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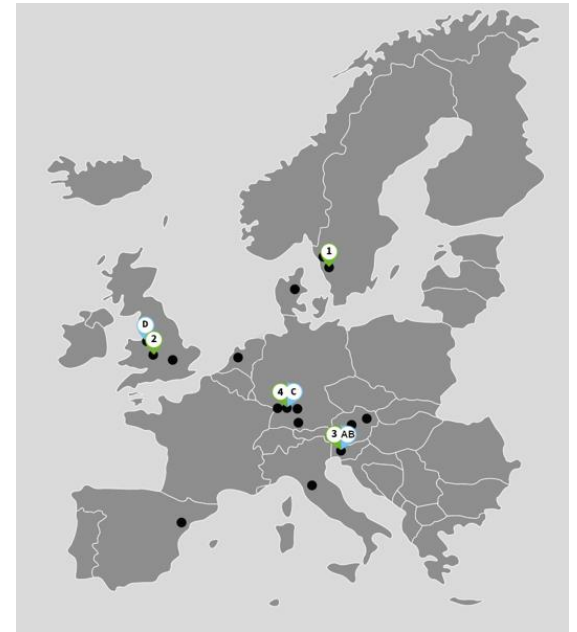
SUSTAINABLE RECOVERY, REPROCESSING AND REUSE
OF RARE-EARTH MAGNETS IN THE CIRCULAR ECONOMY



SUSMAGPRO

Creating a European Circular Economy of Rare Earth Magnets

INFORMATION FOR POLICY STAKEHOLDERS



- 18 partners from 9 European countries
- Duration: June 2019 to November 2023
- Coordination: Pforzheim University, Germany



SUSMAGPRO has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 821114



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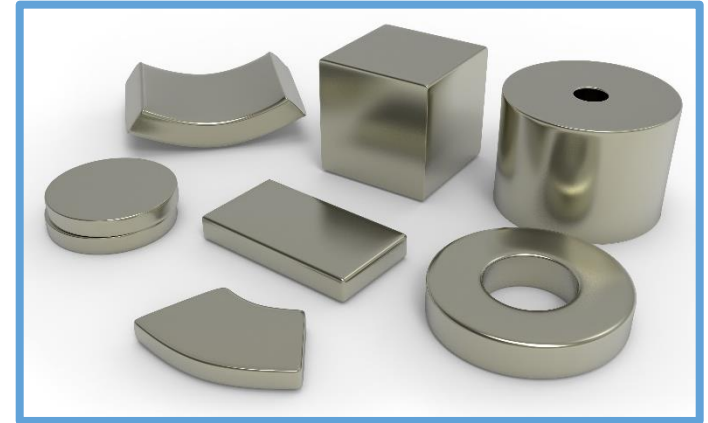
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Introduction

The SUSMAGPRO policy info pack aims to **inform EU institutions and national & regional authorities** about some of the **insights gained** during the implementation of the project and **promote the uptake of a circular economy** for Rare Earth Magnets.



