REE4EU: integrated high temperature electrolysis (HTE) and Ion Liquid Extraction (ILE) for a strong and independent European Rare Earth Elements Supply Chain

Project type:	Innovation action		
Start date of project:	01/10/2015	Duration:	48 months

D9.1 Value Chains Stakeholders Analysis Report

WP n° and title	WP9 - Market analyses, exploitation and dissemination
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Date	31-03-2017

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List of abbreviations and definitions

Abbreviation	Definition
EC	European Commission
GA	Grant Agreement
REA	Rare Earth Alloys
REE	Rare Earth Elements
REE4EU	integrated high temperature electrolysis (HTE) and Ion Liquid Extraction (ILE) for a strong and independent European Rare Earth Elements Supply Chain
PU	Public

Notice and Disclaimer

[1] The authors of this document are working with PNO Innovation N.V. (Brussels office-Belgium) and Ciaotech (Italy). Both PNO Innovation and Ciaotech belonging to the same mother company PNO Group B.V. (PNO). PNO is a European leader in grants and innovation bringing about 1 Billion euro annually to its clients . PNO Innovation (the beneficiary in REE4EU) is located in Brussels and is leading the intelligence services for the PNO Group which encompass value chains and stakeholders analysis, market and business analysis, IPR management and exploitation plans, road-mapping , building innovation ecosystems and new communities around a specific topic, among other services. PNO provides open innovation opportunities and is managing an open innovation portal (www.innovationplace.eu) where information about innovative ideas, projects and funding opportunities in several European countries is constantly provided. For more information about this deliverable, the REE4EU project, or PNO in general, the authors can be contacted at nader.akil@pnoconsultants.com.

Executive Summary

This document provides a helicopter view on the most relevant stakeholders who are connected to the topic of Rare Earth Elements (REE) in general and more specifically to the REE4EU value chain. Although the list of stakeholders provided in this document is by no means exhaustive, the study provides relevant information on the most important industrial stakeholders (SMEs, or large industries) that are performing international research, innovation and business activities across or around the value chain of the REE4EU project. The position of each industrial stakeholder in the global REE supply chain is identified, and concise information about their activities and potential interests, and linkages to the REE4EU project is also provided.

Additionally, the list of the major European research and academic institutions working on the topic of recovery of REE is presented, and their European research projects or patents are concisely presented and can be accessed directly from the links provided in this document.

Moreover, this deliverable provides information on industrial stakeholders who are connected to the most relevant applications, as identified in the ERECON report, that may present a significant opportunity for REE recovery, such as:

1. Hard disk drives, DVD and CD players
2. Automotive applications
3. Motors in industrial applications
4. Loudspeakers
5. Air conditioning compressors
6. Magnetic separators
7. Mixed electronics
8. Electric bicycles
9. Wind turbines

The aim of this study is on one hand, to help the consortium partners in setting up dissemination and communications actions targeted towards group(s) of stakeholders relevant to a specific value chain, and on the other hand, to provide information to the public at large on the relevant industrial and academic stakeholders that are connected to the topic of REE in general and more specifically to the recovery of REE.

This study lays down the foundations for targeted dissemination, networking and business development activities between relevant stakeholders and the REE4EU partners.

1 Introduction

The results presented in this deliverable have been acquired based on a methodology elaborated by PNO to determine the value chain needs analysis for the recovery of REE, and the most relevant stakeholders related to the project activities. The methodology is based on the following approaches:

1- Identification of the position of the REE4EU-specific value chain within the global REE supply chain so that stakeholders from other value chains within the global supply chain are considered in the stakeholder analysis.
2- Illustration of the global supply chain in a user-friendly way permitting to visualise the position of the identified stakeholders into the global supply chain (see figure 1). 6 positions of stakeholders in the global supply chain were specified:
    a. Primary Supplier;
    b. REE recovery;
    c. REA producer;
    d. REE intensive product manufacturer;
    e. End user (mainly stakeholders using REE in the 9 products specified in the ERECON report);
    f. Recycler;
3- Screening of the Cordis database to identify the "Innovators" in EU in the field of recovery of REE
4- Screening of several patent databases such as WIPO, Espacenet, etc. to identify the potential investors in the field of REE recovery
5- Web search and interviews to identify relevant stakeholders as potential business drivers supporting the REE4EU project.

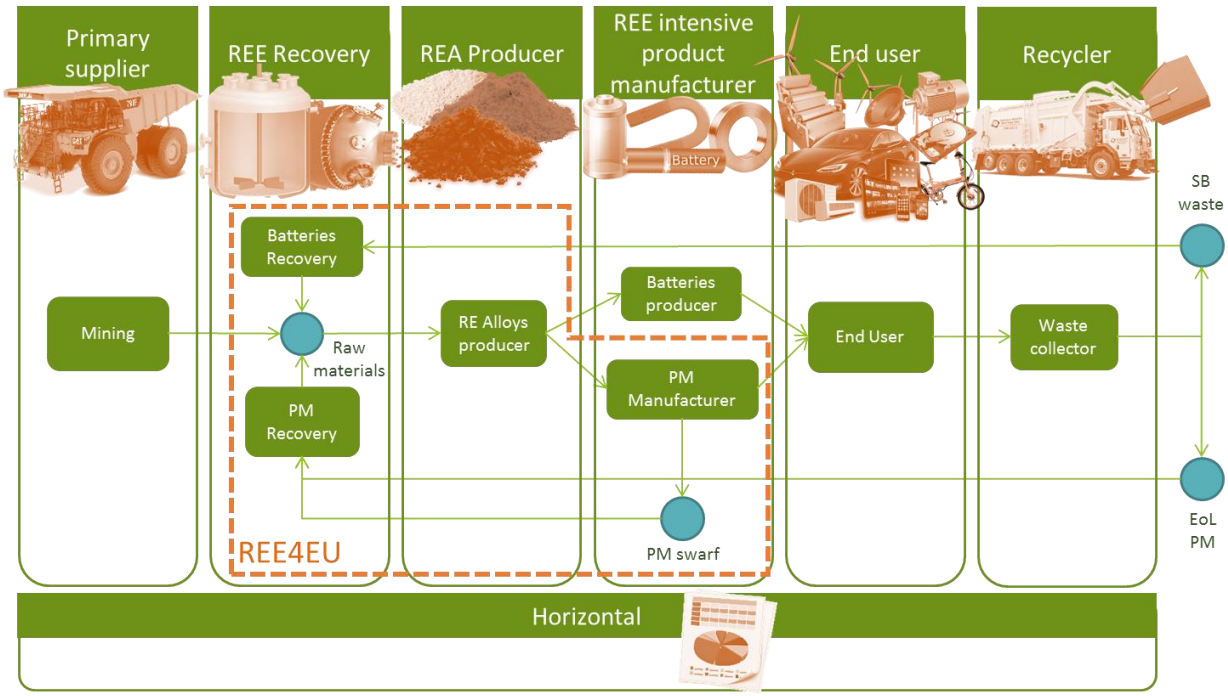

Figure 1 The REE4EU value chain and how it is embedded in the global supply chain

The analysis led to the identification of more than 300 stakeholders that are connected i.e. with a business relationship, to the REE recovery and REE use subjects and therefore to the project. Stakeholders were classified based on their individual position across the global REE supply chain as follows: potential end users of REE, stakeholders with access to feedstocks containing REE, stakeholders involved in (competing) technology development, etc. For each stakeholder, information was gathered from publicly available sources, such as company websites, public reports or other public information about their interests in rare

earth elements. The gathered information for each industrial stakeholder was tabulated following a standardised form (see table 1 below) to facilitate the reading of this document and the retrieval of the information.

Table 1 Standardised table for illustration of information of the identified industrial stakeholders

Company information	**Name:** **Type:** SME or Large Industry **Country:** **Website:**
Value chain position	Primary Supplier, or REE recovery, or REA producer, or REE intensive product manufacturer, or end user or recycler.
General description	General description of the core business and activities of the industrial stakeholder
Link to REE4EU	Concise information on why the identified stakeholders is linked to the REE4EU project and how?
Projects	Link to the project(s) which the stakeholder has been participating to and briefing on the project(s) such corresponding funding programmes, Start date, End date, funding received, number of partners, and coordinating entity.

2 Innovators (EU projects)

The first step in the stakeholder analysis was to focus on the European organisations that have been working on the topic of REE recovery within the context of European projects in the past years. As these EU projects have a strong innovation character, their stakeholders represent the "Innovators" in Europe in the field of REE recovery. Analysis of the aforementioned projects led to the identification on one hand, of the industrial entities (large industries and SMEs) with interest in REE recovery due to business direction, know how, services etc. depending on the availability of REE, and on the other hand, of the RTOs and academic organisations active in the development of new recovery technologies for REE4EU. Both types of stakeholders have strong ties with the project and will be informed about the progress of REE4EU activities with an aim to highlight potential synergies of REE4EU with ongoing European projects and to potentially generate business development opportunities with the industry. The following section provides a detailed description of the methodology implemented to identify those innovators in Europe that are connected to the REE4EU project, and the results obtained.

2.1 Methodology

The first step of the stakeholder analysis, aiming at better understanding "who is doing what" within the REE4EU value chain, was the research on the funded European projects.

Figure 2 CORDIS portal homepage

The Community Research and Development Information Service (CORDIS) is the EC's primary public repository and portal to disseminate information on all the EU-funded research projects and their results. PNO's intelligence methodology is based on the exploitation of the CORDIS database, which makes available a set of structured information about funded projects and the involved entities. Thanks to InnovationPlace (www.innovationplace.eu), the proprietary platform based on the Open Innovation paradigm that also encompasses intelligence tools to tape into large data of publicly available information, the PNO team was able to rapidly explore the CORDIS repository, identify the relevant EU projects and extract the detailed list of all the stakeholders involved in such projects. The actors involved in the REE4EU value chain which participate or have participated in EU projects have been considered as "innovators", as EU projects have a strong innovation character.

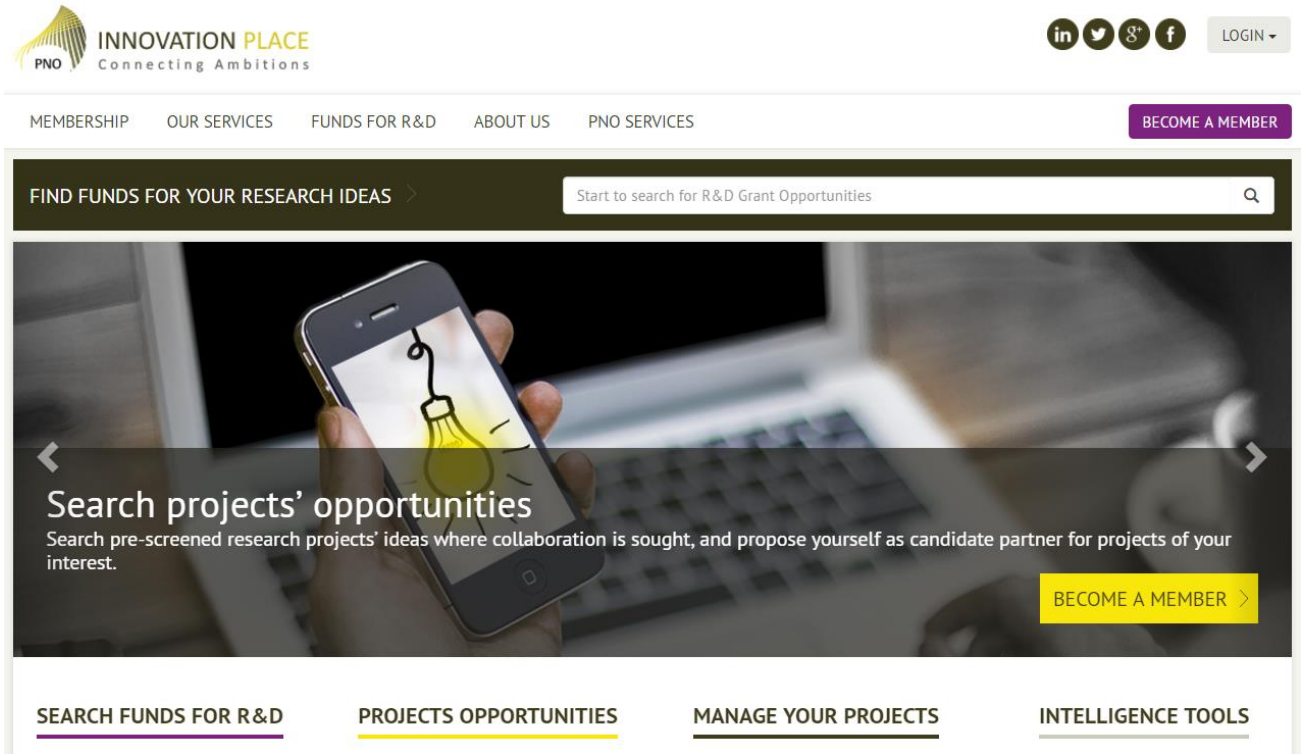

Figure 3 InnovationPlace homepage

The starting point of this process was the identification of the corpus of EU projects related to the REE4EU scope. Guided by the project consortium, PNO team has performed the first queries with 4 keywords and a timeframe. Since the goal of this analysis is to identify the actors that are currently active in REE recovery, projects that have started before 2005 were ignored. The chosen keywords were:

- Batter(y) recycl(e)
- Magnet() recover(y)
- Permanent magnet()
- Dismantl(ing)

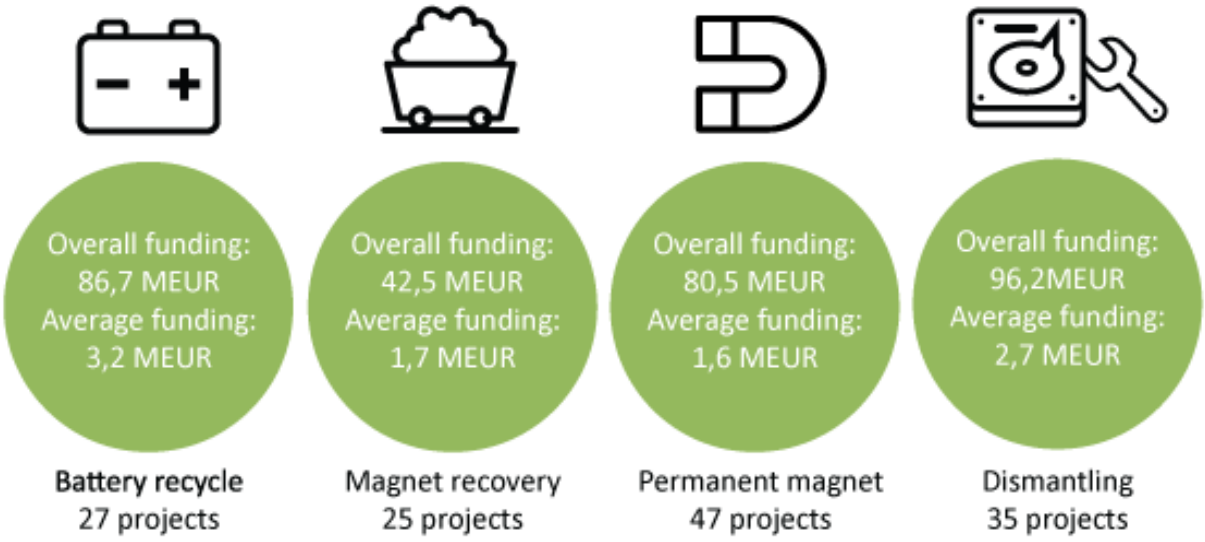

Figure 4 First queries overview

Due to the stemming functionality of the research tool and the broad keywords adopted, the final corpus of 128 projects[2] comprised also items out of scope. The noise generated was considered less problematic than the possibility of missing important projects. Nevertheless, a filtering phase was needed in order to narrow down the corpus to the only relevant contents.

The full list was analysed and each item was tagged in order to cluster the projects into "families". This step was performed in order to ensure a better overview on the identified projects and to better visualise the landscape covered.

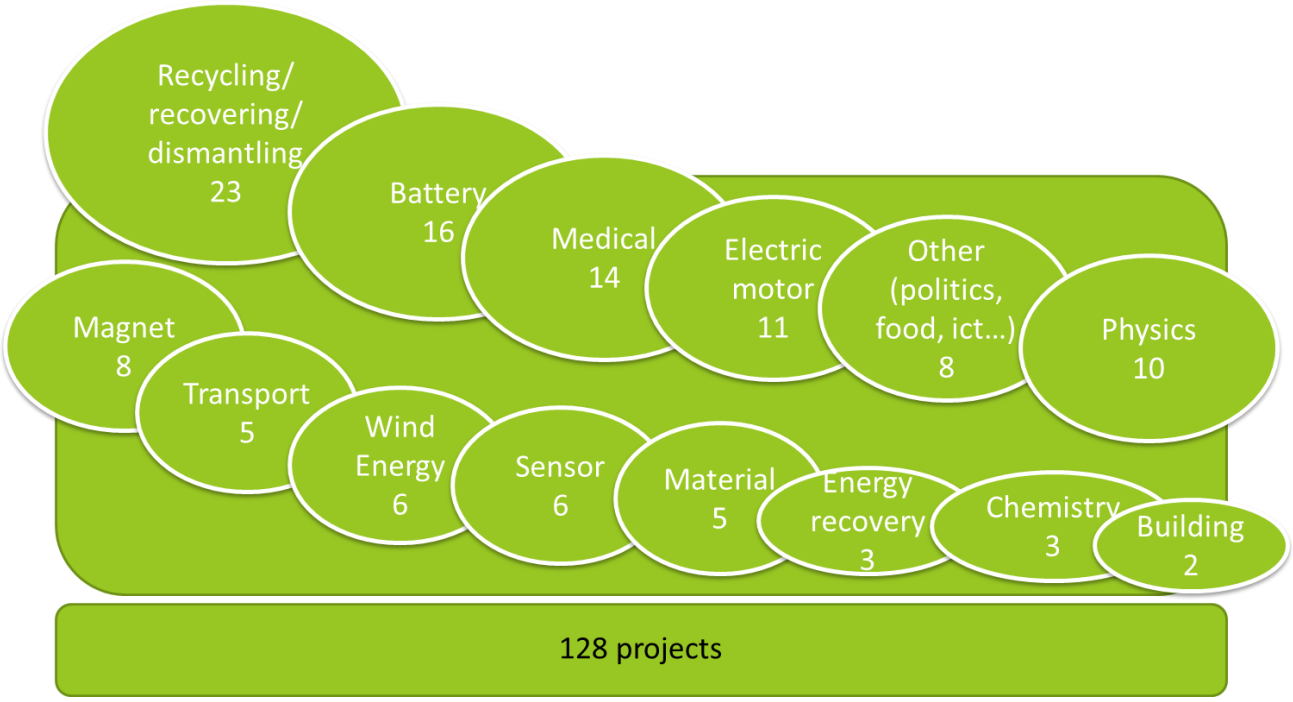

Figure 5 First queries results analysis – project families

The full list of projects was discussed with the coordinator and a brainstorm session about the projects was necessary to refine the list to the most relevant projects. During the brainstorm session, high level information about the projects were investigated and their intimacy and synergies with the REE4EU project were assessed. Following the brainstorm session, the list was reduced to 29 projects related to selected for 5 project families:

- battery
- electrical motor
- magnet
- recycling/recovering/dismantling
- wind turbine

An overview of the selected 29 projects is illustrated in Table 2.

[2] The 134 hints obtained from the 4 queries resulted in 6 overlapping projects. Once removed the redundancies, the final corpus comprised 128 projects.

Table 2 Selected EU projects

TITLE	START DATE	END DATE	PROJECT ACRONYM	COORDINATOR	PROJECT FUNDING	SUBPROGRAMME AREA
Next generation urban mining - Automated disassembly, separation and recovery of valuable materials from electronic equipment	01/09/15	31/08/19	ADIR	FRAUNHOFER GESELLSCHAFT ZUR FOERDERUNG DER ANGEWANDTEN FORSCHUNG E.V.	€ 5.262.201,00	SPIRE-07-2015
Towards Replacement of Critical Catalyst Materials by Improved Nanoparticle Control and Rational Design	01/06/16	31/05/19	CritCat	TTY-SAATIO	€ 4.369.293,00	NMP-23-2015
A Chemical Approach to Molecular Spin Qubits: Decoherence and Organisation of Rare Earth Single Ion Magnets	01/08/15	31/07/20	DECRESIM		€ 1.827.375,00	ERC-CoG-2014
Training Network for the Design and Recycling of Rare-Earth Permanent Magnet Motors and Generators in Hybrid and Full Electric Vehicles	01/09/15	31/08/19	DEMETER	KATHOLIEKE UNIVERSITEIT LEUVEN	€ 3.802.512,00	MSCA-ITN-2015-ETN
Drastically reduced use of rare earths in applications of magnetocalorics	01/01/13	31/12/15	DRREAM	IMPERIAL COLLEGE OF SCIENCE, TECHNOLOGY AND MEDICINE	€ 3.707.143,00	NMP.2012.4.1-3
European Rare Earth Magnet Recycling Network	01/09/13	31/08/17	EREAN	KATHOLIEKE UNIVERSITEIT LEUVEN	€ 3.901.642,00	FP7-PEOPLE-2013-ITN
Development of a sustainable exploitation scheme for Europe's Rare Earth ore deposits	01/01/13	31/12/17	EURARE	NATIONAL TECHNICAL UNIVERSITY OF ATHENS - NTUA	€ 9.000.000,00	NMP.2012.4.1-1

New geomodels to explore deeper for High-Technology critical raw materials in Alkaline rocks and Carbonatites	01/02/16	31/01/20	HiTech AlkCarb	THE UNIVERSITY OF EXETER	€ 5.395.296,00	SC5-11d-2015
Aeronautical Magnetic Gear Box	01/09/12	30/04/14	MAGBOX	UNIVERSIDAD CARLOS III DE MADRID	€ 183.627,00	JTI-CS-2012-1-SFWA-01-048
New permanent magnets for electric-vehicle drive applications	01/10/13	30/09/16	MAG-DRIVE	INSTITUT JOZEF STEFAN	€ 2.549.000,00	GC.SST.2013-2.
Improved magnets for energy generation through advanced tidal technology	01/12/12	30/11/14	MAGNETIDE	ATARD SAVUNMA VE HAVACILIK SANAYI ILERI TEKNOLOJI UYGULAMALARI ARASTIRMA VE GELISTIRME A.S.	€ 1.131.700,00	SME-2011-1
Establishing of a novel technology platform for bio-based mineral processing: Development of peptides as agents for the separation of rare earth minerals via bio-flotation	01/03/15	28/02/17	MINEPEP	HELMHOLTZ-ZENTRUM DRESDEN-ROSSENDORF EV	€ 168.321,00	FP7-PEOPLE-2013-IOF
New Spin for Molecular Magnets	31/08/15	30/08/17	MOLMAG	JYVASKYLAN YLIOPISTO	€ 191.326,00	MSCA-IF-2014-EF
HIGH PERFORMANCE NANOSTRUCTURE PERMANENT MAGNETS	01/06/10	31/12/12	NANOPERMAG	NATIONAL CENTER FOR SCIENTIFIC RESEARCH "DEMOKRITOS"	€ 202.319,00	FP7-PEOPLE-2009-IIF
Nanocrystalline Permanent Magnets Based on Hybrid Metal-Ferrites	01/12/12	30/11/15	NANOPYME	FUNDACION IMDEA NANOCIENCIA	€ 3.479.493,00	NMP.2012.4.1-3

NOVel, critical materials free, high Anisotropy phases for permanent MAGnets, by design.	01/04/16	30/09/19	NOVAMAG	FUNDACION BCMATERIALS - BASQUE CENTRE FOR MATERIALS, APPLICATIONS AND NANOSTRUCTURES	€ 5.562.360,00	NMP-23-2015
Development of novel, high Performance hybrid TWV/GPF Automotive afteR treatment systems by raTIonAL design: substitution of PGMs and Rare earth materials	01/04/16	30/09/19	PARTIAL-PGMs	WARRANT GROUP SRL	€ 4.650.000,00	NMP-23-2015
Rare Earth Oxide Dielectrics for Advanced Germanium CMOS Technology	01/05/11	30/04/13	REACT	"NATIONAL CENTER FOR SCIENTIFIC RESEARCH ""DEMOKRITOS"""	€ 157.720,00	FP7-PEOPLE-2010-IEF
Novel active nanophotonic devices in rare-earth doped double tungstates	01/08/11	31/07/15	RE-ACT	UNIVERSITEIT TWENTE	€ 100.000,00	FP7-PEOPLE-2011-CIG
Reclamation of Gallium, Indium and Rare-Earth Elements from Photovoltaics, Solid-State Lighting and Electronics Waste	01/01/13	31/12/16	RECLAIM	NEDERLANDSE ORGANISATIE VOOR TOEGEPAST NATUURWETENSCHAPPELIJK ONDERZOEK - TNO	€ 4.715.525,00	NMP.2012.4.1-2
Recovery of Rare Earth Elements from magnetic waste in the WEEE recycling industry and tailings from the iron ore industry	01/12/13	30/11/16	REECOVER	NORGES TEKNISK-NATURVITENSKAPELIGE UNIVERSITET NTNU	€ 5.995.741,00	ENV.2013.6.3-1
Rare Earth Element reCYCLing with Low harmful Emissions	01/07/13	30/06/18	REE-CYCLE		€ 2.255.515,00	ERC-AG-PE8

Improvement of Technical Capabilities for Research and Development (R&D) Related to Separation, Determination and Preliminary Production of different Rare Earth Elements.	01/11/09	31/10/11	REESEP	HELSINGIN YLIOPISTO	€ 251.508,00	FP7-PEOPLE-IIF-2008
RARE EARTH FREE PERMANENT MAGNETS	01/05/12	30/04/15	REFREEPERMAG	"NATIONAL CENTER FOR SCIENTIFIC RESEARCH ""DEMOKRITOS"""	€ 3.841.400,00	NMP.2011.2.2-4
New Recovery Processes to produce Rare Earth - Magnesium Alloys of High Performance and Low Cost	01/09/15	31/08/18	REMAGHIC	FUNDACION CIDAUT	€ 3.253.441,00	SPIRE-07-2015
Rare Earth Magnet Recovery for Environmental and Resource Protection	01/01/13	30/06/16	REMANENCE	C-TECH INNOVATION LIMITED	€ 3.722.000,00	NMP.2012.4.1-2
Rare Earth Metal Separation with Ionic Liquids	01/02/15	31/01/17	REMSIL	THE QUEEN'S UNIVERSITY OF BELFAST	€ 231.283,00	FP7-PEOPLE-2013-IIF
Resource Efficient Production Route for Rare Earth Magnets	01/01/15	31/12/17	REProMag	OBE OHNMACHT & BAUMGARTNER GMBH & CO KG	€ 5.726.365,00	FoF-02-2014
Replacement and Original Magnet Engineering Options	01/12/12	30/11/15	ROMEO	INSTITUT JOZEF STEFAN	€ 3.978.306,00	NMP.2012.4.1-3
The development of a novel rare-earth magnet based wave power conversion system - Snapper	01/09/09	31/08/11	SNAPPER	NATIONAL RENEWABLE ENERGY CENTRE LIMITED	€ 988.620,00	SME-1

Thermoelectric power generation from anomalous Nernst effect based on rare earth free hard magnetic materials	01/03/14	29/02/16	THERMO-SPIN	"THE PROVOST, FELLOWS, FOUNDATION SCHOLARS & THE OTHER MEMBERS OF BOARD OF THE COLLEGE OF THE HOLY & UNDIVIDED TRINITY OF QUEEN ELIZABETH NEAR DUBLIN"	€ 254.638,00	FP7-PEOPLE-2013-IEF

2.2 General overview of the industrial "Innovators" identified and their positions in the global REE supply chain

The partners involved in the selected EU projects were extracted, representing the first set of the identified stakeholders active in the REE supply chain. A helicopter view of the industrial innovators and their position in the supply chain is shown in Figure 6. Detailed profiles of all the industrial innovators (SMEs and large industries) are presented in sections 1.3, while section 1.4 provides the list of non-profit stakeholders.

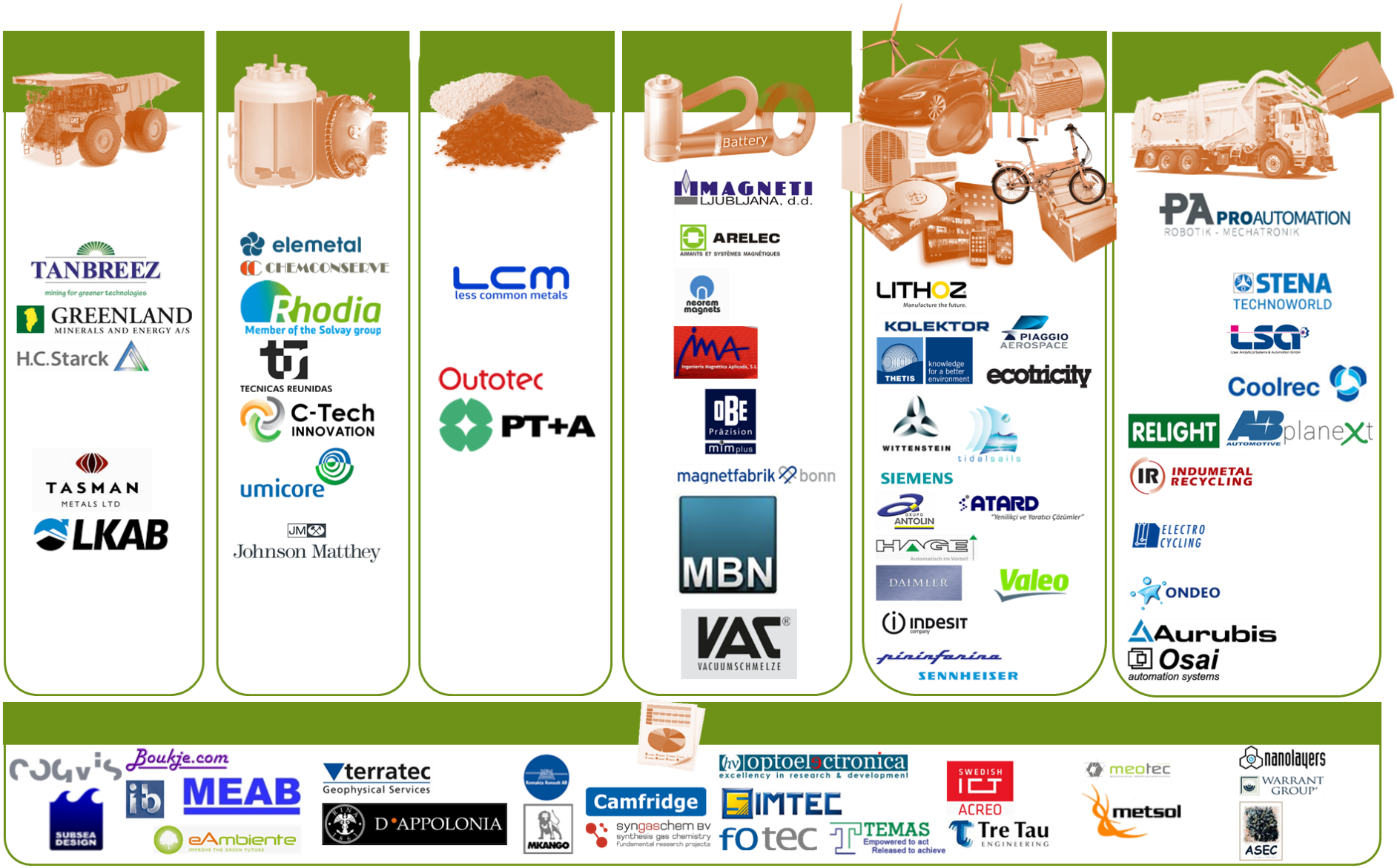

Figure 6 Identified industrial "Innovators" and their positions in the REE supply chain

2.3 Profit Stakeholders

2.3.1 Primary suppliers

2.3.1.1 SMEs

Company information	**Name:** GREENLAND MINERALS AND ENERGY (GME) **Type:** SME **Country:** Greenland **Website:** http://www.ggg.gl/
Value chain position	Primary Supplier
General description	GME is positioned at the forefront of Greenland's emerging minerals industry. Since 2007, the company has been focused on delivering specialty metals from the complex located in South Greenland. Greenland is recognized as one of the world's largest resources for REE, uranium and zinc.
Link to REE4EU	GME is participating to EURARE project to develop and optimize the beneficiation of mining deposits in Europe that will lead to the production of high grade REE concentrates and minimization of produced tailings.
Projects	EURARE: "Development of a sustainable exploitation scheme for Europe's Rare Earth ore deposits" Funding programme: FP7-NMP-2012-LARGE-6 Start date: 2013-01-01 End date: 2017-12-31 Funding: 9 M€ Number of partners: 23 Coordinator: NATIONAL TECHNICAL UNIVERSITY OF ATHENS

Company information	**Name:** TANBREEZ MINING GREENLAND **Type:** SME **Country:** Denmark **Website:** http://tanbreez.com/
Value chain position	Primary supplier
General description	Tanbreez Mining is located in Greenland and rapidly growing for larger scale mining industry. It is expected that Tanbreez will be an abundant REE and some other precious metals supplier for Europe. Tanbreez Mining has the potential to become the largest RE deposit in the world especially of the heavy REs such as dysprosium.
Link to REE4EU	Tanbreez mining site in Greenland is still under development. Sustainable and environmental friendly mining is the core aim of Tanbreez Mining team. They have joined EURARE project where Tanbreez team work on

	sustainable development of Tanbreez mine site and other ore deposits in Europe.
Projects	EURARE: "Development of a sustainable exploitation scheme for Europe's Rare Earth ore deposits" Funding programme: FP7-NMP-2012-LARGE-6 Start date: 2013-01-01 End date: 2017-12-31 Funding: 9 M€ Number of partners: 23 Coordinator: NATIONAL TECHNICAL UNIVERSITY OF ATHENS

Company information	**Name:** TASMAN METALS **Type:** SME **Country:** Sweden **Website:** http://tasmanmetals.se/
Value chain position	Primary supplier
General description	Tasman Metals is a mining exploration and development company with a pure focus on deposits of REE in Europe. The goal of Tasman is to help secure REE supply from stable countries, and the use of sustainable and durable technical solutions.
Link to REE4EU	Tasman has a current strategy finding EU based ore mining resources to reduce the dependency on REE to China. To this aim, they joined EURARE project to develop and optimize of mining deposits in Europe.
Projects	EURARE: "Development of a sustainable exploitation scheme for Europe's Rare Earth ore deposits" Funding programme: FP7-NMP-2012-LARGE-6 Start date: 2013-01-01 End date: 2017-12-31 Funding: 9 M€ Number of partners: 23 Coordinator: NATIONAL TECHNICAL UNIVERSITY OF ATHENS

2.3.1.2 Large industries

Company information	**Name:** H.C. STARCK **Type:** Large industry **Country:** Germany **Website:** https://www.hcstarck.com/en/home.html
Value chain position	Primary supplier

General description	H.C. Starck is a leading premium supplier of the technology metals tungsten, molybdenum, tantalum, niobium, rhenium, high-performance ceramics, and thermal spray powders. Their core competence in powder metallurgy of tungsten, molybdenum, tantalum, niobium, and rhenium.
Link to REE4EU	H.C. Starck is a leading company on recycling of tungsten. H.C. Starck guarantees undiminished recycled product quality and cost-effective for almost all metal products. Apart from tungsten, H.C. Starck now targets to recycle tantalum and molybdenum for electronic industry.
Projects	ADIR: "Next Generation Urban Mining – Automated Disassembly, separation and recovery of valuable materials from electronic equipment" Funding programme: H2020-SPIRE-07-2015 Start date: 2015-09-01 End date: 2019-08-31 Funding: 5.3 M€ Number of partners: 10 Coordinator: FRAUNHOFER GESELLSCHAFT ZUR FOERDERUNG DER ANGEWANDTEN FORSCHUNG E.V.

Company information	**Name:** ALOUMINION **Type:** Large Industry **Country:** Greece **Website:** http://www.alhellas.com/en-us/home/homepage
Value chain position	Primary Supplier
General description	Aluminion has been a pillar of the Greek heavy industry sector with the aim to exploit the rich bauxite deposits of Central Greece for producing bauxite, alumina and aluminium.
Link to REE4EU	Aluminion is in the transition to produce long-term sustainable products. Aluminion is one of the partners of EURARE project which has a total 14 MEUR budget. The project targets to identify the sustainable REE resources in Europe and further to develop, optimize and demonstrate technologies for the efficient and economically viable exploitation of currently available European REE deposits with minimum consequences to the environment.
Projects	EURARE: "Development of a sustainable exploitation scheme for Europe's Rare Earth ore deposits" Funding programme: FP7-NMP-2012-LARGE-6 Start date: 2013-01-01 End date: 2017-12-31 Funding: 9 M€ Number of partners: 23 Coordinator: NATIONAL TECHNICAL UNIVERSITY OF ATHENS

Company information	**Name:** LUOSSAVAARA-KIIRUNAVAARA (LKAB) **Type:** Large Industry **Country:** Sweden **Website:** https://www.lkab.com/en/
Value chain position	Primary supplier
General description	LKAB is a high-tech international minerals group, world leading producer of processed iron ore products for steelmaking, and a growing supplier of mineral products for other industrial sectors.
Link to REE4EU	LKAB investigates the reserves of apatite and REE in present wet tailings deposit. Also, how to make apatite and REE from waste generated during their process.
Projects	REEcover: "Recovery of Rare Earth Elements from magnetic waste in the WEEE recycling industry and tailings from the iron ore industry" Funding programme: FP7-ENV-2013-two-stage Start date: 2013-12-01 End date: 2016-11-30 Funding: 6 M€ Number of partners: 13 Coordinator: NORGES TEKNISK-NATURVITENSKAPELIGE UNIVERSITET

2.3.2 REE recovery

2.3.2.1 SMEs

Company information	**Name:** CHEMCONSERVE **Type:** SME **Country:** Netherlands **Website:** http://www.chemconserve.com/
Value chain position	REE recovery
General description	ChemConserve is active in the development and commercialization of recycling technologies, based on industrial waste as well as end-of-life products.
Link to REE4EU	ChemConserve improved REEcover project for creating the whole hydrometallurgical route of the project. ChemConserve worked closely together with other research centers by means of knowledge, facilities and capacity, to extract the REEs.
Projects	REEcover: "Recovery of Rare Earth Elements from magnetic waste in the WEEE recycling industry and tailings from the iron ore industry" Funding programme: FP7-ENV-2013-two-stage Start date: 2013-12-01 End date: 2016-11-30 Funding: 6 M€

	Number of partners: 13 Coordinator: NORGES TEKNISK-NATURVITENSKAPELIGE UNIVERSITET

Company information	**Name:** ELEMETAL **Type:** SME **Country:** Netherlands **Website:** https://elemetal.com/
Value chain position	REE recovery
General description	Elemetal specializes in hydrometallurgical extraction of metals from waste streams. Elemetal starts with a waste stream sourced from industry and first evaluates the business opportunity in extracting some or more of the components of the related waste stream.
Link to REE4EU	Elemetal developed a process of upscaling of the hydrometallurgical recovery of REE. Besides that, they contributed to the economic studies of REEcover project to assess the impact of developed methodologies and technologies.
Projects	REEcover: "Recovery of Rare Earth Elements from magnetic waste in the WEEE recycling industry and tailings from the iron ore industry" Funding programme: FP7-ENV-2013-two-stage Start date: 2013-12-01 End date: 2016-11-30 Funding: 6 M€ Number of partners: 13 Coordinator: NORGES TEKNISK-NATURVITENSKAPELIGE UNIVERSITET

Company information	**Name:** C-TECH INNOVATION **Type:** SME **Country:** United Kingdom **Website:** http://www.ctechinnovation.com/
Value chain position	REE recovery
General description	C-Tech Innovation is a consulting R&D company. They have experience on innovation management, research and technology development using in-house laboratories and workshops process, product and service improvement, and intellectual property exploitation, the company has an ability to apply chemistry, physics and biological science in innovative commercial applications.
Link to REE4EU	C-Tech Innovation is the project coordinator for REMANENCE project. Apart from the project management, C-Tech Innovation has lab-scale facility to test REE recovery from battery recycling process.

Projects	REMANENCE: "Rare Earth Magnet Recovery for Environmental and Resource Protection" Funding programme: FP7-NMP-2012-SME-6 Start date: 2013-01-01 End date: 2016-06-30 Funding: 3.7 M€ Number of partners: 9 Coordinator: C-TECH INNOVATION LIMITED

2.3.2.2 Large industries

Company information	**Name:** RHODIA OPERATIONS (SOLVAY GROUP) **Type:** Large Industry **Country:** France **Website:** http://www.rhodia.com/ (http://www.solvay.com/en/index.html)
Value chain position	REE Recovery
General description	Rhodia Operations, a member of Solvay Group, is specialized in fine chemistry, synthetic fibers and polymers. They serve the sector of the consumer goods, automotive, energy, manufacturing and processes and electronics.
Link to REE4EU	Solvay group is currently recycling RE from scraps of magnet manufacturers, low energy consumption lamps, rechargeable batteries (in cooperation with Umicore). Rhodia Operations of Solvay group participates in the EREAN project to contribute REE magnet recycling networking.
Projects	EREAN: "European Rare Earth Magnet Recycling Network" Funding programme: FP7-PEOPLE-2013-ITN Start date: 2013-09-01 End date: 2017-08-31 Funding: 3.9 M€ Number of partners: 9 Coordinator: KATHOLIEKE UNIVERSITEIT LEUVEN

Company information	**Name:** TECNICAS REUNIDAS (TR) **Type:** Large Industry **Country:** Spain **Website:** http://www.tecnicasreunidas.es/en/
Value chain position	REE Recovery
General description	TR is a multinational engineering, design and construction company. Their expertise applies to various types of industrial facilities. One of TR's missions is to support European industry by supplying sustainable mineral resources.

Link to REE4EU	TR has developed a novel hydrometallurgical process for the recovery of Yttrium and Europium (Y/Eu) from spent fluorescent lamps and to design and construct a new pilot plant for demonstrating the strength and versatility of this chemical technology.
Projects	RECLAIM: "Reclamation of Gallium, Indium and Rare-Earth Elements from Photovoltaics, Solid-State Lighting and Electronics Waste" Funding programme: FP7-NMP-2012-SME-6 Start date: 2013-01-01 End date: 2016-12-31 Funding: 4.7 M€ Number of partners: 11 Coordinator: NEDERLANDSE ORGANISATIE VOOR TOEGEPAST NATUURWETENSCHAPPELIJK ONDERZOEK TNO

Company information	**Name:** UMICORE **Type:** Large Industry **Country:** Belgium **Website:** http://www.umicore.com/
Value chain position	REE Recovery
General description	Umicore earlier was in the mining, smelting and refinery industries. Since 2003, Umicore extended its areas to generation of magnet generators for the automotive catalyst sector. Currently, Umicore leads technology-focused business encompassing areas such as the refining and recycling of precious metals and the manufacture of specialised products from precious metals, cobalt, germanium, zinc, and other metals.
Link to REE4EU	Umicore generates the majority of its revenues and dedicates most of its R&D efforts to clean technologies, such as emission control catalysts, materials for rechargeable batteries and recycling. Umicore is, now one of the leading enterprises in Europe especially due to its large scale recycling facilities of precious metals.
Projects	EREAN: "European Rare Earth Magnet Recycling Network" Funding programme: FP7-PEOPLE-2013-ITN Start date: 2013-09-01 End date: 2017-08-31 Funding: 3.9 M€ Number of partners: 9 Coordinator: KATHOLIEKE UNIVERSITEIT LEUVEN

Company information	**Name:** JOHNSON MATTHEY PLC (JM) **Type:** Large Industry **Country:** United Kingdom **Website:** http://www.matthey.com/

Value chain position	REE Recovery
General description	JM has a broad expertise on catalysis and material science. They develop and manufacture a wide range of high technology products such as catalyst, adsorbents, precious metal refinery, and processing for metal chemical production, battery technologies, metal joining, etc.
Link to REE4EU	JM is a leading manufacturer of platinum group metal and minor metal compounds, organometallics and fine metal powders for high technology applications ranging from catalysis to advanced coating. JM is also taking an active role in EURARE and Partial-PMGs projects for sustainable utilization of REE ore deposits and development of novel REE substitutions.
Projects	EURARE: "Development of a sustainable exploitation scheme for Europe's Rare Earth ore deposits" Funding programme: FP7-NMP-2012-LARGE-6 Start date: 2013-01-01 End date: 2017-12-31 Funding: 9 M€ Number of partners: 23 Coordinator: NATIONAL TECHNICAL UNIVERSITY OF ATHENS Partial-PMGs: "Development of novel, high Performance hybrid TWV/GPF Automotive afteR treatment systems by raTIonAL design: substitution of PGMs and Rare earth materials" Funding programme: H2020-NMP-2015-two-stage Start date: 2016-04-01 End date: 2019-09-30 Funding: 4.6 M€ Number of partners: 14 Coordinator: WARRANT GROUP

2.3.3 REA producers

2.3.3.1 SMEs

Company information	**Name:** LESS COMMON METALS (LCM) **Type:** SME **Country:** United Kingdom **Website:** http://www.lesscommonmetals.com/profile
Value chain position	REA producer
General description	Less Common Metals manufactures and supplies complex alloy systems and metals, and they have expertise in those based on REE.
Link to REE4EU	Less Common Metals participates in several European projects focusing on the recycling of strategic materials such as REE. In EURARE project

	LCM works in the development of novel REE end products while in REEcover project LCM was responsible to optimize an industrial fluoride based electrolytic process for production of RE metals and alloys, and adjust it to the expected material.
Projects	EURARE: "Development of a sustainable exploitation scheme for Europe's Rare Earth ore deposits" Funding programme: FP7-NMP-2012-LARGE-6 Start date: 2013-01-01 End date: 2017-12-31 Funding: 9 M€ Number of partners: 23 Coordinator: NATIONAL TECHNICAL UNIVERSITY OF ATHENS REEcover: "Recovery of Rare Earth Elements from magnetic waste in the WEEE recycling industry and tailings from the iron ore industry" Funding programme: FP7-ENV-2013-two-stage Start date: 2013-12-01 End date: 2016-11-30 Funding: 6 M€ Number of partners: 13 Coordinator: NORGES TEKNISK-NATURVITENSKAPELIGE UNIVERSITET

Company information	**Name:** POWDER TECHNOLOGIES + ADDITIVES (PT+A) **Type:** SME **Country:** Germany **Website:** www.pt-a.de
Value chain position	REA producer
General description	PT+A is working on powder metallurgy with pressing and sintering and on metal- and ceramic- injection moulding. PT+A's product portfolio covers both heavy and light metals.
Link to REE4EU	PT+A is involved in the development of new binders systems for several materials in REProMag project. Further PT+A closely cooperates with producers of additive manufacturing equipment and contributes in the production of suitable feedstock batches.
Projects	REProMag: "Resource Efficient Production Route for Rare Earth Magnets" Funding programme: H2020-NMP-23-2015 Start date: 2015-01-01 End date: 2017-12-31 Funding: 5.7 M€ Number of partners: 14 Coordinator: OBE OHNMACHT & BAUMGARTNER GMBH & CO KG

2.3.3.2 Large Industries

Company information	**Name:** OUTOTEC **Type:** Large Enterprise **Country:** Finland **Website:** http://www.outotec.com/
Value chain position	REA producer
General description	Outotec designs and delivers sustainable technology and service solutions for processing minerals, ores and metals. Outotec has a strong position along the entire value chain from ores to metals.
Link to REE4EU	Outotec is involved in EURARE project for the development of sustainable and efficient REE Ore beneficiation technologies leads to the production of high grade REE concentrates and minimization of produced tailings.
Projects	EURARE: "Development of a sustainable exploitation scheme for Europe's Rare Earth ore deposits" Funding programme: FP7-NMP-2012-LARGE-6 Start date: 2013-01-01 End date: 2017-12-31 Funding: 9 M€ Number of partners: 23 Coordinator: NATIONAL TECHNICAL UNIVERSITY OF ATHENS

2.3.4 REE intensive product manufacturers

2.3.4.1 SMEs

Company information	**Name:** MAGNETFABRIK BONN **Type:** SME **Country:** Germany **Website:** http://www.magnetfabrik.de/magnetfabrik_de/index.php
Value chain position	REE intensive product manufacturers
General description	Magnetfabrik Bonn is permanent magnets supplier. R&D activities are integrated with design, engineering and production of permanent magnets.
Link to REE4EU	Magnetfabrik participated in the REFREEPERMAG project, succeeding in fabricating bulk permanent magnets with advanced properties.
Projects	REFREEPERMAG: "Rare Earth Free Permanent Magnets" Funding programme: FP7-NMP-2011-SMALL-5 Start date: 2012-05-01 End date: 2015-04-30 Funding: 3.8 M€

	Number of partners: 13 Coordinator: NATIONAL CENTER FOR SCIENTIFIC RESEARCH "DEMOKRITOS"

Company information	**Name:** NEOREM MAGNETS **Type:** SME **Country:** Finland **Website:** http://www.neorem.fi/
Value chain position	REE intensive product manufacturer
General description	Neorem Magnets is specialized in the production of NdFeB magnets and magnet pole elements for large electric motors and generators, especially for renewable energy applications. Magnets in large and complex forms can be manufactured in Neorem and can be assembled under the Hitachi Metals' global (Japan) license.
Link to REE4EU	Sustainability of the REE resources is a key element for Neorem Magnets' process. For this, they joined EURARE project and they work on the development of REE magnets together with other key players of the industry and primary suppliers.
Projects	EURARE: "Development of a sustainable exploitation scheme for Europe's Rare Earth ore deposits" Funding programme: FP7-NMP-2012-LARGE-6 Start date: 2013-01-01 End date: 2017-12-31 Funding: 9 M€ Number of partners: 23 Coordinator: NATIONAL TECHNICAL UNIVERSITY OF ATHENS

Company information	**Name:** INGENIERIA MAGNETICA APLICADA **Type:** SME **Country:** Spain **Website:** http://www.ima-magnets.co.uk/
Value chain position	REE intensive product manufacturer
General description	IMA has a wide experience in the magnetic sector both for manufacturing and marketing. IMA is currently exporting 70% of their production in the international market.
Link to REE4EU	IMA develops a continuous research, testing and development program for new product developments and applications. IMA joined to Nanophyme project to develop efficient materials for permanent magnets.

