Innovation in Motion: RAWMINA's Scalable Solution for Critical Resource Recovery

CLUSTER HUB – ANNUAL MEETING
RAW MATERIALS WEEK 2025
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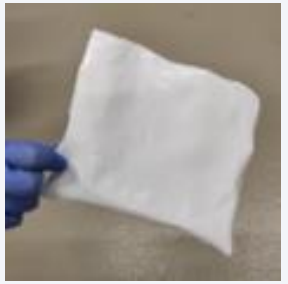
LEITAT Technological Center

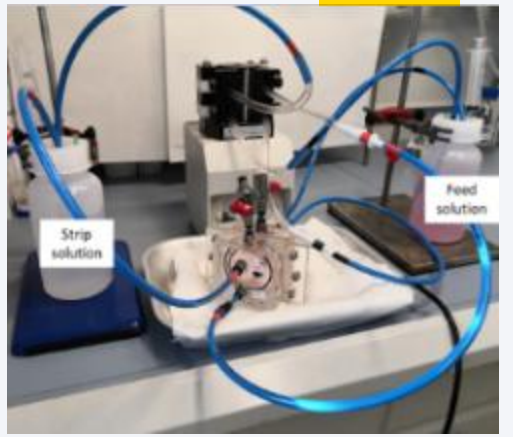
Established in 1906, Leitat is a private non-profit organization.

PURPOSE: We generate technological knowledge and innovation by managing technologies and talent.

MISSION: We manage technologies to create sustainable social, environmental, economic and industrial value, transferring this value to companies and entities through research and technological processes.

Starting Material	Pre-treatment	Hydrometallurgy	Selective recovery
Mine waste, EoL Batteries, PV panels, magnets or wind turbine.	**Flotation**, deactivation, disassembly, **optical shorting**.	**Acid** leaching, **Oxidant** leaching, **Deep Eutectic Solvents**, Bioleaching.	**Membrane technologies**, Solvent Extraction, **Precipitation**, **electrochemical** process.





RAWMINA at a glance

CE-SC5-07-2020 – IA

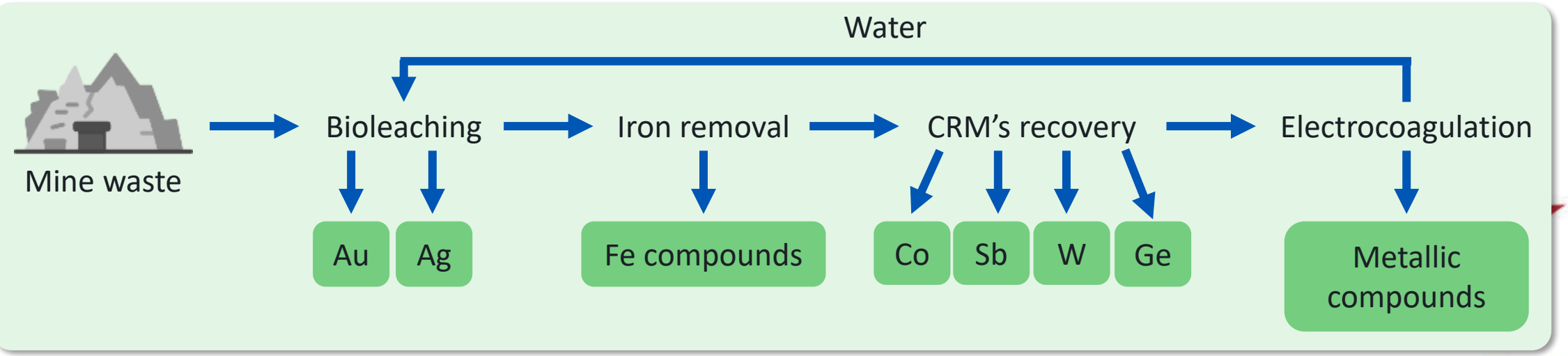
(TRL 4 to 7)

