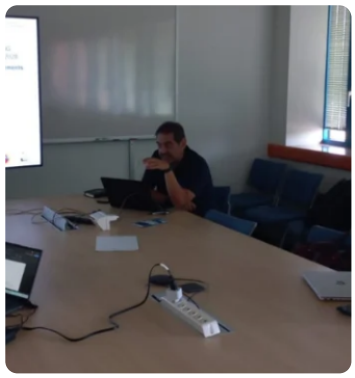
ECO-FRIENDLY HYDROMETALLURGY FOR RARE EARTHS RECYCLING · HORIZON-MSCA-2023-SE-01 · GA 101182579

COVER STORY

# HALFWAY THERE: SCIENCE, TRAINING AND EU–CUBA EXCHANGE



## WELCOME TO THE 4TH EDITION OF THE FREECOVER NEWSLETTER

**Halfway through its four-year journey, FREECOVER has reached an important milestone.**

This edition covers June to October 2026. The consortium met in Udine for its Mid-Term Meeting, presented its research at ISMEC 2026, delivered its third Master Class on life cycle thinking, and continued to build bridges between Europe and Cuba through Marie Skłodowska-Curie Actions (MSCA) staff exchanges. This autumn, FREECOVER also took its work to an invited seminar in Seville, European Researchers' Night in Verona and ICL 2026 in Kyoto.

Each story reflects one shared ambition: developing greener hydrometallurgical routes to recover Rare Earth Elements (REEs) from end-of-life permanent magnets, in support of the EU Critical Raw Materials Act, the European Green Deal and a more circular European economy.

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COVERING JUNE – OCTOBER 2026

CONSORTIUM MEETING · UDINE, ITALY · 14–15 JULY 2026

# FREECOVER MID-TERM MEETING: PROGRESS ACROSS ALL WORK PACKAGES

**On 14–15 July 2026, the FREECOVER consortium gathered at the Università degli Studi di Udine (UNIUD), Italy, for its Mid-Term Meeting.**

Representatives of universities, research institutes, SMEs and associated partners from across Europe and Cuba reviewed the project's scientific achievements, assessed progress in every Work Package and agreed priorities for the second half of the project.

Opening the meeting, Project Coordinator Prof. Andrea Melchior (UNIUD) highlighted the progress achieved during the first eighteen months and the central role of staff exchanges in the project's success.

*Work Package presentations during the Mid-Term Meeting at UNIUD.*

## WORK PACKAGE HIGHLIGHTS

### WP1
Eco-friendly ionic liquids and supported ionic liquid membranes (SILMs)

**Prof. Slobodan Gadžurić**
University of Novi Sad Faculty of Sciences (UNSPMF), Serbia

### WP2
Selective REE extraction: speciation, leaching, liquid–liquid extraction and membrane separation

**Prof. Tatjana Trtić-Petrović**
Vinča Institute of Nuclear Sciences, University of Belgrade (VINS), Serbia

### WP3
Natural adsorbents for wastewater treatment and element recovery, reused as catalysts in advanced oxidation processes

**Prof. Montserrat López-Mesas**
Universitat Autònoma de Barcelona (UAB), Spain

### WP4
Integrated pilot-scale process, life cycle assessment and economic feasibility

**Dr Óscar Jesús Prado Rubianes**
AERIS Tecnologías Ambientales (AERIS), Spain

### WP5
Communication, dissemination and stakeholder engagement

**Dr Leonardo Piccinetti**
Sustainable Innovation Technology Services (SITES), Ireland

### WP6
Project management and coordination

**Prof. Andrea Melchior**
Università degli Studi di Udine (UNIUD), Italy

### MSCA STAFF EXCHANGES IN FOCUS

A dedicated session compared secondment implementation with the project plan. Several secondees shared their experiences, showing how mobility between partners is accelerating knowledge transfer, building laboratory skills and laying the foundations for long-term cooperation. The meeting confirmed that FREECOVER enters its second half on solid ground.