Projects	NANOPYME: "Nanocrystalline Permanent Magnets Based on Hybrid Metal-Ferrites" Funding programme: FP7-NMP-2012-SMALL-6 Start date: 2012-12-01 End date: 2015-11-30 Funding: 3.5 M€ Number of partners: 11 Coordinator: FUNDACION IMDEA NANOCIENCIA

Company information	**Name:** ARELEC **Type:** SME **Country:** France **Website:** http://www.arelec.com/en/
Value chain position	REE intensive product manufacturer
General description	ARELEC has a strong know how on compound manufacturing, anisotropic mould design, ferrite and REE in injection moulding magnets.
Link to REE4EU	Arelec's products are used in the production of sensor and motor magnets. In terms of markets, Arelec has a close contact with automotive industry, electric motors and house appliance.
Projects	NOVAMAG: "NOVel, critical materials free, high Anisotropy phases for permanent MAGnets, by design." Funding programme: H2020-NMP-23-2015 Start date: 2016-04-01 End date: 2019-09-30 Funding: 5.6 M€ Number of partners: 17 Coordinator: FUNDACION BCMATERIALS - BASQUE CENTRE FOR MATERIALS, APPLICATIONS AND NANOSTRUCTURES

Company information	**Name:** MBN NANOMATERIALIA **Type:** SME **Country:** Italy **Website:** http://www.mbn.it/eng/company.php
Value chain position	REE Intensive product manufacturers
General description	MBN Nanomaterialia produces advanced material and nanostructured materials by high energy ball milling.
Link to REE4EU	MBN will be involved in NOVAMAG project by performing initial screening, in the development on the material process and the final upscale of the material production.

Projects	NOVAMAG: "NOVel, critical materials free, high Anisotropy phases for permanent MAGnets, by design." Funding programme: H2020-NMP-23-2015 Start date: 2016-04-01 End date: 2019-09-30 Funding: 5.6 M€ Number of partners: 17 Coordinator: FUNDACION BCMATERIALS - BASQUE CENTRE FOR MATERIALS, APPLICATIONS AND NANOSTRUCTURES

2.3.4.2 Large Industries

Company information	**Name:** VACUUMSCHMELZE (VAC) **Type:** Large Industry **Country:** Germany **Website:** http://www.vacuumschmelze.com/
Value chain position	REE intensive product manufacturer
General description	VAC is a leading global manufacturer of advanced magnetic materials and related products. In recent years, VAC has pioneered the development of innovative and advanced materials for industries such as article surveillance, automotive, clock, electrical engineering and electronics
Link to REE4EU	VAC supports R&D activities on the improvement of materials design, application know-how of magnetic materials and process technology. They have significant contribution to several European projects, DRREAM, NOVAMAG and ROMEO aiming to reduce the usage or substitute the REE in permanent magnets in large scale manufacturing, but also in other projects such as REE4EU for the recovery and reuse of REE.
Projects	DRREAM: "Drastically reduced use of rare earths in applications of magnetocalorics" Funding programme: FP7-NMP-2012-SMALL-6 Start date: 2013-01-01 End date: 2015-12-31 Funding: 3.7 M€ Number of partners: 8 Coordinator: IMPERIAL COLLEGE OF SCIENCE TECHNOLOGY AND MEDICINE NOVAMAG: "NOVel, critical materials free, high Anisotropy phases for permanent MAGnets, by design." Funding programme: H2020-NMP-23-2015 Start date: 2016-04-01 End date: 2019-09-30 Funding: 5.6 M€ Number of partners: 14

	Coordinator: FUNDACION BCMATERIALS - BASQUE CENTRE FOR MATERIALS, APPLICATIONS AND NANOSTRUCTURES ROMEO: "Replacement and Original Magnet Options" Funding programme: FP7-NMP-2002-SMALL-6 Start date: 2012-12-01 End date: 2015-11-30 Funding: 4 M€ Number of partners: 13 Coordinator: INSTITUT JOZEF STEFAN

Company information	**Name:** MAGNETI LJUBLJANA **Type:** Large Industry **Country:** Slovenia **Website:** http://www.magneti.si/about.html
Value chain position	REE intensive product manufacturer
General description	Magneti Ljubljana is a European manufacturer of permanent metallic magnets and magnetic systems with a long-lasting tradition stretching back 60 years.
Link to REE4EU	Magneti Ljubljana is involved in four European projects focused on the topics of recycling old SmCo and NdFeB magnets, reduction or complete substitution of RE in magnets and the production of nanograin magnets from scraps. Magneti Ljubljana has a broad expertise on ionometallurgical methods, and the design of motors and generators with reusable magnets.
Projects	DEMETER: "Training Network for the Design and Recycling of Rare-Earth Permanent Magnet Motors and Generators in Hybrid and Full Electric Vehicles" Funding programme: H2020-MSCA-ITN-2015 Start date: 2015-09-01 End date: 2019-08-31 Funding: 3.8 M€ Number of partners: 7 Coordinator: KATHOLIEKE UNIVERSITEIT LEUVEN MAG-DRIVE: "New permanent magnets for electric-vehicle drive applications" Funding programme: FP7-SST-2013-RTD-1 Start date: 2013-10-01 End date: 2016-09-30 Funding: 2.5 M€ Number of partners: 7 Coordinator: INSTITUT JOZEF STEFAN NANOPYME: "Nanocrystalline Permanent Magnets Based on Hybrid Metal-Ferrites"

	Funding programme: FP7-NMP-2012-SMALL-6 Start date: 2012-12-01 End date: 2015-11-30 Funding: 3.5 M€ Number of partners: 11 Coordinator: FUNDACION IMDEA NANOCIENCIA REMANENCE: "Rare Earth Magnet Recovery for Environmental and Resource Protection" Funding programme: FP7-NMP-2012-SME-6 Start date: 2013-01-01 End date: 2016-06-30 Funding: 3.7 M€ Number of partners: 9 Coordinator: C-TECH INNOVATION LIMITED

Company information	**Name:** OBE OHNMACHT & BAUMGARTNER **Type:** Large Industry **Country:** Germany **Website:** www.obe.de/index.php/en/
Value chain position	REE intensive product manufacturer
General description	OBE is active in the areas of R&D, production and sales of high precision metal components in large quantities. OBE's customers come from the spectacle industry luxury goods, automotive, telecommunications, medical and aerospace sectors for all stages in the production process.
Link to REE4EU	The company OBE is the coordinator of REProMag project. OBE has extensive knowledge in the design, construction and processing of metal injection moulding parts in a variety of materials (low alloy steels, stainless steels, Titanium, Ni-based alloys and hard materials). Further OBE has a wide experience of know-how in production of hard magnets (HDDR and HD route).
Projects	REProMag: "Resource Efficient Production Route for Rare Earth Magnets" Funding programme: H2020-NMP-23-2015 Start date: 2015-01-01 End date: 2017-12-31 Funding: 5.7 M€ Number of partners: 14 Coordinator: OBE OHNMACHT & BAUMGARTNER GMBH & CO KG

2.3.5 End users

2.3.5.1 SMEs

Company information	**Name:** TETHIS **Type:** SME **Country:** Italy **Website:** http://www.tethis-lab.com/
Value chain position	End user (Mixed electronics)
General description	Tethis is a privately held company focused on bio and nanotechnology fields to develop and commercialize In Vitro Diagnostic devices. Thetis develops, designs, manufactures, sales, installs and provides for the maintenance of medical devices.
Link to REE4EU	Tethis, through its biotechnology group, is developing solutions for biomedical applications based on innovative nanostructured materials. Nanostructure expertise of Tethis is applicable for the development of substitute for critical raw materials.
Projects	CritCat: "Towards Replacement of Critical Catalyst Materials by Improved Nanoparticle Control and Rational Design" Funding programme: H2020-NMP-23-2015 Start date: 2016-06-01 End date: 2031-05-31 Funding: 4.4 M€ Number of partners: 9 Coordinator: TTY-SAATIO

Company information	**Name:** ATARD SAVUNMA VE HAVACILIK SANAYI ILERI TEKNOLOJI UYGULAMALARI ARASTIRMA VE GELISTIRME A.S **Type:** SME **Country:** Turkey **Website:** http://www.atard.com.tr/
Value chain position	End user (Automotive/Motors in industrial applications)
General description	ATARD provides defense and aerospace facilities. ATARD's motivation is to service advanced technological applications and solutions based on national resources and worldwide knowledge.
Link to REE4EU	ATARD is the coordinator of MAGNETIDE project. Apart from the coordination, ATARD is providing guidance for identifying required characteristics of new tidal device generator system in this project.
Projects	MAGNETIDE: "Improved magnets for energy generation through advanced tidal technology"

	Funding programme: FP7-SME-2011-1 Start date: 2012-12-01 End date: 2014-11-30 Funding: 1.1 M€ Number of partners: 7 Coordinator: ATARD SAVUNMA VE HAVACILIK SANAYI ILERI TEKNOLOJI UYGULAMALARI ARASTIRMA VE GELISTIRME A.S.

Company information	**Name:** TIDAL SAILS **Type:** SME **Country:** Norway **Website:** http://tidalsails.com/
Value chain position	End user
General description	Tidal Sails is developing and commercializing a unique renewable energy technology that harnesses ocean currents and tidal streams and converts it into emission-free electricity using underwater sails.
Link to REE4EU	Tidal Sails developed several different types of tidal devices, and conducted the field trials for MAGNETIDE project.
Projects	MAGNETIDE: "Improved magnets for energy generation through advanced tidal technology" Funding programme: FP7-SME-2011-1 Start date: 2012-12-01 End date: 2014-11-30 Funding: 1.1 M€ Number of partners: 7 Coordinator: ATARD SAVUNMA VE HAVACILIK SANAYI ILERI TEKNOLOJI UYGULAMALARI ARASTIRMA VE GELISTIRME A.S.

Company information	**Name:** FRANCISCO ALBERO (FAE) **Type:** SME **Country:** Spain **Website:** http://www.fae.es/en/introduction
Value chain position	End user (Automotive)
General description	FAE designs and produces electrical and electronic products for the automotive market. In FAE production facility, critical REE such as yttrium is used.
Link to REE4EU	In RECLAIM project, FAE exchanges information with the recyclers about the quantity and quality that the recycled materials need to reach in order to introduce yttrium in their process of fabrication.

Projects	RECLAIM: "Reclamation of Gallium, Indium and Rare-Earth Elements from Photovoltaics, Solid-State Lighting and Electronics Waste" Funding programme: FP7-NMP-2012-SME-6 Start date: 2013-01-01 End date: 2016-12-31 Funding: 4.7 M€ Number of partners: 11 Coordinator: NEDERLANDSE ORGANISATIE VOOR TOEGEPAST NATUURWETENSCHAPPELIJK ONDERZOEK TNO

Company information	**Name:** WITTENSTEIN CYBER MOTOR **Type:** SME **Country:** Germany **Website:** http://cyber-motor.wittenstein.de/
Value chain position	End user (Motors in industrial applications)
General description	WITTENSTEIN cyber motor produces servo motors and drive systems with maximum power density for power intensive applications. Their expertise lies in the area of specialized motors for ultra-high vacuums, radioactive environments and high temperature ranges.
Link to REE4EU	In REFREEPERMAG project, WITTENSTEIN collaborated in the development of permanent magnets based on nanorods with very high energy product. Mn-Bi based magnets in a motor were first of a kind tested by WITTENSTEIN and reported as they have a promising performance.
Projects	REFREEPERMAG: "Rare Earth Free Permanent Magnets" Funding programme: FP7-NMP-2011-SMALL-5 Start date: 2012-05-01 End date: 2015-04-30 Funding: 3.8 M€ Number of partners: 13 Coordinator: NATIONAL CENTER FOR SCIENTIFIC RESEARCH "DEMOKRITOS"

Company information	**Name:** KOLEKTOR GROUP **Type:** SME **Country:** Germany/Slovenia **Website:** http://www.kolektor.com
Value chain position	End user (Automotive/Permanent magnets)
General description	Kolektor Group produces polymer bonded magnets. Their product range includes NdFeB, hybrid magnets, hard-ferrite magnets, sintered AlNiCo

	magnets, sintered NdFeB and SmCo magnets, primarily for automotive and industrial applications in electric motors.
Link to REE4EU	Kolektor Group's Germany division joined REMANENCE project and the Slovenia division has joined the ROMEO project. The main focus of Kolektor Group is REE recovery or substitution in magnets.
Projects	REMANENCE: "Rare Earth Magnet Recovery for Environmental and Resource Protection" Funding programme: FP7-NMP-2012-SME-6 Start date: 2013-01-01 End date: 2016-06-30 Funding: 3.7 M€ Number of partners: 9 Coordinator: C-TECH INNOVATION LIMITED ROMEO: "Replacement and Original Magnet Options" Funding programme: FP7-NMP-2002-SMALL-6 Start date: 2012-12-01 End date: 2015-11-30 Funding: 4 M€ Number of partners: 13 Coordinator: INSTITUT JOZEF STEFAN

Company information	**Name:** HAGE SONDERMASCHINENBAU **Type:** SME **Country:** Austria **Website:** http://www.hage.at
Value chain position	End user (Automotive/Mixed electronics)
General description	HAGE has been developing and manufacturing high-tech machinery. They cover the entire value chain in the special-purpose machinery building industry, extending from conceptual designs to turnkey equipment and after-sales service.
Link to REE4EU	Within REProMag project HAGE is responsible for the design and construction of a 3D-printer for magnets.
Projects	REProMag: "Resource Efficient Production Route for Rare Earth Magnets" Funding programme: H2020-NMP-23-2015 Start date: 2015-01-01 End date: 2017-12-31 Funding: 5.7 M€ Number of partners: 14 Coordinator: OBE OHNMACHT & BAUMGARTNER GMBH & CO KG

Company information	**Name:** Lithoz **Type:** SME **Country:** Austria **Website:** www.lithoz.com
Value chain position	End user (Mixed electronics)
General description	Lithoz specializes in the development and production of ceramic materials and additive manufacturing systems (3D printing) for the simple and cost-effective production of high- performance ceramic prototypes, small scale series and complex parts.
Link to REE4EU	Lithoz is mainly involved in REProMag project in the evaluation of AM-techniques for the shaping of RE magnets. Further Lithoz exploits its know-how in the field of AM of ceramics to establish a protocol for the lithographic processing of metallic dispersions.
Projects	REProMag: "Resource Efficient Production Route for Rare Earth Magnets" Funding programme: H2020-NMP-23-2015 Start date: 2015-01-01 End date: 2017-12-31 Funding: 5.7 M€ Number of partners: 14 Coordinator: OBE OHNMACHT & BAUMGARTNER GMBH & CO KG

Company information	**Name:** ECOTRICITY GROUP **Type:** SME **Country:** United Kingdom **Website:** https://www.ecotricity.co.uk/
Value chain position	End user (Wind turbines)
General description	Green Electricity is the world's first Green Electricity company by widening wind turbine installations. Their objective is to increase the sustainable electricity production in Britain.
Link to REE4EU	Ecotricity participates in the SNAPPER project. Its role was to ensure that SNAPPER development was carried out with the perspective of exploitation, dissemination and the client at the forefront. To this end, they were highly active in the design phases of each of the major development strands, and has fulfilled the role of Chair of the Exploitation Board.
Projects	SNAPPER: "The development of a novel rare-earth magnet based wave power conversion system" Funding programme: FP7-SME-2008-1 Start date: 2009-09-01 End date: 2011-08-31

	Funding: 1 M€ Number of partners: 8 Coordinator: OFFSHORE RENEWABLE ENERGY CATAPULT

2.3.5.2 Large Industries

Company information	**Name:** SENNHEISER ELECTRONIC **Type:** Large Industry **Country:** Germany **Website:** www.sennheiser.com
Value chain position	End user (Loudspeakers/Mixed electronics)
General description	Sennheiser electronic's objective is to shape the future of the audio industry. Sennheiser is active in the areas of R&D, production and sales of electro-acoustical products such as microphones, headphones, loudspeakers.
Link to REE4EU	Sennheiser is participating to REProMag project by formulating use cases and providing applications to the project, along with the ability to evaluate and support its progress and results. Furthermore, Sennheiser will evaluate the feasibility of the applications shown in the demonstrator descriptions.
Projects	REProMag: "Resource Efficient Production Route for Rare Earth Magnets" Funding programme: H2020-NMP-23-2015 Start date: 2015-01-01 End date: 2017-12-31 Funding: 5.7 M€ Number of partners: 14 Coordinator: OBE OHNMACHT & BAUMGARTNER GMBH & CO KG

Company information	**Name:** SIEMENS **Type:** Large Industry **Country:** Germany **Website:** www.siemens.com
Value chain position	End user (Automotive/Motors in industrial applications/Wind turbines/Mixed electronics)
General description	SIEMENS is involved in many areas of magnet technology, particularly magnets for permanent magnet synchronous motors for industrial drive applications, for direct drive wind turbines and for MRI scanners. Its portfolio of the two technology fields "Materials" and "Power & Energy Technologies" offers a unique combination of competences in key

	technology fields of material development, engineering, hardware design, simulation and manufacturing technologies.
Link to REE4EU	Siemens participates in in REProMag project. Siemen's role is in the specification of permanent magnet materials for electrical machines, demonstration of technical feasibility via machine simulation, cost analysis and validation of permanent magnet materials in electrical machines. Siemens is also involved in providing material specification based on advanced electrical machine designs, evaluation and material testingper the specification and experimental verification of the new material properties and manufacturing tools envisaged in the project via advanced simulation tools for electrical machines. Siemens also joined the ROMEO project for the replacement of REE in permanent magnets.
Projects	REProMag: "Resource Efficient Production Route for Rare Earth Magnets" Funding programme: H2020-NMP-23-2015 Start date: 2015-01-01 End date: 2017-12-31 Funding: 5.7 M€ Number of partners: 14 Coordinator: OBE OHNMACHT & BAUMGARTNER GMBH & CO KG ROMEO: "Replacement and Original Magnet Options" Funding programme: FP7-NMP-2002-SMALL-6 Start date: 2012-12-01 End date: 2015-11-30 Funding: 4 M€ Number of partners: 13 Coordinator: INSTITUT JOZEF STEFAN

Company information	**Name:** DAIMLER **Type:** Large Industry **Country:** Germany **Website:** https://www.daimler.com/en/
Value chain position	End user (Automotive)
General description	Daimler is one of the biggest producers of premium cars and the world's biggest manufacturer of commercial vehicles with a global reach.
Link to REE4EU	Daimler joined the ROMEO project, aiming at reducing the European dependence of REE used to produce magnets.
Projects	ROMEO: "Replacement and Original Magnet Options" Funding programme: FP7-NMP-2002-SMALL-6 Start date: 2012-12-01 End date: 2015-11-30 Funding: 4 M€ Number of partners: 13 Coordinator: INSTITUT JOZEF STEFAN

Company information	**Name:** VALEO **Type:** Large Industry **Country:** France **Website:** http://www.valeo.com/en
Value chain position	End user (Automotive)
General description	Valeo is one of the world's leading automotive suppliers and partner to almost all automakers worldwide. Valeo proposes innovative products and systems that contribute to reduction of CO_2 emissions, improvement of vehicle performance anddevelopment of intuitive driving.
Link to REE4EU	REEs are intensively consumed by Valeo during its manufacturing phase. Valeo is active in EU projects with an aim to reduce the usage of RE in permanent magnets or replace them with alternatives.
Projects	DEMETER: "Training Network for the Design and Recycling of Rare-Earth Permanent Magnet Motors and Generators in Hybrid and Full Electric Vehicles" Funding programme: H2020-MSCA-ITN-2015 Start date: 2015-09-01 End date: 2019-08-31 Funding: 3.8 M€ Number of partners: 7 Coordinator: KATHOLIEKE UNIVERSITEIT LEUVEN MAG-DRIVE: "New permanent magnets for electric-vehicle drive applications" Funding programme: FP7-SST-2013-RTD-1 Start date: 2013-10-01 End date: 2016-09-30 Funding: 2.5 M€ Number of partners: 7 Coordinator: INSTITUT JOZEF STEFAN ROMEO: "Replacement and Original Magnet Options" Funding programme: FP7-NMP-2002-SMALL-6 Start date: 2012-12-01 End date: 2015-11-30 Funding: 4 M€ Number of partners: 13 Coordinator: INSTITUT JOZEF STEFAN

Company information	**Name:** INDESIT COMPANY **Type:** Large Industry **Country:** Italy

	Website: http://www.indesitcompany.com/inst/it/
Value chain position	End user (Mixed electronics)
General description	Indesit Company is one of the biggest manufacturers of washing machines, dryers, washer-dryers, dishwashers, fridges, freezers, ovens and hobs.
Link to REE4EU	Indesit Company joined DRREAM project to reduce the REE usage in magnetocaloric parts of large scale manufacturing.
Projects	DRREAM: "Drastically reduced use of rare earths in applications of magnetocalorics" Funding programme: FP7-NMP-2012-SMALL-6 Start date: 2013-01-01 End date: 2015-12-31 Funding: 3.7 M€ Number of partners: 8 Coordinator: IMPERIAL COLLEGE OF SCIENCE TECHNOLOGY AND MEDICINE

Company information	**Name:** GRUPO ANTOLIN-INGENIERIA **Type:** Large Industry **Country:** Spain **Website:** http://www.grupoantolin.com/en
Value chain position	End user (Automotive)
General description	Grupo Antolin is a leading multinational company in the development, design and manufacture of interior components for the automobile industry.
Link to REE4EU	Grupo Antolin is involved in REMAGHIC project with an aim to develop successful processes for magnesium and magnesium scaling recycling unit and REE alloying unit. Also, they took the lead for the preparation of the project's business plan for magnesium recycling and alloying procedures as well as the overall system evaluation of the final project business plan.
Projects	REMAGHIC: "Reclamation of Gallium, Indium and Rare-Earth Elements from Photovoltaics, Solid-State Lighting and Electronics Waste" Funding programme: H2020-SPIRE-07-2015 Start date: 2015-09-01 End date: 2018-08-31 Funding: 3.3 M€ Number of partners: 10 Coordinator: FUNDACION CIDAUT

Company information	**Name:** PIAGGIO AERO INDUSTRIES

	Type: Large Industry **Country:** Italy **Website:** http://www.piaggioaerospace.it/
Value chain position	End user (Mixed electronics)
General description	Piaggio Aerospace is dedicated to cutting edge aviation technology. The only industry player to design, develop and support unmanned aerial systems, business, special missions and ISR aircraft and aero engines, Piaggio Aerospace is an industry leader in business aviation and Defence and Security.
Link to REE4EU	Piaggio Aerospace is pursuing research-led innovation and continuous product improvement. They give support on REMACHIG project for the penetration of magnesium alloys in important sectors for the European Transport industry.
Projects	REMAGHIC: "Reclamation of Gallium, Indium and Rare-Earth Elements from Photovoltaics, Solid-State Lighting and Electronics Waste" Funding programme: H2020-SPIRE-07-2015 Start date: 2015-09-01 End date: 2018-08-31 Funding: 3.3 M€ Number of partners: 10 Coordinator: FUNDACION CIDAUT

Company information	**Name:** PININFARINA **Type:** Large Industry **Country:** Italy **Website:** http://www.pininfarina.com/en/homepage/homepage.htm
Value chain position	End user (Automotive)
General description	Pininfarina is a design house of international repute. Pininfarina focuses on designing, engineering services, conception and production of unique cars or in very small series.
Link to REE4EU	Pininfarina is increasing investments in the sustainable mobility business in the specific field of electric and hybrid vehicles. Pininfarina has joined the REMAGHIC project for the development of electric or hybrid vehicles.
Projects	REMAGHIC: "Reclamation of Gallium, Indium and Rare-Earth Elements from Photovoltaics, Solid-State Lighting and Electronics Waste" Funding programme: H2020-SPIRE-07-2015 Start date: 2015-09-01 End date: 2018-08-31 Funding: 3.3 M€ Number of partners: 10 Coordinator: FUNDACION CIDAUT

2.3.6 Recyclers

2.3.6.1 SMEs

Company information	**Name:** ELECTROCYCLING **Type:** SME **Country:** Germany **Website:** http://www.electrocycling.de/
Value chain position	Recycler
General description	Electrocycling is specialized in recovering valuable materials from electronic waste such as analog technologies from regular households. Since 2011, they process around 4,000 tons of electronic waste per month.
Link to REE4EU	Electrocycling is active in research projects in cooperation with producers and institutes. Currently, they are active in recycling of lithium-ion batteries and processes to recover indium from flat screens Also, they are participating to ADIR for separation of valuable materials from electronics.
Projects	ADIR: "Next Generation Urban Mining – Automated Disassembly, separation and recovery of valuable materials from electronic equipment" Funding programme: H2020-SPIRE-07-2015 Start date: 2015-09-01 End date: 2019-08-31 Funding: 5.3 M€ Number of partners: 10 Coordinator: FRAUNHOFER GESELLSCHAFT ZUR FOERDERUNG DER ANGEWANDTEN FORSCHUNG E.V.

Company information	**Name:** PROAUTOMATION (PA) **Type:** SME **Country:** Austria **Website:** http://www.proautomation.at/en
Value chain position	Recycler
General description	PA is a growing company specializing in robotics and automation technology, control and quality concepts with advanced techniques of image processing for the automation industry.
Link to REE4EU	PA is exploring new methods of sustainable operation and developing robot structures that increase production efficiency and reduce

	unnecessary energy consumption. They are participating to ADIR, a SPIRE project which focuses on automated disassembly of electronic equipment to recover valuable materials such as tantalum, REE, germanium, cobalt, palladium, gallium and tungsten.
Projects	ADIR: "Next Generation Urban Mining – Automated Disassembly, separation and recovery of valuable materials from electronic equipment" Funding programme: H2020-SPIRE-07-2015 Start date: 2015-09-01 End date: 2019-08-31 Funding: 5.3 M€ Number of partners: 10 Coordinator: FRAUNHOFER GESELLSCHAFT ZUR FOERDERUNG DER ANGEWANDTEN FORSCHUNG E.V.

Company information	**Name:** LASER ANALYTICAL SYSTEMS & AUTOMATION (LSA) **Type:** SME **Country:** Germany **Website:** http://www.lsa-systems.de/en/
Value chain position	Recycler
General description	LSA develops and markets systems for rapid and contactless chemical material analysis. They are specialized in the utilization of laser emission spectrometry for applications in highly automated production facilities. LSA collaborates with several industrial sectors, e.g. metal industry and chemical industry mainly in the process control and quality control phases
Link to REE4EU	LSA can provide devices and components for rapid material analysis, software solutions for interpretation of spectrometric data, and feasibility studies for raw materials. LSA has joined so far three EU funded projects related to separation and recovery of valuable materials. ADIR is the project that LSA joined for recovery of REE.
Projects	ADIR: "Next Generation Urban Mining – Automated Disassembly, separation and recovery of valuable materials from electronic equipment" Funding programme: H2020-SPIRE-07-2015 Start date: 2015-09-01 End date: 2019-08-31 Funding: 5.3 M€ Number of partners: 10 Coordinator: FRAUNHOFER GESELLSCHAFT ZUR FOERDERUNG DER ANGEWANDTEN FORSCHUNG E.V.

Company information	**Name:** OSAI AUTOMATION SYSTEM SPA **Type:** SME **Country:** Italy **Website:** http://osai-as.com/
Value chain position	Recycler
General description	Founded in 1991, OSAI A.S. operates in the field of automation for industrial processes with the aim to offer customers modern solutions to their means of production and the improvement of competitiveness compared to low-cost countries.
Link to REE4EU	OSAI A.S. contributes to ADIR by completing a demonstrator of an automated disassembly of electronic equipment.
Projects	ADIR: "Next Generation Urban Mining – Automated Disassembly, separation and recovery of valuable materials from electronic equipment" Funding programme: H2020-SPIRE-07-2015 Start date: 2015-09-01 End date: 2019-08-31 Funding: 5.3 M€ Number of partners: 10 Coordinator: FRAUNHOFER GESELLSCHAFT ZUR FOERDERUNG DER ANGEWANDTEN FORSCHUNG E.V.

Company information	**Name:** INDUMETAL RECYCLING **Type:** SME **Country:** Spain **Website:** http://www.indumetal.com/
Value chain position	Recycler
General description	Indumetal Recycling is a specialized industry with an extensive experience in the integral handling of WEEE (waste electrical and electronic equipment) and complex scrap, including logistic services, on site dismantling of industrial facilities and recycling at their treatment plants.
Link to REE4EU	Indumetal Recycling has two EC funded projects which have been recently finalized ("RECLAIM"and "RECOVER"). Their participation supported these projects in the efficient recovery of iron, aluminium, copper concentrates with precious metals, as well as different types of plastic and glass, as final products. Their expertise also helped the recovery process to meet the target set in the current EU and Spanish legislation.
Projects	RECLAIM: "Reclamation of Gallium, Indium and Rare-Earth Elements from Photovoltaics, Solid-State Lighting and Electronics Waste"

	Funding programme: FP7-NMP-2012-SME-6 Start date: 2013-01-01 End date: 2016-12-31 Funding: 4.7 M€ Number of partners: 11 Coordinator: NEDERLANDSE ORGANISATIE VOOR TOEGEPAST NATUURWETENSCHAPPELIJK ONDERZOEK TNO REEcover: "Recovery of Rare Earth Elements from magnetic waste in the WEEE recycling industry and tailings from the iron ore industry" Funding programme: FP7-ENV-2013-two-stage Start date: 2013-12-01 End date: 2016-11-30 Funding: 6 M€ Number of partners: 13 Coordinator: NORGES TEKNISK-NATURVITENSKAPELIGE UNIVERSITET

Company information	**Name:** MANUFACTURAS Y TRANSFORMADOS **Type:** SME **Country:** Spain **Website:** -
Value chain position	Recycler
General description	Manufacturas y Transformados is an Innovative Research & Development company, specializing in manufacturing and instillation of different types of recycling machinery for the medical, textile, printing, plastic, metal sectors.
Link to REE4EU	Manufacturas y Transformados participated in REMANENCE, exploiting its latest achievements in all sorting phases of WEEE, ASR, RSU, INCINERATION, Glass, and Plastic wastes.
Projects	REMANENCE: "Rare Earth Magnet Recovery for Environmental and Resource Protection" Funding programme: FP7-NMP-2012-SME-6 Start date: 2013-01-01 End date: 2016-06-30 Funding: 3.7 M€ Number of partners: 9 Coordinator: C-TECH INNOVATION LIMITED

Company information	**Name:** ONDEO INDUSTRIAL SOLUTIONS **Type:** SME **Country:** Netherlands **Website:** http://www.ondeo-is.com/en/ondeo-is/

Value chain position	Recycler
General description	Ondeo Industrial Solutions provides industrial partners with a comprehensive experience and expertise in the entire water cycle and its industrial applications to deliver a solution that fits their individual requirements, including recovery and recycling of by-products.
Link to REE4EU	Ondeo supported RECLAIM project in detailed engineering for all the equipment of the pilot unit for the recovery of Indium and Gallium.
Projects	RECLAIM: "Reclamation of Gallium, Indium and Rare-Earth Elements from Photovoltaics, Solid-State Lighting and Electronics Waste" Funding programme: FP7-NMP-2012-SME-6 Start date: 2013-01-01 End date: 2016-12-31 Funding: 4.7 M€ Number of partners: 11 Coordinator: NEDERLANDSE ORGANISATIE VOOR TOEGEPAST NATUURWETENSCHAPPELIJK ONDERZOEK TNO

Company information	**Name:** RELIGHT **Type:** SME **Country:** Italy **Website:** http://www.relightitalia.it/en/
Value chain position	Recycler
General description	RELIGHT is a pioneer in the collection, recovery and treatment of WEEE. Relight has an advanced system for the storage, recovery and treatment of hazardous and non-hazardous wastes, mainly from electrical and electronic equipment.
Link to REE4EU	RELIGHT takes the key roles of (1) collection, (2) recovery and (3) treatment of WEEE. Processes for the disassembly, disconnection and sorting of e-waste to isolate the parts containing the targeted materials and demonstration of REE recovery technology has been provided by RELIGHT in RECLAIM and REMAGHIC projects.
Projects	RECLAIM: "New Recovery Processes to produce Rare Earth -Magnesium Alloys of High Performance and Low Cost" Funding programme: FP7-NMP-2012-SME-6 Start date: 2013-01-01 End date: 2016-12-31 Funding: 4.7 M€ Number of partners: 11 Coordinator: NEDERLANDSE ORGANISATIE VOOR TOEGEPAST NATUURWETENSCHAPPELIJK ONDERZOEK TNO REMAGHIC: "Reclamation of Gallium, Indium and Rare-Earth Elements from Photovoltaics, Solid-State Lighting and Electronics Waste"

	Funding programme: H2020-SPIRE-07-2015 Start date: 2015-09-01 End date: 2018-08-31 Funding: 3.3 M€ Number of partners: 10 Coordinator: FUNDACION CIDAUT

1.3.6.2 Large Industries

Company information	**Name:** AURUBIS **Type:** Large industry **Country:** Germany **Website:** https://www.aurubis.com/en
Value chain position	Recycler
General description	Aurubis is the leading integrated copper group and the world's largest copper recycler. They produce high-purity copper from copper concentrates, copper scrap and recycling materials. Aurubis can generate more than 1 Mt of copper cathodes each year. Gold, silver, iron silicate are among the other products in Aurubis' portfolio.
Link to REE4EU	Aurubis is considered as one of the most important metal recycling companies in Europe. It has an advanced recycling system starting with an assessment of a material by chemical analysis, followed by pyrometallurgical and hydrometallurgical processing and finally, fabrication to high-quality products.
Projects	ADIR: "Next Generation Urban Mining – Automated Disassembly, separation and recovery of valuable materials from electronic equipment" Funding programme: H2020-SPIRE-07-2015 Start date: 2015-09-01 End date: 2019-08-31 Funding: 5.3 M€ Number of partners: 10 Coordinator: FRAUNHOFER GESELLSCHAFT ZUR FOERDERUNG DER ANGEWANDTEN FORSCHUNG E.V.

Company information	**Name:** COOLREC **Type:** Large industry **Country:** Netherlands **Website:** http://www.coolrec.eu/
Value chain position	Recycler

General description	Coolrec is a leader company in the recycling of electrical and electronic equipment into high-quality recovered plastics, metals and other secondary raw material such as display screens, fridges, ICT equipment and small household appliances.
Link to REE4EU	In RECLAIM project, Coolrec developed a process for semi-automatic treatment which handled partial dismantling of covers and PCBs, followed by a shredding of the remaining fraction.
Projects	RECLAIM: "Reclamation of Gallium, Indium and Rare-Earth Elements from Photovoltaics, Solid-State Lighting and Electronics Waste" Funding programme: FP7-NMP-2012-SME-6 Start date: 2013-01-01 End date: 2016-12-31 Funding: 4.7 M€ Number of partners: 11 Coordinator: NEDERLANDSE ORGANISATIE VOOR TOEGEPAST NATUURWETENSCHAPPELIJK ONDERZOEK TNO

Company information	**Name:** STENA METALL AB **Type:** Large industry **Country:** Sweden **Website:** http://stenametall.com/
Value chain position	Recycler
General description	The Stena Metall group is a Nordic based recycling company with facilities handling industrial waste, offering a wide range of innovative and environmentally safe solutions to its customers.
Link to REE4EU	The Stena Metall Group has its own technical expertise and R&D team. Stena Technoworld AB is a part of the Stena Metall Group and a leading recycler of WEEE in Europe. They participated in REMANENCE project for advanced recycling technologies. Another company in the group is Stena Recycling AB who will supply the REE4EU project with wind mill magnets
Projects	REMANENCE: "Rare Earth Magnet Recovery for Environmental and Resource Protection" Funding programme: FP7-NMP-2012-SME-6 Start date: 2013-01-01 End date: 2016-06-30 Funding: 3.7 M€ Number of partners: 9 Coordinator: C-TECH INNOVATION LIMITED

2.3.7 Horizontal

2.3.7.1 SMEs

Company information	**Name:** TRE TAU ENGINEERING **Type:** SME **Country:** Italy **Website:** http://www.tretau.it/
Value chain position	Horizontal
General description	Tre Tau Engineering develops conceptual engineering designs for novel solutions or adaptations and uses advanced engineering techniques, based on computational fluid dynamics, structural analysis, thermo-economics evaluation and optimization in order to improve engineering performances. They provide services for magnet wire and electronics industries.
Link to REE4EU	Tre Tau Engineering is involved in several competitive EU research projects in the areas of information technologies, mechanics, electronics and management and smart technologies. They joined ADIR consortium for the development of recovery technology of valuable materials from electronics.
Projects	ADIR: "Next Generation Urban Mining – Automated Disassembly, separation and recovery of valuable materials from electronic equipment" Funding programme: H2020-SPIRE-07-2015 Start date: 2015-09-01 End date: 2019-08-31 Funding: 5.3 M€ Number of partners: 10 Coordinator: FRAUNHOFER GESELLSCHAFT ZUR FOERDERUNG DER ANGEWANDTEN FORSCHUNG E.V.

Company information	**Name:** I-CUBE RESEARCH (ICR) **Type:** SME **Country:** France **Website:** -
Value chain position	Horizontal
General description	ICR joint stock company has been in business for 7 years. They are specialized in the sector of engineering and technical studies.
Link to REE4EU	ICR gives engineering and technical guidance to ADIR project.

Projects	ADIR: "Next Generation Urban Mining – Automated Disassembly, separation and recovery of valuable materials from electronic equipment" Funding programme: H2020-SPIRE-07-2015 Start date: 2015-09-01 End date: 2019-08-31 Funding: 5.3 M€ Number of partners: 10 Coordinator: FRAUNHOFER GESELLSCHAFT ZUR FOERDERUNG DER ANGEWANDTEN FORSCHUNG E.V.

Company information	**Name:** NANOLAYERS RESEARCH COMPUTING **Type:** SME **Country:** United Kingdom **Website:** http://www.nanolayers.com/
Value chain position	Horizontal
General description	Nanolayers Research Computing aims to bridge the gap between academic physics and real world products. The company provides consultancy in modelling and simulations rather than "black box" software development.
Link to REE4EU	Nanolayers Research Computing is one of the partners in CritCat project which seeks for nanoparticles substitutions of critical catalysts. Nanolayers Research's focus in CritCat project is the development of catalyst for four applications: proton exchange membrane fuel cells; electrolysers; syngas production from coal, gas and biomass and lastly lithium-air batteries.
Projects	CritCat: "Towards Replacement of Critical Catalyst Materials by Improved Nanoparticle Control and Rational Design" Funding programme: H2020-NMP-23-2015 Start date: 2016-06-01 End date: 2031-05-31 Funding: 4.4 M€ Number of partners: 9 Coordinator: TTY-SAATIO

Company information	**Name:** SYNGASCHEM **Type:** SME **Country:** Netherlands **Website:** http://www.syngaschem.com/
Value chain position	Horizontal

General description	Syngasche's mission is to promote syngas utilization based on molecular scale understanding. They engage in fundamental research on the catalysis with focus on the responsible use of coal and on syngas as intermediate in the storage of green electricity.
Link to REE4EU	Syngaschem participates in CritCat Consortium and takes the lead for industrial evaluation of rationally designed electrode materials.
Projects	CritCat: "Towards Replacement of Critical Catalyst Materials by Improved Nanoparticle Control and Rational Design" Funding programme: H2020-NMP-23-2015 Start date: 2016-06-01 End date: 2031-05-31 Funding: 4.4 M€ Number of partners: 9 Coordinator: TTY-SAATIO

Company information	**Name:** CAMFRIDGE **Type:** SME **Country:** United Kingdom **Website:** http://www.camfridge.com/
Value chain position	Horizontal
General description	Camfridge is a research company testing novel metal alloys and magnetic fields to create a new generation of low carbon cooling products that will dramatically reduce energy consumption and use non polluting gases. Camfridge was selected as part of the Cleantech 100 - one of the top 100 private European clean technology companies.
Link to REE4EU	Camfridge was taking an active role in DRREAM project which aims to reduce the use of RE in the life cycle of technologies that use magnetic phase change materials, such as magnetic cooling.
Projects	DRREAM: "Drastically reduced use of rare earths in applications of magnetocalorics" Funding programme: FP7-NMP-2012-SMALL-6 Start date: 2013-01-01 End date: 2015-12-31 Funding: 3.7 M€ Number of partners: 8 Coordinator: IMPERIAL COLLEGE OF SCIENCE TECHNOLOGY AND MEDICINE

Company information	**Name:** KEMAKTA KONSULT **Type:** SME **Country:** Sweden

	Website: http://www.kemakta.se/en/
Value chain position	Horizontal
General description	Kemakta Konsult is a personnel-owned consulting company specialising in environmental risk assessment, waste disposal and nuclear technology. Kemakta Konsult's knowledge of environmental chemistry, hydrology and physical processes has also been applied to a wide range of environmental impact assessments, e.g. for mine tailings deposits, coal ash, industrial wastes, contaminated land, contaminated sediments and new industrial establishments.
Link to REE4EU	Kemakta is one of the partners of EURARE project and completing the work on geological surveys. Their task is to evaluate the utilization and safe disposal of tailings and residues from the REE mining and processes.
Projects	EURARE: "Development of a sustainable exploitation scheme for Europe's Rare Earth ore deposits" Funding programme: FP7-NMP-2012-LARGE-6 Start date: 2013-01-01 End date: 2017-12-31 Funding: 9 M€ Number of partners: 23 Coordinator: NATIONAL TECHNICAL UNIVERSITY OF ATHENS

Company information	**Name:** MEAB CHEMIE TECHNIK **Type:** SME **Country:** Sweden **Website:** http://www.meab-mx.se/index.html
Value chain position	Horizontal
General description	MEAB is active in the hydrometallurgical field as a consulting and trading company. They are specialized on hydrometallurgical separation procedures, equipment and solvent extraction. MEAB gives support on chemical data and technical information and provides the process engineering service.
Link to REE4EU	In EURARE project, MEAB works on developing sustainable REE extraction and refining technologies to produce pure REE oxides, REE metals and REE alloys suitable for use in downstream industries.
Projects	EURARE: "Development of a sustainable exploitation scheme for Europe's Rare Earth ore deposits" Funding programme: FP7-NMP-2012-LARGE-6 Start date: 2013-01-01 End date: 2017-12-31 Funding: 9 M€ Number of partners: 23

	Coordinator: NATIONAL TECHNICAL UNIVERSITY OF ATHENS

Company information	**Name:** A. SPEISER-ENVIRONMENTAL CONSULTANTS (ASEC) **Type:** SME **Country:** Namibia **Website:** http://www.asecnam.com/
Value chain position	Horizontal
General description	ASEC is focusing on environmental projects mainly environmental investigations and audits of environmental performance.
Link to REE4EU	ASEC is carrying out environmental and social assurance for the research test drilling site in HiTech AlkCarb project.
Projects	HiTech AlkCarb: "New geomodels to explore deeper for High-Technology critical raw materials in Alkaline rocks and Carbonatites" Funding programme: H2020-SC5-2015-one-stage Start date: 2016-02-01 End date: 2020-01-31 Funding: 5.4 M€ Number of partners: 12 Coordinator: The University of Exeter

Company information	**Name:** GEO-AFRICA PROSPECTING SERVICES **Type:** SME **Country:** Namibia **Website:** -
Value chain position	Horizontal
General description	Geo-Africa is specialized in geological and geophysical techniques and exploration of carbonatite-hosted industrial mineral deposits.
Link to REE4EU	Geo-Africa is participating to HiTecAlkCarb project by acquiring exploration and resource evaluation of various critical mineral commodities, including REE, fluorite, apatite, vermiculite, zircon and scandium.
Projects	HiTech AlkCarb: "New geomodels to explore deeper for High-Technology critical raw materials in Alkaline rocks and Carbonatites" Funding programme: H2020-SC5-2015-one-stage Start date: 2016-02-01 End date: 2020-01-31 Funding: 5.4 M€ Number of partners: 12 Coordinator: The University of Exeter

Company information	**Name:** LANCASTER EXPLORATION LIMITED **Type:** SME **Country:** British Virgin Island **Website:** -
Value chain position	Horizontal
General description	The Lancaster Exploration's line of business includes performing metal mining services.
Link to REE4EU	Lancaster Exploration acquires a pre-feasibility study at the early stage of HiTech AlkCarb project.
Projects	HiTech AlkCarb: "New geomodels to explore deeper for High-Technology critical raw materials in Alkaline rocks and Carbonatites" Funding programme: H2020-SC5-2015-one-stage Start date: 2016-02-01 End date: 2020-01-31 Funding: 5.4 M€ Number of partners: 12 Coordinator: The University of Exeter

Company information	**Name:** TERRATEC GEOPHYSICAL SERVICES GMBH & CO KG **Type:** SME **Country:** Germany **Website:** http://terratec-geoservices.com/
Value chain position	Horizontal
General description	Terratec offers surface geophysical and borehole logging services worldwide. The main objectives are the acquisition, compilation, processing, analysis and interpretation of geophysical data for groundwater/geothermal energy prospecting.
Link to REE4EU	Terratec Geophysical Services executes its services for ores and mineral exploration and geotechnical purposes. For this purpose, they are one of the partners in HiTech AlkCarb project.
Projects	HiTech AlkCarb: "New geomodels to explore deeper for High-Technology critical raw materials in Alkaline rocks and Carbonatites" Funding programme: H2020-SC5-2015-one-stage Start date: 2016-02-01 End date: 2020-01-31 Funding: 5.4 M€ Number of partners: 12 Coordinator: The University of Exeter

Company information	**Name:** ITB PRECISIETECHNIEK **Type:** SME **Country:** Netherlands **Website:** http://www.itb.nl/
Value chain position	Horizontal
General description	ITB Precisietechniek is an internationally oriented high tech company. ITB is specialized in the product and tool designing, production stamping and assembly of plastic and metal injection-mouldings. ITB are also a supplier of advanced powder metallurgy parts.
Link to REE4EU	ITB provides an advisory role in MAGNETIDE project, powder feedstock process suitability, processing parameters and component geometry. ITB will use the know-how developed within the MAGNETIDE project to establish a new product line.
Projects	MAGNETIDE: "Improved magnets for energy generation through advanced tidal technology" Funding programme: FP7-SME-2011-1 Start date: 2012-12-01 End date: 2014-11-30 Funding: 1.1 M€ Number of partners: 7 Coordinator: ATARD SAVUNMA VE HAVACILIK SANAYI ILERI TEKNOLOJI UYGULAMALARI ARASTIRMA VE GELISTIRME A.S.

