r³ – Strategic metals and minerals

Innovative technologies for resource efficiency
Securing raw materials for essential technologies

Special metals and minerals are indispensable for the production of high-tech products such as computers, cell phones or energy-saving lamps. These raw metals and minerals are of strategic economic importance and include, for example, indium and gallium, as well as other electronic metals or minerals such as fluorspar. It is of particular importance for Germany, as an importer of raw materials, to secure the supply of these resources. Among the several ways to achieve this important goal, r³ will focus on the development of processes of recycling, economisation and the substitution of scarce with less scarce raw materials. The Federal Ministry of Education and Research's funding initiative “r³ – Innovative technologies for resource efficiency – Strategic metals and minerals”, supports the research and development of innovative technologies, services and processes with the objective of sustainably securing these raw materials. r³ comprises cooperative projects on the following topics:

- Recycling, e.g. from electrical and electronic scrap
- Economisation and substitution in processes and new products
- Urban mining
- Methods of evaluating resource efficiency

Networking and knowledge transfer

The aim of the research projects in the r³ funding initiative is the development of practice-oriented solutions which can be readily applied in the economy and industry. Accordingly, r³ focuses on the networking of partners and on the transfer of information and technology. The associated integration and transfer project INTRA r³+ at the Helmholtz Institute Freiberg for Resource Technology is undertaking these tasks jointly with other partners in order to finally evaluate the research findings in terms of their impact on sustainability.

The research projects are being conducted by over 100 stakeholders who are active in the research sector and along the entire value chain of industry, including in particular small and medium enterprises (SMEs).

This wide involvement of stakeholders along the value chain ensures that the innovative results achieved are aimed towards industrial feasibility.
The highest concentration of metals and minerals of strategic economic importance is to be found in discarded complex-technology products, e.g. electrical and electronic scrap such as fluorescent lamps, monitors or photovoltaic modules. For example, 41 old cell phones contain the amount of gold found in a ton of ore. However, methods to recycle these valuable trace metals from electronic scrap have not yet been fully developed and significant amounts are still lost in waste streams. One goal of the r³ research projects is to improve the collection of old appliances and to develop new recycling technologies so that valuable metals can be recovered with an economically reasonable effort in future.

Touch-screen displays, energy-saving lamps and batteries for electric mobility can only function using strategic metals and minerals. New production approaches or the optimization of manufacturing processes reduce the use of these scarce resources – or ideally even avoid their use completely.

Furthermore, waste generated during the production process is collected and recycled. Economisation and the substitution of metals make it possible to avoid emerging shortages of these materials for key technologies such as wind power, photovoltaics or electromobility.

Landfills and mine dumps as well as old industrial plants and buildings are treasure-troves of strategic metals and minerals and other recyclable materials. A particular challenge for r³ is how to recover valuable materials from these sites. Innovative technologies and economically sustainable concepts are therefore being developed as a prerequisite for the development of future processes for recovering reusable material. It is important to know where these substances are to be found and to make this information readily accessible. Demolition companies, for example, can benefit directly from this know-how when demolishing building infrastructures.

Ultimately the results of r³ are intended to lead to better technology products and effective recycling and manufacturing processes. A meaningful sustainability assessment is therefore particularly important. The evaluation matrix will be further developed on the basis of the current state of science. Questions regarding economic efficiency and security of supply must be considered in the context of energy and environmental policy requirements. One particularly important decision regards the question of which indicators should be applied so that users such as small and medium enterprises (SMEs) can be provided with simple, practical decision aids.