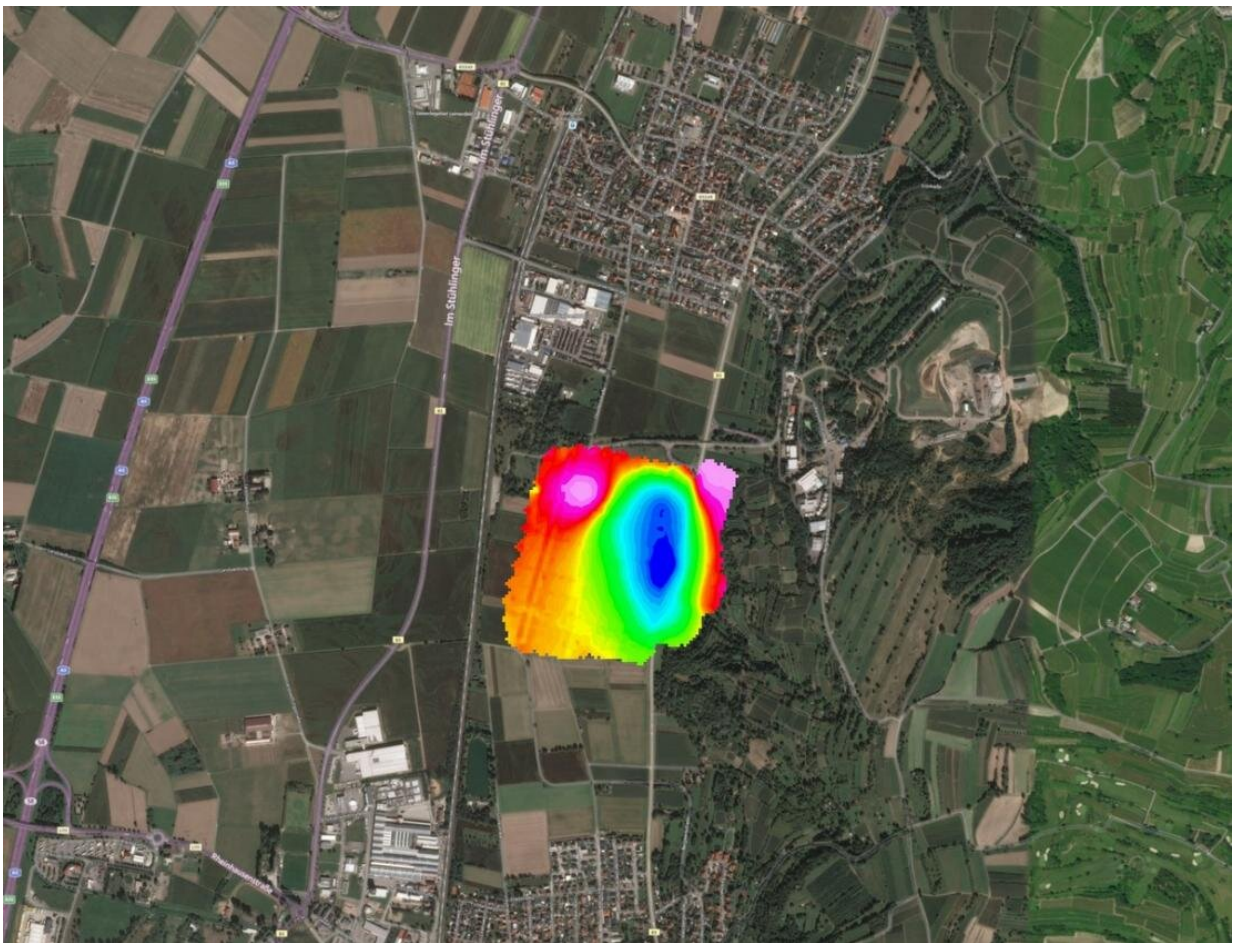


# Europe is finding its hidden treasures to build its green, digital and climate-neutral economy

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Hi-tech models help locate promising sites to mine home-grown raw materials.  
Credit: © Terratec Geophysical Services GMBH & CO KG

Researchers are finding ways to ensure we have a sufficient supply of the raw materials needed to make everything from laptops to satellites. Researchers looked at the high-tech geomodels that could lead Europe into a more secure and independent future.

