

Raw Materials for sustainable development: Opportunities and challenges

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EIT RawMaterials



SUSTAINABLE DEVELOPMENT GOALS

1 NO POVERTY

2 ZERO HUNGER

3 GOOD HEALTH AND WELL-BEING

4 QUALITY EDUCATION

5 GENDER EQUALITY

6 CLEAN WATER AND SANITATION

7 AFFORDABLE AND CLEAN ENERGY

8 DECENT WORK AND ECONOMIC GROWTH

9 INDUSTRY, INNOVATION AND INFRASTRUCTURE

10 REDUCED INEQUALITIES

11 SUSTAINABLE CITIES AND COMMUNITIES

12 RESPONSIBLE CONSUMPTION AND PRODUCTION

13 CLIMATE ACTION

14 LIFE BELOW WATER

15 LIFE ON LAND

16 PEACE, JUSTICE AND STRONG INSTITUTIONS

17 PARTNERSHIPS FOR THE GOALS

SUSTAINABLE DEVELOPMENT GOALS

Raw materials and advanced materials are *THE* key enablers for the transition in the energy and mobility sectors.

Brown Economy

Fossil Fuels for combustion engines, generators and power stations: oil, gas, coal

Energy Transition

Green Economy

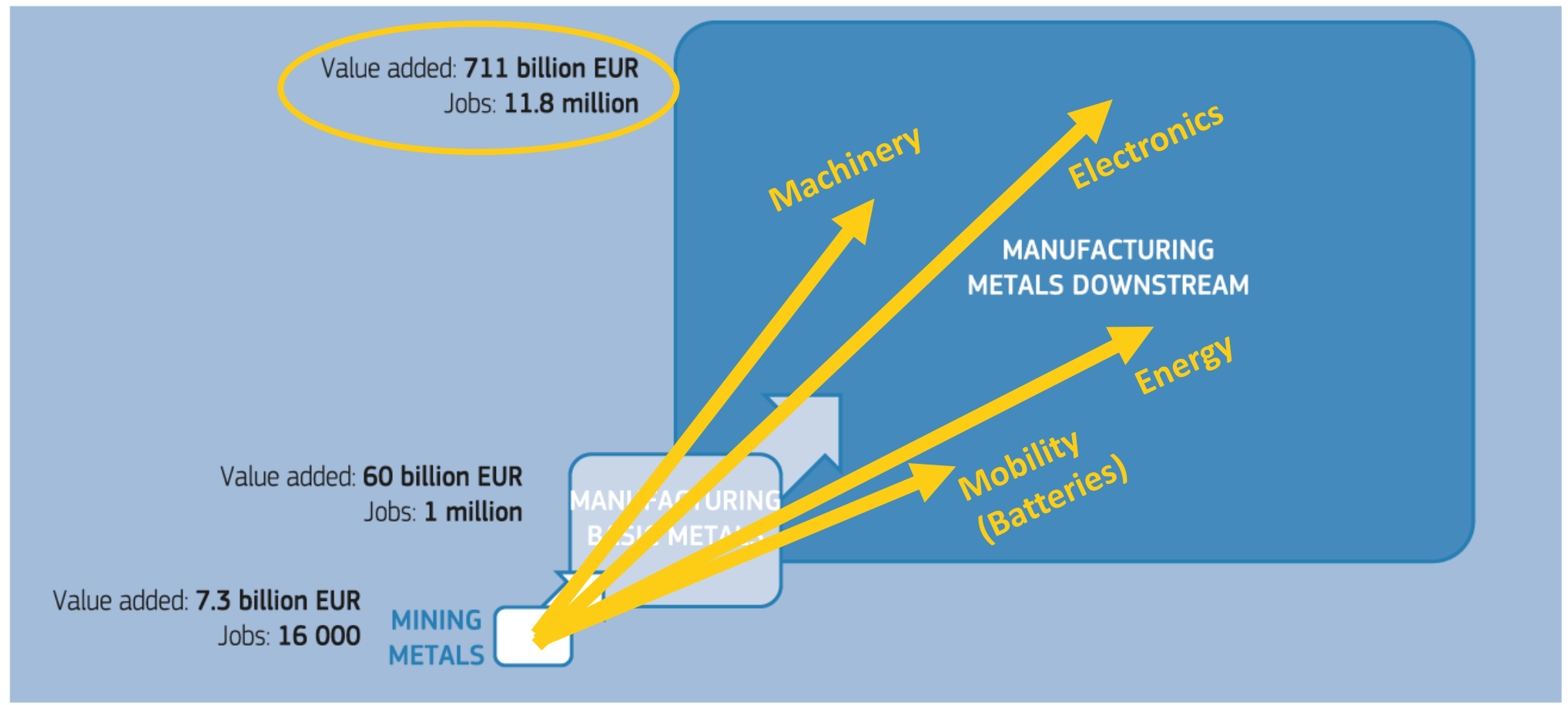
Functional Materials in e-motors, energy storage, energy conversion containing, for example, Co, Li, Pt, REE, Ge, Ga, Si, V