Company information	**Name:** BOUKJE.COM CONSULTING **Type:** SME **Country:** Netherlands **Website:** http://boukje.com/
Value chain position	Horizontal
General description	Boukje.com assists organizations in their R&D strategy and in their new business opportunities. Boukje.com supports companies and research institutes in developing research proposals, building cooperative R&D consortia and carrying out project management. Boukje.com has an extensive experience in the field of PV, related to successfully developing and launching technology.
Link to REE4EU	Boukje.com participated to REEcover project and supports the consortium in the field of New Business Development and related funding acquisition. Boukje.com was responsible in REEcover project for exploitation and dissemination management.
Projects	REEcover: "Recovery of Rare Earth Elements from magnetic waste in the WEEE recycling industry and tailings from the iron ore industry" Funding programme: FP7-ENV-2013-two-stage

	Start date: 2013-12-01 End date: 2016-11-30 Funding: 6 M€ Number of partners: 13 Coordinator: NORGES TEKNISK-NATURVITENSKAPELIGE UNIVERSITET

Company information	**Name:** eAMBIENTE **Type:** SME **Country:** Italy **Website:** http://www.matthey.com/
Value chain position	Horizontal
General description	eAmbiente provides services on the theme of environmental legal compliance, as an auditor and consultant and environmental consulting.
Link to REE4EU	eAmbiente joined Partial-PMGs project to provide consultancy on the recyclability, health impact analysis and Life Cycle Assessment.
Projects	Partial-PMGs: "Development of novel, high Performance hybrid TWV/GPF Automotive afteR treatment systems by raTIonAL design: substitution of PGMs and Rare earth materials" Funding programme: H2020-NMP-2015-two-stage Start date: 2016-04-01 End date: 2019-09-30 Funding: 4.6 M€ Number of partners: 14 Coordinator: WARRANT GROUP

Company information	**Name:** METSOL **Type:** SME **Country:** Sweden **Website:** http://metsol.se/metals-specialist/
Value chain position	Horizontal
General description	Metsol is a consultancy company that combines the supply services and technological services for metals processing industry. Its specific focus is on metallurgical operations and it carries a strategic plant-wide perspective with hands-on implementation at all work levels.
Link to REE4EU	Metsols vast experience in hands-on operations of metals production in combination with a solid R&D background is a valuable combination that ensures a research output adapted to industrial needs. Metsol's key role in RECOVER project was primarily to ensure that industrial viable approaches were pursued in the project, taking into consideration industrial practical challenges and opportunities.

Projects	REEcover: "Recovery of Rare Earth Elements from magnetic waste in the WEEE recycling industry and tailings from the iron ore industry" Funding programme: FP7-ENV-2013-two-stage Start date: 2013-12-01 End date: 2016-11-30 Funding: 6 M€ Number of partners: 13 Coordinator: NORGES TEKNISK-NATURVITENSKAPELIGE UNIVERSITET

Company information	**Name:** WARRANT GROUP **Type:** SME **Country:** Italy **Website:** http://www.warrantgroup.it
Value chain position	Horizontal
General description	Currently Warrant Group offers integrated consulting services and it is specialized in accompanying and supporting companies at all phases of business development.
Link to REE4EU	The Warrant Group is the coordinator of Partial-PMGs project which is currently comprises 14 partners. The project management and business development will be acquired by The Warrant Group.
Projects	Partial-PMGs: "Development of novel, high Performance hybrid TWV/GPF Automotive afteR treatment systems by raTIonAL design: substitution of PGMs and Rare earth materials" Funding programme: H2020-NMP-2015-two-stage Start date: 2016-04-01 End date: 2019-09-30 Funding: 4.6 M€ Number of partners: 14 Coordinator: WARRANT GROUP

Company information	**Name:** COGVIS SOFTWARE UND CONSULTING **Type:** SME **Country:** Austria **Website:** http://www.cogvis.at/en/about-us/
Value chain position	Horizontal
General description	Cogvis creates software for analyzing content in images, videos, and 3D data. Their product portfolio includes many established standard solutions for vertical markets such as security, retail, industry, or medicine/e-health.

Link to REE4EU	In RECLAIM project, CogVis delivered tailor made software solutions for the applications from the initial feasibility analysis to the final software product and implementation.
Projects	RECLAIM: "Reclamation of Gallium, Indium and Rare-Earth Elements from Photovoltaics, Solid-State Lighting and Electronics Waste" Funding programme: FP7-NMP-2012-SME-6 Start date: 2013-01-01 End date: 2016-12-31 Funding: 4.7 M€ Number of partners: 11 Coordinator: NEDERLANDSE ORGANISATIE VOOR TOEGEPAST NATUURWETENSCHAPPELIJK ONDERZOEK TNO

Company information	**Name:** OPTOELECTRONICA - 2001 **Type:** SME **Country:** Romania **Website:** http://www.optoel.ro/index.php/welcome/our_mision
Value chain position	Horizontal
General description	Optoelectronica gives guidance in R&D activities of optical equipment manufacturers. Their expertise mainly supports R&D projects for the development of production capacity in order to meet the requirements of international markets.
Link to REE4EU	Optoelectronica's expertise in RECLAIM project leveraged the investigation of recovery of REE from optoelectronic devices.
Projects	RECLAIM: "Reclamation of Gallium, Indium and Rare-Earth Elements from Photovoltaics, Solid-State Lighting and Electronics Waste" Funding programme: FP7-NMP-2012-SME-6 Start date: 2013-01-01 End date: 2016-12-31 Funding: 4.7 M€ Number of partners: 11 Coordinator: NEDERLANDSE ORGANISATIE VOOR TOEGEPAST NATUURWETENSCHAPPELIJK ONDERZOEK TNO

Company information	**Name:** SIMTEC **Type:** SME **Country:** France **Website:** http://www.simtec.org/
Value chain position	Horizontal
General description	SIMTEC is an engineering modeling company, whose goal is to assist industrial professionals in their processing development, research and

	innovative approaches. Furthermore, SIMTEC develops custom numerical software to provide their customers with a decision support tool based on scientific computations.
Link to REE4EU	SIMTEC has a proven experience in modelling processes, specifically modelling of several kinds of electrochemical processes, electrolysis systems. SIMTEC's role in REEcover project was to evaluate and to optimize the efficiency of the integrated processes.
Projects	REEcover: "Recovery of Rare Earth Elements from magnetic waste in the WEEE recycling industry and tailings from the iron ore industry" Funding programme: FP7-ENV-2013-two-stage Start date: 2013-12-01 End date: 2016-11-30 Funding: 6 M€ Number of partners: 13 Coordinator: NORGES TEKNISK-NATURVITENSKAPELIGE UNIVERSITET

Company information	**Name:** ITRB **Type:** SME **Country:** Cyprus **Website:** http://www.itrb.net/
Value chain position	Horizontal
General description	ITRB is a Global Engineering Services provider in aerospace, present in 4 European countries. ITRB has an experience conducting research on the aerospace field.
Link to REE4EU	ITRB will take the lead for the models simulation of new RE magnesium alloys and their performance analysis.
Projects	REMAGHIC: "Reclamation of Gallium, Indium and Rare-Earth Elements from Photovoltaics, Solid-State Lighting and Electronics Waste" Funding programme: H2020-SPIRE-07-2015 Start date: 2015-09-01 End date: 2018-08-31 Funding: 3.3 M€ Number of partners: 10 Coordinator: FUNDACION CIDAUT

Company information	**Name:** MEOTEC **Type:** SME **Country:** Germany **Website:** http://www.meotec.eu/home/
Value chain position	Horizontal

General description	Meotec is a research company specialized in the development of biodegradable magnesium alloys and coatings.
Link to REE4EU	Meotec is planning to extent topical business fields by the establishment of manufacturing equipment for own magnesium based implants and to provide such for industrial partners in service. For this purpose, Meotec joined REMAGHIC consortium.
Projects	REMAGHIC: "Reclamation of Gallium, Indium and Rare-Earth Elements from Photovoltaics, Solid-State Lighting and Electronics Waste" Funding programme: H2020-SPIRE-07-2015 Start date: 2015-09-01 End date: 2018-08-31 Funding: 3.3 M€ Number of partners: 10 Coordinator: FUNDACION CIDAUT

Company information	**Name:** ACREO SWEDISH ICT **Type:** SME **Country:** Sweden **Website:** https://www.acreo.se/
Value chain position	Horizontal
General description	Acreo offers innovative and value adding solutions in the field of electronics, optics, communication techniques and sensor systems.
Link to REE4EU	Acreo works to facilitate the commercialization of research and to strengthen collaboration between industry and academia. The types of assignments Acreo is involved in range from feasibility studies, long term research projects, prototyping and small scale production, to verification and testing.
Projects	REMANENCE: "Rare Earth Magnet Recovery for Environmental and Resource Protection" Funding programme: FP7-NMP-2012-SME-6 Start date: 2013-01-01 End date: 2016-06-30 Funding: 3.7 M€ Number of partners: 9 Coordinator: C-TECH INNOVATION LIMITED

Company information	**Name:** FOTEC FORSCHUNGS- UND TECHNOLOGIETRANSFER **Type:** SME **Country:** Austria **Website:** http://www.fotec.at

Value chain position	Horizontal
General description	FOTEC has been founded in 1998 and acts as an innovative high-tech research company with numerous partnerships with industry, universities and research institutes worldwide.
Link to REE4EU	Fotec is contributing to REProMag project in powder injection moulding and injection moulding of hard magnets. FOTEC also brings in its extensive knowledge to the consortium in additive manufacturing technologies.
Projects	REProMag: "Resource Efficient Production Route for Rare Earth Magnets" Funding programme: H2020-NMP-23-2015 Start date: 2015-01-01 End date: 2017-12-31 Funding: 5.7 M€ Number of partners: 14 Coordinator: OBE OHNMACHT & BAUMGARTNER GMBH & CO KG

Company information	**Name:** TEKS SARL **Type:** SME **Country:** France **Website:** http://www.teks.eu.com/
Value chain position	Horizontal
General description	TEKS is a privately owned high tech company actively involved in process design and optimization, environmental assessment, training and technology exploitation. TEKS is focused on environmentally friendly manufacturing with a sustainability research team developed to assess the environmental impact of manufacturing processes.
Link to REE4EU	TEKS is leading all activities and support project partners with regard to the environmental and economic impact assessment of the SDS processing route in REProMag project. TEKS activity focuses on R&D for the environmental and cost effective successful introduction of REProMag technologies in a real production environment.
Projects	REProMag: "Resource Efficient Production Route for Rare Earth Magnets" Funding programme: H2020-NMP-23-2015 Start date: 2015-01-01 End date: 2017-12-31 Funding: 5.7 M€ Number of partners: 14 Coordinator: OBE OHNMACHT & BAUMGARTNER GMBH & CO KG

Company information	**Name:** TEMAS AG TECHNOLOGY AND MANAGEMENT **Type:** SME **Country:** Switzerland **Website:** http://www.temas.ch/
Value chain position	Horizontal
General description	TEMAS combines experience and expertise from science, technology and management. TEMAS gives advice to companies and institutions on the planning and implementation of innovations and support projects with very close customer contact.
Link to REE4EU	Dissemination of ROMEO project was acquired by TEMAS.
Projects	ROMEO: "Replacement and Original Magnet Options" Funding programme: FP7-NMP-2002-SMALL-6 Start date: 2012-12-01 End date: 2015-11-30 Funding: 4 M€ Number of partners: 13 Coordinator: INSTITUT JOZEF STEFAN

Company information	**Name:** OFFSHORE RENEWABLE ENERGY CATAPULT (ORE CATAPULT) **Type:** SME **Country:** United Kingdom **Website:** https://ore.catapult.org.uk/
Value chain position	Horizontal
General description	ORE Catapult is the UK's private technology innovation and research centre for advancing wind, wave and tidal energy. ORE Catapult helps to reduce the cost of offshore renewable energy, transforming the industry and delivering UK economic benefit.
Link to REE4EU	ORE Catapult is focusing on development of wind turbines overall. ORE Catapult initiated and coordinated SNAPPER project to improve the generators of wind turbines.
Projects	SNAPPER: "The development of a novel rare-earth magnet based wave power conversion system" Funding programme: FP7-SME-2008-1 Start date: 2009-09-01 End date: 2011-08-31 Funding: 1 M€ Number of partners: 8 Coordinator: OFFSHORE RENEWABLE ENERGY CATAPULT

Company information	**Name:** OCEAN RESOURCE **Type:** SME **Country:** United Kingdom **Website:** http://www.oceanresource.co.uk/
Value chain position	Horizontal
General description	Ocean Resource Ltd (Ocean) is a uniquely innovative ocean and offshore energy engineering company with 40 years of real experience and real expertise in design and engineering for offshore oil and gas, offshore renewables, carbon sequestration and marine applications.
Link to REE4EU	To provide expertise in offshore maintenance, inspection and installation, Ocean Resource joined to SNAPPER project. Their expertise was used in the marine engineering activities and in the final detailed development of the prototype for wet validation.
Projects	SNAPPER: "The development of a novel rare-earth magnet based wave power conversion system" Funding programme: FP7-SME-2008-1 Start date: 2009-09-01 End date: 2011-08-31 Funding: 1 M€ Number of partners: 8 Coordinator: OFFSHORE RENEWABLE ENERGY CATAPULT

Company information	**Name:** TECHNOGAMA (TG) **Type:** SME **Country:** Lithuania **Website:** http://www.technogama.lt
Value chain position	Horizontal
General description	TG is a design and production company that operates in three main areas: electronics (electronic power systems), energy (wind turbines), and linguistic technologies. Specifically, they have a wide experience on the electrical networks, telephone lines and computer or data transmission network protection.
Link to REE4EU	TG consulted on the activities associated with electrical engineering, providing commercial experience and expertise in the design and development of power electronics which was used on SNAPPER project concept.
Projects	SNAPPER: "The development of a novel rare-earth magnet based wave power conversion system" Funding programme: FP7-SME-2008-1 Start date: 2009-09-01 End date: 2011-08-31

	Funding: 1 M€ Number of partners: 8 Coordinator: OFFSHORE RENEWABLE ENERGY CATAPULT

Company information	**Name:** EM RENEWABLES **Type:** SME **Country:** United Kingdom **Website:** -
Value chain position	Horizontal
General description	EM Renewables specializes in providing design and engineering consultation services in the United Kingdom.
Link to REE4EU	EM Renewables took highly proactive role in the design, validation and exploitation stages of SNAPPER project; in particular, the development of the simulation environment, the electrical machine design and both the dry and wet test trials.
Projects	SNAPPER: "The development of a novel rare-earth magnet based wave power conversion system" Funding programme: FP7-SME-2008-1 Start date: 2009-09-01 End date: 2011-08-31 Funding: 1 M€ Number of partners: 8 Coordinator: OFFSHORE RENEWABLE ENERGY CATAPULT

Company information	**Name:** MECCANOTECNICA RIESI **Type:** SME **Country:** Italy **Website:** http://www.meccanotecnicariesi.com/?idPlugin=22739
Value chain position	Horizontal
General description	MECCANOTECNICA RIESI is a family owned design company. Their expertise is designing components in aerospace, defense, oil, gas, research, and more.
Link to REE4EU	MECCANOTECNICA RIESI assisted in SNAPPER project for the design and development of the prototype on assembly and advanced machined components. They supported the actual construction of the prototype linear generator, using their advanced prototyping and workshop experience.
Projects	SNAPPER: "The development of a novel rare-earth magnet based wave power conversion system" Funding programme: FP7-SME-2008-1

	Start date: 2009-09-01 End date: 2011-08-31 Funding: 1 M€ Number of partners: 8 Coordinator: OFFSHORE RENEWABLE ENERGY CATAPULT

2.3.7.2 Large industries

Company information	**Name:** SUBSEADESIGN (SD) **Type:** SME **Country:** Norway **Website:** http://subseadesign.com/
Value chain position	Horizontal
General description	SD is an engineering, design and fabrication company providing equipment such as metal-to-metal seal and pipes and services for the oil and gas industry. SD represents a high level of competence and experience gathered by the senior employees from many years in central positions in the oil and gas industry.
Link to REE4EU	SubseaDesign's key skills and competences were used in the development of the marine and mechanical design phase of SNAPPER project.
Projects	SNAPPER: "The development of a novel rare-earth magnet based wave power conversion system" Funding programme: FP7-SME-2008-1 Start date: 2009-09-01 End date: 2011-08-31 Funding: 1 M€ Number of partners: 8 Coordinator: OFFSHORE RENEWABLE ENERGY CATAPULT

Company information	**Name:** D'APPOLONIA **Type:** Large Enterprise **Country:** Italy **Website:** http://www.dappolonia.it/en
Value chain position	Horizontal
General description	D'Appolonia is an engineering company that provides multidisciplinary engineering consulting and design services to large enterprises, SMEs, research centres, funding institutes, public bodies. D'Appolonia has experts in energy, transport and infrastructures sectors.

Link to REE4EU	D'Appolonia contributes to EURARE project by preparing a survey on the European REE market.
Projects	EURARE: "Development of a sustainable exploitation scheme for Europe's Rare Earth ore deposits" Funding programme: FP7-NMP-2012-LARGE-6 Start date: 2013-01-01 End date: 2017-12-31 Funding: 9 M€ Number of partners: 23 Coordinator: NATIONAL TECHNICAL UNIVERSITY OF ATHENS

Company information	**Name:** NATIONAL PHYSICAL LABORATORY (NPL MANAGEMENT) **Type:** Large Enterprise **Country:** United Kingdom **Website:** http://www.npl.co.uk/
Value chain position	Horizontal
General description	NPL provides services for national economic and social challenges of government and businesses, translating scientific research to improve quality of life, introduce or improve products and processes, and increase commercial competitive advantage.
Link to REE4EU	Group of NPL research team is participating in two EU funded projects working on the REE substitution with engineered nanomaterials, mechanism and performance analysis of catalysts (e.g. platinum) and manufacturing of recycled NdFeB magnets.
Projects	CritCat: "Towards Replacement of Critical Catalyst Materials by Improved Nanoparticle Control and Rational Design" Funding programme: H2020-NMP-23-2015 Start date: 2016-06-01 End date: 2019-05-31 Funding: 4.4 M€ Number of partners: 9 Coordinator: TTY-SAATIO REProMag: "Resource Efficient Production Route for Rare Earth Magnets" Funding programme: H2020-NMP-23-2015 Start date: 2015-01-01 End date: 2017-12-31 Funding: 5.7 M€ Number of partners: 14 Coordinator: OBE OHNMACHT & BAUMGARTNER GMBH & CO KG

2.4 Non-profit stakeholders

Project	ADIR: "Next Generation Urban Mining – Automated Disassembly, separation and recovery of valuable materials from electronic equipment" Funding programme: H2020-SPIRE-07-2015 Start date: 2015-09-01 End date: 2019-08-31 Funding: 5.3 M€ Number of partners: 10 Coordinator: FRAUNHOFER GESELLSCHAFT ZUR FOERDERUNG DER ANGEWANDTEN FORSCHUNG E.V.
Institution Information	**Name:** FRAUNHOFER GESELLSCHAFT ZUR FOERDERUNG DER ANGEWANDTEN FORSCHUNG E.V. **Type:** RTO **Country:** Germany **Website:** https://www.fraunhofer.de/en.html
	Name: INSTYTUT METALI NIEZELAZNYCH **Type:** RTO **Country:** Poland **Website:** http://www.imn.gliwice.pl/

Project	CritCat: "Towards Replacement of Critical Catalyst Materials by Improved Nanoparticle Control and Rational Design" Funding programme: H2020-NMP-23-2015 Start date: 2016-06-01 End date: 2031-05-31 Funding: 4.4 M€ Number of partners: 9 Coordinator: TTY-SAATIO
Institution Information	**Name:** AALTO-KORKEAKOULUSAATIO **Type:** University **Country:** Finland **Website:** http://www.aalto.fi/en/
	Name: FORSCHUNGSZENTRUM JUELICH GMBH **Type:** RTO **Country:** Germany **Website:** http://www.fz-juelich.de/portal/DE/Home/home_node.html
	Name: LABORATORIO IBERICO INTERNACIONAL DE NANOTECNOLOGIA **Type:** RTO

	Country: Portugal **Website:** http://inl.int/
	Name: THE UNIVERSITY OF BIRMINGHAM **Type:** University **Country:** United Kingdom **Website:** http://www.birmingham.ac.uk/
	Name: TTY-SAATIO **Type:** University **Country:** Finland **Website:** http://www.tut.fi/en/about-tut/tut-foundation/

Project	DEMETER: "Training Network for the Design and Recycling of Rare-Earth Permanent Magnet Motors and Generators in Hybrid and Full Electric Vehicles" Funding programme: H2020-MSCA-ITN-2015 Start date: 2015-09-01 End date: 2019-08-31 Funding: 3.8 M€ Number of partners: 7 Coordinator: KATHOLIEKE UNIVERSITEIT LEUVEN
Institution Information	**Name:** AALBORG UNIVERSITET **Type:** University **Country:** Denmark **Website:** http://www.en.aau.dk/
	Name: INSTITUT JOZEF STEFAN **Type:** RTO **Country:** Slovenia **Website:** https://www.ijs.si/ijsw
	Name: INSTITUT POLYTECHNIQUE DE GRENOBLE **Type:** RTO **Country:** FRANCE **Website:** http://www.grenoble-inp.fr/
	Name: KATHOLIEKE UNIVERSITEIT LEUVEN **Type:** University **Country:** Belgium **Website:** https://www.kuleuven.be/english

	Name: THE UNIVERSITY OF BIRMINGHAM **Type:** University **Country:** United Kingdom **Website:** http://www.birmingham.ac.uk/

Project	DRREAM: "Drastically reduced use of rare earths in applications of magnetocalorics" Funding programme: FP7-NMP-2012-SMALL-6 Start date: 2013-01-01 End date: 2015-12-31 Funding: 3.7 M€ Number of partners: 8 Coordinator: IMPERIAL COLLEGE OF SCIENCE TECHNOLOGY AND MEDICINE
Institution Information	**Name:** CENTRE NATIONAL DE LA RECHERCHE SCIENTIFIQUE **Type:** RTO **Country:** France **Website:** http://www.cnrs.com/
	Name: FRAUNHOFER-GESELLSCHAFT ZUR FOERDERUNG DER ANGEWANDTEN FORSCHUNG E.V **Type:** RTO **Country:** Germany **Website:** https://www.fraunhofer.de/en.html
	Name: IMPERIAL COLLEGE OF SCIENCE, TECHNOLOGY AND MEDICINE **Type:** University **Country:** United Kingdom **Website:** https://www.imperial.ac.uk/
	Name: ISTITUTO NAZIONALE DI RICERCA METROLOGICA **Type:** RTO **Country:** Italy **Website:** http://www.inrim.it/n/index.php
	Name: TECHNISCHE UNIVERSITAET DARMSTADT **Type:** University **Country:** Germany **Website:** https://www.tu-darmstadt.de/

Project	EREAN: "European Rare Earth Magnet Recycling Network" Funding programme: FP7-PEOPLE-2013-ITN Start date: 2013-09-01 End date: 2017-08-31 Funding: 3.9 M€ Number of partners: 9 Coordinator: KATHOLIEKE UNIVERSITEIT LEUVEN
Institution Information	**Name:** FRAUNHOFER-GESELLSCHAFT ZUR FOERDERUNG DER ANGEWANDTEN FORSCHUNG E.V **Type:** RTO **Country:** Germany **Website:** https://www.fraunhofer.de/en.html
	Name: KATHOLIEKE UNIVERSITEIT LEUVEN **Type:** University **Country:** Belgium **Website:** https://www.kuleuven.be/english
	Name: CHALMERS TEKNISKA HOEGSKOLA AB **Type:** University **Country:** Sweden **Website:** http://www.chalmers.se/en/Pages/default.aspx
	Name: HELSINGIN YLIOPISTO **Type:** University **Country:** Finland **Website:** https://www.helsinki.fi/en
	Name: OEKO-INSTITUT E.V. - INSTITUT FUER ANGEWANDTE OEKOLOGIE **Type:** RTO **Country:** Germany **Website:** https://www.oeko.de/
	Name: THE UNIVERSITY OF BIRMINGHAM **Type:** University **Country:** United Kingdom **Website:** http://www.birmingham.ac.uk/
	Name: TECHNISCHE UNIVERSITEIT DELFT **Type:** University **Country:** Netherlands **Website:** http://www.tudelft.nl/en/

Project	EURARE: "Development of a sustainable exploitation scheme for Europe's Rare Earth ore deposits" Funding programme: FP7-NMP-2012-LARGE-6 Start date: 2013-01-01 End date: 2017-12-31 Funding: 9 M€ Number of partners: 23 Coordinator: NATIONAL TECHNICAL UNIVERSITY OF ATHENS
Institution Information	**Name:** BUREAU DE RECHERCHES GEOLOGIQUES ET MINIERES **Type:** RTO **Country:** France **Website:** http://www.brgm.eu/
	Name: ETHNIKO KENTRO VIOSIMIS KAI AEIFOROU ANAPTYXIS **Type:** RTO **Country:** Greece **Website:** -
	Name: SVERIGES GEOLOGISKA UNDERSOKNING **Type:** Public Entity **Country:** Sweden **Website:** http://www.sgu.se/en/
	Name: GEOLOGIAN TUTKIMUSKESKUS **Type:** RTO **Country:** Finland **Website:** http://www.gtk.fi/
	Name: GEOLOGICAL SURVEY OF NORWAY **Type:** RTO **Country:** Norway **Website:** https://www.ngu.no/en
	Name: NATIONAL TECHNICAL UNIVERSITY OF ATHENS **Type:** University **Country:** Greece **Website:** https://www.ntua.gr/en/
	Name: NATURAL ENVIRONMENT RESEARCH COUNCIL **Type:** RTO **Country:** United Kingdom

	Website: http://www.nerc.ac.uk/
	Name: KATHOLIEKE UNIVERSITEIT LEUVEN **Type:** University **Country:** Belgium **Website:** https://www.kuleuven.be/english
	Name: RHEINISCH-WESTFAELISCHE TECHNISCHE HOCHSCHULE AACHEN **Type:** RTO **Country:** Germany **Website:** http://www.rwth-aachen.de/cms/~a/root/?lidx=1
	Name: SVERIGES LANTBRUKSUNIVERSITET **Type:** University **Country:** Sweden **Website:** http://www.slu.se/en/
	Name: THE GEOLOGICAL SURVEY OF DENMARK AND GREENLAND **Type:** RTO **Country:** Denmark **Website:** http://www.slu.se/en/

Project	HiTech AlkCarb: "New geomodels to explore deeper for High-Technology critical raw materials in Alkaline rocks and Carbonatites" Funding programme: H2020-SC5-2015-one-stage Start date: 2016-02-01 End date: 2020-01-31 Funding: 5.4 M€ Number of partners: 12 Coordinator: The University of Exeter
Institution Information	**Name:** EBERHARD KARLS UNIVERSITAET TUEBINGEN **Type:** University **Country:** Germany **Website:** https://www.uni-tuebingen.de/
	Name: THE GEOLOGICAL SURVEY OF DENMARK AND GREENLAND **Type:** RTO **Country:** Denmark **Website:** http://www.slu.se/en/
	Name: MENDELOVA UNIVERZITA V BRNE **Type:** University

	Country: Czech Republic **Website:** http://mendelu.cz/en/
	Name: NATURAL ENVIRONMENT RESEARCH COUNCIL **Type:** RTO **Country:** United Kingdom **Website:** http://www.nerc.ac.uk/
	Name: NATURAL HISTORY MUSEUM **Type:** RTO **Country:** United Kingdom **Website:** http://www.nhm.ac.uk/
	Name: THE UNIVERSITY COURT OF THE UNIVERSITY OF ST ANDREWS **Type:** RTO **Country:** United Kingdom **Website:** https://www.st-andrews.ac.uk/about/governance/court/
	Name: THE UNIVERSITY OF EXETER **Type:** University **Country:** United Kingdom **Website:** http://www.exeter.ac.uk/
	Name: UNIVERSITA DEGLI STUDI GABRIELE D'ANNUNZIO DI CHIETI-PESCARA **Type:** University **Country:** United Kingdom **Website:** http://en.unich.it/

Project	MAGBOX: "Aeronautical Magnetic Gear Box" Funding programme: FP7-SP1-JTI-CS-2012-01 Start date: 2012-09-01 End date: 2014-04-30 Funding: 183 k€ Number of partners: 1 Coordinator: Universidad Carlos III De Madrid
Institution Information	**Name:** UNIVERSIDAD CARLOS III DE MADRID **Type:** University **Country:** Spain **Website:** http://www.uc3m.es/Home

Project	MAG-DRIVE: "New permanent magnets for electric-vehicle drive applications" Funding programme: FP7-SST-2013-RTD-1 Start date: 2013-10-01 End date: 2016-09-30 Funding: 2.5 M€ Number of partners: 7 Coordinator: INSTITUT JOZEF STEFAN
Institution Information	**Name:** INSTITUT JOZEF STEFAN **Type:** RTO **Country:** Slovenia **Website:** https://www.ijs.si/ijsw
	Name: INSTITUTE OF CHEMISTRY, TECHNOLOGY AND METALLURGY **Type:** University **Country:** Serbia **Website:** http://bg.ac.rs/en/members/institutes/chemestry-technology-metallurgy.php
	Name: QUEEN MARY UNIVERSITY OF LONDON **Type:** University **Country:** United Kingdom **Website:** http://www.qmul.ac.uk/
	Name: THE UNIVERSITY OF BIRMINGHAM **Type:** University **Country:** United Kingdom **Website:** http://www.birmingham.ac.uk/

Project	MAGNETIDE: "Improved magnets for energy generation through advanced tidal technology" Funding programme: FP7-SME-2011-1 Start date: 2012-12-01 End date: 2014-11-30 Funding: 1.1 M€ Number of partners: 7 Coordinator: ATARD SAVUNMA VE HAVACILIK SANAYI ILERI TEKNOLOJI UYGULAMALARI ARASTIRMA VE GELISTIRME A.S.
Institution Information	**Name:** INSTITUTO SUPERIOR TECNICO **Type:** RTO **Country:** Portugal **Website:** https://tecnico.ulisboa.pt/en/

	Name: ITUNOVA TEKNOLOJI ANONIM SIRKETI **Type:** RTO **Country:** Turkey **Website:** http://www.itunovatto.com.tr/en/
	Name: TWI LIMITED **Type:** RTO **Country:** United Kingdom **Website:** https://www.twi-global.com/
	Name: UNIVERSIDAD CARLOS III DE MADRID **Type:** University **Country:** Spain **Website:** http://www.uc3m.es/Home

Project	MINEPEP: "Establishing of a novel technology platform for bio-based mineral processing: Development of peptides as agents for the separation of rare earth minerals via bio-flotation" Funding programme: FP7-PEOPLE-2013-IOF Start date: 2015-03-01 End date: 2017-02-28 Funding: 168 k€ Number of partners: 1 Coordinator: HELMHOLTZ-ZENTRUM DRESDEN-ROSSENDORF
Institution Information	**Name:** HELMHOLTZ-ZENTRUM DRESDEN-ROSSENDORF **Type:** RTO **Country:** Germany **Website:** https://www.hzdr.de

Project	MOLMAG: "New Spin for Molecular Magnets" Funding programme: MSCA-IF-2014-EF Start date: 2015-08-31 End date: 2017-08-30 Funding: 191 k€ Number of partners: 1 Coordinator: JYVASKYLAN YLIOPISTO
Institution Information	**Name:** JYVASKYLAN YLIOPISTO **Type:** University **Country:** Finland **Website:** https://www.jyu.fi/en

Project	NANOPERMAG: "High Performance Nanostructure Permanent Magnets" Funding programme: FP7-PEOPLE-2009-IIF Start date: 2010-06-01 End date: 2012-12-31 Funding: 202 k€ Number of partners: 1 Coordinator: NATIONAL CENTER FOR SCIENTIFIC RESEARCH ""DEMOKRITOS"
Institution Information	**Name:** NATIONAL CENTER FOR SCIENTIFIC RESEARCH ""DEMOKRITOS" **Type:** RTO **Country:** Greece **Website:** http://www.demokritos.gr/?lang=en

Project	NANOPYME: "Nanocrystalline Permanent Magnets Based on Hybrid Metal-Ferrites" Funding programme: FP7-NMP-2012-SMALL-6 Start date: 2012-12-01 End date: 2015-11-30 Funding: 3.5 M€ Number of partners: 11 Coordinator: FUNDACION IMDEA NANOCIENCIA
Institution Information	**Name:** AARHUS UNIVERSITET **Type:** University **Country:** Denmark **Website:** http://www.au.dk/en/
	Name: AGENCIA ESTATAL CONSEJO SUPERIOR DE INVESTIGACIONES CIENTIFICAS **Type:** RTO **Country:** Spain **Website:** http://www.csic.es/
	Name: CONSORZIO INTERUNIVERSITARIO NAZIONALE PER LA SCIENZA E TECNOLOGIA DEI MATERIALI **Type:** RTO **Country:** Italy **Website:** http://www.instm.it/
	Name: DANMARKS TEKNISKE UNIVERSITET **Type:** University **Country:** Denmark

	Website: http://www.dtu.dk/
	Name: FUNDACION IMDEA NANOCIENCIA **Type:** RTO **Country:** Spain **Website:** http://nanoscience.imdea.org/
	Name: GENERAL NUMERICS RESEARCH LAB E V **Type:** RTO **Country:** Germany **Website:** http://www.general-numerics-rl.de/
	Name: INSTITUT JOZEF STEFAN **Type:** RTO **Country:** Slovenia **Website:** https://www.ijs.si/ijsw
	Name: INSTITUTT FOR ENERGITEKNIKK **Type:** RTO **Country:** Norway **Website:** https://www.ife.no/en
	Name: UNIVERSIDAD COMPLUTENSE DE MADRID **Type:** University **Country:** Spain **Website:** https://www.ucm.es/english/
	Name: VEREIN ZUR FORDERUNG VON INNOVATIONEN DURCH FORSCHUNG ENTWICKLUNG UNDTECHNOLOGIETRANSFER EV **Type:** RTO **Country:** Germany **Website:** http://www.innovent-jena.de

Project	NOVAMAG: "NOVel, critical materials free, high Anisotropy phases for permanent MAGnets, by design." Funding programme: H2020-NMP-23-2015 Start date: 2016-04-01 End date: 2019-09-30 Funding: 5.6 M€ Number of partners: 17 Coordinator: FUNDACION BCMATERIALS - BASQUE CENTRE FOR MATERIALS, APPLICATIONS AND NANOSTRUCTURES

Institution Information	**Name:** CENTRO RICERCHE FIAT SCPA **Type:** RTO **Country:** Italy **Website:** https://www.crf.it/EN
	Name: COMMISSARIAT A L ENERGIE ATOMIQUE ET AUX ENERGIES ALTERNATIVES **Type:** RTO **Country:** France **Website:** http://www.cea.fr/
	Name: FRAUNHOFER GESELLSCHAFT ZUR FOERDERUNG DER ANGEWANDTEN FORSCHUNG E.V. **Type:** RTO **Country:** Germany **Website:** www.fraunhofer.de
	Name: FUNDACION BCMATERIALS - BASQUE CENTRE FOR MATERIALS, APPLICATIONS AND NANOSTRUCTURES **Type:** RTO **Country:** Spain **Website:** http://www.bcmaterials.net/
	Name: NATIONAL CENTER FOR SCIENTIFIC RESEARCH ""DEMOKRITOS" **Type:** RTO **Country:** Greece **Website:** http://www.demokritos.gr/?lang=en
	Name: NATIONAL UNIVERSITY CORPORATION TOHOKU UNIVERSITY **Type:** University **Country:** Japan **Website:** http://www.tohoku.ac.jp/en/
	Name: TECHNION - ISRAEL INSTITUTE OF TECHNOLOGY **Type:** RTO **Country:** Israel **Website:** http://www.technion.ac.il/en/
	Name: TECHNISCHE UNIVERSITAET DARMSTADT **Type:** University **Country:** Germany

	Website: https://www.tu-darmstadt.de/
	Name: UNIVERSIDAD DE BURGOS **Type:** University **Country:** Spain **Website:** http://wwww.ubu.es/
	Name: UNIVERSITAET FUER WEITERBILDUNG KREMS **Type:** University **Country:** Austria **Website:** www.donau-uni.ac.at
	Name: UNIVERSITY OF DELAWARE **Type:** University **Country:** United States **Website:** https://www.udel.edu
	Name: UPPSALA UNIVERSITET **Type:** University **Country:** Sweden **Website:** https://www.uu.se/en

Project	Partial-PMGs: "Development of novel, high Performance hybrid TWV/GPF Automotive afteR treatment systems by raTIonAL design: substitution of PGMs and Rare earth materials" Funding programme: H2020-NMP-2015-two-stage Start date: 2016-04-01 End date: 2019-09-30 Funding: 4.6 M€ Number of partners: 14 Coordinator: WARRANT GROUP
Institution Information	**Name:** L'UREDERRA, FUNDACION PARA EL DESARROLLO TECNOLOGICO Y SOCIAL **Type:** RTO **Country:** Spain **Website:** https://lurederra.es/en
	Name: NATIONAL CENTER FOR SCIENTIFIC RESEARCH ""DEMOKRITOS" **Type:** RTO **Country:** Greece **Website:** http://www.demokritos.gr/?lang=en

	Name: NATIONAL TECHNICAL UNIVERSITY OF ATHENS - NTUA **Type:** University **Country:** Greece **Website:** https://www.ntua.gr/en
	Name: TECHNISCHE UNIVERSITEIT EINDHOVEN **Type:** University **Country:** Netherlands **Website:** https://www.tue.nl/en
	Name: THE UNIVERSITY OF BIRMINGHAM **Type:** University **Country:** United Kingdom **Website:** http://www.birmingham.ac.uk/
	Name: UNIVERSITA DEGLI STUDI DI PADOVA **Type:** University **Country:** Italy **Website:** www.unipd.it/en
	Name: UNIVERSITE DES SCIENCES ET TECHNOLOGIES DE LILLE - LILLE I **Type:** University **Country:** France **Website:** www.univ-lille1.fr/home
	Name: UNIVERSITEIT ANTWERPEN **Type:** University **Country:** Belgium **Website:** https://www.uantwerpen.be/en
	Name: UNIVERSITY OF DELAWARE **Type:** University **Country:** United States **Website:** https://www.udel.edu
	Name: VYSOKA SKOLA CHEMICKO-TECHNOLOGICKA V PRAZE **Type:** University **Country:** Czech Republic **Website:** www.vscht.cz

Project	REACT: "Rare Earth Oxide Dielectrics for Advanced Germanium CMOS Technology" Funding programme: FP7-PEOPLE-2010-IEF Start date: 2011-05-01 End date: 2013-04-31 Funding: 158 k€ Number of partners: 1 Coordinator: NATIONAL CENTER FOR SCIENTIFIC RESEARCH ""DEMOKRITOS"
Institution Information	**Name:** NATIONAL CENTER FOR SCIENTIFIC RESEARCH ""DEMOKRITOS" **Type:** RTO **Country:** Greece **Website:** http://www.demokritos.gr/?lang=en

Project	RE-ACT: "Novel active nanophotonic devices in rare-earth doped double tungstates" Funding programme: FP7-PEOPLE-2011-CIG Start date: 2011-08-01 End date: 2015-07-31 Funding: 100 k€ Number of partners: 1 Coordinator: UNIVERSITEIT TWENTE
Institution Information	**Name:** UNIVERSITEIT TWENTE **Type:** University **Country:** Netherlands **Website:** https://www.utwente.nl/en/

Project	RECLAIM: "Reclamation of Gallium, Indium and Rare-Earth Elements from Photovoltaics, Solid-State Lighting and Electronics Waste" Funding programme: FP7-NMP-2012-SME-6 Start date: 2013-01-01 End date: 2016-12-31 Funding: 4.7 M€ Number of partners: 11 Coordinator: NEDERLANDSE ORGANISATIE VOOR TOEGEPAST NATUURWETENSCHAPPELIJK ONDERZOEK TNO
Institution Information	**Name:** NEDERLANDSE ORGANISATIE VOOR TOEGEPAST NATUURWETENSCHAPPELIJK ONDERZOEK TNO **Type:** RTO **Country:** Netherlands **Website:** https://www.tno.nl/en

	Name: OSTERREICHISCHE GESELLSCHAFT FUER SYSTEM- UND AUTOMATISIERUNGSTECHNIK **Type:** RTO **Country:** Austria **Website:** http://www.sat-research.at/
	Name: TECHNISCHE UNIVERSITAET WIEN **Type:** University **Country:** Austria **Website:** https://www.tuwien.ac.at

Project	REEcover: "Recovery of Rare Earth Elements from magnetic waste in the WEEE recycling industry and tailings from the iron ore industry" Funding programme: FP7-ENV-2013-two-stage Start date: 2013-12-01 End date: 2016-11-30 Funding: 6 M€ Number of partners: 13 Coordinator: NORGES TEKNISK-NATURVITENSKAPELIGE UNIVERSITET
Institution Information	**Name:** FUNDACION TECNALIA RESEARCH & INNOVATION **Type:** RTO **Country:** Spain **Website:** www.tecnalia.com
	Name: LULEA TEKNISKA UNIVERSITET **Type:** University **Country:** Sweden **Website:** www.ltu.se/?l=en
	Name: NORGES TEKNISK-NATURVITENSKAPELIGE UNIVERSITET **Type:** University **Country:** Norway **Website:** https://www.ntnu.no/
	Name: STIFTELSEN SINTEF **Type:** RTO **Country:** Norway **Website:** https://www.sintef.no/en/
	Name: TECHNISCHE UNIVERSITEIT DELFT **Type:** University

	Country: Netherlands **Website:** www.tudelft.nl/en

Project	REESEP: "Improvement of Technical Capabilities for Research and Development (R&D) Related to Separation, Determination and Preliminary Production of different Rare Earth Elements" Funding programme: FP7-PEOPLE-IIF-2008 Start date: 2009-11-01 End date: 2011-10-31 Funding: 251,5 k€ Number of partners: 1 Coordinator: HELSINGIN YLIOPISTO
Institution Information	**Name:** HELSINGIN YLIOPISTO **Type:** University **Country:** Finland **Website:** https://www.helsinki.fi/en

Project	REFREEPERMAG: "Rare Earth Free Permanent Magnets" Funding programme: FP7-NMP-2011-SMALL-5 Start date: 2012-05-01 End date: 2015-04-30 Funding: 3.8 M€ Number of partners: 13 Coordinator: NATIONAL CENTER FOR SCIENTIFIC RESEARCH "DEMOKRITOS"
Institution Information	**Name:** NATIONAL CENTER FOR SCIENTIFIC RESEARCH ""DEMOKRITOS" **Type:** RTO **Country:** Greece **Website:** http://www.demokritos.gr/?lang=en
	Name: AGENCIA ESTATAL CONSEJO SUPERIOR DE INVESTIGACIONES CIENTIFICAS **Type:** RTO **Country:** Spain **Website:** www.csic.es
	Name: COMMISSARIAT A L'ENERGIE ATOMIQUE ET AUX ENERGIES ALTERNATIVES **Type:** RTO **Country:** France **Website:** http://www.cea.fr/

	Name: INSTITUT NATIONAL DES SCIENCES APPLIQUEES DE TOULOUSE INSAT **Type:** University **Country:** France **Website:** www.insa-toulouse.fr/en
	Name: LEIBNIZ-INSTITUT FUER FESTKOERPER- UND WERKSTOFFFORSCHUNG DRESDEN E.V. **Type:** RTO **Country:** Germany **Website:** www.ifw-dresden.de
	Name: RUHR-UNIVERSITAET BOCHUM **Type:** University **Country:** Germany **Website:** www.ruhr-uni-bochum.de
	Name: TECHNISCHE UNIVERSITAET WIEN **Type:** University **Country:** Austria **Website:** https://www.tuwien.ac.at
	Name: TECHNISCHE UNIVERSITAET DARMSTADT **Type:** University **Country:** Germany **Website:** https://www.tu-darmstadt.de/
	Name: UNIVERSITAET DUISBURG-ESSEN **Type:** University **Country:** Germany **Website:** https://www.uni-due.de
	Name: UNIVERSITY OF DELAWARE CORPORATION **Type:** University **Country:** United States **Website:** http://www.udel.edu/
	Name: UPPSALA UNIVERSITET **Type:** University **Country:** Sweden **Website:** https://www.uu.se/en

Project	REMAGHIC: "Reclamation of Gallium, Indium and Rare-Earth Elements from Photovoltaics, Solid-State Lighting and Electronics Waste" Funding programme: H2020-SPIRE-07-2015 Start date: 2015-09-01 End date: 2018-08-31 Funding: 3.3 M€ Number of partners: 10 Coordinator: FUNDACION CIDAUT
Institution Information	**Name:** FUNDACION CIDAUT **Type:** RTO **Country:** Spain **Website:** www.cidaut.es/en
	Name: FUNDACION TECNALIA RESEARCH & INNOVATION **Type:** RTO **Country:** Spain **Website:** www.tecnalia.com
	Name: FRAUNHOFER-GESELLSCHAFT ZUR FOERDERUNG DER ANGEWANDTEN FORSCHUNG E.V **Type:** RTO **Country:** Germany **Website:** https://www.fraunhofer.de/en.html
	Name: KATHOLIEKE UNIVERSITEIT LEUVEN **Type:** University **Country:** Belgium **Website:** https://www.kuleuven.be/english

Project	REMANENCE: "Rare Earth Magnet Recovery for Environmental and Resource Protection" Funding programme: FP7-NMP-2012-SME-6 Start date: 2013-01-01 End date: 2016-06-30 Funding: 3.7 M€ Number of partners: 9 Coordinator: C-TECH INNOVATION LIMITED
Institution Information	**Name:** ACONDICIONAMIENTO TARRASENSE ASSOCIACION **Type:** RTO **Country:** Spain **Website:** http://www.leitat.org

	Name: STIFTELSEN CHALMERS INDUSTRITEKNIK **Type:** RTO **Country:** Sweden **Website:** http://www.cit.chalmers.se/en/
	Name: THE UNIVERSITY OF BIRMINGHAM **Type:** University **Country:** United Kingdom **Website:** http://www.birmingham.ac.uk/

Project	REMSIL: "Rare Earth Metal Separation with Ionic Liquids" Funding programme: FP7-PEOPLE-2013-IIF Start date: 2015-02-01 End date: 2017-01-31 Funding: 231 k€ Number of partners: 1 Coordinator: THE QUEEN'S UNIVERSITY OF BELFAST
Institution Information	**Name:** THE QUEEN'S UNIVERSITY OF BELFAST **Type:** University **Country:** United Kingdom **Website:** www.qub.ac.uk

Project	REProMag: "Resource Efficient Production Route for Rare Earth Magnets" Funding programme: H2020-NMP-23-2015 Start date: 2015-01-01 End date: 2017-12-31 Funding: 5.7 M€ Number of partners: 14 Coordinator: OBE OHNMACHT & BAUMGARTNER GMBH & CO KG
Institution Information	**Name:** MONTANUNIVERSITAT LEOBEN **Type:** University **Country:** Austria **Website:** https://www.unileoben.ac.at
	Name: STEINBEIS INNOVATION GGMBH **Type:** RTO **Country:** Germany **Website:** https://www.steinbeis-europa.de
	Name: INSTITUT JOZEF STEFAN

	Type: RTO **Country:** Slovenia **Website:** https://www.ijs.si/ijsw
	Name: TECHNISCHE UNIVERSITAET WIEN **Type:** University **Country:** Austria **Website:** https://www.tuwien.ac.at
	Name: THE UNIVERSITY OF BIRMINGHAM **Type:** University **Country:** United Kingdom **Website:** http://www.birmingham.ac.uk/

Project	ROMEO: "Replacement and Original Magnet Options" Funding programme: FP7-NMP-2002-SMALL-6 Start date: 2012-12-01 End date: 2015-11-30 Funding: 4 M€ Number of partners: 13 Coordinator: INSTITUT JOZEF STEFAN
Institution Information	**Name:** INSTITUT JOZEF STEFAN **Type:** RTO **Country:** Slovenia **Website:** https://www.ijs.si/ijsw
	Name: CENTRE NATIONAL DE LA RECHERCHE SCIENTIFIQUE **Type:** RTO **Country:** France **Website:** www.cnrs.com
	Name: TECHNISCHE UNIVERSITAET WIEN **Type:** University **Country:** Austria **Website:** https://www.tuwien.ac.at
	Name: THE PROVOST, FELLOWS, FOUNDATION SCHOLARS & THE OTHER MEMBERS OF BOARD OF THE COLLEGE OF THE HOLY & UNDIVIDED TRINITY OF QUEEN ELIZABETH NEAR DUBLIN" **Type:** University **Country:** Ireland

	Website: https://www.tcd.ie
	Name: FACHHOCHSCHULE ST. POELTEN FORSCHUNGS GMBH **Type:** University **Country:** Austria **Website:** https://www.fhstp.ac.at/de
	Name: LEIBNIZ-INSTITUT FUER FESTKOERPER- UND WERKSTOFFFORSCHUNG DRESDEN E.V. **Type:** RTO **Country:** Germany **Website:** https://www.ifw-dresden.de
	Name: TECHNISCHE UNIVERSITAET DARMSTADT **Type:** University **Country:** Germany **Website:** https://www.tu-darmstadt.de/

Project	SNAPPER: "The development of a novel rare-earth magnet based wave power conversion system" Funding programme: FP7-SME-2008-1 Start date: 2009-09-01 End date: 2011-08-31 Funding: 1 M€ Number of partners: 8 Coordinator: OFFSHORE RENEWABLE ENERGY CATAPULT
	Name: NATIONAL RENEWABLE ENERGY CENTRE LIMITED **Type:** RTO **Country:** United Kingdom **Website:** www.narecde.co.uk
	Name: THE UNIVERSITY OF EDINBURGH **Type:** University **Country:** Scotland **Website:** www.ed.ac.uk

Project	THERMO-SPIN: "Thermoelectric power generation from anomalous Nernst effect based on rare earth free hard magnetic materials" Funding programme: FP7-PEOPLE-2013-IEF Start date: 2014-03-01 End date: 2016-02-29

	Funding: 255 k€ Number of partners: 1 Coordinator: THE PROVOST, FELLOWS, FOUNDATION SCHOLARS & THE OTHER MEMBERS OF BOARD OF THE COLLEGE OF THE HOLY & UNDIVIDED TRINITY OF QUEEN ELIZABETH NEAR DUBLIN"
	Name: THE PROVOST, FELLOWS, FOUNDATION SCHOLARS & THE OTHER MEMBERS OF BOARD OF THE COLLEGE OF THE HOLY & UNDIVIDED TRINITY OF QUEEN ELIZABETH NEAR DUBLIN **Type:** University **Country:** Ireland **Website:** https://www.tcd.ie

3 Investors (patents)

3.1 Methodology

Second step of the stakeholder analysis was performed scanning all the patents related to the REE4EU value chain. Exploiting online search tools like PatentScope (patentscope.wipo.int/search), Espacenet (worldwide.espacenet.com) and the PNO's InnovationPlace (www.innovationplace.eu), the stakeholder analysis team was allowed to gather from a database of more than 59 million patent documents.

