

Session 3: Sustainability of PV components

Thursday, December 7
14:00 – 15:00

SUSTAINABLE
SOLAR
EUROPE 2023



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EUROPE 2023

7 December, Brussels, Belgium



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Sustainability of raw materials in PV components

Sustainable Solar Europe 2023

7.12.2023

Daniel Cios

Policy Officer

*GROW I.1 – Energy Intensive Industries
and Raw Materials*

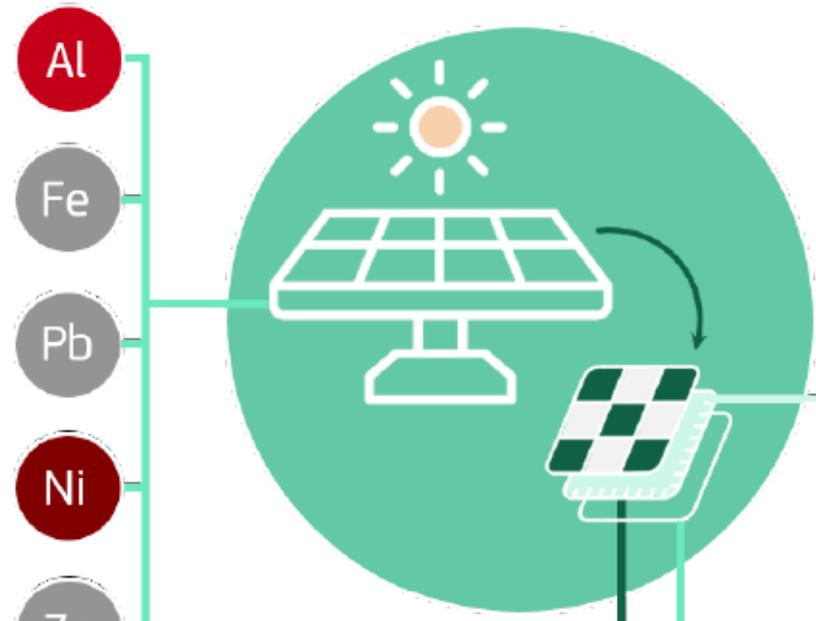
Aluminium in panel frames and inverters in alloys for construction and support

Iron: in steel alloys for different parts and in fixing systems

Lead: in alloys with tin as solder for electric circuits and interconnectors

Nickel: in electroplating or in stainless steel frames, fasteners and connectors

Zinc: as in steel alloys for different parts and in fixing systems transparent conductive oxide in the front contact of solar cells



- Al
- Fe
- Pb
- Ni
- Zn

- Cu
- Se
- In
- Mo
- Ga
- Sn
- Te
- Cd

Copper: highly used for wires, cables, inverters, also in thin-film copper indium gallium selenide (CIGS) technology

Selenium: in thin-film CIGS solar cell

Indium: as indium-tin-oxide (ITO) conductive layer or in CIGS technology

Molybdenum: as back contact for CIGS or in stainless steel frames

Gallium: as dopant in semiconductors or in CIGS technology

Tin: in combination with lead for soldering or with indium in ITO conductive layers