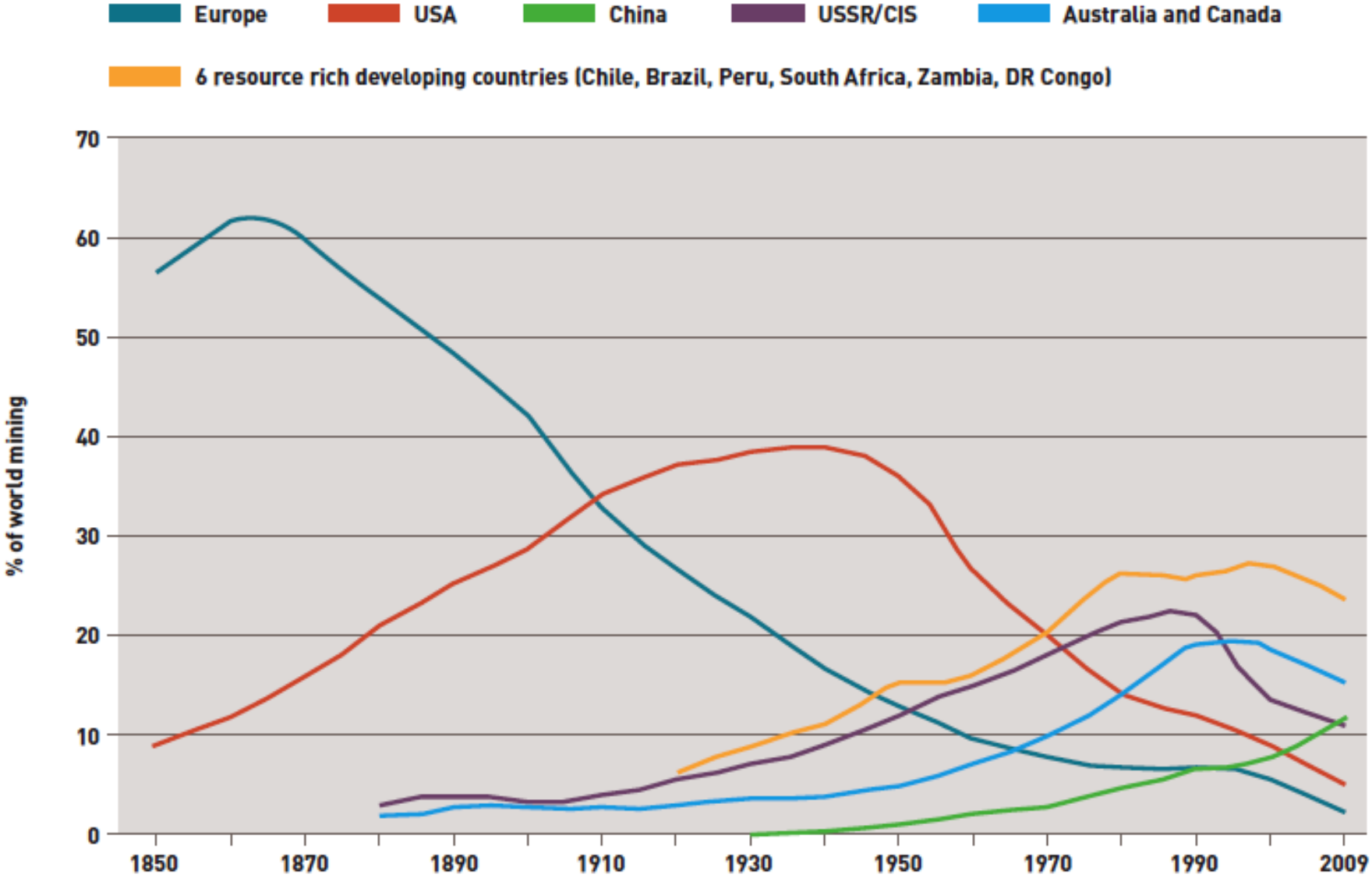
Fundamental shift in the resource basis of a society

Raw Materials as key enabler for sustainability and jobs and growth in Europe

Figure 19: Value added and number of jobs associated with metals (mining, basic manufacture and downstream sectors) in the EU (2012)⁸²



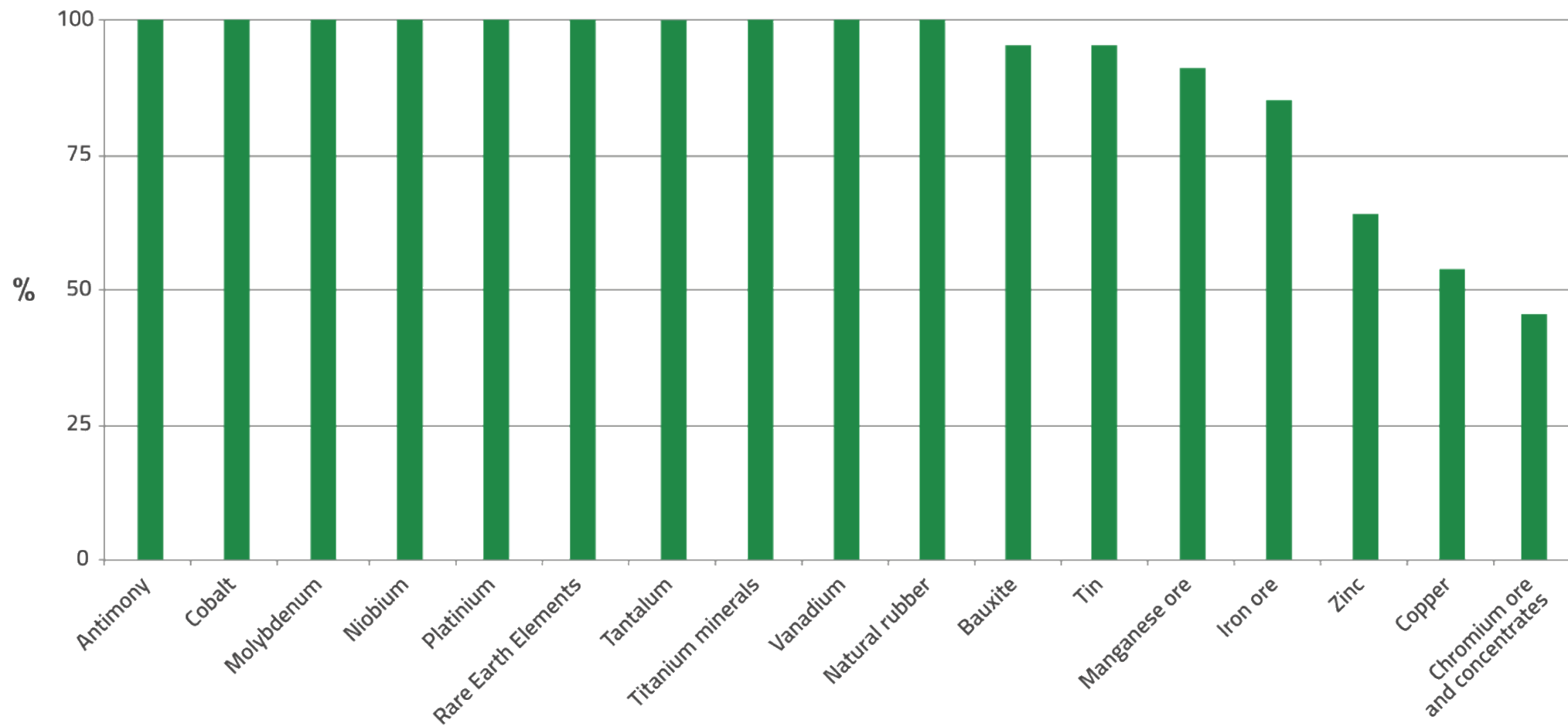
Mining regions 1850 - now



Source: Raw Materials Group, Stockholm, Sweden.