Figure 7 PatentScope homepage

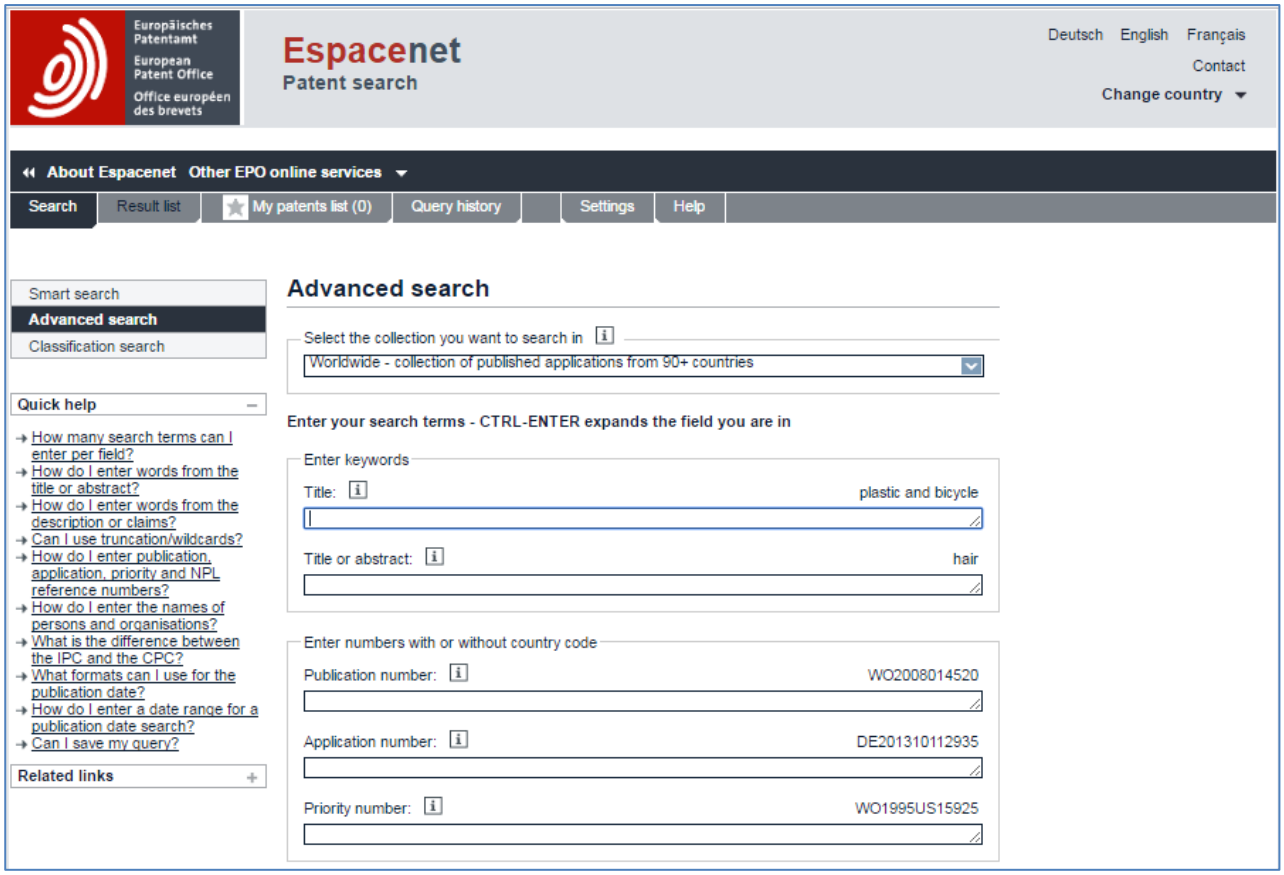

Figure 8 Espacenet homepage

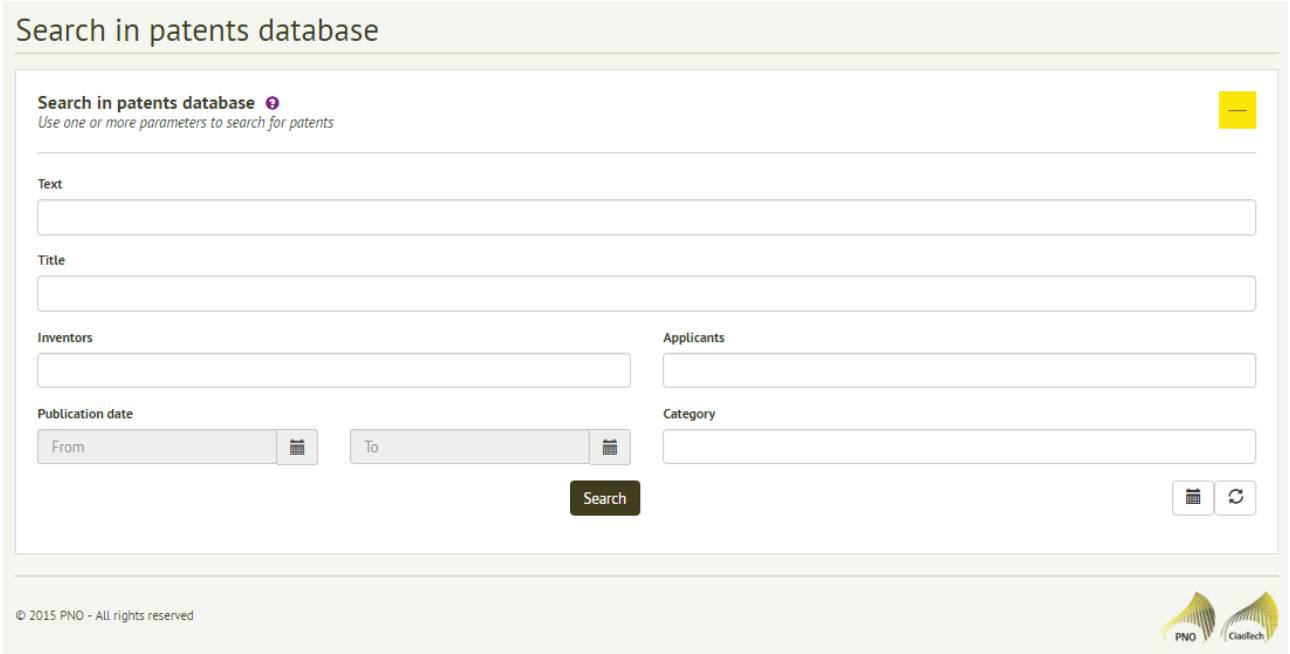

Figure 9 InnovationPlace patent search tool

The identification of the relevant corpus of patents has been made screening the sections, classes and subclasses of the International Patent Classification (IPC) system. This system allows to sort inventions and their documents into technical fields covering all areas of technology. Every patent document, application

and granted patent, has a classification code indicating its allocation to a specific area of technology. This peculiarity has allowed a fast and effective identification of the corpus of patents on which the analysis was based. The whole C22B-059 subclass, comprising more than 640 patent families (about 2,700 documents), was identified:

- C22 - Metallurgy; Ferrous or non-ferrous alloys; Treatment of alloys or non-ferrous metals

- C22B - Production or refining of metals; Pre-treatment of raw materials

- C22B-059 - Obtaining rare earth metals

First screen - quick analysis

The analyst firstly performed a "quick analysis" checking the whole corpus of patents, in order to preliminarily assess the selected documents. Plotting the number of patents released over time, for instance, it was possible to identify two "waves". Plotting the distribution of documents over countries of release and comparing the two scenarios (before/after the second wave), it was possible to appreciate how countries like China and Japan has drastically increased R&D activities in the sector, compared to US or France, who were the leaders before 2009.

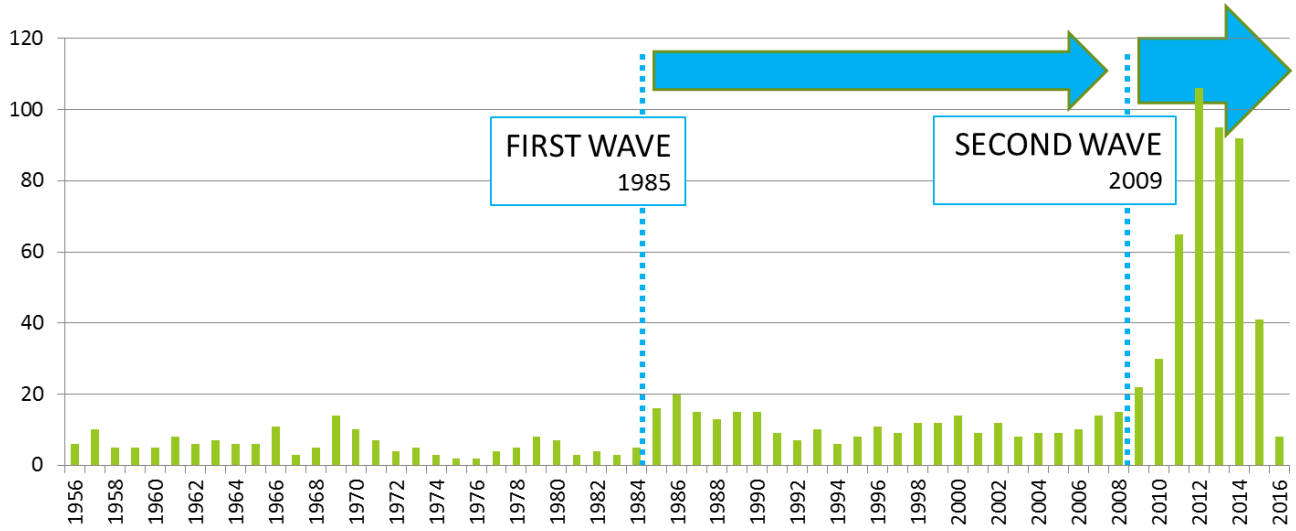

Figure 10 C22B-059 patents released per year – first and second wave

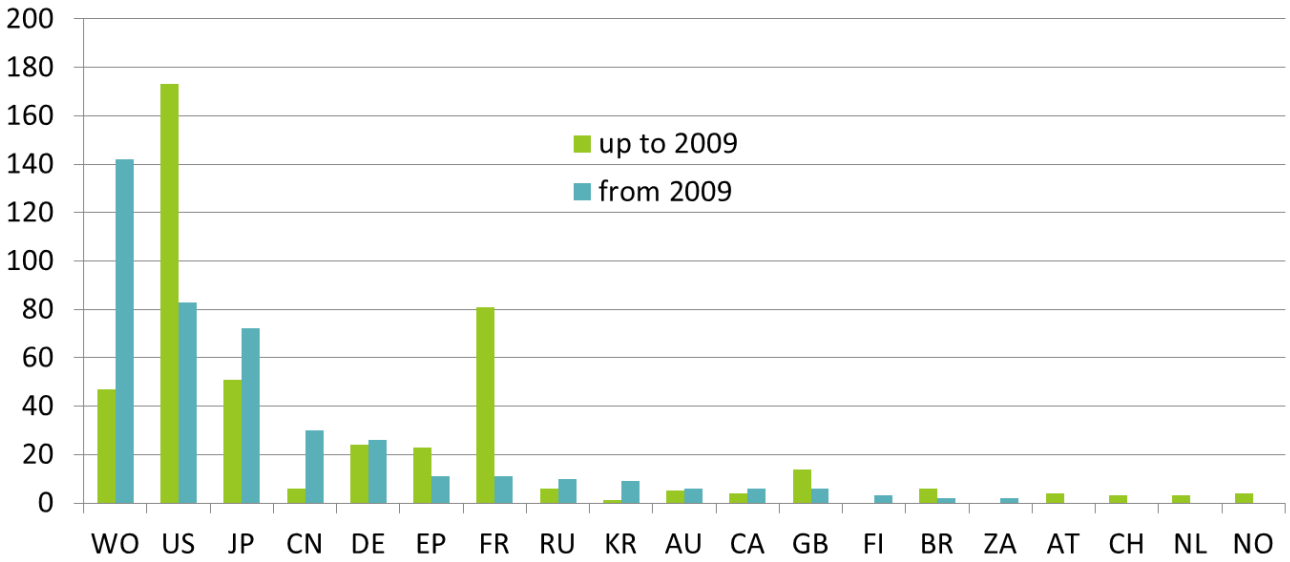

Figure 11 C22B-059 patents released per country – before/after the second wave

The main assignees have also changed before/after the second wave and only 4 entities have remained in the top30 list.

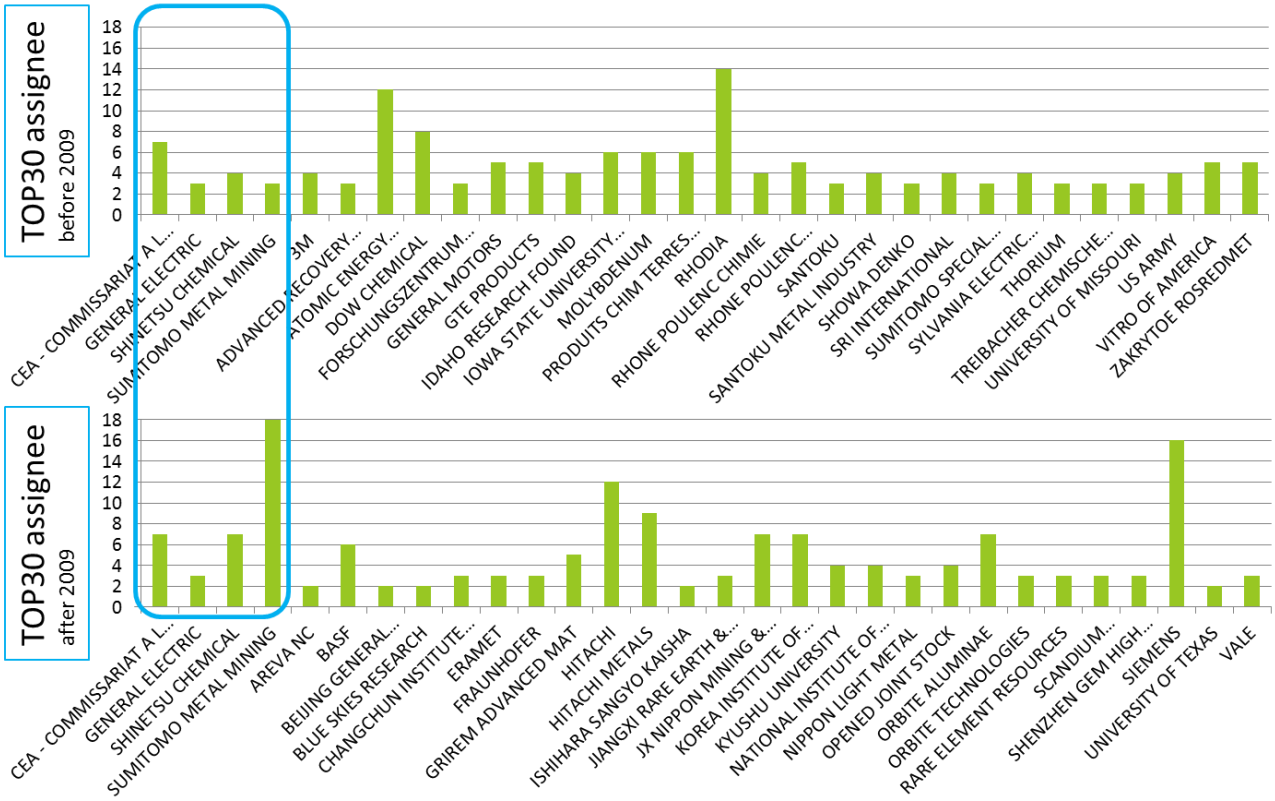

Figure 12 C22B-059 patents top assignees - before/after the second wave

In-depth analysis – Innovation & Investing Map

Second step of the patent analysis was underpinned by a new approach studied by PNO for a fast and effective classification of stakeholders, in order to easily enrich the picture of "who is doing what" in the scope of the REE4EU value chain. With the INNOVATION & INVESTING MAP, in fact, it is possible to extract and perform a preliminary analysis of the main assignees of a selected corpus of patents. The main idea behind this tool is the possibility to visualize the position of stakeholders in terms of innovation capacity and investing capacity. In this specific case, the indicators adopted were, respectively, the number of patents released and the revenue.

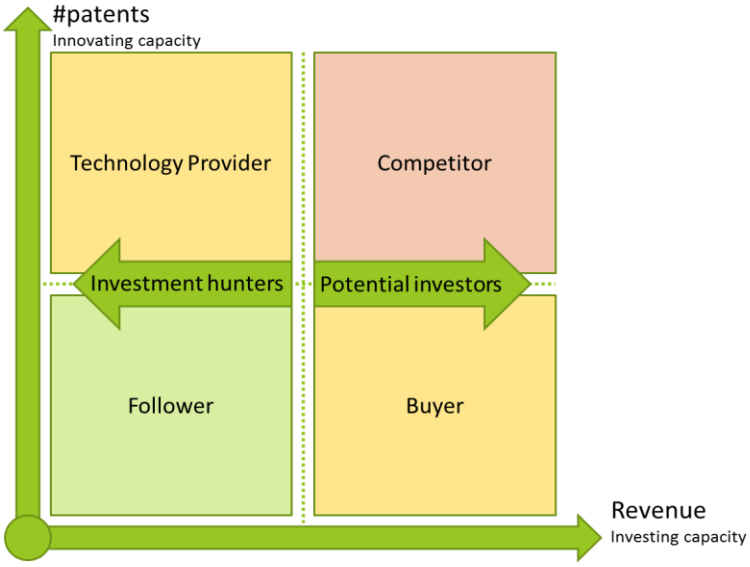

Figure 13 Innovation & Investing Map

Dividing the map in four quarters, the analysts were able to qualitatively assess the profile of each one of the top patent assignees. The four different profiles, organized in two macro-groups, are presented hereafter:

Potential investors - Stakeholders with high investing capacity, fully or marginally interested in the recovery of rare earth elements. In this group there are large industries, capital intensive companies and end users. Most likely, assignees that have released more patents own a strong know-how and can be considered COMPETITORS of the REE4EU technology. Assignees with a reduced number of patents might be interested in acquiring the REE4EU technology to expand in the sector (BUYERS).

Investment hunters - Stakeholders with low investing capacity, fully or marginally interested in the recovery of rare earth elements. In this group there are RTOs and SMEs or companies with low revenue due to their early developing stage. Assignees that have released more patents own a strong know-how and can be considered TECHNOLOGY PROVIDERS. Assignees with a reduced number of patents might be considered FOLLOWERS.

Top assignees were plotted in the Innovation & Investing Map (figure 14). Entities with very small revenue, like startups at their development stage, and RTOs who are not considered with a large revenue that allow a significant industrial investment, have been positioned with artificial revenue values, respectively 1 and 10 MEUR, allocating them in the "investment hunter" section of the map.

In order to improve the visibility of the results, a second version of the map was studied, adopting the number of patents released times the number of citations received as Innovating Capacity indicator (see figure 15). The outcome was a shift of some of the stakeholders from the lower part of the chart to the upper one.

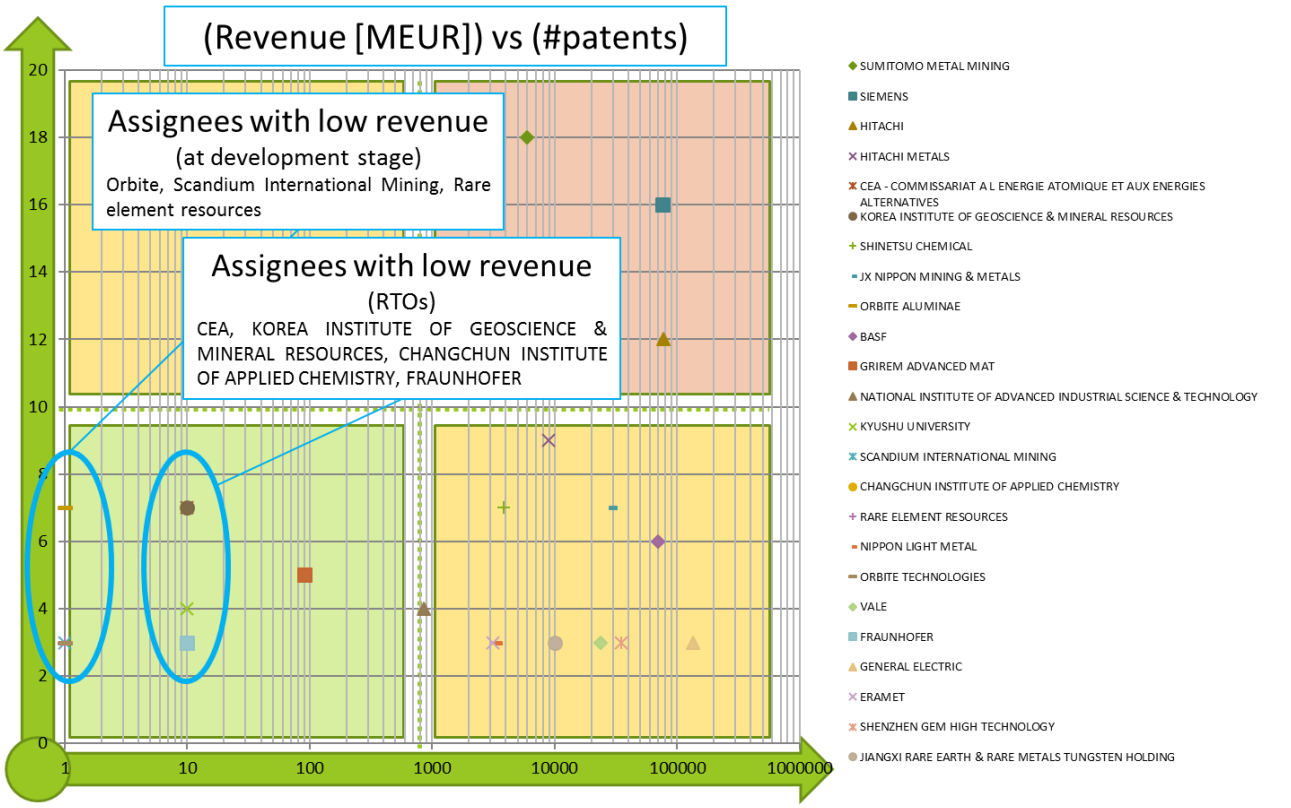

Figure 14 Innovation & Investing Map – top assignees overview (Revenue vs #patents)

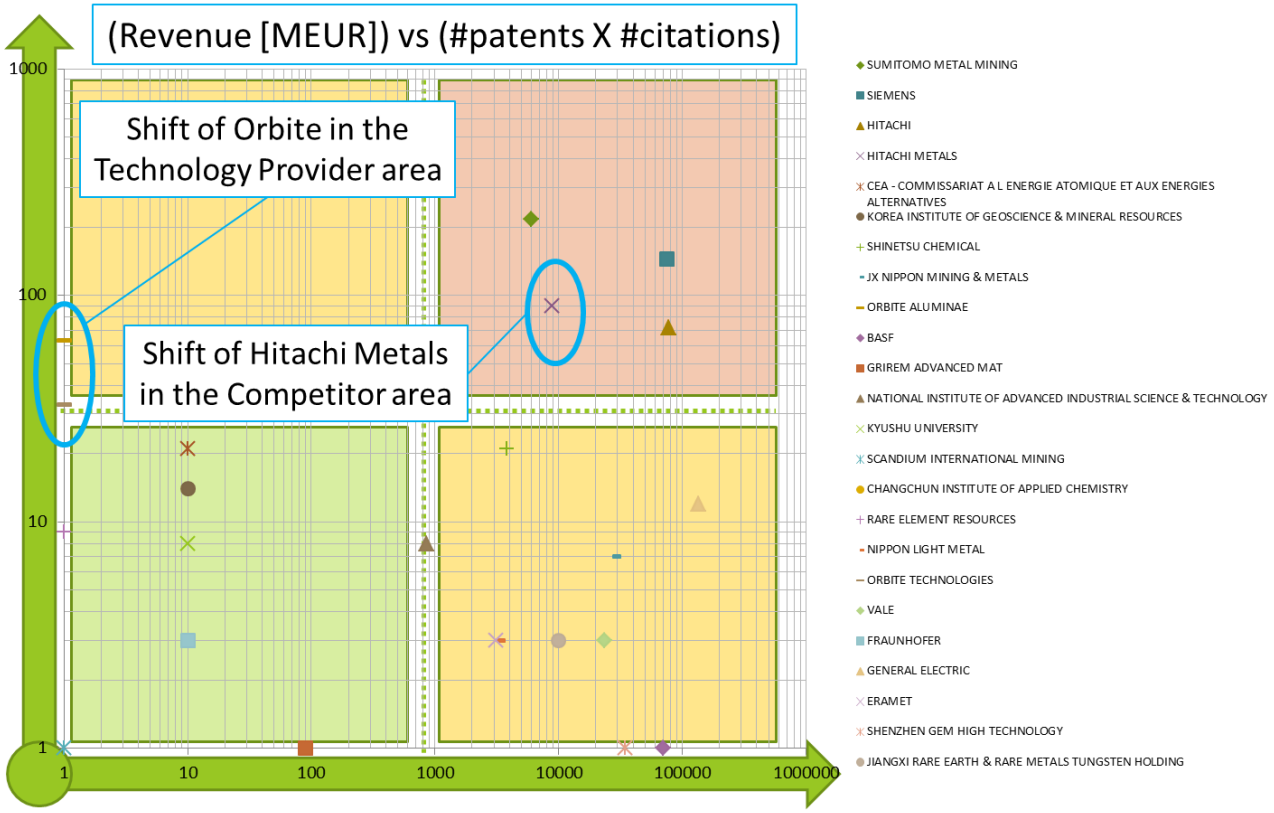

Figure 15 Innovation & Investing Map – top assignees overview (Revenue vs #patents X #citations)

The in-depth analysis of three of the identified stakeholders from different categories is presented in this section.

SIEMENS – GENERAL ELECTRIC

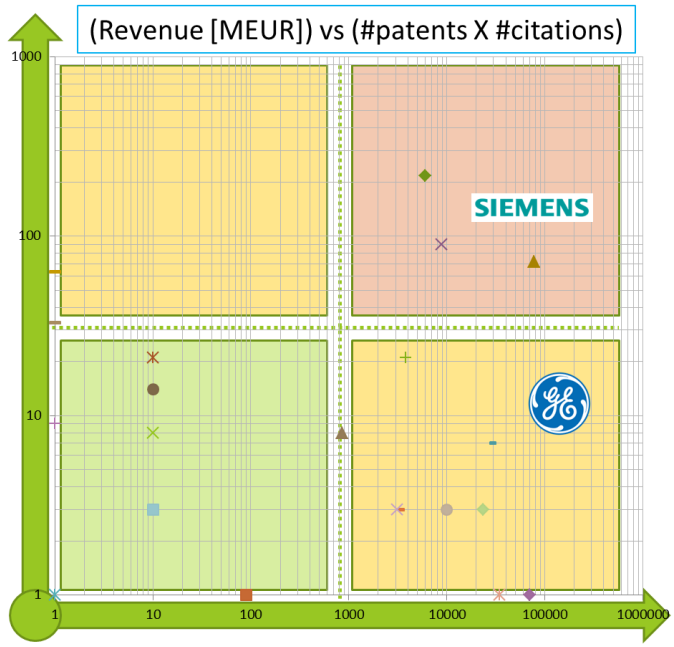

Figure 16 Innovation & Investing Map – Siemens and General Electric

Siemens and General Electric operate in the same market sectors and their revenue is comparable. On the contrary, their patent portfolio is different, showing divergent R&D strategy in the recovery of rare earth metals field.

Covering a large products portfolio (Power generation technology, industrial and buildings automation, medical technology, railway vehicles, water treatment, fire alarms, PLM software), Siemens' business is located in the END-USER block of the value chain. Nevertheless, R&I and IP analysis show that Siemens is interested in REE recovery. The company, in fact, is involved as partner in the EU project ROMEO (FP7-NMP, Replacement and Original Magnet Engineering Options, www.romeo-fp7.eu), and has released 16 patents classified C22B59 (Obtaining rare earth metals).

Table 3 C22B59 Siemens patent portfolio

Title	Publication
Method for synthesising a rare earth element by means of a redox reaction	WO2014206748
A reactor for leaching of rare earth containing material	EP3056577
Method for opening a eudialyte mineral	EP2995692
Preparation of solid, metal-comprising residues from slurries, in particular in magnet production, for further metallurgical processing	DE102014216640
Method for the thermal decomposition of a rare earth ore concentrate	DE102014212908
Method for obtaining a rare earth Element in elemental Form from at least one rare earth Element compound	DE102014201223
Plant and process for separating metals	DE102013205508
Method for obtaining at least one rare earth metal chloride and a rare earth metal	DE102012216647
Recycling waste comprising rare earth elements, produced during manufacturing of detector modules, comprises treating waste by heating to first temperature, and recovering rare earth elements from residues obtained during heating of waste	DE102012213457
Process for separation of rare earth metal ions	DE102014213766
Method for digesting a	DE102014218349

Method for separating rare-earth metal particles from a heterogeneous mixture containing rare-earth metals	WO2014154517
Method for the recovery of rare earths	DE102013203048
Method for the recovery of rare earths	DE102013203058
Process and apparatus for winning at least one valuable metal oxide	WO2014023464
Leaching method for extracting rare earths from rare earth minerals containing phosphate	DE102012210941

Siemens is one of the major European stakeholder active in the wind energy domain. Siemens produces the SWT-6.0-154, a 6MW wind turbine equipped with a 3-tons permanent magnet. Field tests of the turbines started on October 2012 at Siemens' Hovsore test site. Dong energy has a framework agreement with Siemens to supply 300 of the 6MW turbines between years 2014-17. Considering that about 0.6 kg of NdFeB alloys are needed for the production of 1kW, in 2040 about 360 tons of REE will be available to be recovered only from the Dong's wind parks.

General Electric operates through the following segments: Power & Water, Oil and Gas, Aviation, Healthcare, Transportation and Capital which cater to the needs of Financial services, Medical devices, Life Sciences, Pharmaceutical, Automotive, Software Development and Engineering industries. It can be considered a competitor of Siemens. GM's patents are marginally relevant. They are related to the recovery of REE from phosphor via halogenation step and reduction step, and recovery of REE from barrier coatings of combustors, high pressure turbine blades, vanes and shrouds. The company might be interested in investing more in the recovery of rare earths, especially because it appears to be interested in this topic for long term as it appears in the TOP30 assignee before and after 2009.

Table 4 C22B59 General Electric patent portfolio

Title	Publication
Rare earth recovery from phosphor material and associated method	US2012152062
Systems and methods for recovery of rare-earth constituents from environmental barrier coatings	CA2933377
Method for recovering bond coat and barrier coat materials from overspray and articles	US2014165783

ORBITE

A third example of patent assignee is the Canadian Orbite Technologies, former Orbite Aluminae, which has developed and patented its own 5-steps process for the production of High-purity Alumina, Rare earth Elements and Rare Metals. The process will be deployed for waste monetization, exploiting red mud, fly ash and mine tailings.

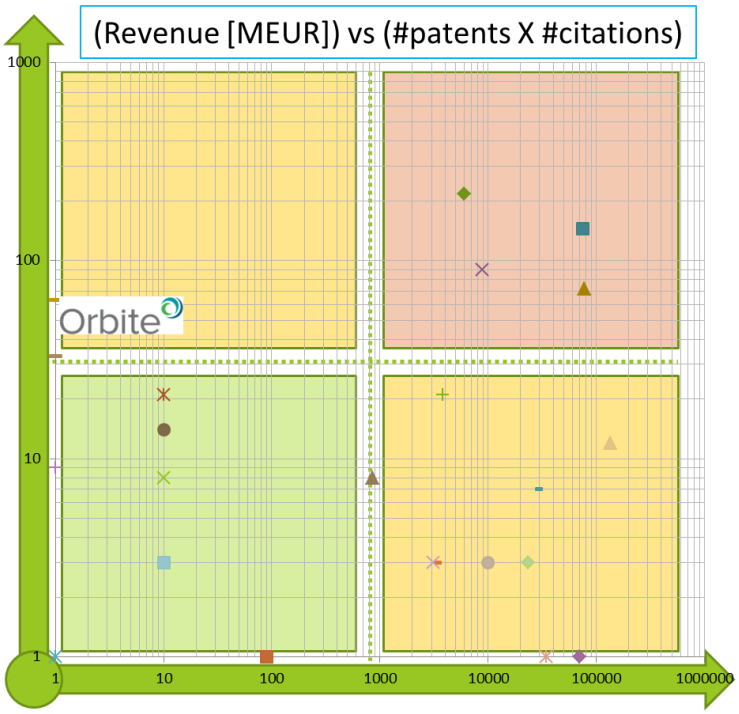

Figure 17 Innovation & Investing Map – Orbite Technologies

Table 5 C22B59 Orbite patent portfolio

Title	Publication
Processes for recovering rare earth elements and rare metals	CA2868363
Processes for recovering rare earth elements from various ores	CA2834151
Processes for preparing titanium oxide and various other products	CA2878744
Processes for preparing alumina and various other products	CA2848751
Processes for treating fly ashes	CA2903512
Processes for recovering rare earth elements from various materials	WO2013170370
Processes for recovering rare earth elements and rare metals	CA2790558
Processes for recovering rare earth elements from aluminum-bearing materials	CA2829049
Processes for preparing titanium oxide and various other products	US2015159239

Together with the shown patents related to REE recovery, Orbite has released several other patents. Currently the firm owns the IP rights to 37 patents and 91 pending patent applications in 11 different countries.

Orbite has signed a 10-year, 100% off-take agreement with Glencore for the alumina produced from their proposed SGA plant. Regarding the waste monetization, in 2013 Orbite and Veolia Environmental Services endeavour to bring the solution to treat the red mud stockpiled around the world in an economically and socially sustainable manner. The Orbite process is the only proven and commercially viable ecofriendly technology for treating Bayer process tailings; it recovers their entire commercial value and can extend the lifespan of Bayer plants.

This exercise has shown the potential of combining the three investigation approaches, EU projects, patents and market, capable of grasping and profiling stakeholders with different market and R&D strategies. The final outcome of the patent analysis is presented in the following sections of this document.

3.2 General overview of the "Investors" identified and their positions in the global REE supply chain

An helicopter view of the top assignees that we call "Investors", as they have been active in protecting their ideas via patents, and their position in the value chain is provided in Figure 18. Detailed profiles of all the "Investors" are presented in sections 3.3 and 3.4, gathered according to their value chain position.

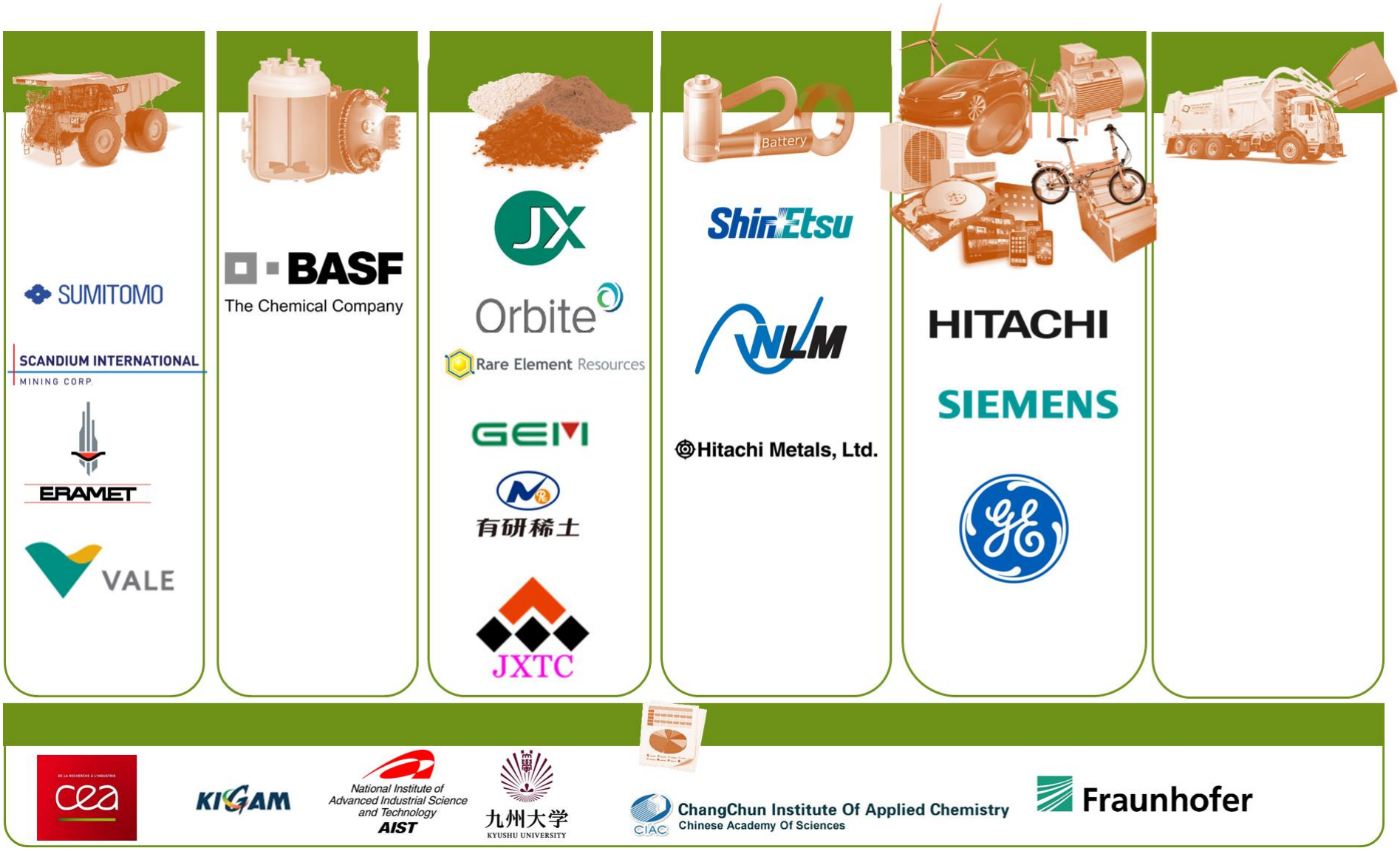

Figure 18 Investors position in the REE4EU value chain

3.3 Profit Stakeholders

3.3.1 Primary suppliers

Company information	**Name:** ERAMET **Type:** Large Industry **Country:** France **Website:** www.eramet.com/en
General description	ERAMET is a French multinational mining and metallurgy company, listed on the Euronext Paris exchange. It produces non-ferrous metals and derivatives, nickel alloys and superalloys, and high-performance special steels (used by industries such as aeronautics, energy production and tooling).
Link to REE4EU	ERAMET has an R&D unit dedicated to work on the recycling of metals, sorting and recovering their own industrial waste; they also develop their production from secondary raw materials. In addition, ERAMET conceives and develops major projects in new activities with high growth potential, such as mineral sands (titanium and zircon), lithium, niobium, rare earths as well as in recycling. Valdi, an ERAMET Group subsidiary, is a Europe-wide solution for battery, catalyst and metal oxide recycling with a strong commitment: zero landfill and 100% recovery.
Websites to patents	1. https://patentscope.wipo.int/search/en/detail.jsf?docId=WO2012093170 2. http://patents.com/us-20160032419.html 3. https://patentscope.wipo.int/search/en/detail.jsf?docId=WO2012093170 4. https://patentscope.wipo.int/search/en/detail.jsf?docId=WO2014118288

Company information	**Name:** SCANDIUM INTERNATIONAL MINING **Type:** Large Industry **Country:** Australia **Website:** www.scandiummining.com/s/Home.asp
General description	Scandium International Mining (SCY) possesses more than 120 years of collective industry experience in all phases of mine development, including financing, property identification, exploration, resource definition and permitting, metallurgical processing, mining, operations and reclamation. The Company is focused on the development of scandium, rare earth minerals, and other specialty metals.
Link to REE4EU	The company has released patents related to new metallurgic solution for obtaining REE.