Tellurium and Cadmium: in thin-film cadmium telluride (CdTe) PV technology

Indium: as indium-tin-oxide (ITO) conductive layer in (CIGS) technology

Boron: as dopant in crystal lattice of the silicon-based wafers

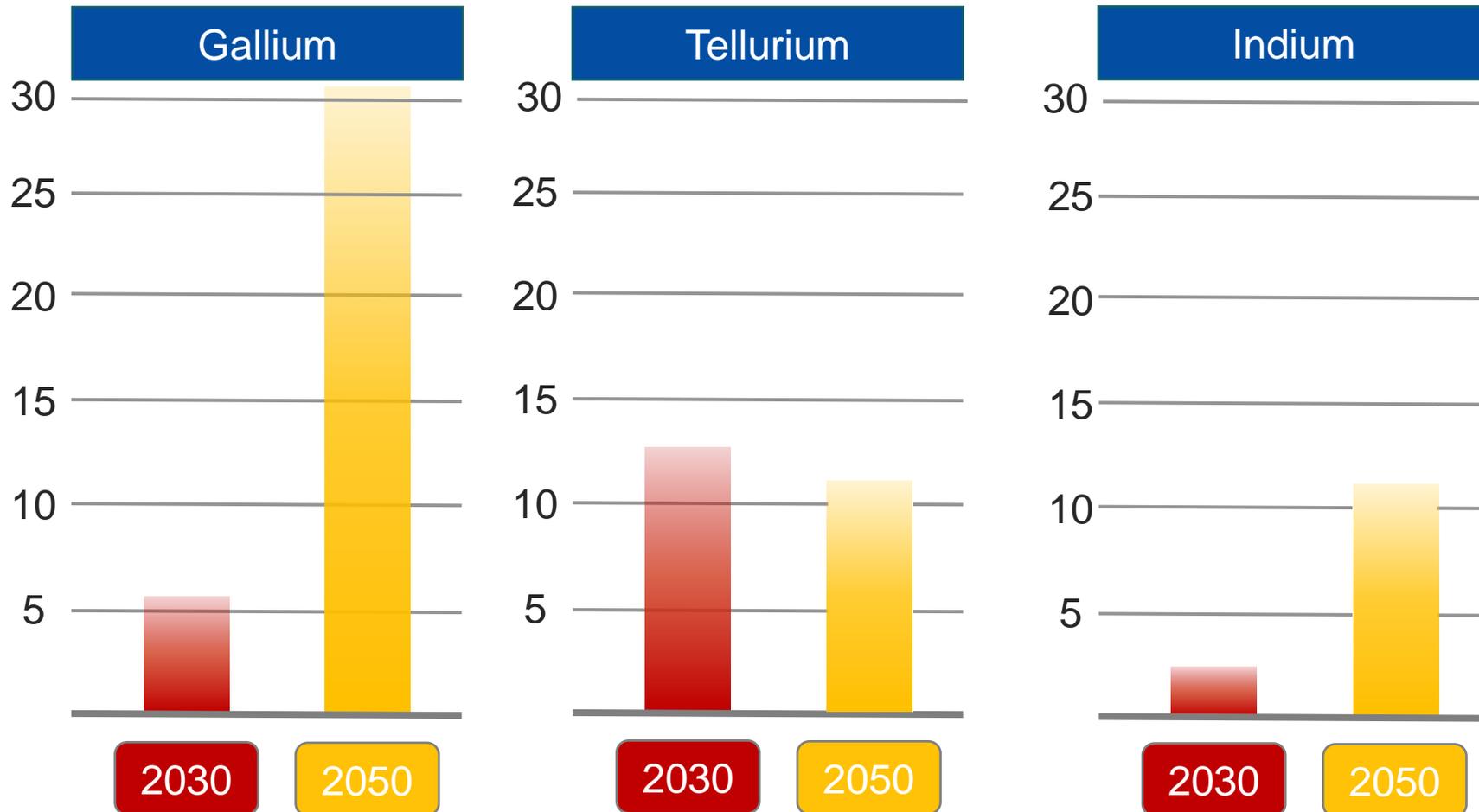
Germanium: as a semiconductor materials for multi-junction solar cells for space applications

Silicon: as semiconductor materials in crystalline solar cells

Silver: as conductive paste on front and back side of the crystalline solar cells

- Strategic Raw Material
- Critical Raw Material

The demand for raw materials will increase



Source:
Supply chain analysis and material demand forecast in strategic technologies and sectors in the EU – A foresight study, Joint Research Centre, European Commission, 2023

Act

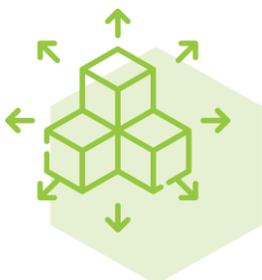
Ensuring a secure and sustainable supply of critical raw materials for the Union



