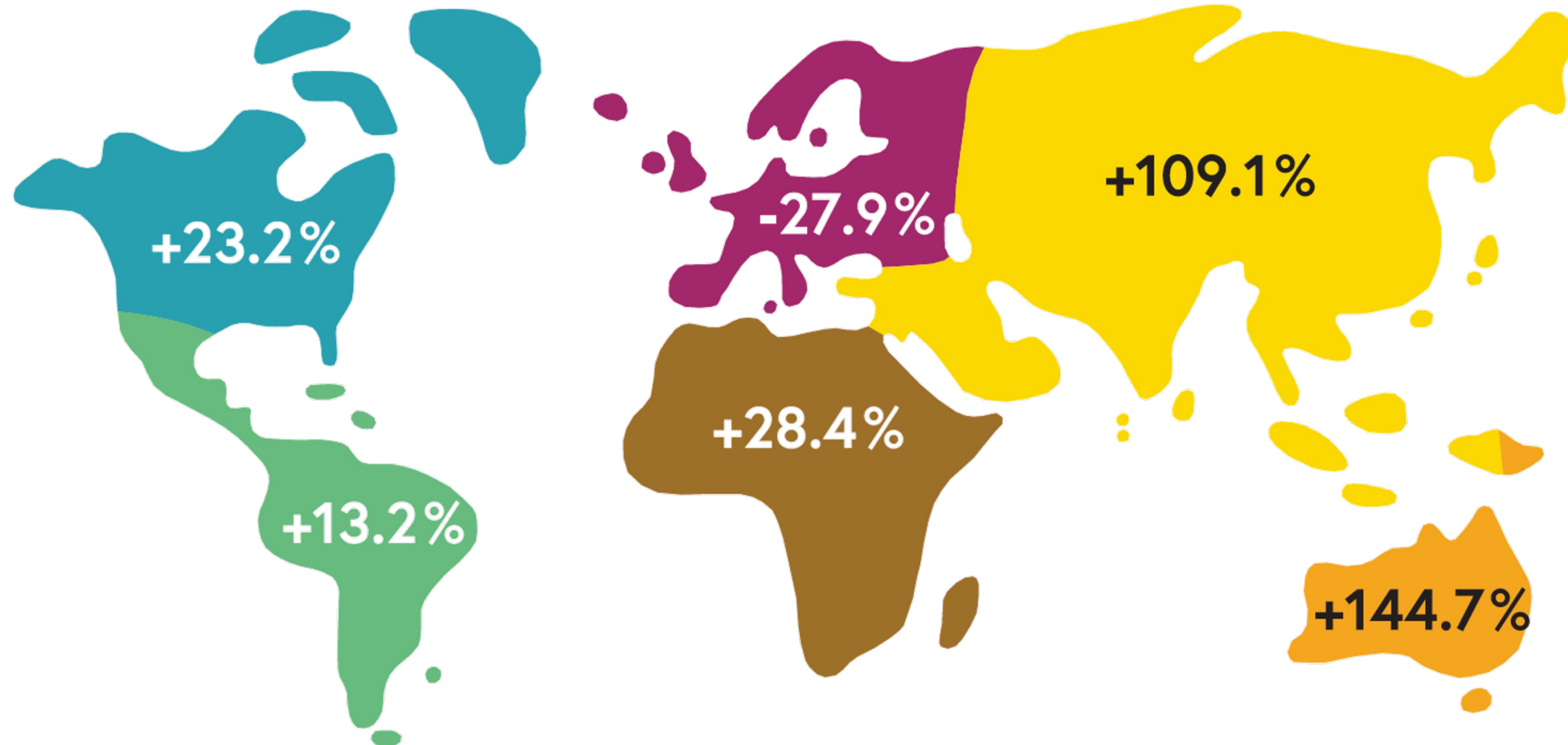
European Commission Strategic Foresight

RECYCLING RATES



EUROPE ONLY CONTINENT WITH DECLINING PRIMARY PRODUCTION

Declining production rates since 2000 only in Europe – Δ 2000 / 2019



EIT RAWMATERIALS AT A GLANCE

- World's largest community in the raw materials sector
- Coverage of the entire raw materials value chain
- Over 300 renowned partners
- 22+ countries
- 16 locations across Europe
- Headquarter in Berlin, Germany



- Innovation Hub
- RC (Regional Center)
- RIS HUB (Regional Innovation Scheme)
- Countries covered by EIT RawMaterials
- Countries covered by EIT RawMaterials and RIS