10 857 403,25 €

(EU Contribution: 9 146 967,26 €)

51 Months

(May 2021 - July 2025)



This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 958252.
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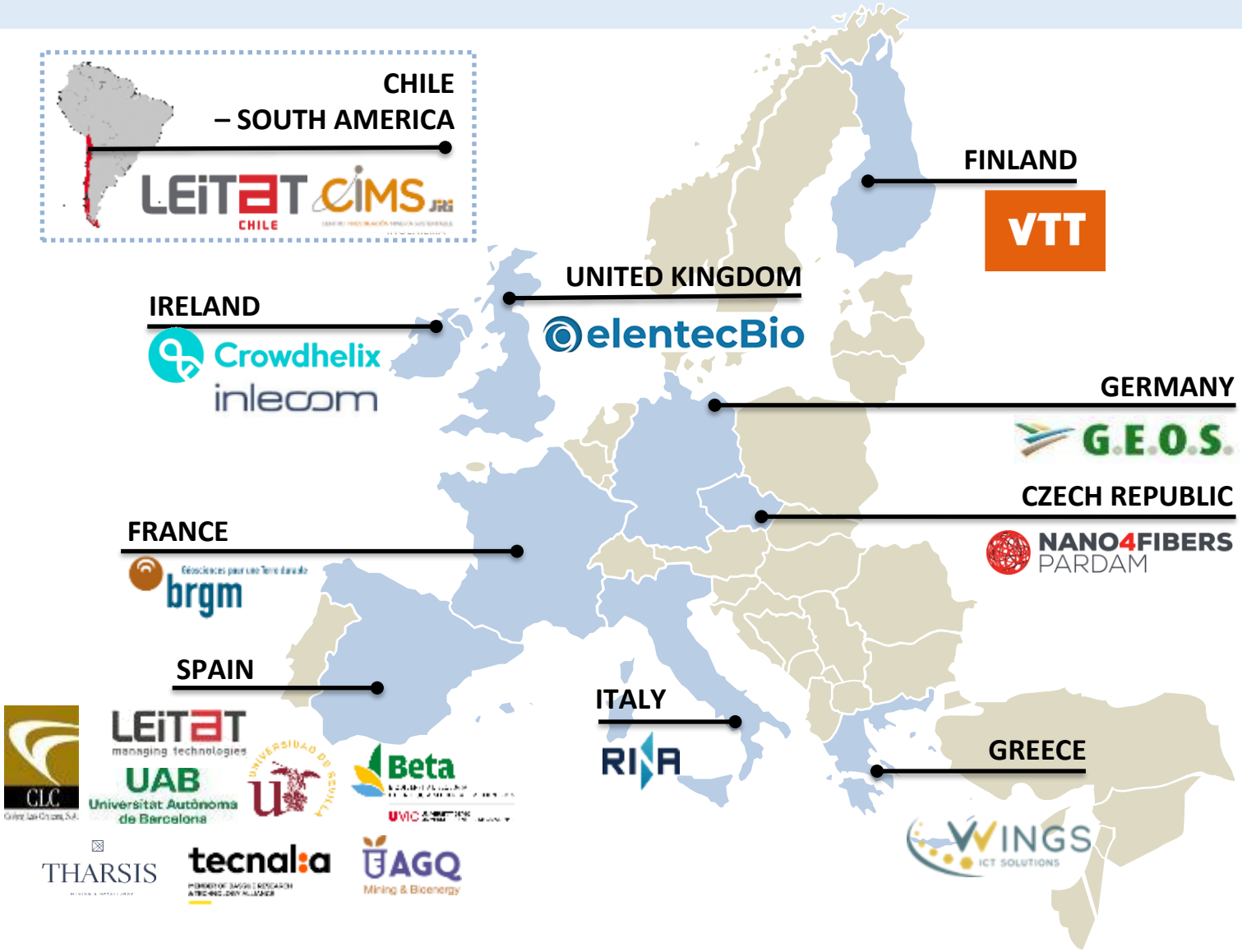
RAWMINA - Consortium