Strengthen all stages of the European CRM value chain



Improve EU capacity to monitor and mitigate risks of disruption to CRM supply



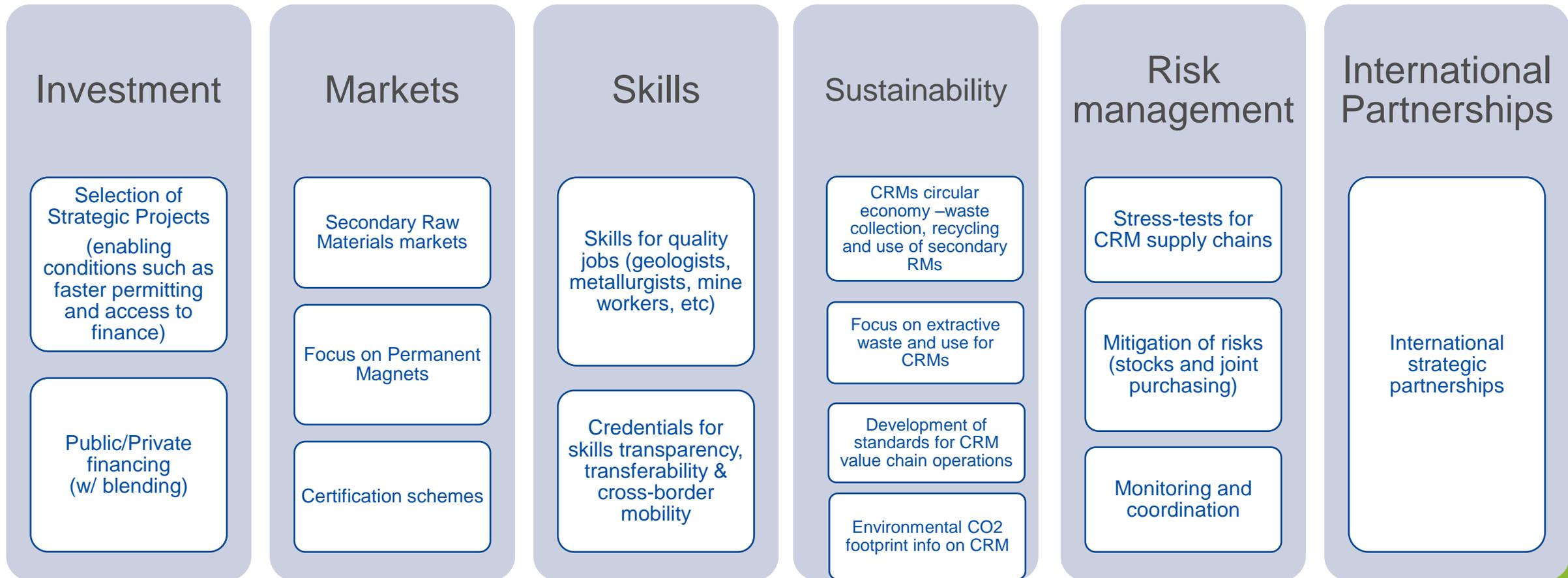
Diversify EU CRM imports to reduce strategic dependencies



Improve CRM circularity and sustainability

Critical Raw Materials Act actions

Ensuring a secure and sustainable supply of critical raw materials for the Union



Setting Priorities

DEFINING CRITICAL AND STRATEGIC RAW MATERIALS

CRM

Whole EU economy, based on :

- supply risk
- economic importance

SRM

SRM are a subset of CRM:

- Key for strategic technologies (green, digital, defence and space)
- Forecast demand risks outstripping supply

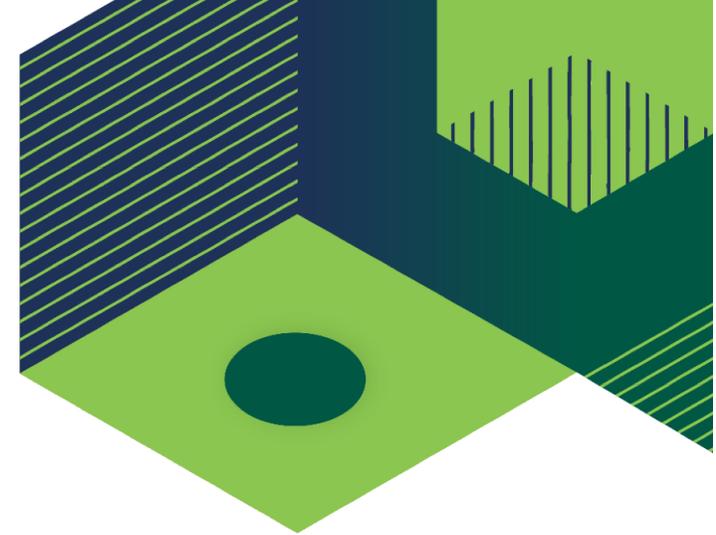
2030 BENCHMARKS

Towards more SRM supply security

- EU's extraction capacity cover at least **10%** of the EU's SRM consumption
- EU's processing capacity cover at least **40%** of the EU's SRM consumption
- EU's recycling capacity cover at least **15%** of the EU's SRM consumption

Towards more diversification of supply

- Not more than **65%** of EU consumption of each SRM should come from a single third country.



Critical Raw Materials

Note: A subset of the CRMs are classified as „**strategic raw materials**“ due to their use in strategic technologies and strong projected demand growth. Certain measures under the CRMA apply only to them.