Websites to patents	1. http://www.freepatentsonline.com/y2016/0177420.html 2. http://www.freepatentsonline.com/y2016/0153070.html 3. https://worldwide.espacenet.com/publicationDetails/biblio?CC=US&NR=2016289795A1&KC=A1&FT=D 4. https://worldwide.espacenet.com/publicationDetails/biblio?CC=US&NR=2012204680A1&KC=A1&FT=D

Company information	**Name:** SUMITOMO METAL MINING **Type:** Large Industry **Country:** Japan **Website:** www.smm.co.jp/E/
General description	Sumitomo Metal Mining (SMM) operates through the following segments: Mineral Resources, Smelting and Refining, and Materials. The Mineral Resources segment includes the exploration, development and production of non-ferrous metal resources as well as the sale of ores and other products. The Smelting and Refining segment sells copper, nickel, ferro-nickel, zinc, lead, and precious metals. The Materials segment manufactures and sells lead frames, tape materials, bonding wires, and advanced materials.
Link to REE4EU	The focus of SMM's R&D activities is the separation of scandium, cobalt, nickel and RE metals from active materials. In total, 18 applications have been patented on the field of extraction of metals.
Websites to patents	1. https://worldwide.espacenet.com/publicationDetails/biblio?CC=CA&NR=2900945A1&KC=A1&FT=D 2. https://patentscope.wipo.int/search/en/detail.jsf?docId=WO2012140998&recNum=162&docAn=JP2012057597&queryString=(PA/sumitomo)%20OR%20(PA/yazaki)%20&maxRec=10258 3. https://patentscope.wipo.int/search/en/detail.jsf?docId=WO2015115269 4. https://patentscope.wipo.int/search/en/detail.jsf?docId=WO2015022843 5. https://worldwide.espacenet.com/publicationDetails/biblio?CC=US&NR=2015284821A1&KC=A1&FT=D 6. https://worldwide.espacenet.com/publicationDetails/biblio?CC=US&NR=9399804B2&KC=B2&FT=D 7. https://worldwide.espacenet.com/publicationDetails/biblio?CC=EP&NR=3091093A1&KC=A1&FT=D 8. https://patentscope.wipo.int/search/en/detail.jsf?docId=WO2013069562 9. https://patentscope.wipo.int/search/en/detail.jsf?docId=WO2013136941&recNum=80&docAn=JP2013054419&queryString=(PA/sumitomo)%20OR%20(PA/yazaki)%20&maxRec=12094 10. https://worldwide.espacenet.com/publicationDetails/biblio?CC=EP&NR=2597164B1&KC=B1&FT=D 11. https://patentscope.wipo.int/search/en/detail.jsf?docId=WO2015111697

	12. https://patentscope.wipo.int/search/en/detail.jsf?docId=WO2015111695 13. https://patentscope.wipo.int/search/en/detail.jsf?docId=WO2016084830 14. https://worldwide.espacenet.com/publicationDetails/biblio?CC=US&NR=9199245B1&KC=B1&FT=D

Company information	**Name:** VALE **Type:** Large Industry **Country:** Brazil **Website:** www.vale.com/EN/business/mining/pages/default.aspx
General description	Vale SA is a Brazilian multinational corporation engaged in metals and mining and one of the largest logistics operators in Brazil. Its main activities include iron ore, alumina and bauxite production; sea and rail transport logistics; and hydroelectric generation The company is listed on the stock exchanges of São Paulo, New York City, Paris, Hong Kong, and Madrid.
Link to REE4EU	Vale has already three patents on the chemical extraction of scandium and other REE from intermediate products in the hydrometallurgical processing.
Websites to patents	1. https://worldwide.espacenet.com/publicationDetails/biblio?CC=US&NR=2013336856A1&KC=A1&FT=D 2. https://worldwide.espacenet.com/publicationDetails/biblio?CC=WO&NR=2015172217A1&KC=A1&FT=D 3. https://worldwide.espacenet.com/publicationDetails/biblio?CC=US&NR=2014314639A1&KC=A1&FT=D

3.3.2 REE Recovery

Company information	**Name:** BASF **Type:** Large Industry **Country:** Germany **Website:** www.basf.com/be/en.html
General description	BASF has a great deal of experience in refining a range of precious metal materials, from automotive catalysts to advanced materials. BASF has joint ventures in Japan and Korea that recycle scrap of precious metal bearing materials.
Link to REE4EU	BASF has six patents directly related to the recovery of rare earth elements and precious metals
Websites to patents	1. https://patentscope.wipo.int/search/en/detail.jsf?docId=WO2012082597

	2. https://patentscope.wipo.int/search/en/detail.jsf?docId=WO2013064944&redirectedID=true 3. https://patentscope.wipo.int/search/en/detail.jsf?docId=WO2007099119&redirectedID=true 4. https://patentscope.wipo.int/search/en/detail.jsf?docId=WO2014056844 5. http://www.patentsencyclopedia.com/app/20130108526 6. https://patentscope.wipo.int/search/ar/detail.jsf;jsessionid=C97E11D6446B269098EA07885D64E48C.wapp1nB?docId=WO2013080066&recNum=181&office=&queryString=&prevFilter=%26fq%3DOF%3AWO%26fq%3DPAF_M%3A%22BASF+SE%22&sortOption=Relevance&maxRec=6050

3.3.3 REA producers

Company information	**Name:** GRIREM ADVANCED MAT **Type:** Large Industry **Country:** China **Website:** www.grirem.com
General description	Grirem Advanced Materials Co., Ltd. operates as a subsidiary of Grinm Advanced Materials. It specializes in the production of rare earth metals and oxides in China. Grirem Advanced Materials develops, mines, and produces rare earth and related materials. It offers RE chemicals, such as high purity RE compounds, RE metals and alloys; RE magnetic effect materials, and agri-RE materials, (such as RE fertilizer and feed additives, and RE plant regulators).
Link to REE4EU	Grirem Advanced Mat has four patents about the rare earth recovery from leachate waste water of metal processing industries.
Websites to patents	1. https://worldwide.espacenet.com/publicationDetails/biblio?CC=US&NR=8721998B2&KC=B2&FT=D 2. https://worldwide.espacenet.com/publicationDetails/biblio?CC=US&NR=2015252449A1&KC=A1&FT=D 3. https://patentscope.wipo.int/search/en/detail.jsf?docId=WO2016106732&recNum=23&docAn=CN2014096023&queryString=&maxRec=2881841 4. https://patentscope.wipo.int/search/en/detail.jsf?docId=WO2016041436

Company information	**Name:** JIANGXI RARE EARTH & RARE METALS TUNGSTEN HOLDING **Type:** Large Industry **Country:** China **Website:** www.jxtc.com.cn

General description	Jiangxi Rare Metals Tungsten is a large-scale Chinese industrial enterprise. The group activities comprise exploration, mining, smelting, processing, trade and equipment manufacturing.
Link to REE4EU	Jixangxi focuses not only the primary sources like mining but also scrap recycling. The research centre of Jixangxi has three patents on recovery of secondary tungsten-containing scrap and waste and other valuable constituents, if available.
Websites to patents	1. https://worldwide.espacenet.com/publicationDetails/biblio?CC=US&NR=9255307B2&KC=B2&FT=D 2. https://google.com/patents/EP2602425A1?cl=no 3. https://worldwide.espacenet.com/publicationDetails/biblio?CC=EP&NR=2602426A1&KC=A1&FT=D

Company information	**Name:** RARE ELEMENT RESOURCES **Type:** SME **Country:** United States **Website:** www.rareelementresources.com/
General description	Rare Element Resources (RER) is a publicly traded mineral resource company focused on exploration and development of rare-earth element deposits that carry a favorable distribution of critical rare earths. The Company is advancing development of the 100% owned Bear Lodge Critical Rare Earth Project, located in northeast Wyoming, the USA.
Link to REE4EU	RER has three patents on the topic of processing schemes for the extraction and/or separation of rare earth elements (REEs) from rare earth containing products such as rare earth mineral ore bodies and intermediate products.
Websites to patents	1. https://worldwide.espacenet.com/publicationDetails/biblio?CC=WO&NR=2016058007A3&KC=A3&FT=D 2. https://worldwide.espacenet.com/publicationDetails/biblio?CC=US&NR=2016002751A1&KC=A1&FT=D 3. https://worldwide.espacenet.com/publicationDetails/biblio?CC=WO&NR=2014113742A2&KC=A2&FT=D

Company information	**Name:** ORBITE ALUMINAE & TECHNOLOGIES **Type:** SME **Country:** Canada **Website:** www.orbitetech.com/English/Home/default.aspx
General description	ORBITE is a mineral processing industry specialized in three business lines: speciality products, waste minimization and commodity minerals. In speciality products the main aim is the production of valuable, highly demanded materials, such as High-Purity Alumina, REs and metals.

Link to REE4EU	RE and metals, such as Gallium, Scandium, Dysprosium, Praseodymium, Yttrium, and Neodymium are the special products which ORBITE technologies intend to produce in sustainable ways. They aim to develop technological devices and processes to recovery these elements through the most efficient and sustainable methods.
Websites to patents	1. https://worldwide.espacenet.com/publicationDetails/biblio?CC=CA&NR=2790558A1&KC=A1&FT=D 2. https://worldwide.espacenet.com/publicationDetails/biblio?CC=US&NR=2014373683A1&KC=A1&FT=D 3. https://worldwide.espacenet.com/publicationDetails/biblio?CC=US&NR=9290828B2&KC=B2&FT=D 4. https://worldwide.espacenet.com/publicationDetails/biblio?CC=WO&NR=2013037054A1&KC=A1&FT=D 5. https://worldwide.espacenet.com/publicationDetails/biblio?CC=US&NR=9181603B2&KC=B2&FT=D 6. https://patentscope.wipo.int/search/en/detail.jsf?docId=WO2013170370&recNum=2&docAn=CA2013000492&queryString=(Nickel%20AND%20laterite)%20&maxRec=266 7. https://worldwide.espacenet.com/publicationDetails/biblio?CC=CA&NR=2790558A1&KC=A1&FT=D 8. https://worldwide.espacenet.com/publicationDetails/biblio?CC=US&NR=9260767B2&KC=B2&FT=D

Company information	**Name:** JX NIPPON MINING & METALS **Type:** Large Industry **Country:** Japan **Website:** www.nmm.jx-group.co.jp/english/
General description	JX offers metal products. The Company develops, mines, smelts, refines, and markets non-ferrous metals, such as copper, gold and silver. It also manufactures and sells copper foils, semiconductor materials, precision-rolled coppers, copper-alloy products, and special steel products.
Link to REE4EU	One of JX'stargets is the recycling of non-ferrous metal materials and the treatment of industrial waste for reuse. JX has several patents on the processes for extraction and purification of RE metals .
Websites to patents	1. https://patentscope.wipo.int/search/en/detail.jsf?docId=WO2014013929&recNum=43&docAn=JP2013068963&queryString=&maxRec=5196 2. https://worldwide.espacenet.com/publicationDetails/biblio?CC=US&NR=2014199203A1&KC=A1&FT=D 3. https://worldwide.espacenet.com/publicationDetails/biblio?CC=CA&NR=2848897A1&KC=A1&FT=D 4. https://patentscope.wipo.int/search/en/detail.jsf?docId=WO2013047104 5. https://worldwide.espacenet.com/publicationDetails/biblio?CC=US&NR=8980169B2&KC=B2&FT=D

	6. https://patentscope.wipo.int/search/en/detail.jsf?docId=WO2012099092

Company information	**Name:** SHENZHEN GEM HIGH TECHNOLOGY **Type:** Large industry **Country:** China **Website:** http://gemhi-tech.lookchem.com/About.html
General description	Shenzhen Gem High Technology headquarter is in Shenzhen, China and was established in 2002. It is the first A-shares listed company in Chinese cobalt industry. The company has been named National High-tech Enterprise, National Recycling Economy Demonstration Pilot and National innovation pilot enterprises. The company's core business is the research and manufacture of ultra-fine cobalt and nickel powder.
Link to REE4EU	Shenzhen Gem High Technology has three important patents on developing a process for recycling REs in permanent magnet scrap of electronic waste
Websites to patents	1. https://patentscope.wipo.int/search/en/detail.jsf?docId=WO2013053186&recNum=242&docAn=CN2011084963&queryString=&maxRec=2224092 2. https://patentscope.wipo.int/search/en/detail.jsf?docId=WO2014000404 3. https://patentscope.wipo.int/search/en/detail.jsf?docId=WO2012162935&recNum=47&docAn=CN2011077723&queryString=&maxRec=4678529

3.3.4 REE intensive product manufacturer

Company information	**Name:** HITACHI METALS **Type:** Large Industry **Country:** JAPAN **Website:** www.hitachi-metals.co.jp
General description	The company manufactures high-grade metal products and materials, magnetic materials and applications, high-grade functional components and equipment, wires, cables, and related products.
Link to REE4EU	Hitachi Metals has devoted itself to the research and development of sintered NdFeB magnets for a long time. Hitachi Metals have several patents towards creating a methodology for REE metals collection and recovery from magnet alloys.
Websites to patents	1. http://www.freepatentsonline.com/y2016/0107197.html 2. https://worldwide.espacenet.com/publicationDetails/biblio?CC=US&NR=9376736B2&KC=B2&FT=D

	3. https://worldwide.espacenet.com/publicationDetails/biblio?CC=US&NR=2014186239A1&KC=A1&FT=D 4. https://patentscope.wipo.int/search/en/detail.jsf?docId=WO2014104205 5. https://patentscope.wipo.int/search/en/detail.jsf?docId=WO2013002376&recNum=274&docAn=JP2012066712&queryString=(FP/Hitachi)%20AND%20(PA/Hitachi)%20AND%20(IC/B)%20OR%20(IC/F)%20OR%20(IC/g)%20OR%20(IC/h)%20&maxRec=10275 6. https://patentscope.wipo.int/search/en/detail.jsf?docId=WO2011013489 7. https://worldwide.espacenet.com/publicationDetails/biblio?CC=US&NR=2014186239A1&KC=A1&FT=D

Company information	**Name:** NIPPON LIGHT METAL **Type:** Large Industry **Country:** Japan **Website:** www.nikkeikin.com/
General description	NIPPON Light Metal carries out manufacturing and sales activities in four business segments: Aluminum Ingot and Chemicals, Aluminum Sheet and Extrusions, Fabricated Products and Others, and Aluminum Foil, Powder and Paste. .
Link to REE4EU	NIPPON has patented three innovations on RE recovery and separation at the R&D centre in Japan.
Websites to patents	1. https://worldwide.espacenet.com/publicationDetails/biblio?CC=US&NR=2015086449A1&KC=A1&FT=D 2. https://worldwide.espacenet.com/publicationDetails/biblio?CC=CA&NR=2857263C&KC=C&FT=D 3. https://worldwide.espacenet.com/publicationDetails/biblio?CC=US&NR=2015086449A1&KC=A1&FT=D

Company information	**Name:** SHINETSU CHEMICAL **Type:** Large Industry **Country:** Japan **Website:** www.shinetsu.co.jp
General description	**Shin-Etsu Chemical is** the largest chemical company in Japan, ranked No. 9 in Forbes Global 2000 for chemical sector. Shin-Etsu had the largest global market share in 2014 for polyvinyl chloride, semiconductor silicon, and photomask substrates. The company has its manufacturing locations in 14 countries worldwide.
Link to REE4EU	R&D department in Shinetsu has specialized in chemical extraction of RE metals and has patented seven RE metal extraction applications.

Websites to patents	1. https://worldwide.espacenet.com/publicationDetails/biblio?CC=EP&NR=2995693A1&KC=A1&FT=D 2. https://worldwide.espacenet.com/publicationDetails/biblio?CC=US&NR=8802040B2&KC=B2&FT=D 3. https://worldwide.espacenet.com/publicationDetails/biblio?CC=EP&NR=2388343B1&KC=B1&FT=D 4. https://worldwide.espacenet.com/publicationDetails/biblio?CC=US&NR=8841482B2&KC=B2&FT=D 5. https://worldwide.espacenet.com/publicationDetails/biblio?CC=EP&NR=2929924A1&KC=A1&FT=D 6. https://worldwide.espacenet.com/publicationDetails/biblio?CC=US&NR=2013183208A1&KC=A1&FT=D

3.3.5 End users

Company information	**Name:** Siemens **Type:** Large Industry **Country:** Germany **Website:** www.siemens.com
General description	Siemens is a German company headquartered in Berlin and Munich. Siemens is the largest engineering company in Europe with numerous branch offices abroad. Siemens is also one of the biggest wind turbine producers in Europe and thus REE consumer to generate permanent magnets.
Link to REE4EU	Siemens has announced that the REE content in the permanent magnet generators will be systematically reduced or replaced by secondary REEs. Siemens has considerable investment on developing patents to create unique REE recovery technology(ies) and integrate them on their production process.
Websites to patents	1. http://www.freepatentsonline.com/y2016/0115569.html 2. https://data.epo.org/gpi/EP3056577A1 3. https://worldwide.espacenet.com/publicationDetails/biblio?CC=EP&NR=2995692A1&KC=A1&FT=D 4. https://patentscope.wipo.int/search/en/detail.jsf?docId=WO2016026632 5. http://www.freepatentsonline.com/y2016/0115569.html 6. https://patentscope.wipo.int/search/en/detail.jsf?docId=WO2014154407 7. https://patentscope.wipo.int/search/en/detail.jsf?docId=WO2014044527 8. https://worldwide.espacenet.com/publicationDetails/biblio?CC=DE&NR=4224931C2&KC=C2&FT=D 9. https://patentscope.wipo.int/search/en/detail.jsf?docId=WO2016008728

	10. https://patentscope.wipo.int/search/en/detail.jsf?docId=WO2014154517 11. http://www.sumobrain.com/patents/wipo/Process-apparatus-winning-at-least/WO2014023464A1.html 12. https://patentscope.wipo.int/search/en/detail.jsf?docId=WO2014000972

Company information	**Name:** GENERAL ELECTRIC **Type:** Large Industry **Country:** United States **Website:** www.ge.com/
General description	General Electric's (GE) products and services range from aircraft engines, power generation, and oil and gas production equipment to medical imaging, financing, and industrial products. The Company's segments include Power, Renewable Energy, Oil & Gas, Energy Management, Aviation, Healthcare, Transportation, Appliances & Lighting, and Capital.
Link to REE4EU	GE uses rare elements in their lightening and power generation instruments. So far, GE has patented three technologies, on rare earth elements recovery.
Websites to patents	1. http://appft1.uspto.gov/netacgi/nph-Parser?Sect1=PTO1&Sect2=HITOFF&d=PG01&p=1&u=/netahtml/PTO/srchnum.html&r=1&f=G&l=50&s1=20120152062.PGNR 2. https://worldwide.espacenet.com/publicationDetails/biblio?CC=US&NR=9409185B2&KC=B2&FT=D 3. https://patentscope.wipo.int/search/en/detail.jsf?docId=WO2014099435

Company information	**Name:** HITACHI **Type:** Large Industry **Country:** JAPAN **Website:** www.hitachi.com
General description	Hitachi is a highly diversified company that operates eleven business segments: Information & Telecommunication Systems, Social Infrastructure, High Functional Materials & Components, Financial Services, Power Systems, Electronic Systems & Equipment, Automotive Systems, Railway & Urban Systems, Digital Media & Consumer Products, Construction Machinery and Other Components & Systems.
Link to REE4EU	Hitachi is active in recycling for Rare Earth Metals by developing machinery to separate and collect rare earth magnets from end-of-life products, and extracting rare earths from rare earth magnets using a dry process.

Websites to patents	1. https://patentscope.wipo.int/search/en/detail.jsf?docId=WO2013011901&recNum=111&docAn=JP2012067736&queryString=(FP/Hitachi)%20AND%20(PA/Hitachi)%20AND%20(IC/B)%20OR%20(IC/F)%20OR%20(IC/g)%20OR%20(IC/h)%20&maxRec=10186 2. https://worldwide.espacenet.com/publicationDetails/biblio?CC=US&NR=9376736B2&KC=B2&FT=D 3. https://worldwide.espacenet.com/publicationDetails/biblio?CC=EP&NR=2684971A4&KC=A4&FT=D 4. http://www.freepatentsonline.com/WO2015083292.html 5. https://patentscope.wipo.int/search/en/detail.jsf?docId=WO2015019434 6. https://patentscope.wipo.int/search/en/detail.jsf?docId=WO2014021119 7. https://worldwide.espacenet.com/publicationDetails/biblio?CC=US&NR=9435009B2&KC=B2&FT=D 8. https://patentscope.wipo.int/search/en/detail.jsf?docId=WO2014030218

3.3.6 Horizontal

Company information	**Name:** UNITED CHEMICAL COMPANY URALCHEM **Type:** Large Industry **Country:** Russia **Website:** www.uralchem.com
General description	United Chemical Company UralChem OJSC was incorporated in 2007 and is based in Moscow. Together with its subsidiaries, it produces and sells mineral fertilizers in the Russian Federation and the CIS countries. The company offers nitrogen based, phosphate based, and complex fertilizers. It is also involved in the provision of construction, repair, and maintenance services; and transportation and logistics services, as well as the supply of electricity and heat energy.
Link to REE4EU	URALCHEM has three patents for developing a methodology for RE extraction and concentration. Several projects have been initiated also on recovery techniques of RE.
Websites to patents	1. https://worldwide.espacenet.com/publicationDetails/biblio?CC=WO&NR=2014148945A1&KC=A1&FT=D 2. https://worldwide.espacenet.com/publicationDetails/biblio?CC=EP&NR=2964794A4&KC=A4&FT=D 3. http://www.freepatentsonline.com/y2016/0047015.html

3.4 Non-profit stakeholders

Company information	**Name:** THE FRENCH ALTERNATIVE ENERGIES AND ATOMIC ENERGY COMMISSION **Type:** RTO **Country:** France **Website:** www.cea.fr/
General description	The French Alternative Energies and Atomic Energy Commission (CEA) is a key player in research, development and innovation in four main areas: defence and security, nuclear energy (fission and fusion), technological research for industry, fundamental research in the physical sciences and life sciences.
Link to REE4EU	Recycling REEs has been CEA's objective since 2005. CEA is specialized on the extraction/separation and valorisation of critical materials. CEA has already seven patents related to recycling of REE and several projects. CEA is also one of the REE4EU project partners to pre-treat raw materials for higher recovery efficiency.
Websites to patents	1. https://worldwide.espacenet.com/publicationDetails/biblio?CC=US&NR=2012175316A1&KC=A1&FT=D 2. https://patentscope.wipo.int/search/en/detail.jsf?docId=WO2014064597 3. https://worldwide.espacenet.com/publicationDetails/biblio?CC=US&NR=9284620B2&KC=B2&FT=D 4. https://patentscope.wipo.int/search/en/detail.jsf?docId=WO2015071848 5. https://patentscope.wipo.int/search/en/detail.jsf?docId=WO2014174483 6. https://patentscope.wipo.int/search/en/detail.jsf?docId=WO2016046179 7. https://patentscope.wipo.int/search/en/detail.jsf?docId=WO2016012413

Company information	**Name:** CHANGCHUN INSTITUTE OF APPLIED CHEMISTRY **Type:** RTO **Country:** China **Website:** www.english.ciac.cas.cn/
General description	Changchun Institute of Applied Chemistry (CIAC) was established in 1948 as a multidisciplinary chemistry institute, comprising 12 laboratories and units that conduct basic and applied research and high-tech innovation in polymer sciences, inorganic chemistry, analytical chemistry and physical chemistry. Currently, CIAC's research focuses on resources and the environment; advanced materials; and new and renewable resources of energy.

Link to REE4EU	CIAC is working in close collaboration with Rare Earth Co., Ltd, in China. They aim to upgrade the REs exploration and application in high-ends industry. It will combine the advantages of both sides in technology, marketing, R&D human resources, and promote the launching of new products in the future. In close collaboration, CIAC has already three patents on extraction and separation techniques of REEs.
Websites to patents	1. https://worldwide.espacenet.com/publicationDetails/biblio?CC=US&NR=2010319491A1&KC=A1&FT=D 2. https://patentscope.wipo.int/search/en/detail.jsf?docId=WO2016090809 3. https://patentscope.wipo.int/search/en/detail.jsf?docId=WO2015051585

Company information	**Name:** NATIONAL INSTITUTE OF ADVANCED INDUSTRIAL SCIENCE & TECHNOLOGY **Type:** RTO **Country:** Japan **Website:** www.aist.go.jp/index_en.html
General description	National Institute of Advanced Industrial Science & Technology (NIAIST) is a Japanese research facility headquartered in Tokyo. Most of its workforce is in Tsukuba Science City, Ibaraki, and in several cities throughout Japan. The institute is managed to integrate scientific and engineering knowledge to address socio-economic needs. It has been restructured as a legal body of independent administrative institution in 2001, remaining under the Ministry of Economy, Trade and Industry.
Link to REE4EU	NIAIST has patented four related technologies and methods, as well as published several scientific papers or book chapters on adsorption, separation and reuse of RE metals.
Websites to patents	1. https://worldwide.espacenet.com/publicationDetails/biblio?CC=US&NR=2016010178A1&KC=A1&FT=D 2. https://patentscope.wipo.int/search/en/detail.jsf?docId=WO2015087845 3. https://worldwide.espacenet.com/publicationDetails/biblio?CC=US&NR=2011192255A1&KC=A1&FT=D 4. https://patentscope.wipo.int/search/en/detail.jsf?docId=WO2016047700

Company information	**Name:** FRAUNHOFER GESELLSCHAFT ZUR FOERDERUNG DER ANGEWANDTEN FORSCHUNG E.V **Type:** RTO **Country:** Germany **Website:** www.fraunhofer.de

General description	Fraunhofer is Europe's largest application-oriented research organization, based in several locations in Germany. The main research focus of Fraunhofer is on health, security, communication, energy and the environment areas
Link to REE4EU	Fraunhofer is part of an ongoing project, entitled Lighthouse, about technologies to process rare earths elements more efficiently, reuse them or to find suitable substitutes for cell phone, laptop permanent magnet motors. It is involved via a group of researchers dedicated in Microstructure of materials and systems department.
Websites to patents	1. https://worldwide.espacenet.com/publicationDetails/biblio?CC=EP&NR=2910654A1&KC=A1&FT=D 2. https://patentscope.wipo.int/search/en/detail.jsf?docId=WO2015040045 3. https://patentscope.wipo.int/search/en/detail.jsf?docId=WO2014033004

Company information	**Name:** KOREA INSTITUTE OF GEOSCIENCE & MINERAL RESOURCES (KIGAM) **Type:** RTO **Country:** KOREA **Website:** www.english.kigam.re.kr/html/en/
General description	Korea Institute of Geoscience & Mineral Resources (KIGAM) is a government funded research institute of Geoscience since 1918. KIGAM aims for world-class R&D in geoscience technology such as rare metal recovery, deep-sea mineral plant, mineral fusion technology, geothermal energy storage.
Link to REE4EU	KIGAM is involved in a project study on the recovery of valuable metals from low grade complex ores using a smelting reduction process in which rare earth metals and strontium were concentrated. KIGAM has several patents on this topic.
Websites to patents	1. https://patentscope.wipo.int/search/en/detail.jsf?docId=WO2011065602 2. https://worldwide.espacenet.com/publicationDetails/biblio?CC=US&NR=2015211095A1&KC=A1&FT=D 3. https://worldwide.espacenet.com/publicationDetails/biblio?CC=US&NR=9458525B2&KC=B2&FT=D 4. https://worldwide.espacenet.com/publicationDetails/biblio?CC=KR&NR=101641074B1&KC=B1&FT=D

Company information	**Name:** KYUSHU UNIVERSITY **Type:** University **Country:** Japan

	Website: www.kyushu-u.ac.jp/en/
General description	Kyushu University (abbreviated to Kyudai), is a Japanese public university located in Fukuoka, Kyushu. It is one of Japan's National Seven Universities. The Faculty of Engineering consists of ten departments that cover all aspects of engineering, from the traditional to the innovative, and is dedicated to the development of new technologies.
Link to REE4EU	A group of researchers in the Faculty of Engineering, Department of Applied Chemistry has specifically focused on recovery and purification of RE and other metals, such as Ni and Co by extraction agents.
Websites to patents	1. https://worldwide.espacenet.com/publicationDetails/biblio?CC=CA&NR=2900945A1&KC=A1&FT=D 2. https://patentscope.wipo.int/search/en/detail.jsf?docId=WO2015022843 3. https://worldwide.espacenet.com/publicationDetails/biblio?CC=US&NR=2015284821A1&KC=A1&FT=D 4. https://patentscope.wipo.int/search/en/detail.jsf?docId=WO2013069562

4 Potential Business drivers

4.1 Methodology

After the identification of stakeholders involved in EU projects and in patents, the stakeholders analysis was complemented with a third pillar which we call "potential business drivers". Here the approach was focused on the identification of stakeholders that could benefit from the technologies and results of the project. Therefore the search was focused on potential end users or business drivers from the 9 products/applications listed in the ERECON report as the major products that use significant amounts of REE:

1. Hard disk drives, DVD and CD players
2. Automotive applications
3. Motors in industrial applications (e.g. servo motors from robotics)
4. Loudspeakers
5. Air conditioning compressors
6. Magnetic separators
7. Mixed electronics
8. Electric bicycles
9. Wind turbines

The search approach to identify relevant stakeholders encompassed several different sources as follow:

- Screening important market reports such as:
  - EREAN (European Rare Earth (Magnet) Recycling Network) ESR/ER JOURNAL PAPERS (http://www.erean.eu/science.php);
  - "Strengthening the European Rare Earths supply-chain – Challenges and policy options", report by ERECON network, 2013;
  - "Recovery of Rare Earths from electronic wastes: an opportunity for High-Tech SMEs", study for the Industry, Research and Energy (ITRE) committee, 2015;
  - Binnemans et al., Journal of Cleaner Production "Recycling of rare earth: a critical review", 2013;
  - Marc Humpries "Rare Earth Elements: the Global Supply Chain", CRS Report for Congress, 2013;
  - R. Schulze, M. Buchert, "Estimates of global REE recycling potentials from NdFeB magnet material, Resources, Conservation and Recycling", 113, 2016, 12–27;
  - "Rare Earths Elements – End Use and Recyclability", USGS Scientific Investigation Report 2011-5094;

- Desktop research and interviews with important industry associations related to the 9 products/applications reported by the ERECON Network such as:

Hard disk drives, DVD and CD players:

- International Disk Drive Equipment and Materials Association (IDEMA);
- Storage Products Association (SPA);
- Optical Storage Technology Association (OSTA);

Automotive applications:

- EUROBAT Association of European Automotive and Industrial Battery Manufacturers;
- The European Automobile Manufacturers Association (ACEA);
- Japan Automobile Manufacturers Association (JAMA);

- Korea Automobile Manufacturers Asssociation (KAMA);

Motors in industrial applications (e.g. servo motors from robotics):

- Glass For Europe;
- International Lead Association (ILA);
- The Motor Industry Association of New Zealand (Inc);
- Motion Control Association (MCA);
- Motor and Equipment Manufacturer Association (MEMA);

Loudspeakers

- Association of Loudspeaker Manufacturing & Acoustics International (ALMA International);

Air conditioning compressors

- Federation of European Heating, Ventilation and Air Conditioning Associations (REHVA);
- Association of the European Heating Industry (EHI);
- Europe's Industry Association for Indoor Climate, Process Cooling, and Food Cold Chain Technologies (EUROVENT);
- Air-Conditioning, Heating and Refrigeration Institute (AHRI)

Magnetic separators

- IMA – The International Magnetics Association;

Mixed electronics

- Association Connecting Electronics Industry (IPC);
- Electronic Components Industry Association (ECIA);
- Electronics Manufacturer Association (EMA);

Electric bicycles

- Bicycle Association of Great Britain (BAGB);
- USA eBike Association;
- China Bicycle Association;
- Light Electric Vehicle Association (LEVA);

Wind turbines

- WIND EUROPE;
- The 'Energy Agency's Secretariat for the Danish Wind Turbine Certification Scheme';
- International Energy Agency - Wind Energy System;

For each ERECON application, about 15 to 20 companies on average have been identified. A complete list of the selected companies and associations with a concise description of their profiles and their link to the REE4EU project are provided, summarising thus the results of the identification of key end users or potential business drivers.

4.2 General overview of the "potential business drivers" identified and their positions in the global REE supply chain

The major potential business drivers identified complements and enriches the database of stakeholders identified during the EU projects and patents analysis. A helicopter view of the potential business drivers and their position in the global REE supply is provided in Figure 19. Detailed profiles of all the potential business drivers are presented in sections 4.3 and 4.4, gathered according to their value chain position and the 9 products/applications listed in the ERECON report.

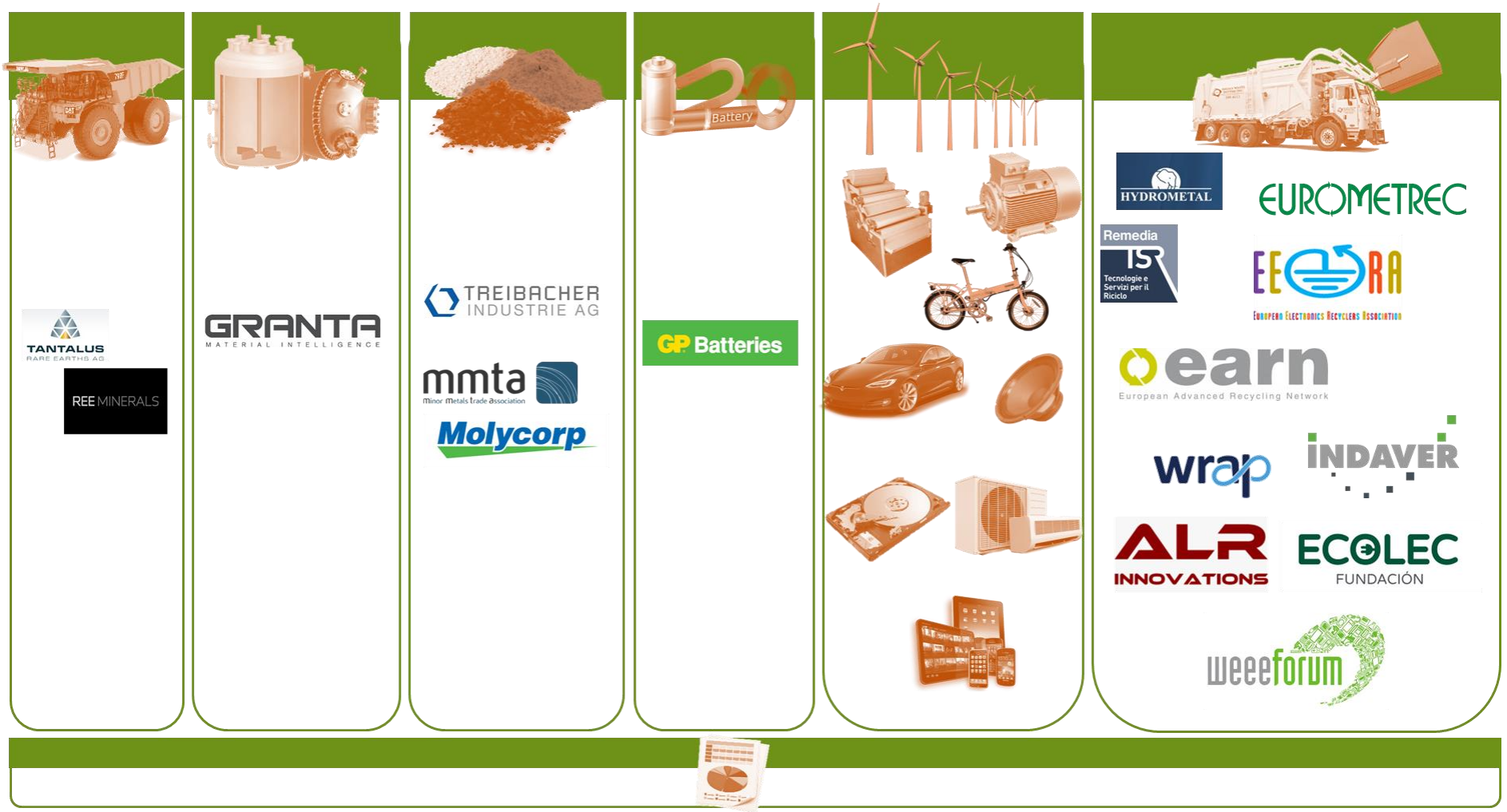

Figure 19 Potential business drivers position in the REE4EU value chain (1)-see figure 21 for the stakeholders under the end user position

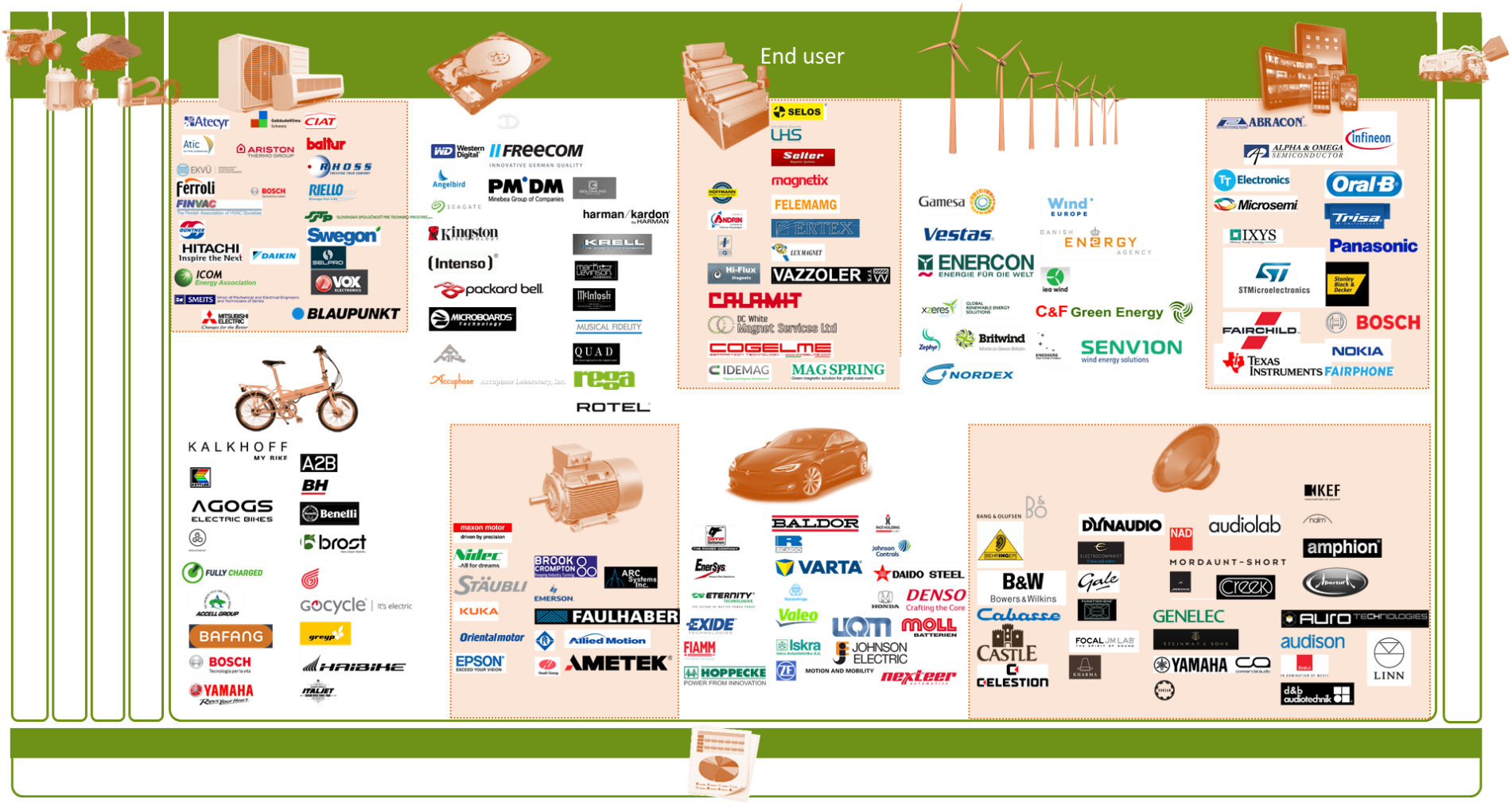

Figure 20 Potential business drivers position in the REE4EU value chain (2)

4.3 Profit Stakeholders and associations

4.3.1 Primary suppliers

Company information	**Name:** REE Minerals AS **Type:** SME **Country:** Norway **Website:** http://www.reeminerals.no/en/HOME/
Value chain position	Primary Suppliers
General description	REE Minerals AS was established in 1998. REE Minerals AS holds 100% of the shares of REE Minerals Fen AS. The FEN field is most famous for its large thorium deposits. The commercially most interesting minerals found are Rare Earth Elements (REE). REE Minerals AS holds very promising prospecting and mining rights in the FENS-field.
Link to REE4EU	The Fen Complex, an early Cambrian intrusive complex of alkaline rocks and carbonatites, is situated in Nome Municipality, Telemark County, 119 kilometers southwest of Oslo in the vicinity of the late Palaeozoic alkaline Oslo Rift. The intrusion has a roughly circular outcrop of 9 km^2 and is placed within Mesoproterozoic Telemark gneisses, which form part of the Gothian-Sveconorwegian terrane of southern Scandinavia. The eastern parts of the complex are strongly enriched in REEs and the radioactive element thorium-232, and to a much lesser degree uranium-238. Concentrations of thorium in the eastern part of the complex are so significant that Norway is considered to host one of the world's largest thorium deposits (OECD NEA and IAEA 2006).

Company information	**Name:** Tantalus Rare Earths AG **Type:** Holding Company **Country:** Germany **Website:** http://www.tre-ag.com
Value chain position	Primary Suppliers
General description	Tantalus Rare Earths AG ("Tantalus") is a Germany company that is primarily engaged in the discovery, selection and development of mineral deposits outside China. The Company focuses its operations on

	preparations for production. It is involved in the Project on the Ampasindava peninsula in northern Madagascar. It engages in exploration and extraction testing, developing a large ionic clay-based rare earth opportunity in the region. Tantalus has entered into binding contracts for the sale of the remaining ownership it holds in the rare earth development project in Madagascar. Tantalus's shares are quoted on the Open Market of the Düsseldorf Stock Exchange, and they have also concluded an exclusive supply agreement for rare earth oxide with ThyssenKrupp Metallurgical Products GmbH.
Link to REE4EU	The members of the Management and Supervisory Boards collectively bring a wealth of mining, financial and/or public company experience in rare earths sectors to TRE AG.

4.3.2 REE Recovery

Company information	**Name:** Granta Design **Type:** SME **Country:** United Kingdom **Website:** https://www.grantadesign.com/
Value chain position	REE Recovery
General description	Founded in 1994 as a spin-out from the University of Cambridge, Granta helps hundreds of engineering enterprises to manage information on the materials (metals, plastics, composites, and more) that are essential to their businesses. They help them to develop and apply material intelligence, making better materials decisions, saving time and money, and reducing risk as they optimize their products. They also provide supporting resources to thousands of university educators worldwide as they teach the next generation of engineers, scientists, and industrial designers about materials, processes, and sustainability.
Link to REE4EU	Granta presented in the 4th Trilateral (EU-US-Japan) Critical Materials Conference (September 2014) on "Software tools for critical materials risk reduction". Critical materials (such as the rare earth elements) pose a significant challenge to product development and design organizations because disruptions to supply or price volatility can have major impacts on product price and production. Granta's summarized how materials information technology can be applied to meet this challenge. Granta Design is the world-leader in this niche, working with many of the world's

	top engineering enterprises in sectors including aerospace, energy, automotive, and consumer products. Granta offers a webinar on business risks associated with critical materials and conflict minerals and the strategies that can be applied to mitigate these risks. Its 'Critical Materials Data Module' enables users to identify and understand supply risk for the materials used in an organization based on factors such as geopolitical risk, physical scarcity, co-production risk, conflict mineral risk, and price volatility.

4.3.3 REA producers

Company information	**Name:** Neo Performance Materials (ex Molycorp Silmet S.A.) **Type:** Large Industry **Country:** Canada **Website:** http://neomaterials.com/
Value chain position	REA Producers
General description	In June 2015 Molycorp Silmet S.A. emerged as Neo Performance Materials (NPM) after financial restructuring. NPM is a privately held company with executive offices in Toronto, Canada. It produces some of the highest performance rare earth and rare metal-based engineered materials in the world according to customers' most challenging product specifications. Operations are organized along three business segments: Neo Chemicals and Oxides, Neo Magnequench (magnetic materials and alloys), and Neo Rare Metals. The Business operates globally with sales and production across 10 countries, including Japan, China, Thailand, Estonia, Singapore, Germany, United Kingdom, Canada, United States, and South Korea.
Link to REE4EU	Through its business segments, the company is engaged in the production, processing and development of rare earth and zirconium-based engineered materials; magnetic powders; and rare metals including gallium, indium, rhenium, tantalum and niobium.

Company information	**Name: Minor Metal Trade Association (MMTA)** **Type:** Association

	Country: United Kingdom **Website:** https://www.mmta.co.uk/
Value chain position	REA Producers
General description	The Minor Metals Trade Association (MMTA) is a not-for-profit organization, which serves to benefit and promote the interests of its international Membership, comprising companies actively involved in all aspects of the international minor metals sector. The MMTA is the world's largest association involved with minor metals. From just 19 founding Members, the MMTA is now comprised of companies from across the globe, engaged in all aspects of minor metals activity, the Association having long since broadened from its original Member base of trading companies.
Link to REE4EU	MMTA has indicated its concerns regarding the sustainability of minor metals. Topics covered in its published newsletters address the issues of Minor Metals in the Renewable Energy Technology supply chain, and the role that Minor Metals play in the circular economy.

Company information	**Name:** TREIBACHER AG **Type:** Large Industry **Country:** Austria **Website:** http://www.treibacher.com/en
Value chain position	REA producers
General description	Treibacher Industrie AG has been an international leading player in the chemistry and metallurgy sectors for decades. Headquartered in Althofen (Austria) and combining sites in Breitungen (Germany), Toronto (Canada), Shanghai (China), and Tokyo (Japan) with a worldwide sales network, they satisfy global market needs in the areas of: • Advanced Ceramic Materials • Hard Metals and Energy Storage • Rare Earths and Chemicals • Environmental Catalysts and Pharmaceutical Chemicals • Steel and Foundry Products

Link to REE4EU	As a market leader for rare earths, they supply the basis for manufacturing high-quality products with very special properties and for process optimization in particular, they often develop new solutions.

4.3.4 REE intensive product manufacturer

Company information	**Name:** GP Batteries **Type:** Large Industry **Country:** Worldwide **Website:** http://www.gpbatteries.com/
Value chain position	End user
General description	GP Batteries International Limited has been listed on the Mainboard of the Singapore Exchange Securities Trading Limited since 1991. The Group is principally engaged in the development, manufacture and marketing of batteries and battery-related products. Since its establishment under the Gold Peak Group in Hong Kong, GP Batteries has rapidly expanded to become one of the world's major suppliers of primary and rechargeable batteries. It is one of the largest consumer battery manufacturers in China. It supplies an extensive range of battery products to original equipment manufacturers, leading battery companies as well as consumer retail markets under its own GP brand name. GP Batteries' production facilities are located in Singapore, Hong Kong, China, Taiwan, and Malaysia, supported by marketing and trading offices spanning across Asia, Europe and North America. The Group currently employs about 5,800 people worldwide and occupies a total floor area of approximately 251,000 square metres.
Link to REE4EU	The negative electrodes of the batteries contain nickel foam, alloys of Titanium, Cobalt, Chromium, Iron and trace of REE.

