ReSilex

18/01/2024

Critical raw materials. What is at stake?

WEBINAR

Santiago Cuesta-López

Executive Director at ISMC Cluster

General Manager in ICAMCyL Foundation

IBERIAN SUSTAINABLE MINING CLUSTER

Funded by the European Union

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MAIN PERSONS INVOLVED IN RESILEX COORDINATION

Santiago Cuesta-López
Executive Director at ISMC Cluster and General Manager in ICAMCyL Foundation

·Expert promoting international activity in raw materials (S3P-Batteries & Mining)

·Representative as member state in the EU EIP Raw Materials Operational Groups (until 2020).

·Directed more than 50 EU FP7/H2020/Horizon EU projects (15 EU projects as coordinator), mobilizing >200 M €

·Author/co-author >150 publications & technical communications to industry, >10 scientific reputed awards.

Francisco J. Luque-Ruiz
Senior Project Manager at ISMC Cluster

·Masters in environmental technologies and water management (Oxford University) combined with research work at USA, India, Spain and UK

·Experience in research, exploitation, dissemination and management sides of EU-funded R&I projects on industrial and environmental issues since 2005

·Expert evaluator of EU-funded R&I proposals

IBERIAN SUSTAINABLE MINING CLUSTER

www.ismc-iberiamine.com

ISMC comprises over 80 regional, national and international companies that join efforts to consolidate the strenghts of the mining sector and its associated services

ISMC covers a wide range of raw materials & CRMs and the whole mining value chain

>80% SMEs

>1,000 M€ turnover

0,06% Spain's GDP

Cross fertilisation – Circular Economy

Core Capacities

IBERIAN SUSTAINABLE MINING CLUSTER

www.ismc-iberiamine.com

Ensuring 17 CRMs and a wide range of Raw Materials

Antimony	Cobalt	Hafnium	Natural Graphite	Phosphorus	Vanadium
Baryte	Coking coal	Heavy rare earths	Natural Rubber	Scandium	Bauxite
Beryllium	Fluorspar	Light rare earths	Niobium	Silicon metal	Litium
Bismuth	Gallium	Indium	PGMs	Tantalum	Titanium
Borate	Germanium	Magnesium	Phospate rock	Tungsten	Strontium

6 interdisciplinary working groups with specific goals

- WG1: International projects, technological projects and grants
- WG2: International business development and financing
- WG3: Technology surveillance
- WG4: Training, health and safety in the workplace
- WG5: Communication and marketing
- WG6: Legislation, European regulations and certifications
- WG7: Environment and sustainability

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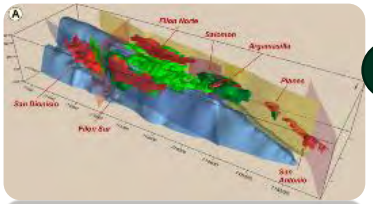
IBERIAN SUSTAINABLE MINING CLUSTER

PILOTS EXPERIENCE

1. Raw Materials recovery pilots from tailings

2. CRMs including REEs extraction and processing pilots



3. Advanced digitization across the mining value chain

EUROPEAN AND NATIONAL AND REGIONAL PROJECTS

Funded by the European Union

TERRAVISION EO MINING PLATFORM

BATMASS

C-SINK

MADITRACE

S3O4I

MINE.THE.GAP

I4-GREEN

ReSilex

RawMaterials

echo

EXPSKILLS-REM

Junta de Castilla y León

clusternet

VIGITECYL 22 MINAS

INNOBASE

EUROPEAN COMMISSION

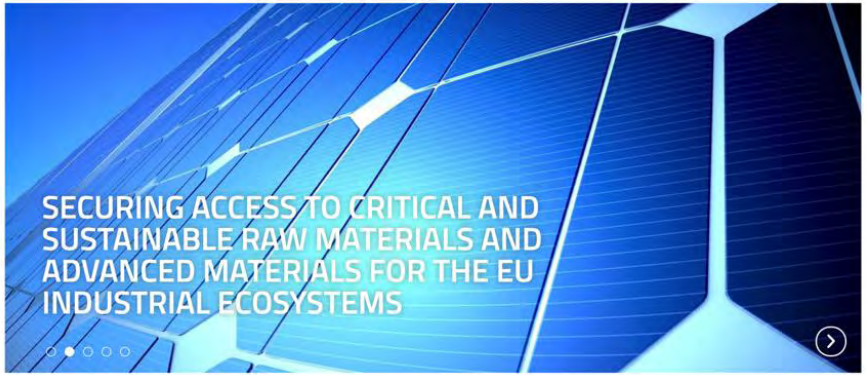
Brussels, 3.9.2020
COM(2020) 474 final

COMMUNICATION FROM THE COMMISSION TO THE EUROPEAN PARLIAMENT, THE COUNCIL, THE EUROPEAN ECONOMIC AND SOCIAL COMMITTEE AND THE COMMITTEE OF THE REGIONS