Import dependence for selected raw materials



Current challenges

- There is a lack of awareness about the need for mineral resources.
- Criticality, scarcity and supply risks are highly dynamic. The critical minerals for the EU have changed and since 2010, and their numbers have increased.
- The current administrative and economic framework regulating both primary and secondary raw materials is heterogeneous and inadequate for sustainable exploitation of the resources.
- Instruments to forecast the dynamics of raw materials consumption are inadequate.
- Materials flows and leakages in the circular economy system for raw materials are poorly understood, resulting in a low exploitation rate for secondary raw materials.

Future needs

- Strengthen expertise covering the entire value chain for raw materials
- Raise awareness and provide solutions for the transition towards a green economy with its key pillars of renewable energies and e-mobility.
- Promote increased process efficiency in the raw materials sector
- Promote improved recycling techniques and reduce the need for rare (critical) metals by looking for alternative materials
- Analyse pathways and barriers for innovation , identify solutions
- Support regulatory, policy and economic framework for primary and secondary raw materials
- Ensure that data is made widely and efficiently available to relevant stakeholders

The EU action to ensure security of supply of raw materials

- The **Raw Materials Initiative** is the EU raw materials policy strategy
- The **European Innovation Partnership on Raw Materials** brings together the entire raw materials community
- **Horizon 2020**: EUR 600 million secured for raw materials (2014- 2020)
 - **EIT RawMaterials**: EUR 400 million (2015-2021)



EU action plan for the Circular Economy

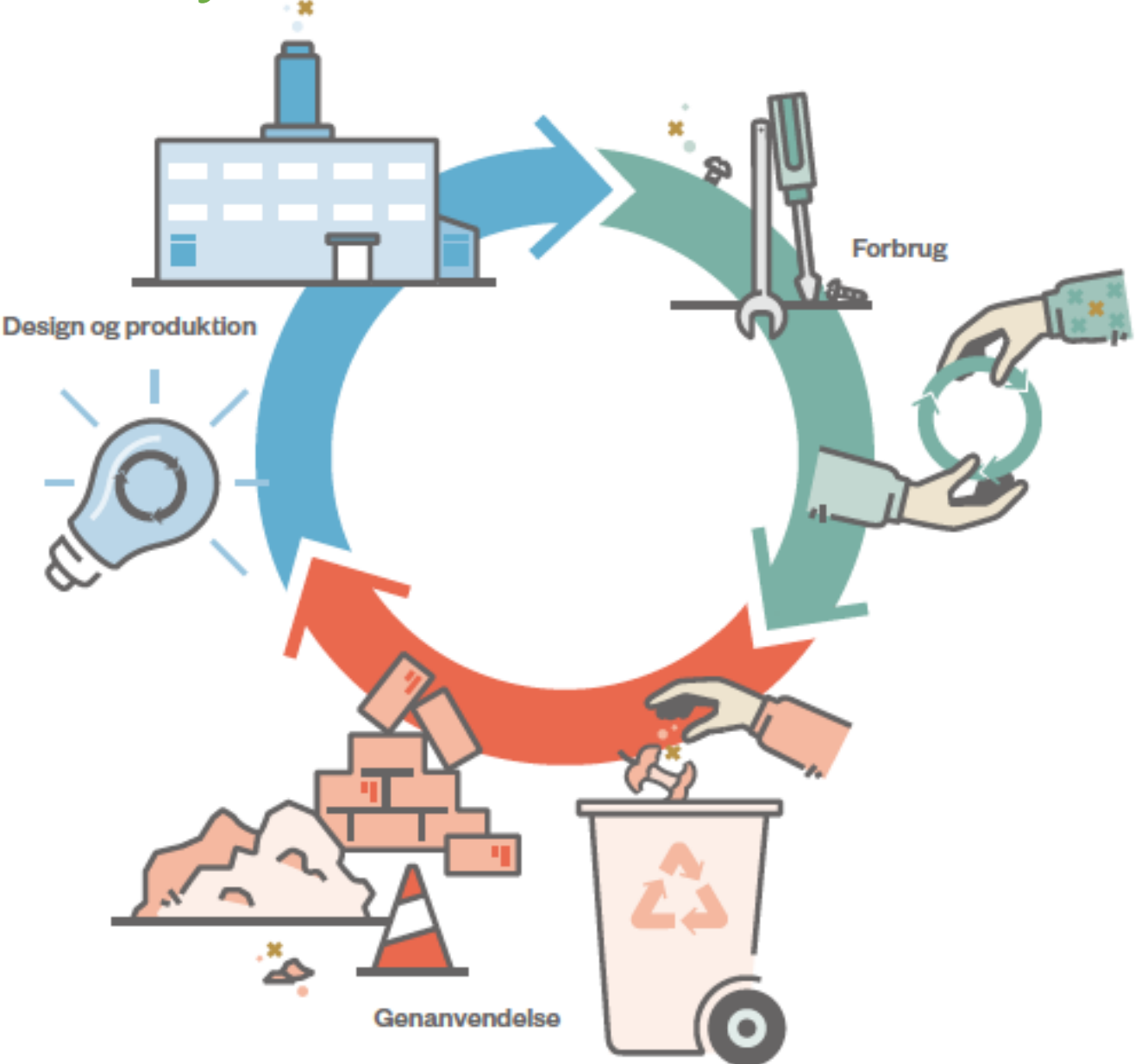
The European Commission adopted an ambitious **Circular Economy Package**

The proposed actions will contribute to "**closing the loop**" of product lifecycles through **greater recycling and re-use, and bring benefits for both the environment and the economy**