19 partners

- 5 RTOs
- 3 Universities
- 6 SMEs
- 5 Large enterprises

9 EU countries

1 Non-EU countries



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RAWMINA - Overview

KEY OBJECTIVES

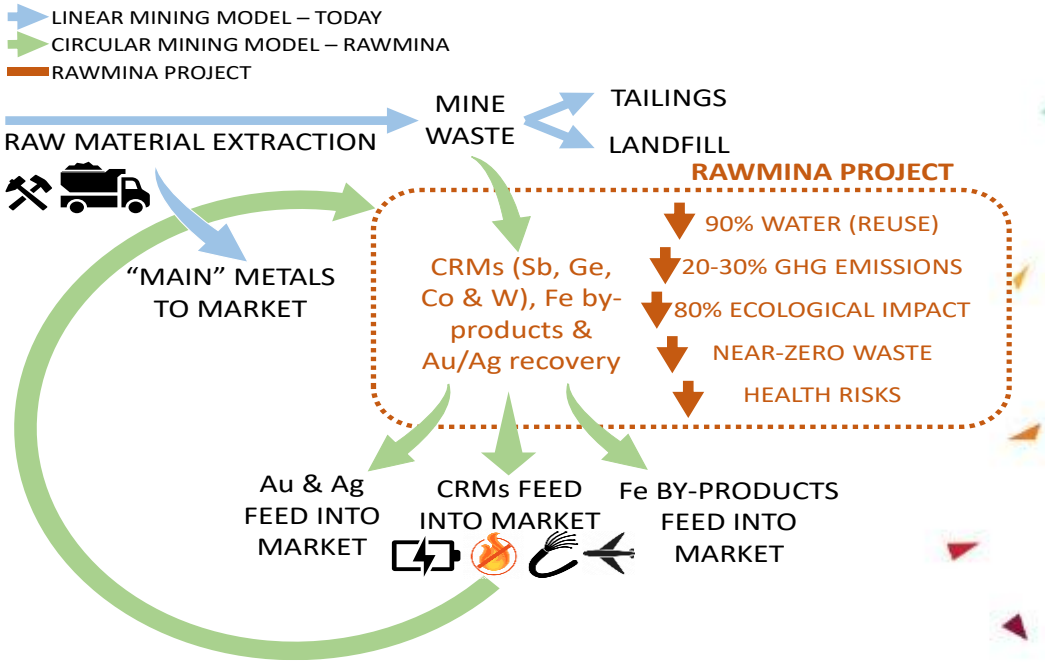
01 **Industrially scalable and flexible for MW valorization** in continuous operation.

02 **95 % recovery rate and selectivity** for CRMs (**Co, Sb, Ge, W**).
90 % of Fe recovery as Fe-based-by-products.
95 % toxic/non-toxic metals recovery from solution.