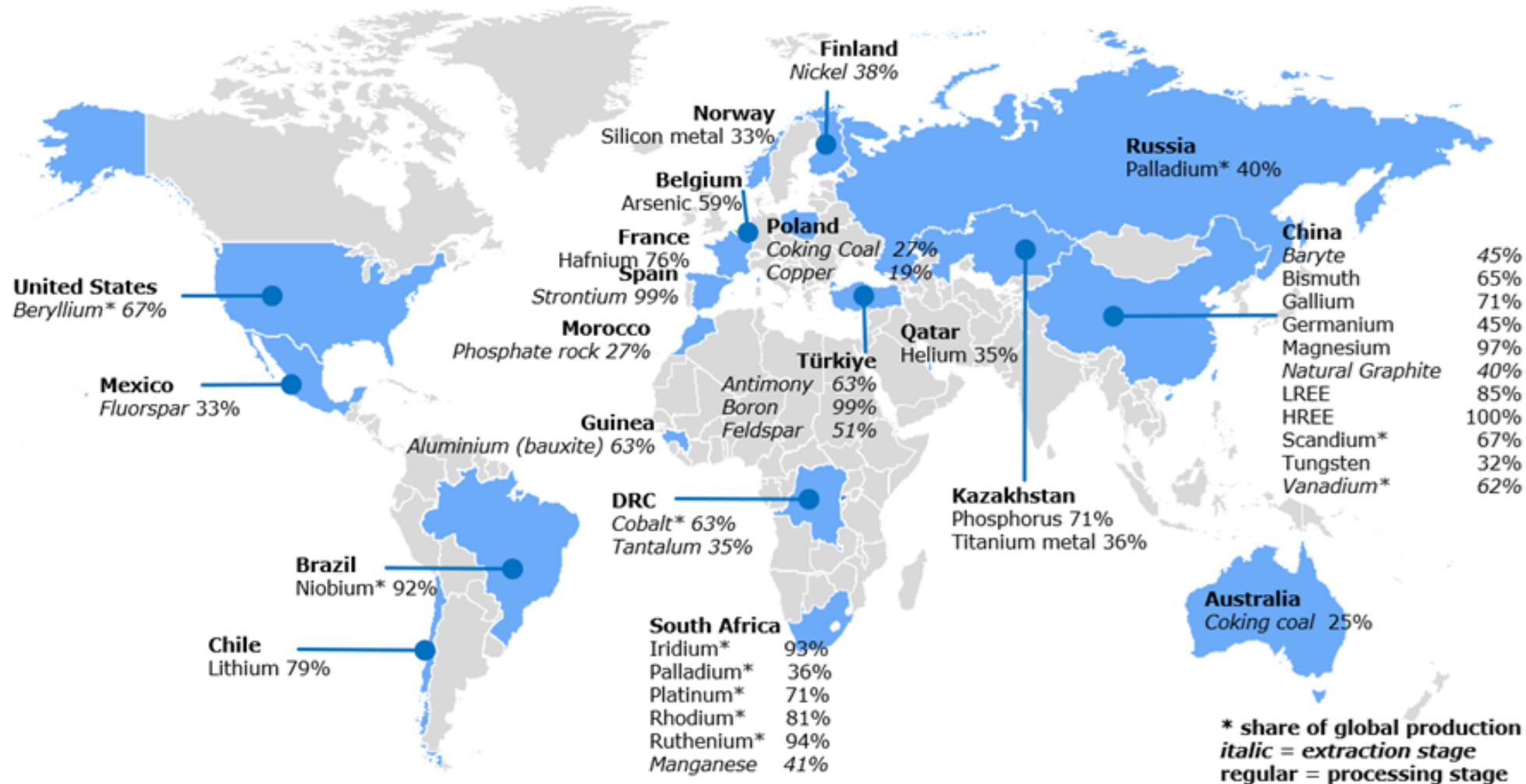
34 RAW MATERIALS DEFINED AS CRITICAL BY THEIR HIGH

- Economic importance
- Supply risk

... based on a regular assessment of available data in an established methodology

- **Aluminium**
- Antimony
- Arsenic
- Bauxite
- Baryte
- Beryllium
- **Bismuth**
- **Boron**
- **Cobalt**
- Coking Coal
- **Copper**
- Feldspar
- Fluorspar
- **Gallium**
- **Germanium**
- Hafnium
- Helium
- **Heavy Rare Earth Elements**
- **Light Rare Earth Elements**
- **Lithium**
- **Magnesium**
- **Manganese**
- **Natural Graphite**
- **Nickel – battery grade**
- Niobium
- Phosphate rock
- Phosphorus
- **Platinum Group Metals**
- Scandium
- **Silicon metal**
- Strontium
- **Synthetic Graphite**
- Tantalum
- **Titanium metal**
- **Tungsten**
- Vanadium

Dependencies in the EU supply of Critical raw materials



11 Source: "European Commission, Study on the Critical Raw Materials for the EU 2023– Final Report"

STRATEGIC PROJECTS

Across the whole SRM value chain: extraction – processing – recycling in the EU and third countries

Selection by the Commission on advice from the Board based on (Article 5, criteria Annex III)

- Contribution to security of supply, Sustainability, Technical feasibility, Cross-border benefits in EU/ Economic and social benefits in third countries

Process (Art. 6)

- Application by the project promoter
- Opinion by the Board, Veto possibility for the MS or third country concerned
- Decision by the Commission

