PRESS RELEASE

Technology at the cutting edge - Resources at the limit

New study reveals the raw materials needed to power progress to the year 2045

Which emerging technologies will need most resources by 2045? This is the question that researchers at Fraunhofer ISI and Fraunhofer IZM are trying to answer on behalf of the Germany Mineral Resource Agency DERA. In its fourth inception, the study on „Raw Materials for Emerging Technologies" is again offering invaluable insights and recommendations for politicians, business leaders, manufacturers, scientists, and the wider public.

Whether we are baking bread, assembling cars, or using cutting-edge technology: We need raw materials in every walk of life. Demand for these resources keeps increasing, but many resources are still being wasted unnecessarily. More than four in every five industrial enterprises in Germany reported difficulties in getting the necessary supplies in late 2023, and the current geopolitical situation is only making matters worse.[1]

One obvious example of a technology that is inherently more sustainable, but also resource-hungry at the same time is electric vehicles: Electric cars offer mobility without harmful emissions at the point of use, but the batteries needed to power them need far more strategically critical and sought-after materials like lithium, cobalt, or nickel than their conventional peers did.

In order to better understand sudden spikes in demand and the resulting bottlenecks or price hikes, Fraunhofer researchers are working to forecasthow resource demand will develop over the decades leading up to 2045. Their new study »Raw Materials for Emerging Technologies 2026« is produced by the Fraunhofer Institute for Systems and Innovation Research ISI and the Fraunhofer Institute for Reliability and Microintegration IZM on behalf of the German Mineral Resource Agency DERA, part of the Federal Institute for Geosciences and Natural Resources BGR.

The researchers conducting the study are looking at 34 emerging technologies in detail, ranging from high-performance lithium batteries to wind power or data centers. They are

[1] Source: IEA, Alkane, ADAMA Intelligence via Wood Mackenzie

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using several socio-economic scenarios to see how changing industrial use of these technologies will affect demand for resources and which resources will become particularly sought-after in each case. The scenarios also include the prospect of a rise in regional rivalry around the world and an erosion of international cooperation. The environment and the laws meant to protect it will likely lose out in this scenario.

Data centers remain resource gluttons
It is not uncommon for companies to have to reduce their output because they lack reliable access to resources. This is a particular concern in the electronics and automotive industries. »As a high-tech economy, Germany is particularly susceptible to this because of our great dependance on imports«, Jana Rückschloss, researcher at Fraunhofer IZM, explains. In the major long-term study, she is investigating the resources needed to produce the storage tech for data centers.

One factor is the likely development in global data traffic. Even minor changes to the growth rate can lead to enormous differences in the amount of data being handled in 2045 as a result of the long timeframe covered by the study and the effects of exponential growth (cf. illustration). Decisions taken now, be it in the scenarios created for the study or in real life, will have a long afterlife in the economy's future.

Not forgetting artificial intelligence
Reliable access to the necessary resources is crucial for keeping Germany's industry competitive on a global scale. New megatrends and recent leaps in the evolution of new technologies can lead to sudden spikes in demand - not least for the raw materials underpinning high technology - and potentially to bottlenecks in supplies or, at the very least, major volatility in the price of resources**.**

Five years ago, artificial intelligence was still a niche pursuit for specialists. Today, it has become a ubiquitous tool. The enormous pace of progress is also supercharging demand for data centers and the requisite IT infrastructure. The rise of AI and its repercussions are also considered in the study, and the researchers are keeping an eye on how new developments in AI are affecting the technologies in their scope.

A national resource strategy: Quo vadis, Germany?
The new study is an important update to the findings from studies with the same design in 2009, 2016, and 2021. It adds important insights to the resource monitoring efforts of Germany's mineral resource agency DERA, which has been feeding into and is being acted upon in the federal government's resource strategies since 2010.

The two participating Fraunhofer Institutes are bringing together expertise from applied research and futures research as well as a considerable breadth of insights concerning a vast range of technologies. The final results of the current fourth edition of the study are expected in early summer 2026, when they will be published as an online report and at a streamed public event. The regular updates to the study are part of DERA's resource monitoring efforts.

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More information:
https://www.izm.fraunhofer.de/en/abteilungen/environmental_reliabilityengineering/projekte/raw-materials-for-future-technologies.html

Jana Rückschloss has spent 15 years investigating resource questions at Fraunhofer IZM.
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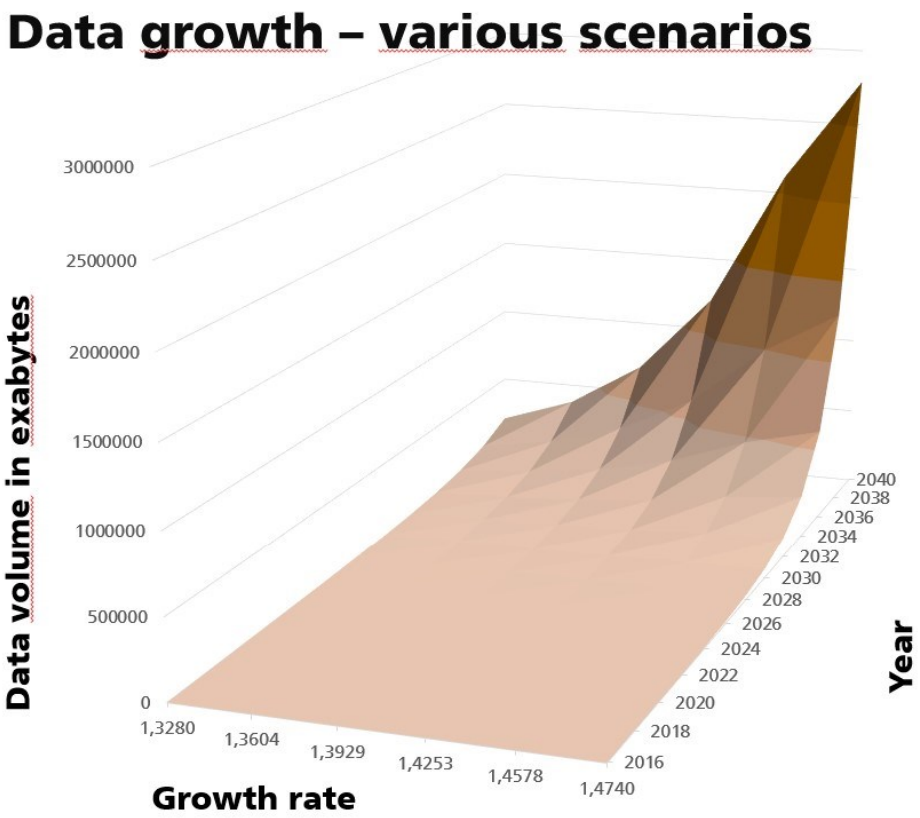

Annual growth in data storage demand as projected by the 2021 study.
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The **Fraunhofer-Gesellschaft**, headquartered Germany, is the world's leading applied research organization. With its focus on developing key technologies that are vital for the future and enabling the commercial exploitation of this work by business and industry, Fraunhofer plays a central now and in the future. Founded in 1949, the Fraunhofer-Gesellschaft currently operates 75 institutes and research institutions throughout Germany. The majority of the organization's 32,000 employees are qualified scientists and engineers, who work with an annual research budget of 3.6 billion euros. Of this sum, 3.1 billion euros are generated through contract research.

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