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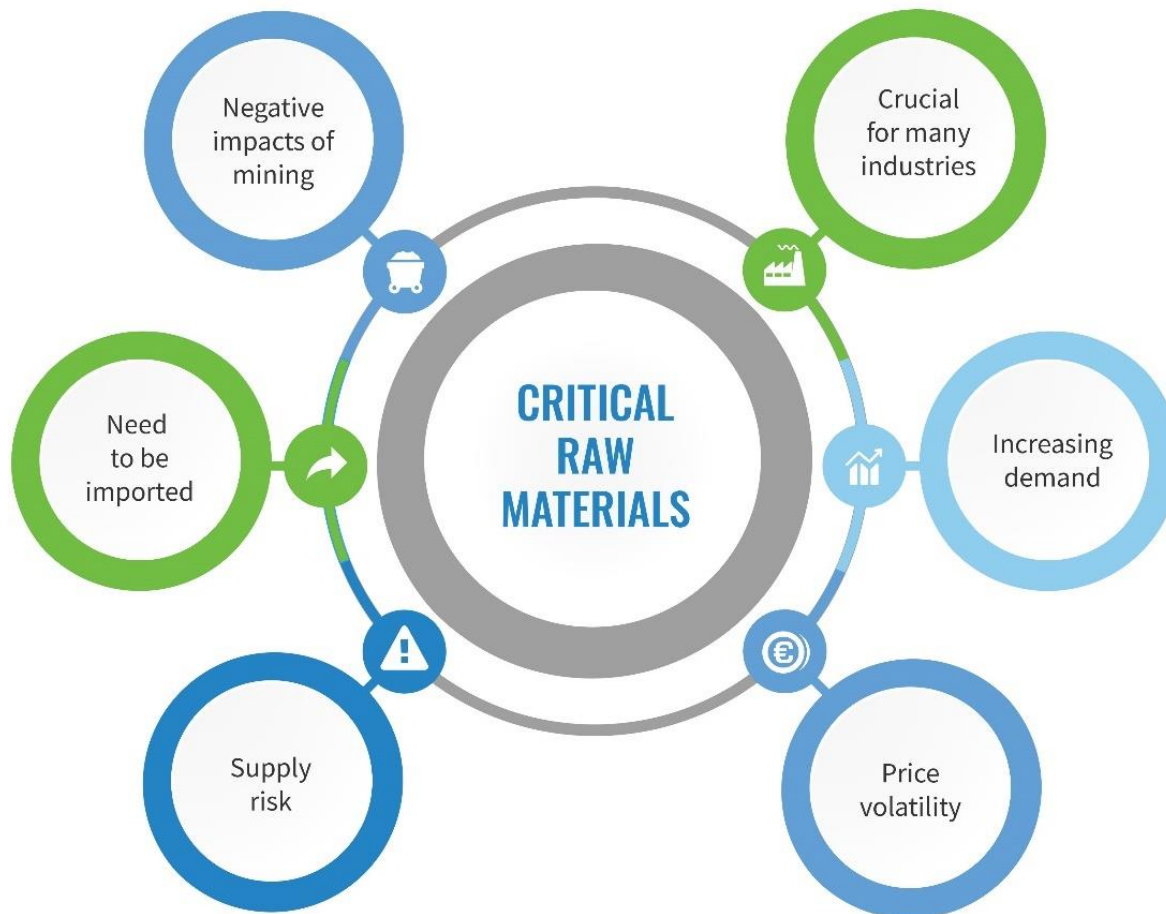
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Context and Challenges



- Rare Earth Magnets as critical components in wind turbines, electric motors and other high-tech products are key enabler of the green transition
- Less than 10% of the RE magnets needed in Europe are also produced here; China is the world's biggest exporter





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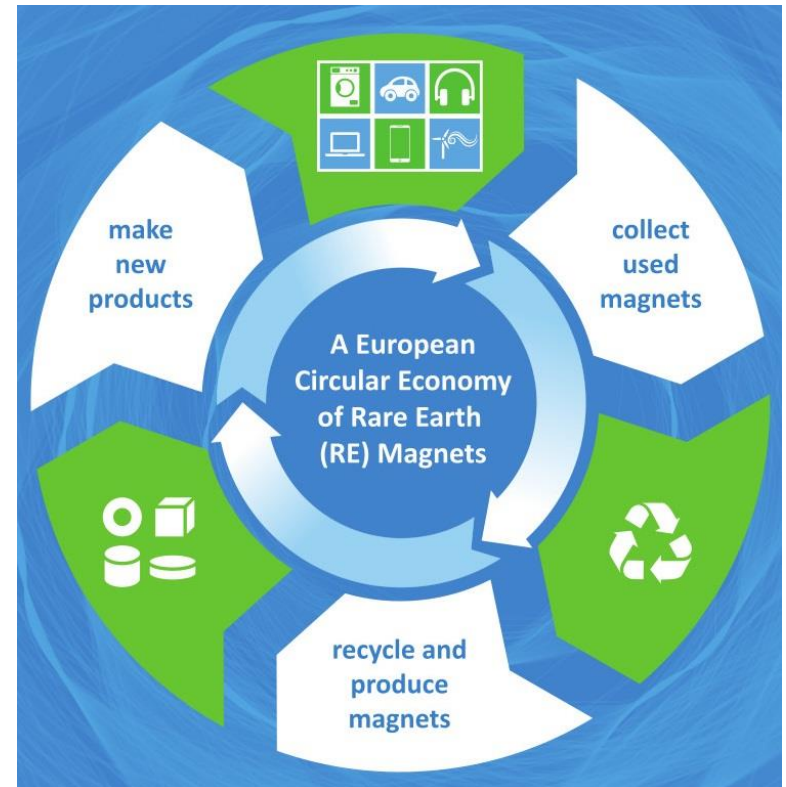
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SUSMAGPRO: A Circular Economy for RE Magnets