Permitting

- One stop shop (OSS) (Art. 8)
- Time limits for the permit granting process (Art. 10)
- Priority status for administrative and judicial processes (Art. 9)
- Considered of public interest in light of potential overriding interest exemption (7(2))
- Bundling and streamlining of environmental assessments (Art. 11)
- Planning (Art. 12)

Coordination of Financing

- Private and public investment
- State aid

Facilitating off-take agreements

- Commission brings together project promoters and off-takers via a system, in compliance with competition rules

with a high level of environmental protection

CIRCULARITY

- National measures on CRMs circularity
 - Increase reuse, collection and recycling
 - Increase use of secondary RM
 - Recycling technologies
- Maximising potential from (closed) extractive waste facilities
- Recyclability and recycled content of permanent magnets

SUSTAINABLE CHOICES

- Recognition of certification schemes on the sustainability of CRMs
- Empowerment to set, at a later stage, information requirements on the environmental footprint of CRMs placed in the EU market

Other Regulatory Measures

- Review of End of Life Vehicles Directive
- Codes in European list of Waste
- Harmonisation of Waste Management Rules
- Review Waste Electrical and Electronic Equipment Directive

Governance

CRITICAL RAW MATERIALS BOARD

The Board has an advisory role supporting the Commission in the implementation of the different actions proposed in the Act.