Critical Raw Materials Resilience: Charting a Path towards greater Security and Sustainability

EUROPEAN RAW MATERIALS ALLIANCE ERMA

About us | Network | Workstreams | News & Events | EU Policy



Internal Market, Industry, Entrepreneurship and SMEs

Home | Single market and standards | Industry | Entrepreneurship and SMEs | Access to finance | Sectors | Tools and databases

Home > Sectors > Raw materials, metals, minerals and forest-based industries > The European innovation partnership (EIP) on raw materials

The European innovation partnership (EIP) on raw materials

The European innovation partnership on raw materials is a stakeholder platform that brings together representatives from industry, public services, academia and NGOs. Its mission is to provide high-level guidance to the European Commission, EU countries and private actors on innovative approaches to the challenges related to raw materials.

The EIP plays a central role in the EU's raw materials policy framework

- It reinforces the raw materials initiative by translating the strategic policy framework into concrete actions and by mobilising the stakeholder community to implement them
- It has been instrumental in **securing R&I funding**: while framework programme 7 (the R&I funding tool for the period 2007-2013) only included approximately €180 million for raw materials R&I, Horizon 2020 (the R&I funding tool for 2014-2020) reserved **€600 million** for research on the challenges related to raw materials.

The European innovation partnerships (EIPs) are a new approach to EU research and innovation. By bringing together actors from the entire research and innovation value chain they aim at streamlining efforts and accelerating market take-up of innovations that address key challenges for Europe.

European Commission

Study on the EU's list of Critical Raw Materials (2020)

Final Report

European Commission

Critical Raw Materials for Strategic Technologies and Secto in the EU

A Foresight Study

EUROPEAN COMMISSION

Brussels, 3.9.2020

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Critical Raw Materials Resilience:
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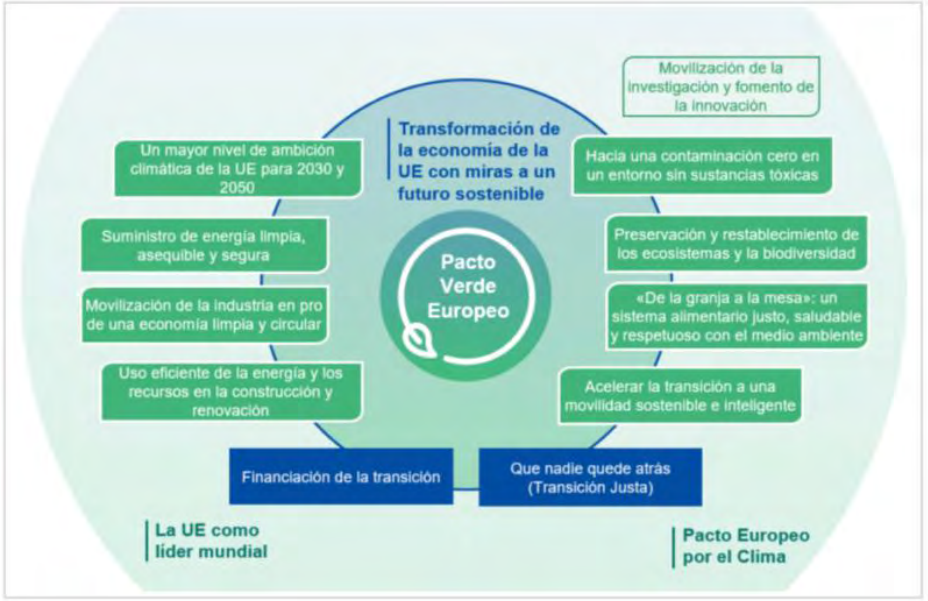

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ased industries > The European innovation partnership (EIP) on raw materials

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March 2023

SECURING CRITICAL RAW MATERIALS IN THE EU

The role of trade and external actions

To become a net-zero economy, the EU needs Critical Raw Materials (CRMs). The EU will never be self-sufficient in CRMs and will continue to rely largely on imports. Therefore, in addition to making the most of its own CRM reserves and enhancing circularity, the EU needs to strengthen its global engagement to develop win-win partnerships with reliable partners. Here's how[1].