Contemporary life would be dramatically different without secure access to raw materials. For example, the [platinum group metals](#) (PGMs)—among the least abundant of the Earth's elements—are found in the touchpads of mobile devices, flat screen televisions, automobiles, jet engines and pacemakers, to name only a few.

Even a device as common as a smart phone can require more than 50 different metals, including silicon, rare earth elements, and lithium that are in huge demand with limited supply. This makes raw materials crucial to Europe's recovery and essential to maintaining and improving our quality of life.

Demand is skyrocketing, with many of these resources essential for technologies and sectors that will underpin the drive toward climate neutrality. The Organisation for Economic Co-operation and Development (OECD) estimates global materials demand will [more than double by 2060](#), reaching a staggering 167 billion tons.

For instance, electric vehicles and energy storage solutions require minerals like graphite, lithium and cobalt, potentially increasing demand by [nearly 500% by 2050](#).

Meanwhile, dependence [on rare earth element permanent magnets for use in space exploration, guidance systems, communications, power generation, and healthcare](#) is driving an exponentially increasing need for [rare earth elements](#) (REEs).

Achieving Europe's goal of a green, digital economy and climate

neutrality by 2050 means we need to boost capacity in green mining, processing, production, reuse, and recycling. The global competition for raw materials is ramping up quickly and Europe is strengthening its links all along the raw materials' value chain.

## **Defining the problem is the first step to solving it**

The looming threat of supply insecurity is not something new to the European Commission (EC), which has been expanding efforts to meet the challenge for more than a decade. The EC launched the Raw Materials Initiative in 2008, aimed at diversifying supply sources to minimize disruptions if one link "breaks." One of its first activities was to establish a list of [critical raw materials](#) (CRMs).

CRMs are defined as those materials that are economically and strategically important for the European economy, have a substantial risk associated with their supply, and are difficult to substitute due to their unique properties. The first list of 14 CRMs was published in 2011 and it has been revised every three years since then.

The [2020 list](#) contains [30 CRMs](#), including newcomer strontium, which was not even considered in 2017. Strontium-90 is one of the best high-energy-beta emitters. Betavoltaic systems, a promising alternative to current battery technologies, are self-contained power sources that convert high-energy beta particles emitted from the decay of radioactive isotopes into electrical current. They could be used to generate electricity for space vehicles or remote weather stations and navigational beacons.

It is relatively straightforward to understand why some materials are strategically and economically important. When it comes to risk, as the saying goes, don't put all your eggs in one basket.

Not only are most of the CRMs, including between [75% and 100% of](#)

[metals](#), obtained primarily from countries outside the EU, but they are often sourced from a few mines in one or two countries. China is a leading supplier overall, meeting about 66% of global demand for the CRMs identified in the 2020 list including more than 80% of global demand for REEs.

The most obvious solution to CRM security is to produce more of these materials and that means both extracting from mines and processing—two highly interdependent activities.

## **Finding the Earth's hidden treasures**

Frances Wall, professor of applied mineralogy at the University of Exeter and one of the 100 Global Inspirational Women in Mining 2016, heads up an international team developing geomodels that will help Europe and other countries locate the most promising sources. These sources have great potential not only for what they contain but the ease with which it can be extracted and processed economically, sustainably and with respect for the environment.

Developed in the context of the [HiTech AlkCarb](#) project coordinated by Wall, the geomodels combine mineralogy, geology, geochemistry and geophysical imaging including magnetic and electromagnetic fields in the Earth's interior. A tremendous amount of data collection and research on [geological processes](#) supported their development, much of it studying the 'roots' of volcanoes millions of years old.

"We are looking at the roots of old volcanoes, a really important place for mineral formation, including REEs," said Wall. "All kinds of complicated processes occur as the magma 50 kilometers down comes up to the surface. We are putting this story together."

