

UPCYCLING OF NdFeB MAGNETS IN THE EU FOR GREEN APPLICATIONS



Advancing Sustainable Upcycling of NdFeB Magnets

The NEO-CYCLE project demonstrates the sustainable upcycling of spent NdFeB magnets from HDDs at TRL6, producing high-quality materials for the pharmaceutical, ammonia, fertilizers, and polymers industries. By engaging key stakeholders the project paves the way for market uptake. NEO-CYCLE aims to strengthen Europe's rare earth and boron recycling capacity, ensuring a secure supply of strategic raw materials and fostering a sustainable European raw materials industry.



The NEO-CYCLE Horizon Europe Project has Officially
Launched!



Kick-off meeting in Sevilla, 2024

On September 5th 2024, in the beautiful city of Sevilla, the NEO-CYCLE journey began, bringing together a dynamic team of the Consortium Partners to collaborate on a groundbreaking initiative!

Discover everything about our project and dive deeper into what we're all about.



[Link to Website](#)



The Executive of Consortium oversees the strategic direction, coordination, and management of collaborative projects within the consortium. This role involves aligning partners' contributions with project objectives, ensuring compliance with funding requirements, facilitating stakeholder engagement, and driving innovation across multiple sectors. The executive serves as a key liaison between consortium members, funding bodies, and external stakeholders to maximize impact and sustainability

IDENER.AI

Interview with the Coordinator: NEO-CYCLE preliminary assessment since the launch of project activities

Expectations at the beginning of the project

In the Kick-off Meeting we conducted in Seville last September 2024, we recognized the significant potential of the NEO-CYCLE concept because of the consortium's multidisciplinary profile and the remarkable experience and knowledge they contributed to the project.

Certainly, the assistance provided to researchers and companies by technology partners will enhance their abilities and aid in achieving the project's established goals, including the upcycling of magnets to recover Critical Raw Materials (CRMs) for various applications: catalysts for ammonia production, the pharmaceutical sector, etc. Furthermore, the project also considers significant European values, such as social assessments, gender inclusiveness, and training initiatives aimed at enhancing the employability of target groups and professionals. We are thus very pleased with the tools and advancements that this Consortium provides to help create a more sustainable Waste Electrical and Electronic Equipment (WEEE) system.

Point of view of the Coordinator after almost one year of running activities

After a year since the start of NEO-CYCLE, we feel positive about the progress of the project. The meeting we held last February in Athens in month 6 of the project showcased the significant progress made, even after a brief period since the project's beginning. For instance, outstanding efforts have been achieved regarding the collection and extraction of magnets with our colleagues from ECORESET and STENA. These materials have been essential for the ongoing activities of the optimisation of Solid-State Chlorination (SSC) and the electrochemical approach through lab tests carried out by TUF, IKTS, etc. In case of IDE, we have achieved interesting advances in the mathematical modelling of SSC and SENE process, which we started to develop during the last four months. We are also immersed in the design of the pilot plant for SSC and SENE processes, to lead the investigations and results to the next level and go to a larger scale, simulating the industrial step. These are just a few instances of the completed work. Also, evaluations concerning the circularity of NEO-CYCLE related processes, along with their environmental, economic, and social impacts evaluation and standardisation efforts, are also underway.

Expectations for the activities of the second year of the project

The project's second year will be crucial for achieving NEO-CYCLE goals. In reality, it is currently the time when additional tasks will be initiated, and increased interactions will emerge among partners. The tasks related to the scaling-up of Fe, Nd and B recovery processes, which will start during next year, are a clear example of that. Another pivotal example of NEO-CYCLE is the beginning of the tasks related to the final products elaboration from those CRMs. The digitalization of the project will also gain strength in this second stage of the project with the complete development of the models to adjust the processes carried out in technical work packages. Certainly, this transition between 2025 and 2026 will boost the project and lay the groundwork for the final year of the NEO-CYCLE to achieve the goals set by the consortium.