03 Alkaline leaching **transform 95 % of the gangue** into marketable products (high value precious metals: **Au, Ag**).

04 Treat up to **100-150 kg MW/day** on an industrial demonstration.

05 Transformation of the **Mine Waste into a Resource**.



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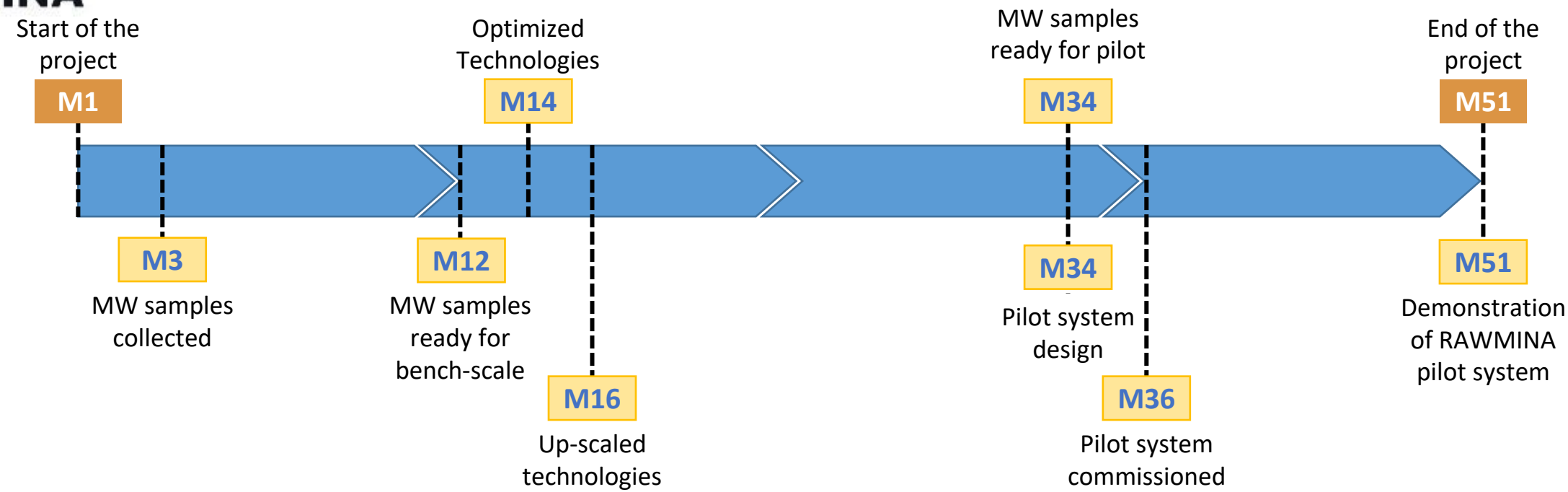
RAWMINA - Overview



Optimisation and up-scaling

Validation & Integration

System engineering & demonstration

Sustainability assessment and social innovation

Exploitation, communication and dissemination

Scientific Coordination and Management

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RAWMINA - Concept

Mining Waste

Bio-leaching

Alkaline Leaching

Alkaline Leachate: Ge, W, M^{2+}

Au/Ag gangue

Iron removal process

Iron species

Acid Leachate: Co, Sb, M^{2+}

Water reuse

NCMs

Ge W

TDP

Ge W

Sb Co

TDP

Sb Co

Electrocoagulation

Metallic compounds

Electrowinning

Ge W Sb Co

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RAWMINA - Achievements

Laboratory optimization & up-scaling

Selection, conditioning and characterization of 3 MWs

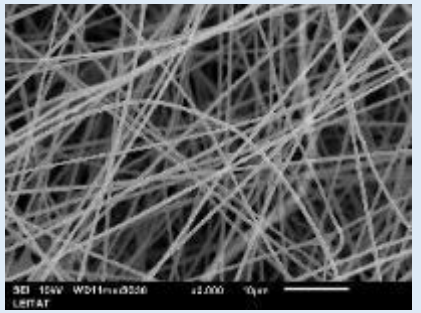
Iron removal → **90 % Fe**

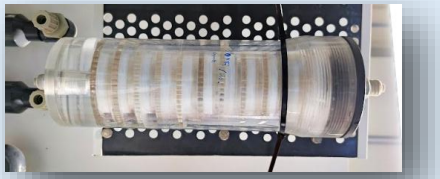
Iron precipitation

Continuous Bioleaching development and optimization *(RAWMINA Patented Process)* → **100 % Co, 70 % Sb**
Alkaline leaching → **90 % W**

Alkaline Leach testing

Nanofibrous Composite Materials → NCMs developed for the 4 metals *(RAWMINA Patented Material)*
Electrowinning → *optimized parameters* for *Co, Sb and Ge*