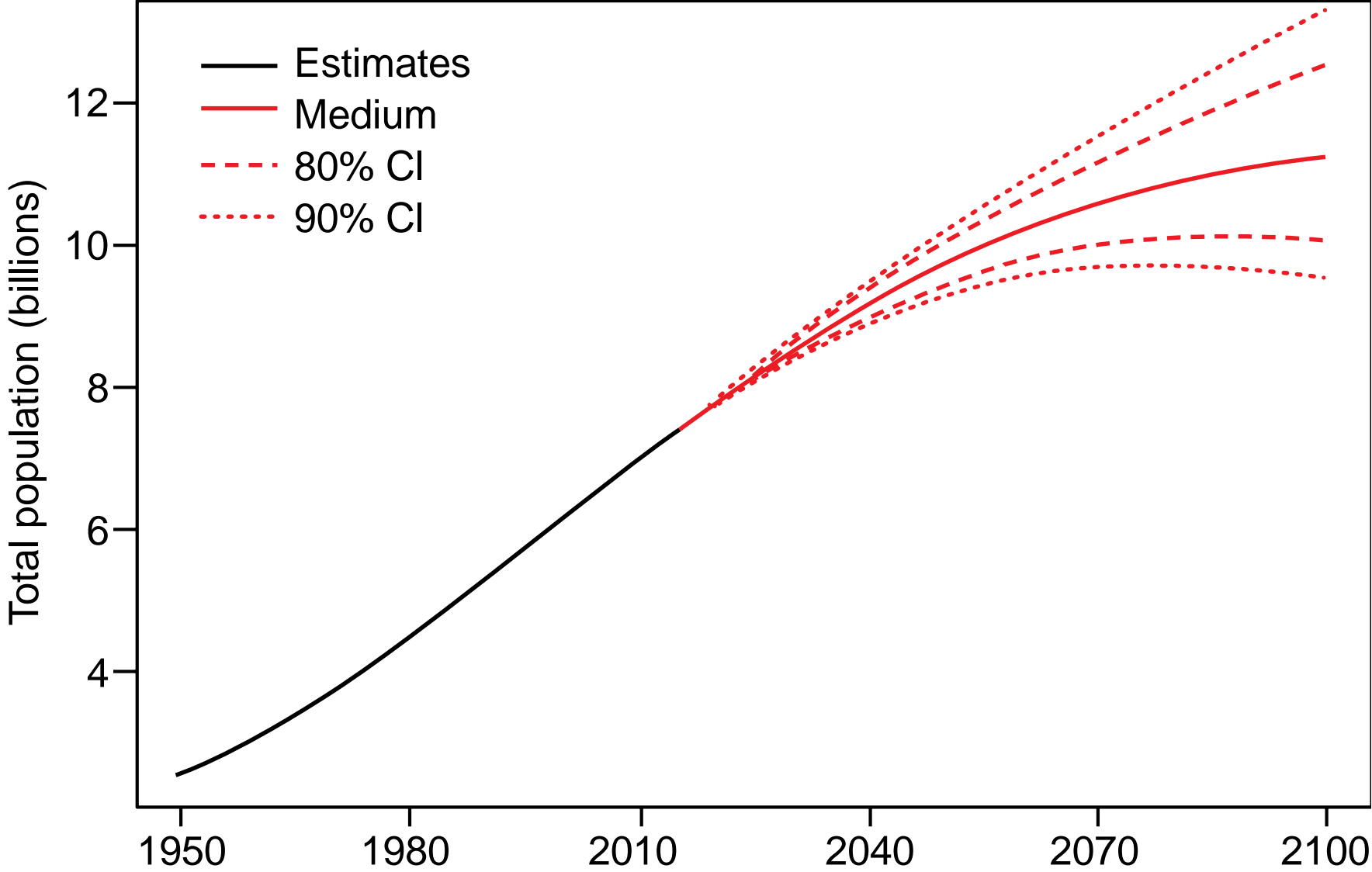
Commitment to:

- ☐ To reduce the amount of waste generated;
- ☐ To maximise recycling and re-use;
- ☐ To limit incineration to non-recyclable materials;
- ☐ To phase out landfilling to non-recyclable and non-recoverable waste;
- ☐ To ensure full implementation of the waste policy targets in all Member States