4.3.5 End users - Air conditioning

Company information	**Name:** Ariston Thermo Group **Type:** Company **Country:** Italy **Website:** http://www.aristonthermo.com/it/

Value chain position	End user
General description	Ariston Thermo produces heating systems and related products, marketed mainly under the Ariston, Chaffoteaux, Elco, Racold, Cuenod, Ecoflam and Thermowatt brands. It hasa strong presence in Europe and emerging countries and a leadership position in the global thermic comfort market for domestic, commercial and industrial spaces.
Link to REE4EU	Ariston Thermo offers a complete range of heating and hot water products, systems,services and solutions designed to provide the maximum degree of comfort with the minimum use of energy. Ariston is also part of the Association CECED that represents the household appliance manufacturing industry in Europe and they cooperate about the WEEE Directive revision.
Application/products	Air conditioning

Company information	**Name:** ATECYR **Type:** Association **Country:** Spain **Website:** http://www.atecyr.org/ eATECYR/index.php
Value chain position	End user
General description	ATECYR (Asociación, Técnica Española de Climatización y Refrigeración) is a non-profit association. ATECYR is part of the Federation of European Heating and Air-conditioning Associations REHVA
Link to REE4EU	ATECYR is comprised of a network of professionals and companies, interested in the advances of environmental engineering. ATECYR's fundamental purposes are oriented to the creation, compilation and dissemination of technical and scientific information related to new technologies in the heating and air-conditioning field.
Application/products	Air conditioning

Company information	**Name:** ATIC vzw-asbl **Type:** Association **Country:** Belgium **Website:** https://www.atic.be/fr/
Value chain position	End user
General description	ATIC (L'Association Royale de la Technique du Chauffage) brings together professionals in the field of "Climate engineering". ATIC is member of the

	Federation of European Heating, Ventilation and Air Conditioning Associations (REHVA).
Link to REE4EU	ATIC aims to promote technical progress in the field of heating, refrigeration, ventilation and air conditioning (supporting research and through dissemination activities); Its network of professionals is linked to many industrial stakeholders.
Application/products	Air conditioning

Company information	**Name:** Baltur **Type:** Company **Country:** Italy **Website:** http://www.baltur.com/
Value chain position	End user
General description	Baltur is an Italian company established in 1950. Baltur designs, manufactures, and sells "intelligent" solutions for heating, climate control, and applications for industry and its processes. Its product portfolio is comprised of burners, heating and air conditioning systems, and renewable energy systems.
Link to REE4EU	Baltur uses REEs and permanent magnets in its DC Inverter Air Conditioners.
Application/products	Air conditioning

Company information	**Name:** Bosch Thermotechnik Gmbh **Type:** Company **Country:** Germany **Website:** http://www.bosch-thermotechnik.de/de/tt_com/startpage/startpage.html
Value chain position	End user
General description	Bosch Thermotechnik GmbH represents the Thermotechnology Division of the Bosch Group. Together with its subsidiaries, the company is a leading supplier of heating products and hot water solutions in Europe. Bosch Thermotechnology has strong international and regional brands and manufactures a diversified product range in European, American and Asian countries.
Link to REE4EU	Thermotechnology division is responsible for all activities involving heating technology and hot-water solutions. The division has major international and regional brands providing state-of-the-art technologies worldwide. The goal for Bosch electric systems by the end of the decade is to develop engine concepts that require either less rare

	earth elements or none at all. Moreover, various divisions of Bosch are committed to reducing the volume of raw materials they use, and where possible feed materials back into the production cycle. For example, As part of the Bosch eXchange program, used car components are industrially remanufactured. (Bosch Worldwide, "Sustainable Production". http://www.bosch.com/en/com/sustainability/environment/sustainable_production_1/sustainable_production.html)
Application/products	Air conditioning, but also Air conditioning, electric bikes and mixed electronics sectors

Company information	**Name:** GebaeudeKlima Schweiz (GKS) **Type:** Association **Country:** Switzerland **Website:** https://www.gebaeudeklima-schweiz.ch/
Value chain position	End user
General description	GKS is a leading Swiss association for heating, ventilation and air-conditioning technology.
Link to REE4EU	The company is interested in the rapid technological progress of the heating industry and is collaborating involving many industrial stakeholders.
Application/products	Air conditioning

Company information	**Name:** CIAT **Type:** Company **Country:** Italy **Website:** http://www.ciat.com/
Value chain position	End user
General description	CIAT is a European leader in heating, cooling and indoor air quality. With over 80 years of experience, CIAT designs, manufactures and markets solutions for the residential, tertiary, healthcare and industrial sectors. Its activities are founded on optimising energy consumption levels and improving air quality and comfort in buildings. Ciat is a major player in the heat pump, refrigeration and air handling sectors, inventing cleaner, more economical and safer solutions. The group is also strongly committed to protecting the environment, which is a major part of its development strategy.
Link to REE4EU	CIAT's eco-design commitment is considering the environmental impact of a product from its design to its recycling and acting at the most

	significant stages in its life cycle. Eco-designing a product also involves mitigating its end-of-life adverse impacts by working to reduce waste and maximize the recyclability of its materials. As a key player in HVAC engineering, CIAT also enforces its expertise in the improved re-use of thermodynamic equipment that has reached the end of its life. (Ciat, "Eco-design". http://www.ciat.com/rubrique/index/eng-CIAT-group-About-CIAT-eco-design/4242)
Application/products	Air conditioning

Company information	**Name:** Daikin Europe N.V. **Type:** Company **Country:** Belgium **Website:** http://www.daikineurope.com/ about-daikin/index.jsp
Value chain position	End user
General description	Daikin Europe N.V. (DENV) is a fully owned subsidiary of Daikin Industries Limited, a Japanese multinational corporation listed on the Japanese stock market, and leading global manufacturer and supplier of HVAC (heating, ventilation and air conditioning) equipment, including heat pump and refrigeration solutions. The company provides innovative, premium quality indoor climate management solutions to meet the changing needs of our residential, commercial and industrial customers.
Link to REE4EU	Daikin provides air conditioning solutions for commercial applications ranging from restaurants and offices to shops, hotels and banks. Daikin manufactures its own compressors in its factories in the Czech Republic and Italy (McQuay). The company has always been at the forefront of developing compressor technology and now offers a comprehensive range of swing, scroll and single-screw compressors. As a result, inverter compressor control is applied throughout their product range, delivering enhanced comfort and system efficiency. Daikin produces Magnetic Bearing Centrifugal Chillers (Magnitude®), Magnitude is up to 40% more efficient than standard centrifugal chillers and can save up to $4 million over the life of the chiller. (Daikin, http://www.daikinapplied.com/chiller-magnitude-magnetic.php)
Application/products	Air conditioning

Company information	**Name:** EKVU **Type:** Association **Country:** Estonia **Website:** http://www.ekvy.ee/en/
Value chain position	End user

General description	The Estonian Society of Heating and Ventilation Engineers is non-profit society of professionals with the objective to organize conferences and develop activities concerning the heating and ventilation fields. EKVU is also a member of the Federation of European Heating and Air-conditioning Associations (REHVA).
Link to REE4EU	EKVU is interested in technical innovation of heating and ventilation and networking with professionals of heating engineering field and with industrial stakeholders
Application/products	Air conditioning

Company information	**Name:** Ferroli **Type:** Company **Country:** Italy **Website:** http://www.ferroli.com/it
Value chain position	End user
General description	Italian company producers of: heating, air conditioning, renewable energy production components.
Link to REE4EU	Air conditioner producers
Application/products	Air conditioning

Company information	**Name:** FINVAC **Type:** Association **Country:** Finland **Website:** http://www.en.finvac.org/
Value chain position	End user
General description	FINVAC is a joint organisation in which four national societies of HVAC (heating, ventilation and air-conditioning) participate. FINVAC cooperate with SCANVAC organisation in the Nordic countries, with the REHVA organisation(Federation of European Heating and Air-conditioning Associations) in Europe, and with ASHRAE organisation in the USA.
Link to REE4EU	FINVAC is interested in promoting the sciences of heating, ventilating, air-conditioning and allied technologies and to informing and organizing training activities in this field.
Application/products	Air conditioning

Company information	**Name:** Guntner **Type:** Company **Country:** Germany **Website:** http://www.guentner.eu/
Value chain position	End user
General description	As one of the leading companies worldwide in the sector of heat transfer technology, the Güntner Group is present on all continents with production sites as well as Güntner affiliated and non-affiliated sales and service companies.
Link to REE4EU	In general, powerful neodymium magnets are used in the rotor of the reluctance DC motor in the compressors. Due to the nature of Guntner business, metal waste forms a large part of our production scrap and residue (ferrous metals, stainless steel, copper and aluminium). In this case, they outsource the recycling and disposal of these materials to companies specializing in this work. When it comes to handling hazardous waste, the partner companies are exemplary market leaders using technologies conforming to international standards. (Guntner, "Waste Management and Recycling of Raw Materials" http://www.guntner.co.uk/company/sustainability/environment/)
Application/products	Air conditioning

Company information	**Name:** HITACHI **Type:** Company **Country:** Japan **Website:** http://www.hitachi.com/
Value chain position	End user
General description	Hitachi is a highly diversified company that operates eleven business segments: Information & Telecommunication Systems, Social Infrastructure, High Functional Materials & Components, Financial Services, Power Systems, Electronic Systems & Equipment, Automotive Systems, Railway & Urban Systems, Digital Media & Consumer Products, Construction Machinery and Other Components & Systems.
Link to REE4EU	Hitachi develops recycling technologies for Rare Earth Metals. It develops machinery to separate and collect rare earth magnets from end-of-life products and it extracts rare earths from rare earth magnets using a dry process.

	The collection and recycling of magnets from air conditioners is already being practiced in Japan from Hitachi since 2010. (http://www.hitachi-recycle.eu/) In this report, Hitachi Group is mentioned also as Innovator and Investor, since it represents one of the most active actors in REE sector.
Application/products	Air conditioning

Company information	**Name:** ICOM **Type:** Association **Country:** UK **Website:** http://icom.org.uk/
Value chain position	End user
General description	The Industrial and Commercial Energy Association (ICOM) is a not-for-profit trade association, representing and promoting the interests of the non-domestic heating sector since 1933. By providing services from direct technical and commercial resources to lobbying for our members' interests at UK Government and European Committees, the Association generates tangible benefits for members. This access to decision makers in Government is one of ICOM's key strengths.
Link to REE4EU	ICOM works closely with other trade associations to optimise its influence, speaking with the combined resource of many industries. The Association has an active and representative membership operating within one or more product-related groups. Each group holds quarterly meetings, participating in commercial and technical discussions as well as valuable networking. When specific issues arise, working groups are formed to produce suitable documents which are presented to the relevant Government department or standards body.
Application/products	Air conditioning

Company information	**Name:** KGH **Type:** Association **Country:** Serbia **Website:** http://www.kgh-drustvo.rs/index.php/sr-rs/
Value chain position	End user
General description	KGH (Serbian HVAC Society) gathers engineers and technicians and related professions who are engaged in the realization of heating, cooling and air conditioning within the Union of Mechanical and Electrical Engineers and Technicians of Serbia (SMEITS), to improve the science and profession, and to improve the conditions of life and preservation

	environment. KGH is a member of the Federation of European Heating and Air-conditioning Associations REHVA.
Link to REE4EU	KGH is a network of professionals and companies interested in the recent advances of the heating and air conditioning technologies.
Application/products	Air conditioning

Company information	**Name:** Mitsubishi **Type:** Company **Country:** Japan **Website:** http://www.mitsubishielectric.com/bu/air/
Value chain position	End user
General description	With more than 90 years' experience in providing reliable, high-tech products to corporate clients and general consumers all over the world, Mitsubishi Electric, formed in 1921, is a recognised world leader in the manufacture, marketing and sale of electrical and electronic equipment. Mitsubishi Electric products and components are used in a wide range of fields: ICT, space research and satellite communications, consumer electronics, industrial applications technology, energy, transport and construction.
Link to REE4EU	"Creating a Recycling-based Society" is one of the main goal of the Environmental Plan in the roadmap aligned with Environmental Vision 2021. Mitsubishi Electric is expanding resource recycling businesses by strengthening partnerships through shared case examples and technical information. In order to reduce the input of new resources, the Mitsubishi Electric Group has commercialized "resource recycling businesses" in which we recover resources from used Mitsubishi Electric products and recycle them, in addition to refurbishing existing products, salvaging components that are still usable and using them as they are. (http://www.mitsubishielectric.com/company/environment/report/recycling/index.html)
Application/products	Air conditioning Mitsubishi is also represented by Freecom for the hard disk drive production and Vestas for the wind turbine.

Company information	**Name:** Rhoss **Type:** Company **Country:** Italy **Website:** www.rhoss.com

Value chain position	End user
General description	Rhoss SpA was founded in 1999. The Company's line of business includes the manufacturing of air conditioning and air handling products and systems. It operates in an international market in strong partnership with customers. Rhoss finds and creates the "solution" for every heating and cooling requirement through innovative integrated systems.
Link to REE4EU	One of the largest Italian groups in the heating and air conditioning industry Rhoss offers a range of hermetic Scroll compressors that use rare earth and permanent magnets. It aims to improve the quality of life within the domestic, residential and commercial environments by offering highly specialised products, services and air-conditioning systems with utmost attention paid to customer needs aimed at sustainable development adequate for green building technologies. (http://www.rhoss.com/company/the-group)
Application/products	Air conditioning

Company information	**Name:** Riello Group **Type:** Company **Country:** Italy **Website:** http://www.riellogroup.com/
Value chain position	End user
General description	Riello Group offers systems and technology for the heating and air-conditioning of all environments. Rapid evolution of environmental regulations led the Group to launch a series of new products on the market.
Link to REE4EU	Air conditioner product of the series AARIA has a compressor inverter which includes Rare Rarth Elements. Moreover, Riello invests heavily in Research and Development. Today, approximately 157 people work in the research laboratories and their target is to create new products which can raise the standards of energy efficiency while simultaneously reducing polluting emissions.
Application/products	Air conditioning

Company information	**Name:** SSTP **Type:** Association **Country:** Slovakia **Website:** http://www.sstp.sk/

Value chain position	End user
General description	The Slovak Society for Environmental Technology (SSTP) is an association that groups together scientists and engineers. SSTP is a member of the Federation of European Heating and Air-conditioning Associations REHVA.
Link to REE4EU	SSTP has a network that includes experts and companies in the HVAC engineering field. SSTP mainly conducts educational and publishing activities related to HVAC engineering topics.
Application/products	Air conditioning

Company information	**Name:** Swegon **Type:** Company **Country:** Sweden **Website:** http://www.swegon.com/en/
Value chain position	End user
General description	Swegons operations are grouped into five business areas - Commercial Ventilation, Light Commercial, Home Solutions, Cooling and North America - to reflect specific customer needs.
Link to REE4EU	Swegon, via its BPD (Building Product Declaration) declared using composite materials that contain rare earth.
Application/products	Air conditioning

Company information	**Name:** Selpro **Type:** Company **Country:** Italy **Website:** http://www.selproweb.com/
Value chain position	End user
General description	For over 30 years SELPRO has been working in the design and manufacturing of electronic devices for industrial applications. Over the years SELPRO has chosen to specialize in systems for command and adjustment of synchronous and asynchronous electric motors, single-phase and three-phase. The quality and high technological value of products, the study of new solutions and the experience in the field, have made SELPRO a market reference and the ideal partner for manufacturers of machines and components for HVAC&R sectors.
Link to REE4EU	Air conditioner and electric motor producers.

Application/products	Air conditioning

Company information	**Name:** VOX Electronics **Type:** Company **Country:** Serbia **Website:** http://www.voxelectronics.com/en/air-conditioners/
Value chain position	End user
General description	VOX Electronics is a trademark for consumer electronics products, specialised in audio visual technology, white goods, small kitchen appliances and air conditioners.
Link to REE4EU	Air conditioner and electric motor producers.
Application/products	Air conditioning

Company information	**Name:** Blaupunkt **Type:** Company **Country:** Germany **Website:** http://www.blaupunkt.com/en/nc/products/air-treatment/
Value chain position	End user
General description	Blaupunkt GmbH is a German manufacturer of electronics equipment, noted for its home and car audio equipment. It was a 100% subsidiary of Robert Bosch GmbH until 1 March 2009, when its Aftermarket and Accessories branch including the brand name were sold to Aurelius AG of Germany for an undisclosed amount.
Link to REE4EU	Air conditioner and electric motor producer.
Application/products	Air conditioning

4.3.6 End users - Automotive application

There are hundreds of applications for permanent magnets in the automotive sector. However, many of the magnets are very small, which creates problems like those for recycling electronic goods. However, there are some products in the automotive sector that use considerable quantities of REE material, for example in drive motors for HEV/EV (1kg-1.5kg), in electric power steering (50g-100g), generators (~0.5 kg) and stop/ start technology (50g-100g). The magnets contained in these applications tend to be rich in Dy, as the devices run hot. Therefore, the potential value of this waste will be higher than that of waste from the electronics sector.

Company information	**Name:** Akkumulatorenfabrik Moll GmbH + Co. KG **Type:** SME **Country:** Germany **Website:** http://www.moll-batterien.de/de/index.php
Value chain position	End user
General description	MOLL manufactures exclusively at its site at Bad Staffelstein in Upper Franconia, thus securing an significant number of jobs for the region. The worldwide granting of licences enables a global exchange of experts. MOLL has decisively influenced the world market in battery technology through innovations developed in-house at its research and development department. MOLL is one of the most renowned battery suppliers for the automotive industry and for commercial vehicle manufacturers.
Link to REE4EU	Moll start/stop (with the Enhanced Flooded Battery EFB technologies) produces batteries that are ideal for application in vehicles with start|stop/Micro Hybrid technology and vehicles with many electrical consumers.
Application/products	Automotive Application

Company information	**Name:** Banner GmbH **Type:** Company **Country:** Austria **Website:** https://www.bannerbatterien.com/en/Home
Value chain position	End user
General description	As a leading European battery brand, Banner manufactures and markets starter batteries and industrial batteries for drive systems and electricity supply, all of which possess premium quality. Banner supplies leading automotive producers such as BMW, VW, Audi, Porsche, Mercedes, Rolls-Royce, Seat, Aston Martin, Suzuki, Volvo, Kässbohrer and Liebherr, to name but a few.
Link to REE4EU	As early as fifty years ago, Banner, which is the only Austrian manufacturer of starter batteries, initiated the recycling of used batteries and the reintroduction of the treated material into the new product production chain. Valuable raw materials such as lead, sulphuric acid and polypropylene were thus returned to the production cycle. In concrete terms, during the past 19 years the Starter Battery Environmental Forum (UFS), with Banner as one of its founder members, has been able to collect over 15 million used batteries. The raw materials that these contained, which for example included 160,000t of lead, were then 99 per cent recycled by a special company in Austria.

	(http://www.bannerbatteries.com/banner/files/mediainfo_recycling_gb.pdf)
Application/products	Automotive Application

Company information	**Name:** EnerSys EMEA EH Europe GmbH **Type:** Large Industry **Country:** Worldwide **Website:** http://www.enersys-emea.com/
Value chain position	End user
General description	EnerSys and its predecessor companies have been manufacturers of industrial batteries for over 100 years. The current company was formed in late 2000 acquiring Yuasa Corporation (Japan), its reserve power and motive power battery businesses in North and South America.
Link to REE4EU	As the world's leading industrial battery manufacturer, EnerSys recognizes the obligation to lead the way in battery recycling. EnerSys® is proud to provide the personnel, facilities and documentation needed to operate a worldwide recycling program. The EnerSys Battery Recycling program accepts lead-acid batteries of all sizes, from all manufacturers. It reclaims lead and plastic for new battery cases. (http://www.fibersafebattery.com/pdf/87.94.pdf)
Application/products	Automotive Application

Company information	**Name:** Eternity Technologies **Type:** Large Industry **Country:** Worldwide **Website:** http://www.eternitytechnologies.com/
Value chain position	End User
General description	Eternity Technologies have recently invested AED 200 million in a state of the art industrial battery plant in Ras Al Khaimah. The company has been established to service the Global Electric Truck Industry, which is currently estimated to be growing at over 10% per year. The company is focused on designing and developing industry leading Motive Power batteries to meet the ever-changing demands of the Global Motive Power market. To meet the increasing global demand for improved quality and performance of Motive Power batteries Eternity Technologies have invested in industry leading Chemical Laboratories and Electrical test Laboratories to facilitate the innovative product design

	that Eternity Technologies will be promoting to the global market. Eternity Technologies manufacturing facility also incorporates the most modern and innovative manufacturing equipment available on the world market including 'state of the art' machinery from Germany, Austria, Italy and UK. The Eternity Technologies plant will have the capacity for around 1 million 2 volt cells putting it at the forefront of the Global Motive Power market.
Link to REE4EU	Eternity Technologies supports applications such as forklift trucks, electric vehicles, telecommunications, UPS systems, emergency lighting and solar / wind power stations. Eternity Technologies is strongly focused on the waste management and batteries recycling. In fact, Eternity provides the collection service that takes care of the old batteries and disposes of them appropriately, whereby attaching great importance to utilizing the recycling circuit while conserving resources wherever possible.
Application/products	Automotive Application

Company information	**Name:** Exide technologies **Type:** Large Industry **Country:** USA **Website:** http://www.exide.com/it/it/
Value chain position	End user
General description	Exide Technologies, with operations in more than 80 countries, has the products and services to meet the world's stored energy needs in transportation and industrial markets. With more than 120 years in the battery business, Exide has the experience, advanced research and development capabilities, and knowledge to provide solutions to various stored energy requirements.
Link to REE4EU	Ordinary golf carts and other electric vehicles require extraordinary batteries to keep them humming worry free and Exide is the specialist producer of these EFB batteries using an amount of REE elements. Recycling of components is an integral part in the life of the lead-acid battery and all materials used in a lead battery can be recycled. Exide Technologies is not only one of the world's largest manufacturers of lead acid batteries , but also one of the largest secondary lead recyclers in the world. Exide Technologies has ten recycling facilities worldwide: - 6 in USA, - 3 in Europe, - 1 in New Zealand.
Application/products	Automotive Application

Company information	**Name:** FIAMM SpA **Type:** Multinational **Country:** Italy **Website:** http://www.fiamm.com/it/
Value chain position	End user
General description	In June 2005, Enersys acquired the motive power battery business of FIAMM, S.p.A. (FIAMM), which complemented their existing European motive power business. Today, FIAMM is present in 60 countries and realizes about 70 percent of its proceeds abroad. To be near the requirements of its clients, it boasts 14 production establishments in strategic markets such as Italy, Switzerland, France, USA, Czech Republic, Brazil and China. The commercial and marketing of its products is entrusted upon 20 sales and technical branches – in Italy, Germany, United Kingdom, Switzerland, Czech Republic, Poland, Slovakia, Austria, France, Russia, USA, Spain, Brazil, Dubai, Japan, Singapore, Korea, Malaysia and China – and a network of important distributors. 63% of FIAMM's proceeds comes from automotive components, Starter Batteries, Acoustic Signals and Antennas, 33% comes from Industrial Batteries and the remaining 4% comes from other activities. Its Acoustic Signals are present in eighty percent of vehicles produced worldwide, while in the Industrial Batteries sector, FIAMM is one of only three global producers and the third producer in Europe. FIAMM represents over 70 years of history, approximately 3,000 employees and 619 million euros in receipts.
Link to REE4EU	Fiamm produces 48V Lithium-Ion Battery: designed for the next generation of micro-hybrid vehicles, the two 48V batteries developed in collaboration with Magneti Marelli represent the state of the art from a technological point of view. The first, created for vehicles with advanced start&stop technology, weighs just 4.5 kg yet allows a 15% reduction of fuel consumption and CO2 emissions. The 12 Kw nominal power, thanks to the recovery of energy while braking, guarantees the necessary sprint for extra support also during the phases of acceleration.
Application/products	Automotive Application

Company information	**Name:** Hoppecke Batterien **Type**: Large Industry **Country:** Germany **Website:** https://www.hoppecke.com/
Value chain position	End user

General description	HOPPECKE Batteries is the largest producer of industry battery systems in European ownership. With its headquarters in Brilon, Hoppecke and 19 subsidiaries, representative offices, partners and distributors as well as production and assembly facilities worldwide, the HOPPECKE Group has more than 1,950 employees and generates turnover of over €400 million.
Link to REE4EU	Hoppecke produces Lithium-ion battery systems for traction applications (Electric and hybrid vehicles of all kinds).
Application/products	Automotive Application

Company information	**Name:** İnci GS Yuasa Akü Industry and Trade Co. Ltd. **Type:** **Country:** Turkey **Website:** http://www.incigsyuasa.com/
Value chain position	End User
General description	İnci Akü, the flagship of İnci Holding, following its foundation in 1984 started its first works with vehicle manufacturers in 1985. In 1997, İnci Akü produced calcium (Ca) battery alloy lead and presented to the market. Inci Akü, partnered with the Japanese giant GS Yuasa (that has global experience and vast knowledge on new generation battery Technologies) to from "GS Yuasa Akü Sanayi ve Ticaret A.Ş". It has 2 production facilities in Manisa and a Sales Office in İstanbul. Its second facility in Manisa, foundations of which were laid in July 2010, has the feature of being the first BREEAM (Building Research Establishment Environmental Assessment Method) certificated production facility of Turkey. İnci GS Yuasa Akü Sanayi ve Ticaret A.Ş is the "export leader" of its sector exporting to over 80 countries in 4 continents under the brands İnci Akü, EAS, and Hugel in automotive, heavy-duty and marine vehicles industries. Moreover, it uses its İnci Battery brand in the industrial produce sector.
Link to REE4EU	Specialist in stop/ start technology.
Application/products	Automotive Application

Company information	**Name:** Johnson Controls Power Solutions Europe **Type:** Large Industry **Country:** USA **Website:** http://www.johnsoncontrols.com/
Value chain position	End User

General description	Johnson Controls Power Solutions is the leading supplier of lead acid batteries for virtually every type of passenger car, light truck or utility vehicle as well as the leading independent supplier of hybrid systems.
Link to REE4EU	Johnson Controls supplies batteries and was the first to provide permanent magnet ECM motors. All of its lithium-ion products contain rare earths, in particular a portfolio of its battery technology for vehicles can be found at the link: http://www.johnsoncontrols.com/batteries/lithium-ion-batteries
Application/products	Automotive Application

Company information	**Name:** Nexteer Automotive **Type:** Large Industry **Country:** USA **Website:** http://www.nexteer.com/
Value chain position	End user
General description	Nexteer Automotive is an automotive parts supplier owned by Pacific Century Motors and headquartered in Saginaw, Michigan, United States. Nexteer is a global manufacturer of steering and driveline products. With more than 10.000 employees, Nexteer operates 20 manufacturing plants worldwide, 14 local customer support centers and five regional engineering centers and test centers. Nexteer is the fourth-largest steering-parts supplier by market share. It has more than 60 customers globally, including BMW, General Motors, Ford, Chrysler, Fiat, Toyota, PSA Peugeot Citroen and manufacturers not only in North America, but in India, China and South America.
Link to REE4EU	Nexteer is one of the biggest steering parts suppliers and the company's use of rare earth metals is on a rising trend alongside the broader adoption of electric power steering (EPS) systems.
Application/products	Automotive Application

Company information	**Name:** Daido Steel **Type:** Large Industry **Country:** Worldwide **Website:** http://www.daido.co.jp/en/index.html
Value chain position	End user

General description	Daido Steel is a Japanese company that produces neodymium magnets for drive motors of electric vehicles.
Link to REE4EU	The production of neodymium magnets requires the addition of heavy rare earth and Daido Steel has been always a mass-producer of such magnets. Working jointly with Honda, Daido Steel are developing a new technology to produce neodymium magnets without heavy rare earth. Through these joint development efforts, the two companies achieved, for the first time in the world, a practical application of a neodymium magnet which contains absolutely no heavy rare earth yet has high heat resistance and high magnetic performance suitable for use in the drive motor of hybrid vehicles. Therefore, Daido Steel is currently pursuing different systems to reduce the contents of REE, or also to replace the REE in their products. (http://world.honda.com/news/2016/4160712eng.html)
Application/products	Automotive applications

Company information	**Name:** Honda **Type:** Large Industry **Country:** Worldwide **Website:** http://www.honda.com/
Value chain position	End user
General description	Honda is a Japanese public multinational corporation primarily known as a manufacturer of automobiles, aircraft, motorcycles, and power equipment. Honda has been the world's largest motorcycle manufacturer since 1959, as well as the world's largest manufacturer of internal combustion engines measured by volume, producing more than 14 million internal combustion engines each year.
Link to REE4EU	Honda products cover several application areas in the sector of automotive applications. Honda produces different types of hybrid vehicles: their batteries contain rare earths. In the past Honda collaborated with Japan Metals & Chemicals Co. to design new systems to reduce REEs contents. Currently, Honda is collaborating with Daido Steel to create new systems to reduce or eliminate REEs in the products.

Application/products	Automotive applications

Company information	**Name:** Ricardo **Type:** Large Industry **Country:** UK **Website:** http://www.ricardo.com/en-GB/
Value chain position	End user
General description	Ricardo is a company established in United Kingdom more than 100 years ago. Ricardo is a global engineering, strategic and environmental consultancy. Ricardo currently employs over 2700 engineers, scientists and consultants around the world. Ricardo operates in the following specialist areas: • Transport and Security • Energy • Scarce Resources and Waste In the Transportation and Security industries, Ricardo provides world class engineering and product development. Ricardo designs and develops engines, transmissions, hybrid and electric systems, right through to complete vehicles. The niche manufacturing and assembly capability delivers finished products to motorsport, aerospace, defence and other high performance industries. In Energy Ricardo focuses on low cost sustainability and engineer solutions for conventional and renewable power generation, energy storage and distribution. Ricardo Scarce Resource and Waste services deliver environmental consulting focused on air quality, chemical risk, climate change, resource efficiency, water and waste management.
Link to REE4EU	Ricardo is formed by a team of experts providing technical consulting and performance tests on products including hybrid & electric systems. Ricardo performs business case analysis, assessment and evaluation for products concerning hybrid system design and development, electric motor, battery management systems and power electronics. These components contain REEs.
Application/products	Automotive applications

Company information	**Name:** ISKRA AVTOELEKTRIKA D.D. **Type:** Large Industry **Country: Slovenia** **Website:** http://www.iskra-ae.com/
Value chain position	End user
General description	Since 1970, Iskra is one of the largest Slovenian company in the fields: ▪ electromechanics ▪ telecommunications ▪ electronics ▪ and automation The vision of Iskra Avtoelektrika is to be a world leading manufacturer of electric motors and controllers for mobile hydraulics and electric motor drive systems, starter motors and alternators for commercial vehicles. Also, it aspires to be an acknowledged parts producer and a respected distributor for the automotive industry and material handling equipment industry.
Link to REE4EU	In the company's product AC INTEGRATED FLYWHEEL GENERATOR 230 V 50Hz 110 V 60Hz'', the rotor is designed with high-energy rare earth permanent magnets and no wearing parts, whích assures long life and maintenance-free operation.
Application/products	Automotive applications

Company information	**Name:** Valeo S.A. **Type:** Large Industry **Country:** France **Website:** http://www.valeo.com/
Value chain position	End user
General description	Valeo S.A. is a multinational automotive supplier based in France, providing a wide range of products to auto manufacturers and after-markets. Valeo is an important partner to all automakers worldwide. As a technology company, Valeo proposes innovative products and systems

	that contribute to the reduction of co2 emissions, the improvement of vehicle performance, and to the development of intuitive driving.
Link to REE4EU	Although rare earth accounts for only 1% of total raw material consumption, the REE costs have a strong impact on the financial balance. In fact Valeo is developing solutions that substitute rare earth consumption, and therefore reduce its exposure to price fluctuations of rare earths. For this reason, they can be considered as relevant stakeholders for the REE4EU project. Valeo is also involved in innovation projects related to REE, as already described in the Innovators chapter.
Application/products	Automotive applications

Company information	**Name:** ThyssenKrupp Metallurgical Products **Type:** Large Industry **Country: Germany** **Website:** http://www.thyssenkrupp.com/
Value chain position	End user
General description	ThyssenKrupp AG is a German multinational conglomerate company based in Duisburg and Essen. The company consists of 670 companies worldwide. While ThyssenKrupp is one of the world's largest steel producers, the company also provides components and systems for the automotive industry, elevators, escalators, material trading and industrial services.
Link to REE4EU	ThyssenKrupp Metallurgical Products GmbH, one of the world's leading raw material distributors, has further expanded its sales activities for rare earth elements. The raw material experts from the Materials Services business area have concluded an exclusive supply agreement for rare earth oxide with Tantalus Rare Earths AG.
Application/products	Automotive applications

Company information	**Name:** VARTA AG **Type:** Large Industry **Country:** Germany

	Website: http://varta.com/
Value chain position	End user
General description	VARTA AG is a German company manufacturing batteries for global automotive, industrial, and consumer markets. It is also specializing in start/stop system production.
Link to REE4EU	NiMH batteries use cathodes of nickel oxyhydroxide, like NiZn batteries, but the anode is made of a hydrogen-absorbing alloy, i.e., a rare earth mixture of lanthanum, cerium, neodymium, praseodymium, and nickel, cobalt, manganese, and/or aluminium. Varta was already interested in the procedure for the recovery of metals from metal hydride batteries (nickel), with a strong focus on the highest opportunity for REE recovery.
Application/products	Automotive applications

Company information	**Name:** ZF Friedrichshafen AG **Type:** Large Industry **Country:** Germany **Website:** http://www.zf.com/
Value chain position	End user
General description	ZF is one of the largest automotive suppliers worldwide. ZF is a global leader in driveline and chassis technology as well as active and passive safety technology. ZF annually invests approximately five percent of its sales in Research & Development (€1.4 billion in 2015) ensuring continued success through the design and engineering of innovative technologies.
Link to REE4EU	In the e-mobility for commercial vehicles the utilization of rare earths is strongly reduced and in some case ZF would like to avoid REE materials.
Application/products	Automotive applications

Company information	**Name:** Johnson Electric **Type:** Large Industry **Country:** USA

	Website: http://www.johnsonelectric.com/
Value chain position	End user
General description	Johnson Electric is a global leader in motion products, control systems and flexible interconnects. They serve a broad range of industries including automotive, building automation and security, business machines, defense and aerospace, food and beverage, home technologies, HVAC, industrial equipment, medical devices, personal care, power equipment and power tools. Established in 1959, Johnson Electric ships its products to more than 30 countries for use in hundreds of different product applications. Innovation and product design centers are located in Hong Kong, China, Switzerland, Germany, Italy, Israel, France, Canada, UK and USA. Johnson Electric employs more than 38,000 employees and subcontract workers in over 23 countries. It is the parent company of Johnson Motors.
Link to REE4EU	Produces REE containing e-motors for automotive applications
Application/products	Automotive Application, electric motors for drive train and power steering

Company information	**Name:** Baldor Electric Company **Type:** Large Industry **Country:** USA **Website:** http://www.baldor.com/
Value chain position	End user
General description	Baldor Electric Company markets, designs, and manufactures industrial electric motors, mechanical power transmission products, drives, and generator sets. The company manufactures its products in 17 U.S. locations, 1 in Canada, 2 in China, and 1 in England. The company's strategy is to be the highest value provider, focusing on quality, service and time. The company has had a long-term focus on energy-efficiency and was the first in the industry to introduce a line of premium-efficiency industrial electric motors, the Super-E in 1983. Baldor's annual revenue is approximately $2.0 billion, and the company produces nearly 3,000,000 motors per year. Baldor is part of the ABB Group since 2010.
Link to REE4EU	Supplier of electric motors. Produces e-motors for automotive and other (heavy duty) applications
Application/products	Automotive Application, electric motors for drive train and power steering

Company information	**Name:** Denso **Type:** Large Industry

	Country: Japan **Website:** http://www.denso.com/
Value chain position	End user
General description	DENSO is a leading supplier of advanced automotive technology, systems and components for major automakers headquartered in the city of Kariya, Aichi Prefecture, Japan. Nippon Denso Co. Ltd. was founded in 1949, after becoming independent from Toyota Motors. About 25% of the company is owned by Toyota Motor. Despite being a part of Toyota Group of companies, as of year ended March 2016, sales to Toyota Group accounts for less than 50% of the total revenue (44% of the revenue originates from other car manufacturers in Japan, Germany, U.S. and China). Denso Corporation has 220 subsidiaries with a total of 151,000 employees and a turnover of 40 billion US $.
Link to REE4EU	Supplier of automotive components as parts of electric motors. Due to its extensive experience in the hybrid electric vehicles sector, DENSO has an interest in REE in the medium and long term, because of their potential uses in electric vehicles.
Application/products	Automotive

Company information	**Name:** UQM **Type:** SME **Country:** USA **Website:** http://www.uqm.com/
Value chain position	Supplier of electric motors for vehicles, LEVs, cars, buses.
General description	UQM Technologies Inc is an American manufacturer of electrical motors, generators, motor controllers, fuel cell compressor systems and hybrid systems for passenger and commercial vehicles. Established in 1967 as Unique Mobility Inc, UQM is based in Longmont, Colorado. UQM's products are sold direct to original equipment manufacturers (OEM). UQM is providing PowerPhase propulsion systems for Zenith Motors shuttles, RegenNautics marine applications, Hino Motors electric city buses and Proterra electric composite buses, among others and has been utilised by several concept cars such as the Audi A1 e-tron and Rolls-Royce 102EX Electric Phantom.
Link to REE4EU	Technology leader for electric motors for LEVs, cars buses.
Application/products	Automotive

4.3.7 End users - Electric bicycles

Company information	**Name:** Fully Charged **Type:** Company **Country:** United Kingdom **Website:** http://www.fullycharged.com/
Value chain position	End user
General description	Fully Charged is a company, based in United Kingdom that stocks electric bikes. The showroom, in London, has a huge variety of electric bicycles from several international brands.
Link to REE4EU	Although Fully Charged does not directly manufactures electrical bicycles, this company is in direct contact with the most important producers in the world.
Application/products	Electric bicycles

Company information	**Name:** GI Flybike **Type:** Company **Country:** Spain **Website:** http://giflybike.com/
Value chain position	End user
General description	Gi FlyBike is a foldable electric bicycle that launched its successful crowdfunding campaign in 2015. The GI Flybike is manufactured by Bignay Inc., a developing company based in New York City. The electric motors in the GI Flybike products are manufactured by BAFANG (http://www.szbaf.com/en.html), a Chinese leading manufacturer of e-mobility components and complete systems that sells its products in Europe, China and the United States.
Link to REE4EU	Although GI Flybike does not directly manufacture electric bicycles, this company is in direct contact with the important stakeholders that may be related to REEs.
Application/products	Electric bicycles

Company information	**Name:** Gocycle **Type:** Company **Country:** United Kingdom **Website:** http://gocycle.com/
Value chain position	End user
General description	Karbon Kinetics Limited was founded in 2002 with the aim to develop innovate and technologically advanced electric bicycle. Using automotive engineering and design, KKL has produced Gocycle®, an award-winning electric two-wheeler. After an extensive and in-depth product development process, Karbon Kinetics' critically acclaimed breakthrough product Gocycle was first made available to the public in April 2009.
Link to REE4EU	Gocycle electric bicycles have their "Gocycle proprietary motors".
Application/products	Electric bicycles

Company information	**Name:** Greyp Bikes **Type:** Company **Country:** Croatia **Website:** http://www.greyp.com
Value chain position	End user
General description	Greyp Bikes is the brainchild of the same people behind the Rimac Automobili Concept One, an electric car of Rimac Automobili manufacture, a Croatian company. Greyp Bikes develops and produces electric bicycles exploiting the engineering innovations and the components created by Rimac Autombili.
Link to REE4EU	Greyp Bikes and Rimac Automobili produce and use Permanent Magnet Electric Motors in their final products.
Application/products	Electric bicycles

Company information	**Name:** Haibike **Type:** Company **Country:** Germany **Website:** http://www.haibike.com/en/IT/home
Value chain position	End user
General description	the brand Haibike was founded in 1995. Previously, Haibike products were offered under the name of their parent brand, Winora Group, a German bicycles manufacturing company. Haibike assembles the electrical bicycles but does not manufacture the internal motors.
Link to REE4EU	The motors used in Haibike electric bikes are not directly manufactured by Haibike, but they are provided by other companies, such as Bosh and Bafang (already described). However, given the direct contact of Haibike with other companies that are manufacturing motors using permanent magnets, Haibike can provides links to other stakeholders interested in REEs.
Application/products	Electric bicycles

Company information	**Name:** Italjet **Type:** Company **Country:** Italy **Website:** https://www.italjet.com/
Value chain position	End user
General description	Italjet is an Italian manufacturer of motorcycles, founded in 1959 and headquartered in Castel San Pietro Terme, Bologna, Italy. The company has a history of producing light motorcycles, scooters and more recently electric bicycles.
Link to REE4EU	The motors used in Italjet electric bikes are not directly manufactured by Italjet, but they are provided by other companies. Hence, Italjet could provide links to other stakeholder interested in REEs.
Application/products	Electric bicycles

Company information	**Name:** Brost Bikes **Type:** Company **Country:** Spain **Website:** http://www.brostbikes.com/es/
Value chain position	End user
General description	Brost Bikes is a Spanish brand assembling and selling electric bicycles.
Link to REE4EU	The motors used in Brost Bikes electric bikes are not directly manufactured by Brost Bikes. However, Brost Bikes is in close contact with the companies producing morors for electric bicycles and therefore interested in REEs.
Application/products	Electric bicycles

Company information	**Name:** EGO Movement **Type:** Company **Country:** Switzerland **Website:** http://egomovement.com/de/de/
Value chain position	End user
General description	EGO Movement is a company based in Zürich, Switzerland. EGO Movement produces Electric Bicycles. EGO Movement does not directly manufacture the components of its electric bicycles, but it collaborates with leading manufacturers in various fields. For instance, motors of EGO Movement bikes are made by Bafang, one the top 3 motor manufacturers in the world (http://www.szbaf.com/). Bafang has manufacturing facilities in China and the Netherlands.
Link to REE4EU	Although the motors used in EGO Movement are manufactured by another company (Bafang), EGO Movement provides a link to other stakeholders interested in REEs.
Application/products	Electric bicycles

Company information	**Name:** ACCELL GROUP **Type:** Large Industry **Country:** The Netherlands **Website:** http://www.accell-group.com/en/home
Value chain position	End users
General description	In Europe, Accell Group is market leader in the bicycle market in terms of revenue. Accell Group's best known brands are Batavus (Netherlands), Sparta (Netherlands), Koga (Netherlands), Loekie (Netherlands), Ghost (Germany), Haibike (Germany), Winora (Germany), Raleigh and Diamondback (UK, US, Canada), Lapierre (France), Tunturi (Finland), Atala (Italy), Redline (US) and XLC (international).
Link to REE4EU	Its products are equipped with a synchronous electric motor with permanent magnets.
Application/products	Electric Bicycles

Company information	**Name:** BAFANG **Type:** Large Industry **Country:** China – The Netherlands **Website:** http://www.szbaf.com/en.html
Value chain position	End users
General description	BAFANG, a leading manufacturer of e-mobility components and complete systems, sells its products in Europe, China and the United States. Thanks to its expertise in production of systems for e-bikes and electric scooters, the company's products are well received in those markets. 3 locations are home to BAFANG's manufacturing places and offices, two in China (Suzhou and Tianjin) and one in Europe (The Netherlands).
Link to REE4EU	For more than ten years BAFANG has been developing components and complete systems for electric vehicles. Moreover its eBikes are equipped with a synchronous electric motor with permanent magnets.
Application/products	Electric Bicycles

Company information	**Name:** Bosch eBike **Type:** Large Industry **Country:** Germany

	Website: https://www.bosch-ebike.com/en/
Value chain position	End Users
General description	The most modern components and high degree of design flexibility offered by the Bosch drive systems form the foundation for bicycle manufacturers' diverse palette of products – whether they are full suspension, mountain, trekking, city or touring bikes. All of the following bicycle manufacturers offer eBikes with factory-installed drive systems from Bosch: Apache, Atala, Batavus, Bergamont, BHEmotion, Bianchi, blueLABEL, Breezer, Bulls, Butchers & Bicycles, Cannondale, Carver, Centurion, Conway, Corratec,Crescent, Cresta, Cube, Dancelli, DBS, Diamant, Diamond, EBIKE, eVICTORIA, Felt, Flyer, Focus, Fuji, Gazelle, Gepida, Ghost, Gitane, Gudereit, Haibike, Hercules, i:SY, Ibex, Kalkhoff, Kettler, Koga, Kreidler, KTM, Lapierre, Lombardo, Matra, Merida, Mondraker, Moustache, Orbea, Pegasus, Peugeot, Puch, Raleigh, Riese & Müller, Rixe, Rose, Scott, Simplon, Sinus, Solex, Sparta, Stevens, tern, Thompson, Trek, Univega, Velo de Ville, Viper, vsf Fahrradmanufaktur, Wanderer, Whistle, Winora.
Link to REE4EU	The German economy would like to use e-bike recycling as a springboard for the development of technology to be later well-positioned for the recycling of permanent magnets (inter alia, from electric cars)- according to Fraunhofer Lighthouse Project "Criticality of Rare Earth Elements"
Application/products	Electric Bicycles. Bosch group is also involved in air conditioning and mixed electronics sectors.

Company information	**Name:** Yamaha **Type:** Large Industry **Country:** Worldwide **Website:** http://global.yamaha-motor.com/business/e-bike-systems/
Value chain position	End Users
General description	Yamaha Motor is a world-leading producer of motorcycles, marine products, power products and surface mounters. The company's diverse business is built around its proprietary technologies focused on small engines, fiberglass-reinforced plastics and electronic control. Yamaha Motor conducts global development, production and marketing operations through 140 subsidiaries and equity-method affiliates in 30 countries. About 90% of consolidated net sales are generated in more than 200 countries outside of Japan. The company is steadily restructuring its global engineering, manufacturing and marketing capabilities for sustainable long-term growth. Yamaha Motor in Europe (YME) is responsible for coordinating the marketing and sales activities of Yamaha Motor products in the European

	marketplace, mainly: Yamaha motorcycles and scooters, marine outboard engines, Waverunner water vehicles, 4-wheel All Terrain Vehicles (ATV's), golf cars, snowmobiles and generators. Yamaha has in invested in France to manufacture motorcycles, scooters and outboard engines.
Link to REE4EU	The Japanese auto maker believes it is near a breakthrough in developing electric motors that do not require of the use of rare earth metals. They can be considered really focused on innovative recycling methods because the rare earths availability is quickly decreasing.
Application/products	Electric Bicycles Yamaha is also involved in Loudspeakers, Hard disk drives, DVD and CD players

Company information	**Name:** A2B **Type:** Large Industry **Country:** United Kingdom **Website:** http://www.wearea2b.com/it
Value chain position	End User
General description	A2B is a premium electric bike brand present in 30 countries worldwide, owned by Hero Eco Ltd. Headquartered in London, UK with offices in Germany and USA.
Link to REE4EU	Its products are equipped with a synchronous electric motor with permanent magnets.
Application/products	Electric Bicycles

Company information	**Name:** Benelli **Type:** Large Industry **Country:** Italy **Website:** http://www.benellibike.com/e-bikes.php
Value chain position	End Users
General description	"BENELLI BICICLETTE" is the new challenge proposed by Benelli Q.J., Italian company known throughout the world for its excellent production of moto e scooter. Besides being ecological, the bicycle remains one of the favourite way of moving in the city, allowing to skip the traffic with absolute ease. Even out-of-town, electric bicycles provide uncountable benefits: thanks to power-assisted bikes every rider can cover long distances leaving the car at home. A real achievement in terms of cost

	and fuel consumption. To meet these challenges Benelli presents a complete range of electric bicycles, city bikes and mountain bikes with a modern and unmistakably design and quality components.
Link to REE4EU	Its components include interior permanent magnet(IPM) motors.
Application/products	Electric Bicycles

Company information	**Name:** Kalkhoff **Type:** Large Industry **Country:** Germany **Website:** http://www.kalkhoff-bikes.com/
Value chain position	End user
General description	Kalkhoff is a German bicycle manufacturer based in Cloppenburg; it was founded in 1919 by Heinrich Kalkhoff as a family business. Founded as a first small workshop in Kalkhoff's parents' house, the company grew steadily. During the 1950s' bicycle boom, Kalkhoff expanded to 1200 employees and daily production reached 5000 frames. Production of Kalkhoff bicycles continues, with its expanding business of electric bicycles.
Link to REE4EU	Today, large part of the Kalkhoff business is based on the production of electric bicycles, making Kalkhoff interested in REEs for their application on bicycle motors. Furthermore they install also electric parts provided by Bosch, as already described.
Application/products	Electric bicycles

Company information	**Name:** AGOGS electric Bikes **Type:** SME **Country:** Czech Republic **Website:** https://www.agogs.com/
Value chain position	End users
General description	Having been founded in 2008, AGOGS is a renowned electric bicycle brand. One of AGOGS's founding ideas was to specialize in electric bikes, most companies which offered e-bikes were actually just offering normal bikes upgraded with an electric bike kit. In this way, it was mainly cyclists

	who were the target group. However, e-bikes have potential to change transportation habits on a bigger scale, especially in cities. This is why AGOGS has and will continue to promote the electric mobility in general and of course its partners in the electric bike market.
Link to REE4EU	Its bikes are equipped with a synchronous electric motor with permanent magnets.
Application/products	Electric Bicycles

Company information	**Name:** BH eBike **Type:** SME **Country:** Spain **Website:** http://www.bhbikes.com/
Value chain position	End Users
General description	Beistegui Hermanos S.A. (BH) is a Basque bicycle manufacturer founded in 1909 to make guns. In 1919, after World War I, BH began making bicycles. In the early 1990s, BH purchased Peugeot and founded Cycleurope. Cycleurope owns Bianchi, Peugeot and Gitane. In 1996, BH sold Cycleurope to concentrate on home markets of Spain and in Portugal. In 2001, it re-focused on the pan-European market. BH manufactures 200,000 bicycles a year, 50% of which are exported to European countries other than Spain. BH sponsors the Direct Énergie Pro Cycling Team in the 2016 season.
Link to REE4EU	Its bikes are equipped with a synchronous electric motor with permanent magnets.
Application/products	Electric Bicycles

Company information	**Name:** Kettler **Type:** Company (large) **Country:** Germany **Website:** http://www.kettler.it/
Value chain position	End user
General description	Kettler is a German company based in Ense-Parsit, with locations all around the world. The company produces bicycles, riding toys, leisure

	gear, patio furniture and exercise equipment (Sports equipment industry). Furthermore they install also electric parts provided by Bosch.
Link to REE4EU	Among all the manufactured sports equipment, Kettler is a producer of electric bicycles, requiring REEs for the production process.
Application/products	Electric bicycles

4.3.8 End users - Hard disk drives, DVD and CD players

Several applications in the electronics sector represent significant opportunities for REE recycling.