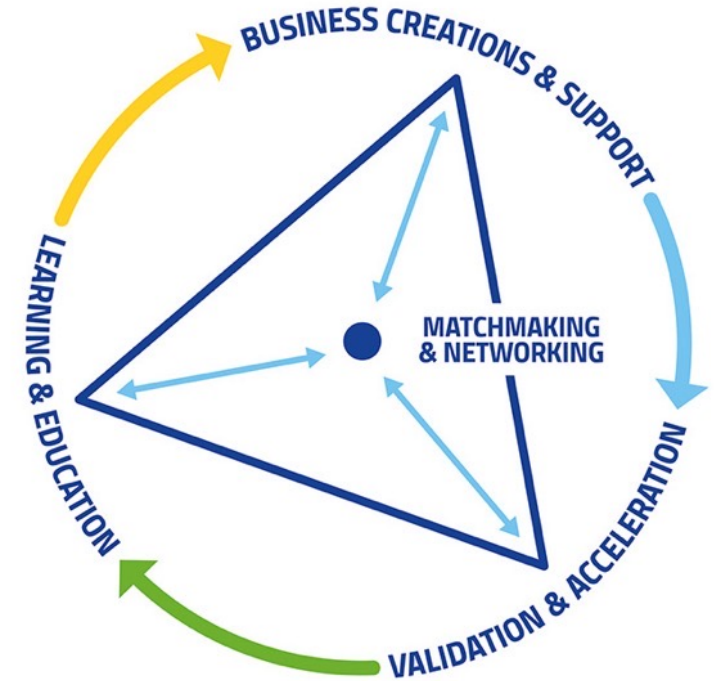
EIT RAWMATERIALS VISION AND MISSION

EIT RawMaterials vision is to develop raw materials into a major strength for Europe.

Its mission is to enable sustainable competitiveness of the European minerals, metals and materials sector along the value chain by driving innovation, education, and entrepreneurship.

EIT RawMaterials strategic objectives are:

1. **Securing raw materials supply:** collaborating across the entire industrial value chain
2. **Designing solutions** for materials innovation, products and processes
3. **Closing material loops:** a radical shift from linear to circular thinking



THREE INNOVATION PROGRAMS (LIGHTHOUSE PROGRAMS)



Responsible Sourcing

Sustainability starts with Europe's resource potential



Sustainable Materials

Innovation in electrification and lightweight design enabling energy transition



Circular Societies

Closing material loops: a radical shift from linear to circular thinking

EIT RAWMATERIALS INNOVATION THEMES

- **Exploration** and raw materials resources assessment
- **Mining** in challenging environments
- Increased **resource efficiency** in mineral and metallurgical processes
- **Recycling** and material chain optimisation for end-of-life products
- **Substitution** of critical and toxic materials in products for optimised performance
- Design of products and services for the **circular economy**