Circular economy



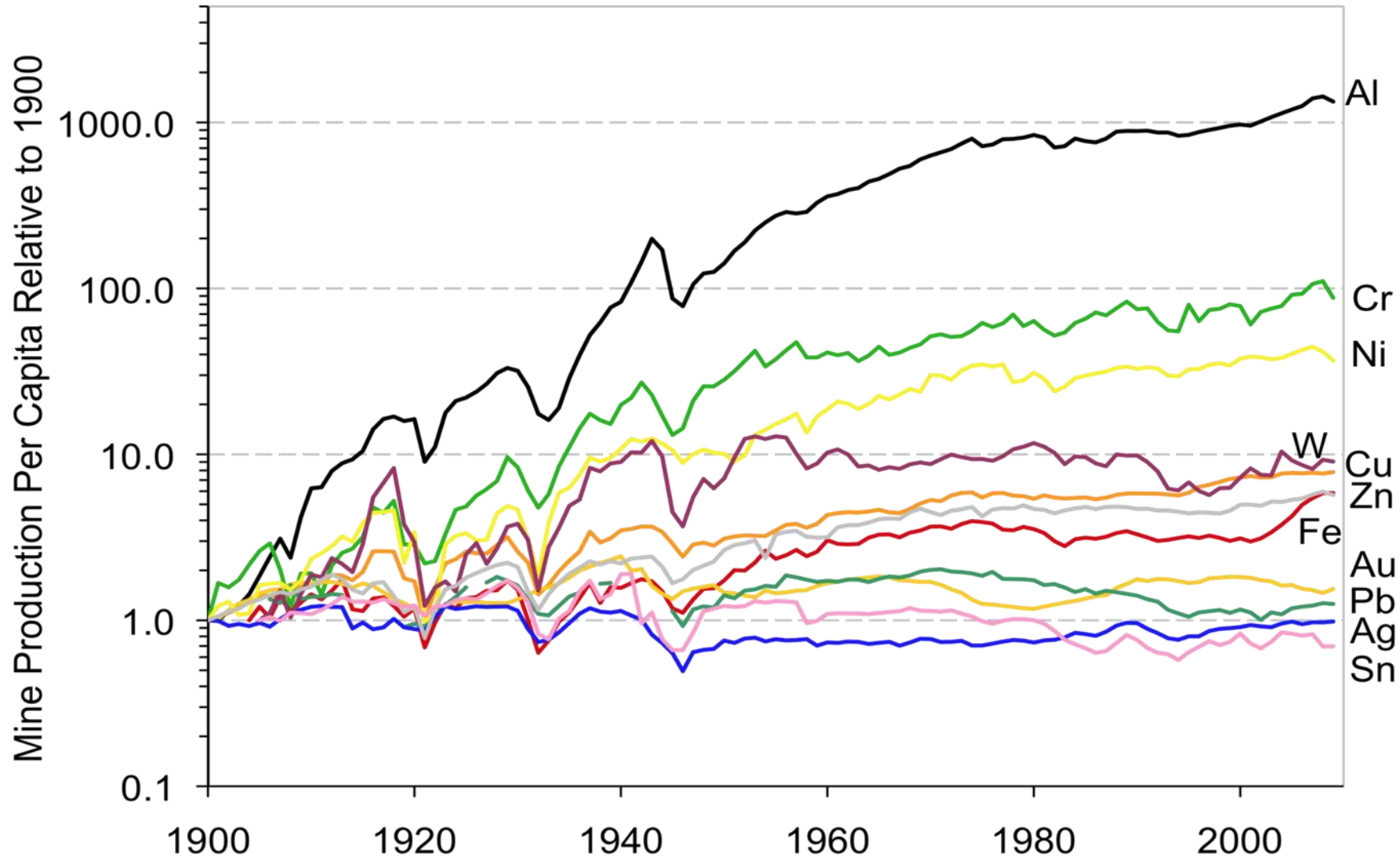
World population



Source: United Nations, Department of Economic and Social Affairs. Population Division (2015). World Population Prospects: The 2015 Revision, New York, United States.