CRM Club

Establish a raw materials alliance with partners to strengthen supply chains and diversify sourcing.

Strategic Partnerships on Raw Materials

Expand our network of strategic raw materials partnerships.

Trade and Investment Agreements

Leverage and expand our trade agreements as regards raw materials extraction, processing and trade.

Global Gateway

Support critical raw material supply projects, including on infrastructure, connectivity and sustainability.

Enforcing Trade Rules

Continue to combat unfair trade practices, especially when they concern trade investment in or access to critical raw materials.

Press release | 16 March 2023 | Brussels

Critical Raw Materials: ensuring secure and sustainable supply chains for EU's green and digital future

European Critical Raw Materials Act

2030 benchmarks for strategic raw materials:

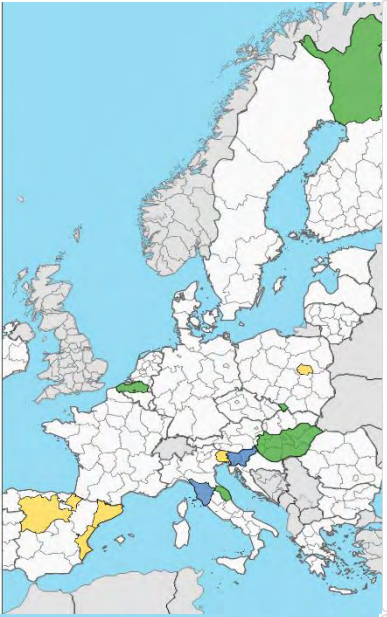
EU EXTRACTION
At least **10%** of the EU's annual consumption for extraction

EU PROCESSING
At least **40%** of the EU's annual consumption for processing

EU RECYCLING
At least **15%** of the EU's annual consumption for recycling

EXTERNAL SOURCES
Not more than **65%** of the EU's annual consumption of **each strategic raw material at any relevant stage of processing** from a single third country

European Commission



SME integration to Industry 4.0

Leading regions

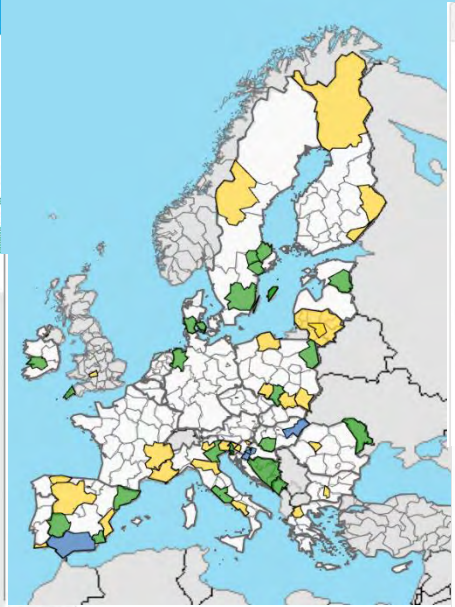
- Slovenia (SI)
- Tuscany, Italy (IT)

Participating regions

- Castile and Leon, Spain (ES)
- Catalonia, Spain (ES)
- Friuli-Venezia Giulia, Italy (IT)
- Mazowieckie, Poland (PL)
- Navarra, Spain (ES)
- Valencia, Spain (ES)

Interested regions

- Bielsko-Biała, Poland (PL)
- Flanders, Belgium (BE)
- Hungary (HU)
- Lapland, Finland (FI)
- Marche, Italy (IT)



Sustainable Buildings

Leading regions

- Andalusia, Spain (ES)
- North Great Plain (Észak-Alföld), Hungary (HU)
- North West Croatia, Croatia (four NUTS 3: HR041, HR042, HR04D, HR043) (HR)
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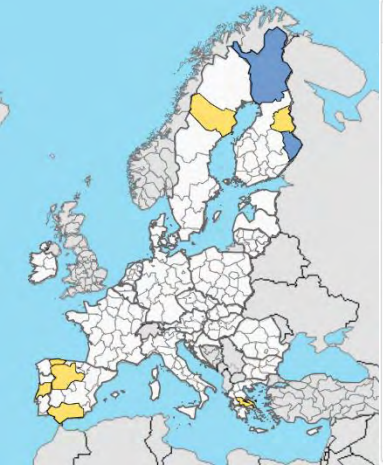
Participating regions