COMPOSITION

Chaired by the European

Commission and the

Representatives from the EP as

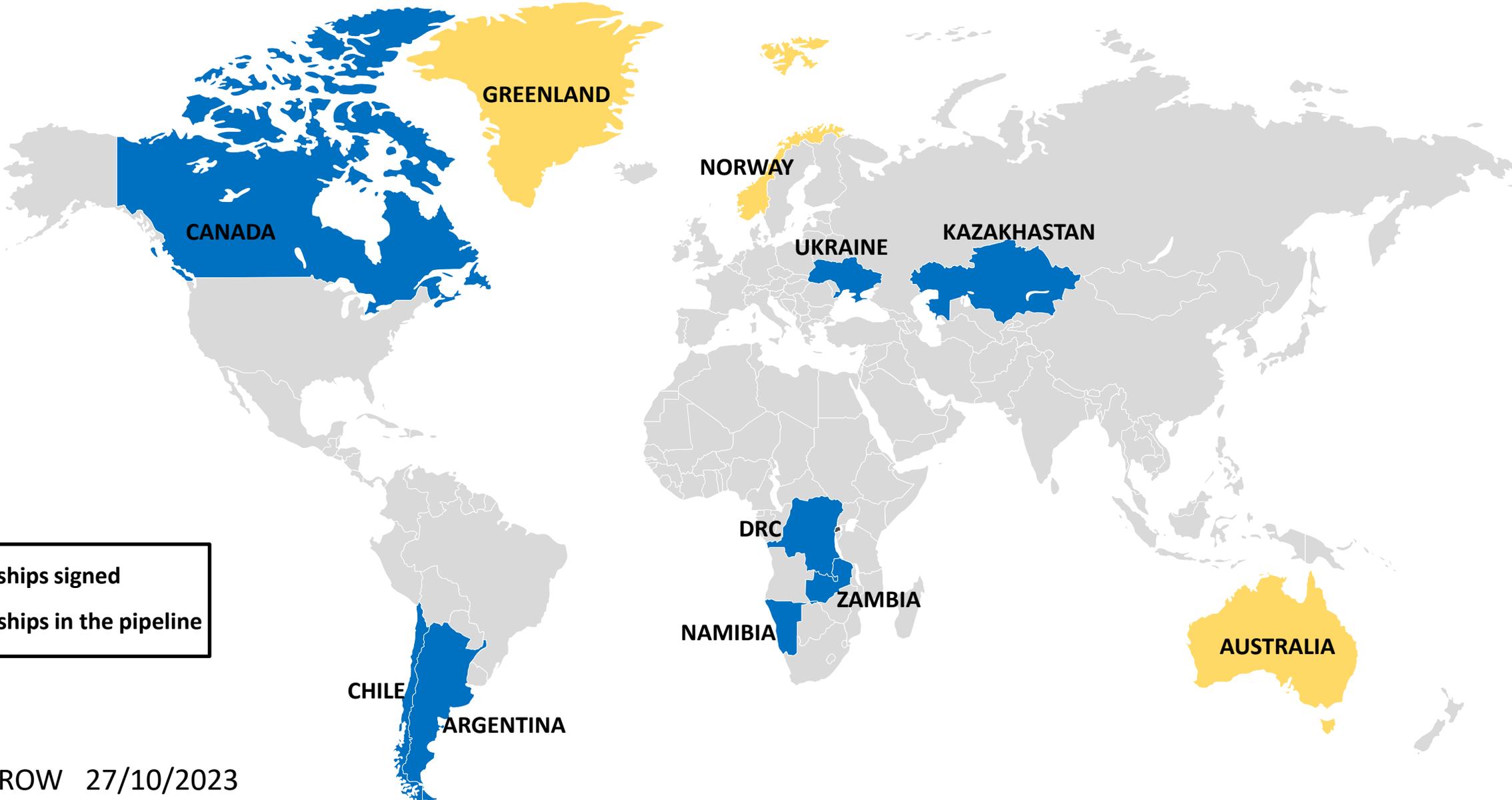
STRATEGIC PARTNERSHIPS

The Board also discusses Strategic Partnerships of the Union with third countries that cover raw materials and ensures their coordination with other international fora and initiatives.

Non-Regulatory Diversification Measures

- International initiatives (MSP, CRM Club, G7, etc)
- Trade and Investment Agreements
- Lowering risk of investing abroad (Export Credit Agencies, etc)

Strategic Partnerships Raw Materials



Partnerships signed
Partnerships in the pipeline



European
Commission

Raw Materials Week

13 • 17 November 2023
Brussels

A wide-angle photograph of a Brussels street scene. In the foreground, there is a large, ornate garden with red and white flower beds. A bronze statue of a man on a horse stands on a pedestal in the middle ground. The background shows a row of colorful, historic buildings and the Atomium tower in the distance under a clear blue sky.

**13-17
November 2023**

The 8th edition of the Raw Materials Week

<https://ec.europa.eu/raw-materials-week>

Raw Materials in Horizon 2020 (2014-2020)

~ EUR 600 mln budget

Exploration	9 projects	EUR 55 mln
Extraction	15 projects	EUR 121 mln
Processing	19 projects	EUR 151 mln
Substitution	4 projects	EUR 19 mln
Reuse, recycling, recovery	6 projects	EUR 57 mln
Policy support	22 projects	EUR 43 mln

Raw materials innovation for the circular economy: sustainable processing, reuse, recycling and recovery schemes

TOPIC ID:

CE-SC5-07-2018-2019-2020

<https://ec.europa.eu/info/funding-tenders/opportunities/portal/screen/opportunities/topic-details/ce-sc5-07-2018-2019-2020;callCode=H2020-SC5-2018-2019-2020;freeTextSearchKeyword=;matchWholeText=true;typeCodes=1;statusCodes=31094501,31094502,31094503;programmePeriod=null;programCcm2Id=31045243;programDivisionCode=31047972;focusAreaCode=null;geographicalZonesCode=null;programmeDivisionProspect=null;startDateLte=null;startDateGte=null;crossCuttingPriorityCode=null;cpvCode=null;performanceOfDelivery=null;sortQuery=submissionStatus;orderBy=asc;onlyTenders=false;topicListKey=topicSearchTablePageState>

Overview calls raw materials 2021-2024*

PRIMARY RAW MATERIALS

EXPLORATION

16 projects
€98.8m

EXTRACTION

15 projects
€107.7m

PROCESSING

9 projects
€74.3m

THROUGHOUT THE PROCESS

SUPPLY CHAIN

7 projects
€78.1m

POLICY SUPPORT

4 projects
€14.8m

REUSE, RECYCLING & RECOVERY

12 projects
€97.9m

SECONDARY RAW MATERIALS

TOTAL BUDGET ALLOCATION FOR RAW MATERIALS



Research & innovation
€456.7m



Policy support
€14.8 m

*Estimated budget and number of projects for 2023 2024

Cluster 4

Digital, Industry and Space

Call HORIZON-CL4-2024-RESILIENCE-01

Opening: 19 Sep 2023
Deadline(s): 07 Feb 2024

Call – RESILIENT VALUE CHAINS 2024

Raw Materials for EU open strategic autonomy and successful transition to a climate neutral and circular economy

- HORIZON-CL4-2024-RESILIENCE-01-01: Exploration of critical raw materials in deep land deposits (RIA)
- HORIZON-CL4-2024-RESILIENCE-01-04: Technologies for processing and refining of critical raw materials (IA)
- HORIZON-CL4-2024-RESILIENCE-01-08: Rare Earth and magnets innovation hubs (IA)
- HORIZON-CL4-2024-RESILIENCE-01-10: Addressing due diligence requirements in raw materials supply chains (CSA)
- HORIZON-CL4-2024-RESILIENCE-01-11: Technologies for extraction and processing of critical raw materials (IA)