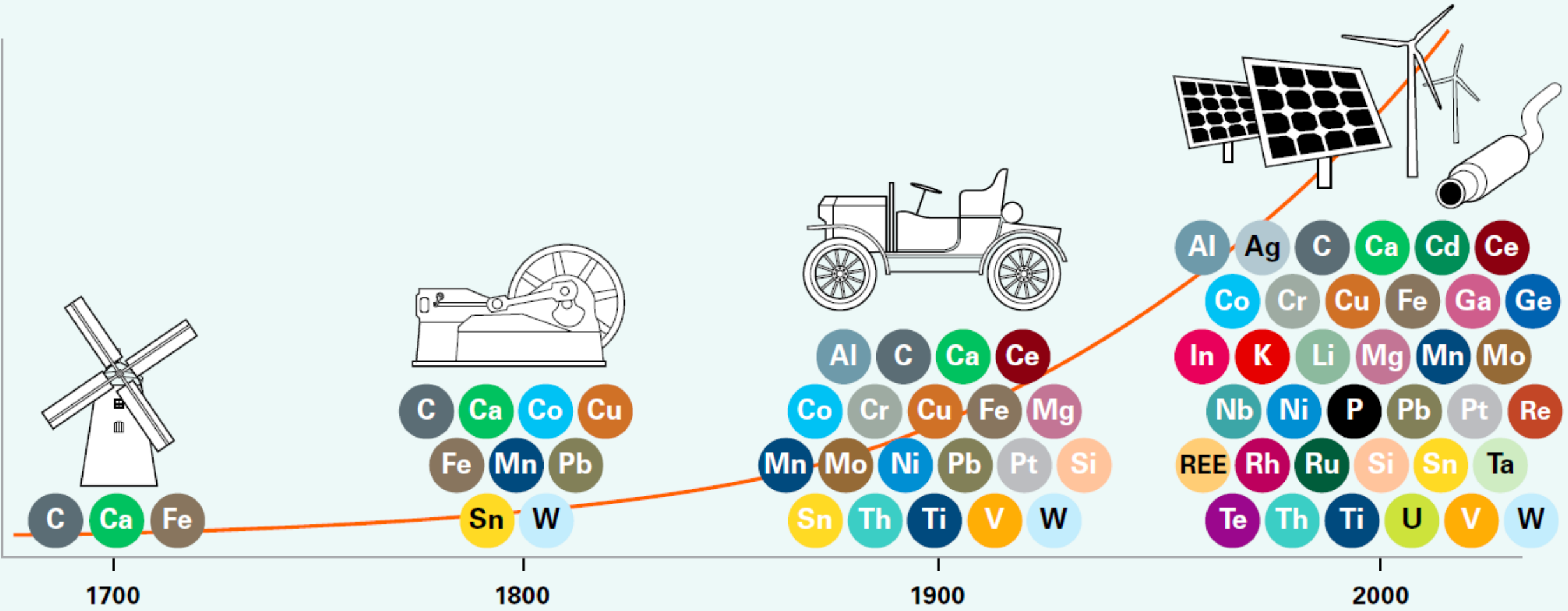


Global per Capita metals use 1900-2008



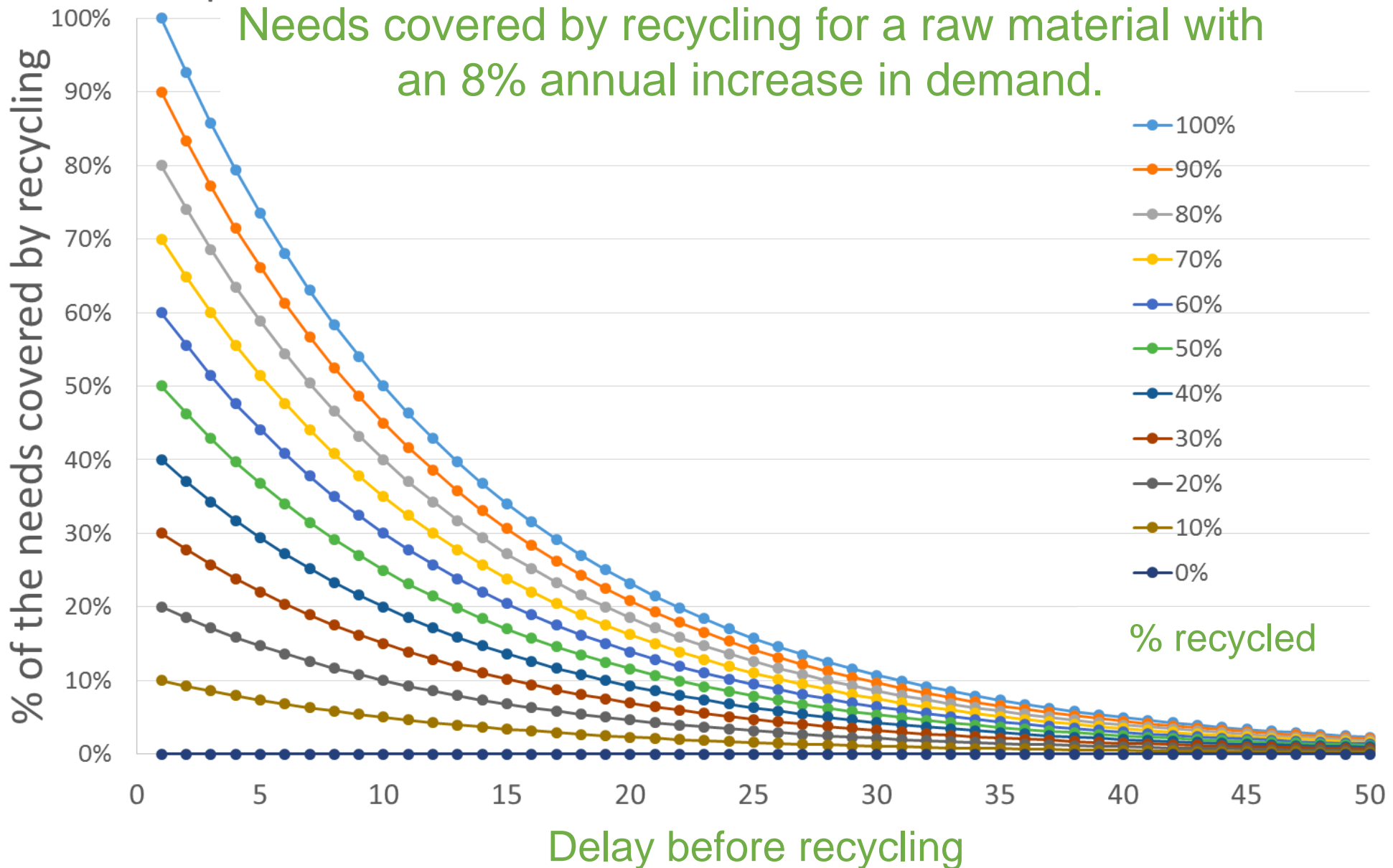
Graedel, Pers. Comm.
(2015)

Consumption of mineral raw materials

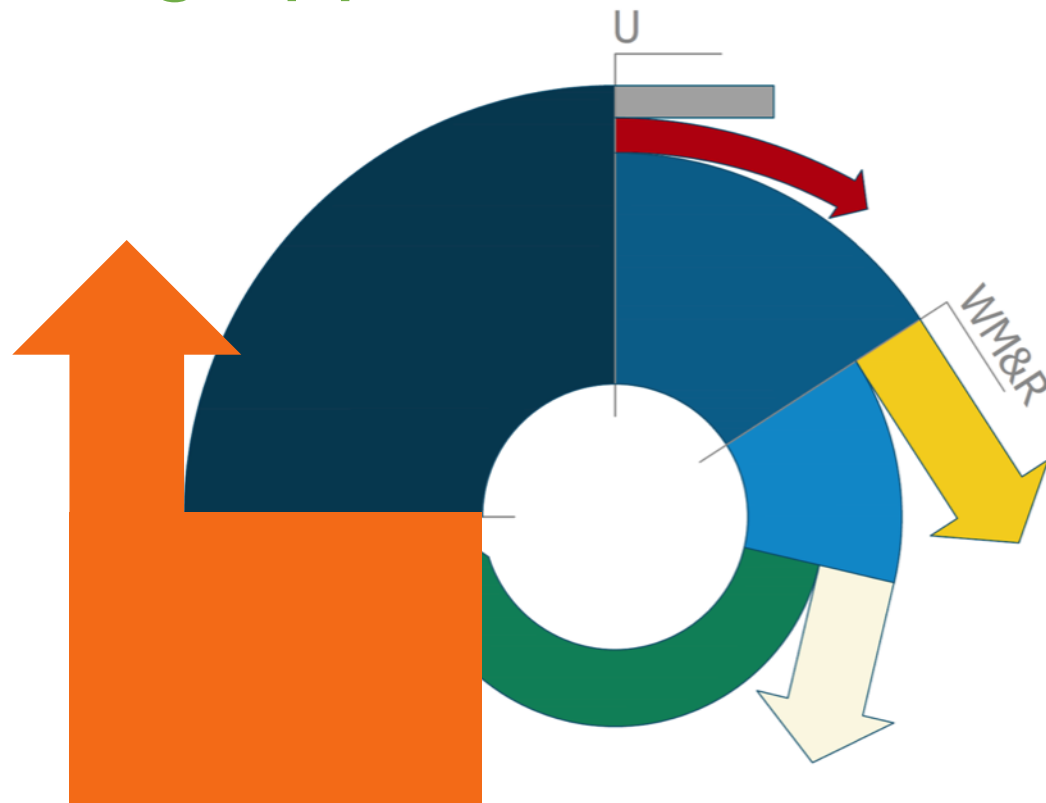


Recycling opportunities

Needs covered by recycling for a raw material with an 8% annual increase in demand.



Recycling opportunities



- Production and manufacturing
- In-use products
- Functionally recycled
- Non-functionally recycled/ not recovered

In-use dissipated

- Se, Mn in fertilizers
- Al, Cu, Mg in pyrotechnics

Currently unrecyclable

- REEs in polishing powders
- Al in steelmaking

Potentially recyclable

- Alloying elements recoverable/recyclable

Unspecified

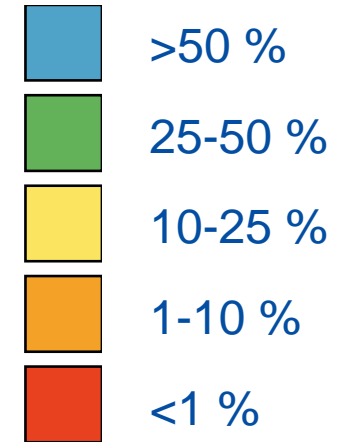
- Miscellaneous uses



(From Graedel Pers. Comm. and Ciacci et al. *Environ Sci. Technol.* 2015.)