INNOVATION, EDUCATION AND ENTREPRENEURSHIP ACTIVITIES

MATCHMAKING & NETWORKING

Digital platform:
RM InfoCenter

Events:
RawMaterials Summit,
Expert Forums

Matches:
Alumni Community
Internationalisation

ACCELERATION

Up-scaling Innovation
Projects

Start-up Booster

RM Accelerator

ACADEMY

Master Education
PhD Education

Lifelong Professional
Education

Wider Society
Learning

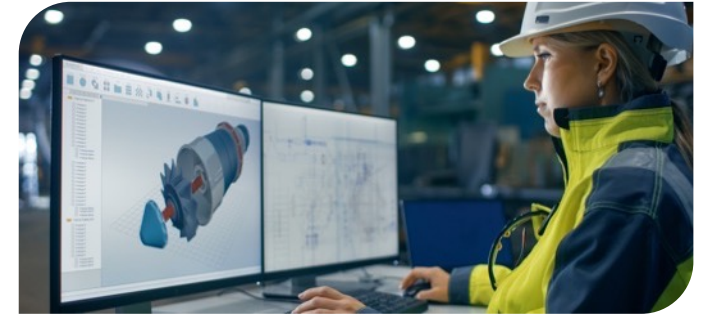
LIGHTHOUSES

CROSS-KIC ACTIVITIES

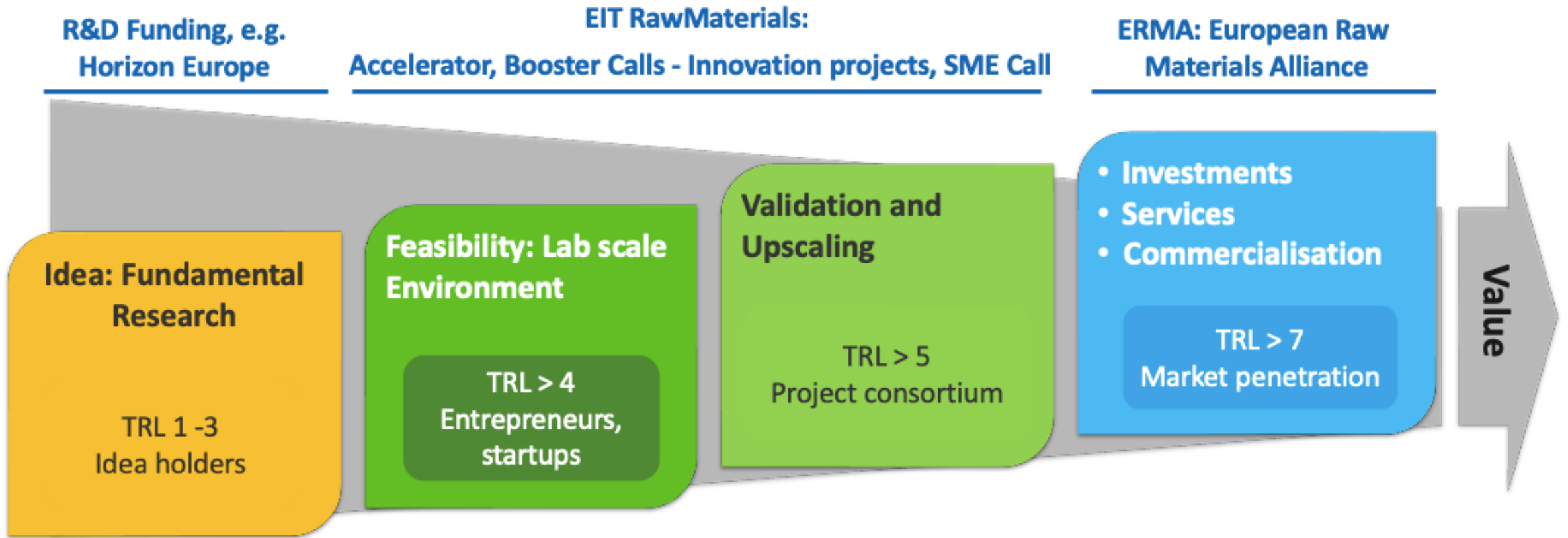
REGIONAL INNOVATION SCHEME (RIS)

INNOVATION, ACCELERATION & EDUCATION

- **Upscaling innovation projects target:**
 - Integration of existing technology
 - De-siloing and value chain co-operation
 - Bringing technologies to the market
- **Education & Entrepreneurship:**
 - Master and PhD Programmes
 - Lifelong Professional Education
 - Wider Society Learning
- **RM Accelerator & Booster**
 - Supporting start-ups, spin-offs and SMEs in creating their business models
 - Accelerate start-ups (scouting, business model development, funding and technology)



ACCELERATE THE INNOVATION FUNNEL



BUSINESS CREATION - START-UPS SUPPORTED 1/2

➤ Product design

Sustainabill: optimised design by product-specific sustainability information
Fairphone - world's first ethical, modular smartphone (SME)

➤ Transparency in Value Chains

Circularise: transparency & communication in circular value chains

➤ Resource Management Systems

Resourcify: online recycling service management platform for companies
Binee: ad-sponsored collection system for WEEE
aSmartWorld: collection, refurbishing & reselling smartphones

➤ Digital market place

Metals Hub: global, digital marketplace for metals & ferroalloys
Socialtec: exchange platform for sharing local goods and services