Main goal: identify, separate, reprocess and reuse permanent Rare Earth magnets all over Europe to create a [circular economy](#)

- **Produce every fourth RE magnet in Europe from recycled material by 2027:** set up of recycling plants and production lines in several European countries
- **Integrate recycled magnets in new products:** automotive motors, water and heating pumps, loudspeakers



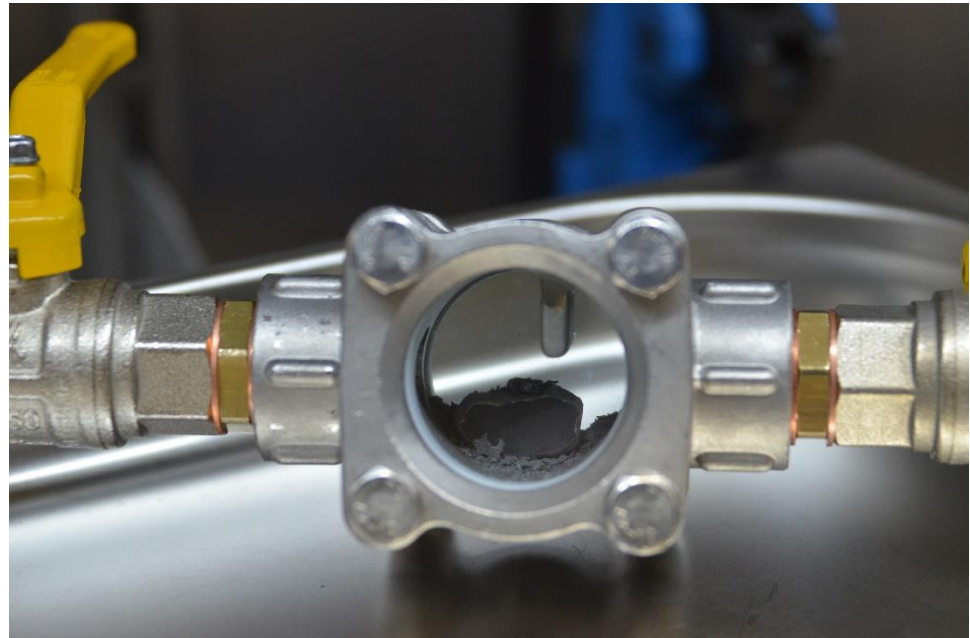
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Hydrogen Processing of Magnet Scrap (HPMS)

This new technology employed in SUSMAGPRO enables the break down of old magnets into powder.

Once separated from other elements and purified, the resulting RE powders are ready to be reprocessed into new magnetic components.