List of Critical Raw Materials for the EU 2023

Aluminium/Bauxite	Fluorspar	Manganese	Tantalum
Antimony	Feldspar	Natural Graphite	Titanium
Arsenic	Gallium	Nickel	Tungsten
Baryte	Germanium	Niobium	Vanadium
Beryllium	Hafnium	Phosphate Rock	
Bismuth	Helium	Phosphorus	
Boron	Heavy Rare Earths	Platinum Group Metals	
Cobalt	Light Rare Earths	Scandium	
Coking Coal	Lithium	Silicon metal	
Copper	Magnesium	Strontium	

Proposal for a REGULATION OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL establishing a framework for ensuring a secure and sustainable supply of critical raw materials and amending Regulations (EU) 168/2013, (EU) 2018/858, 2018/1724 and (EU) 2019/1020

COM/2023/160 final

ANNEX II

Eligibility conditions – Strategic Partnerships on Raw Materials

*Participation in this topic **is limited to** legal entities established in Member States, associated countries, OECD countries, African Union Member States*, MERCOSUR, CARIFORUM, Andean Community and countries with which the EU has concluded strategic partnerships on raw materials.*

Argentina

Canada

Chile

DRC

Greenland

Kazakhstan

Namibia

Ukraine

Zambia

New partnerships that will be signed before the call deadline will be counted as eligible.

HORIZON-CL4-2024-RESILIENCE-01-01: Exploration of critical raw materials in deep land deposits (RIA)

Expected outcomes:

- Develop innovative technologies for exploration of critical raw materials in deep land deposits in the EU and non-EU countries;
- Increase the resources and reserves of various primary critical raw materials within the EU and non-EU countries;
- Accelerate development of EU domestic critical raw materials exploration projects integrating innovative technologies;
- Strengthen EU autonomy and ethical sourcing of raw materials by developing socially and environmentally acceptable means of discovery of primary raw materials.
- Improve responsible supply of raw materials to the EU in line with the EU principles for sustainable raw materials, which are a non-regulatory set of principles based on the EU acquis. They set out requirements for sustainable raw materials and extraction and processing in Europe in terms of social, environmental and economic performance.
- Promote the utilisation of UNFC (United Nations Framework Classification for Resources) and UNRMS (United Nations Resource Management System) in the raw materials sector.
- Actions are expected to contribute to the implementation of the EU action plan on Critical Raw Materials

Indicative budget of the call: EUR 20 million

EU contribution per project: EUR 5 million

Type of Action: RIA

TRL: Achieve TRL 3-5

HORIZON-CL4-2024-RESILIENCE-01-04: Technologies for processing and refining of critical raw materials (IA)

Expected outcomes:

- Increase recovery rates of valuable raw materials, particularly critical raw materials from low grade or complex ores and/or from extractive waste;
- Significantly increase economic performance in terms of higher material-, water-, energy- and cost-efficiency and flexibility in minerals processing and metallurgical processes;
- Significantly improve the health, safety and environmental performance of the operations throughout the whole life cycle which is considered, including a reduction in waste, wastewater and emissions generation and a better recovery of resources from generated waste;
- Improve responsible supply of raw materials to Europe in line with the EU principles for sustainable raw materials, which are a non-regulatory set of principles based on the EU acquis. They set out requirements for sustainable raw materials and extraction and processing in Europe in terms of social, environmental and economic performance. Actions are expected to contribute to the implementation the EU action plan on Critical Raw Materials.

Indicative budget of the call: EUR 22 million

EU contribution per project: EUR 7.30 million

Type of Action: Innovation Actions

TRL: Achieve TRL 6-7

HORIZON-CL4-2024-RESILIENCE-01-08: Rare Earth and magnets innovation hubs (IA)

Expected outcomes:

- Significantly improve supply security and reduced environmental footprint of rare earth value chains in the EU
- Broad access to materials development facilities and services across Europe through a single entry point – innovation hub;
- Accelerate development of products and processes for a faster market entry;
- Reduce costs for both industry and users and increased return on investment in research;
- Improve access to end users and easier marketability of products in Europe;
- Improve responsible supply of raw materials to Europe in line with the EU principles for sustainable raw materials, which are a non-regulatory set of principles based on the EU acquis. They set out requirements for sustainable raw materials and extraction and processing in Europe in terms of social, environmental and economic performance.
- Actions are expected to contribute to the implementation the EU action plan on Critical Raw Materials and the action plan on Rare Earth Magnets and Motors from the European Raw Materials Alliance.