KNOW MORE freecover.eu/freecover-mid-term-meeting

INTERNATIONAL SYMPOSIUM · UDINE, ITALY · 15–18 JUNE 2026

# FREECOVER AT ISMEC 2026

| 55th | 4 days | 1 | 1 |
|---|---|---|---|
| EDITION OF THE SYMPOSIUM | 15–18 JUNE 2026, UDINE | PLENARY LECTURE | ORAL COMMUNICATION |

## FREECOVER SHOWCASES SCIENTIFIC EXCELLENCE

The University of Udine hosted the 55th International Symposium on the Thermodynamics of Metal Complexes (ISMEC 2026), a series dating back to Parma in 1973. Its programme on metal speciation, coordination chemistry, separation technologies and metal recovery sits at the core of FREECOVER's research.

On 17 June, Prof. Slobodan Gadžurić (University of Novi Sad Faculty of Sciences) delivered the plenary lecture *"Design and Thermodynamic Assessment of Functionalized Ionic Liquids for Selective Rare Earth Element Recovery"*. José Alejandro Ricardo García (UNIUD) followed with the oral communication *"Dysprosium and Samarium Recovery via Natural Zeolite: A Study of Process Dynamics and Equilibrium Conditions"*.

KNOW MORE freecover.eu/freecover-showcases-scientific-excellence-at-ismec-2026

## CIRCULAR SOLUTIONS FOR CRITICAL RAW MATERIALS

*Prof. Marilena Tolazzi and Project Coordinator Prof. Andrea Melchior (UNIUD) at ISMEC 2026.*

ISMEC 2026 was also a forum to show how green chemistry, hydrometallurgy, advanced separation and sustainability assessment can be combined to recover and valorise critical raw materials from secondary sources. Prof. Melchior and Prof. Tolazzi engaged with researchers, industry representatives and innovation stakeholders throughout the symposium, linking FREECOVER's work to the EU's goal of more resilient critical raw material supply chains.

KNOW MORE freecover.eu/critical-raw-materials-at-ismec-2026

TRAINING · UDINE, ITALY · 15 JULY 2026

# MASTER CLASS #3: LIFE CYCLE THINKING FOR RARE EARTH RECYCLING

*Master Class #3, "FREECOVER and S-LCA: Driving Sustainable Innovation in Rare Earth Elements Recycling", held at UNIUD.*

**On 15 July 2026, the second day of the Mid-Term Meeting, FREECOVER delivered its third Master Class: *"FREECOVER and S-LCA: Driving Sustainable Innovation in Rare Earth Elements Recycling"*.**

Led by Dr Leonardo Piccinetti (SITES), the session introduced consortium researchers to life cycle assessment (LCA), including Social Life Cycle Assessment (S-LCA), as practical tools for steering innovation from the laboratory onwards. Grounded in ISO 14040/14044, ISO 14075:2024 and United Nations Environment Programme (UNEP) Life Cycle Initiative guidance, it combined theory with hands-on exercises in openLCA.

Participants explored how life cycle thinking links laboratory research to Horizon Europe objectives, the European Green Deal, the Critical Raw Materials Act and responsible innovation, so that new recycling technologies are environmentally effective, economically viable and socially responsible. Participants received numbered certificates, which can now be verified on the FREECOVER website.

KNOW MORE freecover.eu/freecover-master-class-3

**01 ENVIRONMENTAL LCA**
Quantifying environmental impacts across the life cycle of recycling processes.

**02 LIFE CYCLE COSTING**
Assessing economic performance alongside environmental results.

**03 SOCIAL LCA**
Evaluating effects on workers, local communities, value-chain actors and society.

MSCA STAFF EXCHANGES · EU–CUBA COLLABORATION

# FREECOVER SECONDMENTS IN ACTION

*Scientific meeting at the University of Havana during the UNIUD secondment.*

## FROM UDINE TO HAVANA

As part of the MSCA Staff Exchanges programme, José Alejandro Ricardo García, PhD researcher at UNIUD, carried out a secondment at the University of Havana (UH), Cuba. At a scientific meeting with UH researchers, he presented a related study, *"REEs Recovery via Natural Zeolite: A Study of Process Dynamics and Equilibrium Conditions"*, exploring natural zeolite as a low-cost, environmentally friendly adsorbent for recovering REEs from secondary resources.

Discussions covered adsorption dynamics, equilibrium behaviour and sustainable separation approaches. In the laboratory, work focused on characterising natural zeolite and biomass-based materials, opening new avenues for joint research.

