



# REGINA – Rare earth global industry and new applications in Brazil

## Client II – International partnerships for sustainable innovation

Rare earths are needed for the conventional production of high-performance permanent magnets. Mining rare earths is usually associated with significant environmental impacts. Changes in the mobility and energy sectors, in particular, are set to significantly increase global demand for high-performance permanent magnets and, therefore, also for rare earths. Brazil is home to the world's second-largest reserves of rare earths. However, the potential of these reserves remains largely untapped. The "REGINA" project lays the foundation for an ecologically optimized Brazilian magnet industry that utilizes domestic resources. The project also works to develop a value chain for competitive neodymium-iron-boron permanent magnets.

### An untapped potential

Since electromobility and wind power have gained worldwide importance, Brazil has a special role to play, both nationally and internationally, with its wealth of economically strategic raw materials. Brazil has the potential to become the second-largest producer of raw materials after China, especially with regard to its 22 million tons of rare earth reserves. Currently, not only the raw materials required for magnet production but also the magnets themselves, are mainly produced in China.

For Brazilian mining and metals companies, sustainably prospecting for rare earth elements (REE) is a major challenge, as too is ensuring resource-efficient metal and end-product production, especially against the background of China's dominant position. Therefore, the "REGINA" project aims to provide a basis for implementing an ecologically optimized value chain for high-performance permanent magnets on an industrial scale, starting from mixed rare earth oxides to the production of neodymium-praseodymium-iron-boron (Nd/PrFeB) magnets.



Mine in Araxá, Brazil.

### Competitive "green" high-performance magnets

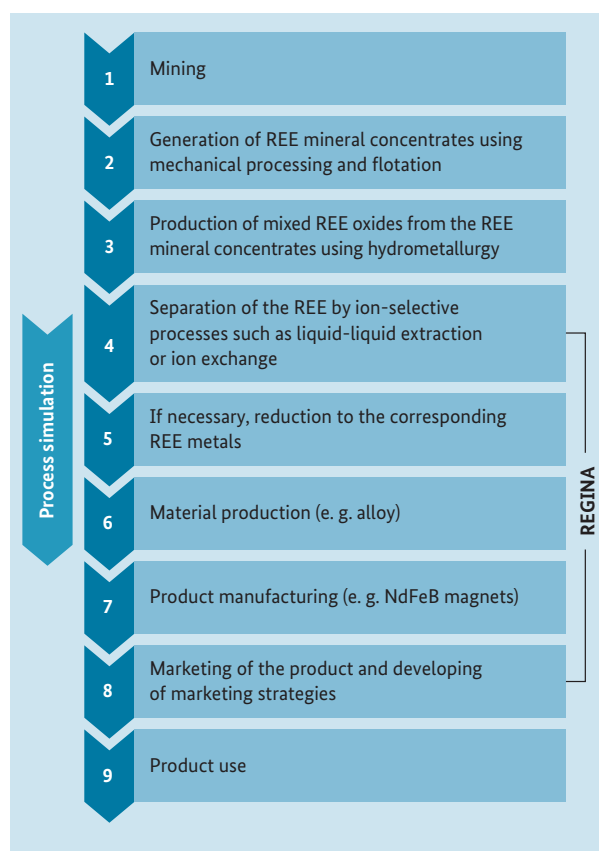
In order to produce "green" high-performance magnets, "REGINA" strives to optimize ecological aspects throughout the entire value chain. First, the project partners separate neodymium/praseodymium compounds from the rare earth element oxide mixture found in the Araxá mine in Brazil. These compounds are then reduced to neodymium/praseodymium metals, also referred to as didymium. This didymium mixture is used to produce magnet alloys and magnets with the best possible combination of properties, exhibiting maximum functionality, and minimum ecological impact.

In the context of producing high-performance permanent magnets with Brazilian resources, "REGINA" aims to optimize every process in the value chain in terms of production costs and environmental impact. On the one hand, this is done with an eye to economic competitiveness. On the other hand, the unique "green magnet" selling point should differentiate the product from other magnet manufacturers. The experimental work is therefore accompanied by a process simulation and life cycle assessment. This methodology creates the basis for realizing a more environmentally sustainable form of magnet production.

### Market positioning

Fundamental knowledge for developing magnet marketing strategies will be compiled based on market studies, empirical market research, and a SWOT analysis. Using these findings, Brazil and its companies should be able to strategically and sustainably position themselves in the global market. For this purpose, the project will produce concrete recommendations for action and measures aimed at harnessing sustainability to create a win-win

situation for both Brazil and the German economy. The results are to be applied in a specific business model which is both economically viable and takes environmental and social impacts into account.



Value chain in the field of rare earths – from raw material extraction to product use.

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Client II – International partnerships for sustainable innovations

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REGINA – Rare earth global industry and new applications in Brazil

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#### Contact

Dr. Andrea Gassmann  
 Fraunhofer Research Institution for Materials Recycling and Resource Strategies IWKS  
 Brentanostr. 2a  
 63755 Alzenau, Germany  
 Phone: +49 6023 32039-878  
 E-mail: andrea.gassmann@iwks.fraunhofer.de

#### Project partner

Helmholtz-Zentrum Dresden-Rossendorf e. V.; TU Clausthal; RWTH Aachen; KME Germany GmbH & Co. KG; TU Darmstadt; GMB Deutsche Magnetwerke GmbH; DMT-Gesellschaft für Lehre und Bildung mbH; Univ. Federal de Santa Catarina; Univ. de São Paulo; Fundação Centros de Referência em Tecnologias Inovadoras; Instituto de Pesquisas Tecnológicas; Centrod Tecnologia Mineral; Companhia Brasileira de Meta-lurgia e Mineração; Companhia de Desenvolvimento de Minas Gerais

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