Click on the image to watch a video of the process





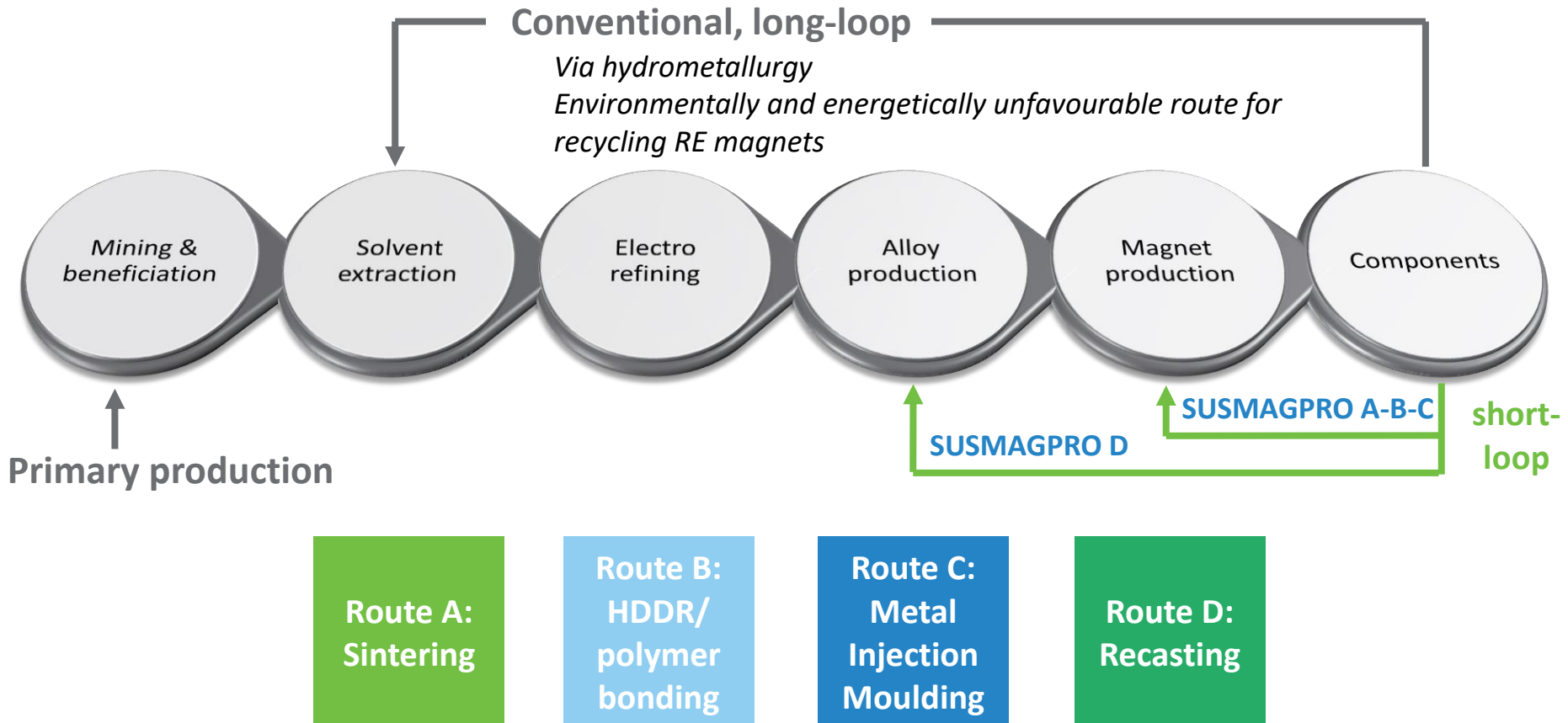
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A Shorter and Environmentally-Friendlier Loop