Recycling Opportunities

1 H																	2 He
3 Li	4 Be											5 B	6 C	7 N	8 O	9 F	10 Ne
11 Na	12 Mg											13 Al	14 Si	15 P	16 S	17 Cl	18 Ar
19 K	20 Ca	21 Sc	22 Ti	23 V	24 Cr	25 Mn	26 Fe	27 Co	28 Ni	29 Cu	30 Zn	31 Ga	32 Ge	33 As	34 Se	35 Br	36 Kr
37 Rb	38 Sr	39 Y	40 Zr	41 Nb	42 Mo	43 Tc	44 Ru	45 Rh	46 Pd	47 Ag	48 Cd	49 In	50 Sn	51 Sb	52 Te	53 I	54 Xe
55 Cs	56 Ba	*	72 Hf	73 Ta	74 W	75 Re	76 Os	77 Ir	78 Pt	79 Au	80 Hg	81 Tl	82 Pb	83 Bi	84 Po	85 At	86 Rn
87 Fr	88 Ra	**	104 Rf	105 Db	106 Sg	107 Sg	108 Hs	109 Mt	110 Ds	111 Rg	112 Uub	113 Uut	114 Uug	115 Uup	116 Uuh	117 Uus	118 Uuo



* Lanthanides

57 La	58 Ce	59 Pr	60 Nd	61 Pm	62 Sm	63 Eu	64 Gd	65 Tb	66 Dy	67 Ho	68 Er	69 Tm	70 Yb	71 Lu
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** Actinides

89 Ac	90 Th	91 Pa	92 U	93 Np	94 Pu	95 Am	96 Cm	97 Bk	98 Cf	99 Es	100 Fm	101 Md	102 No	103 Lr
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Circular economy



... and The value chain



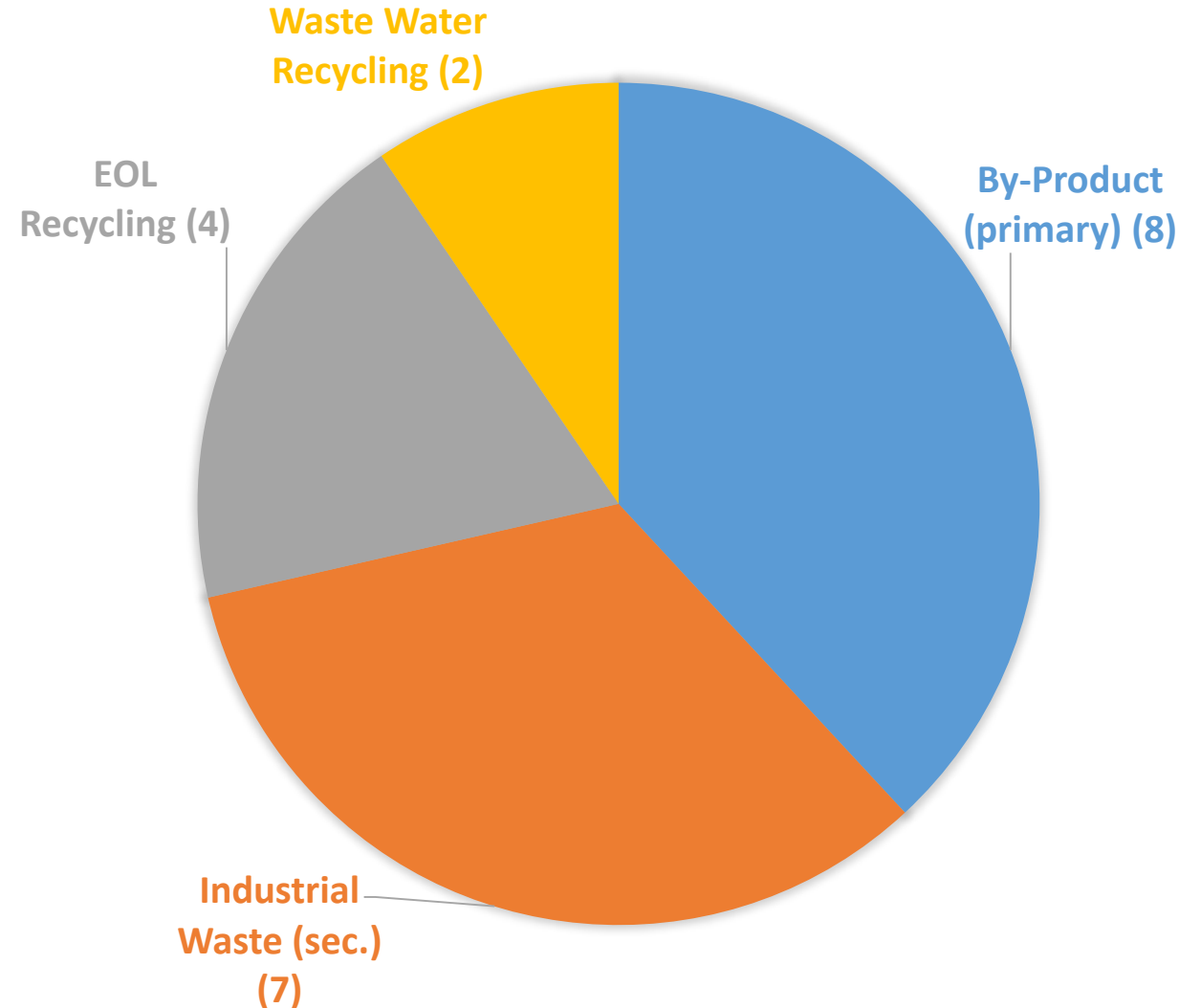
The raw materials value chain



Recycling – EIT RawMaterials project portfolio

The up-scaling portfolio can be classified into projects related to:

- secondary urban waste
- primary by-product extraction
- secondary industrial waste
- end of life product recycling



