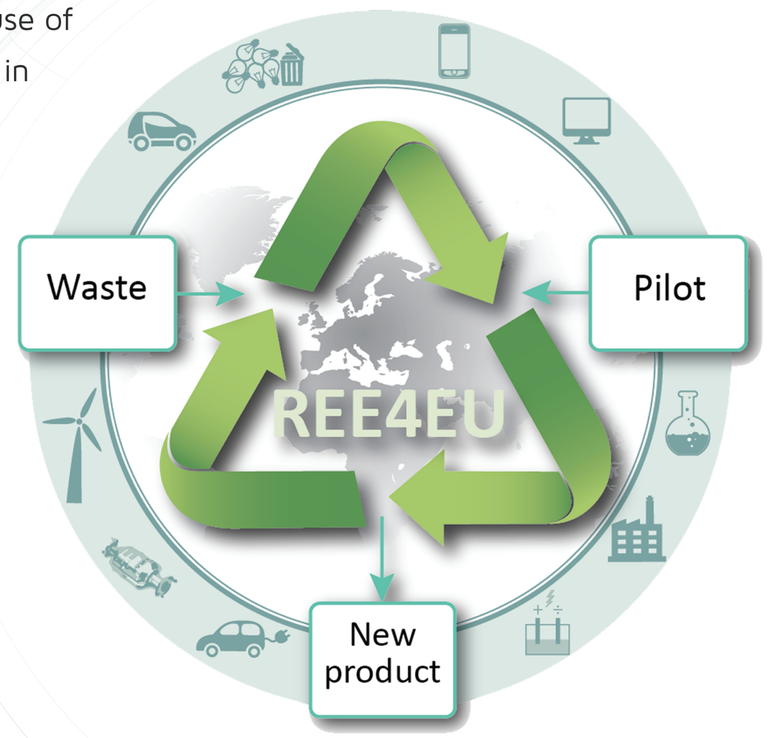
REE4EU PROJECT
RARE EARTH RECYCLING FOR EUROPE

Sustainable Process Industry through Resource and Energy Efficiency

Rare earth elements (REEs) are the seventeen chemical elements lanthanides, Scandium and Yttrium. Because of their geochemical properties, REEs are typically dispersed and not often found concentrated as RE minerals in economically exploitable deposits. REEs are considered "key-enablers" of green technologies, as they are used in hybrid electric vehicles, wind mills, and highly efficient electric motors. The dependence on Chinese exports makes Europe, and western countries in general, extremely dependent and vulnerable to Chinese market control. Therefore REE are considered to be materials with the highest supply-risk.
Regaining REE from RE-containing waste streams may constitute an important RE secondary source in Europe.
A recent study, based on detailed trade data, estimates the global trade in RE-containing products in 2010 at around €1.5 trillion, or 13% of the global trade. However, only 1% of RE waste is being recovered as no adequate process is currently available. REE4EU will open-up a fully new route bringing recovery of in-process wastes from PM manufacturing within reach.



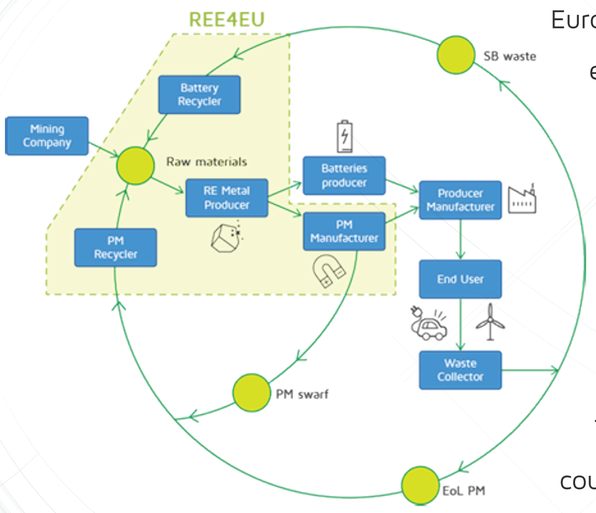
THE PROJECT OBJECTIVES AND BENEFITS

The REE4EU project will develop, validate and demonstrate in 2 industrially relevant Pilots an innovative Rare Earth Alloys (REA) production route from permanent magnets PM and Ni metal hydride (NiMH) Battery waste.
The targeted integrated solution is based on recently developed lab-proven technologies for direct high temperature electrolysis of REA production. It will be combined in the pilots with an innovative and proven Ionic Liquid Extraction or tailored hydrometallurgical pre-treatment to demonstrate dramatic improvements in cost and environmental performance compared to state of the art technologies.

The project will prove technical and economic viability on in-process permanent magnet waste, as well as end-of-life permanent magnets and NiMH battery waste.
The targeted integrated solution will demonstrate dramatic improvements in cost and environmental performance compared to state of the art technologies. This includes avoidance of process steps, 50% energy savings, and 100% recycling of reagents as opposed to disposal of strong acid leaching agents in state of the art pre-treatment steps.

REE4EU will also develop urgently required market data on EoL RE availability and a triple value-chain business case for a new European secondary rare earth alloys production sector. This will create new jobs, increase Europe's independence from imports and last but not least, provide valuable raw materials for fast growing European green-technology industries such as electrical/hybrid vehicles and wind turbines.

REE4EU for business



The estimated global trade in RE-containing products in 2010 was around €1.5 trillion that was the 13% of the global trade. The 10% of the value of Europe's exports consist of products containing REs. RE elements and Alloys are extremely important for Europe's competitiveness, in fact it is estimated that 30 million jobs in Europe depend on the availability of raw materials.

Several studies have also pointed to the critical role that REE supply will play in green energy technologies, as they are used in hybrid electric vehicles, wind mills, and highly efficient electric motors. The Europe and western countries are extremely dependent on Chinese exports for REE supply, China in fact accounts for more than 90% of the REE supply. The recycling of REE from waste is essential to reduce dependency from global supply chains.

REE4EU will potentially bring innovative process technologies to commercial scale in the next 4-7 years, by recovering in-process waste and 20% of European REE demand from waste streams.

The project will carry out a detailed market analysis of REE-containing products in order to estimate the potential quantities of Rare Earths that could be recycled in Europe with the final aim to establish what share of these REE-containing products can be economically collected, and what share of the REE contained in them can be economically recovered.

These data will be very important to enable the development of an integrated value chain needed to demonstrate the economic sustainability of EoL permanent magnet and NiMH battery wastes as feedstock for an investment in a European secondary RE Alloy plant. To this end the value chain here represented will be updated with the stakeholders identified within the project.

The project consortium

The project, led by SINTEF, involves in its consortium the full value chain including (SME and large) RE metal producers, PM manufacturer, SME process engineering companies and LCA experts, large electronics and battery recycling companies, SME technology transfer, innovation specialists as well as chemical and end-user associations. Together with 4 top research institutes on high temperature electrolysis, ionic liquids and RE recycling the REE4EU consortium will prove technical and economic viability on in-process PM waste (swarf), as well as end-of-life (EoL) PM and NiMH battery waste, develop urgently required market data on EoL RE availability and a triple value-chain business case for a new European Rare Earth Alloys (REA) production sector from secondary raw material.

This project has received funding from the European Union's Horizon 2020 Research and Innovation program under Grant Agreement n° 680507

Sustainable Process Industry through Resource and Energy Efficiency