IDENER.AI, NEO-CYCLE Coordination team

María González-Moya Jiménez

Project coordinator

E. Macarena García-Ayala

Technical coordinator



Our partners play a crucial role in every step of the NEO-CYCLE process, from the collection of spent NdFeB magnets to their transformation into high-quality materials for new applications. Their expertise in research, technology development, and policy engagement ensures that NEO-CYCLE continues to make a meaningful impact

ECORESET

Since the discovery of the Nd₂Fe₁₄B compound in the mid-80's, the volume production of powerful magnets increased rapidly. These magnets have been widely used in HDDs and improved largely the performance of the storage device, leading to a decrease in the appliance size. The WEEE management companies may source these magnets from various devices and equipment parts. In the framework of the NEO-CYCLE project, ECORESET SA is manually disassembling three types of devices: desktops, laptops, and servers, and categorizing the contained HDDs. Further manual disassembly is applied at the disk for the removal of the magnet and its casing. This is a very laborious task, as the dismantling may require 3-8 min/disk. The demagnetization of the disks occurs with thermal treatment. According to the literature (N. Menad & A. Seron, Characterization of permanent magnets from WEEE), HDD's are losing their magnetic properties at 297 °C, at Curie temperature. Therefore, they are heated with the casings at 300 °C for 30 min. After this treatment the casing is easily removed, and magnets are demagnetized.





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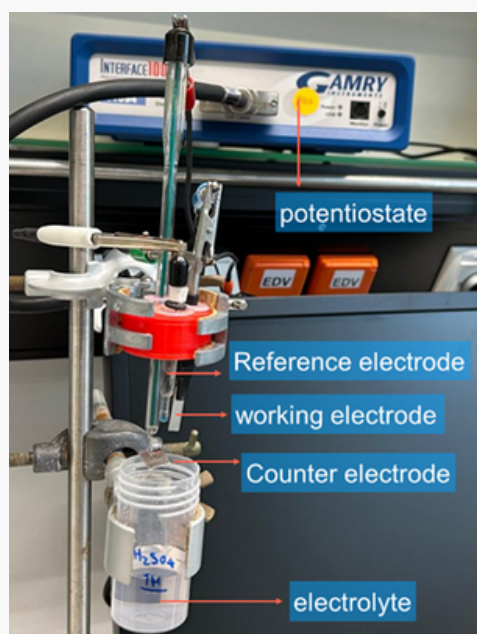
TUF

The growing demand for permanent magnets underscores the importance of recycling end-of-life (EoL) magnets and recovering their key components, primarily rare earth elements (REEs). However, large-scale industrial treatment of EoL magnets remains unimplemented due to challenges related to collection and the complexities of closed-loop hydrometallurgical processing. One major obstacle in hydrometallurgy is the high iron content of magnets, which leads to excessive chemical consumption and complicates separation processes.

To address these challenges, our team at TU Freiberg is investigating two innovative methods for extracting REEs from EoL magnets:

- Solid-State Chlorination (SSC)
- Electrochemically Supported Leaching (ESL)

Electrochemically Supported Leaching (ESL) involves dissolving the magnets—serving as the anode—within an electrolytic cell. This process facilitates the dissolution of REEs while separating non-REEs into anode slimes, precipitating them onto the cathode, or forming oxides/hydroxides in solution. Our experiments utilize aqueous acids alongside deep eutectic solvents (DESs) as electrolytes. DESs offer a broader electrochemical window compared to aqueous systems, enabling reactions that would otherwise be unfavorable. Furthermore, DESs allow precise control over water content and hydroxide precipitation, making them particularly valuable in this study.