- Alba County (Centru), Romania (RO)
- Algarve, Portugal (PT)
- Asturias, Spain (ES)
- Autonomous Province of Trento, Italy (IT)
- Campania, Italy (IT)
- Castile and Leon, Spain (ES)
- Central Slovenia, Slovenia (SI)
- Drava (Podravska), Slovenia (SI)
- Emilia Romagna, Italy (IT)
- Friuli-Venezia Giulia, Italy (IT)
- Gloucestershire, UK (UK)
- Jämtland, Sweden (SE)
- Kaunas County, Lithuania (LT)
- Lapland, Finland (FI)
- Lithuania (LT)
- Malopolska, Poland (PL)
- North Karelia, Finland (FI)
- Opolskie, Poland (PL)
- Plovdiv, Bulgaria (BG)
- Podkarpackie, Poland (PL)
- Pomorskie, Poland (PL)
- Rhône-Alpes, France (FR)
- South Karelia, Finland (FI)
- South Region (Provence-Alpes-Côte d'Azur) France (FR)
- Upper Carniola (Gorenjska), Slovenia



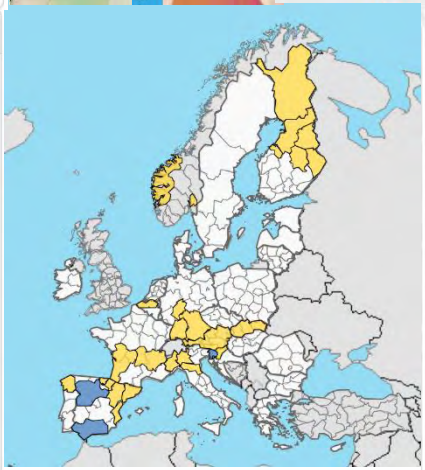
Mining industry

Leading regions

- Lapland, Finland (FI)
- North Karelia, Finland (FI)

Participating regions

- Andalusia, Spain (ES)
- Asturias, Spain (ES)
- Castile and Leon, Spain (ES)
- Centro, Portugal (PT)
- Kainuu, Finland (FI)
- Sterea Ellada (Central Greece) (EL)
- Västerbotten, Sweden (SE)



Advanced materials on batteries

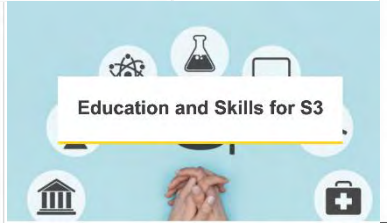
Leading regions

- Andalusia, Spain (ES)
- Castile and Leon, Spain (ES)
- Slovenia West, Slovenia (SI)

Participating regions

- Aragon, Spain (ES)
- Austria (AT)
- Auvergne Rhone-Alpes, France (FR)
- Baden-Württemberg, Germany (DE)
- Basque Country, Spain (ES)
- Bavaria, Germany (DE)
- Brussels-Capital Region, Belgium (BE)
- Catalonia, Spain (ES)
- Central Ostrobothnia, Finland (FI)
- Emilia Romagna, Italy (IT)
- Flanders, Belgium (BE)
- Galicia, Spain (ES)
- Hessen, Germany (DE)
- Kainuu, Finland (FI)
- Lapland, Finland (FI)
- Lombardy, Italy (IT)
- Metropol Region Eindhoven (NL)
- Navarra, Spain (ES)
- North Karelia, Finland (FI)
- North Karelia, Finland (FI)
- Northern Ostrobothnia (Pohjois-Pohjanmaa; Oulu subregion (city of Oulu)), Finland (FI)
- Northern Savonia (Pohjois-Savo), Finland (FI)
- Nouvelle Aquitaine, France (FR)
- Piedmont, Italy (IT)
- Slovakia (SK)
- Slovenia East, Slovenia (SI)
- Valencia, Spain (ES)
- Viken, Norway (NO)
- Western Norway (Vestlandet), Norway (NO)