RAWMINA - Achievements

Bench scale evaluation

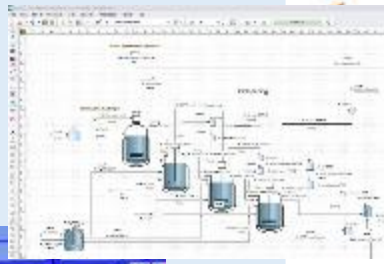
Bioleaching + Alkaline Leaching

Iron Removal

Selective CRMs recovery

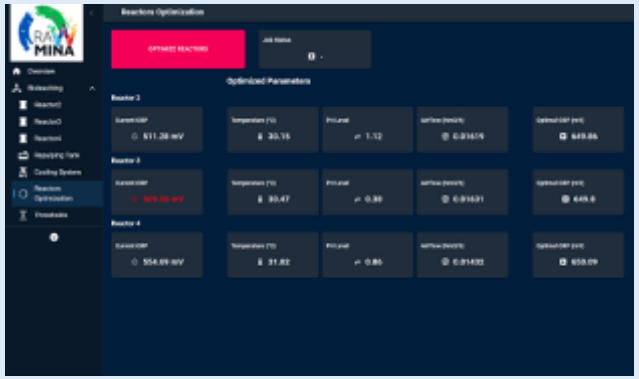
Electrowinning

Electrocoagulation



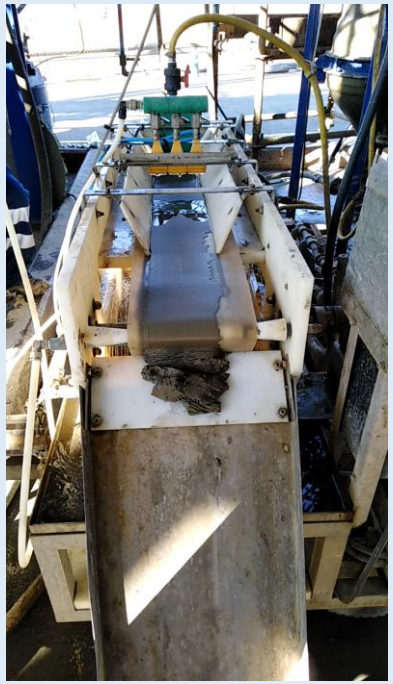
RAWMINA - Achievements

Pilot construction & operation



RAWMINA - Achievements

Pilot construction & operation



Bioleaching residue cake

Iron cake

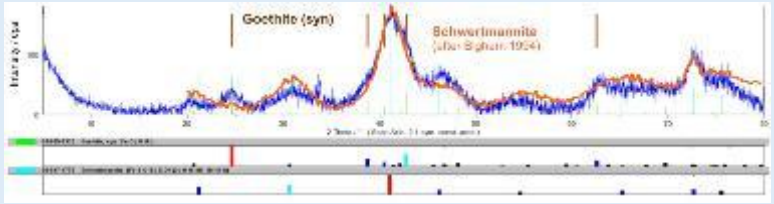
CRM solution

Slurries from bioleaching and iron precipitation

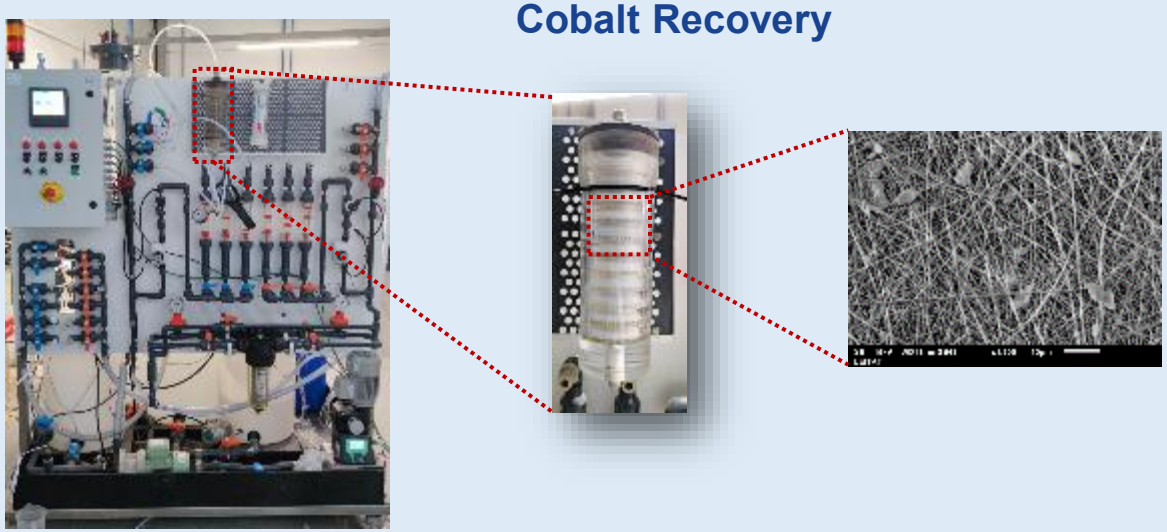
RAWMINA - Achievements

Pilot construction & operation

Iron precipitation



Cobalt Recovery



- ✓ Low Co concentration in PLS: **12-16 mg/L Co** and 35 mg/L Zn (**+ Mg, Mn, Ni, Na**)
- ✓ Till 5 cycles at pilot scale
- ✓ **80 % of Co recovered**
- ✓ Strip concentrate: **25 mg/L Co** (+80 mg/L Zn)

Co-based precursors for battery active materials

- ✓ Concentrate to ELECTROWINNING.
- ✓ Liquor to ELECTROCOAGULATION for water reuse.

RAWMINA - Achievements

Key Performance Indicators

17 PROJECT OBJECTIVES → Technical, sustainability and econometric **ACHIEVED**
1 PROJECT OBJECTIVE → Technical **PARTIALLY ACHIEVED**
4 EXPECTED IMPACTS → **SUPPORTED** WITH PROJECT RESULTS

- **Construction of RAWMINA pilot system with Intelligent Management System implementation**
- **Mine waste** → *Selection, processing and characterization of 3 MWs*
- Continuous Bioleaching → **95 % Fe**, ***95 % Co, 60 % Sb***
- Alkaline leaching → ***90 % W // 40 % Sb*** *from bioleaching residue*