sustainabill

FAIRPHONE

CIRCULARISE

ASW
aSmartWorld

binee

socialtec
VALUE PIONEERS

metals hub

BUSINESS CREATION - START-UPS SUPPORTED

➤ Recycling of end-of-life-products

TND: recycling of PCB by recovering strategic metals

Extracthive: High-quality recycling-technology for fibre reinforced plastics

FLAXRES: rapid separation of photovoltaic modules via light pulse

Circular Industries: recovery of CRMs from (low grade) PCBs

➤ Industrial Waste Valorisation

ResourceFull: concrete out of metallurgic & mining residues

Value Ash: concrete binders and fillers out of fly ashes

PMC: recovery of premium steel from contaminated steel scrap

Black Bear: recovery of carbon black & metals from e.o.l. tires

ROSI: recycling of silicon kerf waste from photovoltaic panels manufacturers

AJELIS: selective sorbents for enrichment and extraction of strategic metals



UPSCALING AND EDUCATION PORTFOLIO IN CIRCULAR SOCIETIES

Modelling Tools & Life Cycle Analysis for Circularity



Design for the Circular Economy



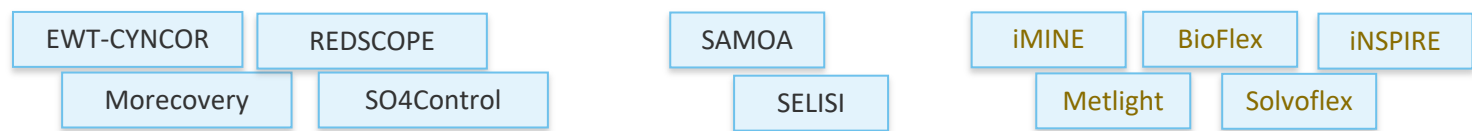
Industrial Symbiosis & Waste Valorisation



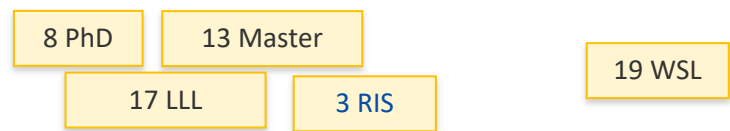
Recycling of End-of-Life Products



Resources efficiency & Metallurgical Processing



Education Program for Circular Societies

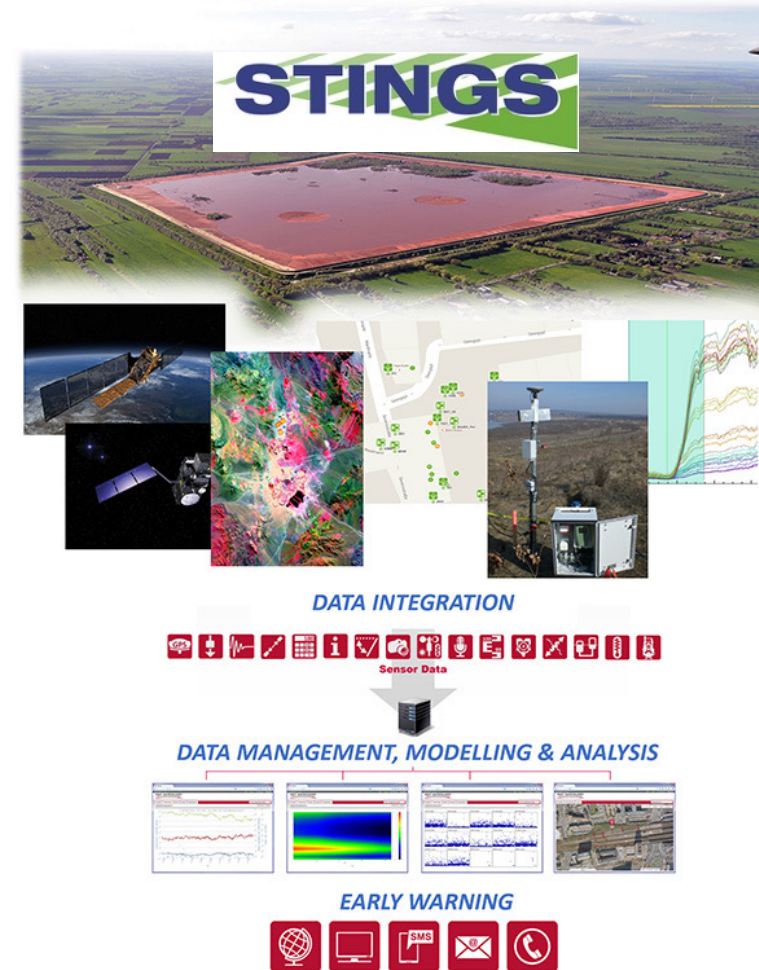


UPSCALING SUPPORTED: RECOVERY FROM TAILINGS



INCO-Piles

International Consortium to recover CRMs from stockpiles/tailings targeting RIS



UPSCALING & EDU. SUPPORTED: NTNU LEAD

 SisAl Pilot



SisAl Pilot – Innovative pilot for Silicon production with low environmental impact using secondary Aluminium and silicon raw materials