KNOW MORE freecover.eu/freecover-secondment-at-the-university-of-havana

## HAVANA RESEARCHERS REPORT BACK ON EUROPEAN SECONDMENTS

On 3 September 2026, the University of Havana hosted a seminar on the results of its researchers' secondments in Europe between October 2025 and August 2026. M.Sc. Yenisleidy Valdés Arencibia, Dr Ana Rosa Lazo Fraga, Dr Lissette Agüero Luztonó and Dr Markel Denet Luaces Alberto presented outcomes from Work Packages 1, 3 and 4, carried out at the University of Novi Sad Faculty of Sciences (Serbia), the Universitat Autònoma de Barcelona and AERIS Tecnologías Ambientales (Spain).

Their results span eco-friendly ionic liquids, water treatment with Cuban zeolite and process integration for REE recovery from metallic waste, demonstrating the lasting value of EU–Cuba scientific cooperation and research capacity building in Havana.

KNOW MORE freecover.eu/freecover-researchers-report-back-on-secondment-results-in-europe

*UH researchers and colleagues at the 3 September 2026 results seminar in Havana.*

### MSCA STAFF EXCHANGES: KNOWLEDGE IN MOTION

The Marie Skłodowska-Curie Staff Exchanges scheme supports the mobility of research and innovation staff between organisations across sectors and countries. In FREECOVER, secondments between European partners and the University of Havana bring together complementary expertise, from ionic liquid design and membrane separation to natural Cuban zeolite, accelerating research while building lasting institutional ties.

PUBLIC ENGAGEMENT AND INTERNATIONAL CONFERENCE · VERONA, ITALY AND KYOTO, JAPAN

# FROM VERONA TO KYOTO: FREECOVER ON TWO STAGES

*The FREECOVER poster on display at European Researchers' Night in Verona.*

**FREECOVER reached two very different audiences this autumn: the public in Verona and the international scientific community in Kyoto.**

At European Researchers' Night in Verona in September 2026, the University of Verona presented the poster *"Eco-Friendly Hydrometallurgy for Rare Earth Recycling"*. Prof. Fabio Piccinelli led it on behalf of the consortium, with authors from ten organisations in seven countries.

Meanwhile, the team presented FREECOVER's results at ICL 2026 in Kyoto, Japan, sharing the project's greener route to rare earth recycling with fellow scientists.

Mobility continues to drive the research. Emanuele De Rienzo will spend three months in Barcelona, and Silvia Ruggieri will spend one month in Ljubljana from 2027.

KNOW MORE freecover.eu/freecover-brings-eco-friendly-rare-earth-recycling-to-icl-2026-in-kyoto

**DOWNLOAD THE POSTER**
freecover.eu/wp-content/uploads/2026/10/FREECOVER-PICCINELLI.pdf

## THE FREECOVER PROCESS IN THREE STEPS

**01 DISSOLVE**
End-of-life NdFeB and SmCo magnets are dissolved and the iron is removed.

**02 EXTRACT**
Rare earths are separated with Supported Ionic Liquid Membranes (SILMs) reinforced with natural minerals.

**03 RECOVER AND RECYCLE**
Natural adsorbents recover cobalt, nickel and copper, and the purified water is recycled.

INVITED SEMINAR · SEVILLE, SPAIN · 23 SEPTEMBER 2026

# INVITED SEMINAR IN SEVILLE: METAL IONS IN IONIC LIQUIDS

*Prof. Andrea Melchior (UNIUD) at the Faculty of Chemistry, University of Seville.*

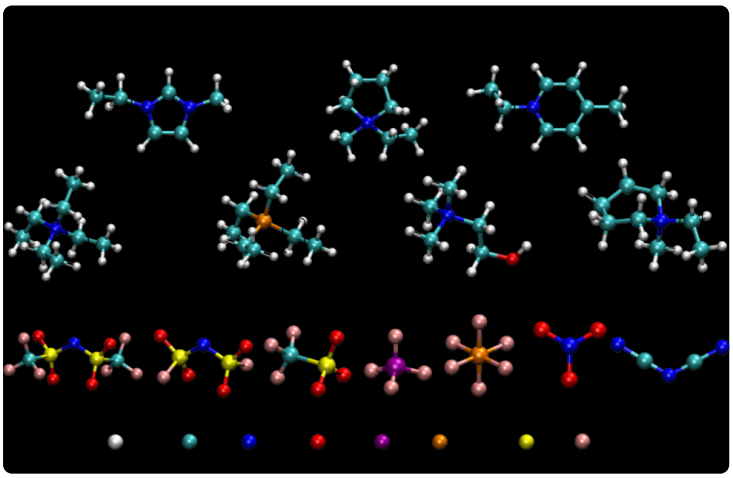
**On 23 September 2026, Project Coordinator Prof. Andrea Melchior (UNIUD) gave an invited seminar at the University of Seville, Spain, showcasing FREECOVER results.**

Hosted by the Department of Physical Chemistry of the Faculty of Chemistry, the seminar *"Metal ions in ionic liquids: from fundamental studies to applications"* drew around 25–30 participants, mostly faculty members, postdoctoral researchers and PhD students.