Indicative budget of the call: EUR 32 million

EU contribution per project: EUR 16 million

Type of Action: Innovation Actions

TRL: Achieve TRL 6-7

HORIZON-CL4-2024-RESILIENCE-01-10: Addressing due diligence requirements in raw materials supply chains (CSA)

Expected outcomes:

- Improve responsible sourcing of raw materials and responsible business conduct initiatives with regard to raw materials;
- Equip the raw materials sector with tools to enable implementation of relevant regulatory initiatives;
- Identify and address gaps in the raw materials supply chains due diligence;
- Improve responsible supply of raw materials to Europe in line with the EU principles for sustainable raw materials, which are a non-regulatory set of principles based on the EU acquis. They set out requirements for sustainable raw materials and extraction and processing in Europe in terms of social, environmental and economic performance.
- Actions are expected to contribute to the implementation the EU action plan on Critical Raw Materials

Indicative budget of the call: EUR 2.2 million

EU contribution per project: EUR 2.2 million

Type of Action: Coordination and Support Actions

HORIZON-CL4-2024-RESILIENCE-01-11: Technologies for extraction and processing of critical raw materials (IA)

Expected outcomes:

- Strengthen EU cooperation with resource rich countries;
- Provide new relevant life cycle inventory data sets based on requirements for Environmental Footprint compliant datasets and in line with the 2021 Recommendation on the use of the Environmental Footprint methods , particularly focusing on the existing knowledge gaps (e.g., new technologies for open pit and underground mining).
- To evaluate the environmental performance of the technologies a Product Environmental Footprint (PEF) study will be produced.
- Improved industrial viability, safety and environmental impacts of the operation in a way that leads to measurable improvements;
- Improved diversification EU sourcing of critical raw materials from third countries;
- Improved responsible supply of raw materials to Europe in line with the EU principles for sustainable raw materials, which are a non-regulatory set of principles based on the EU acquis. They set out requirements for sustainable raw materials and extraction and processing in Europe in terms of social, environmental and economic performance.

Indicative budget of the call: EUR 15 million

EU contribution per project: EUR 7.5 million

Type of Action: Innovation Actions

TRL: Achieve TRL 6-7

HORIZON-CL4-2024-RESILIENCE-01-11: Technologies for extraction and processing of critical raw materials (IA)

Procedure

The procedure is described in General Annex F. The following exceptions apply:

To ensure a balanced portfolio covering the partners from the two partner countries mentioned in the scope below, grants will be awarded to applications in order of ranking but also to **at least one project per each partner country**, provided that the applications attain all thresholds.

Scope

Actions have to collaborate with **Canada or Ukraine**, following the strategic partnership on raw materials established in 2021 between the EU and Canada and with Ukraine. The consortia **should contain raw materials industry from at least one of the partner countries** and raw materials users from the EU. **Technology should be demonstrated on the resources of the partner country.**

Cluster 5

Climate, Energy and Mobility

Call HORIZON-CL5-2023-D2-01

Opening: 13 Dec 2023
Deadline(s): 18 Apr 2024



SCOPE

- Develop and integrate new advanced pre-processing concepts that enable **more efficient and safe technologies** for recycling EoL LIBs.
- Substantial improvements should be achieved in the processes **environmental and economic viability and in the circular economy**
- Concepts to be addressed:
 - Battery sorting at component level, including standardisation of labelling of battery components
 - Advanced pre-processing methods to improve pre-concentration while minimizing waste
 - Process design for recovery and valorisation of anode materials
 - Electrolyte valorisation, recovery of Li salts
 - Separation of strategic battery materials, mitigate impurities
 - Recovery of electrode current collectors (Al and Cu)
 - Non-active materials (solvent, binders, separator...)
 - Life cycle sustainability, safety, techno-economical solutions



EXPECTED OUTCOMES

- European economic base which is stronger, more resilient, competitive and fit for the green and digital transitions, by **reducing strategic dependencies for critical raw materials** by promoting a circular economy.
- Direction towards the **zero-waste concept** by developing holistic, materials and energy efficient recycling processes, increase the content of recovered mass, vertical integration strategy.
- Circularity of battery materials, where **also non-metallic elements** (electrolyte, solvent, salts and polymers) are recycled back to use.
- **Environmentally beneficial processes** for battery pre-treatment to decrease the CO2 footprint and other emissions.
- **Safe** technologies aimed at improved recovery yield, increased quality and purity level of the recycled/recovered materials, improved impurity removal.

HORIZON-CL5-2024-D2-01-01

Advanced sustainable and safe pre-processing technologies for End-of-Life (EoL) battery recycling



TYPE OF ACTION

- RIA – Research & Innovation Action
- Expected **TRL 5** by the end of the project



EU CONTRIBUTION

- Per project: **8 M€**
- Total: **16 M€**



TIMING

- Call opening: **7 Dec 2023**
- Call closing: **18 April 2024**

- *Build on CL5-2023-D2-01-02 – New processes for upcoming recycling feeds*
- *Link to CL5-2022-D2-01-08 – Battery 2030+ CSA*
- *Consider participation of JRC*

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