Hydrometallurgy in raw materials utilization

– an educational and communication programme

 HydroMetEC

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EUROPEAN RAW MATERIALS ALLIANCE: VISION – WORKSTREAMS – CLUSTERS

Announced on 29 September 2020 by Commissioner Breton and VP Šefčovič (Action 1 of the EU Critical Raw Materials Action Plan); **kick-off 23 November 2020. Coordinated by EIT RawMaterials**

VISION: To **secure access to critical and strategic raw materials, advanced materials** and processing know-how for the EU Industrial Ecosystems

WORKSTREAMS

Stakeholder consultation processes – value chain specific, to identify regulatory bottlenecks (> 600 partners)

Raw Materials Investment (> 45 investment projects identified to date)

Clusters defined to date:

- 1. Rare Earth Magnets and Motors**
- 2. Materials for Energy Storage and Conversion**

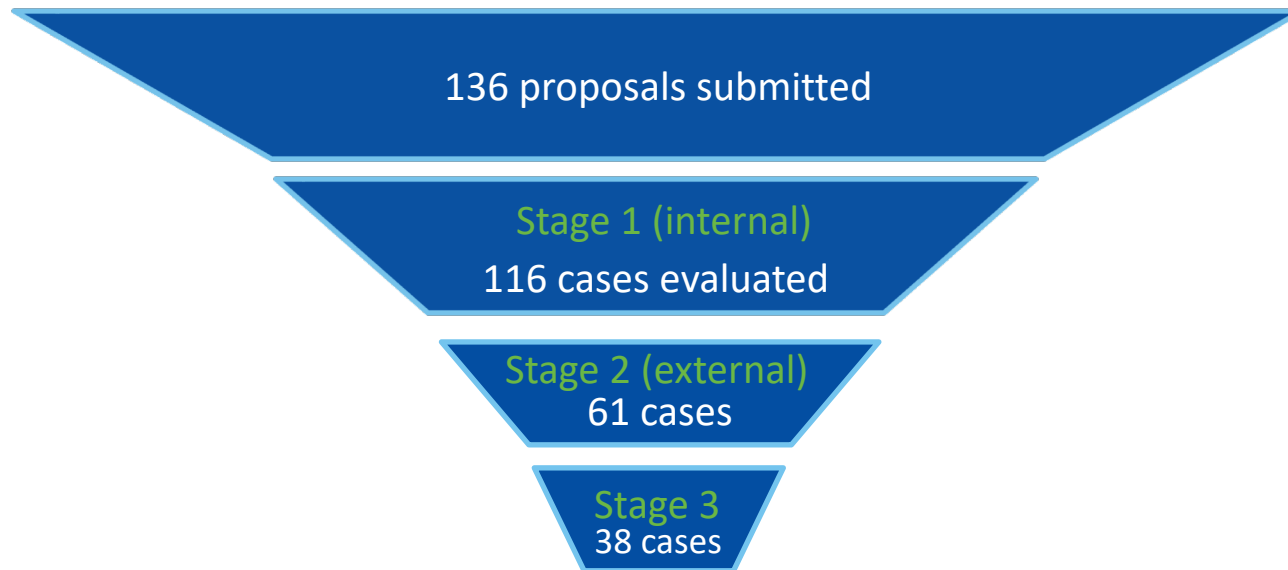
ERMA INVESTMENT OPTIONS – ACCESS TO FINANCE

- GRANTS: European Innovation Fund, Just Transition Fund, IPCEI, Recovery Funds, EIT RM
- LENDING (PUBLIC BANKS): European Investment Bank, European Bank of Reconstruction and Development, Nordic Investment Bank
- LENDING (PRIVATE BANKS): e.g BNP Paribas, Société General

- ERMA Role:
 1. Regular pitching sessions with grantors / banks to pre-screen potential projects
 2. For projects moving to a funding negotiation: ERMA support with the full application
 3. All cases will be tailored up to 100% of finance need

