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Substitution as a strategy for reducing the criticality of raw materials for environmental technologies
Determination of potentials for second-best solutions (SubSKrit)

**Umwelt
Bundesamt** 

Background

The expansion and the implementation of innovative environmental technologies are among the most important factors for increasing resource efficiency and for the transformation to a green economy. Many environmental technologies inherently rely on the use of special raw materials, for which there are – already today – diverse supply risks. These materials are referred to as critical raw materials. It is currently foreseeable that efficiency and recycling strategies will not be sufficient in themselves to markedly decrease the criticality of these materials, nor to ensure a far-reaching expansion of significant environmental technologies, not only in industrialised countries like Germany but also globally. A forward-looking focus on substitution strategies is also necessary.



There is a substantial need for further research in this area within the German government's resource efficiency programme (ProgRes). Measures that increase a substitution of rare and strategic metals with raw materials that have lower environmental impacts are key in this respect.



In the consideration of substitution options, it is important to examine resource efficiency potentials as well as possible additional negative impacts on the environment. For example, wind turbines built without rare earths require significantly more copper, which involves substantial environmental impacts. A comparative assessment of technologies is therefore extremely important.

Goals and approaches

The goal of the research project is to develop a roadmap for the substitution of critical raw materials in environmental technologies. This roadmap aims to show which substitution measures can substantially contribute to enabling a future expansion of environmental technologies – also against the background of rising supply risks for raw materials. Furthermore, it

will take into account the long lead times, barriers and favourable factors of developments from the research stage to market maturity and diffusion. The roadmap aims to make an important contribution to the implementation and further development of a national strategy on raw materials and to Germany's resource efficiency programme as well as to provide impulses for the national and international political debate. To this end, the responsible actors and instruments are identified and external experts are incorporated in the project.

Work programme

The research project is divided into the following work packages (WP):

WP 1: Systematisation and screening

- Development of a selection method for the screening of environmental technologies

WP 2: Functional need for materials

- Estimation of the functional need for materials for 40 priority environmental technologies

WP 3: Criticality analysis

- Criticality analysis for the selection of 20 priority environmental technologies

WP 4: Screening of substitution potentials

- Screening of and in-depth analyses on selected substitutions

WP 5: Criticality effects

- Multi-dimensional analysis of criticality effects

WP 6: Roadmap

- Development of a substitution roadmap