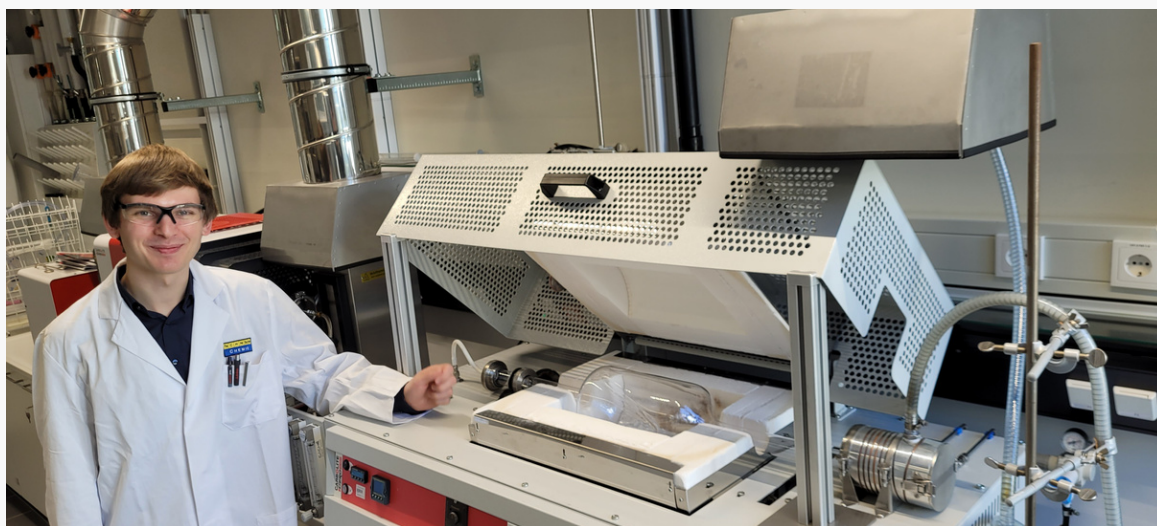


The set-up used for electrochemical-supported leaching



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TUF



Clemens Rogoll is presenting the rotary kiln, which is used for solid state chlorination



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NEO-CYCLE has just been presented by E. Macarena García-Ayala (IDENER) at the European Raw Materials Clustering Event in Seville, Spain.

The EURAW SEVILLE conference is a key event focused on CRMs and their role in Europe's sustainable and strategic autonomy.

The conference will feature keynote presentations, panel discussions, and networking opportunities, providing a platform for knowledge exchange and collaboration across various sectors.

The event provides an opportunity to highlight how NEO-CYCLE contributes to critical raw material recovery, specifically through the upcycling of spent NdFeB magnets from electronic waste

NEO-CYCLE was presented by Professor Gian Andrea Blengini (University of Torino) at Ecomondo, The green technology expo in Rimini on 5th November 2024.

The NEO-CYCLE project aligns strongly with Ecomondo 2025, as both focus on the circular economy, resource efficiency, and sustainable technologies. Ecomondo provides a key platform to showcase NEO-CYCLE's upcycling of NdFeB magnets, positioning it as a cutting-edge innovation in raw material recovery and waste valorization.

[Link to Event](#)



[Link to Event](#)



Our Consortium Partner, Leonardo Brachetti (Confagricoltura) had the pleasure of presenting NEO-CYCLE on November 5th as a pivotal project in agricultural sustainability, highlighting its objectives. This platform is ideal for showcasing the project and promoting NEO-CYCLE's role in advancing agricultural technology.

[Link to Event](#)

Viola Gallina (Fraunhofer Austria) and Felix Freitag (Universitat Politècnica de Catalunya) presented on the dynamic and static data in the digital product passport.

They highlighted NEO-CYCLE and expressed interest in the potential for transferring product passports to material passports and transitioning from material passports back to product passports.

The International Telecommunication Union (ITU) and European Telecommunications Standards Institute (ETSI) organized the "ITU-ETSI Symposium on ICT Sustainability:

Standards Driving Environmental Innovation", which took place from 11–12 December 2024, in ITU Headquarters in Geneva, Switzerland.



[Link to Event](#)



A scheduled meeting where consortium members review project progress, discuss challenges, align strategies, and coordinate upcoming activities. These meetings ensure effective collaboration, compliance with project objectives, and continuous improvement toward achieving consortium goals

M6 Meeting in Athens!

The NEO-CYCLE consortium gathered in Athens for the M6 meeting, hosted by ECORESET and IDENER.AI. It was a great opportunity to discuss our progress in upcycling spent NdFeB magnets and advancing traceability solutions.

As part of the meeting, we also had the chance to visit the ECORESET facility, gaining valuable insights into their innovative approaches to circular economy and material recovery.