ERMA INVESTMENT CASES DEAL FLOW - STATUS AUGUST 2022

**Total investment need identified to date:
ca. € 12.7 billion**



Ongoing process – several new cases in pipeline

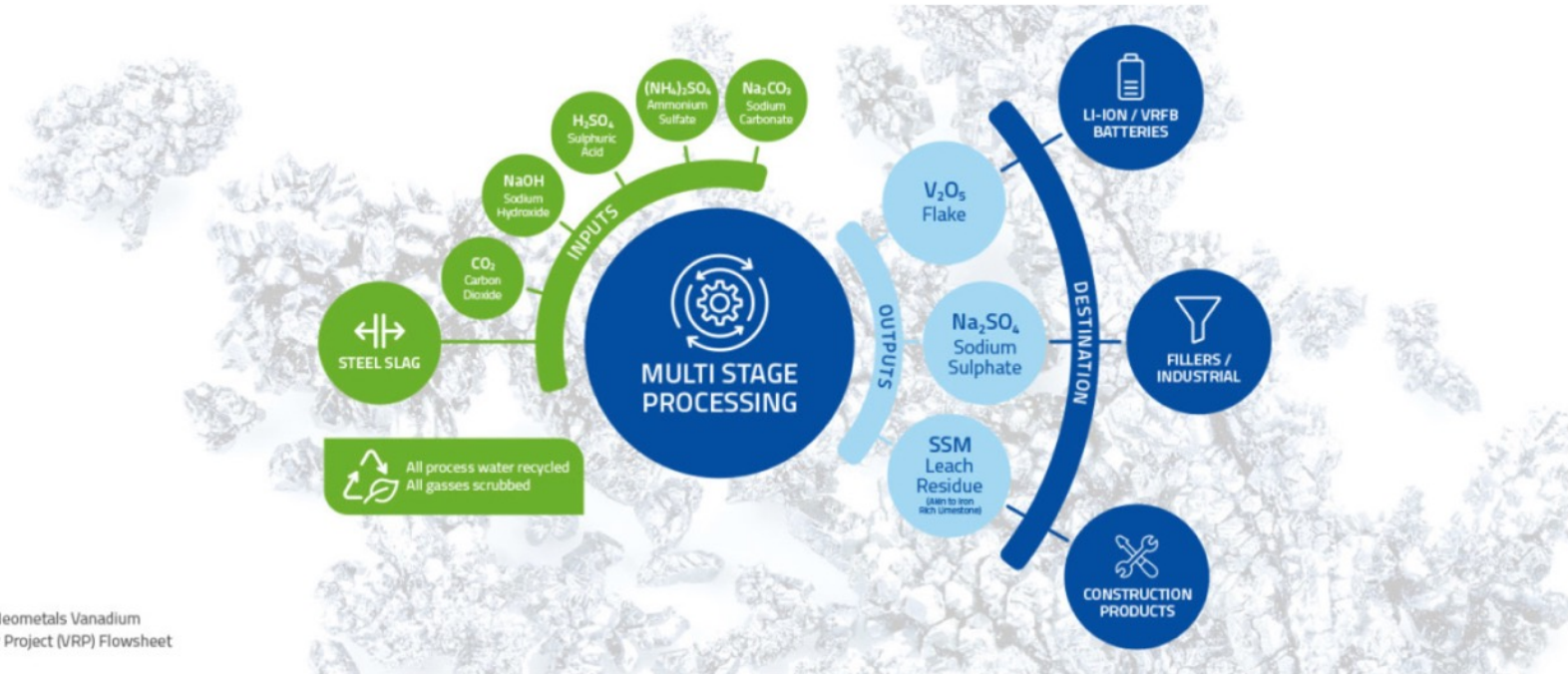
- *Junior exploration to advanced operations by large companies*
- *€ 10 million to > 500 million, 3 to 10+ years*
- *Wide mix of grants/ loans/ equity and financing needs*

60% Cluster 2
25% others
15% Cluster 1

65% primary
17% advanced
18% secondary

Win-Win for Europe: Mineral processing facility in Finland set to increase vanadium production for Europe

24 March, 2022



Source: Neometals Vanadium Recovery Project (VRP) Flowsheet

Savings of up to 1.5 million tonnes of CO2 are predicted over 10 years compared to conventional mining

Minerals and metals are the key enablers of the green energy transition and the circular economy

Clean technologies require radical innovation along the entire value chain from exploration, responsible mining, mineral processing, resource efficiency, recycling and substitution, product design and manufacturing.

In addition to EIT RawMaterials activities, the European Raw Materials Alliance (ERMA) will secure Europe's raw materials supply to enable the EU's green and digital transition, as well as the circular economy. Reliable, secure and sustainable access to raw materials is a key strategic focus for Europe and will not be achieved without secondary sources!

The world is rapidly transitioning to low-carbon technologies to address climate change.

Key low-carbon technologies:





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