S3 SMART SPECIALISATION PLATFORM



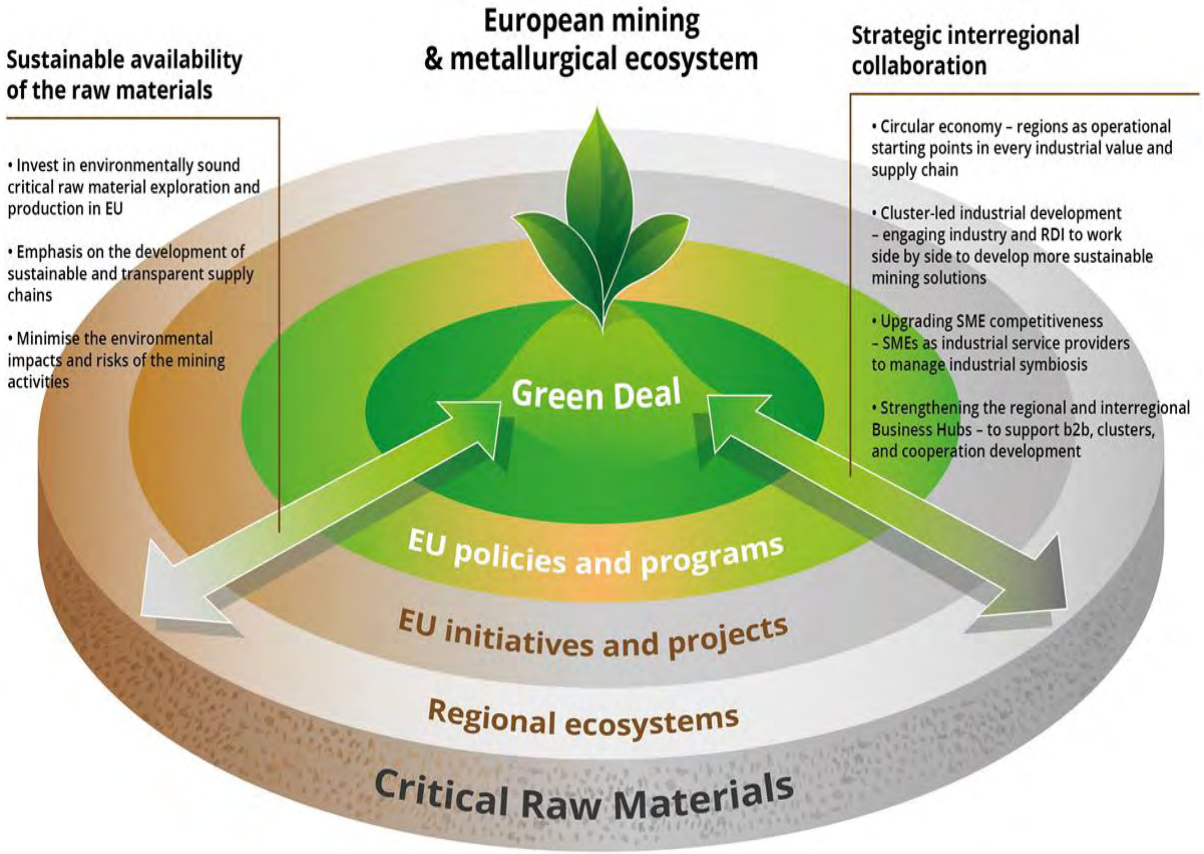
S3P Mining Industry partnership at a glance:

Mining industries and global value chain thematic partnership

- Securing a sustainable supply and industrial value chains are crucial for the future EU
- Primary production will remain important coming decades - minimisation of the environmental impacts and risks linked to RM production is vital
- Regions are the operational starting point for the industrial value and supply chains
- Regional ecosystems are the focal points and the playgrounds in the development of sustainable raw material production –

Mines are always place-based, depending on geology and cannot be moved

Contradictory fact is that when we are trying to reduce the use of the natural resources, we must increase the use of the other natural resources like the mineral ones