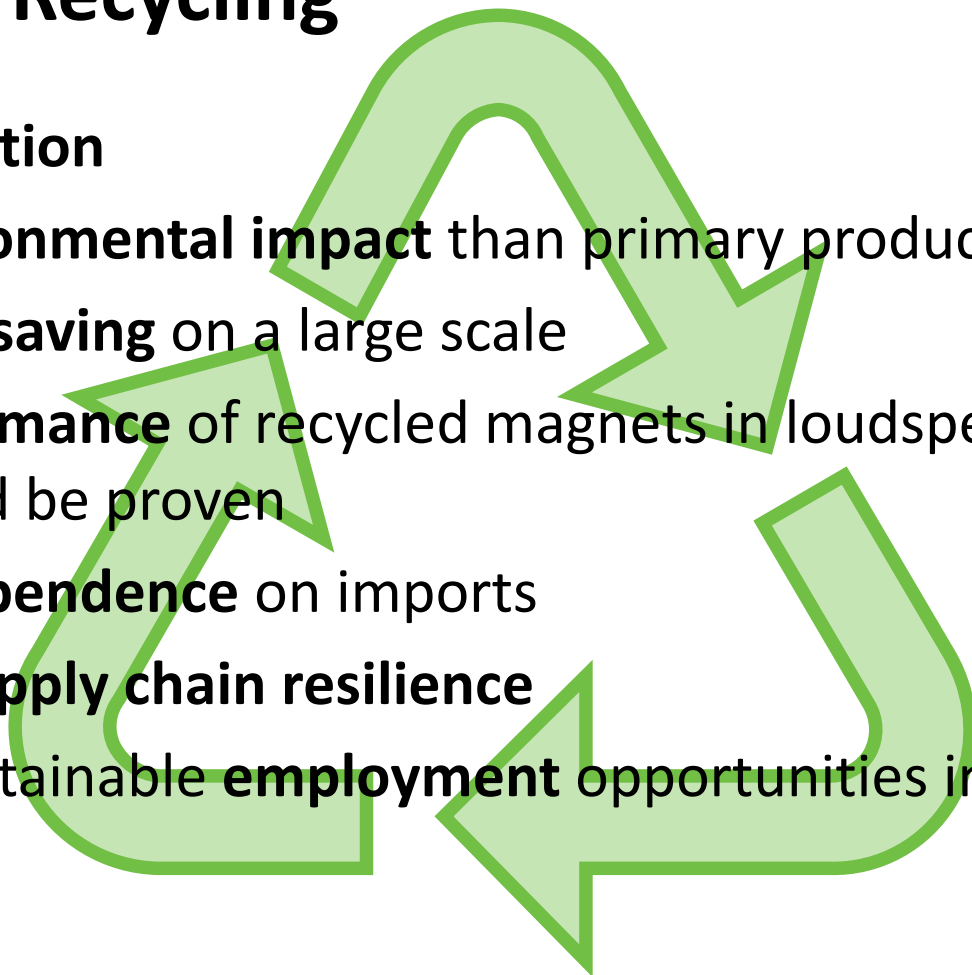


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Benefits of Recycling

- **Waste reduction**
- **Lower environmental impact** than primary production
- Can be **cost-saving** on a large scale
- **Equal performance** of recycled magnets in loudspeakers and motors could be proven
- **Reduced dependence** on imports
- Increased **supply chain resilience**
- New and sustainable **employment** opportunities in the recycling sector





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Techno-Economic Findings

- Industrial-scale recycling can be more cost-effective than producing new magnets. Labour costs are the principal cost driver, rendering manual processing of end-of life (EoL) products impracticable.
- Equipment is the second-largest expense.
- Costs can be reduced by recovering magnets from EoL products with larger magnets or with automated disassembly lines.



To achieve cost-effective magnet recycling, technology developers must focus on **industrial upscaling**, leverage **economies of scale**, **automate processes**, **explore synergies** from sorting additional metals, and **reduce equipment costs**.



Business models can emphasize **sustainability benefits** and **shorter supply chains**. If this results in a price premium, the scope for profitable recycling activities increases.



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Challenges for a Circular Economy

- **Many products are not designed for recycling:** For the HPMS to work, the EoL magnet needs space to expand. If it is too tightly embedded in a component, this is not possible. The magnet needs to be extracted first, which can be a time-consuming process. In the project, partners have therefore developed Design for Recycling Recommendations.
- **Lack of a common labelling system:** From the outside, classification (and an evaluation of recyclability) of magnets used within a given scrap product is mostly impossible. In the ERA-MIN2 project MaXycle, where several SUSMAGPRO members were key partners, a DMC based labelling system was developed that is now an essential part of the SUSMAGPRO database. This could be a starting point for a more extensive labelling system.
- **Image of recycled magnets needs to improve:** Recycling and performance are not mutually exclusive. In the project, recycled magnets were demonstrated in new applications and benchmarked against primary material. Partners have organised an awareness raising roadshow to promote a Circular Economy for Rare Earth Magnets. More remains to be done.
- **Changing waste flows** need to be considered and **access to scrap** guaranteed: Efficient recycling systems and take-back schemes need to be developed.





Recommended Actions



Investments needed to scale up recycling technologies



Monitoring and management of current and future material flows to guarantee access to scrap, including development of efficient take-back schemes



Investment in (up)skilling of current and future labour force



Development of Design for Recycling guidelines / policies for producers



Awareness raising and promotion of a circular economy approach





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SUSMAGPRO Consortium

Coordinator:



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