Computer hard disk drives (HDDs) are one such application. Hard drives are collected in large numbers for secure destruction, which means that there is a well-defined waste stream that can be easily accessed. The content of NdFeB in HDDs is relatively high (1g-30g) and the magnets are nearly always in the same position in the device. Moreover, HDDs have a relatively short lifespan and they are already pre-separated in many instances from the rest of the computer.

On the other hands, CD and DVD drives use nickel-plated Neodymium rare-earth magnets in their laser lens positioning system. This is the subsystem that compensates for things like vibration/wobble, minor variations in track and dot placement from drive to drive, etc. Basically, the very finest level of control on the laser lens position.

It's worthy notice that many producers of CD/DVD driver are also amplifiers/loudspeakers' providers as audio equipment manufacturers, but in the loudspeakers' section only the specialized companies have been included.

Company information	**Name:** Goldmund **Type:** SME **Country:** Switzerland **Website:** http://www.goldmund.com/en
Value chain position	End user
General description	Goldmund is a Swiss Luxury high end audio brand founded in 1978. Goldmund has developed and introduced industry's first home wireless music distribution, DVI output, mechanical grounding, thermal grounding, extreme multichannel processing and many more. Goldmund introduced products such as the Reference II turntable, the world's most expensive turntable, the Telos 5000 limited series 5000 watts amplifier, the Eidos Reference Blue, the most luxurious universal player, and the Goldmund Media Room, a revolutionary customized home theater solution.

Link to REE4EU	Most part of DVD and CD players are driven by REE and permanent magnets.
Application/products	Hard disk drives, DVD and CD players

Company information	**Name:** Krell Industries Inc. **Type:** Large Industry **Country:** USA **Website:** http://www.krellonline.com/
Value chain position	End user
General description	Krell Industries Inc., founded by its C.E.O. and chief designer Dan D'Agostino, is one of America's largest manufacturers of high-end audio systems. While most of their acclaim has come from their power amplifiers and CD players (their flagship model being the Master Reference Amplifier with a price of roughly $100,000), they also make preamplifiers, loudspeakers, subwoofers and SACD players. In 2013 the Acura RLX featured an optional Krell audio system.
Link to REE4EU	Most of the audio systems (both CD/DVD player and loudspeakers) produced are driven by REE and permanent magnets.
Application/products	Hard disk drives, DVD and CD players/loudspeakers

Company information	**Name:** Mark Levinson Audio Systems **Type:** Large Industry **Country:** USA **Website:** http://www.marklevinson.com/
Value chain position	End user
General description	Mark Levinson, as part of Harman International Industries, is a high-end audio equipment (CD players and amplifiers) brand established in 1972 by eponymous founder Mark Levinson.

Link to REE4EU	They use rare earth minerals in their products, specifically rare earth neodymium magnets. A significant disruption in the supply of neodymium would have a material adverse impact on their consolidated results of operations. Beyond the use of REE in CD players, in the Proprietary Metal-Cone 6.5-inch Woofers, Midranges, and Tweeters the rare earth neodymium magnet/motor structures provide higher magnetic flux levels in a smaller and lighter transducer package.
Application/products	Hard disk drives, DVD and CD players/loudspeakers

Company information	**Name:** McIntosh Laboratory **Type:** Large Industry **Country:** USA **Website:** http://www.mcintoshlabs.com/
Value chain position	End user
General description	McIntosh Laboratory is an American manufacturer of handcrafted high-end audio equipment (players, amplifiers and loudspeakers) based in Binghamton, New York. The company was founded in 1949 by Frank McIntosh. McIntosh is highly recognizable for their black glass front panels, "McIntosh Blue" amplifier power meters and iconic logo.
Link to REE4EU	Most produced audio CD players, loudspeakers and amplifiers are driven by REE and permanent magnets.
Application/products	Hard disk drives, DVD and CD players/loudspeakers

Company information	**Name:** Musical Fidelity **Type:** SME **Country:** United Kingdom **Website:** http://www.musicalfidelity.com/
Value chain position	End user
General description	Musical Fidelity is a low volume producer of high-end audio equipment (CD players, loudspeakers and amplifiers). Founded in the United

	Kingdom in 1982, they are known for the unusual industrial design applied to their products. Led by clarinetist Antony Michaelson, who also founded the "Musical Fidelity" record label, the company has a stated mission of producing "state-of-the-art high-end sound at a modest price". Michaelson believes in the superior sonic value of valves. In 2002 he shifted the majority of Musical Fidelity's production to Taiwan. Product design and management duties are carried out in England.
Link to REE4EU	Most produced audio systems (CD players, loudspeakers and amplifiers) are driven by REE and permanent magnets.
Application/products	Hard disk drives, DVD and CD players/loudspeakers

Company information	**Name:** Quad **Type:** Large Industry **Country:** United Kingdom **Website:** http://www.quadindustrial.com/
Value chain position	End user
General description	Quad is part of the IAG Group Ltd. High quality audio solutions for the contract installation, architectural and audio-visual integration sectors. Quad Industrial offers a range of professional audio products that cater for the demanding needs of the fixed installation sector, from retail to houses of worship.
Link to REE4EU	Magnetic screening and shielding is one of the features offered by the company that use REE magnet in most of its products.
Application/products	Hard disk drives, DVD and CD players/Loudspeakers

Company information	**Name:** Rega Research **Type:** SME **Country:** United Kingdom **Website:** http://www.rega.co.uk/

Value chain position	End user
General description	Rega Research Ltd. is a high-end audio equipment (CD player, amplifiers and loudspeakers) manufacturer based in the UK. Rega was founded in 1973. The company's name was formed of the initials of its two founders (Relph & Gandy). Rega are widely known for their turntables, cartridges and tonearms, and has produced award winning amplification and speakers for over 20 years. In addition to manufacturing products under their own brand name, they have also serve as an original equipment manufacturer of turntables and tonearms for other companies such as NAD and Rotel. Rega Research is imported and distributed in the US by The Sound Organisation, based in Dallas, Texas.
Link to REE4EU	Portable CD players and sound systems would not exist in their current form without using neodymium magnets. Neodymium-Iron- Boron (NdFeB) permanent magnets are essential for miniaturizing a variety of technologies. These magnets maximize the power/cost ratio, and are used in a large variety of products by Rega Research.
Application/products	Hard disk drives, DVD and CD players/ Loudspeakers

Company information	**Name: Western Digital Corporation** **Type:** Large Industry **Country:** Worldwide **Website:** http://www.wdc.com
Value chain position	End user
General description	Western Digital Corporation (commonly referred to as Western Digital and often abbreviated as WDC or WD) is an American computer data storage company and one of the largest computer hard disk drive manufacturers in the world, along with Seagate Technology. Western Digital Corporation has a long history in the electronics industry as an integrated circuit maker and a storage products company. Western Digital was founded on April 23, 1970, by Alvin B. Phillips, a Motorola employee, as General Digital, initially (and briefly) a manufacturer of MOS test equipment. It rapidly became a speciality semiconductor maker, with start-up capital provided by several individual investors and industrial giant as Emerson Electric. Around July 1971, it adopted its current name and soon introduced its first product, the WD1402A UART.
Link to REE4EU	Most produced computer hard disk are driven by REE and permanent magnets. WD's next-generation WD Green hard drives are built using less rare earth minerals. As reported in the guide about "WESTERN DIGITAL

	CORP. – RISK FACTORS" WD is strongly focused on price volatility, shortages of critical materials or components, or use by other industries of materials and components used in the storage industry and they consider that: *"Shortages of critical components such as DRAM and NAND flash, or materials such as glass substrates, stainless steel, aluminum, nickel, neodymium, ruthenium, platinum or cerium, may increase our costs and may result in lower operating margins if we are unable to find ways to mitigate these increased costs. We or our suppliers acquire certain precious metals and rare earth metals like ruthenium, platinum, neodymium and cerium, which are critical to the manufacture of components in our products from a number of countries, including the People's Republic of China."*
Application/products	Hard disk drives, DVD and CD players

Company information	**Name: Seagate Technology PLC** **Type:** Large Industry **Country:** Worldwide **Website:** http://www.seagate.com/
Value chain position	End user
General description	Seagate Technology PLC (commonly referred to as Seagate) is an American data storage company. It was incorporated in 1978, as Shugart Technology. Since 2010, the company is incorporated in Dublin, Ireland, with operational headquarters in Cupertino, California, United States.
Link to REE4EU	Seagate is strongly interested in REE4EU project, since the increasing costs of components which contain rare earth metals have strongly affected the financial results of the company.
Application/products	Hard disk drives, DVD and CD players

Company information	**Name: Angelbird Technologies GmbH** **Type:** SME **Country:** Austria **Website:** www.angelbird.com
Value chain position	End user
General description	Angelbird Technologies GmbH is a privately held Austrian computer electronics company that designs and manufactures hard disk drives and

	solid-state drives (SSDs) for both consumer and enterprise markets, including the fastest external SSD in the world. Founded in 2011, Austria was chosen as the company headquarters because of its rapidly expanding tech industry. Unusually, Angelbird handles all stages of development and manufacture of its products in-house.
Link to REE4EU	Beyond the content of NdFeB in HDDs, the rare earth metal terbium is used in the production of SSD and Angelbird could be very interested in the highest opportunity for REE recovery.
Application/products	Hard disk drives, DVD and CD players

Company information	**Name: Kingston Technology Corporation** **Type:** Large Industry **Country:** USA - Ireland **Website:** http://www.kingston.com/
Value chain position	End user
General description	Kingston Technology Corporation is an American, privately held, multinational computer technology corporation that develops, manufactures, sells and supports flash memory products and other computer-related memory products. Headquartered in Fountain Valley, California, United States, Kingston Technology employs more than 3,000 employees worldwide as of Q1 2016. The company has manufacturing and logistics facilities in the United States, United Kingdom, Ireland, Taiwan, and Mainland China. Kingston serves an international network of distributors, resellers, retailers and OEM customers on six continents. The company also provides contract manufacturing and supply chain management services for semiconductor manufacturers and system OEMs.
Link to REE4EU	Kingston Technology Company, Inc., together with its affiliated company, Kingston Digital, Inc., (collectively referred to as “Kingston”) announced that it has joined the Electronic Industry Citizenship Coalition (EICC) and became an Applicant Member on April 15, 2016. EICC Vision foresees that the global electronics industry creates sustainable value for workers, the environment and business.
Application/products	Hard disk drives, DVD and CD players

Company information	**Name: Intenso GmbH** **Type:** SME **Country:** Germany **Website:** http://intenso.de/index_en.php
Value chain position	End user
General description	Intenso GmbH is a German company that offers products from the area of storage media and entertainment electronics under the brand name "Intenso" in Germany and in other European countries. The head office is located in Vechta (Lower Saxony). In addition to storage media such as CD, DVD and BluRay discs, memory cards, external hard drives and USB sticks, the company other products from the field of electronics equipment. Intenso currently employs 90 people at its location in Vechta. In fiscal 2013, the company generated sales of 150 million euros.
Link to REE4EU	Most produced electronic products are driven by REE and permanent magnets.
Application/products	Hard disk drives, DVD and CD players

Company information	**Name: Packard Bell** **Type:** Large Industry **Country:** The Netherlands **Website:** http://www.packardbell.com
Value chain position	End user
General description	Packard Bell is a Dutch-based computer manufacturing subsidiary of Acer. The brand name originally belonged to an American radio manufacturer, Packard Bell, founded by Herbert "Herb" A. Bell and Leon S. Packard in 1933. Some websites use 1926 as the founding date when Herbert Bell was an executive with Jackson Bell Company, Los Angeles, California. In 1986, Israeli investors bought the name for a newly formed personal computer manufacturing company producing discount computers in the United States and Canada. In 2000, Packard Bell, then a subsidiary of NEC, stopped its North American operations while remaining a leading brand in the European markets. In 2008 it was acquired by the Taiwanese consumer electronic firm Acer in the

	aftermath of its takeover of Gateway computers. Gateway products are now sold in the Americas and Asia, while Packard Bell products are sold in Africa, Europe and the Middle East.
Link to REE4EU	Most produced electronic products are driven by REE and permanent magnets.
Application/products	Hard disk drives, DVD and CD players

Company information	**Name:** Rotel **Type:** Large Industry **Country:** Japan – United Kingdom **Website:** http://www.rotel.com/en-gb
Value chain position	End user
General description	Rotel is a family-owned Japanese manufacturer of high end audio and video equipment: home theater, amplifiers, compact disc players, etc. with the establishment of exclusive distribution in North America and several European markets. Over the next 20 years, Rotel appointed virtually all Bowers & Wilkins distributors globally. In 2000 the B&W Group established Rotel Europe in the UK to consolidate all Rotel sales and support activities outside of North America. Rotel maintains an exclusive network of specialist hi-fi dealers around the world.
Link to REE4EU	Rotel is a manufacturer of a wide range of products requiring REEs, for instance CD players and loudspeakers. Rotel sells its products around the world.
Application/products	Hard disk drives, DVD and CD players/Loudspeakers

Company information	**Name:** Microboards **Type:** Large Industry **Country:** United Kingdom **Website:** http://www.microboards.com/
Value chain position	End user

General description	Originally founded in 1989 as the international division of a Japanese CD-engineering firm, Microboards Technology has been growing rapidly along with CD-R technology for the past 21 years. With the introduction and acceptance of DVD-R and now Blu-Ray to the market, Microboards is in a unique position to serve the needs of various industries with all kinds of optical media technology.
Link to REE4EU	DVD and CD drivers would not be possible without REE magnets.
Application/products	Hard disk drives, DVD and CD players

Company information	**Name:** Abbingdon Music Research **Type:** SME **Country:** United Kingdom **Website:** http://www.amr-audio.co.uk/index.html
Value chain position	End user
General description	Founded in 2000, Abbingdon Music Research (AMR) is one of the UK's largest manufacturers of high-end audio systems. It is a subsidiary of the Abbingdon Global Group. While most of their acclaim has come from their amplifiers and CD players, they also make phono pre-amplifier, loudspeakers, cables and accessories.
Link to REE4EU	Most produced speakers are driven by a permanent magnet.
Application/products	Hard disk drives, DVD and CD players/ loudspeakers

Company information	**Name:** Accuphase Laboratory, Inc. **Type:** Large Industry **Country:** Worldwide **Website:** http://www.accuphase.com/
Value chain position	End user
General description	The main activities include: planning, development, manufacture, sales, and servicing of high-end audio equipment. Accuphase's European distribution network is well organized with 28 official distributor in each country.
Link to REE4EU	Hard disk drives, DVD and CD players contain REE magnet. In particular, the centerpiece of the DP-950, SA-CD/CD drive, Chucking magnet using neodymium is designed to firmly and evenly hold the disc to prevent wobble.

Application/products	Hard disk drives, DVD and CD players

Company information	**Name:** Densen Audio Technologies **Type:** **Country:** Denmark **Website:** http://densen.dk/
Value chain position	End user
General description	Densen Audio Technologies is a Danish manufacturer of high fidelity equipment, CD players and amplifiers.
Link to REE4EU	Most produced audio systems are driven by REE and permanent magnets.
Application/products	Hard disk drives, DVD and CD players

Company information	**Name:** Harman Kardon **Type:** Large Industry **Country:** USA **Website:** http://www.harmankardon.com/
Value chain position	End user
General description	Harman Kardon (styled as harman/kardon) is a division of Harman International Industries and manufactures home and car audio equipment. It was founded in 1953 by Sidney Harman and Bernard Kardon. The MNC is now acquired by Korean tech giant Samsung in late 2016 for $8 billion focusing on improving business in car link platform and to improve much anticipated sound quality enhancement for their Galaxy line up. Harman Kardon supplies audio equipment to a several vehicle manufacturers including Audi, BMW, Land Rover, Mercedes-Benz, MG Rover, Volvo, Buick, Kia, Ssangyong, MINI, Saab, Harley-Davidson, Jeep, Chrysler, Dodge, Subaru and Tata Motors. Headquartered in Stamford, Connecticut, Harman maintains major operations in the Americas, Europe, as well as Asia and markets its products under more than twenty brands.
Link to REE4EU	One of the breakthroughs in speaker design is the use of neodymium instead of heavier ferrite materials. Typically, audio makers use small amounts of neodymium in tweeters and midrange drivers. JBL engineers use generous amounts of neodymium in the W15GTi MkII subwoofer to

	ensure much greater magnetic-energy density. As a result, this subwoofer provides superbly accurate cone movements. It delivers a high degree of control that is virtually without comparison among car subwoofers.
Application/products	Hard disk drives, DVD and CD players/Loudspeakers

Company information	**Name:** Freecom **Type:** Large Industry **Country:** Germany **Website:** http://www.freecom.com/
Value chain position	End user
General description	Freecom is a German manufacturer of hard disk drives and computer peripherals, and part of the Mitsubishi Chemical / Verbatim group. Freecom products include USB flash drives, USB DVB-T television receivers and a data recovery service.
Link to REE4EU	Europe hard disk drive market is greatly dependent on American and Eastern stakeholder. Yet, Freecom is one of the European centered USB drive manufacturer and end user of REEs.
Application/products	Hard disk drives, DVD and CD players

Company information	**Name:** PM DM **Type:** Large Industry **Country:** Germany **Website:** http://www.pmdm.de/en
Value chain position	End user
General description	As part of the Minebea group, which has about 70,000 employees and is one of the leading manufacturers of mechanical and electronic components, PM DM develops innovative BLDC motors, drive systems and Energy Harvesting Systems. In addition to the core business, the development of hard disk drives motors (spindle motors), the company also develops precision motors used in the fields of the automotive and industrial motors.

Link to REE4EU	REEs are one of the main feedstock for PM DM products. They use REEs not only in hard drive manufacturing but also in automotive industry. This makes PM DM one of the important European origin end user
Application/products	Hard disk drives/Automotive

4.3.9 End users - Loudspeakers

Company information	**Name:** Auro 3D **Type:** Large Industry **Country:** Belgium **Website:** http://www.auro-3d.com/
Value chain position	End user
General description	Auro 3D (as part of Galaxy Group) is now set to become the industry's most advanced research center for acoustical recording. Wilfried developed the Auro-3D® Concept back in 2005, his idea crystalizing soon thereafter with the help of a team of highly specialized engineers. It was in 2006 that Wilfried first presented his concept along with the Auro-3D® listening formats to the Audio Engineering Society conventions in both Paris and San Fransisco. His innovative audio playback system was to include the technical solutions necessary to bring Auro-3D® to the market while staying within the existing standards. After over five years of development, Auro-3D® and it's ground breaking Auro-Codec are ready to change the way we experience sound.
Link to REE4EU	Among others, the speaker S5N-8 is a 5-inch driver manufactured from Neodymium. This speaker is tailored to reproduce a frequency range from 150Hz-18kHz.
Application/products	Loudspeakers

Company information	**Name:** Audison **Type:** SME **Country:** Italy **Website:** http://www.audison.eu/
Value chain position	End user
General description	**Audison** is one of the brands of Italian Elettromedia s.r.l. company, a manufacturer of consumer audio products. The company was founded at 1979, but Audison name (born from Latin words Audio and Sonus) was

	registered at 1984. Currently Audison has different kinds of mobile audio products: amplifiers, audio processors, speakers and subwoofers.
Link to REE4EU	The TH 3.0 voce midrange was born aiming at the optimization of three-way systems. The X-pulp cone, produced using cellulose pulp and a glass fibre mesh, provides the highest rigidity along with the warm and detailed sound typical of cellulose. The high precision mechanical parts were created by machining solid one piece material, including a REN (Rare Earth Neodymium) magnet.
Application/products	Loudspeakers

Company information	**Name:** Dalì **Type:** SME **Country:** Denmark **Website:** http://www.dali-speakers.com/
Value chain position	End user
General description	DALI offers an exciting range of speakers to suit every taste from the cost-conscious ZENSOR series to the ultimate performance speaker the MEGALINE. With more than one million satisfied DALI owners in more than 65 countries, it brings music and film to life at home, giving proud DALI owners a more honest, nuanced and richly detailed listening experience.
Link to REE4EU	Dali produces 45mm full range rare earth high magnetic speakers used by different brand in audio field.
Application/products	Loudspeakers

Company information	**Name:** d&b audiotechnik **Type:** Large Industry **Country:** Germany **Website:** http://www.dbaudio.com/
Value chain position	End user
General description	As the renowned worldwide market leader, d&b audiotechnik defines the global standard for technology (loudspeakers and amplifiers), quality and support of professional sound reinforcement systems.
Link to REE4EU	d&b audiotechnik offers different sound systems with efficient HF compression driver with rare-earth magnet, 3.25 voice coil and pure Titanium diaphragm.

Application/products	Loudspeakers

Company information	**Name:** Dynaudio **Type:** Large Industry **Country:** Denmark **Website:** http://www.dynaudio.com
Value chain position	End user
General description	Dynaudio is the leading producer of hand-crafted high-end loudspeakers created by impassioned music lovers for living room, professional studio and for car.
Link to REE4EU	Dynaudio uses the magnet in NdFeB rare earth 70mm dia, that is very powerful, large enough to drive a 12" speaker.Uses a 3" voice coil.
Application/products	Loudspeakers

Company information	**Name:** Electrocompaniet **Type:** SME **Country:** Norway **Website:** http://www.electrocompaniet.no/
Value chain position	End user
General description	Electrocompaniet was established in 1973. It is Norway's oldest and largest manufacturer of HiFi and loudspeakers. Their amplifiers have been used in several Recording Studios, including Michael Jackson and Abbey Road Studios.
Link to REE4EU	Its product feature neodymium magnets are the most powerful commercially produced magnets and are popular in high end loud speakers & high intensity separators.
Application/products	Loudspeakers

Company information	**Name:** Gale **Type:** SME **Country:** United Kingdom **Website:** http://www.gale.co.uk/loudspeakers.html
Value chain position	End user

General description	Since the first loudspeaker rolled out of the factory doors in 1972 they have gained a reputation for producing innovative and often striking designs. More recently, the range of monitors have established themselves as some the UK's best selling loudspeakers and their models continue to win an impressive collection of the audio press' most prized awards and recommendations the world over.
Link to REE4EU	Permanent magnet applications are in loudspeakers, earphones in the Gale's production.
Application/products	Loudspeakers

Company information	**Name:** Funktion-one **Type:** SME **Country:** United Kingdom **Website:** http://www.funktion-one.com/
Value chain position	End user
General description	Funktion-one are English inventors and manufacturers of professional loudspeaker systems.
Link to REE4EU	Funktion-one is the owner of the patent "Loudspeaker - US 6650760 B1" with the use of permanent magnet in it.
Application/products	Loudspeakers

Company information	**Name:** Genelec **Type:** SME **Country:** Finland **Website:** http://www.genelec.com
Value chain position	End user
General description	Since 1978 Genelec has developed high quality studio monitors and active speaker systems. Genelec products are designed for demanding professional, home and AV installation use.
Link to REE4EU	One of the most important technology used by Genelec is the magnetic shielding using rare earths. Magnetic shielding reduces the magnetic field around the monitor. Drivers have permanent magnets and are magnetically shielded to minimise stray magnetic fields. The stray magnetic fields can disturb magnetic compasses and other equipment that depend on static magnetic field.

Application/products	Loudspeakers

Company information	**Name:** KEF **Type:** Large Industry **Country:** United Kingdom **Website:** http://www.kef.com/
Value chain position	End user
General description	From the very beginning, the pioneering inventiveness of KEF loudspeakers was undeniable and now for several decades, audiophiles around the world have revered KEF for its innovative, high-performance loudspeakers.
Link to REE4EU	As KEF's signature technology, the Uni-Q concept is renowned for its uncannily natural sound and stable imaging. The tweeter now has a vented motor system with three rare earth magnets, and a unique braced dome.
Application/products	Loudspeakers

Company information	**Name:** Audiolab **Type:** SME **Country:** United Kingdom **Website:** http://www.audiolab.co.uk/
Value chain position	End user
General description	Audiolab is a British manufacturer of audio equipment. It specializes in affordable systems and has a range of stereo and surrounds sound systems. During its ownership under McLaren Group it was named TAGMcLaren Audio.
Link to REE4EU	Audio equipment use REE magnet. For example, The ATH-ANC70 QuietPoint® headphones feature large-aperture 40 mm drivers with a rare earth magnet system and high sensitivity to provide generous volume levels from any music source.
Application/products	Hard disk drives, DVD and CD players/loudspeakers

Company information	**Name:** Naim Audio **Type:** Large Industry

	Country: United Kingdom **Website:** https://www.naimaudio.com/
Value chain position	End user
General description	Founded in 1973, 'Naim Audio' is a hi-fi manufacturer based in Wiltshire, UK. With a history rooted in engineering and design, Naim won the prestigious Queen's Award for Enterprise on three occasions, most recently for its design of digital music systems. Naim designs and engineers a wide range of hi-fi products including digital music systems, amplifiers and loudspeakers.
Link to REE4EU	Most of the produced audio systems are driven by REE and permanent magnets.
Application/products	Loudspeakers

Company information	**Name:** Amphion Loudspeakers **Type:** SME **Country:** Finland **Website:** http://www.amphion.fi/
Value chain position	End user
General description	Amphion Loudspeakers is a Kuopio, Finland based company producing high-quality loudspeakers. Their portfolio includes two main categories ; Enjoy - loudspeakers for home , and Create - studio monitors. Their speaker design is characterized by highly resolving and natural reproduction. Precise driver integration ensures world-class imaging and phase coherence. Controlled dispersion helps achieving more stable results in variety of room acoustics. According to managing director and founder Anssi Hyvönen, Amphion speakers have won many enthusiasts among famous music personalities, such as producer Rick Rubin.
Link to REE4EU	Magnetostrictive rare-earth magnets such as Terfenol-D have application in loudspeakers Amphion.
Application/products	Loudspeakers

Company information	**Name: Apertura** **Type:** SME **Country:** France **Website:** http://www.apertura-audio.com/EN/
Value chain position	End user
General description	Apertura is a brand of Stentor SAS. For almost twenty years it has offered to music lovers around the world, a range of speakers and cables without compromise.
Link to REE4EU	Most of the produced audio systems are driven by REE and permanent magnets.
Application/products	Loudspeakers

Company information	**Name:** Bang & Olufsen **Type:** Large Industry **Country:** Denmark **Website:** www.bang-olufsen.com
Value chain position	End user
General description	Bang & Olufsen (B&O) (stylized as BANG & OLUFSEN) is a Danish consumer electronics company that designs and manufactures audio products, television sets, and telephones. It was founded in 1925 by Peter Bang and Svend Olufsen, whose first significant product was a radio that worked with alternating current at a time when most radios were run on batteries. In 2004, the company opened a factory in the Czech Republic where it employs approximately 250 staff producing mainly audio products.
Link to REE4EU	Many of its headset products, (for example, the BeoPlay H6) deliver authentic, clear and powerful sound and include a 40 mm driver with neodymium magnets to enhance the bass performance.
Application/products	Loudspeakers/ Hard disk drives, DVD and CD players

Company information	**Name:** Behringer **Type:** Large Industry **Country:** Germany **Website:** https://www.music-group.com/brand/behringer/home
Value chain position	End user
General description	Behringer is an audio equipment company founded by Uli Behringer in 1989, in Willich, Germany. Behringer was listed as the 14th largest manufacturer of music products in 2007. Behringer is a multinational group of companies, with direct marketing presence in 10 countries or territories and a sales network in over 130 countries around the world. Though originally a German manufacturer, the company now makes its products in China. The company is owned by Music Group, a holding company chaired by Uli Behringer, which also owns other audio companies such as Midas, Klark Teknik and Bugera, as well as Electronic Manufacturing Services company Eurotec. In June 2012, Music Group also acquired Turbosound company, which designs and manufactures professional loudspeaker systems and was formerly owned by Harman.
Link to REE4EU	Neodymium Speakers are among its the product offerings. In Behringer's web the advantages of rare earth have been stated as follows: "The primary advantage of neodymium, over iron or ceramic magnets, is its much higher magnetic strength-to-weight ratio. Using this rare earth metal allows us to make extremely-powerful LF and HF transducers that are significantly lower in weight. The B912NEO employs this same technology to create a 1,260-Watt active loudspeaker that comes in at just 41 lbs (19 kg), while still maintaining the ultimate in sonic performance – and that's truly a big deal!"
Application/products	Loudspeakers

Company information	**Name:** Bowers & Wilkins **Type:** Large industry **Country:** United Kingdom **Website:** http://www.bowers-wilkins.com/
Value chain position	End user

General description	Bowers & Wilkins, or B&W, is a British company that produces audio equipment, most notably loudspeakers. B&W was founded in 1966 by John Bowers at Worthing, West Sussex, England. Currently, B&W, while still based in Worthing, is part of the B&W Group Ltd., which also includes audio equipment manufacturers Rotel and Classé. B&W previously offered a range of electronics, like amplifiers, under the Aura brand, but it was discontinued in 1997. Other sub-brands were 'John Bowers' for the Active One loudspeaker and preamp and 'Rock Solid' for a lifestyle speaker range. The B&W 'Blue Room' brand for 'Pod' speakers disappeared as these are currently produced and sold by Scandyna. From 1988 to 1996 B&W ran their own record label.
Link to REE4EU	The audio systems are driven by REE and permanent magnets.
Application/products	Loudspeakers

Company information	**Name:** Cabasse **Type:** SME **Country:** France **Website:** http://www.cabasse.com/en/
Value chain position	End user
General description	Cabasse is a French audio manufacturer founded by Georges Cabasse in 1950. It is mainly known for its home loudspeakers but has also produced professional audio speakers for studio recording or sound reinforcement in theatres and power amplifiers.
Link to REE4EU	La Sphère System, is the acoustic master piece, and is made from REE components and the most powerful rare earth magnets available.
Application/products	Loudspeakers

Company information	**Name:** Castle Acoustic **Type:** SME **Country:** United Kingdom **Website:** http://www.castle.uk.com/

Value chain position	End user
General description	Castle Acoustics is a British manufacturer of hi-fi loudspeakers. Castle Acoustics was founded in 1973 and takes its name and its logo from the 11thC historic Skipton Castle, the North Yorkshire market town of Skipton having been Castle's home since its foundation. Castle is the only British loudspeaker manufacturer to build its own cabinets, buy and lay veneers for those cabinets, and develop and build its own drive units; all under one roof.
Link to REE4EU	Castle Acoustics use innovative magnet assemblies with the highest quality copper and aluminium wire.
Application/products	Loudspeakers

Company information	**Name:** Celestion **Type:** Large industry **Country:** United Kingdom **Website:** http://celestion.com/
Value chain position	End user
General description	Founded in 1924, Celestion has grown to become one of the world's largest and most innovative manufacturers of loudspeakers. Responsible for the first ever dedicated guitar speaker, Celestion drivers have become the 'voice of rock & roll', delivering many of the most memorable performances by guitarists including Jimi Hendrix and Slash through to the current crop of high-octane shredders. Celestion is at the heart of the professional sound reinforcement industry, relied upon by many of the world's leading manufacturers to deliver the sound of a great show.
Link to REE4EU	The audio systems are driven by REE and permanent magnets.
Application/products	Loudspeakers

Company information	**Name:** Focal-JMLab **Type:** SME

	Country: France **Website:** http://www.focal.com/
Value chain position	End user
General description	Focal-JMlab is a French company, which has been designing and selling high-fidelity audio systems since the early 1980s. This Saint-Étienne based company manufactures loudspeakers for the home, speaker drivers for automobiles, headphones and professional monitoring loudspeakers. The Grande Utopia is the brand's emblematic loudspeaker, which earned the company its worldwide reputation. It is considered one of the best high-fidelity loudspeakers in the world. Focal's industrial strategy concentrates on having full control over the entire production process, from the design and manufacturing of the speaker drivers to the assembly of the final product. Its products are entirely designed and developed in France, and most of the production is carried out at the factory in Saint-Étienne (France). Focal-JMlab generates a €-42-million annual turnover and employs about 200 people at its facility in Saint-Étienne, which groups the production, R&D and management departments at the same site. Its export share is 70%.
Link to REE4EU	Rare earth samarium-cobalt elements, as well neodymium are used in the audio systems.
Application/products	Loudspeakers

Company information	**Name: Kharma International B.V.** **Type:** **Country:** The Netherlands **Website:** http://www.kharma.com/
Value chain position	End user
General description	Kharma International B.V., usually known as Kharma, is a high-end audio equipment manufacturer producing mainly loudspeakers and cables.
Link to REE4EU	The audio systems are driven by REE and permanent magnets.

Application/products	Loudspeakers

Company information	**Name: Linn Products** **Type:** SME **Country:** United Kingdom **Website:** https://www.linn.co.uk/
Value chain position	End user
General description	Linn Products is an engineering company that manufactures hi-fi and audio equipment. From 2007 Linn was one of the first audio manufacturers to introduce digital music streaming using the home network and internet. This has become the focus of the company's strategy leading to audio systems to support digital music playback of 24bit/192 kHz studio master quality recordings using a digital stream over a home network. Linn Records was the first to sell DRM-free 24-bit Studio Master quality tracks downloaded over the internet. This network approach was extended in 2013 with the introduction of the Linn Exakt technology to retain the 24-bit lossless signal in the digital domain to the active crossover. In late 2014 Linn announced the integration of TIDAL's lossless music streaming service (Tidal (service)) into Linn DS digital players enabling access to over 25 million audio tracks at CD-quality over the Internet. Originally based in the eponymous suburb of Linn, south Glasgow, and opposite Linn Park, it is now based just outside the city, between Waterfoot and Eaglesham, East Renfrewshire.
Link to REE4EU	Most produced audio systems are driven by REE and permanent magnets.
Application/products	Loudspeakers

Company information	**Name:** Meridian Audio **Type:** SME **Country:** United Kingdom **Website:** https://www.meridian-audio.com/

Value chain position	End user
General description	Meridian Audio is an English manufacturer of high-performance, high-fidelity audio (and video) components and systems founded in 1977 by Bob Stuart and Allen Boothroyd.
Link to REE4EU	Many systems feature branded Meridian high-efficiency speakers (with lightweight neodymium rare earth magnets) are famous for their exceptional clarity and dynamics.
Application/products	Loudspeakers

Company information	**Name:** Mordaunt-Short **Type:** SME **Country:** United Kingdom **Website:** http://www.mordaunt-short.com/
Value chain position	End user
General description	Mordaunt-Short is a loudspeaker manufacturer in the United Kingdom. They are currently a subsidiary of Audio Partnership Plc., having been bought from TGI Plc. in 1999.
Link to REE4EU	Among other audio systems, they produce MORDAUNT SHORT PERFORMANCE 6 (Speakers Per Pair) where the midrange drive unit is an intriguing design featuring compact, rare earth, stacked double magnets.
Application/products	Loudspeakers/Hard disk drives, DVD and CD players

Company information	**Name:** NAD Electronics **Type:** Large Industry **Country:** Canada **Website:** http://nadelectronics.com/
Value chain position	End user

General description	NAD was an abbreviation for New Acoustic Dimension. NAD Electronics is part of Lenbrook Group, a brand name of an electronics firm whose products include home hi-fi amplifiers and related components. It produces not only amplifiers and loudspeakers but also CD/DVD players. Its most famous product is the late-1970s NAD 3020, an integrated amplifier designed by Bjørn Erik Edvardsen, which was highly regarded by various magazines in Britain. NAD's philosophy is to include only genuinely useful features for aesthetically understated designs when compared to other competitors' product. NAD was one of the first audio manufacturers to outsource the manufacturing of its products to electronics factories in east Asia. NAD was acquired by the Danish firm AudioNord in 1991 and subsequently sold in 1999 to the Lenbrook Group of Pickering, Ontario, Canada.
Link to REE4EU	VISO HP30 On-Ear Headphones is just one example of the application of the neodymium magnet.
Application/products	Loudspeakers/Hard disk drives, DVD and CD players

Company information	**Name:** Roksan Audio **Type:** Company **Country:** United Kingdom **Website:** http://www.roksan.co.uk/
Value chain position	End user
General description	Roksan is a British company founded over thirty years ago, one of the most recognized names in the audio industry. It offers international, multi-award winning products ranging from the highest level of vinyl replay to amplification, loudspeakers and streaming source products.
Link to REE4EU	Roksan operates in the audio and sound industry, manufacturing products, such as loudspeakers and CD players that need the inclusion of REEs in some of their components.
Application/products	Loudspeakers/Hard disk drives, DVD and CD players

Company information	**Name:** Creek Audio **Type:** SME

	Country: United Kingdom **Website:** http://www.creekaudio.com/
Value chain position	End user
General description	Creek Audio has been an integral part of the British Hi-Fi industry for the past 30 years. Creek Audio is a manufacturer of audio equipment. Creek Audio has been awarded multiple awards over the years for many of its products including: Integrated Amplifiers, CD Players, FM Tuners and accessories such as: Phono Pre-amplifiers, Headphone Amplifiers and Passive Pre-amplifiers.
Link to REE4EU	Most produced audio systems are driven by REE and permanent magnets.
Application/products	Loudspeakers/Hard disk drives, DVD and CD players

Company information	**Name:** Steinway Lyngdorf **Type:** Company **Country:** Denmark **Website:** http://www.steinwaylyngdorf.com/
Value chain position	End user
General description	Steinway Lyngdorf is a Danish professional audio system company. It produces complete high end audio systems such as loudspeakers and amplifiers aimed at high quality and high performance audio. In 2007, the high-quality piano maker Steinway & Sons gave Lyngdorf exclusive rights to manufacture high quality audio systems under the name Steinway Lyngdorf. Steinway & Sons audio products—designed and manufactured in Denmark since 2005 by Steinway Lyngdorf—are the world's finest audio systems.
Link to REE4EU	Steinway Lyngdorf currently manufactures high quality audio system, as loudspeakers and CD players. The Steinway Lyngdorf company is therefore in REEs, as necessary to produce such systems.
Application/products	Loudspeakers/ Hard disk drives, DVD and CD players

Company information	**Name:** Yamaha Pro Audio

	Type: Company **Country:** Japan **Website:** http://www.yamahaproaudio.com/europe/en_gb/
Value chain position	End user
General description	Yamaha Pro Audio, Inc. is a company which is part of the Yamaha Corporation group. It offers a complete line of professional audio products for the live sound and sound reinforcement markets. It has a long history of introducing significant products for the professional audio market.
Link to REE4EU	Yamaha Pro Audio is part of the huge group Yamaha Corporation. Being specialized in audio systems, the products produced and sold by Yamaha Pro Audio include loudspeakers and CD players. Specific parts of such goods require REEs.
Application/products	Loudspeakers/ Hard disk drives, DVD and CD players Yamaha group is also involved in the electric bicycles market.

4.3.10 End users - Magnetic separators

Company information	**Name:** Lift Hold & Separate **Type:** Large Industry **Country:** United Kingdom **Website:** http://www.lhs.uk.com/
Value chain position	End user
General description	Lift Hold & Separate supply the very best high quality and technically advanced magnets, all manufactured in Europe. With over 75 years industry experience the company designs solutions and can provide bespoke magnets for dedicated applications.
Link to REE4EU	They have strong interest in recovery methods for REE recycling. They produce machines for magnetic separations that contain Neodimium.
Application/products	Magnetic Separator

Company information	**Name:** ANDRIN MAGNETISME INDUSTRIEL **Type:** SME **Country:** France **Website:** http://www.andrin.fr
Value chain position	End user
General description	Located since 1947 at the heart of the European iron and steel basin, the ANDRIN family has developed an activity involving the repair and winding of electrical rotating and static machines. Activities include; construction and repair of lifting electromagnets, magnetic separators of ferrous and non-ferrous metals, construction and maintenance of electrical rotating or static magnetic or electromagnetic machines.
Link to REE4EU	Based on the REE4EU industrial pilot validations Andrine Magnetisme Industriel will be able to make adequate estimations and on the cost of recovered REE (Nd and Dy) and direct production of Rare Earth Alloys (REA) through the new processing route versus currently incomes from exporting in-process waste outside of Europe.
Application/products	Magnetic Separator

Company information	**Name:** FELEMAMG. S.L. **Type:** Company **Country:** Spain **Website:** http://www.felemamg.com/
Value chain position	End user
General description	FELEMAMG. S.L is a Spanish company, founded more than 40 years ago, specialized in the manufacture of magnetic equipment. The FELEMAMG magnetic products are used in almost all production sectors such as Steel plants, foundry, shredders, scrap yards, clinkers, iron stores, shipyards, mechanical workshops, oxycutting, port facilities, railways, cars, cement manufactures, plaster, sugar, ceramics, feldspar, incinerators, RSU, CDR, glasses, electronic waste, recyclers.
Link to REE4EU	FELEMAMG. S.L produces machines for magnetic separations that contain Neodimium.
Application/products	Magnetic separators

Company information	**Name:** SGM GANTRY SPA **Type:** SME **Country:** Italy **Website:** http://www.sgm-magnetics.com/
Value chain position	End user
General description	SGM has developed a position of pioneer and leader on industrial lifting magnets and has extended its magnetic separation expertise to other in-house separation technologies that are inductive based sensor separators, X-ray separators, color sorters, gravimetric separation and processes.
Link to REE4EU	SGM GANTRY SPA is the patent owner of *Magnetic separator with ferrite and rare earth permanent magnets (United States Patent 7564333)* and it is deeply interested in economically sustainable Rare Earth Alloys (REA) production from multiple waste streams.
Application/products	Magnetic Separator

Company information	**Name:** HI-FLUX MAGNETS LTD **Type:** SME **Country:** United Kingdom **Website:** http://hi-flux.co.uk/
Value chain position	End user
General description	Hi-FLUX supplies a complete range of magnetic equipment, materials and accessories. Their products include Magnetic Separator for plant protection and decontamination of raw materials and now include a range of products aimed at the recycling sector.
Link to REE4EU	Strong interest in recovery methods for REE recycling.
Application/products	Magnetic Separator

Company information	**Name:** CALAMIT MAGNETE GMBH **Type:** Large Industry **Country:** Germany **Website:** **http:/www.calamit.de/**
Value chain position	End user

General description	Production and sale of magnets and permanent magnets in Milan, Barcelona, Paris and Munich
Link to REE4EU	Calamit Magnete GBMH is an important REE product manufacturer and it is focused on the cost beneficial or neutral REE recovery from in-process waste.
Application/products	Magnetic Separator

Company information	**Name:** LUX MAGNET **Type:** Company **Country:** Luxembourg **Website:** http://www.luxmagnet.lu/Index.1.html
Value chain position	End user
General description	LUX MAGNET is a company, based in Luxembourg, specialized in the design, manufacture and repair of the following products: • Magnet separator with permanent magnet and electromagnetic. • Metal detectors • Magnetic lifting system with permanent magnet and electromagnetic. .
Link to REE4EU	LUX MAGNET produces overbands-magnets with neodymium magnets, fixed 'block' magnets with neodymium, and drums 'rollers' with permanent magnets containing neodymium. Given that its business is strongly based on magnets containing neodymium, LUX MAGNET has an interest in REEs.
Application/products	Magnetic separators

Company information	**Name:** MAGNET SERVICES LTD **Type:** SME **Country:** United Kingdom **Website:** http://www.magnet-services.co.uk/
Value chain position	End user

General description	They have many years of experience in the sale and repair of a wide range of industrial magnets, scrap handling magnets and steel magnets used in the recycling, waste management and steel industries.
Link to REE4EU	Strong interest in recovery methods for REE recycling
Application/products	Magnetic Separator

Company information	**Name:** COGELME S.R.L. **Type:** SME **Country:** Italy **Website:** http://www.cogelme.com/
Value chain position	End user
General description	Cogelme engineers and produces durable and high-performing equipment for recycling industries. In fact, among their products they have Magnetic Separator with Permanent Magnets, with Neodymium magnets - mod. SMN - for optimal extraction of little ferrous metals parts: iron dusts, little pieces of wired glass, iron powder, etc.
Link to REE4EU	Strong interest in recovery methods for REE recycling
Application/products	Magnetic Separator

Company information	**Name:** IDEMAG **Type:** SME **Country:** Spain **Website:** http://idemag.com/en/
Value chain position	End user
General description	IDEMAG is a magnetic system manufacturer and supplier of all kinds of magnets.
Link to REE4EU	Currently Rare earth magnets neodymium-iron-boron (NdFeB) are manufactured by sintering; commonly known as Neo magnet. This material provides the maximum magnetic force, a very high resistance to demagnetization and is ideal for applications requiring maximum force in a limited area. The Neo magnet is generally coated to protect oxidation. IDEMAG is strongly inclined to improve and make more efficient all the magnet's production.
Application/products	Magnetic Separator

Company information	**Name:** MAG SPRING NINGBO ZHENHAI I&E LTD **Type:** Company **Country:** China **Website:** http://www.mag-spring.com/company.html
Value chain position	End user
General description	MAG SPRING NINGBO ZHENHAI I&E LTD is a Chinese company that designs, manufactures and exports industrial magnets and magnetic products. The company owns the factory of Neodymium magnets, SmCo Magnets, magnetic system and multiple magnets developing center. Based on more than ten years of experience with cooperation with high end customers from USA, UK, Japan and so on, Mag Spring's professional factory has developed series of motor segment magnets, multipole magnets, magnetic assemblies and magnetic tools, such as Special Neodymium motor magnet, magnetic filter tube with 13000Gs, multipole ferrite ring magnet with 1900Gs, multipole nedodymium ring magnet with 6000Gs,etc.
Link to REE4EU	MAG SPRING NINGBO ZHENHAI I&E LTD, for its production of industrial magnets and magnet products, uses considerable quantities of Neodymium, one of the REEs. Since its business is based on nedodymium-containing magnets, MAG SPRING NINGBO ZHENHAI I&E LTD is interested in REEs.
Application/products	Magnetic separators

Company information	**Name:** ERTEX SCIENTIFIC & PRODUCING LTD **Type:** Company **Country:** Russia **Website:** http://www.ertex.ru/modules/tinyd1/
Value chain position	End user
General description	Ertex, a Russian company founded in 1994, is a leading manufacturer of modern magnets. Ertex produces a wide range of magnetic separators: suspended magnetic separators, magnetic grid separators, drum separators, pulley separators columnar separators and magnetic bars.