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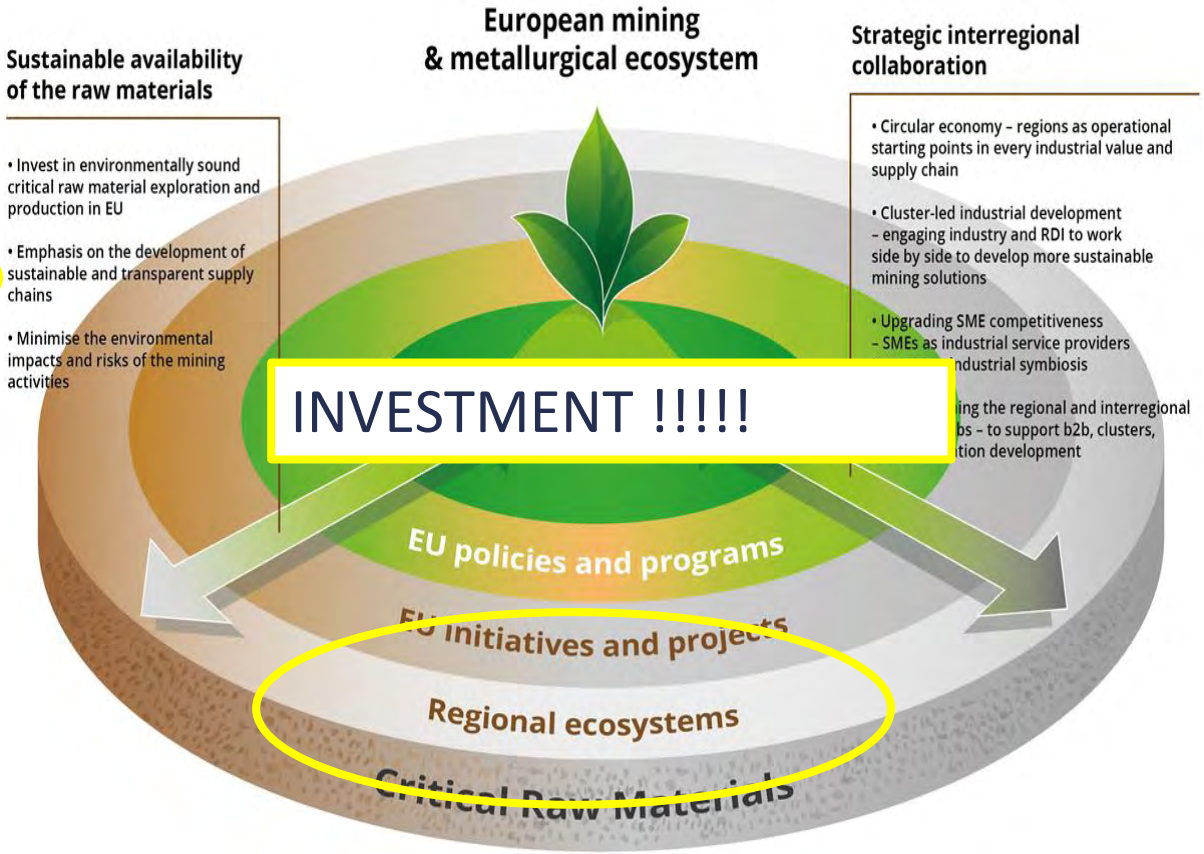

Funded by the European Union

Grant Agreement Number 101058583

RESiLEX project

www.resilex-project.eu

Context : Development of technological solutions for reusing Silicon, recycling PV modules and designing new products in the fields of mining, solar & batteries

The RESiLEX Consortium gathers 24 participants from 8 different countries:

Industries & SMEs

THARSIS MINING

NanoPow

groupe comet

Recma GROUPE

envie — Nos valeurs redonnent de la valeur

Cleancarb

etaflorence renewable energies

GESMINLE

Pasek MINERALES

LEONORE DEVELOPMENT

Industry-driven Clusters & Associations

IBERIAN SUSTAINABLE MINING CLUSTER

ICAMCYL

Tenerrdis

CETAQUA WATER TECHNOLOGY CENTRE

SolarPower Europe

RTOs

cea

LIÈGE université

GHENT UNIVERSITY

Brunel University London

GRENOBLE INP UGA

NTNU

csem

cnrs

Project ambition

Demonstrate **7 industry-driven technological and business innovative solutions** covering the full **Silicon value chain**

- ✓ the **resilience** and **sustainability** of this **critical raw material value chain in Europe**

Assess the **economical, social and environmental impact** of these solutions

Identify, **roadmap, provide open-source policy-making recommendations** to accelerate the replication of the ones with the highest potential

Address **challenges** from the European mining industry with pilot transversal demonstration.

Funded by the European Union

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Grant Agreement Number 101058583

RESiLEX project

www.resilex-project.eu

- **Budget → 12 M €**
- **Duration → 4 years, started on June 2022**
- **7 Technologies → 8 Demonstrations**