Scientists are also fine-tuning models at Songwe Hill in Malawi, a site of

active exploration rich in the carbonatites in which REE mineralisation occurs and one of the key targets of HiTech AlkCarb. This ensures the models will be useful in the field since the presence of a deposit doesn't guarantee a profitable or sustainable mine.

"Unless you can get your minerals separated efficiently from the waste rock, you will either not have an economically fruitful deposit or you will be generating a huge amount of waste," explained Wall. "Our models will help enable better and more efficient design of minerals' processing, in turn enabling a better choice of deposits that will behave well during processing, resulting simultaneously in lower environmental impact."

The HiTech AlkCarb team is now traveling around the world consulting and carrying out geophysical surveys at mining projects, helping companies use the openly available geomodels. Spin-off research projects will expand application of the models to other CRMs like lithium, used for batteries found in everything from mobile phones and laptops to electric vehicles and pacemakers, and also come up with innovations that reduce the environmental impact of mining.

## **Strengthening the supply chain**

Extracting more raw materials is the first step in a long value chain, and processing is the second. Europe not only imports CRMs but often imports them after they've been processed as well as importing important products that contain them. For example, China currently produces [more than 90% of rare earth magnets, which are used in nearly all electric vehicles.](#)

"To have a secure supply chain, we need enhanced exploration and new deposits, but we also need processing, metal making and magnet production," said Wall. "The European Raw Materials Alliance is

working on developing the other links in the chain. We need investment in all these stages and incentives to link those together."

According to Wall, some materials like REEs will always have a global supply chain due to where these deposits are found in the Earth's crust, but Europe can increase its presence beyond its borders by, for example, partnering in mine development and operation. However, the later steps of processing should really be in Europe to remove dependence on China, she added. Other countries including Australia, Malaysia, and the US are rapidly expanding processing capability, and we should too.

Tackling the gaps and paving the way to a secure raw materials value chain to meet future demand requires a multidisciplinary effort. The Expert Network on Critical Raw Materials created by the SCRREEN and [SCRREEN2](#) projects (referred to collectively as SCRREEN) is addressing this challenge. The team is collecting and analyzing data on CRMs and updating factsheets regularly while analyzing the future supply and demand of raw materials, policy and technology gaps and innovation potential along the raw materials value chains to support targeted and effective EC policymaking.

According to Stéphane Bourg of the French Alternative Energies and Atomic Energy Commission and SCRREEN2 project coordinator, SCRREEN analyzed the value chains of the raw materials that were identified as critical in 2017 and then evaluated all of the more than 80 materials under consideration for the 2020 criticality exercise.

"Much like the weather these days, the "criticality" of raw materials can alter relatively quickly as supply and/or demand change due to anything from geopolitical tensions to the development of innovative technologies and applications. For this reason, the European Union decided to include CRMs and non-CRMs in more frequent updates of materials factsheets and foresight reports on the future of target sector value chains," said

Bourg.

SCRREEN2 and the EC's Directorate-General for Internal Market, Industry, Entrepreneurship and SMEs ([DG GROW](#)) are now working together to prioritize the factsheets and thematic foresight reports to help keep stakeholders including industry representatives, investors, and policymakers on the same page.

## **From a chain to a circle**

Although SCRREEN2 is just beginning its work and it is early to make predictions and identify gaps in technologies and policies regarding the [raw materials](#) supply chain, Bourg is already certain about one thing: "To ensure sustainable access to required materials, the EU must support the responsible sourcing of strategic materials by promoting innovation in mining and recycling. To achieve this goal, we need technologies, of course, but also reliable data on primary and secondary resources and traceability of materials and waste." And the SCRREEN Expert Network is meeting this critical need.

SCRREEN is also co-organizing the CRM day on 15 November at [EU Raw Materials Week 2021](#) and Bourg encouraged all interested in joining the Expert Network to register. "We are always looking for experts—in physics, chemistry, engineering, geosciences, environment, policy, business—on any part of the value chain of the 80-plus materials screened or on CRM methodology."

Europe is not leaving anything to chance in the global competition to secure access to the materials it needs for a green, digital, climate-neutral economy in 2050.

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