- Iron removal → **> 99 % Fe & As** from the PLS
- ***92 % Fe*** *transformation into* ***SHM*** *and* ***nano-magnetite***
- *Ag & Au → >* ***90 % Recovery*** *in bioleaching residue*
- Nanofibrous Composite Materials → ***Co and W*** *final application*
- NCMs Thermal desorption → *Optimized parameters*
- Electrowinning → *Validated for* ***Co and W***
- Electrocoagulation of other metals→ ***95-100 %*** **removal → > 90 % water recovery for reuse**

RAWMINA - Achievements

Sustainability assessment

- **Human risk assessment**
  - No toxicity risk of the nanomaterials developed and used.
  - No detect exposure scenarios with high likelihood of exposure
- **Environmental, Economic and Social LCA & Circular economy**
  - Emissions reduction and energy efficiency (up to 88 %)
  - RAWMINA demonstrates that it is financially viable in the medium term.
  - Ideal performance in most social indicators
- **Social Innovation actions**
  - Sparked debate among stakeholders.
  - Confirmed the gap between mining actors and environmental and civil organizations.
- **Ecotoxicity and Ecological Impact**
  - Bioleaching step removes all environmental harmful elements.
  - Internal water recovery about 90 %. Only 10 % is potentially released to freshwaters environment. Not induce ecological impacts on the receiving water body under fluctuating hydrological conditions.

CONTACT

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RAWMINA Final Conference

Watch the full video here

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