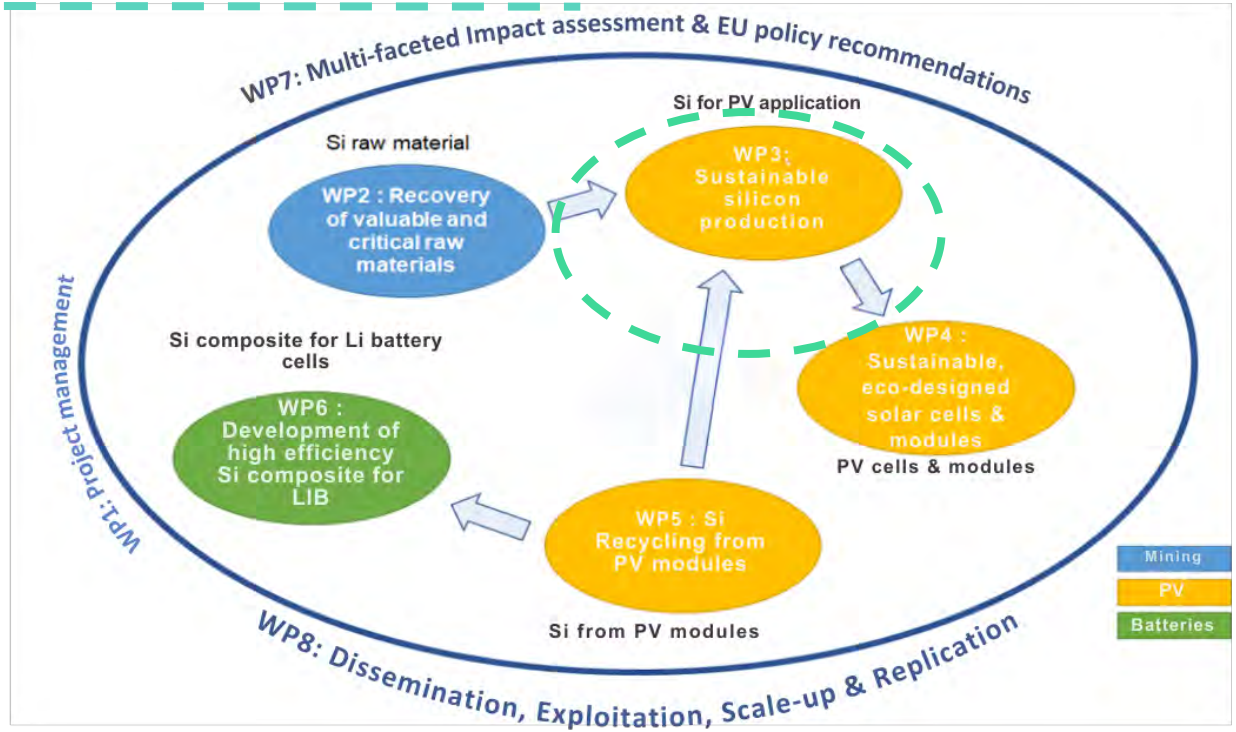




- **Work packages → 8 WP**
  - **5 WP** technical
    - **WP2 :** Mining & Raw materials extraction
    - **WP3 :** Production of Solar-grade polysilicon
    - **WP4 :** Cells & modules manufacturing
    - **WP5 :** Recycling of PV panels
    - **WP6 :** Manufacturing of Si-based anodes for Li batteries
  - **3 WP** organisation & analysis
    - **WP1 :** Project management
    - **WP7 :** LCC, LCA, social impact, …
    - **WP8 :** D&C + Exploitation strategy

- **ISMC role**
  - **COORDINATOR**
  - **WP Leader: DEC (Dissemination, Exploitation & Communication)**

Project methodology and structure



The project activities will revolve around the development of three value chains, each one will valorize a specific waste stream, to transform into new valuable products, reducing the EU dependence from abroad

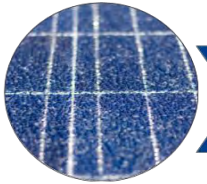
1
Critical Raw Materials from waste

Mining activities → Mining waste and acid waste waters → Recovery of Critical Raw Materials

2
PV modules from recycled silicon

End of Life Solar panels or kerf → Recycling Treatment and Purification → Ingots from recycled silicon → Wafers and solar cells

3
Anodes for batteries



End of Life Solar panels → Recycling Treatment and Purification → Silicon based anode

Silicon is used in most of the strategic renewable energy applications: improving its value chain is of major importance for the resilience of the entire European Union and for the energy transition.

Project scientific objectives

- **Circular CRM** recovery process for waste streams in mining industry
- Al-thermic slag reduction using different secondary silicate and Al-containing raw materials for **Si production**
- **Crystalline nano-powder** production with thin carbon-coating layers from purified kerf & end-of-life solar cells
- **Solar cells** using wafers made from revalorized Si waste
- **In-free and Ag-free solar cells** with passivated contacts
- PV modules with **bio-sourced encapsulant** and recycled frame
- **Froth flotation and electrostatism** for Silicon separation in end-of-life PV modules
- Development of Silicon composite material **for Li-ion battery** cell

Funded by the European Union

Project scientific objectives (progress)

Demonstrate and develop a new carbon-free, sustainable, and more efficient process for production of Si and Si alloys compatible with c-Si ingot production for solar applications.