The Gender Aspects in Engineering Projects workshop sparked so many ideas and reflections

On 16 April 2025, the NEO-CYCLE project held an online workshop on gender aspects in engineering projects organized by Agency of European innovations.

The online workshop focused on gender aspects in engineering projects, emphasizing the importance of gender equality and its consequences for innovation and societal advancement.

Ivan Kulchytskyy (AEI) opened the discussion by highlighting the importance of evaluating gender influences in project tasks and fostering collaboration among partners.

E. Macarena García-Ayala (IDENER) reinforced the seminar's role in promoting inclusivity and encouraged participants to share diverse perspectives.

Khrystyna Fogel (AEI) presented critical insights on gender inequalities in engineering, noting that women in the EU earn significantly less than men and are underrepresented in leadership roles, accounting for only 22% of technology professionals worldwide.

The NEO-CYCLE project has a very good gender balance across its partner project teams. Participants emphasized the importance of increasing women's participation in project activities and maintaining gender balance in project assignments. Workshops on women's leadership and skill development were planned, with a commitment to producing results that reflect gender views. The discussion ended with a consensus on incorporating gender balance into all project duties and taking a proactive approach to overcoming remaining barriers.





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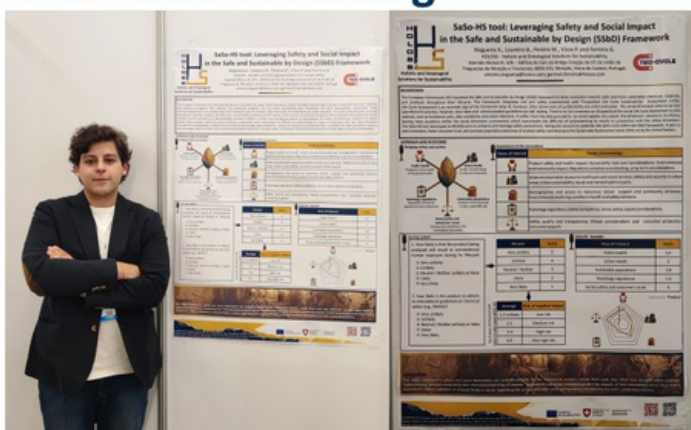
On May 12th, HOLOSS had the pleasure of presenting a poster at the SETAC Europe 35th Annual Meeting in beautiful Vienna, Austria

Our colleague, **António Nogueira**, showcased SaSo-HS — an innovative, in-house developed tool designed to bridge the safety and social dimensions within the Safe and Sustainable by Design (SSbD) framework.

This tool will continue to evolve and be applied within the NEO-CYCLE project, where HOLOSS leads the Social Life Cycle Assessment (S-LCA) efforts.

It was a fantastic way to kick off a week filled with insightful presentations, cutting-edge research, and inspiring discussions across the diverse fields of toxicology and environmental science.

SETAC Europe 35th Annual Meeting



**Knowledge that drives
join us and stay ahead!**





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The EUIndTech 2025 conference provided various opportunities to disseminate information about the NEO-CYCLE project in the form of a poster, presentation of the project leaflet at the exhibition, and meetings with various stakeholders.



Ivan Kulchytsky



www.indtech2025.eu

The new technologies of the NEO-CYCLE project for WEEE recycling

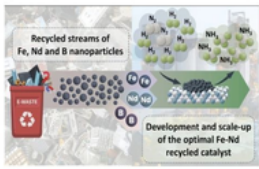
Ivan Kulchytsky, NGO AEI

Project Summary

The NEO-CYCLE project aims to demonstrate at TRL6 the sustainable upcycling of spent NdFeB magnets coming from hard disk drives (HDDs), reaching high-quality end products for 4 case studies: pharmaceutical, ammonia, fertilizers, and polymers industries and will include necessary paths, including standardisation activities, to reach the market uptake.



UPCYCLING OF NdFeB MAGNETS IN THE EU FOR GREEN



Industrial exploitation

NEO-CYCLE will develop a strong and sustainable business model to reach industrial cooperation agreements with different industrial companies.