Link to REE4EU	The separators produced by Erex are manufactured using neodymium, making this company interested in REEs production and recovery.
Application/products	Magnetic separators

Company information	**Name:** VAZZOLER S.R.L. **Type:** Company **Country:** Italy **Website:** http://www.vazzoler.it/
Value chain position	End user
General description	Vazzoler s.r.l, established in 1998, is an Italian company that arises from a wide experience in the sector of the electromagnets and of the electro-permanents, handed down from two generations in more than 45 years. Vazzoler s.r.l has a technical know-how, acquired together with the constant research of innovative solutions. Vezzoler s.r.l. designs and manufactures different typologies of magnetic equipment for the lifting, de-ferrization and separation of metals The company, located in the North of Italy, operates all over the world.
Link to REE4EU	Vezzoler s.r.l. is specialized in the production of magnetic lifters, magnetic automation systems, magnet deferrization machines and separation of metals machines. Inside these machineries, Vezzoler s.r.l installs permanent magnets of neodymium, that make this company interested in the use of REEs.
Application/products	Magnetic separators

Company information	**Name:** HOFFMANN MASCHINEN- UND APPARATEBAU GMBH **Type:** SME **Country:** Germany **Website:** https://hoffmann-filter.de
Value chain position	End user

General description	HOFFMANN offers system solutions for the filtration and re-cooling of cutting fluids used in the manufacture of gears, compressors, cam shafts, crank shafts, turbine blades and many other industrial applications.
Link to REE4EU	They are supplier of magnetic separators.
Application/products	Magnetic separators

Company information	**Name:** SELOS S.R.O. **Type:** SME **Country:** Slovakia **Website:** http://www.selos.sk/
Value chain position	End user
General description	SELOS S.R.O. is an industrial company established by Mr. Jan Liptak in 1991. They are located in Trencin, Slovakia and Brno, Czech Republic. The product range consists of the folowing: - magnetic raw materials -- hard ferrite, neodymium, SmCo, AlNiCo- magnetic systems for industry -- lifting magnets, clamping permanent magnets, electromagnets, solenoids, magnetic brakes, magnetic tools- magnetic separators and filters- CNC machine tools EMCO- tapping machine tools Roscamat- RUKO tools, NES tools, SCM toolholders- service and repairs of TOS conventional machine tools.
Link to REE4EU	The separators produced by SELOS S.R.O. are manufactured using neodymium, making this company interested in REEs production and recovery.
Application/products	Magnetic separators

Company information	**Name:** SELTER S.A. **Type:** **Country:** Spain **Website:** http://www.selter.es/

Value chain position	End user
General description	The company is specialized in the design and manufacture of magnetic applications for the industry. Founded in 1956, the main activity is the production of magnetic chucks, expanding during the 60 range of chucks with other magnetic and electromagnetic systems. In 1969 SELTER initiated the exportations, which have been increasing until today, exporting to Europe, America and other areas. The range of magnetic systems is very useful in machine tools and general industry. Apart from standard products, SELTER designs and manufactures personalized magnetic systems to suit the specific requirements of the customers.
Link to REE4EU	Since 1990 Selter started with the neodymium magnet chucks, and created a new range of separator with Neodymium magnets which replaced the previous range made with ceramic magnets.
Application/products	Magnetic separators

Company information	**Name:** MAGNETIX SP.ZO.O. **Type:** SME **Country:** Poland **Website:** http://magnetix.com.pl/
Value chain position	End user
General description	Magnetix is a Polish manufacturer of magnetic systems. They have been operating on the market since 2000, as manufacturer of metal separators, lifting magnets to lift and transport ferromagnetic materials and magnetic transporters. The machines are used in mining, power, cement, metallurgical, ceramic, and food industries.
Link to REE4EU	The separators produced by MAGNETIX SP.ZO.O. are manufactured using neodymium, making this company interested in REEs production and recovery.
Application/products	Magnetic separators

4.3.11 End users - Mixed electronics

Company information	**Name:** Oral-B part of P&G **Type:** Company **Country:** USA **Website:** https://www.pg.com/en_ZA/brands/products/oral-b.shtml
Value chain position	End user
General description	Part of the Procter & Gamble Company since 2005, the Oral-B brand includes manual and power toothbrushes for children and adults, oral irrigators, oral care centers, and interdental products, such as dental floss. Oral-B manual and power toothbrushes are used by more dentists than any other brand in the U.S. and worldwide
Link to REE4EU	Oral-B business is mostly driven by the production and selling of electric power toothbrushes, and is one of the biggest company of the world in this sector. As part of the Procter & Gamble group, Oral-B is linked to many relevant industrial stakeholder producing electric devices for health and wellness market.
Application/products	Mixed electronics

Company information	**Name:** Panasonic Corporation **Type:** Company **Country:** Japan **Website:** http://www.panasonic.com/global/home.html
Value chain position	End user
General description	Panasonic Corporation is a large Japanese company founded in 1918, that is one of the leaders in the electronic appliances business at the global level. Panasonic Corporation is comprised of four business segments: Appliances Company, Eco Solutions Company, AVC Networks Company, and Automotive & Industrial Systems Company. Each of the business segments has its distinct R&D, production, and sales functions that satisfy specific consumer needs worldwide.

Link to REE4EU	Panasonic Corporation is a player in different markets and spreads its production activities in multiple areas, including the manufacturing of power appliances, electronic devices, loudspeakers, hard-disks, DVD players as well air-conditioning systems. Given this market diversification, Panasonic Corporation employ REEs in several products.
Application/products	Mixed electronics

Company information	**Name:** Stanley Black & Decker **Type:** Company **Country:** USA **Website:** http://www.stanleyblackanddecker.com/
Value chain position	End user
General description	Stanley Black & Decker is an American company founded in 1843. It has become today the world's largest tools and storage company, the world's second-largest commercial electronic security company, and a world leading provider of engineered fastening systems with unique and powerful growth platforms in the oil & gas and infrastructure industries. Stanley Black & Decker has a company policy committed to the pursuit of a sustainable future, in respect with the environment.
Link to REE4EU	Stanley Black & Decker produces a wide range of building and repairing tools, as well small appliances, with a huge market of power tools. The company is constantly expanding, with a strong interest in improving the production of power appliances.
Application/products	Mixed electronics

Company information	**Name:** Robert Bosch GmbH **Type:** Company **Country:** Germany **Website:** http://www.bosch.com/en/com/home/index.php
Value chain position	End user

General description	Robert Bosch GmbH is a German company founded in 1886 by Robert Bosch, initially called "Workshop for Precision Mechanics and Electrical Engineering" in Stuttgart. From over 130 years, Bosch Group has become a leading global supplier of technology and services. Bosh is today divided into the four business sectors of Mobility Solutions, Industrial Technology, Consumer Goods, and Energy and Building Technology.
Link to REE4EU	As a leading producer of small and medium power appliances, Robert Bosch GmbH has a strong interest in innovations and improvements concerning the REE use and employment. In addition, Robert Bosch GmbH invites and promotes sustainability and the transition to manufacturing that takes in account environmental issues.
Application/products	Mixed electronics Bosch group is also involved in air conditioning, electric bicycles and mixed electronics sectors.

Company information	**Name:** Nokia Corporation **Type:** Large Industry **Country:** Finland **Website:** http://www.nokia.com/
Value chain position	End user
General description	Nokia Corporation, stylised as NOKIA, is a Finnish multinational communications and information technology company, founded in 1865. Nokia is headquartered in Espoo, Uusimaa, in the greater Helsinki metropolitan area. In 2014, Nokia employed 61,656 people across 120 countries, did business in more than 150 countries and reported annual revenues of around €12.73 billion. Nokia is a public limited company listed on the Helsinki Stock Exchange and New York Stock Exchange. It is the world's 274th-largest company measured by 2013 revenues according to the Fortune Global 500 and is a component of the Euro Stoxx 50 stock market index.
Link to REE4EU	Neodymium and dysprosium can be linked to the powerful loudspeaker magnets and passive components, cobalt and lithium to the battery, indium to the LEDs and displays and gallium to the processor. The most used rare earth in Nokia products is neodymium (80-90% of all rare

	earths). For example in the Nokia 5530 XpressMusic the total mass is 107g and 0.24g is the REE content.
Application/products	Mixed electronics

Company information	**Name:** FairPhone **Type:** SME **Country:** The Netherlands **Website:** https://www.fairphone.com/it/
Value chain position	End user
General description	Fairphone is a social enterprise company which aims to develop smartphones that are designed and produced with minimal harm to people and the planet. The company is based in Amsterdam, Netherlands and was supported in its startup phase by the Waag Society, a foundation which aims to foster experimentation with new technologies, art and culture. The main motivations for founding Fairphone were to develop a mobile device that does not contain conflict minerals (which in smartphones are typically gold, tin, tantalum and tungsten), has fair labor conditions for the workforce along the supply chain producing it and help people to use their phone longer. The second version of the company's handset is one of the first modular smartphones available for purchase, with the product being designed to be easily repaired and upgraded.
Link to REE4EU	FairPhone is strongly interested in problem solving derived from choosing the right materials for the mobile phone. In fact, Fairphone sources its rare-earth metals from the Democratic Republic of Congo, as the company explains: "While conflict-free minerals are certainly available from other countries, our goal is to work directly where we can contribute to alternatives to current mining practices, empowering workers and improving the livelihoods of the local population. We want to become a vehicle for change in the regions that need it most."
Application/products	Mixed electronics

Company information	**Name:** Texas Instruments **Type:** Large Industry **Country:** Worldwide **Website:** http://www.ti.com/

Value chain position	End user
General description	Texas Instruments Inc. (TI) is an American technology company that designs and manufactures semiconductors, which it sells to electronics designers and manufacturers globally. Headquartered in Dallas, Texas, United States, TI is one of the top ten semiconductor companies worldwide, based on sales volume. Texas Instruments's focus is on developing analog chips and embedded processors, which accounts for more than 85% of their revenue. TI also produces TI digital light processing (DLP) technology and education technology products including calculators, microcontrollers and multi-core processors. To date, TI has more than 43,000 patents worldwide.
Link to REE4EU	An amount of cerium, which is a light rare earth metal, is critical for the fabrication of some of TI semiconductor devices.
Application/products	Mixed electronics

Company information	**Name:** Abracon **Type:** Large Industry **Country:** Worldwide **Website:** http://www.abracon.com/
Value chain position	End user
General description	Abracon LLC. is a global manufacturer of frequency control, signal conditioning, clock distribution and magnetic components. Abracon offers a wide selection of Quartz Crystals, Crystal and MEMS Oscillators, Real Time Clocks, Antennas, Bluetooth Modules, Ceramic Resonators, SAW Filters and Resonators, Inductors, Transformers and Circuit Protection Components. The company is ISO9001-2008 certified with design & Application Engineering resources in California & Illinois; and Sales offices in Texas, California, China, Taiwan, Singapore, Scotland, and Germany. Abracon's products are offered through its Global Distribution Network.
Link to REE4EU	Abracon is one of the most important magnetic component's producers.
Application/products	Mixed electronics

Company information	**Name:** Alpha and Omega Semiconductors **Type:** Large Industry **Country:** Worldwide **Website:** http://www.aosmd.com/

Value chain position	End user
General description	The company designs and sells more than 1,500 types of analog power semiconductors, including power ICs (integrated circuits) and power discrete (non-integrated circuits) chips, such as power MOSFETs (metal-oxide semiconductor field-effect transistors). Power semiconductors are used in power switches to control the amount of electricity needed to run electronic devices. AOS primarily uses Hua Hong NEC in China to manufacture its chips, which are distributed in Asia and resold to customers such as ASUSTeK, Dell, HP, Samsung, Hon Hai Precision Industry, Quanta Computer, and Wistron.
Link to REE4EU	Among others, patent US 20070187751 A1 ”Method of fabrication and device configuration of asymmetrical DMOSFET with Schottky barrier source” describe the role of the rare earths in its devices.
Application/products	Mixed electronics

Company information	**Name:** TT Electronics - BI Technologies **Type:** Large Industry **Country:** United Kingdom **Website:** http://www.ttelectronics.com/bi-technologies
Value chain position	End user
General description	The brand BI Technologies supplies magnetic components, potentiometers, trimmers, contacting and non-contacting automotive and industrial sensors and hybrid microelectronic assemblies to the world’s leading businesses. The magnetic components portfolio includes both power and signal products, used for transportation and industrial applications and BI Technologies has one of the industry’s most extensive lines of precision and trimming potentiometers, panel pots and tactile switches. They also design, develop and manufacture custom precision potentiometers and microelectronic assemblies for advanced sensing and control applications.
Link to REE4EU	TT Electronics offers a wide portfolio of magnetic products and technologies for applications across aerospace, automotive, industrial and medical markets. Through the product brand Aero Stanrew, TT Electronics offers a wide range of custom electromagnetic components and electronic systems for harsh environments and safety-critical applications. The BI Technologies brand specialises in power transformers, inductors and chokes, providing both custom and standard products, supported by a wide range of accreditations.

Application/products	Mixed electronics

Company information	**Name:** Microsemi **Type:** Large Industry **Country:** Worldwide **Website:** http://www.microsemi.com/
Value chain position	End user
General description	Microsemi Corporation offers a comprehensive portfolio of semiconductor and system solutions for aerospace & defense, communications, data center and industrial markets. Products include high-performance and radiation-hardened analog mixed-signal integrated circuits, FPGAs, SoCs and ASICs; power management products; timing and synchronization devices and precise time solutions, setting the world's standard for time; voice processing devices; RF solutions; discrete components; enterprise storage and communication solutions, security technologies and scalable anti-tamper products; Ethernet solutions; Power-over-Ethernet ICs and midspans; as well as custom design capabilities and services. Microsemi is headquartered in Aliso Viejo, Calif., and has approximately 4,800 employees globally.
Link to REE4EU	Magnetic components
Application/products	Mixed electronics

Company information	**Name:** TRISA **Type:** Company **Country:** Switzerland **Website:** http://www.trisatoothbrush.com/toothbrushes.html
Value chain position	End user
General description	TRISA is a Swiss company, founded in 1887. TRISA is a key global player in the provision of products for oral, hair and body care. TRISA has thus become an internationally operating high-tech company with currently about 1,150 employees working for the group.
Link to REE4EU	TRISA company produces and offers a wide array of electrical toothbrushes products.
Application/products	Mixed electronics/Shavers

Company information	**Name:** Ixys **Type:** SME **Country:** USA **Website:** http://www.ixys.com/
Value chain position	End user
General description	Since its inception in 1983, IXYS Corporation, a Silicon Valley power semiconductor company, has been developing technology-driven products to improve power conversion efficiency, generate clean energy, improve automation and provide advanced products in the transportation, medical and telecom industries. IXYS is a pioneer in the development of power semiconductors, integrated circuits and RF systems that effectively monitor electrical voltage to produce maximum effect with least expenditure of energy.
Link to REE4EU	Ixys uses REE magnets in its production processes
Application/products	Mixed electronics

Company information	**Name:** STMicroelectronics **Type:** Large Industry **Country:** France - Italy **Website:** http://www.st.com/content/st_com/en.html
Value chain position	End user
General description	STMicroelectronics is a French-Italian multinational electronics and semiconductor manufacturer headquartered in Geneva, Switzerland. It is commonly called ST, and it is Europe's largest semiconductor chip maker based on revenue. While STMicroelectronics corporate headquarters and the headquarters for EMEA region are based in Geneva, the holding company, STMicroelectronics N.V. is registered in Amsterdam, Netherlands. The company's US headquarters is in Coppell, Texas. Headquarters for the Asia-Pacific region are in Singapore whilst Japan and Korea operations are headquartered in Tokyo. The company headquarters for the Greater China region are in Shanghai.
Link to REE4EU	Among other components produced, Lanthanum chip is one of the richest in rare earths components.
Application/products	Mixed electronics

Company information	**Name:** Fairchild Semiconductor **Type:** Large Industry **Country:** Worldwide **Website:** https://www.fairchildsemi.com/
Value chain position	End user
General description	Fairchild Semiconductor International, Inc. is an American semiconductor company based in San Jose, California. Founded in 1957 as a division of Fairchild Camera and Instrument, it became a pioneer in the manufacturing of transistors and of integrated circuits. Schlumberger bought the firm in 1979 and sold it to National Semiconductor in 1987; Fairchild was spun off as an independent company again in 1997. The company has locations in the United States at San Jose, California; South Portland, Maine; West Jordan, Utah; Mountaintop, Pennsylvania. Outside the U.S. it operates locations in Singapore; Bucheon, South Korea; Penang, Malaysia; Suzhou, China; and Cebu, Philippines; among others. A design center has been launched in Pune, India.
Link to REE4EU	In the "Environment, Health, and Safety Requirements for Suppliers of Equipment, Materials, and Services to Fairchild Semiconductor" all the rare earths are listed (https://www.fairchildsemi.com/legal/EHS_REQUIREMENTS.pdf)
Application/products	Mixed electronics

Company information	**Name:** Infineon Technologies AG **Type:** SME **Country:** Germany **Website:** https://www.infineon.com/
Value chain position	End user
General description	Infineon Technologies AG is a German semiconductor manufacturer founded on 1 April 1999, when the semiconductor operations of the parent company Siemens AG were spun off to form a separate legal entity. As of 30 September 2015, Infineon had 35,424 employees worldwide. In fiscal year 2015, the company achieved sales of €5.795 billion. On 1 May 2006, Infineon's Memory Products division was carved out as a distinct company called Qimonda AG, which at its height employed about 13,500 people worldwide. Qimonda was listed on the New York Stock Exchange until 2009.
Link to REE4EU	Led by Infineon, a total of 30 partners from nine European countries are conducting the European research project MotorBrain with the goal of

	increasing the range and safety of electric vehicles while at the same time reducing dependency on rare earth metals.
Application/products	Mixed electronics

4.3.12 End users - Motors in industrial applications

Company information	**Name:** Stäubli Robotics **Type:** SME **Country:** Switzerland **Website:** http://www.staubli.com/en/robotics/
Value chain position	End user
General description	Stäubli Robotics is a Swiss mechatronics company, primarily known for its textile machinery, connectors and robotics products. Stäubli was founded in Horgen, Switzerland in 1892. In 1956, the company diversified its line of products into the field of hydraulics and pneumatics and commenced the production of rapid action couplings. In 1982 the company diversified again, this time into automation and robotics. In 2002 Stäubli acquired a majority stake in Multi-Contact, a leading provider of electrical connectors. In 2004, they acquired German competitor Bosch Rexroth's robotics division and incorporated their products into their own product line. In 2007 the Stäubli Group acquired a stake in the Italian electronic engineering company DEIMO.
Link to REE4EU	The division of Robotics of Stäubli, since 1982, produces a complete range of 4-axes and 6-axes robots, adding REEs to the motors during the manufacturing processes.
Application/products	Motors in industrial applications (e.g. servo motors from robotics)

Company information	**Name:** KUKA Robotics **Type:** Large Industry **Country:** Germany

	Website: https://www.kuka.com/en-us/about-kuka/corporate-structure/kuka-robotics
Value chain position	End user
General description	KUKA is a German manufacturer of industrial robots and solutions for factory automation. The KUKA Robotics Corporation has 25 subsidiaries worldwide, mostly sales and service subsidiaries, including in the United States, Australia, Canada, Mexico, Brazil, China, Japan, South Korea, Taiwan, India, Russia and most European countries.
Link to REE4EU	As a specialist in the field of robotics and automation technology, KUKA Robotics is one of the leading manufacturers of industrial robots. KUKA requires REEs to manufacture robotic motors.
Application/products	Motors in industrial applications (e.g. servo motors from robotics)

Company information	**Name:** Stepper motors from Oriental Motor USA Corp. **Type:** Large Industry **Country:** USA **Website:** http://www.orientalmotor.com/products/stepper-motors/
Value chain position	End user
General description	Since its founding in Japan in 1885, Oriental Motor globally has been providing the optimal motion systems as part of their services, to meet the widest market demands. Oriental Motor offers an extensive product line-up of about 50,000 different products that provide the optimal motion system. For over a century they have concentrated on technological advancement and product design improvement. This emphasis is evident in the sophisticated devices that they market today. Oriental Motor's sales and service network is international, with offices throughout North America, Europe and Asia. Domestically, ORIENTAL MOTOR U.S.A. CORP. was established in 1978. ORIENTAL MOTOR U.S.A. CORP produces a wide variety of fractional horsepower products to meet all motion control needs.
Link to REE4EU	The division of “stepper motors” from Oriental Motor USA Corp, produces different types of stepper motor solutions, encoder options and various motor windings, that require REEs addition.

	As part of Oriental Motor corporation group, they also provide contacts of potential stakeholders in other REEs application fields.
Application/products	Motors in industrial applications (e.g. servo motors from robotics)

Company information	**Name:** EPSON Robots **Type:** Large Industry **Country:** Worldwide **Website:** http://robots.epson.com/
Value chain position	End user
General description	EPSON Robots is the robotics design and manufacturing department of Japanese corporation Seiko Epson, the brand-name watch and computer printer producer. EPSON has a 30-year heritage and there are more than 55,000 EPSON robots installed in manufacturing industries around the world. EPSON Robots are well known in the industrial robot market for their ease of use, reliability, performance and overall value.
Link to REE4EU	EPSON Robots manufactures Cartesian, SCARA and 6-axis industrial robots for factory automation. As leading industry in Factory Automation products and solutions, EPSON produces and distributes robots around the world. The robot motors require REEs, making EPSON Robots strongly interested in the topic.
Application/products	Motors in industrial applications (e.g. servo motors from robotics)

Company information	**Name:** Allied Motion Technologies **Type:** Large Industry **Country:** Worldwide **Website:** http://www.alliedmotion.com/
Value chain position	End user
General description	Allied Motion Technologies Inc. (“Allied Motion” or the “Company”) is a global company that designs, manufactures and sells precision and specialty motion control components and systems used in a broad range of industries.

	The company designs and manufactures electric motors, electronic motion control components, gear motors, transaxles and traction wheels, control electronics and drives, and optical encoders. It sells its products primarily to original equipment manufacturers (OEMs) utilizing its own direct sales force, independent sales representatives and distributors.
Link to REE4EU	Allied Motion's line of brushless DC motors includes the EnduraMax™ family of integrated motor-drives, and the INB/NB family of smaller frame, rare-earth motors.
Application/products	Motors in industrial applications (e.g. servo motors from robotics)

Company information	**Name:** Ametek Inc. **Type:** Large Industry **Country:** USA **Website:** http://www.ametek.com/
Value chain position	End user
General description	AMETEK, Inc is an American global manufacturer of electronic instruments and electromechanical devices with headquarters in the United States and over 220 manufacturing sites worldwide. The company was founded in 1930. The company's original name, American Machine and Metals, was changed to AMETEK in the early 1960s, reflecting AME's evolution from a provider of heavy machinery to a manufacturer of analytical instruments, precision components and specialty materials
Link to REE4EU	D.C. Torque Motors are servo actuators which, in their simplest form, comprise a permanent magnet field and a wound armature designed to convert electrical power into mechanical torque. As well as offering D.C. Motors in brushed or brushless form. Models may be supplied housed or unhoused with a choice of permanent magnets such as Alnico, or Rare Earth types.
Application/products	Motors in industrial applications (e.g. servo motors from robotics)

Company information	**Name:** ARC System Inc. **Type:** Large Industry **Country:** USA **Website:** http://www.arcsystemsinc.com/
Value chain position	End user

General description	ARC Systems, Inc. was founded in 1967 to provide the aerospace industry with a dependable source for high-precision motors and A.C. components.
Link to REE4EU	ARC Systems, Inc. uses high energy materials including Neodymium- Iron-Boron, Samarium Cobalt, and Hyperco 50, which enables us to meet and exceed the rigid performance requirements of our customers. Brushless DC motor designs from ARC Systems, Inc. deliver maximum power in the smallest package.
Application/products	Motors in industrial applications (e.g. servo motors from robotics)

Company information	**Name:** Brook Crompton **Type:** SME **Country:** United Kingdom **Website:** http://brookcrompton.com
Value chain position	End user
General description	Brook Crompton is a leading provider of energy efficient electric motors, known for delivering quality and innovation for over a century. Driven by technology and innovation, Brook Crompton has a comprehensive range of low, medium & high voltage motors for safe & hazardous duty designed to provide cost effective, energy-saving solutions across a range of industrial processes and our drives packages can provide assured efficiency and reliability in a user-friendly variable speed drive system.
Link to REE4EU	ATB Brook Crompton MP80 Permanent Magnet DC Motors is only one example of the product REE magnets based.
Application/products	Motors in industrial applications (e.g. servo motors from robotics)

Company information	**Name:** Emerson **Type:** Large Industry **Country:** USA **Website:** http://www.emerson.com/en-us
Value chain position	End user
General description	The Emerson Electric Company is an American multinational corporation headquartered in Ferguson, Missouri, United States. This Fortune 500 company manufactures products and provides engineering services for a wide range of industrial, commercial, and consumer markets. Emerson has approximately 111,000 employees and 205 manufacturing locations worldwide.

Link to REE4EU	Producer of sensors, magnets & mounting pads
Application/products	Motors in industrial applications (e.g. servo motors from robotics)

Company information	**Name:** Faulhaber Group **Type:** Large Industry **Country:** Switzerland **Website:** https://www.faulhaber.com/en/global/
Value chain position	End user
General description	FAULHABER is a leading supplier in the area of high precision miniature and micro drive systems. FAULHABER offers the most extensive range of miniature and micro drive technologies available from a single source worldwide. From high performance DC Motors, BLDC Motors, to Linear Motors, and Stepper Motors, each drive is designed to achieve maximum performance in minimum dimensions and weight. Matching precision gearheads, encoders, linear components and drive electronics are available to complete the system.
Link to REE4EU	FAULHABER DC Motors are designed with a variety of different types of magnets to suit the performance of the given motor type. These materials include AlNiCo magnets and high performance rare earths type such as SmCo and NdFeB.
Application/products	Motors in industrial applications (e.g. servo motors from robotics)

Company information	**Name:** Franklin Electric **Type:** Large Industry **Country:** USA **Website:** https://franklin-electric.com/
Value chain position	End user
General description	Franklin Electric is a manufacturer of submersible pumps, fueling systems and other applications such as submersible electric motors and center pivot irrigation systems.
Link to REE4EU	Franklin Electric can be considered one of the most important key vendors in the Global Permanent Magnet Motor Market**.**
Application/products	Motors in industrial applications (e.g. servo motors from robotics)

Company information	**Name:** Shandong Huali Electric Motor **Type:** SME **Country:** China **Website:** http://www.hualimotor.cn/en/about.asp
Value chain position	End user
General description	Since its founding in 1970, Huali has been a leading organization in the Chinese electric motor industry. With more than 40 years of experience, it is now a modern enterprise with its own production, distribution, R&D and customer service teams. Based on the development strategy of 'Adopting high technology, and exploring the global market', Huali has built three production bases in China, in order to satisfy the demand from both domestic and foreign markets. After many years of research in their three R&D centers and joint science projects with Universities, Huali have become leaders not only in large and special electric motors, but also in high voltage, high efficiency and high quality motors
Link to REE4EU	Huali Group received the honorary title granted by the Shandong Province Science and Technology Department of Shandong Province, rare earth permanent magnet motor engineering technology research center. Huali Group has the following utility model patent, "a cast aluminum rotor plate", the State Intellectual Property Office issued patent certificate.
Application/products	Motors in industrial applications (e.g. servo motors from robotics)

Company information	**Name:** Maxon Motor AG **Type:** SME **Country:** Switzerland **Website:** http://www.maxonmotor.com
Value chain position	End user
General description	Maxon Motor is a supplier of high precision drive systems up to 500 W. The company develops and manufactures brushed and brushless electric DC servo motors as well as corresponding encoders, gears and control electronics.
Link to REE4EU	Miniature DC motors from Maxon Motor offer high torque and efficiency via longer rare earth magnet variants and additional gearhead selections.
Application/products	Motors in industrial applications (e.g. servo motors from robotics)

Company information	**Name:** Nidec **Type:** Large Industry **Country:** Japan **Website:** http://www.nidec.com/en-EU/
Value chain position	End user
General description	Nidec Corporation is a Japanese manufacturer of electric motors. Their products are found in hard-disk drives, electric appliances, automobiles and commercial and manufacturing equipment. The company has the largest global market share for the tiny spindle motors that power hard-disk drives. The two product groups with the largest sales are hard-disk drive motors and electrical and optical components with 21.5% and 30% of sales, respectively. As of 2015, the company has 230 subsidiaries companies located across Japan, Asia, Europe and the Americas. Nidec is listed on the first section of the Tokyo Stock Exchange and is a constituent of the TOPIX 100 stock market index. Nidec was featured on the 2014 Forbes World's Most Innovative Companies list.
Link to REE4EU	Japan's Nidec Corp already began making switched reluctance motors from 2012 as it reduces its reliance on rare earth materials used in the production of precision motors. Nidec started producing the switched reluctance motors, which do not use rare earth metals such as neodymium, for heavy machinery from 2012, for tractors from 2013, and eventually for motor vehicles. In this context Nidec can be considered an important stakeholder.
Application/products	Motors in industrial applications (e.g. servo motors from robotics)

4.3.13 End users - Wind turbines

Company information	**Name:** ENERCON **Type:** Large Industry **Country:** Germany **Website:** http://www.enercon.de/home/
Value chain position	End user
General description	Enercon is the fourth-largest wind turbine manufacturer in the world and has been the market leader in Germany more than 20 years. Enercon has production facilities in Germany, Sweden, Brazil, India, Canada, Turkey

	and Portugal. Enercon has a world-wide market share of around 10% and more than half of the share in Germany
Link to REE4EU	Enercon is one of the most important large consumers of REE. As the energy need increases, wind turbine engineering designs bigger generators. This demand steers the REE market significantly.
Application/products	Wind turbines

Company information	**Name:** Gamesa **Type:** Large Industry **Country:** Spain **Website:** http://www.gamesacorp.com/en/
Value chain position	End user
General description	Gamesa is the biggest wind turbine and solar panel manufacturing company in Spain for more than 22 year-experience. The company has installed over 35,800 MW wind farms in 55 countries total in Europe, America and Asia.
Link to REE4EU	Gamesa has large investment on off-shore wind turbines which REEs are intensively used. Only in 2011, Gamesa has committed to the expenditure of M£133.7 on off-shore wind turbine electricity production site and other facilities in the UK.
Application/products	Wind turbines

Company information	**Name:** Nordex **Type:** Large Industry **Country:** Germany **Website:** http://www.nordex-online.com/en
Value chain position	End user
General description	Nordex designs, sells and manufactures wind turbines.
Link to REE4EU	Nordex has installed Germany's first offshore turbine in 2006. Although Nordex is specialized in gearbox generator wind turbine (REE is not used), small scale Nordex off-shore wind turbines are still on the market.
Application/products	Wind turbines

Company information	**Name:** Vestas

	Type: Large Industry **Country:** Denmark **Website:** https://www.vestas.com/
Value chain position	End user
General description	Vestas is active in the development, manufacturing, sale and maintenance of wind power plants – with competencies that cover every aspect of the value chain from site studies to service and maintenance.
Link to REE4EU	Vestas and Mitsubishi Heavy Industries (MHI) joined forces in 2014 to increase their offshore wind turbine installations capacity in Europe. A joint venture, MHI Vestas design, manufacture, install and service wind turbines for the offshore wind industry. The company is founded on collaboration, and creating powerful partnerships with key stakeholders will be the cornerstone of its business model. As wind turbines producers they use REE elements and permanent magnets in their products.
Application/products	Wind turbines

Company information	**Name:** Senvion S.A. **Type:** Large Industry **Country:** Germany **Website:** https://www.senvion.com/global/en/
Value chain position	End user
General description	Senvion S.A. (formerly REpower Systems SE) is a wind turbine manufacturer founded in 2001 in Germany, now majority owned by the private equity firm, Centerbridge Partners. Registered business address is in Luxembourg. Its product range comprises several types of turbines with rated outputs of between 1.8 and 6.15 megawatts.
Link to REE4EU	In the future, in Senvion one of the most important design features to be discussed is the balance of rare metals in the magnet generator and their eventual eradication.
Application/products	Wind turbines

Company information	**Name:** Britwind **Type:** SME **Country:** United Kingdom **Website:** http://www.britwind.co.uk/

Value chain position	End user
General description	Britwind is a step up for the small wind industry, delivering 100% British windmills to landowners and business across Britain.
Link to REE4EU	Some of the low inertia axial flux generators utilize Neodymium rare earth magnetic materials to allow the turbine to spin in the lightest of breezes and to react quickly to gusts.
Application/products	Wind turbines

Company information	**Name:** C&F Green Energy **Type:** Large Industry **Country:** Ireland **Website:** http://www.cfgreenenergy.com/
Value chain position	End user
General description	C&F Green Energy is a world leading, industry setting, manufacturer of small and medium sized wind turbines with a mission to make wind energy affordable and accessible to the farm, home and business. C&F Green Energy provide and install high yield, efficient and low noise wind turbines in Ireland, the UK, Italy, Switzerland, France, Japan and increasingly across the world.
Link to REE4EU	High-quality rare earth neodymium magnets within the generator characterize the C&F wind turbines.
Application/products	Wind turbines

Company information	**Name:** Enessere **Type:** SME **Country:** Italy **Website:** http://www.enessere.com/it/
Value chain position	End user
General description	ENESSERE is an Italian company, founded in 2009, with headquarters in Brendola and a manufacturer of small vertical wind turbines. Its foundation and the development of the Hercules wind turbine is a response to the Environmental impact of wind power, namely to the aestethic concerns. Hercules was launched in 2015 as a piece of Design with wooden wings and applying the Golden Ratio. ENESSERE is one of the 100 energy stories that Italy provided to the 2015 United Nations Climate Change Conference in Paris in December 2015.

Link to REE4EU	The rare earth magnets are a key component for the turbine's magnetic rotor, such as Hercules' rotor.
Application/products	Wind turbines

Company information	**Name:** XZERES **Type:** Company **Country:** USA **Website:** http://www.xzeres.com/
Value chain position	End user
General description	XZERES Wind is an American company that designs, manufactures, and distributes high quality distributed small wind turbines (2.4kW -10kW). XZERES Wind offers wind energy solutions. XZERES wind turbine systems are used to electrical power generation for applications and markets such as residential, micro-grid based rural electrification, agricultural, small business, rural electric utility systems, as well as other private, corporate infrastructure and government applications.
Link to REE4EU	As a company that manufactures wind turbines, XZERES has an interest in REEs and their use. XZERES is a member of the American Wind Energy Association (AWEA), providing a further link with other potential stakeholders interested in wind turbines production.
Application/products	Wind turbine

Company information	**Name:** Zephyr **Type:** Company **Country:** Japan **Website:** https://www.zephyreco.co.jp/en/
Value chain position	End user
General description	Zephyr is a Japanese company established in 2007. The principal business of Zephyr consists in design, manufacture, import, consultation and sales (comprehensive package of installation design, installation, leasing, and

	maintenance), of a range of wind/solar/water power generation equipment and peripheral.
Link to REE4EU	Zephyr is a company focused on energy solutions. Zephyr produces wind turbines and distributes the products in several Countries in Europe, America and Asia. Zephyr manufacturing requires REEs.
Application/products	Wind turbine

Company information	**Name:** WIND EUROPE **Type:** Association **Country:** Europe **Website:** http://www.windeurope.org
Value chain position	End user
General description	WIND EUROPE, formerly the European Wind Energy Association (EWEA), is an association based in Brussels, promoting the use of wind power in Europe. It has over 600 members, which are active in over 50 countries, including manufacturers with a leading share of the world wind power market, component suppliers, research institutes, national wind and renewables associations, developers, contractors, electricity providers, finance companies, insurance companies, and consultants.
Link to REE4EU	WIND EUROPE Association groups members interested in wind energy solutions, specifically turbines, such as manufacturers, component suppliers, associations, and developers. WIND EUROPE is also active in events organization or in releasing of newsletter about renewable energy issues, providing a connection channel with stakeholders.
Application/products	Wind turbine

Company information	**Name:** The 'Energy Agency's Secretariat for the Danish Wind Turbine Certification Scheme **Type:** Association **Country:**

	Website: http://www.wt-certification.dk/
Value chain position	Wind turbine
General description	The Energy Agency's Secretariat for Danish Wind Turbine Certification Scheme is a Danish organization that manages the Certification Scheme for design, manufacture, installation, maintenance and service of wind turbines. The Certification Scheme concerns the whole process, from construction, production and operation of the wind turbines.
Link to REE4EU	The Energy Agency's Secretariat for Danish Wind Turbine Certification Scheme in Denmark manages the directives about wind turbine manufacturing and controls that the production processes respect the national and international directives. The Secretariat is composed by experts in the field of engineering and energy, with a specific focus in wind turbines.
Application/products	Wind turbine

Company information	**Name:** International Energy Agency - Wind Energy System **Type:** Association **Country:** Europe **Website:** https://www.ieawind.org/
Value chain position	End user
General description	Founded in 1977, the International Energy Agency (IEA)-Wind is an international association that sponsors cooperative research tasks and provides a forum for international discussion of research and development issues. This organization includes 25 countries, in Europe, USA, and China, Korea and Japan. The Strategic Plan goal of the IEA Wind is to stimulate co-operation on wind energy research and development among the members. The IEA Wind agreement is a vehicle for member countries to exchange information on the planning and execution of national large-scale wind system projects and to undertake co-operative research and development (R&D) projects called Tasks or Annexes.
Link to REE4EU	The International Energy Agency (IEA)-Wind objective is the co-operation among countries about research, innovation and development of wind

	energy systems. All IEA-Wind members are therefore interested in wind turbines (that contain REEs) construction topics.
Application/products	Wind turbine

4.3.14 Recyclers

Company information	**Name:** European Metal Trade and Recycling Association **Type:** Association **Country:** Belgium **Website:** http://www.euric-aisbl.eu/members-euric/european-member-organisations/eurometrec
Value chain position	REE Recyclers
General description	EUROMETREC, the European Metal Trade and Recycling Federation is located in Brussels, Belgium and it was created in 1990 from the Liaison Committee for non-ferrous metals trade within the E.E.C, which was itself formed in 1969. EUROMETREC members are national associations in the EU Member States representing the interests of companies that are primarily involved in the collection, processing, recycling and trade of non-ferrous metal scrap. A number of these companies are involved in the recycling of Waste of electrical and electronic equipment (WEEE). In the E.U. member states, more than a thousand large companies and SMEs are represented through EUROMETREC.
Link to REE4EU	The members will be strongly interested in the market analyses and generation of currently missing data on available REE in different End-of-Life products and their economically viable collection, dismantling and recycling with proven capabilities of the new REE4EU recovery technologies to exploit waste from one or more products in a sustainable recovery process.

Company information	**Name:** European Electronic Recyclers Association **Type:** Association

	Country: The Netherlands **Website:** http://www.eera-recyclers.com/
Value chain position	REE Recyclers
General description	EERA is a professional association for the recycling and reprocessing industry dealing with WEEE. The vision of the association is for a resource efficient economy where WEEE is managed as a resource and is returned into the economy as a raw material or as equipment for re-use. A full recycling economy with market actors cooperating along the value chain, better collection processes, high quality recycling, appropriate regulatory framework, eradication of illegal practices and product design integrating a life-cycle approach is what EERA envisages. The mission is to achieve a level playing field for fair competition in the WEEE value chain, harmonisation of regulations, effective and efficient recycling and reprocessing with prevention of pollution, minimization of emissions and a high quality of secondary raw materials and components. Energy recovery is limited to non-recyclable materials and landfilling is virtually eliminated.
Link to REE4EU	The European Electronic Recyclers Association suggests that increasing complexity of EEE (Elelectrical and Electronic Equipment), miniaturisation and shorter life cycles of products pose technical and economic challenges that have led to reduced recovery rates and lower returns (http://www.greenweek2014.eu/docs/presentations/parallel-side-sessions-2/2-4/zonneveld_2.4.pdf). In this context, they are strongly interested in bringing recycling/recovery processes to an industrial scale.

Company information	**Name:** European Advanced Recycling Network (EARN) **Type:** Association **Country:** Germany **Website:** http://www.earn-service.com/
Value chain position	REE Recyclers
General description	The European Advanced Recycling Network, EARN, was founded by Europe's market leaders in the recycling of electrical and electronic equipment (EEE). This is a broad and specialized association with combined experience in the areas of environmental management, transport & logistics, waste disposal & recycling. EEE manufacturers are

	also responsible for their products when they reach the end of their service life. Requirements must be outlined for this based on the European WEEE Directive (WEEE = Waste Electrical and Electronic Equipment), the individual implementations of which require comprehensive solutions in the member states.
Link to REE4EU	The members will be strongly interested in the market analyses and generation of currently missing data on available REE in different End-of-Life products and their economically viable collection, dismantling and recycling with proven capabilities of the new REE4EU recovery technologies to exploit waste from one or more products in a sustainable recovery process.

Company information	**Name:** HYDROMETAL S.A. **Type:** SME **Country:** Belgium **Website:** http://www.hydrometal.be/cms/index/cms/page/homepage/lang/en
Value chain position	REE Recyclers
General description	Recycling specialists for more than 50 years. They are a major industrial recycler dealing with a wide range of complex non-ferrous metal bearing residues, by-products, secondary raw materials… They represent a more than valuable alternative to land-filling and, as such, contribute significantly to the development of sustainable solutions to the depletion of natural resources. The Group's mission is to be THE reference partner in terms of non-ferrous metal recycling in the world.
Link to REE4EU	They are trading the traditional non-ferrous metals such as Zn, Pb, Sn, Cu and Ni. In addition, they are also active in Precious Metals (Ag, Au, Pt, Pd, Rh, …) and also a range of Minor Metals such as Bi, Co, Sb, Mo, In, Se, Te, Ge, Ga, V, Ta, Nb, Re, As, Hg, Ti and others. Finally, they have been doing business in more exotic materials containing FeW, Rare Earths and many others.

Company information	**Name:** ReMedia **Type:** Private non-profit organisation

	Country: Italy **Website:** http://www.consorzioremedia.it/
Value chain position	Recycler
General description	ReMedia is a leading Italian consortium that handles Waste Electrical and Electronic Equipment (WEEE) as well as end-of-life batteries and accumulators. ReMedia directly represents the firms shouldering the legal duties relating to WEEE, batteries, and accumulators and it gives form to the environmental commitment of over 1200 members - firms that produce consumer electronic equipment, small and large electrical domestic appliances, computer and telecommunications equipment, air-conditioning apparatus, toys, medical and monitoring and control devices, musical instruments, batteries and accumulators. ReMedia Consortium boasts a broad and exhaustive portfolio of services both for producers of Electrical and Electronic Equipment as well as of Batteries and Accumulators that have to face with the relevant legal requirements. ReMedia offers also services to the companies that use these products that must dispose of Waste Electrical and Electronic Equipment (WEEE) and spent batteries and accumulators.
Link to REE4EU	Offering concerning recycle and waste management of electronic Equipment, ReMedia Consortium members have a strong interest in the topics proposed by REE4EU project. Apart from the consultancy in waste management, ReMedia also actively organizes events to inform the Public about recycling, as well as its contribution and participation to research activities to the development of new technologies for Electronic Equipment treatments. ReMedia Consortium provides a network of members interested in the WEEE, and therefore in REEs recovery.

Company information	**Name:** ALR Innovation **Type:** Company **Country:** Ireland **Website:** http://www.alr.ie/index.html
Value chain position	Recycler
General description	ALR Innovation (Automated LCD Recycling) is a company specialized in the recycling technologies and recovering of waste materials from

	electronic equipment. ALR Innovation has developed a state of the art recycling technology which through a fully automated process removes the hazardous waste materials from LCD flat screen panels and monitors. The process has been developed to be compliant with the European Directive on waste electrical and electronic equipment (WEEE). ALR Innovations has a large portfolio of industry partners within the recycling industry, including suppliers and distributors of recycling equipment, and organizations which implement the WEEE directive on a national level.
Link to REE4EU	The ALR Innovation Company is focused on the recycling and recovery of hazardous materials from of LCD screens that contain REE. The ALR Innovation may therefore benefit of REE4EU innovations. In addition, due to its close contact with several industrial partners of the recycling industry, ALR Innovation provide also a connection with a network of stakeholders.

Company information	**Name:** WEEEFORUM-European Association of Electrical and Electronic waste take back systems **Type:** Association **Country:** Worldwide **Website:** http://www.weee-forum.org/
Value chain position	Recycler
General description	The WEEE Forum (WEEE stands for 'waste electrical and electronic equipment') is a non-profit association of 30 WEEE producer responsibility organizations in Europe. The WEEE Forum provides a platform for producer responsibility organizations to take on the challenge of electrical and electronic waste in Europe by fostering ideas and sharing best practices whilst optimizing environmental performance through a proper management of WEEE. The objectives of the WEEE Forum are to: • Deal with matters arising from European legislation concerning WEEE; • Promote exchange of know-how and best practice; • Develop standards and technical specifications to fulfil producer responsibility on behalf of producers; • Strive towards harmonisation of procedures regarding members and associated members or other structures that assume responsibility of producers for the management of WEEE. In order to achieve such objectives the WEE Forum conducts the following activities:

	• Collecting, exchanging and comparing information from its members (concerning legislation of WEEE); • Liaising with and providing to all parties concerned (European and international institutions) with all pertinent information about WEEE • Organization and participation in events and projects, for the exchange of information and experiences; • Helping members and potential members, upon request, with the planning, creation, implementation and management of their projects in the field of WEEE; • Publication and dissemination of codes of practice and provide support services to its members.
Link to REE4EU	The WEEE Forum consists of a community of members that discuss, update, inform and want to improve technologies related to the management of electric waste materials. The WEEE Forums is therefore strongly interested in the issues linked to the REE4EU projects, and the Forum represents a valuable channel to disseminate REE4EU results and impacts. The WEEE Form is also a huge network of stakeholders.

Company information	**Name:** Indaver **Type:** Company **Country:** Belgium **Website:** http://www.indaver.com/en/home/
Value chain position	Recycler
General description	Indaver is a Belgian company that operates in the field of Sustainable Waste Management. Invader assists companies and public authorities to retain and further improve their (sustainable) performance by supporting and continuously improving their waste management.
Link to REE4EU	Invader company team is composed of expert professionals in technology, market and legislation concerning sustainable waste management. Therefore it has a strong interest in the REE4EU innovations and results. Invader is a company that potentially will advertise and propose REE4EU innovations to its clients. Moreover the Belgian waste-processing company Indaver has already developed in close collaboration with Philips Lighting a process to recycle the phosphors from Philips' linear fluorescent tube lamps (Indaver, 2000).

Company information	**Name:** WRAP **Type:** SME **Country:** United Kingdom **Website:** http://www.wrap.org.uk/
Value chain position	REE Recovery
General description	WRAP is a catalyst for positive economic and environmental action. They work uniquely, and by design, in the space between governments, businesses, communities, thinkers and individuals – forging powerful partnerships and delivering ground-breaking initiatives to support more sustainable economies and society, in order to deliver practical solutions to improve resource efficiency. They drive change in three priority sectors: ▪ Food and drink ▪ Clothing and textiles ▪ Electricals and electronics
Link to REE4EU	Researchers and experts from WRAP were interviewed for the stakeholder analysis for the report "Recovery of Rare Earths from Electronic wastes: An opportunity for High-Tech SMEs" of the DG for the internal policy of the European Commission. They already worked on a recent research in waste electrical and electronic equipment (WEEE) disposal and processing in the UK. The summary is available at link: http://www.wrap.org.uk/sites/files/wrap/WEEE%20recovery%20in%20the%20UK.pdf.

Company information	**Name:** ECOLEC **Type:** Private non-profit organisation **Country:** Spain **Website:** http://ecolec.es/
Value chain position	Recycler

General description	ECOLEC Foundation is a non-profit organization created by business associations that represent the manufacturing sector and importers of large and small electrical appliances. The objective of this organization is to contribute to maintain and improve the natural and energy resources through collection, treatment, recovery and disposal of waste electronic equipment and batteries. The goals of ECOLEC are to inform about environmental management, and to function as an exchange of knowledge about proper waste management of electrical devices. ECOLEC Foundation is a member of the WEEE-Forum, an international association that deals with "waste electrical and electronic equipment" topics. ECOLEC Foundation operates mainly in Spain.
Link to REE4EU	The association actively works for the environmental awareness of the Public and promotes the culture of Sustainable Development. ECOLEC Foundation groups members that have to be continuously updated regarding on waste management and recycle. ECOLEC offers consultancy and management services to Electrical devices producers and Distributors, and therefore they are interested in the recycle of electronic equipment containing REEs. ECOLEC represents also a network of members interested in REEs and potential stakeholders.

5 Conclusions

This value chains and stakeholders analysis report provides concise information on relevant stakeholders interested in REE and more particularly in the topic of recovery of REE, and identifies their position in the global REE supply chain. Although the list of stakeholders identified is by no means exhaustive, the report lays down the foundations of an international community of more than 300 stakeholders and provides concise information[3] about their main interests in REE. The emphasis was placed on industrial stakeholders that could directly benefits from the results of the project or could potentially develop business relationships with the REE4EU consortium partners.

This study is also a part of the dissemination and exploitation strategy that will be adopted by the dissemination and exploitation work package leader PNO together with the partners of the REE4EU project to set up targeted dissemination and exploitation actions to the identified group of stakeholders according to their positions in the REE global supply chain.

[3] Disclaimer: Although the authors strived to provide accurate content in this report based on publicly available information such as websites, news, reports etc., there is no guarantee on the accuracy or correctness of the information provided on those publicly available information. In no case the authors can be held responsible for any damage of any kind resulting from or in connection with the use of the information.