AVAR	Raw materials from wastes from the alumina refining industry.	primary by-product
NewEco	To produce a Ni/Cu/Co/PGM/S product from new sources of nickel sulphide	primary by-product
COPPLEX	New Sustainable Process to treat Complex Raw Materials, Revaluating Residues	primary by-product
MIN-PET	Mineral Products from Petrit-T sidestream technology	primary by-product
RIGaT	Recovery of Indium, Germanium and Tin	primary by-product
RECOVER	Red mud and Copper slag Valorisation in Engineered Products	primary by-product
Go-4-0	Valuable metal alloys from iron and manganese oxides wastes	primary by-product
ReclaMet	Reclaiming valuable metals from process residues with the HIsarna process	primary by-product
FLAME	Fly Ash to valuable MinErals	secondary ind. waste
SELISI	Second life of Silicon	secondary ind. waste
raPHOSafe	Classification and Sorting of Radium-rich Phosphogypsum Tailings	secondary ind. waste
REGENERATION	Reusable Germanium wafers for the next high-Efficiency t-f solar cell geneRATION	secondary ind. waste
OpTaRec	Optimising the Tantalum Recycling Process	secondary ind. waste
SPL-CYCLE	Closing the loop of the Spent Pot-line (SPL) in Al smelting process	secondary ind. waste
RADIUS	Recycled automotive components by upgrading metallic scraps	secondary ind. waste
TiSPHERO	Manufacturing of spherical powders from scraps for special applications	secondary ind. waste
ViviMag	Phosphorus and iron recovery from sewage sludge	urban waste
PHOS-FORCE	Market ready technologies for P-recovery from municipal wastewater	urban waste
AutoBat-Rec	Automotive Battery Recycling 2020	end of life product r
DISPLAY	Material recovery from display applications and Printed Circuit Boards	end of life product r
ReSiELP	Recovery of Silicon and other materials from Photovoltaic Panels	end of life product r
WEEE REC	Key technology for a recycling facility for 30,000 t/a WEEE-concentrate	end of life product r

Trends and Predictions in Raw Materials

World Economic Forum (2015) Mining and Metals in a Sustainable World 2050:

- A strong move towards recycling and circularity
- Mining will not disappear
- The need for raw materials will not disappear
- Technology will matter more than ever
- Understanding value chains will be important

Thank you for your
attention



European Institute of Innovation and Technology - EIT

EIT brings together the three sides of the “knowledge triangle”: business, education and research.

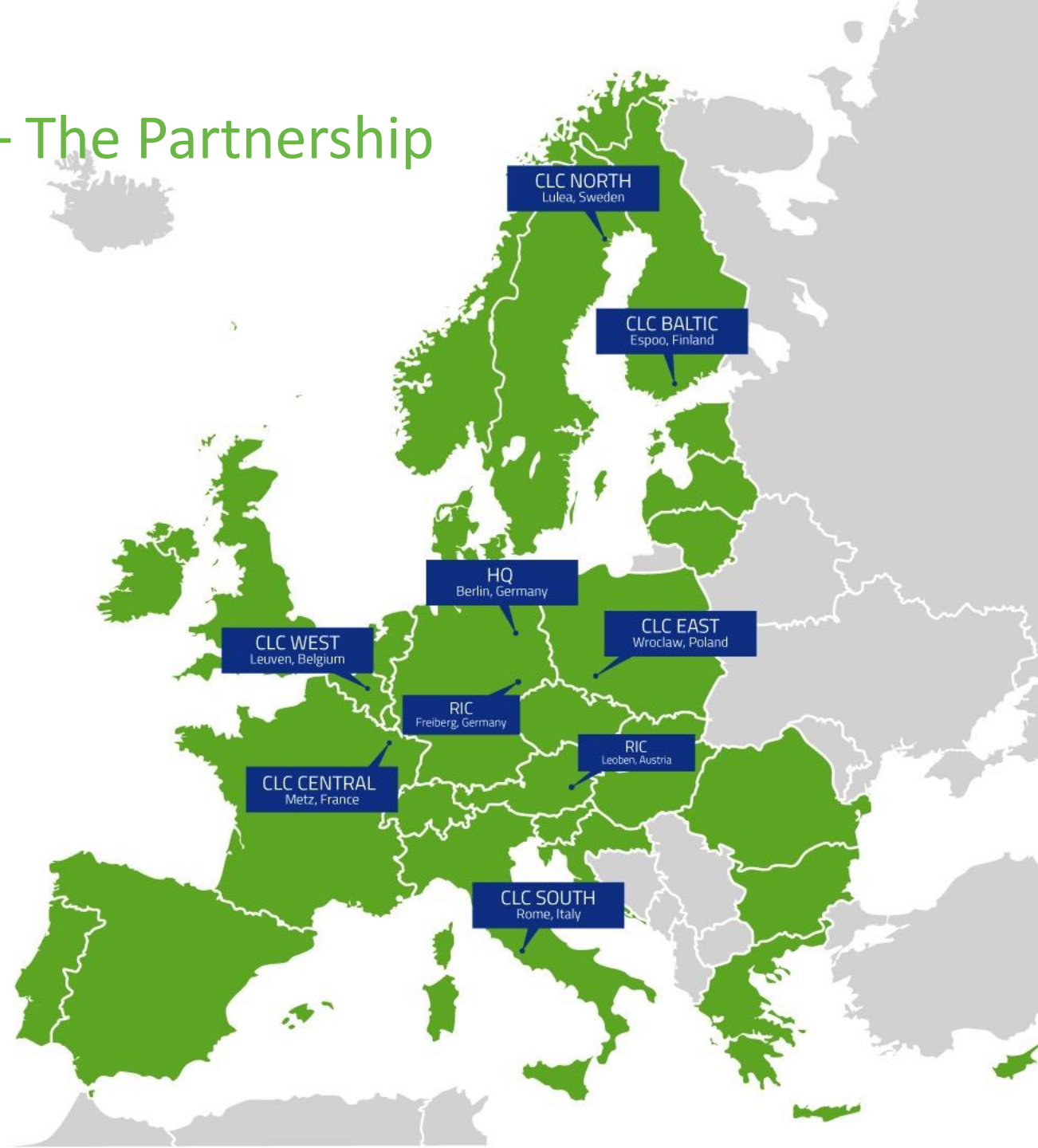
EIT strengthens innovation in Europe by supporting new talent and new ideas through *Knowledge and Innovation Communities* (KICs).



The strategic backbone of the KIC – The Partnership

>120 partners, 23 countries

- Northern CLC: Luleå, Sweden:
- Eastern CLC: Wroclaw, Poland
- Southern CLC: Rome, Italy
- Central CLC: Metz, France
- Western CLC: Leuven, Belgium
- Baltic Sea CLC: Espoo, Finland
- HQ: Berlin, Germany



Portfolio 2018 (total KAVA budget: 68 million EUR)