<https://neo-cycle.eu/>













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Renata Dagiliūtė attended the 12th International Conference on Environmental Management, Engineering, Planning and Economics (CEMEPE 2025) and SECOTOX Conference, presenting NEO- CYCLE project, which focuses on upcycling of Neodymium (Nd) from spent hard disk drives





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12th International Conference on Sustainable Solid Waste Management Cyprus 2025

Fraunhofer IKTS in cooperation with **TU Bergakademie Freiberg** had the opportunity to present our work focused on **Critical Raw Material** recovery from secondary sources: **Sandra Pavón**, presented the NEO-CYCLE Project, which explores how to create synergies between different technologies to develop upcycling approaches for critical raw materials coming from magnets. Collaboration and innovation are key to building resilient and circular value chains! Proud to contribute to the transition towards a more sustainable and resource-efficient future.





A press release is a key communication tool that helps share important news with the public, media, and stakeholders

We're proud to announce that the first press release of the NEO-CYCLE project is now live!

A big thank you to all consortium members for your collaboration — and especially to **Renata Dagiliūtė** and her team for their great effort in making this possible.

Read more about how NEO-CYCLE is driving breakthrough technologies for upcycling critical raw materials — from element recovery to women's leadership in sustainability:

Baltic News Service (BNS) agency: <https://lnkd.in/d9HArS4d>

The Baltic Times:

<https://lnkd.in/duaKG8ZS>

VMU webpage:

<https://lnkd.in/d4P7Hhjv>



● **BNS** Spaudos centras

Breakthrough Technologies for Upcycling of Critical Raw Materials In EU From Elements' Recovery to Women's Leadership

Challenge of critical raw materials and circularity

Batteries, solar panels, wind turbines, electric vehicles, drones and other green and digital technologies are heavily dependent on critical raw materials. However, most of these critical raw materials needed for the European Union's economy are imported. For example, 85% of neodymium (Nd) used in the EU is imported from China, and 99% of boron (B) comes from Turkey (EC, Study on the Critical Raw Materials for the EU, 2023). Neodymium, a rare earth element, and boron are of particular strategic importance, i.e., exponential growth in demand of these elements is expected, which in turn poses supply risks. European Critical Raw Materials Act (2024) lists 34 critical materials in total and emphasises the need of strong, resilient supply chains as well as circularity and sustainability of raw critical materials.



Quizzes help people learn and remember information better. They make learning interactive, show what you know, and keep you engaged. For projects like NEO-CYCLE, quizzes also help gather useful insights while raising awareness in a fun way.

VMU has prepared Quiz as part of information and communication activities.



Welcome to NEO-CYCLE quiz!

The European Union (EU) funded project NEO-CYCLE aims at creating breakthrough technologies transforming waste from electric and electronic equipment (e-waste) into high quality end products for pharmaceutical, ammonia, fertilizers, and polymers industries; and includes necessary paths to reach the market uptake. Project provides solutions to multiple environmental, social and economic challenges related to waste management, critical materials, resource scarcity and environmental pollution.

Are you ready to jump into some "magnetic" e- waste adventure and check your knowledge?

All answers are anonymous, only aggregated data of the answers and quizzes taken will be used for NEO-CYCLE project information, communications activities and reporting. By starting a quiz, you express your consent to participate in this activity. If you would like to be kept informed on projects activities and results, you will be able to do that at the end of the quiz. Email will be used only for NEO-CYCLE communication and dissemination activities (newsletters, training and clustering events).

[Link to the Quiz](#)



! Call for Partners! Are you a researcher, policymaker, or industrial end-user interested in sustainable NdFeB magnet solutions? Let's collaborate!

🔍 The ability to track NdFeB magnets from collection to end use is critical for sustainability. NEO-CYCLE is pioneering traceability solutions to ensure material quality, regulatory compliance, and environmental impact reduction.

Stay Connected!

📢 Follow us on [linkedin.com/company/neo-cycle] & [x.com/neo_cycle] for the latest updates.

✉ For inquiries, contact us at neo-cycle.eu



Thank you for supporting the future of sustainable NdFeB magnet upcycling!



**Funded by
the European Union**

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