- **Si alloy produced using the SisAl method has been produced in different g and kg scales**
- **Dissolution of kerf into the metal is now under investigation**
- **Next step will be to refine the formed metal to expected quality**

Project scientific objectives (progress)

Develop more efficient, sustainable, eco-designed and cost-competitive photovoltaic solar cells and modules.

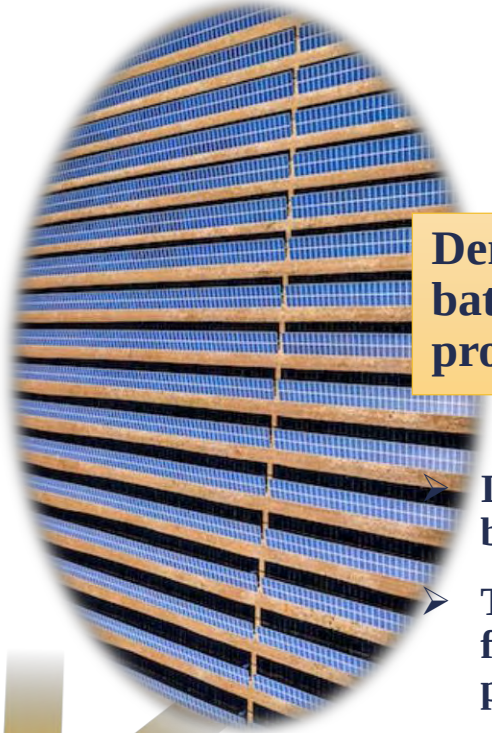
- **On track and successful collaboration between CEA, CSEM and CRNS teams on CRM-free PV panels**
- **70% Indium reduction reached with means covering this goal**
- **Promising results in reduction of Ag and on new eco-designed materials for module encapsulation towards better recyclability**

Project scientific objectives (progress)

Demonstrate a highly efficient Silicon recycling process from end-of-life PV modules, in order to substitute primary Silicon source in major applications such as Silicon wafers or anodic materials.

- **Excellent progress on: sourcing and characterization of PPV panels; tracing of Si concentration in treatment residues; plant trials for Si extraction optimization; lab-scale Si refining testworks on preliminary samples**
- **Currently studying if leached Si can be upgraded from battery grade to PV grade**
- **Change in the methodology for separation pilot line: electrostatism was chosen against froth flotation**

Project scientific objectives (progress)



Demonstrate high energy density 2 Ah Li-ion battery from secondary raw Silicon locally produced in the EU.

- **Initial specifications developed. Final design will be ready by May 2024**
- **The preparation of the Si/C composite as anode materials for lithium-ion batteries is achieved using crushed solar panels as source of Si**

Project scientific objectives (progress)

Demonstrate a sustainable circular process to recover waste critical raw material in the mining industry, targeting 80% reduction of mining water discharge waste into the environment at a very low cost.

- **Different acid mine waters and wastes were analysed in order to understand the concentration of CRM to be recovered and the presence of the other pollutants that will need to be removed**
- **All pilots are expected to be working during the first half of 2024**

RESILEX NETWORK

https://www.resilex-project.eu/resilex-network/

Resilex Network

Keep up to date with our latest news and analysis by joining the RESILEX Network.
Write to our e-mail address if you have inquiries and be sure to follow the Linkedin page.

First Name | Last Name

Organisation | Role

Country

Email

☐ I have read the informed consent form and would like to become a member of the Resilex stakeholder network, I hereby authorize the use and processing of my personal data in compliance with EU Regulation no. 2016/679 GDPR.

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Resilex Project

CONNECT WITH OUR ACTIVITIES AND EVENTS!

Funded by the European Union

Stakeholder Engagement Event in Brussels

ETIP Photovoltaics

When: afternoon 23rd May 2024

Framework: Annual Conference of the European Technology and Innovation Platform (ETIP PV) in cooperation with the HE project EVERPV

MORE INFORMATION HERE
https://etip-pv.eu/events/etip-pv-conference

ReSilex

PROJECT TEAM

Thank you!

www.resilex-project.eu

RESiLEX Project

info@resilex-project.eu

www.ismc-iberiamine.com

@ISMC_cluster

Iberian Sustainable Mining Cluster (ISMC)

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