Ionic liquids are salts that stay liquid below 100 °C. Their negligible volatility, non-flammability and stability make them promising "green" alternatives to volatile organic solvents in the hydrometallurgical recovery of critical raw materials.

Prof. Melchior presented recent studies on how metal ions such as cobalt, zinc and silver behave in common ionic liquids. His group combines spectroscopic and thermodynamic techniques with quantum chemical calculations and molecular dynamics simulations. Knowing which species form, and how stable they are, is essential for designing efficient separation processes.

| 23 Sept | 25–30 | Co · Zn · Ag | Co & REEs |
|---|---|---|---|
| 2026, SEVILLE | PARTICIPANTS | METAL IONS STUDIED | EXTRACTION CASE STUDIES |



*Structures of some common ionic components of ionic liquids. Source: seminar abstract, Prof. Andrea Melchior (UNIUD).*

## FROM FUNDAMENTALS TO RECOVERY

The seminar closed with case studies on extracting cobalt and rare earth elements from aqueous solutions, linking fundamental coordination chemistry directly to FREECOVER's goal of greener rare earth recycling.

KNOW MORE freecover.eu/freecover-at-the-university-of-seville-metal-ions-in-ionic-liquids

### IONIC LIQUIDS AT THE HEART OF FREECOVER

In FREECOVER, eco-friendly ionic liquids are immobilised on polymer supports to form Supported Ionic Liquid Membranes (SILMs), which separate neodymium, praseodymium, dysprosium and samarium from dissolved magnet waste. Understanding how metal ions behave in these liquids helps partners design more selective and efficient separation processes.

## LOOKING AHEAD

As FREECOVER moves into its second half, partners will continue to advance eco-friendly hydrometallurgical technologies across all Work Packages, from ionic liquids and membranes to natural adsorbents and the integrated pilot-scale process, while expanding staff exchanges between Europe and Cuba.

Upcoming secondments, Science Cafés, Master Classes and conference contributions will be announced on the project website and social media channels.

## STAY CONNECTED

Visit **freecover.eu** for news, the project poster, all previous newsletters (Issues #1–#3), the Mid-Term Meeting press release and the Master Class certificate verification page.

Follow FREECOVER on LinkedIn, X, Instagram and YouTube for regular updates on research, secondments and events.

## ABOUT FREECOVER

FREECOVER – *Eco-Friendly Hydrometallurgy for Rare Earths Recycling* develops sustainable processes to recover Rare Earth Elements from end-of-life permanent magnets, combining natural acids, bio-based ionic liquids, supported ionic liquid membranes and natural adsorbents within an integrated, low-impact process. Implemented through Marie Skłodowska-Curie Staff Exchanges, the project connects partners in Europe and Cuba to strengthen research capacity, knowledge transfer and the circular economy for critical raw materials.

| PROGRAMME | GRANT AGREEMENT | DURATION | COORDINATOR |
|---|---|---|---|
| HORIZON-MSCA-2023-SE-01 | 101182579 | 01/01/2025 – 31/12/2028 | Università degli Studi di Udine |

## THE FREECOVER CONSORTIUM

**Università degli Studi di Udine**
Coordinator · Italy

**University of Novi Sad Faculty of Sciences**
Serbia

**Vinča Institute of Nuclear Sciences, University of Belgrade**
Serbia

**Universitat Autònoma de Barcelona**
Spain

**University of Ljubljana**
Slovenia

**Università degli Studi di Verona**
Italy

**AERIS Tecnologías Ambientales**
Spain

**Sustainable Innovation Technology Services – SITES**
Ireland

**AD Harbi**
Bosnia and Herzegovina

**Universidad de La Habana**
Associated Partner · Cuba

Funded by the European Union

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